ANNEXURE-10

AICTE Mandatory Disclosures

Nitte Meenakshi Institute of Technology Yelahanka

Bangalore – 560 064

MANDATORY DISCLOSURE

Mandatory Disclosure updated on December 31, 2022

1	Name of the Institution	Nitte Meenakshi Institute of Technology
	Address of the Institution	Nitte Meenakshi Institute of Technology, P.B.No.6429. Yelahanka, Bangalore 560064,Karnataka, India
	Telephone No	1800-102-4984, 080- 2216 7929,080-2216 7950
	Mobile No	+91-81473-54951, +91-81473-54955
	E-Mail	enquiry@nitte.edu.in, principal@nmit.ac.in
2	Name of the Trust	Nitte Education Trust
	Address of the Trust	7th Floor Ram Bhavan Complex, Kodialbail, Manglore, 575003 Karnataka
	Telephone No	0824-2441025
	Mobile No	9820409881
	E-Mail	rohit.punja@nitte.edu.in ,ntrust@hotmail.com
3	Name of the Principal	DR. H. C. NAGARAJ
	Address of the Institution	Nitte Meenakshi Institute of Technology, P.B.No.6429. Yelahanka, Bangalore 560064,Karnataka, India
	Telephone No	080-22167803
	Mobile No	9845275240
	E-Mail	principal@nmit.ac.in
4	Name of the affiliating University	Visvesvaraya Technological University Belgaum, Karnataka santhibastawad road, Jnanasangama Machche , Belgaum-590014, Karnataka
5	Governance	

Members of the Board and their brief background	Annexure-01
Members of Academic Advisory Body	Annexure-02
Frequency of the Board Meeting and Academic Advisory Body	Twice in a year
Organizational chart and processes	Annexure-03
Nature and Extent of involvement of Faculty and students in academic affairs/improvements	Every department has Departmental advisory committee and Board of studies. Faculty

	members, Industry experts and alumni's helps to improve the curriculum and teaching learning process . The faculty members in the above committees which supports in development of department. Meeting with parents will helps in improvement of academics and other improvements. NCC, NSS,ISSS will supports the social activities of the students. IETE,IEEE,WIE and other professional bodies will contribute for cocurricular activities. The Hostel, Transport, Sports and cultural committees will help and support extracurricular activities .
Student Feedback on Institutional Governance/ Faculty performance	Feedback mechanism is confidential. 360-degree feedback includes feedback on faculty, facilities available and laboratory infrastructure and other amenities in the college. Based on the feedback necessary measures are taken to overcome the lacuna and improve the facility and governance. Feedback on individual faculty along with subject handled is taken in every semester. The feedback given by the students will be informed to the faculty for necessary improvement in teaching learning process.
Grievance Redressal mechanism for Faculty, staff and students	Online Grievance Redressal mechanism is available for both faculty and students .
Establishment of Anti Ragging Committee	Annexure-04
Establishment of Online Grievance Redressal Mechanism	Link for online Grievance Redressal Mechanism :https://docs.google.com/forms/d/e/1FAIpQLSex2UcGSELusOSdhX_mo-BMRpDD_zOnthnZwRnW41zden9K7w/viewform
Establishment of Grievance Redressal Committee in the Institution and Appointment of OMBUDSMAN by the University	Annexure-05
Establishment of Internal Complaint Committee (ICC)	Annexure-06
Establishment of Committee for SC/ST	Annexure-07
Internal Quality Assurance Cell	Annexure-08

Annexures

Annexure-01

Members of the Academic Advisory Board

SL No	Name	Designation	Position
1.	Dr. H C Nagaraj	Principal, NMIT	Chairman
2.	Dr. V. Sridhar	Dean Academic, NMIT	Member Secretary
3.	Mr. Rohit Punja	Administrator, NMIT	Special Invitee (Governing Council Nominee)
4.	Dr. Mohan S G	HOD, ISE, NMIT	Member
5.	Dr.Nalini	HOD, CSE, NMIT	Member
6.	Dr. Ramachandra C	HOD, ECE, NMIT	Member
7.	Dr.Pramila	HOD, EEE, NMIT	Member
8.	Dr. Sudheer Reddy	HOD, ME, NMIT	Member
9.	Dr. Piyush Kumar Pareek	HOD, AI -ML, NMIT	Member
10.	Dr.P.V.R. Murthy	HOD, AI -DS, NMIT	Member
11.	Dr. Bharathi Ganesh	HOD, CV, NMIT	Member
12.	Dr. Srikanth	HOD, AE, NMIT	Member
13.	Dr. Indira	HOD, Mathematics, NMIT	Member
14.	Dr. Srilatha Rao	HOD, Chemistry, NMIT	Member
15.	Dr. Hitha Shetty	HOD, Physics, NMIT	Member
16.	Dr. Shilpa Ajay	HOD, MBA, NMIT	Member
17.	Dr. Prasad Naik Hamsavath	HOD, MCA, NMIT	Member
18.	Dr. Smitha Prabhu	Associate Professor, Dept. of ECE, NMIT	Member
19.	Mr. Prashanth N	Assistant Professor, Dept. of ME, NMIT	Member
20.	Dr. Kanchan Garg	Controller of Examinations, NMIT	Member
21.	Dr. VIdyavathi N	Professor, Dept. of Civil Engineering, NMIT	Member
22.	Dr. K Rajnikanth	Former Principal, MSRIT, Bangalore	External Member (Governing Council Nominee)
23.	Dr. Guru	Professor, UOM Department of Computer Science	External Member (Governing Council Nominee

		Manasa Gangothri Mysore Specialisation: Image processing dsg@compsci.uni-mysore.ac.in	
24.	Dr. Navakanta Bhat	Professor, ECE, IISc, Bangalore	Member (Governing Council Nominee)
25.	Dr. Santhosh Deshpande	Professor in Computers Science Engineering PG Centre, Jnana Sangama, VTU, Belagavi Mobile:9448428785 Email: sld@vtu.ac.in	Member (Governing Council Nominee) External Member,
26.	Meena lochani Rajnish	Engineering Director, Unisys (Cloud Computing) Bangalore	Member (Governing Council Nominee) External Member, Industry
27.	Girish Ramachandra	Co-Founder, Knowledge Foundry (Data Science) Banglore	Member (Governing Council Nominee) External Member, Industry
28.	Prof. Govindarajan	Professor & Chairman, SERC, IISc, Bangalore	Member VTU Nominee
29.	Dr. A. G Rama Krishanan	Professor, Department of EEE Indian Institute of Science	Member VTU Nominee
30.	Dr. B R Srinivasmurthy	Technical Advisor & Adjunct Professor,RASTA Center for Road Technology, Bangalore	Member VTU Nominee

Annexure-02

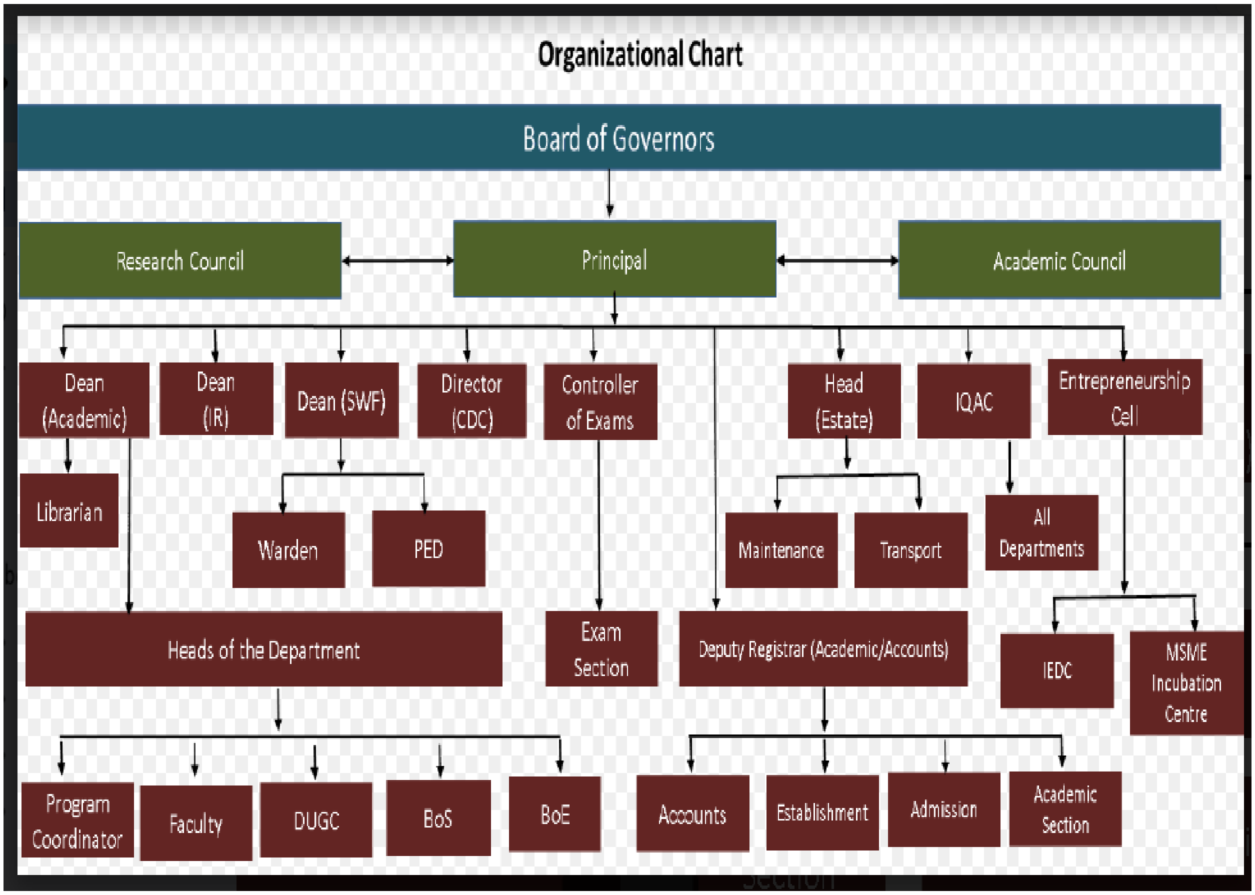
Members of Governing Council

SL NO	Name	Designation	Brief Background
1.	Mr. N Vinaya Hegde President, Nitte Education Trust	Chairman	President, Nitte Education Trust & Chancellor, Nitte (Deemed to be University)
2.	Dr. N R Shetty Advisor, Nitte Education Trust	Member	Advisor, Nitte Education Trust Chancellor, Central University of Karnataka, Kalburgi
3.	Mr. Vishal Hegde Trustee Nitte Education Trust	Member	Pro Chancellor Nitte (Deemed to be University)
4.	Mr. Rajendra M Director of Finance, Nitte Education Trust	Member	Director (Finance & Planning) at Nitte M. Rajendra is a Director (Finance & Planning) at Nitte based in Mangalore, Karnataka
5.	Mr. Rohit Punja Administrator, Nitte Education Trust	Member	Administrator at Nitte Meenakshi Institute of Technology
6.	Dr. P N Singh Former Director, NITK, Surathkal	Member	Former Director, NITK, Surathkal
7.	Dr. K D Nayak Former DS &Director General, DRDO, New Delhi	Member	Former DS &Director General, DRDO, New Delhi
8.	Dr. L M Patnaik Honorary Professor, IISc.	Member	Honorary Professor, IISc.
9.	Dr. Pratosh Bansal Institute of Engineering & Technology, Devi Ahilya Vishwavidyalaya.	Member (UGC Nominee)	Institute of Engineering & Technology, Devi Ahilya Vishwavidyalaya.
10.	Dr. N C Shivaprakash Professor, Emeritus,IISc.	Member (VTU Nominee)	Professor, Emeritus,IISc.
11.	Dr. G. Pundarika Principal, Govt. Engineering College, Ramanagara	Member, (State Govt. Nominee)	Principal, Govt. Engineering College, Ramanagara
12.	Mr. Sanjeev Kubakaddi Founder, ITIE Knowledge Solutions, Bangalore	Member	Founder, ITIE Knowledge Solutions, Bangalore
13.	Mr.Niranjan N Chiplunkar Principal, NMAMIT, Nitte	Member	Principal, NMAMIT, Nitte

14.	Dr. Shrinivasa Rao B R Vice Principal, NMAMIT, Nitte	Member	Vice Principal, NMAMIT, Nitte
15.	Dr. V. Sridhar Dean (Academic), NMIT	Member	Dean (Academic), NMIT
16.	Mr. K Venkatesh Professor, Dept. of CS&E, NMIT	Member (Faculty)	Professor, Dept. of CS&E, NMIT
17.	Dr. H C Nagaraj Principal, NMIT	Dr. H C Nagaraj Principal, NMIT	Principal, NMIT,Bangalore

Annexure-03

Organizational Chart



NITTE
EDUCATION TRUST

NITTE MEENAKSHI INSTITUTE OF TECHNOLOGY

An Autonomous Institution Approved by UGC/AICTE/Govt. of Karnataka
Accredited by NBA (Tier-I) and NAAC 'A+' Grade
Affiliated to Visvesvaraya Technological University, Belagavi
Post Box No. 6429, Yelahanka, Bengaluru-560064, Karnataka, INDIA

KNOWLEDGE • CHARACTER • UNITY

Reference No. NMIT/2022-23/ARC/ 4337

Date: 17-08-2022

CIRCULAR

ANTI RAGGING COMMITTEE

An Anti-Ragging Committee is formed to curb the menace of ragging in the college campus as per AICTE regulations. The members of the committee should hold meetings frequently initially and later once a month to discuss ways of curbing ragging. They should maintain a register to record the meetings & proceedings.

The following are the members of the committee:

Name	Designation	Position	Mobile Number	E-mail id
Dr.Dhananjaya Murthy	Professor	Chairman	9886002272	dhananjayamurthy.bv@nmit.ac.in
Dr.Vidyadevi Biradar (Warden)	Professor	Member	8660414794	vidyadevi.g.biradar@nmit.ac.in
Dr.Sowmyashree A S	Associate Professor	Member Secretary	9611948974	sowmyashree.as@nmit.ac.in
Mrs. Prathima G	Assoc. Professor, CV	Member	9739913814	prathima.g@nmit.ac.in
Dr. Chandrashekar BN	Assoc. Professor, ISE	Member	9972277667	chandrashekar.bn@nmit.ac.in
Mr. Hemanth Kumar	Asst. Professor, ME	Member	9035870712	hemanthkumar.n@nmit.ac.in
Dr.Dileep Reddy	Asst. Professor, CS	Member	9980417673	dileep.bolla@nmit.ac.in
Dr.Srinivasa (Warden)	Assoc. Professor, CS	Member	9611494607	sreenivasa.n@nmit.ac.in
Dr.Thimmaraja Yadava	Asst. Professor, EC	Member	9743244344	thimmaraja.yg@nmit.ac.in
Mr.Rajendran	Transport Head	Member	9686980819	transport@nmit.ac.in
Mr. Mallikarjun Gowda	Security Supervisor	Member	9343862544	rmallikarjunagowda@gmail.com
Police Inspector	Yelahanka New Town	Member	-	-

The above staff members are requested to monitor the activities in our college, buses and hostel premises. They may also recommend any measure to be initiated to attain "Zero ragging" in our campus.

Dr H C Nagaraj
Principal

Principal
Nitte Meenakshi Institute of Technology
Govindapura, Yelahanka,
BANGALORE-560 064.

Copy to

Sri Rohit Punja (Administrator), Dean–Academic, CoE, HoDs, Autonomous-Academic Section, Faculty & Mentors through HoD, Library, All notice Boards of NMIT, Notice Boards of Hostel, NMIT Website, All the members of the committee.

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Reference No. NMIT/2021-22/ARC/ 900 Date: 30-08-2021

CIRCULAR

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Dr.Sowmyashree A S	Associate Professor	Member Secretary	9611948974	sowmyashree.as@nmit.ac.in
Mrs. Prathima G	Assoc. Professor, CV	Member	9739913814	prathima.g@nmit.ac.in
Dr. Chandrashekar BN	Assoc. Professor, ISE	Member	9972277667	chandrashekar.bn@nmit.ac.in
Mr. Hemanth Kumar	Asst. Professor, ME	Member	9035870712	hemanthkumar.n@nmit.ac.in
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Dr.Thimmaraja Yadava	Asst. Professor, EC	Member	9743244344	thimmaraja.yg@nmit.ac.in
Mr.Rajendran	Transport Head	Member	9686980819	transport@nmit.ac.in
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Police Inspector	Yelahanka New Town	Member	-	-

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Reference No. NMIT/2021-22/ARC/ 800 **Date:** 30-08-2021

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Dr.Vidyadevi Biradar (Warden)	Professor	Member	9900407008	srilatha.rao.p@nmit.ac.in
Dr.Sowmyashree A S	Associate Professor	Member Secretary	9611948974	sowmyashree.as@nmit.ac.in
Mrs. Prathima G	Assoc. Professor, CV	Member	9739913814	prathima.g@nmit.ac.in
Dr. Chandrashekar BN	Assoc. Professor, ISE	Member	9972277667	chandrashekar.bn@nmit.ac.in
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Dr.Dileep Reddy	Asst. Professor, CS	Member	9980417673	dileep.bolla@nmit.ac.in
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Mr. Mallikarjun Gowda	Security Supervisor	Member	9343862544	rmallikarjunagowda@gmail.com
Police Inspector	Yelahanka New Town	Member	-	-

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30/08/21

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KNOWLEDGE • CHARACTER • UNITY

Reference No. NMIT/2022-23/ARC/ 4356 **Date:** 17-08-2022

CIRCULAR

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The following are the members of the committee:

Name	Designation	Position	Mobile Number	E-mail id
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Dr.Vidyadevi Biradar (Warden)	Professor	Member	9900407008	srilatha.rao.p@nmit.ac.in
Dr.Sowmyashree A S	Associate Professor	Member Secretary	9611948974	sowmyashree.as@nmit.ac.in
Mrs. Prathima G	Assoc. Professor, CV	Member	9739913814	prathima.g@nmit.ac.in
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Dr.Thimmaraja Yadava	Asst. Professor, EC	Member	9743244344	thimmaraja.yg@nmit.ac.in
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Police Inspector	Yelahanka New Town	Member	-	-

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17/08/22

Dr H C Nagaraj
Principal

Principal
Nitte Meenakshi Institute of Technology
Govindapura, Yelahanka,
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KNOWLEDGE • CHARACTER • UNITY

Reference No. NMIT/2021-22/GRC/ 799 **Date:** 29-08-2021

CIRCULAR

GRIEVANCE REDRESSAL COMMITTEE

This is to bring to the notice of all the faculty and students that, the Grievance Redressal Cell has been reconstituted from the academic year 2021-2022. The following members have been nominated by the Management with Prof. K Venkatesh, Professor, Department of CSE, as Chairman for the Grievance Redressal Cell.

Members of Grievance Redressal Cell:

Name	Designation	Position	Mobile Number	e-mail id
Prof. K Venkatesh	Professor, Dept. of CSE	Chairman	9844057194	krishnarao.venkatesh@nmit.ac.in
Dr. N. G. Goudru	Professor, Dept. of ISE	Member	9341384414	goudru.ng@nmit.ac.in
Dr. Kiran Aithal	Professor, Dept. of ME	Member	9845133607	kiranaithal.s@nmit.ac.in
Dr. Vidyavathi N	Professor, Dept. of CV	Member	9686712343	vidyavathi.n@nmit.ac.in
Mr.Shreyas A V	Dy.Registrar	Member Secretary	9663451007	shreyas.av@nmit.ac.in

The Grievance Redressal Cell is responsible for upholding the dignity of the college by ensuring strife free atmosphere, through promoting cordial student-student relationship and student –teacher relationship and also encouraging the students to express their grievances /problems freely and frankly, without any fear of being victimized.

29/08/21

Dr H C Nagaraj
Principal

Principal
Nitte Meenakshi Institute of Technology
Govindapura, Yelahanka,
BANGALORE-560 064.

Copy to

Sri Rohit Punja (Administrator), Dean–Academic, CoE, HoDs, Autonomous-Academic Section, Faculty & Mentors through HoD, Library, All notice Boards of NMIT, Notice Boards of Hostel, NMIT Website, All the members of the committee.

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Post Box No. 6429, Yelahanka, Bengaluru-560064, Karnataka, INDIA

Reference No. NMIT/2022-23/GRC/ 4355 Date: 17-08-2022

CIRCULAR

GRIEVANCE REDRESSAL COMMITTEE

This is to bring to the notice of all the faculty and students that, the Grievance Redressal Cell has been reconstituted from the academic year 2022-2023. The following members have been nominated by the Management with Prof. K Venkatesh, Professor, Department of CSE, as Chairman for the Grievance Redressal Cell.

Members of Grievance Redressal Cell:

Name	Designation	Position	Mobile Number	e-mail id
Prof. K Venkatesh	Professor, Dept. of CSE	Chairman	9844057194	krishnarao.venkatesh@nmit.ac.in
Dr. N. G. Goudru	Professor, Dept. of ISE	Member	9341384414	goudru.ng@nmit.ac.in
Dr. Kiran Aithal	Professor, Dept. of ME	Member	9845133607	kiranaithal.s@nmit.ac.in
Dr. Vidyavathi N	Professor, Dept. of CV	Member	9686712343	vidyavathi.n@nmit.ac.in
Mr.Shreyas A V	Dy.Registrar	Member Secretary	9663451007	shreyas.av@nmit.ac.in

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17/08/22

Dr H C Nagaraj
Principal

Principal
Nitte Meenakshi Institute of Technology
Govindapura, Yelahanka,
BANGALORE-560 064.

Copy to

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NITTE

NITTE MEENAKSHI INSTITUTE OF TECHNOLOGY
P.O.Box 6429, Yelahanka, Bangalore 560 064

CIRCULAR

Date: 25/03/2022

Constitution of College Internal Complaints Committee (CICC) w.r.t Prevention, Prohibition and Redressal of Sexual Harassment

Ref: Visvesvaraya Technological University (Prevention, Prohibition and Redressal of Sexual harassment of Women Employees and Students) Regulations 2019

To Comply with Visvesvaraya Technological University (Prevention, Prohibition and Redressal of Sexual harassment of Women Employees and Students) Regulations 2019, the Internal Complaints Committee (ICC) is reconstituted at Women Cell, Nitte Meenakshi Institute of Technology, Yelahanka, Bangalore-560 064, as below:

Sl.No.	Name and Designation	Position in CICC	Gender	Mobile Number and E-mail ID	Official Number
1.	Dr.NALINI.N Professor (CSE) and Dean-Students' Welfare	Chairperson (Shall be Woman)	F	8722455452 nalini.n@nmit.ac.in	+91-80-22167870
2.	Dr.Shilpa Ajay Professor and Head, MBA	Faculty Member	F	9900447462 hod-mba@nmit.ac.in	
3.	Mr.Shreyas A V	Faculty Member	M	9663451007 dyregistrar@nmit.ac.in	
4.	Ms.Sonymalli Manager-Office	Member (Non-Teaching Employee)	F	9845293340 sonymalli@nitte.edu.in	+91-80-22167809
5.	Ms.Sneha Shetty PA-Director	Member (Non-Teaching Employee)	F	962006484 snehanitte@gmail.com	
6.	Shreerakhsa 6ht Sem CSE	Student	F	7899559438 1nt19cs180.shreeraksha@nmit.ac.in	
7.	Ms.Shobha P	Research Scolar	F	9845733151 shoba.p@nmit.ac.in	
8.	Rtn Prof Elizabeth Cherian Paramesh	Member from the NGO	F	9945166887 elizabethcherianp@gmail.com	

25/03/2022

Dr. H C Nagaraj
PRINCIPAL

PRINCIPAL
NITTE MEENAKSHI INSTITUTE OF TECHNOLOGY
P.O. BOX 6429, GOVINDAPURA, GOLLAHALLI
YELAHANKA, BENGALURU-560 064

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Affiliated to Visvesvaraya Technological University, Belagavi
Post Box No. 6429, Yelahanka, Bengaluru-560064, Karnataka, INDIA

KNOWLEDGE • CHARACTER • UNITY

Reference No. NMIT/2021-22/SCST/ 801 **Date:** 30-08-2021

CIRCULAR

SC ST BCM CELL

As per the directions of Visvesvaraya Technological University, Belgaum, this is to bring to your notice that an SC, ST and BCM Cell has been constituted at our college with the following members for the academic year 2021-22.

Sl. No	Name	Designation/ Department	Position
1.	Dr.Ramachandra A C	Professor & Head, EC	Chairman
2.	Dr.Avinash L	Assistant Professor, ME	Member
3.	Mr. Anand S	Assistant Professor, EEE	Member
4.	Ms. Pramodhini R	Assistant Professor, ECE	Member
5.	Mr.Sridhar K	Assistant Professor, AE	Member
6.	B Rakesha	VI semester, CV	Member
7.	S Sushma Nayak	VI semester, CS	Member
8.	Chandan N	VI semester, EC	Member
9.	Bhoomika Venugopal	VI semester, AE	Member
10.	Supriya	VI semester, CV	Member

All the members are requested to carry out the duties as per the guidelines of VTU.

30/08/21

Dr H C Nagaraj
Principal

Principal
Nitte Meenakshi Institute of Technology
Govindapura, Yelahanka,
BANGALORE-560 064.

Copy to

Sri Rohit Punja (Administrator), Dean–Academic, CoE, HoDs, Autonomous-Academic Section, Faculty & Mentors through HoD, Library, All notice Boards of NMIT, Notice Boards of Hostel, NMIT Website, All the members of the committee.

NITTE EDUCATION TRUST

NITTE MEENAKSHI INSTITUTE OF TECHNOLOGY

An Autonomous Institution Approved by UGC/AICTE/Govt. of Karnataka
Accredited by NBA (Tier-I) and NAAC 'A+' Grade
Affiliated to Visvesvaraya Technological University, Belagavi
Post Box No. 6429, Yelahanka, Bengaluru-560064, Karnataka, INDIA

KNOWLEDGE • CHARACTER • UNITY

Reference No. NMIT/2022-23/SCST/ 4357 **Date:** 17-08-2022

CIRCULAR

SC ST BCM CELL

As per the directions of Visvesvaraya Technological University, Belgaum, this is to bring to your notice that an SC, ST and BCM Cell has been constituted at our college with the following members for the academic year 2022-23.

Sl. No	Name	Designation/ Department	Position
1.	Dr.Ramachandra A C	Professor & Head, EC	Chairman
2.	Dr.Avinash L	Assistant Professor, ME	Member
3.	Mr.Anand S	Assistant Professor, EEE	Member
4.	Ms.Pramodhini R	Assistant Professor, ECE	Member
5.	Mr.Sridhar K	Assistant Professor, AE	Member
6.	Tusher	VI semester, CV	Member
7.	Hanumantha V	VI semester, CS	Member
8.	Kadambari K	VI semester, EC	Member
9.	Hamsa B T	VI semester, AE	Member
10.	Chithralekha S	VI semester, EE	Member

All the members are requested to carry out the duties as per the guidelines of VTU.

17/08/22

Dr H C Nagaraj
Principal

Principal
Nitte Meenakshi Institute of Technology
Govindapura, Yelahanka,
BANGALORE-560 064.

Copy to

Sri Rohit Punja (Administrator), Dean–Academic, CoE, HoDs, Autonomous-Academic Section, Faculty & Mentors through HoD, Library, All notice Boards of NMIT, Notice Boards of Hostel, NMIT Website, All the members of the committee.

Programme

Name of Programmes approved by AICTE

Course Unique Id	Programme	Affiliating University/Board	Level of course	Name of the Course
1-2187186186	ENGINEERING AND TECHNOLOGY	Visvesvaraya Technological University, Belgaum	Post Graduate	Renewable energy
1-1374575785	ENGINEERING AND TECHNOLOGY	Visvesvaraya Technological University, Belgaum	Post Graduate	Computer science and engineering
1-1374575787	ENGINEERING AND TECHNOLOGY	Visvesvaraya Technological University, Belgaum	Post Graduate	VLSI design and embedded systems
1-1489709834	ENGINEERING AND TECHNOLOGY	Visvesvaraya Technological University, Belgaum	Post Graduate	Structural engineering
1-1489775252	ENGINEERING AND TECHNOLOGY	Visvesvaraya Technological University, Belgaum	Post Graduate	Robotics and artificial intelligence
1-5027123293	ENGINEERING AND TECHNOLOGY	Visvesvaraya Technological University, Belgaum	Post Graduate	Data science
1-5068405385	ENGINEERING AND TECHNOLOGY	Visvesvaraya Technological University, Belgaum	Post Graduate	Aerospace engineering
1-10247944073	ENGINEERING AND TECHNOLOGY	Visvesvaraya Technological University, Belgaum	Post Graduate	Defence technology
1-1374575789	MASTERS IN COMPUTER APPLICATIONS	Visvesvaraya Technological University, Belgaum	Post Graduate	Masters in computer applications
1-1495757245	MANAGEMENT	Visvesvaraya Technological University, Belgaum	Post Graduate	MBA
1-1374575777	ENGINEERING AND TECHNOLOGY	Visvesvaraya Technological University, Belgaum	Under Graduate	Computer science and engineering
1-1374575779	ENGINEERING AND TECHNOLOGY	Visvesvaraya Technological University, Belgaum	Under Graduate	Information science and engineering
1-1374575781	ENGINEERING AND TECHNOLOGY	Visvesvaraya Technological University, Belgaum	Under Graduate	Electrical and electronics engineering

1-1374575783	ENGINEERING AND TECHNOLOGY	Visvesvaraya Technological University, Belgaum	Under Graduate	Civil engineering
1-1374575791	ENGINEERING AND TECHNOLOGY	Visvesvaraya Technological University, Belgaum	Under Graduate	Aeronautical engineering
1-1374575799	ENGINEERING AND TECHNOLOGY	Visvesvaraya Technological University, Belgaum	Under Graduate	Electronics and communications engineering
1-1374596801	ENGINEERING AND TECHNOLOGY	Visvesvaraya Technological University, Belgaum	Under Graduate	Mechanical engineering
1-9413682880	ENGINEERING AND TECHNOLOGY	Visvesvaraya Technological University, Belgaum	Under Graduate	Artificial intelligence and machine learning
1-9413682884	ENGINEERING AND TECHNOLOGY	Visvesvaraya Technological University, Belgaum	Under Graduate	Artificial intelligence and data science
1-2191981504	ENGINEERING AND TECHNOLOGY	Directorate of Technical Education	Diploma(Shift)	Computer science and engineering
1-1374596803	ENGINEERING AND TECHNOLOGY	Directorate of Technical Education	Diploma(Shift)	Mechanical engineering
1-1374596805	ENGINEERING AND TECHNOLOGY	Directorate of Technical Education	Diploma(Shift)	Electronics and communications engineering
1-1449823924	ENGINEERING AND TECHNOLOGY	Directorate of Technical Education	Diploma(Shift)	Civil engineering
1-2057575887	ENGINEERING AND TECHNOLOGY	Directorate of Technical Education	Diploma(Shift)	Electrical and electronics engineering
1-7491074483	ENGINEERING AND TECHNOLOGY	Directorate of Technical Education	Diploma(Shift)	Aeronautical engineering

Name of Programmes Accredited by NBA

Course Unique Id	Programme	Affiliating University/Board	Level of course	Name of the Course
1-1374575777	ENGINEERING AND TECHNOLOGY	Visvesvaraya Technological University, Belgaum	Undergraduate	Computer science and engineering

1-1374575779	ENGINEERING AND TECHNOLOGY	Visvesvaraya Technological University, Belgaum	Undergraduate	Information science and engineering
1-1374575781	ENGINEERING AND TECHNOLOGY	Visvesvaraya Technological University, Belgaum	Undergraduate	Electrical and electronics engineering
1-1374575783	ENGINEERING AND TECHNOLOGY	Visvesvaraya Technological University, Belgaum	Undergraduate	Civil engineering
1-1374575791	ENGINEERING AND TECHNOLOGY	Visvesvaraya Technological University, Belgaum	Undergraduate	Aeronautical engineering
1-1374575799	ENGINEERING AND TECHNOLOGY	Visvesvaraya Technological University, Belgaum	Undergraduate	Electronics and communications engineering
1-1374596801	ENGINEERING AND TECHNOLOGY	Visvesvaraya Technological University, Belgaum	Undergraduate	Mechanical engineering

Status of Accreditation of the Courses

No of post graduate Courses (PG)	No of Under graduate Courses(UG)	No of Diploma Courses	Total number of Courses	No. of Courses for which applied for Accreditation	Name of the dept applied for Accreditation	Status of Accreditation – Preliminary/ Applied for SAR and results awaited/ Applied for SAR and visits completed/ Results of the visits awaited/ Rejected/ Approved for . . .Courses (specify the number of courses
10	09	06	25	3	ECE EEE CSE	Results of the NBA visits awaited
--	--	--	--	4	--	CV,ME,AE,ISE Already accredited

For each Programme the following details are to be given(Preferably in Tabular form)

UG Programes:

Name	CSE	ISE	CV	AE	AI-DS	AI-ML	ECE	ME	EEE
Number of seats	180	180	120	120	60	60	180	120	120
Duration in years	4	4	4	4	4	4	4	4	4
Cut off marks/rank of admission during the last three years									
2019-2020	3086-122317	7419-101679	22270-140913	6352-115492	NA	NA	7118-134377	15349-139815	9607-101359
2020-2021	3216-91253	7040 - 12924	32982-151879	17772-139689	NA	NA	8595-143795	32089 - 130003	20004 -99296
2021-2022	10357-36853	10742-31527	92944-63371	16057-14981	8587-14539	24693-22912	12944-53570	53104-176729	38834-39159
Fee (as approved by the state government)	COMED K CET								
Placement Facilities	available	available	available	available	NA	NA	available	available	available
	Mentoring, Cubicles for interviews, seminar halls, conference rules, Board rooms, Computer training centers with a capacity of 100				NA	NA	Mentoring, Cubicles for interviews, seminar halls, conference rules, Board rooms, Computer training centers with a capacity of 100		
	Campus placement in last three years with minimum salary ,maximum salary and average salary in Lakhs								
2020-2021	Min:3 Max:24	Min:3 Max:24	Min:1 Max:5	Min:3 Max:5	NA	NA	Min:3 Max:24	Min:1 Max:21	Min:2 Max:5
2021-2022	Min:2 Max:30	Min:2 Max:24	Min:1 Max:6	Min:1 Max:6	NA	NA	Min:2 Max:18	Min:1 Max:6	Min:2 Max:21

PG Programes:

Name	MBA	MCA	MTECH							
			Renewable energy	VLSI design and embedded systems	Structural engineering	Data science	Aerospace engineering	Defence technology	Machine Design//Robotics and Artificial Intelligence	Computer science and engineering
Number of seats	120	120	18	18	24	18	18	18	18	18
Duration in years	2	2	2	2	2	2	2	2	2	2
Cut off marks/rank of admission during the last three years										
2019-2020	486-18705		6819-10301	3193-8799	2239-8270	4786-5486	413-10340	NA	7866-9894	3365-7951
2020-2021	1438-19976		5067-10156	3870-10856	3652-7675	2512-10285	3006-9025	NA	8696-9168	4627-10332
Fee (as approved by the state government)	As per Govt approval	As per Govt approval	As per Govt approval	As per Govt approval	As per Govt approval	As per Govt approval	As per Govt approval	As per Govt approval	As per Govt approval	As per Govt approval
Placement Facilities	available	available	available	available	available	available	available	available	available	available
	Mentoring, Cubicles for interviews, seminar halls, conference rules, Board rooms, Computer training centers with a capacity of 100									
	Campus placement in last three years with minimum salary ,maximum salary and average salary in lakhs									
2020-2021	--	Min:3 Max:5	--	--	--	--	--	--	Min:8 Max:15	Min:2 Max: 10
2021-2022	--	Min:2 Max:7	Min:3 Max:4	Min:4 Max:7	Min:3 Max: 5	Min:4 Max:9	--	Min:1 Max: 7	Min:4 Max:4	Min:2 Max:8

PROFILE
OF
PRINCIPAL

NITTE EDUCATION TRUST

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Profile of the Faculty

BRANCH: ELECTRONICS AND COMMUNICATION ENGINEERING

Name	Dr.H C Nagaraj	
Designation	Principal	
Department	**ECE**	
Date of Joining the Institution	28-12-2001	
Date of Birth	04/04/1959	
Faculty Unique	1-410763421	
Email Id	principal@nmit.ac.in	

Education Qualifications:

SL.No	Degree Obtained	Year of Obtaining the highest degree	Class/ Grade obtained
1	UG	1981	FCD
2	PG	1984	First Rank
3	Ph.D	2000	Awarded
4	Others	--	--

Total Work Experience in Years:

SL.No	Work Experience	Total in Years
1	Teaching	36
2	Research	05
3	Industry	--
4	others	--

Area of Specialization:

	Undergraduate	1.Basic Electronics 2.Analog Electronics 3.Digital Electronics 4.Communication System

Courses taught at		5.Image Processing 6.Biomedical Signal Processing 7.Power Electronics.
	Post Graduate	--
	Post Graduate Diploma Level	--

Research Guidance (Number of Students):UG students-

No. of papers published:

SL.No	Type	Numbers
1	National	08
2	International Journals	25
3	Conferences	22
4	Others	--

Master (Completed (Year of Completion)/Ongoing): 1984
s

Ph.D. (Completed Year of Completion)/Ongoing): 2000

Projects Carried out :

Patents (Filed & Granted):

SL No	Topic	**Patent Application No**	Filed/ Granted
1			
2			

Technology Transfer:

a) **Best Student Paper Award** at the 5th National Conference of Biomechanics held During Feb. 22-24, 1996 at I.I.T. Madras, Chennai.

b) **Best Paper Award** at the Karnataka State Level Seminar on “Introduction of Flexible System in Technical Education” held on 8th Feb, 1999 at P.E.S. Institute of Technology, Bangalore.

c) **Delivered Invited Talks** at various Conferences & Workshops organized in the areas of Mobile Communication, Biomedical Engineering, Digital Communication, Instrumentation, Digital Signal Processing , Image Processing etc.

No. of Books published with details: VLSI Circuits”, Star- Tech Education, Bangalore, 2006

BIODATA OF Dr. H C NAGARAJ

Dr. H C Nagaraj

Principal
Nitte Meenakshi Institute of Technology
P.B. No. 6429, Yelahanka, Bangalore – 560 064
Phone: Off: (080) 22167800 / 22167803 || Fax: (080) 22167805 Mobile: 9845275240
|| E-mail: principal@nmit.ac.in ||

Member, Academic Senate of Visvesvaraya Technological University, Belagavi, from 15.06.2019 for a period of three years

Member of the Court
Pondicherry University, Puducherry,
from 02.01.2017 for a period of three years

&

Former Dean, Faculty of Engineering
Visvesvaraya Technological University, Belagavi, Karnataka

1. GENERAL INFORMATION

Permanent & Correspondence Address	:	**Dr. H C Nagaraj** No. 1124, 'SKANDA', HMT Layout, 6th Block, Vidyaranyapura, Bangalore - 560097
Email ID Landline Mobile	: : :	principal@nmit.ac.in 080-22167803/800 9845275240

2. EDUCATIONAL QUALIFICATION

Sl. No.	Degree/ Specialization	University/ Institution	Year of Award of Degree	Remarks
1.	**B.E.** (Electronics & Communication)	University of Mysore	1981	First Class with Distinction
2.	**M.E.** (Communication Systems)	P.S.G College of Technology, Coimbatore	1984	First Rank
3.	**Ph.D** (Biomedical Signal Processing and Instrumentation)	Indian Institute of Technology Madras, Chennai	2000	

3. POSITIONS HELD

Sl. No.	Period		Designation	Department/ College/ University	Nature of work and level of responsibilities
	From	To			
1	02.06.2016	01.06.2019	Dean, Faculty of Engineering	Visvesvaraya Technological University (VTU), Belagavi	Involved in complete academic and developmental work of VTU, Belagavi
2	02.01.2017	01.01.2020	Member of Court	Pondicherry University, Pondicherry	To approve the various academic, planning, and developmental activities of Pondicherry University
3	15.06.2019	14.06.2022	Academic Senate Member	Visvesvaraya Technological University (VTU), Belagavi	Involved in complete academic and developmental work of VTU, Belagavi
4	01.09.2003	Till Date	Principal	Nitte Meenakshi Institute of Technology, Bangalore - 560064	Planning, Development, Quality & Assurance, Implementation and day to day administration
5	28.12.2001	31.08.2003	Professor & Head, Dept. of ECE	Nitte Meenakshi Institute of	Department Level Administration,

				Technology, Bangalore - 560064	Teaching and Research
6	01.07.2000	27.12.2001	Professor & Head, Dept. of Telecommunication Engineering (TCE)	JNN College of Engineering, Shimoga - 577204	Department Level Administration, Teaching and Research
7	16.08.1987	30.06.2000	Assistant Professor, Dept. of ECE	JNN College of Engineering, Shimoga - 577204	Teaching and Research
8	28.12.1981	15.08.1987	Lecturer, Dept. of ECE	JNN College of Engineering, Shimoga - 577204	Teaching

4. PROFESSIONAL ACHIEVEMENTS

I. Professional Affiliation:

i. Life Member of the Indian Society for Technical Education (LM - 04427)
ii. Life Member of The Biomedical Engineering Society of India (L – 431)
iii. Fellow of the Institution of Electronics and Telecommunication Engineers (F - 192154)
iv. Member of the Global Engineering Deans Council (GEDC)

II. Examinership:

Working as an Examiner for B. E., M. Tech., and Ph. D. Programmes of:

i. Visvesvaraya Technological University, Belagavi, Karnataka
ii. Sri Venkateshwara University, Tirupati, Andhra Pradesh
iii. Manipal University (Deemed University), Manipal, Karnataka
iv. Kuvempu University, Shimoga, Karnataka
v. Bangalore University, Bangalore, Karnataka
vi. University of Mysore, Mysore, Karnataka
vii. SRM Deemed University, Chennai, Tamil Nadu
viii. Jain University, Bangalore, Karnataka
ix. Savitribai Phule Pune University, Pune, Maharashtra

III. Chairman/ Membership of University Boards:

i. Dean, Faculty of Engineering, Visvesvaraya Technological University Belagavi, for three years from June 2016 to May 2019.
ii. Member of the Court, Pondicherry University, Puducherry for a period of three years w.e.f January 2017.
iii. Member of Board of Examiners in EC/TE/ML/BM (UG) Board of Visvesvaraya Technological University, Belagavi during the Academic Years 2002 - 2004.
iv. Member of Board of Examiners in M.Tech (Digital Communication and Network Engineering) of Kuvempu University during the Year 2003-2004.
v. Served as Chairman, Member, Board of Studies and Board of Examiners in EC/IT Board of Kuvempu University during the Academic Years 1998 – 2000.
vi. Member of Board of Examiners for B.E (E&CE) & M.E (Power Electronics) of UVCE, Bangalore University for the Academic Years 2007 – 2009.
vii. Chairman, BOS of IT/BM/ML of VTU for 2010-13[03years].
viii. Member, Academic Senate of VTU for 09 years w.e.f. April 2010.Further extended for a period of three years w.e.f 15-06-2019
ix. Member, Karnataka State Innovation Council, Government of Karnataka
x. Member of NAAC (UGC) Peer Team to assess the institution for Accreditation
xi. Visited as an Expert Member of the UGC, New Delhi for inspecting the colleges seeking Autonomous Status.
xii. Associated as an expert member in UPSC related works.

IV. **Delivered Invited Talks** at various Conferences & Workshops organized in the areas of Mobile Communication, Biomedical Engineering, Digital Communication & Digital Signal Processing, Image Processing etc.

V. **Technical Papers Published: 54**
(In National, International Conferences and Journals)

VI. **Book Published:** “VLSI Circuits”, Star- Tech Education, Bangalore, 2006

VII. **No. of candidates completed and pursuing Ph.D Programme under my guidance:**

a) No. of Students completed and awarded Ph.D: 05
b) No. of Students submitted Ph.D thesis & awaiting reports: 01
c) No. of students pursuing Ph.D: 07

VIII. **Awards / Prizes won:**

a) Best Student Paper Award at the 5th National Conference of Biomechanics held during Feb. 22-24, 1996 at I.I.T. Madras, Chennai.

b) Best Paper Award at the Karnataka State Level Seminar on "Introduction of Flexible System in Technical Education" under Visvesvaraya Technological University (VTU), Belagavi held on Feb. 8, 1999 at P.E.S. Institute of Technology, Bangalore.

c) Best Paper Award at IEEE 2nd International Conference on Intelligent Communication and Computational Techniques (ICCT'19), Manipal University, Jaipur held during Sep. 28-29, 2019.

IX. International journal/conferences publications

1. Sundari Tribhuvanam, H.C. Nagaraj, V.P.S. Naidu, "Analysis and Classification of ECG beat Based on Wavelet Decomposition and SVM", Indian Journal of Science and Technology, Vol 13(24): 2404-2417, 2020 (Web of Science)
2. Prasanna G Paga , H C Nagaraj , Tejas R ,Krishnananda Shet "Dual Band Monopole Antenna with Concentric Square Electromagnetic Band Gap (EBG) Structure", 2020 IEEE International Conference on Computing, Power and Communication Technologies (GUCON) Galgotias University, Greater Noida, UP, India. Oct 2-4, 2020. doi: 10.1109/GUCON48875.2020.9231234.
3. Vidyadevi G. Biradar, H.C. Nagaraj, "Leveraging X-Ray and CT-Scans for COVID-19 infection investigation using deep learning models: Challenges and Research directions", ERCICA 2020.
4. Tejas K. Rayangoudar, H.C. Nagaraj, "Significance of Effective Local Gradient Distribution Technique with Eft on Multi-View and Cloth Invariant Gait Recognition," in International Journal of Future Generation Communication and Networking Web of Science, Vol. 13, No. 3, (2020), pp. 243- 252.
5. Rekha Phadke, Varsha Prasad, Abhijit Bhograj, H C Nagaraj, Univariate data-driven models for glucose level prediction of CGM sensor dataset for T1DM management, Sadhana, Indian academy of sciences.
6. Ashwini S R, H C Nagaraj, "Data driven spatial technique for enhancing the steady state visual evoked potentials detection at brain computer interface" Published in 2nd international conference on smart systems and inventive technology (ICSSIT) 2019.
7. Rekha Phadke, H C Nagaraj, Varsha Prasad, Precise Humane Diabetes Management: Synergy of Physiological and Psychological Data in AI Based Diabetes, IJSTR, Scopus Indexed Elsevier Journal, 2019.
8. Sundari Tribhuvanam, H.C. Nagaraj, V.P.S. Naidu, "Arrhythmia Classification using ECG Single Beat Evaluation and Support Vector Machine" International Journal of Innovative Technology and Exploring Engineering (IJITEE), ISSN: 2278-3075, Volume-8 Issue-12, October 2019, 2814-2820 (Scopus).
9. Rekha Phadke, Varsha Prasad, H C Nagaraj, Time Series Based Short Term T1DM Prediction of Librepro CGM Sensor Data: A Novel Ensemble Method, IJEAT, Scopus Indexed Elsevier Journal, 2019.

10. Rekha Phadke, H C Nagaraj, Varsha Prasad, K P Nagesh, Glucose Level Prediction of LIBREPRO CGM Sensor Data Using Machine Learning Algorithm for Enhanced Diabetes Mellitus Management, IJCSE,
11. Sundari Tribhuvanam, H. C. Nagaraj, V.P.S. Naidu, "ECG Abnormality Classification with Single Beat Analysis", International Conference on Vision Towards Emerging Trends in Communication and Networking (ViTECoN), VIT, Vellore, March 30-31, 2019.
12. Rekha Phadke, H C Nagaraj, Electrochemical Glucose Sensor on modified Platinum electrodes, JETIR, UGC approved, 2019.
13. Prasanna Paga, H. C. Nagaraj, T. S. Rukmini," Design and analysis of a Dual Band Monopole antenna for resonating between Wi-Fi & Wi-Max Applications", International Journal of Applied Engineering Research ISSN 0973-4562 Volume 13, Number 16 pp. 12570-12581,2018.
14. Prasanna Paga, H. C. Nagaraj, T. S. Rukmini," Design of Dual Band Slotted Microstrip Patch antenna for Wi-Fi & Wi-Max applications", International Journal of Applied Engineering Research (IJAER), Volume 13, No.11, July 2018.
15. Prasanna Paga, H. C. Nagaraj, T. S. Rukmini," Investigation of the effect of metamaterial on the performance of the Dual Band antenna for resonating between GSM 900 and Wi-Fi", International Journal of Applied Engineering Research", Volume 13, No 5, pp 2714-2724, July 2018.
16. Prasanna Paga, H.C.Nagaraj, T.S.Rukmini," Design of a Dual Band Frequency reconfigurable Microstrip patch antenna for GPS and Wi-Fi Applications", Int. J. Vehicle Information and Communication Systems, Vol. 3, No. 4, 2018.
17. Prasanna Paga, H. C. Nagaraj, T. S. Rukmini," Design Simulation and Fabrication of a Dual Band Frequency Reconfigurable Monopole antenna for Wi-Fi and WiMAX Applications", Open Journal of antennas and Propagation, pp-151-167, Vol. No 5, 2017.
18. Sundari Tribhuvanam, Swati Somayaji, H C Nagaraj "Quality Evaluation of Gray Scale Images with Single Image Metrics" International conference on Advances in Science, Engineering and Technology (ICASET-2017), at RGIT, Bangalore on 24th April 2017.
19. Prasanna Paga, H.C. Nagaraj, T.S. Rukmini, "Design of a Dual Band CSRR based Fractal antenna for Wi-Fi and Wi-Max Applications", International Journal of Current Engineering and Scientific Research, Volume 4, August 2017.
20. Rekha Phadke, H C Nagaraj, Fabrication and Characterization of Enzymatic Electrochemical Glucose Sensor for Closed Loop System, Physics of semiconductor devices, IWPSD conference.
21. Prasanna Paga, H.C.Nagaraj, T.S.Rukmini," Simulation and performance Analysis of a Metamaterial based Dual band Monopole antenna using Rectangular Complementary Split Ring Resonator in the Ground plane for GSM900 and Wi-Max Applications", IJIRCE, Vol. 5, Issue 7, July 2017.
22. Prasanna Paga, H.C.Nagaraj, T.S.Rukmini," Design of a Tri- Band Frequency reconfigurable Monopole antenna for GSM UMTS and Wi-Fi Applications", IJECT Vol. 8, Issue 2, April – June 2017.

23. Vidyadevi G Biradar, H Sarojadevi, H C Nagaraj, Segmentation of overlapped fingerprint using Autoregressive Model, International Journal of Computer Science and Information Security, Vol.15, No.6, pp.221-227, June 2017.
24. Vidyadevi G Biradar, H Sarojadevi, H C Nagaraj, Autoregressive Model based Segmentation of Overlapped Region, International Journal of Computer Science and Information Security, Vol. 14, No.4. pp. 168-174, April 2016.
25. T.S. Rukmini, Prasanna Paga, Nithin Nagar, "Enhancement of Gain of Printed T Monopole Antenna Using Uniplanar EBG for ISM Band (2.4GHz) Applications" in IJIRCCE, Volume 3, Issue 4, April 2015.
26. Vidyadevi G B, Sarojadevi H, Nagaraj H C, Fractal Analysis for Classification of Regions in Overlapped Fingerprints, Journal of Signal and Image Processing, Vol. 5, Issue 1, pp.149- 152, 2015.
27. Sundari Tribhuvanam, H C Nagaraj, Akshya Amrutha Chandra, "Real Time Acquisition and Analysis of ECG Signal", International Journal of Advanced Research in Electrical, Electronics & Instrumentation Engineering (IJAREEIE), Vol 3 Special Issue 5 December 2014 (ISSN2320-3765) pp-515-520,
28. Sundari Tribhuvanam, H C Nagaraj "Medical Image Filtering, Segmentation and Registration with MATLAB-ITK interface", Vol. 42 No 1 March 2012(ISSN 0970-9983)
29. Sundari Tribhuvanam, H C Nagaraj, "Study of different factors affecting the menstrual cycle- A literature Survey", National conference on "Image Processing, Computer Vision and Pattern Recognition (NCIPV'09)", 2009.
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X. AREAS OF ACADEMIC INTEREST

i. Electronics and Communication Engineering
ii. Telecommunication Engineering

iii. Digital Image Processing
iv. Digital Signal Processing
v. Bio Medical Engineering and Instrumentation
vi. Medical Electronics
vii. Mobile Communication
viii. Wireless Communication

FEE
AND
ADMISSION

	Fee	
	Details of Fee as approved by State Fee Committee for the Institution	As per approval of State Fee Committee
	Time schedule for payment of Fee for the entire Programme	Yearly payment at the beginning of the academic year and one month time will be given to pay the fees
	Criteria for Fee waivers/scholarship	EWS/Merit based scholarship
	Estimated cost of Boarding and Lodging in Hostels	Rs.70000/Year Mess bill is based on dividing system, actuals per month.
10	Admission	
	Number of seats sanctioned with the year of approval	As per AICTE approval
	Number of Students admitted under various categories each year in the last three years	KCET,COMED-K and Management
	Number of applications received during last two years for admission under Management Quota and number admitted	1500 per year

Admission Procedure

	Admission Procedure	
	Mention the admission test being followed, name and address of the Test Agency/State Admission Authorities and its URL (website)	Aptitude and technical test for the management seats to get admission at NMIT NMIT Internal by the college management (No agency)
	Number of seats allotted to different Test Qualified candidate separately (AIEEE/ CET (State conducted test/ University tests/ CMAT/ GPAT)/ Association conducted test etc.)	As per Karnataka government order for self-financing colleges
	Calendar for admission against Management/vacant seats:	
	Last date of request for applications	10 days After the announcement of PUC/CBSC result
	Last date of submission of applications	One month after the last date of request for applications
	Dates for announcing final results	10 working days after submission of applications
	Release of admission list (main list and waiting list shall be announced on the same day)	10 working days after submission of applications
	Date for acceptance by the candidate (time given shall in no case be less than 15days)	30 days after the announcement of results
	Last date for closing of admission	As per Karnataka Govt order (KEA)
	Starting of the Academic session	As per VTU calendar
	The waiting list shall be activated only on the expiry of date of main list	Yes
	Criteria and Weightages for Admission	
	Describe each criterion with its respective weightages i.e. Admission Test, marks in qualifying examination etc.	---

	Mention the minimum Level of acceptance if any	50% of total marks allotted for entrance exam
	Mention the cut-off Levels of percentage and percent ilescore of the candidates in the admission test for the last three years	50% of total marks allotted for eligibility for management seats
	Display marks scored in Test etc. and in aggregate for all candidates who were admitted	Yes

15a	Information of Infrastructure and Other Resources Available	
	Number of Class Rooms and size of each	Out of 107 rooms 88 of about 77sq m
	Number of Tutorial rooms and size of each	19 tutorials rooms few of which are 76.14 sq m
	Number of Laboratories and size of each	95 labs ,around 76.14 sq m size and few are of 128sq m
	Number of Drawing Halls with capacity of each	06 rooms around 76.14 sq m
	Number of Computer Centres with capacity of each	Four computer centers with a capacity of 25 computers in each lab
	Central Examination Facility, Number of rooms and capacity of each	95 Rooms Each can accommodate 36 students
	Online examination facility (Number of Nodes, Internet bandwidth, etc.)	1Gbps 2 connections,100nNodes
	Barrier Free Built Environment for disabled and elderly persons	Annexure -01
	Fire and Safety Certificate	Annexure -02
	Hostel Facilities	Hostel facility is available for both girl and boy students Annexure -03

Physical Facilities:

Lift Facility

NITTE MEENAKSHI INSTITUTE OF TECHNOLOGY

(A Unit of Nitte Educational Trust(R),Mangalore)
(AN AUTONOMOUS INSTITUTION AFFILIATED TO VISVESVARAYA TECHNOLOGICAL UNIVERSITY,BELGAUM)
APPROVED BY UGC,ACCREDITED BY NATIONAL BOARD OF ACCREDITATION (AICTE), NEW DELHI & NAAC
Govindapura, Gollahalli, P.B. No 6429, Yelahanka, Bangalore 560-064, Karnataka, India

Signature Not Verified
Digitally signed by DR H C NAGARAJ
Date: 2022.04.13 00:40:10 PDT

NITTE MEENAKSHI INSTITUTE OF TECHNOLOGY

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Ramp Facility

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Toilets for Physically Challenged (Gents)

Toilets for Physically Challenged (Ladies)

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Govindapura, Gollahalli, P.B. No 6429, Yelahanka, Bangalore 560-064, Karnataka, India

Wheel Chair Facility

Signature Not Verified
Digitally signed by DR H C NAGARAJ
Date: 2022.04.13 00:40:10 PDT

NITTE MEENAKSHI INSTITUTE OF TECHNOLOGY

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Wide Corridors

NITTE MEENAKSHI INSTITUTE OF TECHNOLOGY

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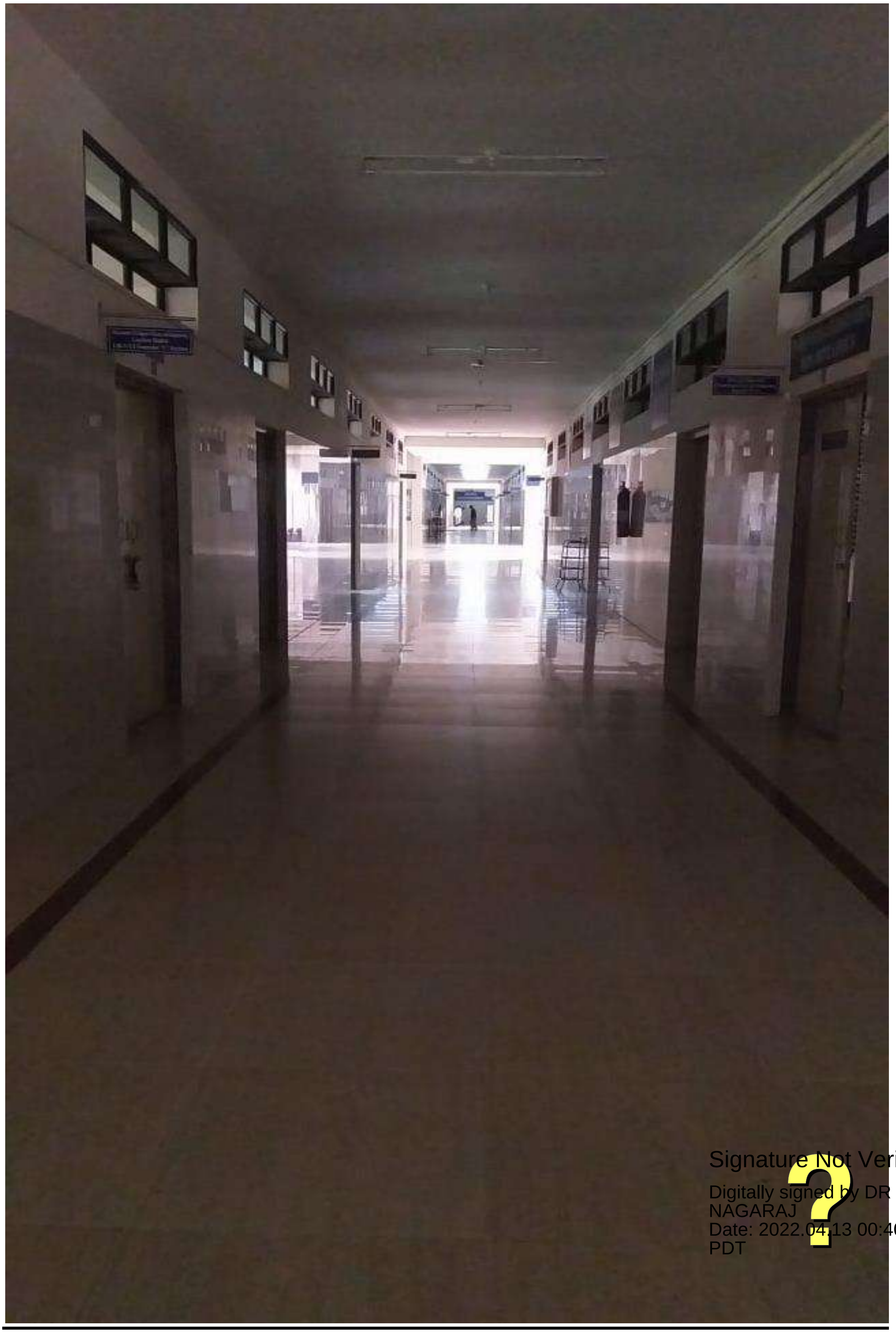
Govindapura, Gollahalli, P.B. No 6429, Yelahanka, Bangalore 560-064, Karnataka, India



Signature Not Verified
Digitally signed by DR H C NAGARAJ
Date: 2022.04.13 00:40:10 PDT

NITTE MEENAKSHI INSTITUTE OF TECHNOLOGY

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Govindapura, Gollahalli, P.B. No 6429, Yelahanka, Bangalore 560-064, Karnataka, India

Mobile Auto

Additional time is given to Physically challenged students during CIE and SEE.

APPOINTMENT OF SCRIBE

Preamble: Physically handicapped candidate writing the SEE can take assistance from another person who is normally called as AMANUENSIS (SCRIBE). A scribe can be appointed by the COE of the college in consultation with the Principal to the candidate who is disabled to write his/her examination with his own hand. While appointing anscribe the following guidelines are to be followed strictly.

10.2 Guidelines:

a. AScribe can be appointed to the candidate who is blind or disabled from writing the examination with his/her own hand.
b. A candidate seeking the assistance of anScribe shall submit an application to the COE through the HOD of the department duly recommended by the proctor, with the following documents.
   i. Medical Certificate from Medical Officer of a Government District or higher-grade hospital or a registered Medical Practitioner showing the inability of the candidate to write the examination with his/her own hand, which shall be attested by the HOD.
   ii. No relation Certificate - An undertaking by the student and the Amanuensis showing that there is no relation between them with an authentication by the Notary Public.
   iii. Attested copies of testimonials of the Scribe.
   iv. One A4 size paper hand written matter which is written by the Scribe.
   v. Three recent Passport size photos of the Scribe attested by the HOD.
c. AScribe appointed must be of lower grade education than the candidate and should not be studying in the same field (Engineering/Architecture).
d. The Chief Superintendent/ Chief coordinator shall arrange a suitable room for the candidate & the Scribe and appoint a room superintendent for the candidate who shall be changed daily.
e. If the disabled candidate (temporarily disabled) requests to write the examination with his own hand with an extra time (60 minutes for 3 hours examination i.e. 20 minutes per hour), he/she shall submit an application to the Principal of the college through the COE seeking grant of extra time to write the examination, with concerned medical certificates and the attested copies of such permission letters, if any, given earlier by any of the Boards or Universities in India.
f. The permission granted in the case of permanently disabled students shall be valid for the entire period of his study in the program, whereas, in the case of temporary disability the cility extended shall be for the specific period only

Signature Not Verified
Digitally signed by DR H C NAGARAJ
Date: 2022.04.13 00:40:10 PDT

Minimak Fire Services
No. 54, IInd Cross, Hutchins Road, St. Thomas Town, Bangalore - 560 084
Phone : 25467513, 2547067?, Fax ...
E-Mail : minimakblr@rediffmail.com
Minimak
Fire Protection Engineers

TO WHOMSOEVER IT MAY CONCERN

04 Feb 2022

CERTIFICATE

We hereby certify that the following extinguishers has been installed at NITTE MEENAKSHI INSTITUTE OF TECHNOLOGY, Govindapura, Gollahalli, Yelahanka Bangaore - 560064, on 20th Jan 2022 which stands guarantee for a period of one year from the date of installation:

Sl No	Units	Refilled on	Due dated on	Fire extinguishers			
				ABC 6 Kgs	ABC 2 Kgs	ABC 1kg	Co2 4.5 kgs
01	Nmit College PGDM NSOA NCOPS	20th Jan 22	19th Jan 22	107 Nos.	01 Nos.	09 Nos.	24Nos.
02	NSFT&ID	15th Dec 21	14th Dec 22	06 Nos.	-	-	-
03	Nmit 04 Boys hostels	03rd Feb 22	02nd Feb 23	35 Nos.	01No.	-	01No.
04	Fire buckets	48	Total	**148**	**02**	**09**	**25**
05	Fire stands	24	-	-	-	-	-

Yours faithfully,

For MINIMAK FIRE SERVICES,

T. Suresh

(T.Suresh)
Manager
Ph: 9844163292

Signature Not Verified
Digitally signed by DR H C NAGARAJ
Date: 2022.04.19 23:54:41 PDT

Minimak Fire Services
No. 54, IInd Cross, Hutchins Road, St. Thomas Town, Bangalore - 560 084.
Phone : 25467513, 25470078, Fax : 080-25470078.
E-Mail : minimakblr@rediffmail.com

Minimak
Fire Protection Engineers

04 Feb 2022

TO WHOMSOEVER IT MAY CONCERN

CERTIFICATE

We hereby certify that the following extinguishers has been installed at NITTE School of Management, Govindapura, Gollahalli, Yelahanka Bangaore - 560064, on 20th Jan 2022 which stands guarantee for a period of one year from the date of installation:

Sl No	Units	Refilled on	Due dated on	Fire extinguishers			
				ABC 6 Kgs	ABC 2 Kgs	ABC 1kg	Co2 4.5 kgs
01	Nitte school of Management	20th Jan 22	19th Jan 22	06 Nos.	-	-	02Nos.
04	Fire buckets	02	Total	**06**	**-**	**-**	**02**
05	Fire stands	01	-	-	-	-	-

Yours faithfully,

For MINIMAK FIRE SERVICES,

(T.Suresh)
Manager
Ph: 9844163292

Signature Not Verified
Digitally signed by DR H C NAGARAJ
Date: 2022.04.19 23:54:41 PDT

fssai

Form C
Government of Karnataka
Food Safety and Standards Authority of India
License under FSS Act, 2006

Office of the Designated Officer, Bangalore Urban Dist. PHI, Govt. of Karnataka

License Number: **11221302000190**

1. Name & Registered Office address of Licensee: M/s SAI YUG HOSPITALITY SERVICES (NMIT CANTEEN) NITTE MEENAKSHI COLLEGE, GOLLAHALLI, GOVINDAPURA, YELAHANKA, BANGALORE, Bangalore Urban, Karnataka-560064
2. Address of Authorized Premises: NITTE MEENAKSHI COLLEGE, GOLLAHALLI, GOVINDAPURA, YELAHANKA, BANGALORE, Bangalore North, Bangalore Urban, Karnataka-560064
3. Kind of Business: Food Services - Restaurants
Food Services - Club/Canteen
4. Dairy Business Details: No
5. Category of License: **State License**

This license is granted under and is subject to the provisions of FSS Act, 2006 all of which must be complied with by the licensee.

Place: Bangalore Urban

Issued On: 18-02-2021 (New License)

Valid Upto: 17-02-2022 (For details, refer Annexure)

Designated Officer

Designated Officer
Food Safety & Standards Dept.
Bangalore Urban Dist., PHI
Sheshadri Road, Bangalore-560 001.

Annexures:
1. Product Annexure
2. Validity Annexure
3. Non-Form C Annexure
4. Conditions Of License

Note:

1. **Application for renewal of License can be filed as early as 180 days prior to expiry date of License. You can file application for renewal or modification of License by login into FSSAI's Food Safety Compliance System(https://foscos.fssai.gov.in) with your user id and password or call us at 1800112100 for any clarification.**
2. **This License is only to commence or carry on food businesses and not for any other purpose.**
3. **This is computer generated license and doesn't require any signature or stamp by authority.**

Signature Not Verified
Digitally signed by DR H C NAGARAJ
Date: 2022.04.12 02:23:23 PDT

Product Annexure

Form C
Government of Karnataka
Food Safety and Standards Authority of India
License under FSS Act, 2006

License Number: **11221302000190**

Kind Of Business: Food Services - Restaurants

Sl.No.	Product(s)
1	16 - Prepared Foods
2	14 - Beverages, excluding dairy products

Kind Of Business: Food Services - Club/Canteen

Sl.No.	Product(s)
1	14 - Beverages, excluding dairy products
2	16 - Prepared Foods

Signature Not Verified
Digitally signed by DR H C NAGARAJ
Date: 2022.04.12 02:23:23 PDT

Validation And Renewal Annexure

Form C

Government of Karnataka

Food Safety and Standards Authority of India
License under FSS Act, 2006

License Number: 11221302000190

Validity From	Validity Upto	Issued On	Fee Paid	Type
18-02-2021	17-02-2022	18-02-2021	2000 INR	New

Note:

1. **Application for renewal of License can be filed as early as 180 days prior to expiry date of License. You can file application for renewal or modification of License by login into FSSAI's Food Safety Compliance System(https://foscos.fssai.gov.in) with your user id and password or call us at 1800112100 for any clarification.**
2. **The Application for renewal of license shall be submitted 30 days prior to the expiry date mentioned above after which Rs. 100 per day will be charged up to the date of expiry.**

Signature Not Verified
Digitally signed by DR H C NAGARAJ
Date: 2022.04.12 02:23:23 PDT

Non-Form C Annexure

Government of Karnataka

Food Safety and Standards Authority of India

License under FSS Act, 2006

License Number: 11221302000190

Person in charge of operations

Name:	RAJESH SHETTY	Qualification:	DEGREE
Contact No:	N/A	Mobile No:	6363097610
Email-ID:	nammaslnenterprises@gmail.com	Address:	Nitte meenakshi college, gollahalli, govindapura, bangalore urban
State:	Karnataka	District:	Bangalore Urban
Pin Code:	560094	Photo Id Card:	Aadhar Card
Photo Id No:	884449271398	Photo Id Expiry Date:	N/A
FoSTaC No:	Not Provided		

Person responsible for complying with conditions of license(The person must be same as mentioned in Form IX, as per FSS Regulations, 2011)

Name:	RAJESH SHETTY	Qualification:	DEGREE
Contact No:	N/A	Mobile No:	6363097610
Email-ID:	nammaslnenterprises@gmail.com	Address:	Nitte meenakshi college, gollahalli, govindapura, bangalore urban
State:	Karnataka	District:	Bangalore Urban
Pin Code:	560094	Photo Id Card:	Aadhar Card
Photo Id No:	884449271398	Photo Id Expiry Date:	N/A

Place: Bangalore Urban

Issued On: 18-02-2021 (New License)

Designated Officer

Designated Officer
Food Safety & Standards Dept.
Bangalore Urban Dist., PHI
Seshadri Road, Bangalore-560 001.

Note: Any change in above details shall be immediately communicated to authorities. Apply for modification of license for updation of details without any cost through Food Safety Compliance System (https://foscos.fssai.gov.in)

Signature Not Verified
Digitally signed by DR H C NAGARAJ
Date: 2022.04.12 02:23:23 PDT

NMIT HOSTELS

NMIT provides On-campus Hostels for about 1000 boys and 500 girls. There are four hostels for boys and three for girls. Twin and triple sharing rooms are available. Vegetarian and non-vegetarian meals are available for students.

Students may order extra and special items for all meals in addition to the standard menu. These items are available for a minimum charge.

In-house wardens take care of the needs of students and help maintain discipline in the hostel.

All the Hostels have common areas with TV and reading rooms where students can relax. Campus has good security with CCTV surveillance. Transport facility for students is available.

Amenities:

- Gym for boys and girls
- Outdoor and indoor sport facility
- Wi- Fi connectivity
- 24/7 HT power supply with 320 KVA generator
- Reading room, TV rooms and music room
- Medical center at the college and MOU with two hospitals for medical care
- Security with CCTV surveillance
- Cooperative Stationary store
- ATM of two banks --- AXIS bank and Corporation Bank
- On campus bank counter
- Open Air Theatre
- Eateries

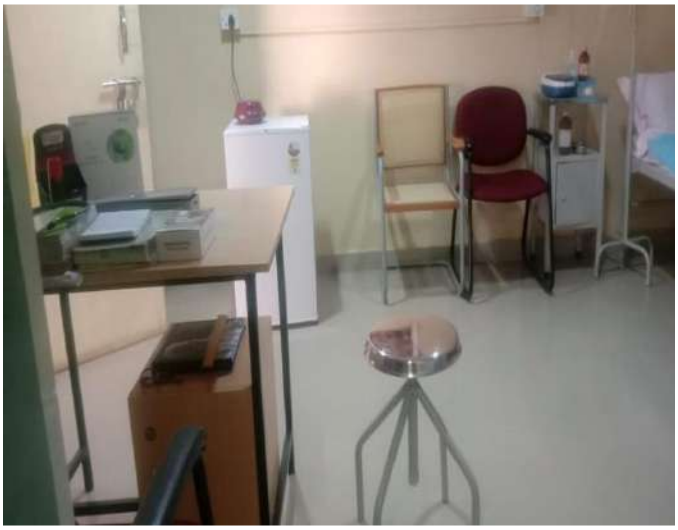
Facility at Boys' hostel

Washing Machine

GYM

Vending Machine

Medical centre



In Hostel for any emergency first aid box

First Aid

Facility at Girls hostel

1. Girl’s Gymnasium
2. Wi- Fi connectivity (24/7)
3. 24/7 backup power supply
4. Reading rooms
5. Vendiman Machine
6. Washing Machines
7. Separate study Rooms (2)
8. Medical Facility
9. Free Yoga classes

Study rooms


Gym Room

Washing Machine

Vending machine

Yoga Class

Library

Library

Number of Library books/ Titles/ Journals available(Programme-wise)	<table><tr><th>Sl. No.</th><th>Particulars</th><th>Numbers</th></tr><tr><td>1</td><td>Titles</td><td>11,200</td></tr><tr><td>2</td><td>Volumes</td><td>83,890 Print Books-58,733 E-Books-25,157</td></tr><tr><td>3</td><td>National Journals</td><td>110</td></tr><tr><td>4</td><td>International Journals</td><td>5754</td></tr><tr><td>5</td><td>Technical Magazines</td><td>20</td></tr></table>
List of online National/ International Journals subscribed	Annexure-2
E- Library facilities	Annexure-3
National Digital Library(NDL) subscription details	**National Digital Library(NDL) subscription details** NDLI Club Registration Number: INKANC3HMVR4KJE

Annexure-2

National Journals

Dept. of Aeronautical Engineering

Sl.No.	Title	Frequency
1	ICAO JOURNAL (ICAO 01)	Quarterly
2	Journal of Automobile Engineering and Applications	Half-Yearly
3	Advances in Aerospace Science & Applications	Half-Yearly
4	Jnl of Aerospace Sciences & Technologies	Quarterly
5	Indian Jnl of Aerospace Engineering.	Half Yearly
6	Indian Journal of Advances in Robotics & Automation	Half Yearly

Dept. of Artificial Intelligence & Machine Learning

Sl.No.	Title	Frequency
1	ICTACT Journal on Soft Computing	Quarterly
2	Current Development In Artificial Intelligence	Half-Yearly
3	International Journal of Computer Science & Mobile Computing	Half-Yearly
4	Journal of Computer Science Engineering & Software Testing	Tri-Annual
5	Advances Research In Applied Artificial Intelligence & Neural Net.	Tri-Annual
6	Research & Review: Machine Learning and Cloud Computing	Tri-Annual

Dept. of Computer Science & Engineering

Sl.No.	Title	Frequency
1	Intl. Journal of Advanced Networking and Applications	Bi-Monthly
2	Research & Application of Web Development & Design	Tri-Annual
3	International Journal of Information Technology and Web EngG	Half-Yearly
4	Indian Jnl .of Neural Networks Research	Half-Yearly
5	International Journal of Mathematical Education	Half-Yearly
6	Indian Journal of Mathematics & Mathematical science	Half-Yearly

Dept. of Information Science & Engineering.

Sl.No.	Title	Frequency
1	Indian Journal of Advances in Electronics Engg.	Half-Yearly
2	Journal of Electronics Design & Technology	Tri-Annual
3	Indian Journal of VLSI Design	Half-Yearly

4	Int. Journal of Instrumentation Science & Engg.	Half-Yearly
5	Journal of Instrumentation Technology & Innovations	Tri-Annual
6	Journal of Telecommunication Switching systems and Networks	Tri-Annual

Dept. of Civil Engineering

Sl.No.	Title	Frequency
1	Indian concrete Journal	Monthly
2	Journal of Structural Engineering	Bi-Monthly
3	Indian Construction Journal	Monthly
4	Indian Geotechnical Journal	Bi-Monthly
5	Global.Jnl.of Structural Design and Construction	Half-Yearly
6	Ind.Jnl.of Structural Design and Construction	Half-Yearly

Dept. of Electronics & Communication Engineering

Sl.No.	Title	Frequency
1	Indian Journal of Electrical Engineering	Half-Yearly
2	IEEEMA Journal	Monthly
3	Indian Journal of Power River Valley Development	Bi-Monthly
4	IETE Journal of Research	Bi-Monthly
5	International Journal of Applied Physics	Half-Yearly
6	CPRI Journal	Quarterly

Dept. of Electrical & Electronics Engineering

Sl.No.	Title	Frequency
1	Indian Journal of Electrical Engineering	Half-Yearly
2	IEEEMA Journal	Monthly
3	Indian Journal of Power River Valley Development	Bi-Monthly
4	IETE Journal of Research	Bi-Monthly
5	International Journal of Applied Physics	Half-Yearly
6	SRELS Journal of Information Management	Monthly

Dept. of Mechanical Engineering

Sl.No.	Title	Frequency
1	Indian Journal of Mechanical Engineering & Research	Half-Yearly
2	Journal of Mechanics & Mems	Half-Yearly
3	Journal of Manufacturing Engineering	Quarterly
4	Mapan - Journal of Metrology Society of India	Quarterly
5	Manufacturing Technology Today	semi-annual
6	INT.JNL.OF DESIGN ENGG & TECHNOLOG (GRP 141)	Half-Yearly

Dept. of Data Science & Machine Learning

Sl.No.	Title	Frequency
1	Advancement of IoT in Blockchain technology and its applications	Tri-Annual
2	International Journal of Information Technology & Database Sys.	Half-Yearly
3	International Journal of Data Modelling in Knowledge Manag.	Half-Yearly
4	International Journal of Data Analysis and Information Systems	Half-Yearly
5	International Journal of Data Mining and Warehousing.	Half-Yearly
6	International Journal of Combinatorial Graphics and Applications	Half-Yearly

Dept. of Basic Sciences

Sl.No.	Title	Frequency
1	Journal Modern Chemistry & Chemical Technology	Tri-Annual
2	International Journal of Pure & Applied Physics	Half-Yearly
3	Indian Journal of Physics	Monthly

Dept. of M. Tech- Aeronautical Engineering

Sl.No.	Title	Frequency
1	Indian Journal of Aeronautical Engineering Research & Development	Half-Yearly
2	Indian Journal of Aerospace & Mechanical Engineering	Half-Yearly
3	Journal of Aerospace Engineering & Technology	Tri-Annual
4	VAYU Aerospace Review	Bi-Monthly
5	Air power Journal	Quarterly

Dept. of M.Tech- Computer Science & Engg

Sl.No.	Title	Frequency
1	International Journal of Scientific Res. in Computer Sciences & Engg.	Half-Yearly
2	SIGACT(ALGORITHMS & COMPTN.THEORY)	Quarterly
3	International Journal of Next-generation Computing	Half-Yearly
4	Journal of 'The Indian Mathematical Society'	Quarterly
5	Indian Journal of Advance In Computer Science & Engg.	Half-Yearly

Dept. of M.Tech- Data Science

Sl.No.	Title	Frequency
1	Journal of Big Data Technology and Business Analytics	Tri-Annual
2	Journal of Innovations in Data Science and Big Data Management	Tri-Annual
3	Journal of Neural Computing Systems	Half-Yearly
4	Journal of Cyber Security in Computer System	Tri-Annual
5	International Journal of Business Analytics and Intelligence.	Half-Yearly

Dept. of M. Tech-VLSI & Embedded Systems

Sl.No	Title	Frequency
1	International Journal of Information & Communication Technology	Half-Yearly
2	International Journal of Network & Mobile Technologies	Half-Yearly
3	International Journal of Embedded System & Computer Engg.	Half-Yearly
4	International Journal for Advances VLSI Design	Half-Yearly
5	IOSR Journal of VLSI & Signal Processing	Bi-Monthly

Dept. of M. Tech- Machine Design

Sl. No.	Title	Frequency
1	Journal of The Institution of Engineers (India): Series C	Bi-Monthly
2	Journal of The Institution of Engineers (India): Series D	Bi-Monthly
3	Journal of The Institution of Engineers (India): Series E	Half-Yearly
4	Journal of Automation & Automobile Engineering	Tri-Annual
5	Journal of Mechatronics & Automation	Tri-Annual

Dept. of M.Tech- Defence Technology

Sl.No.	Title	Frequency
1	Journal of Scientific and Industrial Research	Monthly
2	Indian Journal of intellectual Property Rights	Quarterly
3	Indian Journal of Engineering and Material Sciences	Quarterly
4	Journal of the Indian Institute of Science	Quarterly
5	Current Science	

Dept. of M.Tech- Structural Engineering

Sl.No.	Title	Frequency
1	International Journal of Geotechnic & Environment	Half-Yearly
2	Journal of Indian Water Works Association	Quarterly
3	Journal of Construction Management,	Quarterly
4	International Journal of Construction Engineering & Management	Half-Yearly
5	Indian Journal of Construction Engineering & Technology	Half-Yearly

Dept. of M.Tech-Renewable Energy

Sl.No.	Title	Frequency
1	International Journal of Power Engineering	Half-Yearly
2	International Journal of Power System & Energy Conversion	Half-Yearly
3	Trends in Electrical Engineering	Tri-Annual
4	IOSR Journal of Electrical & Electronics Engineering	Bi-Monthly
5	International Journal Electrical Power Energy	Half-Yearly

Dept. of Management Studies

Sl.No.	Title	Frequency
1	Journal of Management & Entrepreneurship	Quarterly
2	IIMB Management Review	Quarterly
3	Journal of Asian Business Management	Half-Yearly
4	Indian Journal of Economics & Business	Half-Yearly
5	Indian Journal of Finance & Economics Management	Half-Yearly
6	South Asian Journal of Management	Quarterly
7	Harvard Business Review	Tri-Annual

Department of MCA

Sl.No	Title	Frequency
1	Indian Journal of Computer Graphics & Visualiztion	Half-Yearly
2	Indian Journal of Digital Information Technology	Half-Yearly
3	Journal of Software Project Management & Quality Assurance	Half-Yearly
4	Journal of Web Development and Web Designing	Tri-Annual
5	Journal of Android and IOS Applications and Testing	Tri-Annual

International Journals subscribed

E-journal Databases:

Sl.No	E-journal Database	No. of E-journals	Web-address
1	IEEE-IEL Online	Journals-193	https://ieeexplore.ieee.org/Xplore/home.jsp
2	Science Direct	Journals-296	https://www.sciencedirect.com
3	Emerald	Journals-120	https://www.emeraldinsight.com/
4	Taylor & Francis	Journals-555	www.tandfonline.com
5	Springer Nature	e-Journals-690	https://link.springer.com
6	ProQuest	e-Journals-3900	https://www.proquest.com/
7	Turnitin	Plagiarism Originality Online Check	https://www.turnitin.com/
8	NetAnalytiks	Writing Grammar Tool	https://sententia.online/

E-Book Database:

Sl.No.	Database	No. of E-Books	Web-address
1	CRC	259	www.crcnetbase.com/ www.crcpress.com
2	Taylor & Francis	5731	www.tandfonline.com
3	Springer	13004	www.link.springer.com
4	McGraw Hill Education	505	http://mcgrawhilleducation.pdn.ipublishcentral.com/
5	New Age International	220	http://www.newagepublishers.com/servlet/nahome
6	Packt	5002	https://prod.packtpub.com/in/
7	Elsevier	436	https://www.sciencedirect.com/
	Total	25157	
	Rare books		www.archive.org; www.gutenberg.org

Annexure-3

E- Library facilities

PCs	P-IV	40 No.
Printers	Laser	1 No.
Scanner	HP Scanjet-5590	1 No.
Barcode Scanner	Symbol	3 No.

Digital Library Services/Facilities

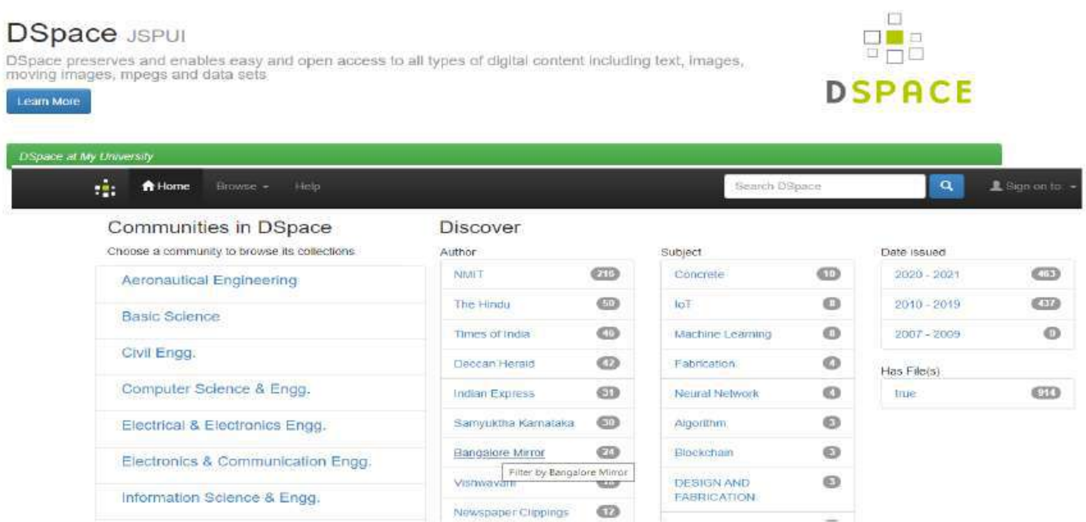
- Reprography
- Access to Electronic Resources
- Printing
- Scanning
- CD Writing
- E-Journals
- E-Books
- CDs & DVDs

- DSpace: DSpace –An Institutional Repository Software
- Online Courseware:National Programme for Technology Enhanced Learning (NPTEL)
- Archiving E-Books in Calibre Software
- National Digital Library of India(NDLI)
- Remote Access Facilities-MapMyAccess
- Anti-Plagiarism Web-Tool-TURNITIN
- Grammar Tool-Lanquill
- Links to MOOCs, Swayam, Epg Pathshala, Vidyamitra, VTU EShikhana, Spoken Tutorials etc..

DSpace:

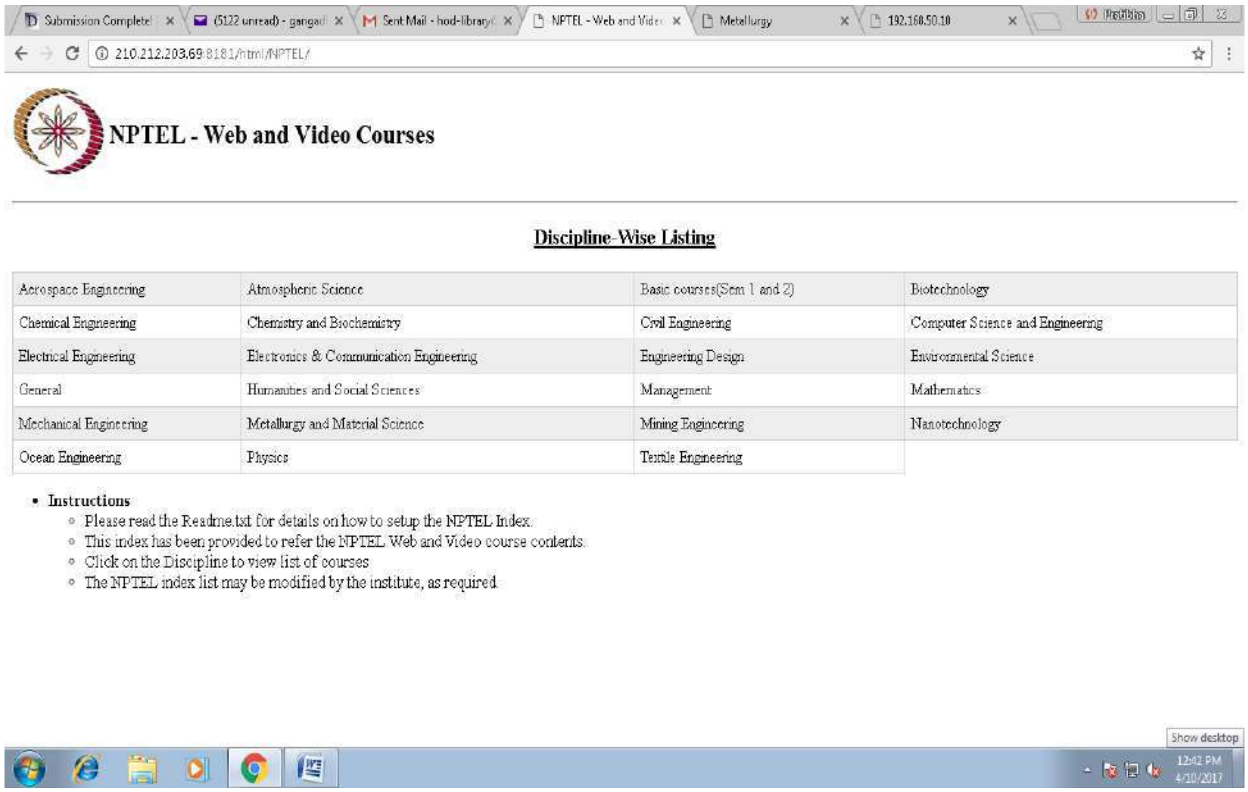
DSpace is institutional repository software that preserves and enables easy and open access to all types of digital content including text, images, moving images, mpegs and data sets.

DSpace is the software of choice for academic, non-profit, and commercial organizations building open digital repositories. It is free and easy to install "out of the box" and completely customizable to fit the needs of any organization. DSpace preserves and enables easy and open access to all types of digital content including text, images, moving images, mpegs and data sets. Users can access E-Seminar Papers/ Journal Articles –presented/published by the Faculty Members (NMIT); Newspaper clippings about NMIT, STUDSAT project-accessed through 'DSpace' software. Resources archived in DSpace can be accessed in the http://172.17.15.168:8080/xmlui/



National Programme for Technology Enhanced Learning (NPTEL)-Online   E-Resource:

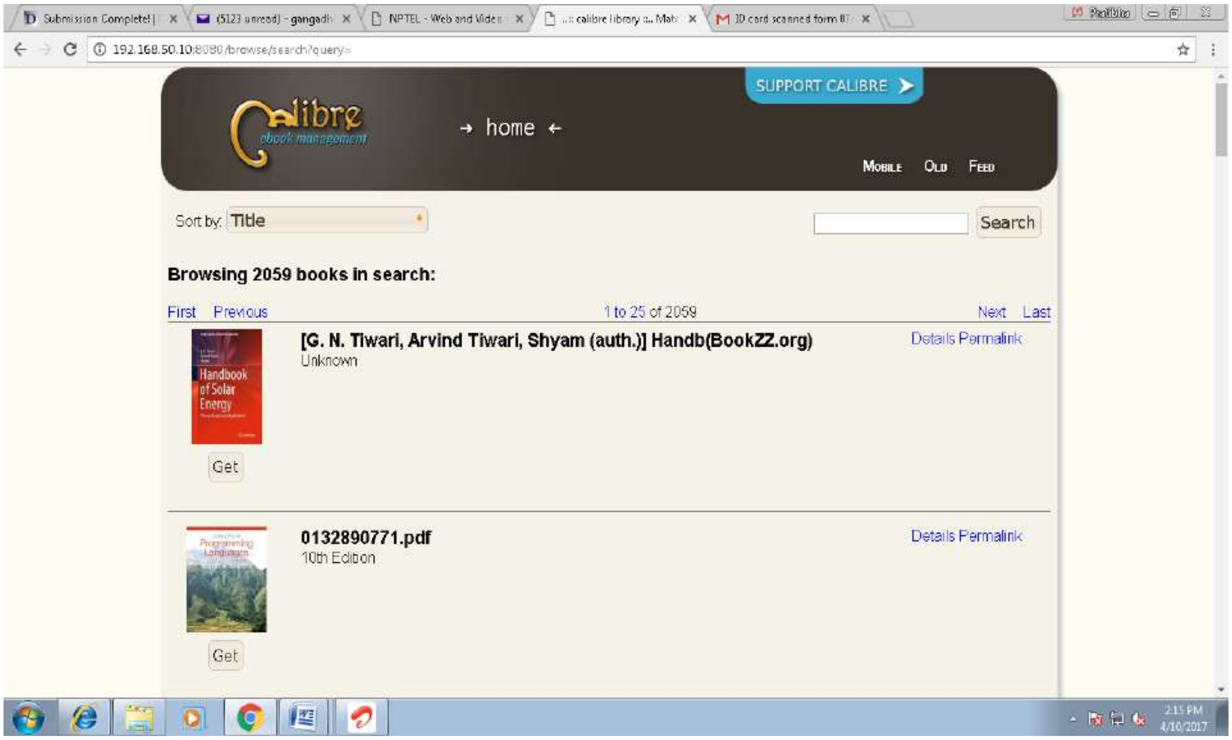
We have uploaded Video courses, Lecture notes, power point presentations prepared by National Programme for Technology Enhanced Learning (NPTEL). This resources can be accessed inside the campus at https://nmit.ac.in/pdf/e-Content-URL.pdf Click Discipline, select Content at right end.



NPTEL courseware is well utilized by the faculty members and students. Based on this courseware, online certification course from IIT, Madras will be issued, where extra credits will be given to the students.

Archiving E-Books in Calibre Software

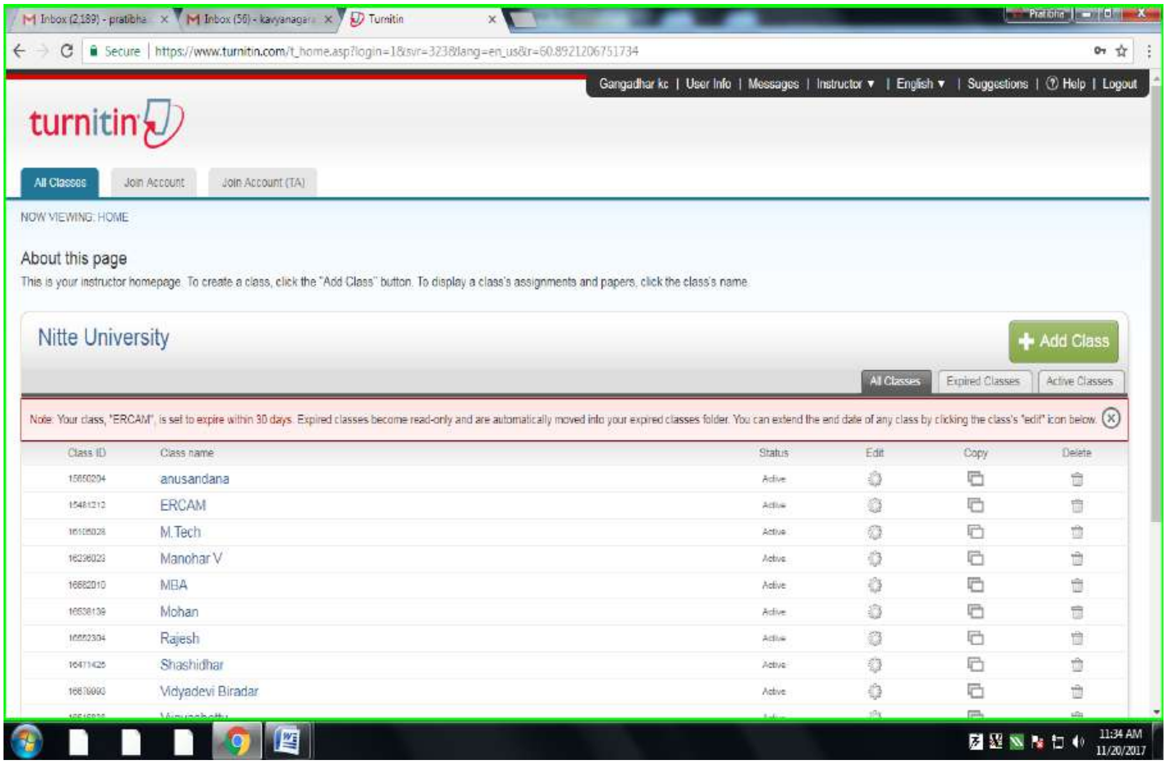
Calibre is Free Book Indexing software where more than 2300 Text and Reference E-books are loaded. The E-books can be accessed/ downloaded from http://172.17.13.57:8080 in the campus only. These can be searched by Author, Title, Subject Language.



More than 2300 Open E-Books are indexed and preserved in Calibre Software. It is accessible within the campus only.

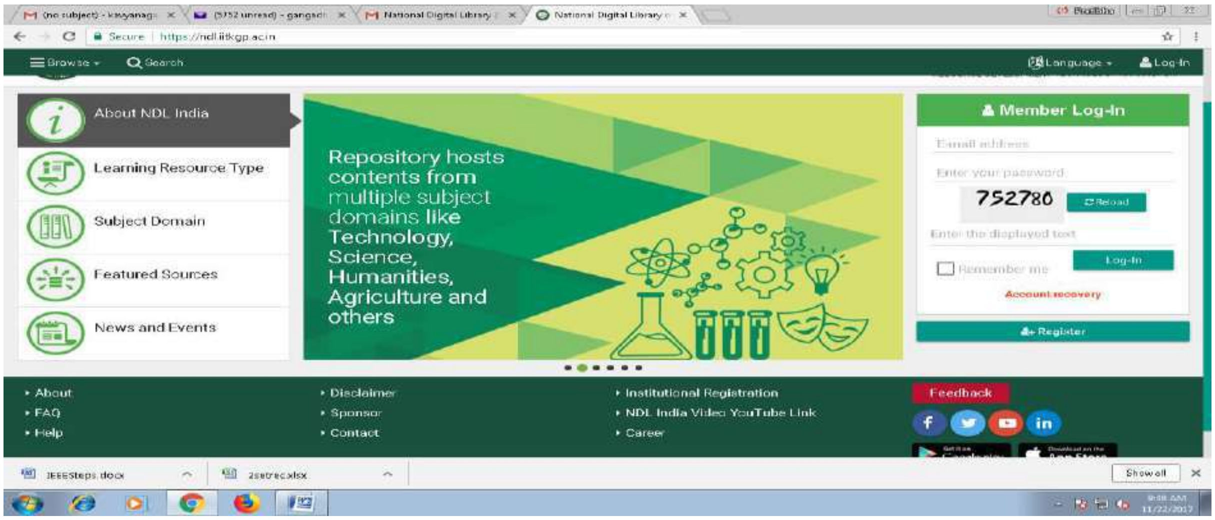
Anti-Plagiarism Web-Tool-TURNITIN

Turnitin is leading software used by researchers all over the world for checking originality and prevention of plagiarism. Library has subscribed to this software to check similarity index of the document. So that, students can avoid plagiarism and inculcate best practices while using /citing material written by other people. Students of UG, PG courses and faculty members are encouraged to check their projects/thesis/articles using this software.



National Digital Library of India (NDLI)

National Digital Library (NDL) is an initiative of MHRD through IIT, Kharagpur. We have got institutional membership for NDL and created accounts for students and staff members where they can access to its collection. The NDL collection has more than 11,72,133 items related to Engineering, Social Sciences, Philosophy in the form of articles, books, theses, audio lectures, video lectures, manuscripts etc.


National Digital Library
https://ndl.iitkgp.ac.in
Browse
Search
Language
Log-In
About NDL India
Learning Resource Type
Subject Domain
Featured Sources
News and Events
Repository hosts contents from multiple subject domains like Technology, Science, Humanities, Agriculture and others
Member Log-In
Email address
Enter your password
752780
Reload
Enter the displayed text
Remember me
Log-In
Account recovery
Register
About
FAQ
Help
Disclaimer
Sponsor
Contact
Institutional Registration
NDL India Video YouTube Link
Career
Feedback
IEEESteps.docx
2setrec.xlsx
Show all

Annexure-4

National Digital Library(NDL) subscription details

NDLI Club Registration Number: INKANC3HMVR4KJE

LABORATORY WORKSHOP AND COMPUTING FACILITY

AERONAUTICAL ENGINEERING DEPARTMENT

List of Major Equipment/Facilities in each Laboratory/Workshop

Sl. No	Name of the Laboratory	Major Equipment's
1	Aerodynamics Lab	Subsonic wind tunnel
2	Solid Mechanics Lab	Computerized Universal Testing Machine
3	Composite Material lab	Hand Layup Set Up Vacuum bag setup
4	Flight Physics Lab	Simulator Air bus 380
5	Research center	Amwin Workstation, corei7, 12 Generation, 64GB RAM, 1TB SSD.

List of Experimental Setup in each Laboratory/Workshop

Sl. No	Name of the Laboratory	Experimental setup
1.	Aerodynamics Lab	➢ Computerized subsonic wind tunnel ➢ Smoke flow generator ➢ Data acquisition system
2.	Solid Mechanics Lab	➢ Computerized Universal Testing Machine ➢ Vickers/Brinell Hardness Testing Machine ➢ Digital Torsion Testing Machine ➢ Impact Testing Machine ➢ Brinell Hardness Testing Machine ➢ Digital Fatigue Testing Machine ➢ Rockwell Hardness Testing Machine
3.	Structures Lab	➢ Vibration of Beam setup ➢ Beam test setup ➢ Wagner beam setup ➢ Column test apparatus
4.	Aircraft Propulsion Lab	➢ Free/ forced convection apparatus ➢ Axial compressor and turbine blade ➢ Subsonic free jet / wall jet setup ➢ Combustion performance study in duct ➢ Nozzle flow measurements ➢ Propeller performance setup ➢ Bomb calorie meter ➢ Study of premixed flame characteristics
5.	Composite Material lab	➢ Vacuum bagging setup ➢ Hand Layup Set Up ➢ Filament Winding Set Up ➢ Autoclave ➢ Hand Injection Moulding ➢ NDT Set Up ➢ Tensile And Flexural Testing ➢ Composite Beam Test Set Up ➢ Hydraulic Press
6.	Design Modeling & Analysis Lab & Simulation lab	➢ Desktop Computer- 56 ➢ Laptop and Accessories ➢ UPS-15KVA ➢ LAN/ WAN ➢ Epson Laser Printer ➢ Hp scan jet scanner ➢ Hp printers ➢ Projector with screen ➢ Software ➢ MATLAB 2022 ➢ 3D experience ➢ Windows 10Pro

7.	Aircraft System Lab	➢ Hydraulic flow System ➢ Hydraulic Pressure System ➢ Hydraulic Break system ➢ Fuel System(Filter clogging simulator) ➢ Breaking Loading test Rig ➢ Sukhoi 30MKI
8.	Aircraft Structures Design Lab	➢ Aero Structural Components, ➢ Column Test Set Up. ➢ Creep Testing Machine. ➢ Photo Elastic Apparatus ➢ Bending Stresses In a Beam. ➢ Fatigue Testing Machine ➢ Indeterminate Beam Structure- Digital. ➢ Beam Test Set Up. ➢ Thin Walled Pressure Vessel. ➢ Pin Jointed Frame Analysis. ➢ Uniaxial Testing Frames. ➢ Universal Vibration Test Apparatus
9.	Avionics Lab	➢ ARM Cortex M4 Microcontroller Kit ➢ Microwave Signal Source (VCO) ➢ Transmitting antenna turn table ➢ Receiving antenna turn table ➢ Transmitting Dipole antenna ➢ Receiving Dipole antenna ➢ Desktop Computer- 26 ➢ UPS-10KVA ➢ LAN/ WAN ➢ Software ➢ 3D experience ➢ Windows 10 Pro
10	Flight Physics Lab	➢ Hanger ➢ CESSNA 172 ➢ Simulator Air bus 380 ➢ Desktop Computer -9 ➢ Projector ➢ UPS 10KVA ➢ LAN/WAN ➢ Software ➢ Windows 10 Pro
11	Research Centre	➢ Telescope ➢ Wireless Speaker ➢ Camera ➢ Amwin Workstation ➢ Desktop Computer – 6 ➢ Laptop -1 ➢ Projector

Computing Facilities

Sl.No	Lab Name	Details
1	Design Modeling & Analysis Lab & Simulation lab	Desktop computers- 57 Specifications 16GB RAM, core i3,1TB SSD -30Nos 8 GB RAM, core i5, 1TB SSD -2 Nos 4GB RAM, core i3, 1TB SSD -10Nos 2GB RAM, corei3, 500GB SSD -15 Nos Accu touch Smart Board- 8GB RAM, corei5, 500GB SSD Projector LAN connection = 56
2	Avionics Lab	Desktop computers- 26 Specifications 8 GB RAM, core i5, 1TB SSD -18 Nos 2GB RAM, corei3, 500GB SSD -8 Nos LAN connection = 20 Projector
3	Flight Physics Lab	Desktop computers- 9 Specifications 4GB RAM, core i3, 1TB SSD -6Nos 2GB RAM, corei3, 500GB SSD -2 Nos Projector LAN -9
4	Research Centre	Workstation-1 Specifications Desktop computers- 7 Specifications 16GB RAM, core i5,1TB SSD -3Nos 8 GB RAM, core i5, 1TB SSD -3Nos Lap Top -8 GB RAM, core i5, 512 GB SSD Projector Wired and Wireless Mic and Speaker-2 nos Web cam LAN-7
5	BMT Lab	Desktop computers-1 Specifications 4GB RAM, core i3, 1TB SSD -1No HP Laser Printer

Sl.No	particulars	Details
1	Internet Bandwidth	1GBbps

Number and configuration of System

Sl.No	Configuration of system	Total No. of Systems
1	16GB RAM, core i3,1TB SSD	30
2	16GB RAM, core i5,1TB SSD	3
3	8 GB RAM, core i5, 1TB SSD	20
4	8 GB RAM, core i5, 1TB SSD	3
5	4GB RAM, core i3, 1TB SSD	15
6	2GB RAM, corei3, 500GB SSD	25
7	Lap Top -8 GB RAM, core i5, 512 GB SSD	1
8	Amwin Workstation, corei7, 12 Generation, 64GB RAM, 1TB SSD.	1
9	Hp Note book - Core i3 ,15 Gb/8GB Ram ,512 Gb SSD	1
10	Real data flight simulator 1.Operating system- windows 10 version 18362.0 2. Architecture- x64 3. DirectX- Version11 4. Memory- 32GB 5. Video memory- 4GB 6. Processor- Intel i7-10400, AMD Ryzen7 1500X 7. Graphics- NVIDIA GTX 1070, AMD Radeon RX 590 8. All Demonstration instruments are installed with a 12V-20A Adaptor for DC supply.	1

Special purpose facilities available (Conduct of online Meetings/Webinars/Workshops, etc.)	
Sl.No	**Equipment**
1.	Accu touch Smart Board- 8GB RAM, corei5, 500GB SSD
2.	EPSON Projectors-5Nos
3.	Wired and Wireless Mic and Speaker-2 nos
4.	Web cam
5	I Scribe -5 nos
6	Hp Note book -1 Core i3 15 Gb/8GB Ram 512 Gb SSD

Total number of system connected by LAN

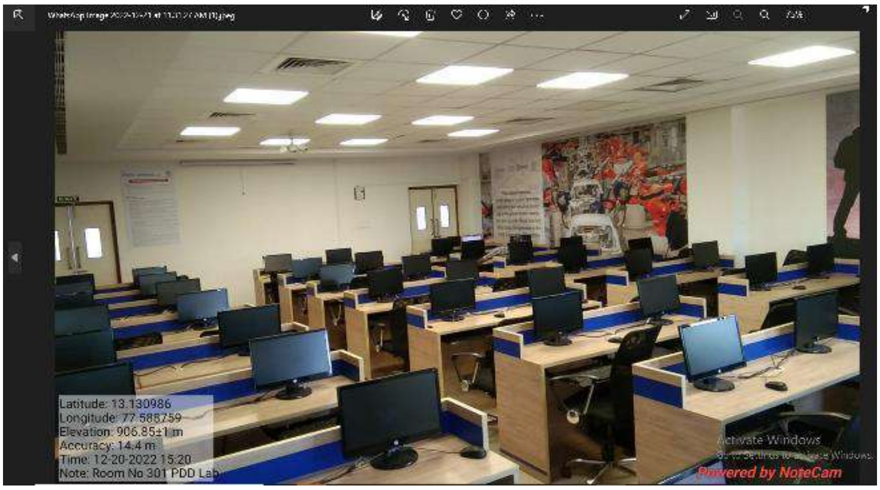
Sl.No.	Total Connection LAN
1	92

Major software packages available

Sl.No.	Software
1	MATLAB 2022
2	Windows 10 Pro
3	3D Experience
4	windows 10 version 18362.0

Glimpses of Labs and classrooms in the Department

Facilities for conduct of classes/courses in online mode (Theory & Practical)	
Sl.No	**Equipment**
1.	Accu touch Smart Board- 8GB RAM, corei5, 500GB SSD BENQ smart board
2.	EPSON Projectors-5Nos
3.	Wired and Wireless Mic and Speaker-2 nos
4.	Web cam
5	I Scribe -5 nos
6	Hp Note book -1 Core i3 15 Gb/8GB Ram 512 Gb SSD


Latitude: 13.130986
Longitude: 77.588759
Elevation: 906.85±1 m
Accuracy: 14.4 m
Time: 12-20-2022 15:20
Note: Room No 301 PDD Lab
Activate Windows
Powered by NoteCam


Latitude: 13.130971
Longitude: 77.58876
Elevation: 906.85±1 m
Accuracy: 20.0 m
Time: 12-20-2022 15:25
Note: Aircraft System Lab
Activate Windows
Powered by NoteCam


Latitude: 13.128771
Longitude: 77.58666
Elevation: 900.65±2 m
Accuracy: 14.6 m
Time: 12-20-2022 14:55
Note: Room No 033 Aerodynamic Lab
Powered by NoteCam


Latitude: 13.129152
Longitude: 77.586606
Elevation: 900.65±5 m
Accuracy: 16.5 m
Time: 12-20-2022 15:00
Note: Hanger Flight Simulation Lab
Activate Windows
Powered by NoteCam


PSLV
Latitude: 13.129001
Longitude: 77.585743
Elevation: 905.15±1 m
Accuracy: 13.4 m
Time: 12-20-2022 14:41
Note: Room No 349 Aerospa R&D Center
Activate Windows


Latitude: 13.128869
Longitude: 77.586489
Elevation: 908.45±1 m
Accuracy: 17.7 m
Time: 12-20-2022 14:52
Note: Room No 370 Simulation Lab
Powered by NoteCam


Latitude: 13.128791
Longitude: 77.586366
Elevation: 903.15±3 m
Accuracy: 18.0 m
Time: 12-20-2022 14:28
Powered by NoteCam


Latitude: 13.12901
Longitude: 77.58636
Elevation: 899.95±8 m
Accuracy: 21.9 m
Time: 12-20-2022 14:30
Note: Room No 377 Staff Room
Activate Windows
Powered by NoteCam


Latitude: 13.128712
Longitude: 77.586485
Elevation: 908.45±1 m
Accuracy: 12.5 m
Time: 12-20-2022 14:23
Activate Windows
Go to Settings to activate Windows.


Latitude: 13.128852
Longitude: 77.586424
Altitude: 817.3±3 m
Accuracy: 17.9 m
Time: 12-20-2022 14:27
Note: Room No 369 Structure Lab
Activate Windows
Powered by NoteCam


Latitude: 13.128727
Longitude: 77.58642
Elevation: 908.95±4 m
Accuracy: 14.4 m
Time: 12-20-2022 14:19
Note: Room No 367 Class Room
Powered by NoteCam


Latitude: 13.128639
Longitude: 77.586515
Elevation: 908.45±1 m
Accuracy: 12.0 m
Time: 12-20-2022 14:14
Note: Room No 361 Flight Physics Lab
Activate Windows
Powered by NoteCam

Details of Computers &Equipment's (CSE Dept)

Name of Lab	No. of Computers	Computers Model and Details	Operating System
M.Tech CSE R&D Lab (R.No :250)	11	**HP** Processor: Core 2 duo Hard disk: 160GB RAM: 1GB	
	02	**Oddyssey** Processor: Core 2 duo Hard disk**:** 500GB RAM**:** 2GB	
	01	**HP** Processor**:** Core 2 Quad Hard disk**:** 750GB RAM**:** 2GB &2GB	
	02	**HP** Processor**:** Intel Core i3 Hard disk**:** 500GB RAM**:** 4GB	
	01	**Lenova Think Centre** Hard disk**:** 160GB RAM**:** 2GB	
	01	**UPS:** Model **:** APC10KVA Centralized UPS 32 Batteries	
	01	**Printer:** **HP LaserJet P1007**	
	02	**N/W Switches:**	
	03	**A/C**	

Total Systems :17

SL NO	Laboratory	Description of Equipment	Qty
1	**COMPUTER LABORATORY - 1 ROOM NO-120 COMPUTER NETWORKS AND DBMS LAB**	**HP** Processor: AMD PRO A-10 Processor Speed : 3.60 GHz Hard disk: 1TB RAM: 4GB	**27**
		20 KVA UPS Online with ½ hour backup Sharing with lab1 & lab2	**-**
		1.5 Ton split AC	**04**
		D-Link & Intel, 24 & 16 port Manageable switch	**02**
		LCD Projector with Screen	**01**
2	**COMPUTER LABORATORY - 2 ROOM NO-117 ANDROID AND WEB PROGRAMMING LAB**	**DELL** Processor: Intel Core I3 Processor speed : 3.50 GHz Hard disk: 1TB RAM: 8GB	**28**
		AMWIN GPU WORKSTATION Ryzen Thread ripper 3960X Processor:3.8GHZ 32GB DDR4 3200=256GB RAM SSD:500GB NVMe SATA:12TB	**01**
		HP Processor: Intel Core I3 Processor Speed : 3.60 GHz Hard disk: 500GB RAM: 8GB	**05**
		20 KVA UPS Online with ½ hour backup Sharing with lab1 & lab2 Model : NL-203 BI UPS	**01**
		1.5 Ton split AC	**04**
		D-Link 24 & 16 port Manageable switch	**02**
		HP Laser jet 1020 Plus	**01**
		LCD Projector with Screen	**01**
		Smart Board	**01**
03	**COMPUTER LABORATORY - 3 ROOM NO-116**	**HP** Processor: Intel® Core™ I3-7100 CPU@3.90GHz Processor speed : 3.90 GHz Hard disk: 1TB RAM: 8GB	**15**

	HPC AND BIG DATA LAB	**HP** Processor: : Intel® Core™ I3-6100 CPU@3.70GHz Processor Speed : 3.70 GHz Hard disk: 1TB RAM: 4GB	**14**
		DELL Processor: Intel® Core™ I3-4160 CPU@3.60GHz Processor speed : 3.60 GHz Hard disk: 500GB RAM: 8GB	**01**
		10 KVA UPS Online with ½ hour backup Sharing with lab3 & lab4	**01**
		D-Link 16 port Manageable switch	**02**
		Smart Board	**01**
		1.5 Ton split AC	**03**
		LCD Projector with Screen	**01**
4	**COMPUTER LABORATORY - 4 ROOM NO-114** **AI WITH PYTHON AND PRODUCT DEVELOPMENT LAB**	**DELL** Processor: Intel(R) Core(TM) i3-8100 CPU @ 3.60GHz Processor speed : 3.6 GHz Hard disk: 1TB RAM: 8GB	**29**
		HP Processor: Intel® Core™ I3-6100 CPU@3.70GHz Processor Speed : 3.7 GHz Hard disk: 1TB RAM: 4GB	**01**
		D-Link 16 port Manageable switch	**02**
		1.5 Ton split AC	**03**
		LCD Projector with Screen	**01**

5	**COMPUTER LABORATORY - 5 ROOM NO-114 ADA / COMPUTER NETWORKS AND DATA STRUCTURE LAB**	**DELL** Dell OptiPlex 3060 HDD: 1TB RAM: 8GB Processor: Intel core i3 GHz Speed: 3.60 GHz	**13**
		DELL Dell OptiPlex 360 HDD:360 GB RAM: 4GB Processor: Intel core 2Duo Speed: 2.93 GHz	**17**
		D-Link 8 & 24 port Manageable switch	**02**
		1.5 Ton split AC	**03**
		LCD Projector with Screen	**01**
		10 KVA UPS Online with ½ hour backup	**01**
6	**COMPUTER LABORATORY - 6 ROOM NO-204 MICRO PROCESSOR LAB**	**HP** Processor: AMD Pro A10 Hard disk: 1TB RAM: 12GB	**01**
		HP Processor: Core i3 Hard disk: 1TB RAM: 8GB	**02**
		HP Processor: Core i3 Hard disk: 500GB RAM: 4GB	**08**
		HP Processor: Core i3 Hard disk: 500GB RAM: 2GB	**01**
		Iball Processor: Core 2 Duo Hard disk: 500GB DDR3 RAM: 2GB	**03**

7		**Oddyssey** Processor: Core 2 duo Hard disk: 500GB RAM: 4GB	**05**
		Processor: AMD Athlon 11 Hard disk: 500GB RAM: 3GB	**01**
		Model : APC 10KVA Centralized UPS 32 Batteries	**01**
		D-Link 24 port Manageable switch	**02**
		1.5 Ton split AC	**02**
7	**COMPUTER LABORATORY - 7 ROOM NO-129 C PROGRAMMING LAB AND DADC LAB**	**Think Centre** Desktop PC, Intel ® Core™ ,i3-3220 CPU@3.30GHz,2GB RAM, 500 GB Hard Disk	**20**
		HP Desktop PC, Intel ® Core™ ,i3-4230 CPU@2.90GHz,2GB RAM,500 GB Hard disk,	**09**
		Projector with screen	**01**
		D-Link 24 port Manageable switch	**02**
		1.5 Ton split AC	**02**

<table>
<tr><td rowspan="8">8</td><td rowspan="8">COMPUTER LABORATORY - 8
ROOM NO-131
C PROGRAMMING LAB
AND
DADC LAB</td><td>Think Centre
Desktop PC, Intel ® Core™ ,i3-3220
CPU@3.30GHz,2GB RAM,500 GB Hard</td><td>28</td></tr>
<tr><td>HP
Desktop PC, Intel ® Core™ ,i3-4230
CPU@2.90GHz,2GB RAM,500 GB Hard disk</td><td>05</td></tr>
<tr><td>HP
Desktop PC, Intel ® Core™ ,i3-4230
CPU@2.90GHz,4GB RAM,500 GB Hard disk</td><td>03</td></tr>
<tr><td>HP
Desktop PC, Intel ® Core™ ,i3-7100
CPU@3.30GHz,8GB RAM, 1 TB Hard disk</td><td>01</td></tr>
<tr><td>UPS : 01 Model: Hykon 15 KVA Centralized UPS</td><td>01</td></tr>
<tr><td>Projector with Screen:
Epson(EB-X05)</td><td>01</td></tr>
<tr><td>1.5 Ton split AC</td><td>02</td></tr>
<tr><td>D-Link 24 port Manageable switch</td><td>02</td></tr>
<tr><td>9</td><td>COMPUTER LABORATORY - 9
ROOM NO-133
DESIGN OF ANALOG AND
DIGITAL CIRCUITS LAB</td><td>CRO
DIGITAL IC TRAINER KIT
AC SIGNAL GENERATOR
VRPS
MULTI METER
MILI AMMETER
LAN SWITCHES
VOLT METER
DRB
DCB
12 VOLTS TRANSFORMER
IC TESTER KIT</td><td>16
26
10
11
05
06
04
11
05
02
10
01</td></tr>
</table>

10	**COMPUTER LABORATORY - 10 ROOM NO-247 PROJECT LAB AND MACHINE LEARNING LAB**	**HP** Processor: Intel Core i3 Processor Speed : 3.3 GHz Hard disk: 500GB RAM: 2&4GB	**22**
		UPS Model : Hykon 5KVA Centralized UPS 10 Batteries	**01**
		Projector with Screen(NEC):	**01**
		D-Link 24 port Manageable switch	**02**
11	**COMPUTER LABORATORY - 11 ROOM NO-250 DIGITAL IMAGE PROCESSING LAB**	**HP** Processor: Core 2 duo Hard disk: 160GB RAM: 1GB	**11**
		Oddyssey Processor: Core 2 duo Hard disk: 500GB RAM: 2GB	**02**
		HP Processor: Core 2 Quad Hard disk: 750GB RAM: 2GB &2GB	**01**
		HP Processor: Intel Core i3 Hard disk: 500GB RAM: 4GB	**02**
		Lenova Think Centre Processor: Intel Core i3 Hard disk: 160GB RAM: 2GB	**01**
		UPS Model : APC10KVA Centralized UPS 32 Batteries	**01**
		Printer: HP LaserJet P1007	**01**
		D-Link 24 port Manageable switch	**02**

		1.5 Ton split AC	**03**
12	**SUBEX LAB REASEARCH & DEVELOPMENT LAB**	**Dell** Processor Intel Xeon (Quad Core) with 3.30 GHz RAM: 8 GB Hard disk:2TB	**10**
		HP 280 G3 MT Processor : Intel Corei3 Speed : 3.9 GHz Memory : 8 GB HDD: : 1TB	**10**
		Server (Honeypot) HP Z 240 Tower Workstation/ Processor Intel® Core™ i7-7700 CPU @ 3.60 GHz/64 GB / Windows 10 Pro / Ubuntu 20.04.3 LTS / 4GB HDD / 64 bit	**01**
		Server (HPC) Intel Xeon® Silver 4216 CPU@2.10 GHz/ NVIDIA CV100GL (Tesla V100 PCIe 32GB)/ 2GB HDD / 64 bit / Ubuntu 20.04.3 LTS	**01**
		Workstation	**02**
		1.5 Ton split AC	**02**
		Projector with Screen	**01**

Details of Computers

Name of Lab	No. of Computers	Computers Model and Details	Operating System
M.Tech CSE Lab (R.No :247)	**22**	**HP** Processor**:** Intel Core i3 Processor Speed **:** 3.3 GHz Hard disk**:** 500GB RAM**: 2&**4GB	Ubuntu 20.04
	01	**UPS:** Model **:** Hykon 5KVA Centralized UPS 10 Batteries	

	01	**Projector (NEC):**	
	02	**N/W Switches:**	

List of Major Equipment / Facilities in each Laboratory / Workshop

LIST OF EXPERIMENTAL SETUP IN EACH LABORATORY /WORKSHOP

SR.NO	LABORATORY NAME	EQUIPMENT NAME	QUANTITY
1	**COMPUTER NETWORKS AND DBMS LAB**	**CPU MONITORS MOUSE KEYBOARDS LAN SWITCHES**	**27 27 27 27 02**
2	**ANDROID AND WEB PROGRAMMING LAB**	**CPU MONITORS MOUSE KEYBOARDS LAN SWITCHES PRINTER SMART BOARD**	**33 33 33 33 03 01 01**
3	**HPC AND BIG DATA LAB**	**CPU MONITORS MOUSE KEYBOARDS LAN SWITCHES SMART BOARD**	**30 30 30 30 02 01**
4	**AI WITH PYTHON AND PRODUCT DEVELOPMENT LAB**	**CPU MONITORS MOUSE KEYBOARDS LAN SWITCHES**	**30 30 30 30 02**
5	**ADA AND DATA STRUCTURE LAB**	**CPU MONITORS MOUSE KEYBOARDS LAN SWITCHES**	**30 30 30 30 02**
6	**MICROPROCESSOR LAB**	**CPU MONITORS MOUSE KEYBOARDS LAN SWITCHES MICRO PROCESSOR KIT CRO**	**30 30 30 30 02 45 03**
7	**C PROGRAMMING LAB AND DADC LAB**	**CPU MONITORS MOUSE KEYBOARDS LAN SWITCHES**	**29 29 29 29 02**

8	**C PROGRAMMING LAB**	**CPU MONITORS MOUSE KEYBOARDS LAN SWITCHES**	**37 37 37 37 02**
9	**DESIGN OF ANALOG AND DIGITAL CIRCUITS LAB**	**CRO IC TRAINER KIT AC SIGNAL GENERATOR VRPS MULTI METER MILI AMMETER VOLT METER DRB DCB 12 VOLTS TRANSFORMER IC TESTER KIT STABILIZAR**	**16 26 10 11 05 06 11 05 02 10 01 02**
10	**PROJECT LAB AND MACHINE LEARNING LAB**	**CPU MONITORS MOUSE KEYBOARDS LAN SWITCHES**	**22 22 22 22 02**
11	**DIGITAL IMAGE PROCESSING LAB**	**CPU MONITORS MOUSE KEYBOARDS LAN SWITCHES PRINTER**	**17 17 17 17 02 01**
12	**SUBEX LAB REASEARCH & DEVELOPMENT LAB**	**CPU MONITORS MOUSE KEYBOARDS LAN SWITCHES VGST SERVER**	**20 21 20 20 03 02**

Computing Facilities

Sl No	dept Name	Lab Name	No. of Computers	Minimum Config	Maximum Config	Software	
						System Software	Application Software
1	CSE	Lab 1	27	Processor: AMD pro A-10 RAM: 4GB Hard disk Drive: 500 GB	Processor: AMD pro A-10 RAM: 4 GB Hard disk Drive: 1 TB	Windows -10 pro, Ubuntu 18.04	Ms office, mysql, mongodb
2	CSE	Lab 2	33+1GPU Server	Processor: Intel Core i3 RAM: 8 GB Hard disk Drive: 500 GB	Processor: Intel Core i3,GPU SERVER AMD Ryzn Thredripper 3960x 24 core processor RAM: 8 GB ,RAM:251.6 GB Hard disk Drive: 1TB,12.5TB	Windows -10 pro, Ubuntu 18.04,Ubuntu 20.04	Andriod Studio, C Programming, AI&ML
3	CSE	Lab 3	30	Processor: Intel Core i3 RAM: 4 GB Hard disk Drive: 1 TB	Processor: Intel Core i3 RAM: 8 GB Hard disk Drive: 1 TB	Windows -10 pro, Ubuntu 20	R Studio, Spark Shell, Sbt, Scala
4	CSE	Lab 4	30	Processor: Intel Core i3 RAM: 4 GB Hard disk Drive: 1 TB	Processor: Intel Core i3 RAM: 8 GB Hard disk Drive: 1 TB	Windows -10 pro, Ubuntu 18.04	Python Programming & C Programming
5	CSE	Lab 5	30	Processor: Intel core 2Duo RAM: 4 GB Hard disk Drive: 360 GB	Processor: Intel Core i3 RAM: 8 GB Hard disk Drive: 1 TB	Windows -10 pro, Ubuntu 18.04	MS Office, CC, GCC, MySQL, NS2
6	CSE	Lab 6	30	Processor: Intel Duo core2 Duo	Processor: Intel corei3	Windows-10	

				RAM: 3 GB Hard disk Drive: 160 GB	RAM: 8 GB Hard disk Drive: 1TB	pro,Ubuntu 18.04	Microprocessor Keil, CCP, S/W testing, Multimedia, MySQL
7	CSE	Lab 7	29	Processor: Intel Corei3 RAM: 2 GB Hard disk Drive: 500 GB	Processor: Intel Corei3 RAM: 8 GB Hard disk Drive: 1 TB	Ubuntu 18.04	MySQL, MongoDB, C Programming
8	CSE	Lab 8	37	Processor: Intel Core i3 RAM: 2 GB Hard disk Drive: 500 GB	Processor: Intel Core i3 RAM: 8 GB Hard disk Drive: 1 TB	Windows -10 pro, Ubuntu 18.04	C Programming
9	CSE	Lab 10 CSE (PG) Lab	22	Processor: Intel Core i3 RAM: 2 GB Hard disk Drive: 500 GB	Processor: Intel Core i3 RAM: 4 GB Hard disk Drive: 500 GB	Windows 10 pro, Ubuntu 20.04	C,C++,Scala,Sbt,R Studio,Spark, Java
10	CSE	Lab 11 CSE R&D Lab	17	Processor: Core 2 duo RAM: 1 GB Hard disk Drive: 160 GB	Processor: Intel Core i3 RAM: 4 GB Hard disk Drive: 500 GB	Windows 10 pro	Ms Office ,Basic Softwares
11	CSE	Subex Lab	20	Processor: Intel(R) Core(TM) i3-7100CPU@3.90GHz RAM: 8 GB Hard disk Drive: 1 TB	Processor: Intel(R) Xeon(R) E-2124 CPU@3.30GHz RAM:16 GB Hard disk Drive: 2 TB	Windows -10 pro, Ubuntu 18.04	Ms Office,Security CoE Software Kit, Subex Secure and Honeypot Software.

Internet Bandwidth	Internet Bandwidth: 1Gbps

Number and configuration of System

Sl No	Department Name	Lab Name	No. of Computers	Minimum Config	Maximum Config
1	CSE	Lab 1	27	Processor: AMD pro A-10	Processor: AMD pro A-10
				RAM: 4GB	RAM: 4 GB
				Hard disk Drive: 500 GB	Hard disk Drive: 1 TB
2	CSE	Lab 2	33+1	Processor: Intel Core i3	Processor: Intel Core i3,GPU SERVER AMD Ryzn Thredripper 3960x 24 core processor GPU Server
				RAM: 8 GB	RAM: 8 GB ,RAM:251.6 GB
				Hard disk Drive: 500 GB	Hard disk Drive: 1TB,12.5TB
3	CSE	Lab 3	30	Processor: Intel Core i3	Processor: Intel Core i3
				RAM: 4 GB	RAM: 8 GB
				Hard disk Drive: 1 TB	Hard disk Drive: 1 TB
4	CSE	Lab 4	30	Processor: Intel Core i3	Processor: Intel Core i3
				RAM: 4 GB	RAM: 8 GB
				Hard disk Drive: 1 TB	Hard disk Drive: 1 TB
5	CSE	Lab 5	30	Processor: Intel core 2Duo	Processor: Intel Core i3
				RAM: 4 GB	RAM: 8 GB
				Hard disk Drive: 360 GB	Hard disk Drive: 1 TB
6	CSE	Lab 6	30	Processor: Intel Duo core2 Duo	Processor: Intel corei3
				RAM: 3 GB	RAM: 8 GB
				Hard disk Drive: 160 GB	Hard disk Drive: 1TB

7	CSE	Lab 7	29	Processor: Intel Corei3	Processor: Intel Corei3
				RAM: 2 GB	RAM: 8 GB
				Hard disk Drive: 500 GB	Hard disk Drive: 1 TB
8	CSE	Lab 8	37	Processor: Intel Core i3	Processor: Intel Core i3
				RAM: 2 GB	RAM: 8 GB
				Hard disk Drive: 500 GB	Hard disk Drive: 1 TB
9	CSE	Lab 10 CSE (PG) Lab	22	Processor: Intel Core i3	Processor: Intel Core i3
				RAM: 2 GB	RAM: 4 GB
				Hard disk Drive: 500 GB	Hard disk Drive: 500 GB
10	CSE	Lab 11 CSE R&D Lab	17	Processor: Core 2 duo	Processor: Intel Core i3
				RAM: 1 GB	RAM: 4 GB
				Hard disk Drive: 160 GB	Hard disk Drive: 500 GB
11	CSE	Subex Lab	20	Processor: Intel(R) Core(TM) i3-7100CPU@3.90GHz	Processor: Intel(R) Xeon(R) E-2124 CPU@3.30GHz
				RAM: 8 GB	RAM:16 GB
				Hard disk Drive: 1 TB	Hard disk Drive: 2 TB
	Total Systems		**306**		

Total number of system connected by LAN

Sl No	Department Name	Lab Name	No. of Computers LAN Connected
1	CSE	Lab 1	27
2	CSE	Lab 2	30+1GPU Workstation
3	CSE	Lab 3	30
4	CSE	Lab 4	30
5	CSE	Lab 5	30
6	CSE	Lab 6	30

7	CSE	Lab 7	29
8	CSE	Lab 8	30
9	CSE	Lab 10 CSE (PG) Lab	22
10	CSE	Lab 11 CSE R&D Lab	17
11	CSE	Subex Lab	18
Total number of system connected by LAN			**306**

Total number of system connected by WAN

Sl no		
1	CSE STAFF ROOM NO-108	02
2	CSE STAFF ROOM NO-110	01
3	CSE STAFF ROOM NO-112	02
4	CSE STAFF ROOM NO-113	02
5	CSE STAFF ROOM NO-123	02
6	CSE STAFF ROOM NO-124	02
7	CSE STAFF ROOM NO-125	02
8	CSE STAFF ROOM NO-126	01
9	CSE STAFF ROOM NO-111	03
	Total number WAN Connected	**17**

Software	
System Software	**Application Software**
Windows-10, Ubuntu 18.04	Ms office 365, mysql, mongodb
Windows-10, Ubuntu 18.04,Ubuntu 20.04	Andriod Studio, C Programming, AI&ML
Windows-10, Ubuntu 20	R Studio, Spark Shell, Sbt, Scala
Windows-10, Ubuntu 18.04	Python Programming & C Programming
Windows-10, Ubuntu 18.04	MS Office, CC, GCC, MySQL, NS2
Windows-10 pro,Ubuntu 18.04	Microprocessor Keil, CCP, S/W testing, Multimedia, MySQL
Ubuntu 18.04	MySQL, MongoDB, C Programming
Windows-10, Ubuntu 18.04	C Programming
Windows10, Ubuntu 20.04	C,C++,Scala,Sbt,R Studio,Spark, Java

Windows 10	Ms Office ,Basic Softwares
Windows-10, Ubuntu 18.04	Ms Office,Security CoE Software Kit, Subex Secure and Honeypot Software.

Facilities for conduct of classes/courses in online mode (Theory & Practical)

Facilities for conduct of classes		
ROON NO	**ITEMS**	**TOTAL**
128	**LCD PROJECTOR WITH SCREEN (MOUNTED)/WIFI /LAN**	**1**
130	**LCD PROJECTOR WITH SCREEN (MOUNTED)/WIFI /LAN**	**1**
132	**LCD PROJECTOR WITH SCREEN (MOUNTED)/WIFI /LAN**	**1**
134	**LCD PROJECTOR WITH SCREEN (MOUNTED)/WIFI /LAN**	**1**
135	**LCD PROJECTOR WITH SCREEN (MOUNTED)/WIFI /LAN**	**1**
138	**LCD PROJECTOR WITH SCREEN (MOUNTED)/WIFI /LAN**	**1**
307	**LCD PROJECTOR WITH SCREEN (MOUNTED)/WIFI /LAN**	**1**
310	**LCD PROJECTOR WITH SCREEN (MOUNTED)/WIFI /LAN**	**1**
312	**LCD PROJECTOR WITH SCREEN (MOUNTED)/WIFI /LAN**	**1**
M.TECH 244	**LCD PROJECTOR WITH SCREEN (MOUNTED)/WIFI /LAN**	**1**

Innovation Cell

Sl No	**Room No**	**Lab Name**	**Dimension**	**Item**	**Quantity**	**Software's**
1	136	Centre for Innovation in Cyber Security and IOT	770 sqft	Computers	18	Honeypot
				Servers	2	Arduino IDE
				Developement Boards	5 (Arduino + Pi)	

Glimpses of Labs and classrooms in the Department (CSE)


Latitude: 13.128528
Longitude: 77.588092
Elevation: 903.65±1 m
Accuracy: 21.8 m
Time: 12-21-2022 13:49
Note: ANDROID JAVA LAB
Activate Windows
Go to Settings to activate Windows.
Powered by NoteCam


Latitude: 13.12879
Longitude: 77.587929
Elevation: 903.75±1 m
Accuracy: 20.6 m
Time: 12-21-2022 13:54
Note: COMPUTER NETWORK & DAA LAB -107
Activate Windows
Go to Settings to activate Windows.
Powered by NoteCam


Latitude: 13.128535
Longitude: 77.587941
Altitude: 817.8±1 m
Accuracy: 12.8 m
Time: 12-21-2022 13:42
Note: DBMS ADA LAB -114
Activate Windows
Go to Settings to activate Windows
Powered by NoteCam
Type here to search
7:52 PM


Latitude: 13.128535
Longitude: 77.587931
Elevation: 903.65±1 m
Accuracy: 14.4 m
Time: 12-21-2022 13:43
Note: BIG DATA LAB -116
Activate Windows


Latitude: 13.128483
Longitude: 77.587628
Altitude: 817.9±1 m
Accuracy: 18.0 m
Time: 12-21-2022 13:28
Note: C program &DS lab -12
Powered by NoteCam


Latitude: 13.128512
Longitude: 77.587285
Elevation: 903.75±4 m
Accuracy: 89.2 m
Time: 12-21-2022 13:27
Note: C program&DS lab -13
Powered by NoteCam


Latitude: 13.128474
Longitude: 77.587188
Elevation: 903.55±1 m
Accuracy: 10.1 m
Time: 12-21-2022 13:23
Note: subex lab room -136
Powered by NoteCam


Latitude: 13.128508
Longitude: 77.587284
Altitude: 817.9±1 m
Accuracy: 16.4 m
Time: 12-21-2022 13:21
Note: cse class room -134
Activate Windows
Go to Settings to activate Windows.
Powered by NoteCam


Latitude: 13.128791
Longitude: 77.586807
Elevation: 906.05±2 m
Accuracy: 13.5 m
Time: 12-21-2022 14:41
Note: Lab M.Tech Room -247
Activate Windows
Powered by NoteCam


Latitude: 13.12903
Longitude: 77.586874
Elevation: 901.35±1 m
Accuracy: 29.5 m
Time: 12-21-2022 14:42
Note: R&D Center Room -25
Activate Windows
Go to Settings to activate Windows.
Powered by NoteCam

Department of Electronics and Communication Engineering

List of major equipment in each lab

s.no	Name of the laboratory	Major Equipment
1	DCN LAB	WiCOM OFDM Kit, DSO, Interactive Panel, ALITIM mother board, Spectrum analyser 2.3GHZ, RX and
2	Communication LAB1	Microwave test bench, Antenna setup, OFC kits, Communication Kits, Gunn diode, CRO, Function Generator, DSO ,DIGITAL FUNCTION GENERATOR
3	Electronic circuits LAB2	power Supply,Digital Trainer kits, DSO ,DIGITAL FUNCTION GENERATOR
4	ECE LAB3	Microprocessor 8051 kits,microcontroller kits, projecetrs , DSP kits , Vivado kits
5	Digital lab LAB5	COMPUTERS
	Power electronics LAB6	DRB, LCR Meter, CRO,Signalgenerator,RPS,Stabilizer, multi output. powersupply, RPS dual
6	LIC LAB7	DRB, LCR Meter, CRO, Signalgenerator, RPS, Stabilizer, multi output. powersupply, RPS dual
7	PROJECT LAB	UPS, projectors
8	R & D LAB	Psoc Development Kit, Virtex-2pro Development Kit, Sparton-III Development kit, Arm Linux Development, Z-Board, Nexys-4,
9	Embeded system lab 8	ARM TIVA STARTER KIT
10	Center for Nanomaterial and MEMS	SPIN COATER, EVAPORATION UNIT, CVD FURNACE, MAGNETIC STIRRER

List of experimental setup in each lab / workshop

s.no	name of the laboratory	major equipment
1	DCN LAB	WiCOM OFDM Kit, DSO, Interactive Panel, ALITIM mother board, Spectrum analyser 2.3GHZ, RX and
2	Communication LAB1	Microwave test bench, Antenna setup, OFC kits, Communication Kits, Gunn diode,

3	Power electronics LAB6	AC Vltage converter setup , DC motor setup , Universal Motor setup , series inverter , stepper motor controller , Parallel inverter , UJT firing ciruit
4	R & D LAB	Psoc Development Kit, Virtex-2pro Development Kit, Sparton-III Development kit, Arm Linux Development, Z-Board, Nexys-4,
5	Center for Nanomaterial and MEMS	SPIN COATER, EVAPORATION UNIT, CVD FURNACE, MAGNETIC STIRRER

COMPUTING FACILITIES

S.NO	LAB NAME	COMPUTER NAME	DISCRIPTION	QUANTITY
1	Embedded Systems Solutions Lab(ECE LAB 11)	HP	MODEL :HP 280 G1 MTPROCESSOR: INTEL CORE I3 CPU @3.60GHZ, RAM:4GB DDR3 RAM , HARD DISK :500GB HDD	28
2	DCN LAB(ECE LAB 7)	HP	MODEL :HP 280 G1 MTPROCESSOR: INTEL CORE I3 CPU @3.60GHZ, RAM:4GB DDR3 RAM , HARD DISK :500GB HDD	20
3	Electronic circuits LAB2	HP	MODEL :HP 280 G1 MTPROCESSOR: INTEL CORE I3 CPU @3.60GHZ, RAM:4GB DDR3 RAM , HARD DISK :500GB HDD	1
4	5G LAB (ECE LAB 3)	HP	HP 280 G6 DESKTOP CORE i3 -10100, 3.6GHZ , 1TB HDD , 8GB RAM	29
5	R&D LAB	DELL	DELL OPTIPLEX , 11TH GEN , INTEL CORE I5-11500, 2.70GHZ, 16GB RAM ,	10
		HP ,IBALL , LENOVO	MODEL :HP 280 G1 MTPROCESSOR: INTEL CORE I3 CPU @3.60GHZ, RAM:4GB DDR3 RAM , HARD DISK :500GB HDD	9
6	VLSI LAB	HP	MODEL :HP 280 G1 MTPROCESSOR: INTEL CORE I5 CPU @3.60GHZ 8TH GEN, RAM:4GB RAM , HARD DISK :1TB HDD	19
		HP	MODEL :HP 280 G1 MTPROCESSOR: INTEL CORE I3 CPU @3.60GHZ, RAM:4GB DDR3 RAM , HARD DISK :500GB HDD	3
		I BALL	500GB HDD, 4GB RAM ,INTEL DUAL CORE	2

7	PROJEECT LAB	I BALL , HP , ODYSSEY	MODEL :HP 280 G1 MTPROCESSOR: INTEL CORE I3 CPU @3.60GHZ, RAM:4GB DDR3 RAM , HARD DISK :500GB HDD	4
8	STAFF	HP	MODEL :HP 280 G1 MTPROCESSOR: INTEL CORE I3 CPU @3.60GHZ, RAM:4GB DDR3 RAM , HARD DISK :500GB HDD	23
9	ECE LAB 4	HP	MODEL :HP 280 G1 MTPROCESSOR: INTEL CORE I3 CPU @3.60GHZ, RAM:4GB DDR3 RAM , HARD DISK :500GB HDD	21

INTERNET BANDWIDTH --1GBPS

NUMBER AND CONFIGERATION OF SYSTEM				
S.NO	LAB NAME	COMPUTER NAME	DISCRIPTION	QUANTITY
1	Embedded Systems Solutions Lab(ECE LAB 11)	HP	MODEL :HP 280 G1 MTPROCESSOR: INTEL CORE I3 CPU @3.60GHZ, RAM:4GB DDR3 RAM , HARD DISK :500GB HDD	28
2	DCN LAB(ECE LAB 7)	HP	MODEL :HP 280 G1 MTPROCESSOR: INTEL CORE I3 CPU @3.60GHZ, RAM:4GB DDR3 RAM , HARD DISK :500GB HDD	20
3	Electronic circuits LAB2	HP	MODEL :HP 280 G1 MTPROCESSOR: INTEL CORE I3 CPU @3.60GHZ, RAM:4GB DDR3 RAM , HARD DISK :500GB HDD	1
4	5G LAB (ECE LAB 3)	HP	HP 280 G6 DESKTOP CORE i3 -10100, 3.6GHZ , 1TB HDD , 8GB RAM	29
		AMWIN	AMWIN DESKTOP , i7 ,10TH GEN , 5gHz, 8GB RAM , 1TB HDD	3
5	R&D LAB	DELL	DELL OPTIPLEX , 11TH GEN , INTEL CORE I5-11500, 2.70GHZ, 16GB RAM ,	10
		HP ,IBALL , LENOVO	MODEL :HP 280 G1 MTPROCESSOR: INTEL CORE I3 CPU @3.60GHZ, RAM:4GB DDR3 RAM , HARD DISK :500GB HDD	9

		HP	MODEL :HP 280 G1 MTPROCESSOR: INTEL CORE I5 CPU @3.60GHZ 8TH GEN, RAM:4GB RAM , HARD DISK :1TB HDD	19
		HP	MODEL :HP 280 G1 MTPROCESSOR: INTEL CORE I3 CPU @3.60GHZ, RAM:4GB DDR3 RAM , HARD DISK :500GB HDD	3
6	VLSI LAB	I BALL	500GB HDD, 4GB RAM ,INTEL DUAL CORE	2
7	PROJEECT LAB	I BALL , HP , ODYSSEY	MODEL :HP 280 G1 MTPROCESSOR: INTEL CORE I3 CPU @3.60GHZ, RAM:4GB DDR3 RAM , HARD DISK :500GB HDD	4
8	STAFF	HP	MODEL :HP 280 G1 MTPROCESSOR: INTEL CORE I3 CPU @3.60GHZ, RAM:4GB DDR3 RAM , HARD DISK :500GB HDD	23
9	ECE LAB 4	HP	MODEL :HP 280 G1 MTPROCESSOR: INTEL CORE I3 CPU @3.60GHZ, RAM:4GB DDR3 RAM , HARD DISK :500GB HDD	21

TOTAL NUMBER OF SYSTEM CONNECTED BY LAN --- 180 SYSTEM
TOTAL NUMBER OF SYSTEM CONNECTED BY WAN **01 NUMBER (MAIN SERVER IN CS DEPT)**

Major software packages available

Sl No	Dept.	Description of Item	Date of Purchase	Quantity	Actual Cost(INR)	Name and Address of Venders/Suppliers
1	ECE	CADENCE SOFTWARE	13/12/2019	20	1100000	ENTUPLE TECOLOGIES Pvt. Ltd. INDIANAGARA ,BANGALORE
2	ECE	MATLAB SOFTWARE	29/7/2022	1	1146693	COREL TECHNOLOGIES KORAMANGALA BANGALORE

3	ECE	HFSS SOFTWARE	30/3/2022	1	879100	ENTUPLE TECOLOGIES Pvt. Ltd. INDIANAGARA ,BANGALORE
4	ECE	XILINK VIVADO	27-03-2019	1	188210	COREL TECHNOLOGIES KORAMANGALA BANGALORE

SPECIAL PURPOSE FACILITES AVAILABLE (CONDUCT OF ONLINE MEETING /WORSHOPS , ETC)

S.NO	EQUIPMENT NAME	QUANTITY	SPECIFICATION
1	SMART BOARD (ACCUTOUCH)	1	ACCUTOUCH 4K75EDUCATION INTERACTIVE LAT PANEL,ASPECT RATIO 61.09, ANDROID 8,INTEL i5 11TH GEN , 8GB RAM ,128GB SSD AND 1TB HDD
2	SMART BOARD (SAMSUNG FLIP)	1	Tizen 5.0 operating system,Power Supply AC 100~240V 50/60Hz,Resolution 3,840 x 2,160
3	INTERACTIVE PANLE BOARD	2	INTERACTIVE PANLE BOARD B&S INTERACTIVE PANEL JPM 17.7"

FACILITES FOR CONDUCT OF CLASSES / COURSES IN ONLINE MODE (THEORY AND PRACTICAL)

S.NO	EQUIPMENT NAME	QUANTITY	SPECIFICATION
1	SMART BOARD (ACCUTOUCH)	1	ACCUTOUCH 4K75EDUCATION INTERACTIVE LAT PANEL,ASPECT RATIO 61.09, ANDROID 8,INTEL i5 11TH GEN , 8GB RAM ,128GB SSD AND 1TB HDD
2	SMART BOARD (SAMSUNG FLIP)	1	Tizen 5.0 operating system,Power Supply AC 100~240V 50/60Hz,Resolution 3,840 x 2,160
3	Projectors		

Glimpses of labs and classrooms-ECE


Latitude: 13.128498
Longitude: 77.587659
Elevation: 903.85±1 m
Accuracy: 14.4 m
Time: 21-12-2022 14:32
Note: ECE lab 5 research development design/ simulation lab
Room. No 225
Activate Windows
Powered by NoteCam


Latitude: 13.12849
Longitude: 77.587648
Elevation: 903.85±3 m
Accuracy: 20.0 m
Time: 21-12-2022 14:25
Note: ECE lab 7 VLSI design/ simulation lab
Room. No 227
Activate Windows
Powered by NoteCam


Latitude: 13.128477
Longitude: 77.587287
Elevation: 907.05±2 m
Accuracy: 31.0 m
Time: 21-12-2022 14:29
Note: ECE lab 9 digital electronics lab
Room. No 231
Powered by NoteCam


Latitude: 13.128525
Longitude: 77.587457
Elevation: 903.85±2 m
Accuracy: 14.7 m
Time: 21-12-2022 14:31
Note: ECE lab 8 project lab
Room. No 228
Powered by NoteCam


Latitude: 13.128464
Longitude: 77.587592
Elevation: 908.35±4 m
Accuracy: 46.0 m
Time: 21-12-2022 14:19
Note: ECE lecture Hall 4 Room. No 321
Powered by NoteCam


Latitude: 13.128532
Longitude: 77.587941
Elevation: 903.65±1 m
Accuracy: 13.4 m
Time: 21-12-2022 14:23
Note: ECE lab 3 5g lab Room. No 314
Powered by NoteCam


Latitude: 13.128475
Longitude: 77.587555
Elevation: 908.35±2 m
Accuracy: 13.8 m
Time: 21-12-2022 14:18
Note: ECE lecture Hall 6 Room. No 323
Powered by NoteCam


Latitude: 13.12891
Longitude: 77.586344
Elevation: 899.75±3 m
Accuracy: 24.5 m
Time: 21-12-2022 14:11
Note: ECE MEMS Room. No 276
Powered by NoteCam


Latitude: 13.128527
Longitude: 77.587185
Elevation: 906.35±2 m
Accuracy: 68.9 m
Time: 21-12-2022 14:08
Note: ECE Embedded systems solutions lab 11 Room. No 277
Powered by NoteCam


Latitude: 13.128525
Longitude: 77.587244
Elevation: 906.95±1 m
Accuracy: 38.5 m
Time: 21-12-2022 14:03
Note: ECE lab 10 communication systems Room. No 23
Powered by NoteCam

Laboratory Facility :

Artificial Intelligence and Data Science

List of Major Equipment/Facilities in Lab – AI & Data Science	1. GPU System 256 GB;500 GB SSD PRO 5965 WX ; Processor ; 12 TB storage(Quantity: 2 Workstations) 2. Amwin Desktop: i7 12th Gen processor, 16GB RAM, Windows 10 (quantity 42) 3. Desktop based on i3 8GB(quantity 20) 4. Amwin Desktop: i7 12th Gen processor , 64GB RAM, Windows 10.(quantity: 4) 5. EPSON Projector with Screen for Lab 6. UPS System 15 KVA
List of Experimental Setup in AI&Data Science Lab	A)Weekly Lab sessions being conducted for Data Structures, Python Programming and Statistics using R. Software Packages mentioned below. B) Student assignments carried out in lab using packages below 1.C Compiler gcc (open source) 2.Python and libraries for Data Science : Pandas and various other libraries- Open Source 3.CUDA libraries on GPU Workstations 4. R Language environment
Computing Facilities	60 Desktops(16 GB RAM) , 2 GPU workstations and 4 high-end desktops(64 GB)
Internet Bandwidth	50Mbps
Number and configuration of System	1. GPU System 256 GB;500 GB SSD PRO 5965 WX ; Processor ; 12 TB storage(Quantity: 2 Workstations) 2. Amwin Desktop: i7 12th Gen processor, 16GB RAM, Windows 10 (quantity 42) 3. Desktop based on i3 8GB(quantity 20) 4. Amwin Desktop: i7 12th Gen processor , 64GB RAM, Windows 10.(quantity: 4) 5. EPSON Projector with Screen for Lab UPS System 15 KVA
Total number of system connected by LAN	64
Total number of system connected by WAN	40
Major software packages available	1.C Compiler gcc (open source) 2.Python and libraries for Data Science : Pandas and various other libraries- Open Source 3.CUDA libraries on GPU Workstations 4. R Language environment
Special purpose facilities available (Conduct of online Meetings/Webinars/Workshops, etc.)	LCD Projector
Facilities for conduct of classes/courses in online mode (Theory & Practical)	Internet connection tool and access to online meeting tools made available in lab

Innovation Cell	
Social Media Cell	
Compliance of the National Academic Depository (NAD), applicable to PGCM/ PGDM Institutions and University Departments	

Laboratory facilities

DEPARTMENT OF ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING

1. **Total Number of Systems----------→ 32**
2. **Server----------------------------------→ 1**
3. **SYSTEM CONFIGURATION**
   - **i) RAM - 32GB**
   - **ii) HDD – 1 TB HDD**
   - **iii) NVIDIA Display Drivers- 256 MB**
   - **iv) OS- UBUNTU 22.02**

Laboratory facilities

MBA Dept

No.of computers	32
configuration of System	i3 processor, 4GB RAM, Hard disk: 1 TB
Total number of system connected by LAN	Annexure-06 No: 32
Facilities available in lab	32 computers, 1 Smart board, 2 Web cam

Laboratory facilities

Information Science and Engineering

List of Major Equipment/Facilities in each Laboratory/Workshop

Sl.no	Laboratories	Description Equipment's	Quantity
1	Lab1-261	Desktop Pcs Projector-Epson Smart APC UPS-6KVA AC's	27 01 01 03
2	Lab2-262	Desktop Pcs Projector-Epson Smart APC UPS-6KVA AC's	27 01 01 03
3	Lab3-248	Desktop Pcs Projector(Epson) UPS Ac's	37 01 01 03
4	Lab4-249	Desktop Pcs' Digital IC Trainer Kit Microcontroller kit	25 13 08
5	Ignis lab-372	Desktop Pcs' Projector(Epson) 10KVA UPS Ac's	30 01 01 02
6	New lab-371	Desktop Pcs' Projector(Epson) 10KVA UPS	30 01 01
7	Lab-330	Desktop Pcs' Projector(Epson), 6KVA Adela UPS Ac's	36 01 01 02
8	IOT lab-274 (1&2)	Desktop Pcs' Projector(Epson) UPS Ac's	58 01 01 03

		Aurdino kit,Ics	
9	Grid Lab-260	Desktop Pcs' UPS	18 01

List of Experimental Setup in each Laboratory/Workshop

Sl.no	Laboratories	Description Equipment's	Quantity
1	Lab1-261	Projector-Epson WIFI router	01 01
2	Lab2-262	Projector-Epson WIFI router	01 01
3	Lab3-248	Projector(Epson)	01
4	Lab4-249	Digital IC Trainer Kit Microcontroller kit	13 08
5	Ignis lab-372	Projector(Epson) Wifi Router	01 01
6	New lab-371	Projector(Epson) Wifi Router	01 01
7	Lab-330	Projector(Epson),	01
8	IOT lab-274	Projector(Epson) Aurdino kit,Ics Wifi	01 01 01
9	Grid Lab-260	Pc's	18

Computing Facilities

Sl.No	**Laboratories**	**Software –Open source**
1	Lab1-261	Mysql, eclipse
2	Lab2-262	Mysql, NS3
3	Lab3-248	Python
4	Lab4-249	Keil
5	Ignis lab-372	Jupiter Notebook, Visual Studio
6	New lab-371	Hadoop, Android Application
7	Lab-330	Python, Mu-editor
8	IOT lab-274	Eclipse, mysql workbench
9	Grid Lab-260	--

Internet Bandwidth--1Gbps

Number and configuration of System

Sl.no	Laboratories	Total Number	Configuration

1	Lab1-261	Total -27	1.)5 I ball systems (Intel ®Core(™)2 Duo, 2 GB Ram, 500 GB HDD) 2.) 2 Odyssey Systems (Intel ®Core(™)2 Duo, 2 3.) 20 Dell systems (Intel ®Core(™)2
2	Lab2-262	Total -27	1.)HP-Intel Core i3 10thGen-23 2.)HP pro-intel inside core-i3 RAM-4GB ,Harddisk-500GB
3	Lab3-248	Total-37	1.)30 HP Systems (i3 processor,1TB ,8GB Ram, 512GB SSD) 2.) 7 HP Systems(i3 processor, 4GB)
4	Lab4-249	Total-25	1.)Zeneth PC-13 Nos,Dual core processor,3gb ram, 500 Gb Hdd **2.)M- Express-01 Nos**, Dual core processor, 500gb HDD,2Gb ram **Mercury-01 Nos**,Core2 duo processor,2GB Ram,80Gb HD**Odyssey-09 Nos**, core2 duo,2Gb ram,500GB HDD 3.) **Hp Systems 01** nos(Dual core processor,500gb, 4Gb RAM)
5	Ignis lab-372	Total-30	30 lenovo Systems (i3 processor,1TB HDD ,8GB Ram
6	New lab-371	Total-30	30 HP Systems (i3 processor,1TB HDD ,8GB Ram
7	Lab-330	Total-36	1.)30 HP Systems (i3 processor, ,8GB Ram, 512GB SSD) 2.)10 HP Systems (i3 processor, 4GB Ram, 1TB HDD)
8	IOT lab-274(1 and 2)	Total-58	1.) Lab1:6 hp systems (i3 processor,4gb ram,ubuntu 20.04),24 dell systems(2.) **Mercury-04Nos**,Core2 duo processor,2GB **I bALL1 Nos**, 1 core2 duo,2Gb ram,500GB HDD 3.) Lab 2:20 Dell systems (Intel ®Core(™)2
9	Grid Lab-260	Total-18	1.) HP Systems (i3 Processor ,HDD 500GB, 8 GB RAM, 2.

Total number of systems connected to LAN

Sl.no	Laboratories	Total system	Total Systems Connected By LAN
1	Lab1-261	27	27
2	Lab2-262	27	27
3	Lab3-248	37	37
4	Lab4-249	25	1
5	Ignis lab-372	30	30
6	New lab-371	30	30
7	Lab-330	58	57
8	IOT lab-274	58	57
9	Grid Lab-260	18	18

Special purpose facilities available (Conduct of online Meetings/Webinars/Workshops, etc.)

Projectors

Sl.no	Laboratories	Description Equipment’s	Quantity
1	Lab1-261	Projector-Epson	01
2	Lab2-262	Projector-Epson	01
3	Lab3-248	Projector(Epson)	01
4	Lab4-249	Projector(Epson)	01
5	Ignis lab-372	Projector(Epson)	01
6	New lab-371	Projector(Epson)	01
7	Lab-330	Projector(Epson)	01
8	IOT lab-274	Projector(Epson)	01

- The lab is equipped with four Wacom (creative pen tablets).
- One by Wacom can be used with most pen-enabled creative software as well as many online learning applications and platforms on PC and Mac.
- We have four **C270 HD WEBCAM**
- The C270 HD Webcam gives us sharp, smooth conference calls in a widescreen format. Automatic light correction shows you in lifelike, natural colors.
- Mac computer system -for IOS related projects and development.

Smart Boards

Sl.no	Room	Description Equipment’s	Quantity
1	265	Smartboard	01
2	268	Smartboard	01
3	Dept. Seminar Hall	Smartboard	01
4	Hod cabin	Smartboard	01

- One Bluetooth enabled Microphone/ Speaker one tripod for online meeting in Board Room
- smart LED projector-For IOT live streaming and online classes.
- Technical Clubs existing and New from Oct-Dec 2022 (proofs (Report) to be maintained by the department coordinator)

Sl.No	Name of Technical Clubs	Quterly Report
1	CloudZilla	Getting Started with Cloud on 2nd December 2022 Speaker: Mr. Prajwal N, TechLead, WellsFargo
2	HackClub	Web3: The Infrastructure on 22nd November 2022 Speaker: Mr. Pranshu Rastogi, Vice President of Push Protocol

Facilities for conduct of classes/courses in online mode (Theory & Practical)

- We have four Wacom (creative pen tablets).
- One by Wacom can be used with most pen-enabled creative software as well as many online learning applications and platforms on PC and Mac.
- We have four **C270 HD WEBCAM**
- The C270 HD Webcam gives us sharp, smooth conference calls in a widescreen format. Automatic light correction shows you in lifelike, natural colors.
- Mac computer system -for IOS related projects and development.
- Smart Boards

Sl.no	Room	Description Equipment’s	Quantity
1	265	Smartboard	01
2	268	Smartboard	01
3	Dept. Seminar Hall	Smartboard	01
4	Hod cabin	Smartboard	01

- One Bluetooth enabled Microphone/ Speaker one tripod for online meeting in Board Room

- Smart LED projector-For IOT live streaming and online classes.
- **Microsoft Teams**
- **LMS Moodle -3.9**

Learning management system implemented using Moodle in our Department. Every course activity is created in LMS and concerned teachers and students are enrolled to the course. All the Learning Activities pertaining to the course such as: Assignments, quiz, Attendance, feedback , course materials are managed through LMS.

GAMES AND SPORTS FACILITY

NITTE EDUCATION TRUST

NITTE MEENAKSHI INSTITUTE OF TECHNOLOGY

An Autonomous Institution Approved by UGC/AICTE/Govt. of Karnataka
Accredited by NBA (Tier-I) and NAAC 'A+' Grade
Affiliated to Visvesvaraya Technological University, Belagavi
Post Box No. 6429, Yelahanka, Bengaluru-560064, Karnataka, INDIA

KNOWLEDGE • CHARACTER • UNITY

DEPARTMENT OF PHYSICAL EDUCATION

DETAILS OF PARTICIPATION AND ACHIEVEMENTS-2021-2022

1. Football

Sl no.	NAME OF THE TOURNAMENT	ORGANISED BY	DATE	RESULT
1.	SPARDHA-22	CMRIT	16^{th} & 17^{th} DECEMBER 2022	RUNNERS UP
2	KREEDOTSAV-22	BMSCE	27^{th} & 28^{th} DECEMBER 2022	WINNERS

State Level Inter Collegiate Football (M) Tournament Runners Up at CMRIT.

State Level Inter Collegiate Football (M)Tournament WINNERS at BMSCE.

ANAADYANTA Foot Ball (Men) Touranment Runners Up , on 10th & 11th May 2022 at NMIT,Bangalore

2. Volleyball (Women)

Sl no.	NAME OF THE TOURNAMENT	ORGANISED BY	DATE	RESULT
1.	VTU BANGLORE ZONE INTER COLLEGIATE TOURNAMENT	BMSSA	23rd & 24th NOVEMBER 2022	WINNERS
2.	VTU STATE LEVEL	PES,MANDYA	15th & 16th DECEMBER 2022	RUNNERS
3.	SPARDHA-22	CMRIT	13th & 14th DECEMBER 2022	WINNERS

VTU Bangalore Zone Volleyball (W) Tournament WINNERS at BMSSA, Bangalore.

VTU State Level Volleyball (W) Tournament RUNNERS at PES, Mandya.

.

State Level Inter Collegiate Volleyball (W) Tournament WINNERS at CMRIT.

3. Basketball (Men)

Sl no.	NAME OF THE TOURNAMENT	ORGANISED BY	DATE	RESULT
1.	VTU NORTH DIVISION	NMIT,BANGLORE	30th NOVEMBER & 1st DECEMBER 2022	WINNERS
2.	VTU STATE LEVEL	NMIT,BANGLORE	2nd & 3rd DECEMBER 2022	RUNNERS UP
3.	SPARDHA-22	CMRIT	16th & 17th DECEMBER 2022	WINNERS

VTU Bangalore North Zone Basketball (M) Tournament WINNERS at NMIT, Bangalore

VTU State Level Basketball (M) Tournament RUNNERS at NMIT, Bangalore

State Level Inter Collegiate Volleyball (W) Tournament WINNERS at CMRIT

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4. Badminton (Men)

Sl No	NAME OF THE TOURNAMENT	ORGANISED BY	DATE	RESULT
1.	VTU BANGALORE NORTH ZONE	NCET, Devanahalli	2nd &3rd NOVEMBER 2022	WINNERS

VTU Bangalore North Zone Badminton (M) WINNERS at NCET, Devanahalli.

5. Badminton (Women)

Sl No	NAME OF THE TOURNAMENT	ORGANISED BY	DATE	RESULT
1.	VTU BANGALORE NORTH ZONE	NCET, Devanahalli	2^{nd} & 3^{rd} NOVEMBER 2022	WINNERS

VTU Bangalore North Zone Badminton (W) WINNERS at NCET, Devanahalli.

VTU Inter Zone Hockey Men 1st Runners up on 21st December 2021 held at Sir RYMEC, Bellary.

6. Kabaddi (Men)

Sl No	NAME OF THE TOURNAMENT	ORGANIZED BY	DATE	RESULT
1.	SPARDHA-22	CMRIT	14th & 15th DECEMBER 2022	WINNERS

State Level Inter Collegiate Volleyball (M) Tournament WINNERS at CMRIT

7. Volleyball (Men)

Sl No	NAME OF THE TOURNAMENT	ORGANIZED BY	DATE	RESULT
1.	VTU BANGALORE NORTH ZONE	SKIT, Bangalore	17th & 18th NOVEMBER 2022	RUNNERS UP

VTU Bangalore North Zone Volleyball (M) Tournament RUNNERS at SKIT.

REPRESENTED VTU IN INTER UNIVERSITY COMPETITION IN THE YEAR OF 2022-2023

1	2022-23	**Ms. ANISHREE P**	CIVIL	**VOLLEYBALL (W)**
2	2022-23	**Ms. SUDEEKSHA**	ECE	**VOLLEYBALL (W)**
3	2022-23	**Ms. ADITI S NAIR**	AERO	**BASKETBALL (W)**
4	2022-23	**Mr. SAGAR P**	CIVIL	**ATHLETICS (M)**
5	2022-23	**Mr. BHUVAN C RAJU**	MECH	**BASKETBALL (M)**
6	2022-23	**Mr. SUMANTH S**	AERO	**BASKETBALL (M)**
7	2022-23	**Mr. DHEERAJ REDDY Y A**	M.TECH	**BASKETBALL (M)**

Our college 1st sem Mechanical Department student **SRIJAY T R** felicitated with **Ekalavya** Award for his achievements in **Shooting**.

DEPARTMENT OF PHYSICAL EDUCATION

No. of Students participated and Won Medals /Awards in Sports, Games and other Events :Jan 2022 to June 2022								
VTU Bangalore North Zone BADMINTON (W) Date:- 02 to 03 Nov 2022, Venue: NCET, Devanahalli								
SL No	Student Name	USN	Department	State University level	National level	International level	Date	Awards won
1	Ashitha R	1NT19ME019	MECH	University			02 to 03 Nov 2022	WINNERS
2	Amruthavarshini M	1NT20EC013	ECE	University			02 to 03 Nov 2022	WINNERS
3	Fouziya	1NT20CS407	CSE	University			02 to 03 Nov 2022	WINNERS
4	Kavya S	INT20IS076	ISE	University			02 to 03 Nov 2022	WINNERS
VTU Inter Zone BADMINTON (W) Date:- 07 to 09 Nov 2022, Venue: BMSCE, Bangalore								
SL No	Student Name	USN	Department	State University level	National level	International level	Date	Awards won
1	Ashitha R	1NT19ME019	MECH	University			07 to 09 Nov 2022	Participation
2	Amruthavarshini M	1NT20EC013	ECE	University			07 to 09 Nov 2022	Participation
3	Fouziya	1NT20CS407	CSE	University			07 to 09 Nov 2022	Participation
4	Kavya S	INT20IS076	ISE	University			07 to 09 Nov 2022	Participation

BADMINTON (WOMEN)

BADMINTON (MEN)

No. of Students participated and Won Medals /Awards in Sports, Games and other Events :Jan 2022 to June 2022								
VTU Bangalore North Zone BADMINTON (M) Date:-02 to 03 Nov 2022, Venue: NCET, Devanahalli								
SL No	Student Name	USN	Department	State University level	National level	International level	Date	Awards won
1	Vishwas S Nayak	1NT19IS193	ISE	University			02 to 03 Nov 2022	WINNERS
2	Eshan Muthappa M M	INT20ME023	MECH	University			02 to 03 Nov 2022	WINNERS
3	Rohith Pal	1NT20EC118	ECE	University			02 to 03 Nov 2022	WINNERS
4	A V S Adithya	1NT19IS001	ISE	University			02 to 03 Nov 2022	WINNERS
5	Dhanush A	1NT20EC042	ECE	University			02 to 03 Nov 2022	WINNERS
6	Kishore K	1NT20EC118	ECE	University			02 to 03 Nov 2022	WINNERS

VTU Inter Zone BADMINTON (M) Date:-07 to 09 Nov 2022, Venue: BMSCE, Bangalore								
SL No	**Student Name**	**USN**	**Department**	**State University level**	**National level**	**International level**	**Date**	**Awards won**
1	Vishwas S Nayak	1NT19IS193	ISE	University			07 to 09 Nov 2022	Participation
2	Eshan Muthappa M M	INT20ME023	MECH	University			07 to 09 Nov 2022	Participation
3	Rohith Pal	1NT20EC118	ECE	University			07 to 09 Nov 2022	Participation
4	A V S Adithya	1NT19IS001	ISE	University			07 to 09 Nov 2022	Participation
5	Dhanush A	1NT20EC042	ECE	University			07 to 09 Nov 2022	Participation
6	Kishore K	1NT20EC118	ECE	University			07 to 09 Nov 2022	Participation
7	P S Sai Adithya Rao	1NT21EE040	EEE	University			07 to 09 Nov 2022	Participation

Inter Collegiate BADMINTON (M) Date:- 15 to 16 Dec 2022, Venue: CMRIT, Bangalore								
SL No	**Student Name**	**USN**	**Department**	**State University level**	**National level**	**International level**	**Date**	**Awards won**
1	Vishwas S Nayak	1NT19IS193	ISE	University			15 to 16 Dec 2022	Participation
2	A V S Adithya	1NT19IS001	ISE	University			15 to 16 Dec 2022	Participation
3	Rohith Pal	1NT20EC118	ECE	University			15 to 16 Dec 2022	Participation

DEPARTMENT OF PHYSICAL EDUCATION

THROWBALL (WOMEN)

No. of Students participated and Won Medals /Awards in Sports, Games and other Events :Jan 2022 to June 2022								
Inter Collegiate THROWBALL (W) Date: 29 to 30 Dec 2022, Venue: BMSCE, Bangalore								
SL No	**Student Name**	**USN**	**Department**	**State University level**	**National level**	**International level**	**Date**	**Awards won**
1	Pallavi V N	1NT20EC091	ECE	University			29 to 30 Dec 2022	Participation
2	Anishree P	1NT17CV115	CIVIL	University			29 to 30 Dec 2022	Participation
3	Deeksha	1NT21AD038	AI & DS	University			29 to 30 Dec 2022	Participation
4	Kushi	1NT21AE040	AERO	University			29 to 30 Dec 2022	Participation
5	Kavya S	1NT20IS076	ISE	University			29 to 30 Dec 2022	Participation
6	Sudeeksha K	1NT20EC151	ECE	University			29 to 30 Dec 2022	Participation
7	Keerthi M	1NT20EC065	ECE	University			29 to 30 Dec 2022	Participation
8	V K Dhyaanaa	1NT21EE019	EEE	University			29 to 30 Dec 2022	Participation
9	D Sai Venila	1NT21AD017	AI & DS	University			29 to 30 Dec 2022	Participation
10	Mandara N G	1NT21AE045	AERO	University			29 to 30 Dec 2022	Participation

DEPARTMENT OF PHYSICAL EDUCATION

VOLLEYBALL (WOMEN)

No. of Students participated and Won Medals /Awards in Sports, Games and other Events :Jan 2022 to June 2022								
VTU INTER ZONE VOLLEYBALL (W) Date: 15 to 16 December 2022, Venue: PES, Mandya								
SL No	**Student Name**	**USN**	**Department**	**State University level**	**National level**	**International level**	**Date**	**Awards won**
1	Anishree P	1NT17CV115	CIVIL	University			15 to 16 Dec 2022	RUNNERS
2	V K Dhyaanaa	1NT21EE019	EEE	University			15 to 16 Dec 2022	RUNNERS
3	Fouziya	INT20CS407	CSE	University			15 to 16 Dec 2022	RUNNERS
4	Sudeeksha K	1NT20EC151	ECE	University			15 to 16 Dec 2022	RUNNERS
5	Madhuri C	1NT19IS077	ISE	University			15 to 16 Dec 2022	RUNNERS
6	Thanu Shree H L	1NT21CS191	CSE	University			15 to 16 Dec 2022	RUNNERS
7	Kavya S	1NT20IS076	ISE	University			15 to 16 Dec 2022	RUNNERS
8	Shruthi S Rao	1NT21EC143	ECE	University			15 to 16 Dec 2022	RUNNERS
VTU BANGALORE ZONE VOLLEYBALL (W) Date: 23 to 24 Nov 2022, Venue: BMSSA, Bangalore								

1	Anishree P	1NT17CV115	CIVIL	University			23 to 24 Dec 2022	WINNERS
2	V K Dhyaanaa	1NT21EE019	EEE	University			23 to 24 Dec 2022	WINNERS
3	Fouziya	INT20CS407	CSE	University			23 to 24 Dec 2022	WINNERS
4	Sudeeksha K	1NT20EC151	ECE	University			23 to 24 Dec 2022	WINNERS
5	Madhuri C	1NT19IS077	ISE	University			23 to 24 Dec 2022	WINNERS
6	Thanu Shree H L	1NT21CS191	CSE	University			23 to 24 Dec 2022	WINNERS
7	Kavya S	1NT20IS076	ISE	University			23 to 24 Dec 2022	WINNERS
8	Shruthi S Rao	1NT21EC143	ECE	University			23 to 24 Dec 2022	WINNERS
Inter Collegiate VOLLEYBALL (W) Date: 14 to 15 Dec 2022, Venue: CMRIT ,Bangalore								
1	Anishree P	1NT17CV115	CIVIL	State			14 to 15 Dec 2022	WINNERS
2	V K Dhyaanaa	1NT21EE019	EEE	State			14 to 15 Dec 2022	WINNERS
3	Fouziya	INT20CS407	CSE	State			14 to 15 Dec 2022	WINNERS
4	Sudeeksha K	1NT20EC151	ECE	State			14 to 15 Dec 2022	WINNERS
5	Madhuri C	1NT19IS077	ISE	State			14 to 15 Dec 2022	WINNERS
6	Thanu Shree H L	1NT21CS191	CSE	State			14 to 15 Dec 2022	WINNERS
7	Kavya	1NT20IS076	ISE	State			14 to 15 Dec 2022	WINNERS

DEPARTMENT OF PHYSICAL EDUCATION

VOLLEYBALL (MEN)

No. of Students participated and Won Medals /Awards in Sports, Games and other Events :Jan 2022 to June 2022								
VTU Bangalore North ZONE VOLLEYBALL (M) Date: 17 to 18 Nov 2022, Venue: SKIT, Bangalore								
SL No	**Student Name**	**USN**	**Department**	**State University level**	**National level**	**International level**	**Date**	**Awards won**
1	Deepak R	1NT21BA019	MBA	University			17 to 18 Nov 2022	RUNNERS
2	Ranjan L M	1NT19ME107	MECH	University			17 to 18 Nov 2022	RUNNERS
3	Deepak S V	1NT19IS048	ISE	University			17 to 18 Nov 2022	RUNNERS

4	Bharath G S	1NT21BA027	MBA	University			17 to 18 Nov 2022	RUNNERS
5	Eshan Muthappa M M	1NT20ME023	MECH	University			17 to 18 Nov 2022	RUNNERS
6	L J Nayan	1NT21CV022	CIVIL	University			17 to 18 Nov 2022	RUNNERS
7	Suresh	1NT21CS414	CSE	University			17 to 18 Nov 2022	RUNNERS
8	Manoj Kumar K S	1NT21AE042	AERO	University			17 to 18 Nov 2022	RUNNERS
9	G Vamsi Nivas	1NT20ME024	MECH	University			17 to 18 Nov 2022	RUNNERS
10	Darshan M Jainapur	1NT18CV026	CIVIL	University			17 to 18 Nov 2022	RUNNERS
11	Rahul C S	1NT21AE062	AERO	University			17 to 18 Nov 2022	RUNNERS
12	Aashutosh B M	1NT20CV001	CIVIL	University			17 to 18 Nov 2022	RUNNERS

VTU Inter ZONE VOLLEYBALL (M) Date: 21 to 22 Nov 2022, Venue: AIT, Chikkamagalore

SL No	Student Name	USN	Department	State University level	National level	International level	Date	Awards won
1	Deepak R	1NT21BA019	MBA	University			21 to 22 Nov 2022	Participation
2	Ranjan L M	1NT19ME107	MECH	University			21 to 22 Nov 2022	Participation
3	Deepak S V	1NT19IS048	ISE	University			21 to 22 Nov 2022	Participation
4	Bharath G S	1NT21BA027	MBA	University			21 to 22 Nov 2022	Participation
5	Eshan Muthappa M M	1NT20ME023	MECH	University			21 to 22 Nov 2022	Participation
6	L J Nayan	1NT21CV022	CIVIL	University			21 to 22 Nov 2022	Participation
7	Suresh	1NT21CS414	CSE	University			21 to 22 Nov 2022	Participation
8	Manoj Kumar K S	1NT21AE042	AERO	University			21 to 22 Nov 2022	Participation
9	G Vamsi Nivas	1NT20ME024	MECH	University			21 to 22 Nov 2022	Participation
10	Darshan M Jainapur	1NT18CV026	CIVIL	University			21 to 22 Nov 2022	Participation
11	Rahul C S	1NT21AE062	AERO	University			21 to 22 Nov 2022	Participation
12	Aashutosh B M	1NT20CV001	CIVIL	University			21 to 22 Nov 2022	Participation

Inter Collegiate VOLLEYBALL (M) Date: 29 to 30 Dec 2022, Venue: BMSCE, Bangalore

SL No	Student Name	USN	Department	State University level	National level	International level	Date	Awards won
1	Deepak R	1NT21BA019	MBA	State			29 to 30 Dec 2022	Participation

2	Ranjan L M	1NT19ME107	MECH	State			29 to 30 Dec 2022	Participation
3	Deepak S V	1NT19IS048	ISE	State			29 to 30 Dec 2022	Participation
4	Bharath G S	1NT21BA027	MBA	State			29 to 30 Dec 2022	Participation
5	Eshan Muthappa M M	1NT20ME023	MECH	State			29 to 30 Dec 2022	Participation
6	L J Nayan	1NT21CV022	CIVIL	State			29 to 30 Dec 2022	Participation
7	Suresh	1NT21CS414	CSE	State			29 to 30 Dec 2022	Participation
8	Manoj Kumar K S	1NT21AE042	AERO	State			29 to 30 Dec 2022	Participation
9	G Vamsi Nivas	1NT20ME024	MECH	State			29 to 30 Dec 2022	Participation
10	Darshan M Jainapur	1NT18CV026	CIVIL	State			29 to 30 Dec 2022	Participation
11	Rahul C S	1NT21AE062	AERO	State			29 to 30 Dec 2022	Participation
12	Aashutosh B M	1NT20CV001	CIVIL	State			29 to 30 Dec 2022	Participation

DEPARTMENT OF PHYSICAL EDUCATION

TABLE TENNIS (MEN)

No. of Students participated and Won Medals /Awards in Sports, Games and other Events :Jan 2022 to June 2022

VTU Bangalore North ZONE TABLE TENNIS (M) Date: 27 to 29 Oct 2022, Venue: CITNC, Bangalore

SL No	Student Name	USN	Department	State University level	National level	International level	Date	Awards won
1	A V S Adithya	1NT20ME025	MECH	University			24 to 25 Nov 2021	Participation
2	Rishik Makhija	1NT19IS132	ISE	University			24 to 25 Nov 2021	Participation
3	Abishek Rawal	1NT18CV097	CIVIL	University			24 to 25 Nov 2021	Participation
4	Rahul Chakravarti	1NT20IS129	ISE	University			24 to 25 Nov 2021	Participation
5	Akhilesh Mishra	1NT19IS010	ISE	University			24 to 25 Nov 2021	Participation
6	Samir Mulmi	1NT20CS153	CSE	University			24 to 25 Nov 2021	Participation
7	Devesh Mirani	1NT18CS037	CSE	University			24 to 25 Nov 2021	Participation

DEPARTMENT OF PHYSICAL EDUCATION

HOCKEY (MEN)

No. of Students participated and Won Medals /Awards in Sports, Games and other Events :Jan 2022 to June 2022								
VTU Bangalore North Zone HOCKEY (M) Date:10 Nov 2022, Venue: SJCIT, Chikkaballapura								
SL No	**Student Name**	**USN**	**Depart ment**	**State University level**	**National level**	**Internati onal level**	**Date**	**Awards won**
1	Jatin Ponnappa	1NT19ME057	MECH	University			10 Nov 2022	Participation
2	M.A Devaiah	1NT19ME071	MECH	University			10 Nov 2022	Participation
3	Vivan C V	1NT19EC182	ECE	University			10 Nov 2022	Participation
4	R I L Rishank Kariappa	1NT19ME052	MECH	University			10 Nov 2022	Participation
5	Barath Kumar	1NT19AE008	AERO	University			10 Nov 2022	Participation
6	Chalan Appachu P V	1NT19ME024	MECH	University			10 Nov 2022	Participation
7	Varshith E	1NT19ME140	MECH	University			10 Nov 2022	Participation
8	Aryan C Mouli	1NT19EE019	EEE	University			10 Nov 2022	Participation
9	Ganapathy N B	1NT20IS054	ISE	University			10 Nov 2022	Participation
10	Shreeshail	1NT21AD047	AI & DS	University			10 Nov 2022	Participation
11	T K Bhuvan Raju	1NT19AE011	AERO	University			10 Nov 2022	Participation
12	Yashas R Shetty	1NT19ME147	MECH	University			10 Nov 2022	Participation
13	Reuben Jacob Mathews	1NT21ME039	MECH	University			10 Nov 2022	Participation
14	Deekshith B H	1NT21EC402	CIVIL	University			10 Nov 2022	Participation
15	Dhaarmik	24927 (SAN)	CSE	University			10 Nov 2022	Participation
16	Darshan J	1NT20ME020	MECH	University			10 Nov 2022	Participation
17	Likith	1NT19ME069	MECH	University			10 Nov 2022	Participation
18	Prashanth	1NT19EE074	EEE	University			10 Nov 2022	Participation
Inter Collegiate HOCKEY (M) Date: 16 to 17 Dec 2022, Venue: CMRIT, Bangalore								
1	Jatin Ponnappa	1NT19ME057	MECH	University			16 to 17 Dec 2022	Participation
2	M.A Devaiah	1NT19ME071	MECH	University			16 to 17 Dec 2022	Participation
3	Vivan C V	1NT19EC182	ECE	University			16 to 17 Dec 2022	Participation
4	R I L Rishank Kariappa	1NT19ME052	MECH	University			16 to 17 Dec 2022	Participation

5	Barath Kumar	1NT19AE008	AERO	University			16 to 17 Dec 2022	Participation
6	Chalan Appachu P V	1NT19ME024	MECH	University			16 to 17 Dec 2022	Participation
7	Varshith E	1NT19ME140	MECH	University			16 to 17 Dec 2022	Participation
8	Aryan C Mouli	1NT19EE019	EEE	University			16 to 17 Dec 2022	Participation
9	Ganapathy N B	1NT20IS054	ISE	University			16 to 17 Dec 2022	Participation
10	Shreeshail	1NT21AD047	AI & DS	University			16 to 17 Dec 2022	Participation
11	T K Bhuvan Raju	1NT19AE011	AERO	University			16 to 17 Dec 2022	Participation
12	Yashas R Shetty	1NT19ME147	MECH	University			16 to 17 Dec 2022	Participation
13	Reuben Jacob Mathews	1NT21ME039	MECH	University			16 to 17 Dec 2022	Participation
14	Deekshith B H	1NT21EC402	CIVIL	University			16 to 17 Dec 2022	Participation
15	Dhaarmik	24927 (SAN)	CSE	University			16 to 17 Dec 2022	Participation
16	Darshan J	1NT20ME020	MECH	University			16 to 17 Dec 2022	Participation
17	Likith	1NT19ME069	MECH	University			16 to 17 Dec 2022	Participation
18	Prashanth	1NT19EE074	EEE	University			16 to 17 Dec 2022	Participation

DEPARTMENT OF PHYSICAL EDUCATION

HANDBALL (MEN)

No. of Students participated and Won Medals /Awards in Sports, Games and other Events :Jan 2022 to June 2022								
Inter Collegiate HANDBALL (M) Date: 16 to 17 Dec 2022, Venue: CMRIT, Bangalore								
SL No	**Student Name**	**USN**	**Department**	**State University level**	**National level**	**International level**	**Date**	**Awards won**
1	Prajwal Banajager	1NT19ME094	MECH	University			16 to 17 Dec 2022	Participation
2	Deekshith B H	1NT21EC402	ECE	University			16 to 17 Dec 2022	Participation
3	Dushyanth Chilukuri	1NT20ME022	MECH	University			16 to 17 Dec 2022	Participation
4	Jai Maruthi	1NT19ME056	MECH	University			16 to 17 Dec 2022	Participation
5	Karthik Hukkeri	1NT20EE028	EEE	University			16 to 17 Dec 2022	Participation
6	Karthik K	27306	CSE	University			16 to 17 Dec 2022	Participation
7	Darshan C	1NT20ME019	MECH	University			16 to 17 Dec 2022	Participation
8	Sathvik Daruvuru	27244	ISE	University			16 to 17 Dec 2022	Participation
9	Syed Irfan	1NT20CS192	CSE	University			16 to 17 Dec 2022	Participation
10	Pavan K	26954	MBA	University			16 to 17 Dec 2022	Participation
11	Rakshith	28052	MBA	University			16 to 17 Dec 2022	Participation

DEPARTMENT OF PHYSICAL EDUCATION

TABLE TENNIS (WOMEN)

No. of Students participated and Won Medals /Awards in Sports, Games and other Events :Jan 2022 to June 2022								
VTU Bangalore North Zone Table Tennis (W) Date: 27 to 29 Oct 2022, Venue: CITNC, Bangalore								
SL No	**Student Name**	**USN**	**Department**	**State University level**	**National level**	**International level**	**Date**	**Awards won**
1	Kavya S	1NT20IS076	ISE	University			27 to 29 Oct 2022	Participation
2	Dhyaanaa V K	1NT21EE019	EEE	University			27 to 29 Oct 2022	Participation
3	Anishree P	1NT17CV115	CIVIL	University			27 to 29 Oct 2022	Participation

DEPARTMENT OF PHYSICAL EDUCATION

Basketball (m)

No. of Students participated and Won Medals /Awards in Sports, Games and other Events :Jan 2022 to June 2022								
VTU Bangalore North Zone BASKETBALL (M) Date: 29 to 30 Nov 2022, Venue: NMIT, Bangalore								
SL No	**Student Name**	**USN**	**Department**	**State/ University level**	**National level**	**International level**	**Date**	**Awards won**
1	Sumanth S	1NT19AE069	AERO	University			29 to 30 Nov 2021	WINNERS
2	Bhuvan C Raju	1NT19ME098	MECH	University			29 to 30 Nov 2021	WINNERS
3	Sharvin pinto	1NT19CS174	CSE	University			29 to 30 Nov 2021	WINNERS
4	Pavan Preet	1NT19IS105	ISE	University			29 to 30 Nov 2021	WINNERS
5	Merven	1NT19ME080	MECH	University			29 to 30 Nov 2021	WINNERS
6	Manav	1NT20ME038	MECH	University			29 to 30 Nov 2021	WINNERS
7	Dheeraj Reddy	27205	M.Tech	University			29 to 30 Nov 2021	WINNERS
8	Darshan	27522	MBA	University			29 to 30 Nov 2021	WINNERS
9	Roshan	27750	MBA	University			29 to 30 Nov 2021	WINNERS
10	Jason	1NT20ME030	MECH	University			29 to 30 Nov 2021	WINNERS
11	Siv Kiran	1NT21AE025	AERO	University			29 to 30 Nov 2021	WINNERS
12	Piyush	1NT19IS110	ISE	University			29 to 30 Nov 2021	WINNERS
VTU Inter Zone BASKETBALL (M) Date: 01 to 03 Dec 2022, Venue: NMIT, Bangalore								
SL No	**Student Name**	**USN**	**Department**	**State/ University level**	**National level**	**International level**	**Date**	**Awards won**
1	Sumanth S	1NT19AE069	AERO	University			01 to 03 Dec 2022	RUNNERS
2	Bhuvan C Raju	1NT19ME098	MECH	University			01 to 03 Dec 2022	RUNNERS
3	Sharvin pinto	1NT19CS174	CSE	University			01 to 03 Dec 2022	RUNNERS
4	Pavan Preet	1NT19IS105	ISE	University			01 to 03 Dec 2022	RUNNERS
5	Merven	1NT19ME080	MECH	University			01 to 03 Dec 2022	RUNNERS
6	Manav	1NT20ME038	MECH	University			01 to 03 Dec 2022	RUNNERS
7	Dheeraj Reddy	27205	M.Tech	University			01 to 03 Dec 2022	RUNNERS
8	Darshan	27522	MBA	University			01 to 03 Dec 2022	RUNNERS
9	Roshan	27750	MBA	University			01 to 03 Dec 2022	RUNNERS
10	Jason	1NT20ME030	MECH	University			01 to 03 Dec 2022	RUNNERS
11	Siv Kiran	1NT21AE025	AERO	University			01 to 03 Dec 2022	RUNNERS

12	Piyush	1NT19IS110	ISE	University			01 to 03 Dec 2022	RUNNERS

Inter Collegiate BASKETBALL (M) Date: 24 to 28 Nov 2022, Venue: Parivarthana college, Mysore

SL No	Student Name	USN	Departmen t	State/ Universit y level	Nationa l level	Internationa l level	Date	Awards won
1	Sumanth S	1NT19AE069	AERO	State			24 to 28 Nov 2022	Participation
2	Bhuvan C Raju	1NT19ME098	MECH	State			24 to 28 Nov 2022	Participation
3	Sharvin pinto	1NT19CS174	CSE	State			24 to 28 Nov 2022	Participation
4	Pavan Preet	1NT19IS105	ISE	State			24 to 28 Nov 2022	Participation
5	Merven	1NT19ME080	MECH	State			24 to 28 Nov 2022	Participation
6	Manav	1NT20ME038	MECH	State			24 to 28 Nov 2022	Participation
7	Dheeraj Reddy	27205	M.Tech	State			24 to 28 Nov 2022	Participation
8	Darshan	27522	MBA	State			24 to 28 Nov 2022	Participation
9	Roshan	27750	MBA	State			24 to 28 Nov 2022	Participation
10	Jason	1NT20ME030	MECH	State			24 to 28 Nov 2022	Participation
11	Siv Kiran	1NT21AE025	AERO	State			24 to 28 Nov 2022	Participation
12	Piyush	1NT19IS110	ISE	State			24 to 28 Nov 2022	Participation

Inter Collegiate BASKETBALL (M) Date: 16 to 17 Dec 2022, Venue: CMRIT, Bangalore

SL No	Student Name	USN	Departmen t	State/ Universit y level	Nationa l level	Internationa l level	Date	Awards won
1	Sumanth S	1NT19AE069	AERO	State			16 to 17 Dec 2022	WINNERS
2	Bhuvan C Raju	1NT19ME098	MECH	State			16 to 17 Dec 2022	WINNERS
3	Sharvin pinto	1NT19CS174	CSE	State			16 to 17 Dec 2022	WINNERS
4	Pavan Preet	1NT19IS105	ISE	State			16 to 17 Dec 2022	WINNERS
5	Merven	1NT19ME080	MECH	State			16 to 17 Dec 2022	WINNERS
6	Manav	1NT20ME038	MECH	State			16 to 17 Dec 2022	WINNERS
7	Dheeraj Reddy	27205	M.Tech	State			16 to 17 Dec 2022	WINNERS
8	Darshan	27522	MBA	State			16 to 17 Dec 2022	WINNERS
9	Roshan	27750	MBA	State			16 to 17 Dec 2022	WINNERS
10	Jason	1NT20ME030	MECH	State			16 to 17 Dec 2022	WINNERS
11	Siv Kiran	1NT21AE025	AERO	State			16 to 17 Dec 2022	WINNERS
12	Piyush	1NT19IS110	ISE	State			16 to 17 Dec 2022	WINNERS

Inter Collegiate BASKETBALL (M) Date: 29 to 30 Dec 2022, Venue: BMSCE, Bangalore

SL No	Student Name	USN	Department	State/ University level	National level	International level	Date	Awards won
1	Sumanth S	1NT19AE069	AERO	State			29 to 30 Dec 2022	Participation
2	Bhuvan C Raju	1NT19ME098	MECH	State			29 to 30 Dec 2022	Participation
3	Sharvin pinto	1NT19CS174	CSE	State			29 to 30 Dec 2022	Participation
4	Pavan Preet	1NT19IS105	ISE	State			29 to 30 Dec 2022	Participation
5	Merven	1NT19ME080	MECH	State			29 to 30 Dec 2022	Participation
6	Manav	1NT20ME038	MECH	State			29 to 30 Dec 2022	Participation
7	Dheeraj Reddy	27205	M.Tech	State			29 to 30 Dec 2022	Participation
8	Darshan	27522	MBA	State			29 to 30 Dec 2022	Participation
9	Roshan	27750	MBA	State			29 to 30 Dec 2022	Participation
10	Jason	1NT20ME030	MECH	State			29 to 30 Dec 2022	Participation
11	Siv Kiran	1NT21AE025	AERO	State			29 to 30 Dec 2022	Participation
12	Piyush	1NT19IS110	ISE	State			29 to 30 Dec 2022	Participation

NITTE MEENAKSHI INSTITUTE OF TECHNOLOGY

(An Autonomous Institution Under Visvesvaraya Technological University Belagavi)

Yelahanka, Bengaluru – 560064.

DEPARTMENT OF PHYSICAL EDUCATION AND SPORTS

SPORTS FACILITES, STUDENTS PARTICIPATION AND ACHIEVEMENTS-2021-22

DEPARTMENT OF PHYSICAL EDUCATION

Sports Facilities Available:

INDOOR

Multi-Gymnasium Men

Multi-Gymnasium Women

Fitness Center

Table Tennis Centre

Badminton

Carrom

Chess

OUTDOOR

Football

Basketball

Cricket

Volleyball

Throw ball

Soft ball

Hand ball

Badminton

Kabaddi

200mtr Track

Coaches: For Volleyball, Basketball, Football, Hockey, Cricket, Handball and Throwball

HUMAN RESOURCE

STAFF MEMBERS NAME	DESIGNATION
1. SOMASHEKHARAPPA K.L	PHYSICAL EDUCATION DIRECTOR
2. SHRUTHI T.R	PHYSICAL EDUCATION DIRECTOR
3. SHASHIKUMAR. R	TECHNICAL ASSISTANT & VOLLEYBALL COACH

PART TIME COACHES

4. NARESH .P. B Com, NIS	BASKETBALL COACH
5. NARAYAN .H. B A, B PED, NIS	HOCKEY COACH
6. VINOD .S. NIS	HAND BALL COACH
7. ANUDEEP. M. BE	FOOTBALL COACH
8. UDAY KUMAR.	CRICKET COACH
9. GANESH. P.	THROWBALL COACH
10. ANIL KUMAR. V.	GYM INSTRUCTOR

Multi-Gymnasium Men


Latitude: 13.130915
Longitude: 77.588776
Elevation: 911.51±3 m
Accuracy: 41.4 m
Time: 08-25-2021 15:22
Note: 13/08/21
Powered by NoteCam


Latitude: 13.127879
Longitude: 77.588627
Elevation: 909.77±3 m
Accuracy: 1300.0 m
Time: 08-25-2021 15:21
Note: 13/08/21
Powered by NoteCam


Latitude: 13.130915
Longitude: 77.588776
Elevation: 911.51±3 m
Accuracy: 41.4 m
Time: 08-25-2021 15:22
Note: 13/08/21
Powered by NoteCam


Latitude: 13.130904
Longitude: 77.588735
Elevation: 911.41±3 m
Accuracy: 88.7 m
Time: 08-25-2021 15:22
Note: 13/08/21
Powered by NoteCam

Multi-Gymnasium Women


Latitude: 13.129622
Longitude: 77.587161
Elevation: 904.31±3 m
Accuracy: 5.4 m
Time: 08-25-2021 15:04
Note: 13/08/21
Powered by NoteCam


Latitude: 13.129477
Longitude: 77.587213
Elevation: 903.7±3 m
Accuracy: 53.4 m
Time: 08-25-2021 14:58
Note: 13/08/21
Powered by NoteCam

NITTE EDUCATION TRUST

NITTE MEENAKSHI INSTITUTE OF TECHNOLOGY

An Autonomous Institution Approved by UGC/AICTE/Govt. of Karnataka
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Affiliated to Visvesvaraya Technological University, Belagavi
Post Box No. 6429, Yelahanka, Bengaluru-560064, Karnataka, INDIA

KNOWLEDGE • CHARACTER • UNITY

Badminton and Table Tennis Centre

OUTDOOR SPORTS FACILITIES

Basketball

Multi-Purpose Ground

Cricket Nets

VOLLEYBALL


atitude: 13.128072
ongitude: 77.587913
levation: 769.02±150 m
ccuracy: 69.0 m


Latitude: 13.130046
Longitude: 77.587216
Elevation: 908.15±3 m
Accuracy: 96.0 m
Time: 10-08-2021 11:30
Note: 09/10/21
Powered by NoteCam

Throw ball and Hockey

Badminton outdoor

DEPARTMENT OF PHYSICAL EDUCATION

DETAILS OF PARTICIPATION AND ACHIEVEMENTS-2021-2022

1. Football

Sl no.	NAME OF THE TOURNAMENT	ORGANISED BY	DATE	RESULT
1.	VTU NORTH ZONE	NCET	27^{TH} & 28^{TH} DECEMBER 2021	RUNNERS
2	ANAADYANTA	NMIT,BANGALORE	10^{TH} MAY 2022	RUNNERS UP

VTU North Zone Foot Ball (Men) Touranment Runners Up , on 27^{th} & 28^{th} Decmber 2021 at NCET,Bangalore

ANAADYANTA Foot Ball (Men) Touranment Runners Up , on 10^{th} & 11^{th} May 2022 at NMIT,Bangalore

2. Volleyball (Women)

Sl no.	NAME OF THE TOURNAMENT	ORGANISED BY	DATE	RESULT
1.	B.S NARAYANA MEMORIAL STATE LEVEL INTER COLLEGIATE TOURNAMENT	BMS COLLEGE OF ENGINEERING	23^{RD} TO 25^{TH} NOVEMBER 2021	WINNERS
2.	VTU BANGLORE ZONE INTER COLLEGIATE TOURNAMENT	NMIT	29^{TH} & 30^{TH} NOVEMBER 2021	WINNERS
3.	VTU INTER ZONE TOURNAMENT	NMIT	9^{TH} & 10^{TH} DECEMBER 2021	WINNERS
4.	CHIGURU-2022	CAMBRIDGE I T	24^{TH} JUNE 2022	WINNERS
5.	RHAPSODY-22 EXOUSIA	IISC,BANGALORE	26^{TH} JUNE 2022	WINNERS

VTU Inter Zone Volley Ball Women Winner's, on 10^{th} December 2021 held at NMIT, Bangalore.

B.S Narayana Memorial State Level Inter Collegiate Tournament Volley Ball Women Winner's on 23rd November 2021 held at BMSCE, Bangalore.

VTU Rest of Bangalore Zone Volley Ball Women Winner's, on 6th December 2021 held at NMIT, Bangalore.

CHIGURU - 2022 State Level Inter Collegiate Tournament Volley Ball Women Winner's on 24th June 2022 held at Cambridge IT, Bangalore.

RHAPSODY-22 EXOUSIA - 2022 State Level Inter Collegiate Tournament Volley Ball Women Winner's on 26th June 2022 held at IISC, Bangalore.

3. Basketball (Men)

Sl no.	NAME OF THE TOURNAMENT	ORGANISED BY	DATE	RESULT
1.	VTU North Zone	BMSSA	17TH &18TH DECEMBER 2021	WINNERS
2.	VTU Inter-Zone	GMIT,DAVANGERE	19TH & 20TH DECEMBER 2021	1ST RUNNERS UP
3.	INFINI 2021	PES UNIVERSITY	4TH & 5TH DECEMBER 2021	WINNERS
4.	ANAADYANTA	NMIT,BANGALORE	10TH MAY 2022	RUNNERS UP
5.	ST.CLARET CUP-2022	ST.CLARET COLLEGE	29TH JUNE 2022	WINNERS

VTU Bangalore North Zone Basket Ball Men Winner's, on 18th December 2021 held at BMSSA, Bangalore.

VTU Inter Zone Basket Ball Men 1st Runners Up, on 20th December 2021 held at GMIT, Davangere.

"INFINI 2021" Basket Ball Men Winner's, on 5th December 2021 held at PES Uni, Bangalore.

ANAADYANTA Basket Ball Men Runners on 11th May 2022 held at NMIT, Bangalore.

ST.CLARET CUP Basket Ball Men Winners on 29th June 2022 held at St.Claret College, Bangalore

4. Badminton (Men)

Sl No	NAME OF THE TOURNAMENT	ORGANISED BY	DATE	RESULT
01	VTU BANGALORE NORTH ZONE	BMSIT	15TH & 16TH NOVEMBER 2021	WINNERS
02	INFINI 2021	PES UNIVERSITY	4TH TO 7TH DECEMBER 2021	RUNNER UP

VTU Bangalore North Zone Badminton Men Winner's, on 17th November 2021

held at BMSIT, Bangalore.

5. Badminton (Women)

Sl No	NAME OF THE TOURNAMENT	ORGANISED BY	DATE	RESULT
01	VTU BANGALORE NORTH ZONE	BMSIT	15TH & 16TH NOVEMBER 2021	WINNERS

VTU Bangalore North Zone Badminton Women Winner's, on 17th November 2021 held at BMSIT, Bangalore.

6. Hockey (Men)

Sl No	NAME OF THE TOURNAMENT	ORGANIZED BY	DATE	RESULT
01	VTU BANGALORE NORTH ZONE	SIR MVIT	17^{TH} & 18^{TH} DECEMBER 2021	WINNERS
02	VTU INTERZONE	RYMCE,BELLARY	20^{TH} & 21^{ST} DECEMBER 2021	1^{ST} RUNNERS UP

VTU Bangalore North Zone Hockey Men Winner's, on 18^{th} December 2021 held at Sir MVIT, Bangalore.

VTU Inter Zone Hockey Men 1^{st} Runners Up on 18^{th} December 2021 held at RYMCE, Bellary.

7. Kabaddi (Men)

Sl No	NAME OF THE TOURNAMENT	ORGANIZED BY	DATE	RESULT
01	VTU BANGALORE NORTH ZONE	DR.TTIT,KGF	15TH TO 18TH DECEMBER 2021	RUNNERS UP
02	ANAADYANTA	NMIT,BANGALORE	11TH MAY 2022	RUNNERS UP
03	TRIUMPH CUP-2022	JSSATE,BANGALORE	24TH TO 25TH JUNE 2022	WINNERS

VTU Bangalore North Zone Kabaddi Men Runners on 16th December 2021 held at Dr. TTIT, KGF.

TRIUMPH CUP-2022 Kabaddi Men Winners from 24th to 25th June 2022 held at JSSATE, Bangalore.

ANAADYANTA -2022 Kabaddi Men Runners on 11th May 2022 held at NMIT, Bangalore.

8. Hand Ball (Men)

Sl No	NAME OF THE TOURNAMENT	ORGANIZED BY	DATE	RESULT
01	VTU BANGALORE NORTH ZONE	NMIT,BANGALORE,	22ND JUNE 2022	WINNERS
02	VTU INTERZONE	MIT,MYSORE	25TH JUNE 2022	2ND RUNNERS UP

VTU Bangalore North Zone Hand Ball Men Winners on 22nd June 2022 held at NMIT, Bangalore.

9. Athletic (Men & Women)

Sl No	NAME OF THE TOURNAMENT	ORGANIZED BY	DATE	RESULT
01	**VTU 23rd Athletic Meet**	**SJCIT Chickballapur**	**27th to 30th June 2022**	Silver Medal 4X100 relay
				Bronze Medal 200mtrs Run

VTU 23rd Athletic Meet Men Bronze Medal in 200 mtr Run From 27th to 30th June 2022 held at SJCIT, Chickballapur

VTU 23rd Athletic Meet Men Silver Medal in 4x100 mtr Run From 27^{th} to 30^{th} June 2022 held at SJCIT, Chickballapur

REPRESENTED VTU IN INTER UNIVERSITY COMPETITION IN THE YEAR OF 2021-2022

1	2021-22	**Ms. ANISHREE P**	CIVIL	**VOLLEYBALL (W)**
2	2021-22	**Ms. PHALGUNI S KOPPAR**	EEE	**VOLLEYBALL (W)**
3	2021-22	**Ms. MADHURI C**	ISE	**VOLLEYBALL (W)**
4	2021-22	**Ms. VARUNSHIKA VINAY**	CSE	**FOOTBALL(W)**
5	2021-22	**Ms. SUDEEKSHA**	ECE	**VOLLEYBALL (W)**
6	2021-22	**Ms. CHANDANA**	AERO	**HANDBALL(W)**
7	2021-22	**Mr. I L RISHANK CARIAPPA**	ME	**HOCKEY (M)**
8	2021-22	**Mr. ABHISHEK K R**	EEE	**KABADDI(M)**
9	2021-22	**Mr. SUMANTH S**	AERO	**BASKETBALL(M)**
10	2021-22	**Mr. SHAMANTH**	AERO	**HANDBALL(M)**

DEPARTMENT OF PHYSICAL EDUCATION

BADMINTON WOMEN

No. of Students participated and Won Medals /Awards in Sports, Games and other Events :Jan 2022 to June 2022

VTU Bangalore North Zone BADMINTON (W) Date:-15 to 16 Nov 2021, Venue: BMSIT & M ,Bangalore

SL No	Student Name	USN	Department	State University level	National level	International level	Date	Awards won
1	Tejaswini U	1NT18EC175	ECE	University			15 to 16 Nov 2021	WINNERS
2	Spandana I Shekar	1NT18EC164	ECE	University			15 to 16 Nov 2021	WINNERS
3	Ashitha R	1NT19ME019	MECH	University			15 to 16 Nov 2021	WINNERS
4	Amruthavarshini M	INT20EC013	ECE	University			15 to 16 Nov 2021	WINNERS
5	Ananya	1NT20EC015	ECE	University			15 to 16 Nov 2021	WINNERS

VTU Inter Zone BADMINTON (W) Date:-18 to 20 Nov 2021, Venue: VVCE ,Mysore

SL No	Student Name	USN	Department	State University level	National level	International level	Date	Awards won
1	Tejaswini U	1NT18EC175	ECE	University			18 to 20 Nov 2021	Participation
2	Spandana I Shekar	1NT18EC164	ECE	University			18 to 20 Nov 2021	Participation
3	Ashitha R	1NT19ME019	MECH	University			18 to 20 Nov 2021	Participation
4	Amruthavarshini M	INT20EC013	ECE	University			18 to 20 Nov 2021	Participation
5	Ananya	1NT20EC015	ECE	University			18 to 20 Nov 2021	Participation

BADMINTON MEN

No. of Students participated and Won Medals /Awards in Sports, Games and other Events :Jan 2022 to June 2022

VTU Bangalore North Zone BADMINTON (M) Date:-15 to 16 Nov 2021, Venue: BMSIT & M ,Bangalore

SL No	Student Name	USN	Department	State University level	National level	International level	Date	Awards won
1	Nithin H V	1NT18ME096	MECH	University			15 to 16 Nov 2021	WINNERS
2	Anikait Targolli	1NT18EC016	ECE	University			15 to 16 Nov 2021	WINNERS
3	Vishwas S Nayak	1NT19IS193	ISE	University			15 to 16 Nov 2021	WINNERS
4	Eshan Muthappa M M	INT20ME023	MECH	University			15 to 16 Nov 2021	WINNERS
5	Rohith Pal	1NT20EC118	ECE	University			15 to 16 Nov 2021	WINNERS
6	A V S Adithya	1NT19IS001	ISE	University			15 to 16 Nov 2021	WINNERS
7	Dhanush A	1NT20EC042	ECE	University			15 to 16 Nov 2021	WINNERS

VTU Inter Zone BADMINTON (M) Date:-18 to 20 Nov 2021, Venue: VVCE ,Mysore								
SL No	Student Name	USN	Department	State University level	National level	International level	Date	Awards won
1	Nithin H V	1NT18ME096	MECH	University			18 to 20 Nov 2021	Participation
2	Anikait Targolli	1NT18EC016	ECE	University			18 to 20 Nov 2021	Participation
3	Vishwas S Nayak	1NT19IS193	ISE	University			18 to 20 Nov 2021	Participation
4	Eshan Muthappa M M	INT20ME023	MECH	University			18 to 20 Nov 2021	Participation
5	Rohith Pal	1NT20EC118	ECE	University			18 to 20 Nov 2021	Participation
6	A V S Adithya	1NT19IS001	ISE	University			18 to 20 Nov 2021	Participation
7	Dhanush A	1NT20EC042	ECE	University			18 to 20 Nov 2021	Participation

VTU Inter Zone BADMINTON (M) Date:-04 to 07 Dec 2021, Venue: PES Uni ,Bangalore								
SL No	Student Name	USN	Department	State University level	National level	International level	Date	Awards won
1	Nithin H V	1NT18ME096	MECH			International	04 to 7 Dec 2021	Runners Up
2	Anikait Targolli	1NT18EC016	ECE			International	04 to 7 Dec 2021	Runners Up
3	Vishwas S Nayak	1NT19IS193	ISE			International	04 to 7 Dec 2021	Runners Up
4	Eshan Muthappa M M	INT20ME023	MECH			International	04 to 7 Dec 2021	Runners Up
5	A V S Adithya	1NT19IS001	ISE			International	04 to 7 Dec 2021	Runners Up

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DEPARTMENT OF PHYSICAL EDUCATION

THROWBALL WOMEN

No. of Students participated and Won Medals /Awards in Sports, Games and other Events :Jan 2022 to June 2022								
VTU Bangalore North Zone THROWBALL (W) Date:06-06-2022, Venue: RRIT, Bangalore								
SL No	Student Name	USN	Department	State University level	National level	International level	Date	Awards won
1	Phalguni S Koppar	1NT18EE034	EEE	University			06-06-2022	1ST RUNNERS UP
2	Anishree P	1NT17CV115	CIVIL	University			06-06-2022	1ST RUNNERS UP
3	Sharanya A	1NT18ME002	MECH	University			06-06-2022	1ST RUNNERS UP
4	Fouziya	INT20CS407	CSE	University			06-06-2022	1ST RUNNERS UP
5	Kavya S	1NT20IS076	ISE	University			06-06-2022	1ST RUNNERS UP
6	Pallavi V N	1NT20EC091	ECE	University			06-06-2022	1ST RUNNERS UP
7	Keerthi M	1NT20EC065	ECE	University			06-06-2022	1ST RUNNERS UP
8	V K Dhyaanaa	1NT21EE019	EEE	University			06-06-2022	1ST RUNNERS UP
9	D Sai Venila	1NT21AD017	AI & DS	University			06-06-2022	1ST RUNNERS UP
10	Rashi Himatsingka	INT21CS144	CSE	University			06-06-2022	1ST RUNNERS UP
11	Karishma C Sindhe	1NT21IS072	ISE	University			06-06-2022	1ST RUNNERS UP
12	Mandara N G	1NT21AE045	AERO	University			06-06-2022	1ST RUNNERS UP
Inter Collegiate THROWBALL (W) Date:06-12-2021, Venue: PES Uni, Bangalore								
1	Phalguni S Koppar	1NT18EE034	EEE	State			06-12-2021	Participation
2	Anishree P	1NT17CV115	CIVIL	State			06-12-2021	Participation
3	Sharanya A	1NT18ME002	MECH	State			06-12-2021	Participation
4	Fouziya	INT20CS407	CSE	State			06-12-2021	Participation
5	Kavya S	1NT20IS076	ISE	State			06-12-2021	Participation
6	Pallavi V N	1NT20EC091	ECE	State			06-12-2021	Participation
7	Keerthi M	1NT20EC065	ECE	State			06-12-2021	Participation
8	Madhuri C	1NT19IS077	ISE	State			06-12-2021	Participation
9	Likitha M	1NT19AE023	AERO	State			06-12-2021	Participation
Inter Collegiate THROWBALL (W) Date:23 to 25 Nov 2021, Venue: BMSCE, Bangalore								
1	Phalguni S Koppar	1NT18EE034	EEE	State			23 to 25 Nov 2021	Participation
2	Anishree P	1NT17CV115	CIVIL	State			23 to 25 Nov 2021	Participation
3	Fouziya	INT20CS407	CSE	State			23 to 25 Nov 2021	Participation

4	Sharanya A	1NT18ME002	MECH	State			23 to 25 Nov 2021	Participation
5	Sudeeksha K	1NT20EC151	ECE	State			23 to 25 Nov 2021	Participation
6	Madhuri C	1NT19IS077	ISE	State			23 to 25 Nov 2021	Participation
7	Kavya S	1NT20IS076	ISE	State			23 to 25 Nov 2021	Participation
8	Likitha M	1NT19AE023	AERO	State			23 to 25 Nov 2021	Participation

DEPARTMENT OF PHYSICAL EDUCATION

VOLLEYBALL WOMEN

No. of Students participated and Won Medals /Awards in Sports, Games and other Events :Jan 2022 to June 2022								
VTU INTER ZONE VOLLEYBALL (W) Date:09 to10 December 2021, Venue: NMIT, Bangalore								
SL No	Student Name	USN	Department	State University level	National level	International level	Date	Awards won
1	Phalguni S Koppar	1NT18EE034	EEE	University			09 to 10 Dec 2021	WINNERS
2	Anishree P	1NT17CV115	CIVIL	University			09 to 10 Dec 2021	WINNERS
3	V K Dhyaanaa	1NT21EE019	EEE	University			09 to 10 Dec 2021	WINNERS
4	Fouziya	INT20CS407	CSE	University			09 to 10 Dec 2021	WINNERS
5	Nikita B Radder	1NT18EC100	ECE	University			09 to 10 Dec 2021	WINNERS
7	Sudeeksha K	1NT20EC151	ECE	University			09 to 10 Dec 2021	WINNERS
8	Madhuri C	1NT19IS077	ISE	University			09 to 10 Dec 2021	WINNERS
9	Kavya P Naik	1NT18CS071	CSE	University			09 to 10 Dec 2021	WINNERS
10	Sangeetha Patil P	1NT19AE044	AERO	University			09 to 10 Dec 2021	WINNERS
11	Yashodha	1NT20IS416	ISE	University			09 to 10 Dec 2021	WINNERS
12	Aishanya Tiwari	1NT18EE009	EEE	University			09 to 10 Dec 2021	WINNERS
VTU BANGALORE ZONE VOLLEYBALL (W) Date:29-11-2021, Venue: NMIT,Bangalore								
1	Phalguni S Koppar	1NT18EE034	EEE	University			29-11-2021	WINNERS
2	Anishree P	1NT17CV115	CIVIL	University			29-11-2021	WINNERS
3	V K Dhyaanaa	1NT21EE019	EEE	University			29-11-2021	WINNERS
4	Fouziya	INT20CS407	CSE	University			29-11-2021	WINNERS
5	Nikita B Radder	1NT18EC100	ECE	University			29-11-2021	WINNERS
6	Sudeeksha K	1NT20EC151	ECE	University			29-11-2021	WINNERS
7	Madhuri C	1NT19IS077	ISE	University			29-11-2021	WINNERS
8	Kavya P Naik	1NT18CS071	CSE	University			29-11-2021	WINNERS
9	Sangeetha Patil P	1NT19AE044	AERO	University			29-11-2021	WINNERS
10	Yashodha	1NT20IS416	ISE	University			29-11-2021	WINNERS
11	Aishanya Tiwari	1NT18EE009	EEE	University			29-11-2021	WINNERS
Inter Collegiate VOLLEYBALL (W) Date:23 to 25 Nov 2021, Venue: BMSCE ,Bangalore								
1	Phalguni S Koppar	1NT18EE034	EEE	State			23 to 25 Nov 2021	WINNERS
2	Anishree P	1NT17CV115	CIVIL	State			23 to 25 Nov 2021	WINNERS

3	Fouziya	INT20CS407	CSE	State			23 to 25 Nov 2021	WINNERS
4	Nikita B Radder	1NT18EC100	ECE	State			23 to 25 Nov 2021	WINNERS
5	Sudeeksha K	1NT20EC151	ECE	State			23 to 25 Nov 2021	WINNERS
6	Madhuri C	1NT19IS077	ISE	State			23 to 25 Nov 2021	WINNERS
7	Kavya P Naik	1NT18CS071	CSE	State			23 to 25 Nov 2021	WINNERS
Inter Collegiate VOLLEYBALL (W) Date:24-06-2022, Venue: Cambridge I T ,Bangalore								
1	Phalguni S Koppar	1NT18EE034	EEE	State			24-06-2022	WINNERS
2	Anishree P	1NT17CV115	CIVIL	State			24-06-2022	WINNERS
3	Fouziya	INT20CS407	CSE	State			24-06-2022	WINNERS
4	Sudeeksha K	1NT20EC151	ECE	State			24-06-2022	WINNERS
5	Kavya P Naik	1NT18CS071	CSE	State			24-06-2022	WINNERS
6	Seema P	1NT20BA110	MBA	State			24-06-2022	WINNERS
7	V K Dhyaanaa	1NT21EE019	EEE	State			24-06-2022	WINNERS
8	Kavya S	1NT20IS076	ISE	State			24-06-2022	WINNERS
Inter Collegiate VOLLEYBALL (W) Date:26-06-2022, Venue: IISC ,Bangalore								
1	Phalguni S Koppar	1NT18EE034	EEE	State			26-06-2022	WINNERS
2	Anishree P	1NT17CV115	CIVIL	State			26-06-2022	WINNERS
3	Fouziya	INT20CS407	CSE	State			26-06-2022	WINNERS
4	Sudeeksha K	1NT20EC151	ECE	State			26-06-2022	WINNERS
5	V K Dhyaanaa	1NT21EE019	EEE	State			26-06-2022	WINNERS
6	Kavya S	1NT20IS076	ISE	State			26-06-2022	WINNERS

DEPARTMENT OF PHYSICAL EDUCATION

VOLLEYBALL MEN

No. of Students participated and Won Medals /Awards in Sports, Games and other Events :Jan 2022 to June 2022								
VTU Bangalore North ZONE VOLLEYBALL (M) Date: 29-11-2021, Venue: SJCIT, Chikballapura								
SL No	Student Name	USN	Depart ment	State University level	National level	International level	Date	Awards won
1	Pavan Kumar A S	1NT20BA058	MBA	University			29-11-2021	Participation
2	Ranjan L M	1NT19ME107	MECH	University			29-11-2021	Participation
3	Deepak S V	1NT19IS048	ISE	University			29-11-2021	Participation
4	Ayush Kumar	1NT19AE007	AERO	University			29-11-2021	Participation
5	Eshan Muthappa M M	1NT20ME023	MECH	University			29-11-2021	Participation
6	Dhanush Bhat	1NT19CS064	CSE	University			29-11-2021	Participation
7	Omkar G Vernekar	1NT19EC118	ECE	University			29-11-2021	Participation
8	Bharath Anand	1NT20BA014	MBA	University			29-11-2021	Participation
9	G Vamsi Nivas	1NT20ME024	MECH	University			29-11-2021	Participation
10	Darshan M Jainapur	1NT18CV026	CIVIL	University			29-11-2021	Participation
11	Rakesh Patil	1NT20AE048	AERO	University			29-11-2021	Participation
12	Raghavendra V Hegde	1NT19ME416	MECH	University			29-11-2021	Participation

DEPARTMENT OF PHYSICAL EDUCATION

TABEL TENNIS MEN

No. of Students participated and Won Medals /Awards in Sports, Games and other Events :Jan 2022 to June 2022								
VTU Bangalore North ZONE TABLE TENNIS (M) Date:24 to 25 Nov 2021, Venue: SVIT, Bangalore								
SL No	Student Name	USN	Department	State University level	National level	International level	Date	Awards won
1	D Goutham	1NT20ME025	MECH	University			24 to 25 Nov 2021	Participation
2	Rishik Makhija	1NT19IS132	ISE	University			24 to 25 Nov 2021	Participation
3	Abishek Rawal	1NT18CV097	CIVIL	University			24 to 25 Nov 2021	Participation
4	Rahul Chakravarti	1NT20IS129	ISE	University			24 to 25 Nov 2021	Participation
5	Akhilesh Mishra	1NT19IS010	ISE	University			24 to 25 Nov 2021	Participation
6	Samir Mulmi	1NT20CS153	CSE	University			24 to 25 Nov 2021	Participation
7	Devesh Mirani	1NT18CS037	CSE	University			24 to 25 Nov 2021	Participation

DEPARTMENT OF PHYSICAL EDUCATION

HOCKEY MEN

No. of Students participated and Won Medals /Awards in Sports, Games and other Events :Jan 2022 to June 2022

VTU INTER ZONE HOCKEY (M) Date:20 to 21 Dec 2021, Venue: RYMEC, BELLARY

SL No	Student Name	USN	Depart ment	State University level	National level	Internati onal level	Date	Awards won
1	Jatin Ponnappa	1NT19ME057	MECH	University			20 to 21 Dec 2021	1st Runners Up
2	M.A Devaiah	1NT19ME071	MECH	University			20 to 21 Dec 2021	1st Runners Up
3	Vivan C V	1NT19EC182	ECE	University			20 to 21 Dec 2021	1st Runners Up
4	I L Rishank Kariappa	1NT19ME052	MECH	University			20 to 21 Dec 2021	1st Runners Up
5	Barath Kumar	1NT19AE008	AERO	University			20 to 21 Dec 2021	1st Runners Up
6	Chalan Appachu P V	1NT19ME024	MECH	University			20 to 21 Dec 2021	1st Runners Up
7	Varshith E	1NT19ME140	MECH	University			20 to 21 Dec 2021	1st Runners Up
8	Aryan C Mouli	1NT19EE019	EEE	University			20 to 21 Dec 2021	1st Runners Up
9	Ganapathy N B	1NT20IS054	ISE	University			20 to 21 Dec 2021	1st Runners Up
10	Prajwal N	1NT20ME050	MECH	University			20 to 21 Dec 2021	1st Runners Up
11	T K Bhuvan Raju	1NT19AE011	AERO	University			20 to 21 Dec 2021	1st Runners Up
12	Yashas R Shetty	1NT19ME147	MECH	University			20 to 21 Dec 2021	1st Runners Up
13	Reuben Jacob Mathews	1NT21ME039	MECH	University			20 to 21 Dec 2021	1st Runners Up
14	Relvin N	1NT18CV068	CIVIL	University			20 to 21 Dec 2021	1st Runners Up
15	Dhaarmik	24927 (SAN)	CSE	University			20 to 21 Dec 2021	1st Runners Up
16	Darshan J	1NT20ME020	MECH	University			20 to 21 Dec 2021	1st Runners Up
VTU Bangalore North Zone HOCKEY (M) Date:17-12-2021, Venue: Sir MVIT, Bangalore								
1	Jatin Ponnappa	1NT19ME057	MECH	University			17-12-2021	WINNERS
2	M.A Devaiah	1NT19ME071	MECH	University			17-12-2021	WINNERS
3	Vivan C V	1NT19EC182	ECE	University			17-12-2021	WINNERS
4	I L Rishank Kariappa	1NT19ME052	MECH	University			17-12-2021	WINNERS
5	Barath Kumar	1NT19AE008	AERO	University			17-12-2021	WINNERS
6	Chalan Appachu P V	1NT19ME024	MECH	University			17-12-2021	WINNERS
7	Varshith E	1NT19ME140	MECH	University			17-12-2021	WINNERS
8	Aryan C Mouli	1NT19EE019	EEE	University			17-12-2021	WINNERS
9	Ganapathy N B	1NT20IS054	ISE	University			17-12-2021	WINNERS

10	Prajwal N	1NT20ME050	MECH	University			17-12-2021	WINNERS
11	T K Bhuvan Raju	1NT19AE011	AERO	University			17-12-2021	WINNERS
12	Yashas R Shetty	1NT19ME147	MECH	University			17-12-2021	WINNERS
13	Reuben Jacob Mathews	1NT21ME039	MECH	University			17-12-2021	WINNERS
14	Relvin N	1NT18CV068	CIVIL	University			17-12-2021	WINNERS
15	Dhaarmik	24927 (SAN)	CSE	University			17-12-2021	WINNERS
16	Darshan J	1NT20ME020	MECH	University			17-12-2021	WINNERS

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DEPARTMENT OF PHYSICAL EDUCATION

HANDBALL MEN

No. of Students participated and Won Medals /Awards in Sports, Games and other Events :Jan 2022 to June 2022

VTU INTER ZONE HANDBALL (M) Date:29-06-2022, Venue: MIT, MYSORE

SL No	Student Name	USN	Department	State University level	National level	International level	Date	Awards won
1	Shamant S Acharya	1NT18AE048	AERO	University			29-06-2022	2 nd Runners Up
2	Koushik K A	1NT18CS078	CSE	University			29-06-2022	2 nd Runners Up
3	Shashank R	1NT18EC148	ECE	University			29-06-2022	2 nd Runners Up
4	Ankith B C	1NT18CV011	CIVIL	University			29-06-2022	2 nd Runners Up
5	Pavan Kumar A S	1NT20BA058	MBA	University			29-06-2022	2 nd Runners Up
7	Prajwal Banajager	1NT19ME094	MECH	University			29-06-2022	2 nd Runners Up
8	Deekshith B H	1NT21EC402	ECE	University			29-06-2022	2 nd Runners Up
9	Dushyanth Chilukuri	1NT20ME022	MECH	University			29-06-2022	2 nd Runners Up
10	Jai Maruthi	1NT19ME056	MECH	University			29-06-2022	2 nd Runners Up
11	Karthik Hukkeri	1NT20EE028	EEE	University			29-06-2022	2 nd Runners Up
12	V Koti Karthik	1NT21CS197	CSE	University			29-06-2022	2 nd Runners Up
13	Vinesh Vikshith	1NT21AD061	AI & DS	University			29-06-2022	2 nd Runners Up
14	Bishwas	1NT21IS044	ISE	University			29-06-2022	2 nd Runners Up

VTU BANGALORE NORTH ZONE HANDBALL (M) Date:22-06-2022, Venue: NMIT ,Bangalore

SL No	Student Name	USN	Department	State University level	National level	International level	Date	Awards won
1	Shamant S Acharya	1NT18AE048	AERO	University			22-06-2022	Winners
2	Koushik K A	1NT18CS078	CSE	University			22-06-2022	Winners
3	Shashank R	1NT18EC148	ECE	University			22-06-2022	Winners
4	Ankith B C	1NT18CV011	CIVIL	University			22-06-2022	Winners
5	Pavan Kumar A S	1NT20BA058	MBA	University			22-06-2022	Winners
6	Prajwal Banajager	1NT19ME094	MECH	University			22-06-2022	Winners
7	Deekshith B H	1NT21EC402	ECE	University			22-06-2022	Winners
8	Dushyanth Chilukuri	1NT20ME022	MECH	University			22-06-2022	Winners
9	Jai Maruthi	1NT19ME056	MECH	University			22-06-2022	Winners
10	Karthik Hukkeri	1NT20EE028	EEE	University			22-06-2022	Winners
11	V Koti Karthik	1NT21CS197	CSE	University			22-06-2022	Winners
12	Vinesh Vikshith	1NT21AD061	AI & DS	University			22-06-2022	Winners
13	Bishwas	1NT21IS044	ISE	University			22-06-2022	Winners

Inter Collegiate HANDBALL (M) Date:28-04-2022, Venue: Christ Uni ,Bangalore								
1	Shamant S Acharya	1NT18AE048	AERO	State			28-04-2022	participated
2	Koushik K A	1NT18CS078	CSE	State			28-04-2022	participated
3	Shashank R	1NT18EC148	ECE	State			28-04-2022	participated
4	Ankith B C	1NT18CV011	CIVIL	State			28-04-2022	participated
5	Pavan Kumar A S	1NT20BA058	MBA	State			28-04-2022	participated
6	Prajwal Banajager	1NT19ME094	MECH	State			28-04-2022	participated
7	Deekshith B H	1NT21EC402	ECE	State			28-04-2022	participated
8	Dushyanth Chilukuri	1NT20ME022	MECH	State			28-04-2022	participated
9	Jai Maruthi	1NT19ME056	MECH	State			28-04-2022	participated
10	Karthik Hukkeri	1NT20EE028	EEE	State			28-04-2022	participated
11	V Koti Karthik	1NT21CS197	CSE	State			28-04-2022	participated
12	Vinesh Vikshith	1NT21AD061	AI & DS	State			28-04-2022	participated

DEPARTMENT OF PHYSICAL EDUCATION

ATHLETIC

No. of Students participated and Won Medals /Awards in Sports, Games and other Events :Jan 2022 to June 2022

VTU 23rd Inter Collegiage Athletic Meet-2021-22 From 27th to 30th june 2022 at SJCIT ,Chickballapur

SL No	Student Name	USN	Department	State University level	National level	International level	Date	Awards won
1	Dhanush Kumar S	1NT18ME044	MECH	University			27 to 30 June 2022	2nd 4*100 relay
2	Sagar P	1NT20CV413	CIVIL	University			27 to 30 June 2022	2nd 4*100 relay
3	Reuben Jacob Mathews	1NT21ME039	MECH	University			27 to 30 June 2022	2nd 4*100 relay
4	Jason Alexander Lakra	1NT20ME030	MECH	University			27 to 30 June 2022	2nd 4*100 relay
5	Sagar P	1NT20CV413	CIVIL	University			27 to 30 June 2022	3rd 200mtrs Run
	Participant List							
1	Dhanush Kumar S	1NT18ME044	MECH	University			27 to 30 June 2022	Participation
2	Pratish Thakur	1NT19CV043	CIVIL	University			27 to 30 June 2022	Participation
3	Sagar P	1NT20CV413	CIVIL	University			27 to 30 June 2022	Participation
4	Jason Alexander Lakra	1NT20ME030	MECH	University			27 to 30 June 2022	Participation
5	S Vrajesh	1NT20EC123	ECE	University			27 to 30 June 2022	Participation
6	Reuben Jacob Mathews	1NT21ME039	MECH	University			27 to 30 June 2022	Participation
7	Allister Russell A	1NT21AI004	AI	University			27 to 30 June 2022	Participation
8	Varun Sagar M S	1NT21CV049	CIVIL	University			27 to 30 June 2022	Participation
9	Darshan M P	1NT21CV009	CIVIL	University			27 to 30 June 2022	Participation
10	Keerthan P	1NT21EC064	ECE	University			27 to 30 June 2022	Participation
11	Anvith Skanda Hegde K S	1NT21AI007	AI	University			27 to 30 June 2022	Participation
12	Chandana M S	1NT19AE014	AERO	University			27 to 30 June 2022	Participation
13	Jalina Maris I	1NT21ME020	MECH	University			27 to 30 June 2022	Participation
14	Sanskruthi S Chinchewadi	1NT21AE068	AERO	University			27 to 30 June 2022	Participation
15	Thanushree H L	1NT21CS191	CSE	University			27 to 30 June 2022	Participation
16	Chethana P V	1NT21AE018	AERO	University			27 to 30 June 2022	Participation

DEPARTMENT OF PHYSICAL EDUCATION

BASKETBALL (M)

No. of Students participated and Won Medals /Awards in Sports, Games and other Events :Jan 2022 to June 2022

Inter Collegiate BASKETBALL (M) Date: 24 to 25 Nov 2021, Venue: BMSCE, Bangalore

SL No	Student Name	USN	Department	State/ University level	National level	International level	Date	Awards won
1	Aditya V	1NT18ME009	MECH	State			24 to 25 Nov 2021	Participation
2	Sumanth S	1NT19AE069	AERO	State			24 to 25 Nov 2021	Participation
3	Bhuvan C Raju	1NT19ME098	MECH	State			24 to 25 Nov 2021	Participation
4	Nandan	1NT18ISE098	ISE	State			24 to 25 Nov 2021	Participation
5	Suraj K H	1NT18ME155	MECH	State			24 to 25 Nov 2021	Participation
6	Sharvin pinto	1NT19CS174	CSE	State			24 to 25 Nov 2021	Participation
7	Mahendra	1NT18ME074	MECH	State			24 to 25 Nov 2021	Participation
8	Dishad	1NT18ME046	MECH	State			24 to 25 Nov 2021	Participation
9	Pavan Preet	1NT19IS105	ISE	State			24 to 25 Nov 2021	Participation
10	Merven	1NT19ME080	MECH	State			24 to 25 Nov 2021	Participation
11	Parth	1NT20EC093	ECE	State			24 to 25 Nov 2021	Participation
12	Abhinav S	1NT18EE004	EEE	State			24 to 25 Nov 2021	Participation

Inter Collegiate BASKETBALL (M) Date: 04 to 05 Dec 2021, Venue: PES Uni, Bangalore

SL No	Student Name	USN	Department	State/ University level	National level	International level	Date	Awards won
1	Aditya V	1NT18ME009	MECH	State			04 to 5 Dec 2021	Winners
2	Sumanth S	1NT19AE069	AERO	State			04 to 5 Dec 2021	Winners
3	Bhuvan C Raju	1NT19ME098	MECH	State			04 to 5 Dec 2021	Winners
4	Nandan	1NT18ISE098	ISE	State			04 to 5 Dec 2021	Winners
5	Suraj K H	1NT18ME155	MECH	State			04 to 5 Dec 2021	Winners
6	Sharvin pinto	1NT19CS174	CSE	State			04 to 5 Dec 2021	Winners
7	Mahendra	1NT18ME074	MECH	State			04 to 5 Dec 2021	Winners
8	Dishad	1NT18ME046	MECH	State			04 to 5 Dec 2021	Winners

9	Pavan Preet	1NT19IS105	ISE	State			04 to 5 Dec 2021	Winners
10	Merven	1NT19ME080	MECH	State			04 to 5 Dec 2021	Winners
11	Anubhav Yadav	1NT18CS017	CSE	State			04 to 5 Dec 2021	Winners
12	Abhinav S	1NT18EE004	EEE	State			04 to 5 Dec 2021	Winners

VTU Bangalore North Zone BASKETBALL (M) Date: 17 to 18 Dec 2021, Venue: BMSSA, Bangalore

SL No	Student Name	USN	Department	State/ University level	National level	International level	Date	Awards won
1	Aditya V	1NT18ME009	MECH	University			17 to 18 Dec 2021	Winners
2	Sumanth S	1NT19AE069	AERO	University			17 to 18 Dec 2021	Winners
3	Bhuvan C Raju	1NT19ME098	MECH	University			17 to 18 Dec 2021	Winners
4	Nandan	1NT18ISE098	ISE	University			17 to 18 Dec 2021	Winners
5	Suraj K H	1NT18ME155	MECH	University			17 to 18 Dec 2021	Winners
6	Sharvin pinto	1NT19CS174	CSE	University			17 to 18 Dec 2021	Winners
7	Mahendra	1NT18ME074	MECH	University			17 to 18 Dec 2021	Winners
8	Dishad	1NT18ME046	MECH	University			17 to 18 Dec 2021	Winners
9	Pavan Preet	1NT19IS105	ISE	University			17 to 18 Dec 2021	Winners
10	Dilip Kumar	25354(SAN)	EEE	University			17 to 18 Dec 2021	Winners
11	Anubhav Yadav	1NT18CS017	CSE	University			17 to 18 Dec 2021	Winners
12	Abhinav S	1NT18EE004	EEE	University			17 to 18 Dec 2021	Winners

VTU Inter Zone BASKETBALL (M) Date: 19 to 20 Dec 2021, Venue: GMIT, Davangere

SL No	Student Name	USN	Department	State/ University level	National level	International level	Date	Awards won
1	Aditya V	1NT18ME009	MECH	University			19 to 20 Dec 2021	1st Runners Up
2	Sumanth S	1NT19AE069	AERO	University			19 to 20 Dec 2021	1st Runners Up
3	Bhuvan C Raju	1NT19ME098	MECH	University			19 to 20 Dec 2021	1st Runners Up
4	Nandan	1NT18ISE098	ISE	University			19 to 20 Dec 2021	1st Runners Up
5	Suraj K H	1NT18ME155	MECH	University			19 to 20 Dec 2021	1st Runners Up
6	Sharvin pinto	1NT19CS174	CSE	University			19 to 20 Dec 2021	1st Runners Up
7	Mahendra	1NT18ME074	MECH	University			19 to 20 Dec 2021	1st Runners Up
8	Dishad	1NT18ME046	MECH	University			19 to 20 Dec 2021	1st Runners Up
9	Pavan Preet	1NT19IS105	ISE	University			19 to 20 Dec 2021	1st Runners Up
10	Dilip Kumar	25354(SAN)	EEE	University			19 to 20 Dec 2021	1st Runners Up

11	Anubhav Yadav	1NT18CS017	CSE	University			19 to 20 Dec 2021	1st Runners Up
12	Abhinav S	1NT18EE004	EEE	University			19 to 20 Dec 2021	1st Runners Up

Inter Collegiate BASKETBALL (M) Date: 07 to 08 April 2022, Venue: St.Josephs College, Bangalore

SL No	Student Name	USN	Department	State/ University level	National level	International level	Date	Awards won
1	Aditya V	1NT18ME009	MECH	State			07 to 08 April 2022	Participation
2	Sumanth S	1NT19AE069	AERO	State			07 to 08 April 2022	Participation
3	Bhuvan C Raju	1NT19ME098	MECH	State			07 to 08 April 2022	Participation
4	Nandan	1NT18ISE098	ISE	State			07 to 08 April 2022	Participation
5	Suraj K H	1NT18ME155	MECH	State			07 to 08 April 2022	Participation
6	Sharvin pinto	1NT19CS174	CSE	State			07 to 08 April 2022	Participation
7	Siv Kiran G	26068(SAN)	AERO	State			07 to 08 April 2022	Participation
8	Dishad	1NT18ME046	MECH	State			07 to 08 April 2022	Participation
9	Pavan Preet	1NT19IS105	ISE	State			07 to 08 April 2022	Participation
10	Dilip Kumar	25354(SAN)	EEE	State			07 to 08 April 2022	Participation
11	Anubhav Yadav	1NT18CS017	CSE	State			07 to 08 April 2022	Participation
12	Abhinav S	1NT18EE004	EEE	State			07 to 08 April 2022	Participation

Inter Collegiate BASKETBALL (M) Date: 19 to 23 April 2022, Venue: Christ Uni, Bangalore

SL No	Student Name	USN	Department	State/ University level	National level	International level	Date	Awards won
1	Aditya V	1NT18ME009	MECH	State			19 to 23 April 2022	Participation
2	Sumanth S	1NT19AE069	AERO	State			19 to 23 April 2022	Participation
3	Bhuvan C Raju	1NT19ME098	MECH	State			19 to 23 April 2022	Participation
4	Nandan	1NT18ISE098	ISE	State			19 to 23 April 2022	Participation
5	Suraj K H	1NT18ME155	MECH	State			19 to 23 April 2022	Participation
6	Parth	1NT20EC093	ECE	State			19 to 23 April 2022	Participation
7	Siv Kiran G	26068(SAN)	AERO	State			19 to 23 April 2022	Participation
8	Dishad	1NT18ME046	MECH	State			19 to 23 April 2022	Participation
9	Pavan Preet	1NT19IS105	ISE	State			19 to 23 April 2022	Participation
10	Dilip Kumar	25354(SAN)	EEE	State			19 to 23 April 2022	Participation
11	Anubhav Yadav	1NT18CS017	CSE	State			19 to 23 April 2022	Participation
12	Abhinav S	1NT18EE004	EEE	State			19 to 23 April 2022	Participation

Inter Collegiate BASKETBALL (M) Date: 28 to 30 April 2022, Venue: Christ Uni, Kengeri, Bangalore								
SL No	Student Name	USN	Department	State/ University level	National level	International level	Date	Awards won
1	Aditya V	1NT18ME009	MECH	State			28 to 30 April 2022	Runners Up
2	Sumanth S	1NT19AE069	AERO	State			28 to 30 April 2022	Runners Up
3	Bhuvan C Raju	1NT19ME098	MECH	State			28 to 30 April 2022	Runners Up
4	Nandan	1NT18ISE098	ISE	State			28 to 30 April 2022	Runners Up
5	Suraj K H	1NT18ME155	MECH	State			28 to 30 April 2022	Runners Up
6	Parth	1NT20EC093	ECE	State			28 to 30 April 2022	Runners Up
7	Manav	1NT20ME038	MECH	State			28 to 30 April 2022	Runners Up
8	Dishad	1NT18ME046	MECH	State			28 to 30 April 2022	Runners Up
9	Pavan Preet	1NT19IS105	ISE	State			28 to 30 April 2022	Runners Up
10	Dilip Kumar	25354(SAN)	EEE	State			28 to 30 April 2022	Runners Up
11	Anubhav Yadav	1NT18CS017	CSE	State			28 to 30 April 2022	Runners Up
12	Abhinav S	1NT18EE004	EEE	State			28 to 30 April 2022	Runners Up

Inter Collegiate BASKETBALL (M) Date: 01 to 02 June 2022, Venue: RVCE, Bangalore								
SL No	Student Name	USN	Department	State/ University level	National level	International level	Date	Awards won
1	Aditya V	1NT18ME009	MECH	State			01 to 02 June 2022	Participation
2	Sumanth S	1NT19AE069	AERO	State			01 to 02 June 2022	Participation
3	Bhuvan C Raju	1NT19ME098	MECH	State			01 to 02 June 2022	Participation
4	Nandan	1NT18ISE098	ISE	State			01 to 02 June 2022	Participation
5	Suraj K H	1NT18ME155	MECH	State			01 to 02 June 2022	Participation
6	Parth	1NT20EC093	ECE	State			01 to 02 June 2022	Participation
7	Manav	1NT20ME038	MECH	State			01 to 02 June 2022	Participation
8	Dishad	1NT18ME046	MECH	State			01 to 02 June 2022	Participation
9	Pavan Preet	1NT19IS105	ISE	State			01 to 02 June 2022	Participation
10	Sharvin pinto	1NT19CS174	CSE	State			01 to 02 June 2022	Participation
11	Anubhav Yadav	1NT18CS017	CSE	State			01 to 02 June 2022	Participation
12	Abhinav S	1NT18EE004	EEE	State			01 to 02 June 2022	Participation

Inter Collegiate BASKETBALL (M) Date: 10 to 11 May 2022, Venue: NMIT, Bangalore								
SL No	Student Name	USN	Department	State/ University level	National level	International level	Date	Awards won
1	Aditya V	1NT18ME009	MECH	State			10 to 11 May 2022	Runners Up
2	Sumanth S	1NT19AE069	AERO	State			10 to 11 May 2022	Runners Up
3	Bhuvan C Raju	1NT19ME098	MECH	State			10 to 11 May 2022	Runners Up
4	Nandan	1NT18ISE098	ISE	State			10 to 11 May 2022	Runners Up
5	Suraj K H	1NT18ME155	MECH	State			10 to 11 May 2022	Runners Up
6	Parth	1NT20EC093	ECE	State			10 to 11 May 2022	Runners Up
7	Manav	1NT20ME038	MECH	State			10 to 11 May 2022	Runners Up
8	Dishad	1NT18ME046	MECH	State			10 to 11 May 2022	Runners Up
9	Pavan Preet	1NT19IS105	ISE	State			10 to 11 May 2022	Runners Up
10	Sharvin pinto	1NT19CS174	CSE	State			10 to 11 May 2022	Runners Up
11	Anubhav Yadav	1NT18CS017	CSE	State			10 to 11 May 2022	Runners Up
12	Abhinav S	1NT18EE004	EEE	State			10 to 11 May 2022	Runners Up

Inter Collegiate BASKETBALL (M) Date: 29-06-2022, Venue: St.Claret College, Bangalore								
SL No	Student Name	USN	Department	State/ University level	National level	International level	Date	Awards won
1	Aditya V	1NT18ME009	MECH	State			29-06-2022	Winners
2	Sumanth S	1NT19AE069	AERO	State			29-06-2022	Winners
3	Bhuvan C Raju	1NT19ME098	MECH	State			29-06-2022	Winners
4	Nandan	1NT18ISE098	ISE	State			29-06-2022	Winners
5	Suraj K H	1NT18ME155	MECH	State			29-06-2022	Winners
6	Parth	1NT20EC093	ECE	State			29-06-2022	Winners
7	Manav	1NT20ME038	MECH	State			29-06-2022	Winners
8	Dishad	1NT18ME046	MECH	State			29-06-2022	Winners
9	Pavan Preet	1NT19IS105	ISE	State			29-06-2022	Winners
10	Sharvin pinto	1NT19CS174	CSE	State			29-06-2022	Winners
11	Anubhav Yadav	1NT18CS017	CSE	State			29-06-2022	Winners
12	Abhinav S	1NT18EE004	EEE	State			29-06-2022	Winners

UG
SYLLABUS

NITTE MEENAKSHI INSTITUTE OF TECHNOLOGY

(AN AUTONOMOUS INSTITUTION, AFFILIATED TO VTU, BELGAUM AND ACCREDITED BY NBA, NEW DELHI)

YELAHANKA, BANGALORE – 560064

Department of Computer Science and Engineering

SCHEME AND SYLLABUS

BE PROGRAMME– 2018 BATCH (AUTONOMOUS SCHEME)

Academic Year 2021-22

TABLE OF CONTENTS

VISION & MISSION OF THE COLLEGE

Vision

To provide India and the World, technical manpower of the highest academic excellence and World class by shaping our youth through holistic and integrated education of the highest quality.

Mission

To develop Nitte Meenakshi Institute of Technology through Quality, Innovative and State-of-art educational initiatives into a centre of academic excellence that will turn out youth with well-balanced personality & commitment to rich cultural heritage of India and who will successfully face the Scientific and Technological challenges in the fast-evolving Global scenario with a high degree of credibility, integrity and ethical standards.

Quality Policy

To bring about constant and Continuous Improvement in the Quality of Education Imparted and Turning out High Quality Professionals with Balanced and Globally Competitive Personality through Regular Monitoring of the Academic/ Administrative Activities of the Institution and Implementing Corrective Actions in the Best Ethical and Transparent Traditions.

1. Vision and Mission of Department

1.1 Vision:

To empower students of Computer Science and Engineering Department to be technologically adept, innovative, self-motivated and responsible global citizen possessing human values and enable them to contribute in the industrial development innovation, high quality technical education and research with the ever changing world.

1.2 Mission:

The department of Computer Science and Engineering strives to prepare students

- For a challenging professional career and nurture their entrepreneurship ability by grooming their leadership skills and innovative ability, thereby enabling them to serve the engineering profession and society.
- To accomplish higher studies by providing conducive teaching-learning, research environment.

2. Programme Education Objectives (PEOs)

PEO1: Excel in Professional career by acquiring knowledge in basic sciences and Computer Science and Engineering principles.

PEO2: Graduates are capable of pursuing higher education and research.

PEO3: Adapt to technological advancements by engaging in lifelong learning with leadership qualities, professional ethics and soft skills**.**

3. Programme Specific Outcomes (PSO)

PSO 1: Professional Skills: The ability to comprehend, analyze, design and implement an conduct research in the domain of Computing Algorithms, Application Development, Operating System, and Allied Areas, Computer Networks& security, Software Design, Data Mining and Big Data Analytics, Cloud computing, Analog and Digital Circuits.

PSO 2: Problem Solving Skills: Ability to apply the techniques of Data Base Management, Mathematical techniques, and adopt standard software engineering and professional practices to evolve optimal solutions.

PSO 3: Ethics and Career Development: Inculcate skills for a successful career in the industry based on sound principles of software project management, team work and ethical practices, develop the spirit of entrepreneurship and also nurture the quest for higher levels of knowledge.

4. Programme Outcomes (POs)

1	**PO1. Engineering knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
2	**PO2. Problem analysis:** Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
3	**PO3. Design/development of solutions**: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
4	**PO4. Conduct investigations of complex problems:** Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
5	**PO5. Modern tool usage**: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
6	**PO6. The engineer and society:** Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
7	**PO7. Environment and sustainability:** Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
8	**PO8. Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
9	**PO9. Individual and team work:** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
10	**PO10. Communication:** Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
11	**PO11. Project management and finance:** Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
12	**PO12. Life-long learning:** Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

5. Approach to Curriculum:

The curriculum is framed by keeping in mind the ever changing industrial trends in technology. The Stakeholders in preparing the curriculum involve the Industry experts, Academicians with expertise, Alumni of the department, Parents, Internal Faculty and the Final year students. The suggestions are taken and discussed in the BoS (Board of Studies). After approval from the BoS, the DUGC approval is taken and then the Academic Council approves the final curriculum.

The main objective of framing the curriculum:

- To build a strong technical, analytical and mathematical foundation in students. This will enable the students to be proficient in their technical profession.
- To inculcate in students the good ethical conduct, great team-spirit, excellent leadership qualities and provide a wholesome growth by encouraging Life-long learning which is needed for an excelling career.
- To make the students more competent to face challenges in the outside world.

6. Courses Inclined Towards Cutting Edge Technologies.

Department of CSE offers courses which are inclined towards cutting edge technologies along with the basic fundamental courses.

- Internet Of Things (IoT)
- Deep Learning
- Data Science/Big Data Analytics
- Block Chain Technologies
- Machine Learning
- Artificial Intelligence
- Virtual Reality
- Cloud Computing
- Robotics
- Quantum Computing
- Cyber Security

7. Definitions/Descriptions:

- **Semester Scheme:** Each UG degree is a 4 Academic year Program, each year being divided into 2 semesters. Each semester is for duration of 20 weeks, which includes Course work, CIE (Continuous Internal Evaluation), SEE (Semester End Examination). The CIE is conducted unit-wise on a monthly basis. The SEE is conducted at the end of every semester to evaluate the students' overall performance and achievement.
- **Credit System:** Each unit of a course is assigned *one credit*. The students earn the credits by registering to the respective courses, completing a teaching-learning process which is then followed by CIE and SEE. The CBCS (Choice Based Credit System) helps customizing the course work for a student by including Core Courses and Elective Courses.

- **Core Course:** Courses that are declared as mandatory for the students.
- **Electives:** Courses that are offered to the students from which they are allowed to choose.

- **Credit Courses:** Students earn *one credit* by registering for the course,
  - Attending Lecture (L) - *One hour/Week/Semester* Theory courses.
  - Attending Laboratory or Practical (P)/ Tutorials (T) - *Two Hours/Week/Semester*.
- **Course load:** Every student who registers for the courses in a semester for an average total credits of anywhere between 23 to 26 credits if the student is registered under the scheme of earning a total of 200 credits by the end of the UG degree (In the new scheme students must earn a total of 175 credits). The permissible contact hours are maximum 35 Hours/week. Typical Course Load in a semester is shown in the Table 1.

Course Load per semester			
No. of Courses	**Credits per Course**	**Total Credits**	**Total contact Hours/ week**
Three Lecture Courses	4:0:0	12	12
One Lecture Course	3:0:0	3	3
One Lecture + One tutorial	3:2:0	4	5
Two Lectures + Practical	3:0:2	8	10
Two Practical courses	0:0:2	2	4

Table 1: Typical Course load

- **Credit Representation:** Credits for different academic activities are represented in the **Table 1.**

Lectures (Hours/Week/Semester)	**Tutorials** (Hours/Week/Semester)	**Practical** (Hours/Week/Semester)	**Credits (L:T:P)**	**Total Credits**
4	0	0	4:0:0	4
3	2	0	3:1:0	4
0	2	0	0:1:0	1
0	0	2	0:0:1	1
2	2	2	2:1:1	4
0	2	2	0:1:1	2

Table 1: Credit Representation

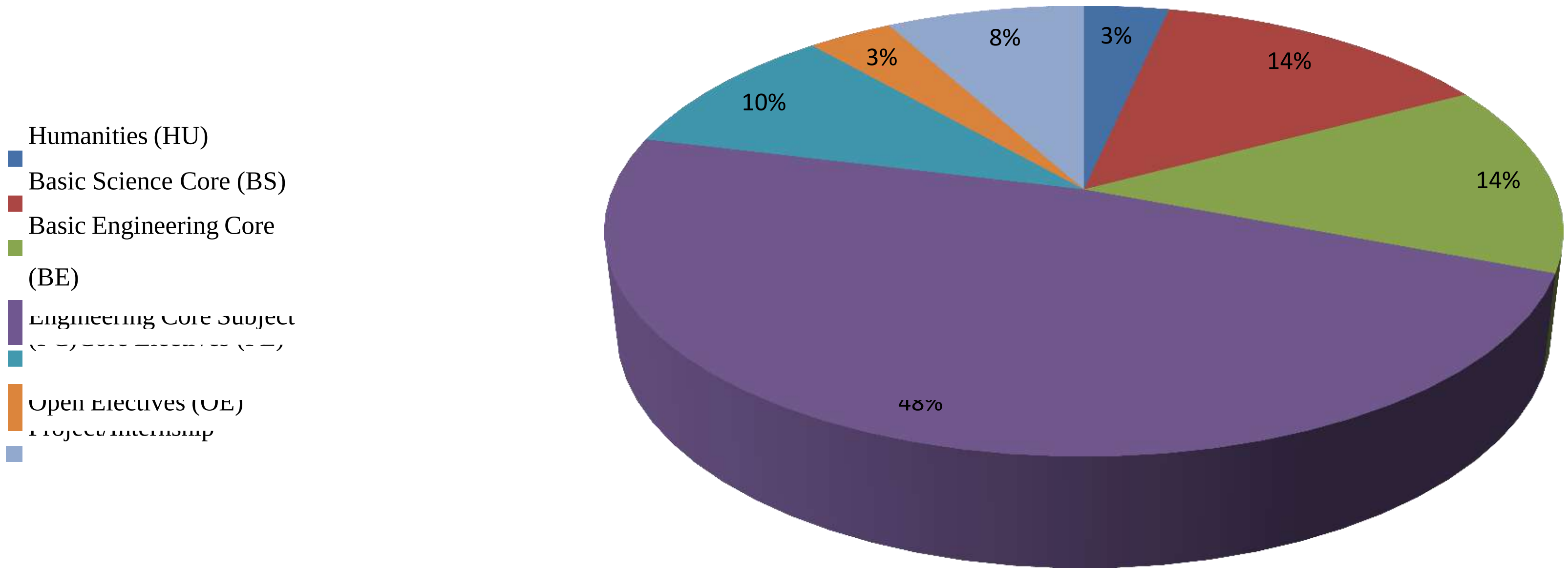
2018 SCHEME

SCHEME – I TO VIII SEMESTERS

Typical Curriculum Structure for UG CS&E Degree Programmes

Sl. No.	Course Components	SEMESTERS							Total Credits
		I/II	III	IV	V	VI	VII	VIII	
1	Humanities (HU)						3	3	6
2	Basic Science Core (BS)	16	4	4					24
3	Basic Engineering Core (BE)	24							24
4	Engineering Core Subject (PC)		19	16	19	15	12	3	84
5	Core Electives (PE)			3	5	3	3	3	17
6	Open Electives (OE)					3	3		6
7	Project/Internship					1	2	11	14
TOTAL		**40**	**23**	**23**	**24**	**22**	**23**	**20**	**175**

CREDIT DISTRIBUTION



Department of Computer Science and Engineering

SEMESTER: I (PHYSICS CYCLE)

SL. NO.	COURSE CODE	COURSE NAME	COURSE TYPE	TEACHING DEPT.	TEACHING HOURS/WEEK			EXAMINATION			CREDITS
					L#	T#	P#	CIE*	SEE**	TOTAL	
1	18MAT11	ENGINEERING MATHEMATICS-I	BS^	MATHS	3	1	0	50	50	100	4
2	18PHY12	ENGINEERING PHYSICS	BS^	PHY	3	0	0	50	50	100	3
3	18CP13	C- PROGRAMMING- I	EC$	CS/IS	0	0	4	50	50	100	2
4	18ELN14	BASIC ELECTRONICS ENGINEERING	EC$	EC	3	1	0	50	50	100	4
5	18CED15	COMPUTER AIDED ENGINEERING DRAWING	EC$	ME	2	0	2	50	50	100	3
6	18CIV16	ENGINEERING MECHANICS	EC$	CIV	3	1	0	50	50	100	4
7	18PHL17	ENGINEERING PHYSICS LAB	BS^	PHY	0	0	2	50	50	100	1
8	18CIV18	CONSTITUTION OF INDIA AND PROFESSIONAL ETHICS	HU@	HU	2	0	0	100	0	100	-
TOTAL								450	350	800	21

Department of Computer Science and Engineering

SEMESTER: I (CHEMISTRY CYCLE)											
SL. NO.	COURSE CODE	COURSE NAME	COURSE TYPE	TEACHING DEPT.	TEACHING HOURS/WEEK			EXAMINATION			CREDITS
					L#	T#	P#	CIE*	SEE**	TOTAL	
1	18MAT11	ENGINEERING MATHEMATICS-I	BS^	MATHS	3	1	0	50	50	100	4
2	18CHE12	ENGINEERING CHEMISTRY	BS^	CHE	3	0	0	50	50	100	3
3	18CP13	C- PROGRAMMING- I	EC$	CS/IS	0	0	4	50	50	100	2
4	18ELE14	BASIC ELECTRICAL ENGINEERING & ELECTRICAL LAB	EC$	EEE	3	1	2	50	50	100	5
5	18EME15	ELEMENTS OF MECHANICAL ENGINEERING & WORKSHOP	EC$	ME	3	0	2	50	50	100	4
6	18CHL16	ENGINEERING CHEMISTRY LAB	BS^	CHE	0	0	2	50	50	100	1
7	18ENG17	COMMUNICATIVE ENGLISH	HU@	ENG	2	0	0	100	0	100	-
8	18CIV18	ENVIRONMENTAL STUDIES	HU@	HU	2	0	0	100	0	100	-
							TOTAL	500	300	800	19

Department of Computer Science and Engineering

SEMESTER: II (PHYSICS CYCLE)

SL. NO.	COURSE CODE	COURSE NAME	COURSE TYPE	TEACHING DEPT.	TEACHING HOURS/WEEK			EXAMINATION			CREDITS
					L#	T#	P#	CIE*	SEE**	TOTAL	
1	18MAT21	ENGINEERING MATHEMATICS-II	BS^	MATHS	3	1	0	50	50	100	4
2	18PHY22	ENGINEERING PHYSICS	BS^	PHY	3	0	0	50	50	100	3
3	18CP23	C- PROGRAMMING- II	EC$	CS/IS	0	0	4	50	50	100	2
4	18ELN24	BASIC ELECTRONICS ENGINEERING	EC$	EC	3	1	0	50	50	100	4
5	18CED25	COMPUTER AIDED ENGINEERING DRAWING	EC$	ME	2	0	2	50	50	100	3
6	18CIV26	ENGINEERING MECHANICS	EC$	CIV	3	1	0	50	50	100	4
7	18PHL27	ENGINEERING PHYSICS LAB	BS^	PHY	0	0	2	50	50	100	1
8	18CIV28	CONSTITUTION OF INDIA ANDPROFESSIONAL ETHICS	HU@	HU	2	0	0	100	0	100	-
							TOTAL	450	350	800	21

Department of Computer Science and Engineering

SEMESTER: II (CHEMISTRY CYCLE)											
SL. NO.	COURSE CODE	COURSE NAME	COURSE TYPE	TEACHING DEPT.	TEACHING HOURS/WEEK			EXAMINATION			CREDITS
					L#	T#	P#	CIE*	SEE**	TOTAL	
1	18MAT21	ENGINEERING MATHEMATICS-I	BS^	MATHS	3	1	0	50	50	100	4
2	18CHE22	ENGINEERING CHEMISTRY	BS^	CHE	3	0	0	50	50	100	3
3	18CP23	C- PROGRAMMING- II	EC$	CS/IS	0	0	4	50	50	100	2
4	18ELE24	BASIC ELECTRICAL ENGINEERING & ELECTRICAL LAB	EC$	EEE	3	1	2	50	50	100	5
5	18EME25	ELEMENTS OF MECHANICAL ENGINEERING & WORKSHOP	EC$	ME	3	0	2	50	50	100	4
6	18CHL26	ENGINEERING CHEMISTRY LAB	BS^	CHE	0	0	2	50	50	100	1
7	18ENG27	COMMUNICATIVE ENGLISH	HU@	ENG	2	0	0	100	0	100	-
8	18CIV28	ENVIRONMENTAL STUDIES	HU@	HU	2	0	0	100	0	100	-
							TOTAL	500	300	800	19

Department of Computer Science and Engineering

SEMESTER: III													
SL NO	COURSE CODE	COURSE NAME	COURSE TYPE	TEACHING DEPT.	TEACHING HOURS/WEEK				EXAMINATION			CREDITS
					L#	T#	P#	S#	CIE*	SEE**	Total	
1	18MAT31	ENGINEERING MATHEMATICS –III	BS	Mat	3	2	-	-	50	50	100	4
2	18CS32	DESIGN OF ANALOG AND DIGITAL CIRCUITS	PC	CSE	3	-	-	-	50	50	100	3
3	18CS33	DATA STRUCTURES	PC	CSE	3	-	-	-	50	50	100	3
4	18CS34	DISCRETE MATHEMATICAL STRUCTURES AND GRAPH	PC	CSE	3	-	-	-	50	50	100	3
5	18CS35	COMPUTER ORGANIZATION AND ARCHITECTURE	PC	CSE	4	-	-	-	50	50	100	4
6	18CSE36	OBJECT ORIENTED PROGRAMMING WITH C++	PC	CSE	3	-	-		50	50	100	3
7	18CSL37	MICROPROCESSOR LAB	PC	CSE	-	-	2	-	50	50	100	1
8	18CSL38	DATA STRUCTURES LAB	PC	CSE	-	-	2	-	50	50	100	1
9	18CSL39	DESIGN OF ANALOG AND DIGITAL CIRCUITS LAB	PC	CSE	-	-	2	-	50	50	100	1
TOTAL									450	450	900	23

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SEMESTER: IV

SL NO	COURSE CODE	COURSE NAME	COURSE TYPE	TEACHING DEPT.	TEACHING HOURS/WEEK				EXAMINATION			CREDITS
					L#	T#	P#	S#	CIE*	SEE**	TOTAL	
1	18MAT41	ENGINEERING MATHEMATICS –IV	BS	MAT	3	2			50	50	100	4
2	18CS42	DESIGN AND ANALYSIS OF ALGORITHMS	PC	CSE	3				50	50	100	3
3	18CS43	DATABASE MANAGEMENT SYSTEMS	PC	CSE	3				50	50	100	3
4	18CS44	OPERATING SYSTEM	PC	CSE	3		2		50	50	100	4
5	18CS45	APPLICATION DEVELOPMENT USING JAVA	PC	CSE	3		2		50	50	100	4
6	18CSE46X	PROGRAM ELECTIVE – A	PE	CSE	3				50	50	100	3
7	18CSL47	DATA BASE MANAGEMENT SYSTEMS LAB	PC	CSE			2		50	50	100	1
8	18CSL48	DESIGN AND ANALYSIS OF ALGORITHMS LABORATORY	PC	CSE			2		50	50	100	1
								TOTAL	450	450	900	23

Department of Computer Science and Engineering

NOTE: FOLLOWING SUBJECT IS OFFERED AS AN OPEN ELECTIVE SUBJECT FOR SEMESTER III AND IV SEM, OPEN ELECTIVE SUBJECT WILL BE EXEMPTED IN SEMESTER-VI

SL. NO.	COURSE CODE	COURSE NAME	COURSE TYPE	TEACHING DEPT	L#	T#	P#	S#	CIE*	SEE**	TOTAL	CREDITS
1	18CSO39/49	ROBOTICS ENGINEERING-LEGO MINDSTORM & TETRIX	OE	CSE	2	0	3	-	50	50	100	3

PROGRAM ELECTIVE – A					
SL.NO	**COURSE CODE**	**COURSE NAME**	**L#**	**T#**	**P#**
1.	18CSE461	INTRODUCTION TO EMBEDDED SYSTEMS	2	-	2 *
2.	18CSE462	WEB APPLICATION DEVELOPMENT	2	-	2 *
3.	18CSE463	INTRODUCTION TO UNIX	2	-	2*
4.	18CSE464	INTRODUCTION TO IMAGE PROCESSING	2	-	2*
5.	18CSE465	INTRODUCTION TO SOFTWARE TECHNOLOGIES	2	-	2*
6	18CSE466	INTRODUCTION TO CLOUD COMPUTING	2	-	2*

- **INTRODUCTION TO FLUTTER: MOBILE UI FRAMEWORK and introduction to IOS – offered as an add-on Certification course in 4th Semester.**

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SEMESTER: V												
SL. NO.	COURSE CODE	COURSE NAME	COURSE TYPE	TEACHING DEPT.	TEACHING HOURS/WEEK				EXAMINATION			CREDITS
					L#	T#	P#	S#	CIE*	SEE**	TOTAL	
1	18CS51	COMPUTER NETWORKS	PC	CSE	3	2	-	-	50	50	100	4
2	18CS52	SOFTWARE ENGINEERING	PC	CSE	3		-	-	50	50	100	3
3	18CSE53X	PROGRAM ELECTIVE – B	PE	CSE	3	-	-	-	50	50	100	3
4	18CSE54	DATA MINING	PC	CSE	3	-	-	-	50	50	100	3
5	18CSMOOC55	PROGRAM ELECTIVE – C (MOOC BASED) **	PE	CSE	-	-	-	8	50	50	100	2
6	18CS56	ARTIFICIAL INTELLIGENCE AND NEURAL NETWORKS	PC	CSE	3	-	-	-	50	50	100	3
7	18CS57	FORMAL LANGUAGESAND AUTOMATA THEORY	PC	CSE	3	2	-	-	50	50	100	4
8	18CSL58	ARTIFICIAL INTLLIGENCE WITHPYTHON LAB	PC	CSE	-	-	2	-	50	50	100	1
9	18CSL59	COMPUTER NETWORKS LAB	PC	CSE	-	-	2	-	50	50	100	1
10	18CSP510	PROJECT-WORK-I	PR	CSE	-	-	-	8	50^	-	-	-
								TOTAL	500	450	900	24

PROGRAM ELECTIVE – B

SL.NO	COURSE CODE	COURSE NAME	L#	T#	P#
1	18CSE531	COMPUTER GRAPHICS	2	-	2
2	18CSE532	INFORMATION SECURITY	3	-	-
3	18CSE533	INTERNET OF THINGS	2	-	2
4	18CSE534	ADVANCED JAVA PROGRAMMING	2	-	2
5	18CSE535	ADVANCED IMAGE PROCESSING	3	-	-
6	18CSE536	ADVANCED WEB PROGRAMMING-I	2	-	2
7	18CSE537	LINUX ADMINISTRATION AND PROGRAMMING	3	-	-
8	18CSE538	AMAZON WEB SERVICES (AWS)	2	-	2

PROGRAM ELECTIVE – C - MOOC BASED **					
SL. NO	**COURSE NAME**	**L#**	**T#**	**P#**	**S#**
1	INTRODUCTION TO DATA SCIENCE	-	-	-	8
2	INTRODUCTION TO HASKELL PROGRAMMING	-	-	-	8
3	GOOGLE CLOUD COMPUTING FOUNDATION	-	-	-	8
4	OBJECT ORIENTED ANALYSIS DESIGN	-	-	-	8

Students are advised to select courses offered by NPTEL/SWAYAM during the semester. Not restricted to the above listed courses. Titles of the courses chosen under MOOC should not match with any of the **course titles in the curriculum (Core or Elective) from the 1st semester to the 8th semester.

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SEMESTER: VI

SL. NO.	COURSE CODE	COURSE NAME	COURSE TYPE	TEACHING DEPT.	TEACHING HOURS/WEEK				EXAMINATION			CREDITS
					L#	T#	P#	S#	CIE*	SEE**	TOTAL	
1.	18CS61	BIG DATA TECHNOLOGIES	PC	CSE	4	-	-	-	50	50	100	4
2.	18CS62	CRYPTOGRAPHY AND NETWORK SECURITY	PC	CSE	4	-	-	-	50	50	100	4
3.	18CS63	SOFTWARE PROJECT MANAGEMENT	PC	CSE	3	-	-	-	50	50	100	3
4.	18CSE64X	PROGRAM ELECTIVE – C	PE	CSE	3	-	-	-	50	50	100	3
5	18CSMOOC65	OPEN ELECTIVE – 1(MOOC)	OE	CSE	3	-	-	-	50	50	100	3
6	18CSL66	BIG DATA TECHNOLOGIES LAB	PC	CSE	-	-	2	-	50	50	100	1
7	18CSL67	MOBILE APPLICATION DEVELOPMENT LAB	PC	CSE	-	-	4	-	50	50	100	2
8	18CSL68	CRYPTOGRAPHY AND NETWORK SECURITY LAB	PC	CSE	-	-	2	-	50	50	100	1
9	18CSP69	PROJECT WORK-II	PR	CSE	-	-	-	4	50^	50	100	1
								TOTAL	400	800	800	22

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PROGRAM ELECTIVE – C (VI SEMESTER)

SL.NO	COURSE CODE	COURSE NAME	L#	T#	P#
1.	18CSE641	ADVANCED COMPUTER NETWORKS	3	-	-
2.	18CSE642	ADVANCED ALGORITHMS	3	-	-
3.	18CSE643	ADVANCED COMPUTER ARCHITECTURE	3	-	-
4.	18CSE644	VIRTUAL REALITY	3	-	-
5.	18CSE645	INTRODUCTION TO C# PROGRAMMING	2	-	2
6.	18CSE646	ADVANCED OPERATING SYSTEMS	3	-	-
7.	18CSE647	ADVANCED DATA BASE MANAGEMENT SYSTEMS	3	-	-
8.	18CSE648	ADVANCED WEB PROGRAMMING – II	3	-	-
9.	18CSE649	UNIX SYSTEM PROGRAMMING	3	-	-
10	18CSE650	GOOGLE CLOUD	3	-	-
11	18CSE651	CYBER PHYSICAL SYSTEMS	3	-	-

OPENELECTIVE –1 (MOOC BASED) (VII SEMESTER) – NOT RESTRICTED TO ONLY THE ONES LISTED BELOW				
SL. NO.	**COURSE NAME**	**L#**	**T#**	**P#**
1	INTRODUCTION TO DATABASE MANAGEMENT SYSTEMS	3	-	-
2	INTRODUCTION TO PYTHON PROGRAMMING	3	-	-
3	INTRODUCTION TO ARTIFICIAL INTELLIGENCE	3	-	-
4	ALGORITHMS FOR DIGITAL IMAGE & VIDEO PROCESSING	3	-	-
5	OBJECT ORIENTED MODELLING AND DESIGN	3	-	-
6	INTRODUCTION TO JAVA PROGRAMMING	3	-	-
7	INTRODUCTION TO SYSTEMS SIMULATION AND MODELLING	3	-	-
8	INTRODUCTION TO WEB PROGRAMMING	3	-	-

SCHEME – VII SEMESTER												
SL. NO.	COURSE CODE	COURSE NAME	COURSE TYPE	TEACHING DEPT.	TEACHING HOURS/WEEK				EXAMINATION			CREDITS
					L#	T#	P#	S#	CIE*	SEE**	TOTAL	
1	18CS71	HIGH PERFORMANCE COMPUTING	PC	CSE	3	-	-	-	50	50	100	3
2	18CS72	CYBER SECURITY	PC	CSE	3	-	-	-	50	50	100	3
3	18CS73	COMPILER DESIGN	PC	CSE	3	-	-	-	50	50	100	3
4	18CSH74	ENTREPRENEURSHIP DEVELOPMENT& IPR	HU	CSE	3	-	-	-	50	50	100	3
5	18CSE75X	PROGRAM ELECTIVE – D (INDUSTRY SUPPORTED)	PE	CSE	3	-	-	-	50	50	100	3
6	18CSO76X	OPEN ELECTIVE – 2	OE	CSE	3	-	-	-	50	50	100	3
7	18CSL77	HIGH PERFORMANCE COMPUTING	PC	CSE	-	-	2	-	50	50	100	1
8	18CSL78	PRODUCT DEVELOPMENT LAB	PC	CSE	-	-	2	-	50	50	100	1
9	18CSP79	PROJECT WORK-III	PC	CSE	-	-	-	4	50	50	100	1
10	18CSI/RP / VS710	INTERNSHIP /RESEARCH PROJECT/ VIRTUAL START-UP	IN /RP/VS	CSE	-	-	-	8	50	50	100	2
TOTAL									500	500	1000	23

Department of Computer Science and Engineering

PROGRAM ELECTIVE -D (VII SEMESTER) – INDUSTRY SUPPORTED COURSES					
SL.NO	**COURSE CODE**	**COURSE NAME**	**L#**	**T#**	**P#**
1	18CSE751	INTRODUCTION TO MACHINE LEARNING	3	-	-
2	18CSE752	INTRODUCTION TO BLOCK CHAIN TECHNOLOGY	3	-	-
3	18CSE753	BUILDING APPLICATIONS USING MICROSERVICES ARCHITECTURE	3	-	-
4	18CSE754	GAME THEORY	3	-	-
5	18CSE755	COMPUTER VISION	3	-	-
6	18CSE756	LINUX KERNEL PROGRAMMING	3	-	-
7	18CSE757	BUILDING ENTERPRISE APPLICATIONS	3	-	-
8	18CSE758	MODERN WEB APPLICATION DEVELOPMENT	3	-	-
9	18CSE759	MICROSOFT AZURE	3	-	-

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OPEN ELECTIVE –2 (VII SEMESTER)					
SL.NO	**COURSE CODE**	**COURSE NAME**	**L#**	**T#**	**P#**
1	18CSO761	INTRODUCTION TO CYBER SECURITY	3	-	-
2	18CSO762	INTRODUCTION TO SOFTWARE TESTING	3	-	-
3	18CSO763	INTRODUCTION TO BUSINESS INTELLIGENCE AND ITS APPLICATIONS	3	-	-
4	18CSO764	INTRODUCTION TO MOBILE COMPUTING	3	-	-

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SCHEME – VIII SEMESTER												
SL. NO	COURSE CODE	COURSE NAME	COURSE TYPE	TEACHING DEPT.	TEACHING HOURS/WEEK				EXAMINATION			CREDITS
					L#	T#	P#	S#	CIE*	SEE**	TOTAL	
1.	18CS81	GREEN COMPUTING	PC	CSE	3	-	-	-	50	50	100	3
2.	18CS82	FUNDAMENTALS OF CYBER LAWS AND ETHICS	HU	CSE	3	-	-	-	50	50	100	3
3.	18CSE83X / 18CSE84X	PROGRAM CORE ELECTIVE – F	PE	CSE	3	-	-	-	50	50	100	3
4.	18CSP84	MAJOR PROJECT	PR	CSE	-	-	12	20	50^	50^^	100	11
								TOTAL	200	200	400	20

$ - TO BE COMPLETED DURING ANY ONE OF THE SUMMER VACATION FOR ABOUT 6 WEEKS.
NOTE: PAPER PUBLICATION IS MANDATORY FOR INTERNSHIP AND PROJECT SUBMISSION.
^ - GUIDE, ^^ - DEPARTMENTAL COMMITTEE

NOTE: STUDENTS ARE FREE TO CHOOSE ANY MOOC BASED COURSE, EITHER FROM THE LIST GIVEN BELOW OR ANY OF THEIR CHOICE; PROVIDED THE COURSE WAS NOT OFFERED TO THEM IN ANY OF THEIR PREVIOUS SEMESTERS

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PROGRAM ELECTIVE -D (VIII SEMESTER)						
SL.NO	**COURSE CODE**	**COURSE NAME**	**L#**	**T#**	**P#**	**S#**
1	18CSE831	ADVANCED ARTIFICIAL INTELLIGENCE	3	-	-	-
2	18CSE832	AGILE SOFTWARE DEVELOPMENT	3	-	-	-
3	18CSE833	INTRODUCTION TO NATURAL LANGUAGE PROCESSING	3	-	-	-
4	18CSE834	PATTERN RECOGNITION	3	-	-	-
5	18CSE835	QUANTUM COMPUTING	3	-	-	-
6	18CSE836	SYSTEMS SIMULATION AND MODELLING	3	-	-	-
7	18CSE837	INTRODUCTION TO DEEP LEARNING	3	-	-	-
8	18CSE838	STORAGE AREA NETWORKS	3	-	-	-
9	18CSE839	MULTIMEDIA COMPUTING	3	-	-	-

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NOTE * - EVALUATION FOR THE INTERNAL MARKS WILL BE BASED ON PRACTICAL ORIENTED ASSIGNMENTS / COURSE PROJECT / MINIPROJECT / TESTS. IN ADDITION, AS A COMPONENT OF TEACHING METHODS THE COURSE CONTENT WILL BE DELIVERED BY DEMOS AND OR ACTUAL HANDS-O N ACTIVITY BY THE STUDENTS IN THE LAB/CLASSROOM.

****Integrated Course:** This course contains 60% of hands-on/practical sessions and 40% of theory. Continues Internal Evaluation (CIE) conducted for 50 Marks theory (70% of theory: Mid Semester Evaluation + Learning Assessment1+Learning Assessment2) and 50 Marks Laboratory (30% of Practical: Record Writing + Observation +Experiment Conduction +Mid Semester Evaluation). To appear in SEE Students should score minimum of 20 Marks in CIE.
Semester End Examination (SEE) evaluation has Theory examination conducted for 100 Marks and then reduced to 50 Marks, there is no Semester End Examinationfor Laboratory. Final Marks of the course is the combination of CIE+SEE.

^BS- BASIC SCIENCE, $EC-ENGG. CORE, @HU-HUMANITIES,

***CONTINUOUS INTERNAL EVALUATION, ** SEMESTER END EXAMINATION,**

 # L- LECTURE, T- TUTORIAL, P- PRACTICALNOTE: ONE HOUR OF LECTURE = 1 CREDIT, TWO HOURS OF TUTORIALS = 1 CREDIT, TWO HOURS OF PRACTICALS = 1 CREDIT, FOUR HOURS OF SELF-STUDY = 1 CREDIT.

Course Content for

III – Semester

2018 Scheme

Department: *Computer Science and Engineering*	***Course Type:*** *Programme Core*
Course Title: *Engineering Mathematics – III*	***Course Code:*** *18MAT31*
L-T-P: *3-1-1*	***Credits:*** *4*
Total Contact Hours: *52 Hours*	***Duration of SEE:*** *3 Hours*
SEE Marks: *50*	***CIE Marks:*** *50*

COURSE DESCRIPTION

Errors and approximations, Finite differences and interpolation, Numerical integration, Fourier series, Fourier Transforms, Laplace Transforms are introduced in this course contains

PREREQUISITES

- Basics of Mathematics

COURSE OBJECTIVES

To understand the periodic and harmonic phenomena and to be able to model them using Fourier series and use integral transforms such as Laplace and Fourier transforms, To understand the advantages, limitations and applications of different numerical techniques.

COURSE CONTENTS

UNIT-I **08 Hours**

Laplace Transforms: Definition, Transforms of standard functions (derivation and problems),

Transforms of $e^{at} f(t)$, $t^n f(t)$, $f(t)/t$, Laplace transforms of derivatives and integrals, Laplace transforms of periodic functions, unit step function (problems only, no derivations), Dirac delta function . Inverse Laplace transforms, convolution theorem (without proof), solutions of 1st and 2nd order ODE using Laplace transforms.

UNIT-II **08 Hours**

Fourier series: Euler’s formulae, Dirichlet’s conditions for Fourier series expansion, change of interval, Even and odd function, half range series, Practical harmonic analysis.

Fourier Transforms: Definition, Complex Fourier transforms, Cosine and Sine transforms, Inverse Fourier transforms.

UNIT – III **8 Hours**

Roots of transcendental equations by Newton Raphson and Secant method Interpolation: Newton's forward and backward formulae, Newton's divided difference formulae and Lagrange's formula for unequal intervals and inverse interpolation by Lagrange's formula, Stirling's and Bessel's central difference formula, Numerical differentiation with Newton's forward and backward difference interpolation.

UNIT – IV **08 Hours**

Numerical Integration by Trapezoidal, Simpson's 1/3 and 3/8 , Weddle's rule, Gaussian Quadrature.

Numerical solution of ordinary differential equations: Taylor's series method, Runge-Kutta 4^{th} order method, Milne's predictor corrector method.

UNIT – V **7 Hours**

Linear algebra: LU decomposition, Solution of Tridiagonal system using Thomas algorithm, Eigen values of symmetric matrix by Jacobi method, Reduction to Tridiagonal system by Given's method, Largest Eigen value by Power method.

TEXT BOOKS

1. Numerical Methods By ***R. K. Jain***, S. R. K. Iyengar
2. Higher Engg. mathematicsby Dr. B S Grewal, 42^{nd} Edition.
3. Advanced Engg. Mathematics by Erwin E Kreyszig, 10^{th} edition, Wiley.
4. Introductory methods of numerical analysis, by S SSastry, PHI India.

REFERENCE BOOKS

1. Numerical Methods: For Scientific and Engineering Computation By R. K. Jain, S. R. K. Iyengar
2. Advanced Engg. Mathematics by Erwin Kreyszig, 10^{th} edition,Wiley,2011
3. Numerical Algorithms by Sen and Krishnamurthy

TEACHING METHODS

- Black Board Teaching.
- Power point presentation (If needed).
- Tutorial Classes.

ASSESSMENT METHODS

Parameter	Marks
Surprise test / Tutorials tests to be conducted	10
Quiz/ MATLAB assignment based on practical application	10
Three mid semester examinations will be conducted	30
Total	**50**
Final Exam will be conducted for 100 marks(SEE)	

COURSE OUTCOMES

COs	Description	Bloom's Level
CO 1	Analyze physical situations relevant to periodic and aperiodic functions for solving problems using the concepts of Fourier Theory and Transforms.	L3
CO 2	Model Engineering Problems by applying Fourier Theory and Transforms.	L3
CO 3	Solve Equations, Interpolate and Extrapolate Data using Finite Differences and Matrices by adopting Numerical methods.	L3
CO 4	Interpret solutions by finding Eigen values applying Numerical methods.	L5
CO 5	Solve problems on linear algebra	L4

Course Outcome to Programme outcome Mapping:

POs COs	Mapping of Course outcomes (COs) to Program outcomes (POs)											Program Specific Outcomes(PSOs)		
PO	1	2	3	4	5	6	7	8	9	10	11	12	PSO1	PSO 2	PSO3
CO1	2	1		1	1									1	
CO2	2	1		1	1									1	
CO3	2	1		1	1									1	
CO4	2	1			1									1	
CO5	2	1			1									1	

Department: *Computer Science and Engineering*	***Course Type:*** *Programme Core*
Course Title: *Design of Analog and Digital Circuits*	***Course Code:****18CS32*
L-T-P:*3-0-0*	***Credits:*** *03*
Total Contact Hours:*39Hours*	***Duration of SEE:****3 Hours*
SEE Marks: *50*	***CIE Marks:*** *50*

COURSE DESCRIPTION

The fundamentals of digital circuits and their applications are introduced in this course. Topics covered include; the characteristics of basic and derived logic gates. Boolean algebra applications in the analysis and design of combinational and sequential logic circuits applications such as arithmetic circuits are introduced. This course introduces the characteristics and applications of semiconductor devices and circuits. Emphasis is placed on analysis, selection, biasing, and applications.

PREREQUISITES

- Students should have knowledge of basic concepts of electronics, Binary System.

COURSE OBJECTIVES

To acquire the basic knowledge of digital logic levels and application of knowledge to understand digital electronics circuits. To prepare students to perform the analysis and design of various digital electronic circuits,

COURSE CONTENTS

UNIT–I **8 Hours**

Boolean laws, theorems and Combinational Circuits: Boolean laws and theorems, logic functions, minimization of Boolean functions using theorems. SOP methods and POS method and simplifications. Truth table to Karnaugh map. K-map simplifications Don’t care conditions.

Data Processing Circuits: Multiplexers, Demultiplexers, BCD to decimal decoders, , Encoders, Magnitude Comparator, Read – only memory, programmable array logic, Programmable logic array.

UNIT–II **7 Hours**

Flip-flops :RS flip flop, Gated Flip-flops, Edge triggered RS- flip flop, Edge triggered JK flip-flop. JK Master Slave Flip-flop **Registers:** types of registers, Serial In Serial Out, SIPO, PISO, PIPO. **Counters:** Asynchronous counters, Synchronous Counters, Counter design as synthesis Problem.

UNIT–III **9 Hours**

Design of sequential Circuits. State Transition Diagram, State Synthesis Table, Design Equation and Circuit Diagram, Implementation using Read Only Memory. , Algorithmic State Machine. State reduction techniques **D/A conversion and A/D conversion :**Variable, Resistor Networks, Binary Ladders, D/A Converters, D/A Accuracy and Resolution, A/D Converter-Simultaneous Conversion, A/D Converter-Counter Method, Continuous A/D Conversion, A/D Accuracy and Resolution.

UNIT–IV **7 Hours**

Diode Theory: Basic idea, Ideal Diode, the second approximation, the third approximation. Diode Circuits : Half-wave Rectifier, The transformer, Full-wave Rectifier, The Bridge Rectifier, Clipper and limiters, Clampers.

UNIT–V **08 Hours**

Operational Amplifier: Introduction to Op amps, The 741 op amp, The Inverting Amplifier, The non inverting amplifier. Two op amp applications . Comparators with zero reference, non zero references, Comparators with hysteresis. Window comparators The integrators. Waveform Conversion, Waveform generation, the differentiator.

TEXT BOOKS

1. Donald P Leach, Albert Paul Malvino & Goutam Saha “Digital Principles and Applications” , 6th Edition, TMH, 2006.(UNIT 1,2,3)
2. Albert Malvino & David J Bates “Electronic Principles” , 7th Edition, TMH, 2007.(UNIT 4, 5)

REFERENCE BOOKS

1. M Morris Mano “Digital logic and computer design”, Prentice-Hall of India.(UNIT 1,2,3).
2. Charles H. Roth, Jr. “Fundamentals of Logic Desi`gn” , 5th Edition, Thomson, 2004.
3. Ronald J. Tocci Neal S. Widmer, Gregory L. Moss“Digital Systems Principles and Applications” 10th Edition, PHI/Pearson Education, 2007.

TEACHING METHODS

1. Black Board Teaching.
2. Power point presentation (If needed).
3. Tutorial Classes.

ASSESSMENT METHODS

Parameter	Marks
Midterm Test (Avg. of 2 Tests)	30
Surprise Test	10
Problem Solving	10
Total	**50**
Final Exam will be conducted for 100 marks(SEE)	

COURSE OUTCOMES

At the end of the course students will be able to :

CO	Description	Bloom’s Level
CO 1	Relate Boolean laws, combinational circuits, sequential circuits and basics of electronic circuits.	**L2**
CO 2	Develop various synchronous and asynchronous circuits using flip flop and ROM.	**L3**
CO 3	Design clipper, clamper and operational amplifiers.	**L3**
CO 4	Analyze concept of analog to digital and digital to analog convertors.	**L4**
CO 5	Model Combinational and Sequential circuits by applying the knowledge of k-map.	**L3**

Mapping of Course outcomes (COs) to Program outcomes (POs*)& PSO **															
Course Outcomes mapping to Program Outcomes													PSOs		
POs COs	1	2	3	4	5	6	7	8	9	10	11	12	PSO1	PSO2	PSO3
CO1	3												3	3	3
CO2	3	3		2		3							3	3	3
CO3		3		2		3							3	3	3
CO4	3	3				3							3	3	3
CO5	3	3		2	3	3							3	3	3

3: Strong, 2: Medium, 1: Weak **** H: Highly related S: Supportive**

Department of Computer Science and Engineering

Department: *Computer Science and Engineering*	***Course Type:*** *Programme Core*
Course Title*: Data Structures*	***Course Code:*** *18CS33*
L-T-P:3-0-0	***Credits:*** *03*
Total Contact Hours: *39 Hours*	***Duration of SEE:*** *3 Hours*
SEE Marks*: 50*	***CIE Marks:*** *50*

COURSE DESCRIPTION

This course provides an in-depth knowledge of structures, pointers and dynamic memory allocation in C. The course also provides the knowledge of different data structures and their applications in solving real-world problems.

PREREQUISITES

- Computer Concepts and C Programming.

COURSE OBJECTIVES

- To understand the concept of pointers and, allocate and deallocate memory dynamically to pointers.
- To understand working principle of different types of data structures
- To identify and apply the appropriate data structure to solve a given problem.

COURSE CONTENTS

UNIT– I **7 Hours**

Pointers: Introduction ,Understanding Pointers, Accessing the Address of a Variable, Declaring Pointer Variables, Initialization of Pointer Variables, Accessing a Variable through the Pointer, Chain of Pointers, Pointer Expressions, Pointer Increments and Scale Factor, Pointers and Arrays, Pointers and Character Strings, Array of Pointers, Pointer as Function Arguments, Functions Returning Pointers, Pointers to Functions, Pointers and Structures

Dynamic Memory Allocation: Introduction, Dynamic Memory Allocation, Allocating a Block of Memory: Malloc, Allocating a Multiple Blocks of Memory: Calloc, Releasing the Used Space: Free, Altering the size of Block: Realloc.

UNIT– II **8 Hours**

The Stack: Definition and Examples— Primitive operations, examples

Representing Stacks in C: Implementing the POP operation, testing for exceptional conditions, implementing the PUSH operation An Example: Infix, Postfix, and Prefix – Basic definitions and examples, Stack Applications---Evaluating a postfix expression, program to evaluate a postfix expression, Converting an expression from infix to postfix, program to convert an expression from infix to postfix.

Recursion (Applications of Stack): Recursive Definition and Processes— factorial function, multiplication of natural numbers. Fibonacci sequence, binary search

Recursion in C – factorial, Fibonacci numbers, binary search, recursive chains, Writing Recursive Programs – Towers of Hanoi, Binary Search.

UNIT– III **8 Hours**

Queues: The Queue and its Sequential Representation **: C Implementation of Queues, Insert Operation, Priority Queue, Array Implementation of a Priority Queue.**

Linked Lists : Inserting and Removing Nodes from a List, Linked Implementation of Stacks, getnode and free node Operations, Linked Implementation of Queues, Linked List as a Data Structure, Examples of List Operations, List Implementation of Priority Queues, Header Nodes

Lists in C: Array Implementation of Lists, Limitations of the Array Implementation, Allocating and Freeing of Dynamic variables, Linked Lists using Dynamic Variables, Queues as List in C, Examples of List Operations in C, Noninteger and Nonhomogeneous Lists, Comparing the Dynamic and Array Implementations of Lists, Implementing Header Nodes.

UNIT–IV **8 Hours**

Other List Structures: Circular Lists, Stack as a Circular List, Queue as a Circular List, Primitive Operations on Circular Lists, Header nodes, Addition of Long Positive Integers Using Circular Lists, Doubly Linked Lists.

Binary Trees: operations on Binary Trees, Applications of Binary Trees.

UNIT–V **8 Hours**

Binary Tree Representations: Node Representation of Binary Trees, Internal and External Nodes, Implicit Array Representation of Binary Trees, Binary Tree Traversal in C, Threaded Binary Trees.

Representing Lists as Binary Trees: Finding the k^{th} Element, Implementing Tree-Represented Lists in C, Constructing a Tree-represented List

Trees and Their Applications: C Representations of Trees, Tree Traversals, General Expressions as Trees, evaluating an expression tree, constructing a Tree.

TEXTBOOKS

1. Data Structures using C, Aaron M. Tanenbaum, YedidyahLangsam& Moshe J. Augenstein, Pearson Education/PHI, 2006.
2. Programming in ANSI C: E Balagurusamy, Third edition, TATA McGraw HILL

REFERENCE BOOKS

1. The C Programming Language, Brian W Kernighan and Dennis M Ritchie, Prentice Hall Software Series, 2nd Edition.
2. Data Structures A Pseudo code approach with C, Richard F. Gilberg and Behrouz A. Forouzan, Thomson, 2005.
3. Data Structures & Program Design in C, Robert Kruse & Bruce Leung, Pearson Education, 2007.
4. Fundamentals of Data Structures in C, Horowitz, Sahani, Anderson, Freed, Second edition, 2008

TEACHING METHODS

- Lecture using Black board and chalk
- Presentations
- Programming Assignments
- Problem Solving Assignments

ASSESSMENT METHODS

Parameter	Marks
Three internals(Average of best of two)	3
Rubrics for the evaluation of Programming Assignments	1
Problem Solving Test	1
Total	**5**
Final Exam will be conducted for 100 marks(SEE)	

COURSE OUTCOMES

At the end of Course, Student will be able to :

CO	Description	Bloom's Level
CO1	Identify the purposes of dynamic memory in applications, Illustrate arrays and structures with programming solutions for real world problems	**L2**
CO2	Quote the implication of stacks and queues for different problems, Build programming solutions using variations of stacks and queues.	**L3**
CO3	Examine data set operations using variations of linked list	**L4**
CO4	Appraise the purposes of Trees to represent data sets, Devise application to solve tree oriented problems.	**L3**
CO5	Develop solutions to given problems based on the application of various data structures.	**L3**

Mapping of Course outcomes (COs) to Program outcomes (POs*)& PSO **															
Course Outcomes mapping to Program Outcomes													PSOs		
POs / COs	1	2	3	4	5	6	7	8	9	10	11	12	PSO1	PSO2	PSO3
CO1	3	3	2										3		
CO2	3	2	3										3		
CO3	3	2	3										3		
CO4	3	3	2										3		
CO5	3	3	3					2	2	2			3		2

Department: *Computer Science and Engineering*	***Course Type:*** *Programme Core*
Course Title: *Discrete Mathematical Structures and Graph Theory*	***Course Code:*** *18CS34*
L-T-P: *3-1-0*	***Credits:*** *3*
Total Contact Hours: *39 Hours*	***Duration of SEE:*** *3 Hours*
SEE Marks*: 50*	***CIE Marks:*** *50*

COURSE DESCRIPTION

This is an introductory course in Discrete Mathematics and Graph theory. The goal of this course is to introduce students to ideas and techniques from discrete mathematics that are widely used in science and engineering. This course teaches the students techniques in how to think logically and mathematically and apply these techniques in solving problems. To achieve this goal, students will learn logic and proof, sets, functions, as well as algorithms and mathematical reasoning. Key topics involving relations, groups, graphs, trees, and formal languages and computability are covered in this course.

PREREQUISITES

- Basic knowledge of mathematics and probability.

COURSE OBJECTIVES

- Prepare for a background in abstraction, notation, and critical thinking for the mathematics most directly related to computer science.
- Understand and apply logic, relations, functions, basic set theory, countability and counting arguments, proof techniques,
- Understand and apply mathematical induction, combinatorics, recursion, sequence and recurrence relations.
- Understand and apply graph theory concept in solving computer network problems.
- Understand and apply mathematical proof techniques.

COURSE CONTENTS

UNIT–I **8 Hours**

Fundamentals of Logic: Basic Connectives and Truth Tables, Logic Equivalence – The Laws of Logic, Logical Implication – Rules of Inference. Predicates and Quantifiers. Introduction to proofs.

UNIT–II **8 Hours**

Properties of the Integers: Mathematical Induction. Fundamental Principles of Counting: The Rules of Sum and Product, Permutations, Combinations – The Binomial Theorem, Combinations with Repetition.

Recursive Definitions, Recurrence Relations: First Order Linear Recurrence Relation, the Second Order Linear Homogeneous Recurrence Relation with Constant Coefficients.

UNIT–III **7 Hours**

Relations and Functions: Cartesian Products, Relations, Computer Recognition – Zero-One Matrices and Directed Graphs. Properties of Relations, Equivalence Relations and Partitions. Partial Orders – Hasse Diagrams and Lattices. Functions – Plain and One-to-One, Onto Functions. Function Composition and Inverse Functions. The pigeonhole principle.

UNIT–IV **7 Hours**

Algebraic structures: Groups, Semi groups, Monoids, Cosets and Lagrange's Theorem. Homomorphisms, Isomorphisms, Cyclic Groups, Permutation groups, Rings, Integral Domain, Fields - definitions and examples. (Theorems - statements only, no proofs).

UNIT–V **9 Hours**

Introduction to Graph Theory: Graphs and Graph Models, subgraphs, Connected Graphs, bipartite graphs, Degree of a vertex, Graph Isomorphism, Eulerian Graphs, Hamiltonian Graphs. Trees and Spanning Trees - definition and examples, minimum spanning trees algorithms. Matching, Graph coloring. (Theorems - statements only, no proofs).

TEXT BOOKS

1. Discrete Mathematics & its Applications, Keneth H Rosen, 6th Edition, McGraw-Hill.
2. Ralph P. Grimaldi: Discrete and Combinatorial Mathematics, 5th Edition, Pearson Education.
3. Introduction to Graph Theory, Grary Chartrand and Ping Zhang, Tata McGraw-Hill Edition 2006.

REFERENCE BOOKS

- Basavaraj S Anami and Venakanna S Madalli: Discrete Mathematics – A Concept based approach, Universities Press, 2016.
- D. S. Malik and M. K. Sen: Discrete Mathematical Structures: Theory and Applications, Thomson, 2004.
- Thomas Koshy: Discrete Mathematics with Applications, Elsevier, 2005, Reprint 2008.

OTHER MATERIALS

- https://nptel.ac.in/course.php
- GATE Question Papers

TEACHING METHODS

- Black Board.
- Presentation.
- Tutorial Classes.
- Problem Solving Assignments

ASSESSMENT METHODS

Parameter	Marks
3 Mid Semester Examinations(Average of best of two tests)	30
Surprise test / Tutorials/ Quiz tests	10
Programming Assignments	10
Total	**50**
Final Exam will be conducted for 100 marks(SEE)	

COURSE OUTCOMES

At the end of this course students will be able to,

COs	Description	Bloom's Level
CO 1	Verify the correctness of argument using truth table, propositional and predicate logic.	**L3**
CO 2	Apply and analyze the concepts of counting techniques.	**L3**
CO 3	Make use of Relations and Functions in modeling the solutions.	**L3**
CO 4	Apply the concepts of Groups and Ring structures.	**L3**
CO 5	Apply and Analyze the concepts of graphs and trees.	**L3**

Mapping of Course outcomes (COs) to Program outcomes (POs*)													**Program Specific Outcomes(PSOs**)**		
POs / COs	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO1	3	3	2										3	2	
CO2	3	2	2										3	2	
CO3	3	2	2										3	2	
CO4	3	2	2										3	2	
CO5	3	2	2										3	2	
Correlation Level	3	2	2										3	2	

3: Strong, 2: Medium, 1: Weak** * 2: Highly related 3: Supportive**

Department: *Computer Science and Engineering*	***Course Type:*** *Programme Core*
Course Title: *Computer Organization & Architecture*	***Course Code:*** *18CS35*
L-T-P: *4-0-0*	***Credits:*** *04*
Total Contact Hours: *52Hours*	***Duration of SEE:*** *3 Hours*
SEE Marks: *50*	***CIE Marks:*** *50*

COURSE DESCRIPTION

The course will work from the understanding the basic concepts of increase the performance of the embedded systems. With a complete understanding of how computer systems execute programs and manipulate data, Topics covered include: data representation, machine-level code, computer arithmetic, elements of code compilation, optimization of memory and runtime performance, and memory organization and management.

PREREQUISITES

- Student should have prior knowledge of Logic Design, Electronic Circuits
- Student should have prior knowledge of Computer Concepts such as memory, I/O Devices, and CPU.

COURSE OBJECTIVES

- Understand basic structure of computers, different memory access types, salient features of a Computer System from the executing program viewpoint: what are the computer system components and how they execute a given program.
- The assembly language level operation of a processor is viewed both in general as well as in operational level using a simple example machine, its (symbolic) assembly language, and simulator that runs assembly language programs developed for that machine. We also look at the operating system role in the program execution.

COURSE CONTENTS

UNIT-I **10 Hours**

Basic Structure of Computers: Computer Types, Functional Units, Basic Operational Concepts, Bus Structures, Performance – Processor Clock, Basic Performance Equation, Pipelining and Superscalar Operation, Clock Rate, Instruction set: CISC and RISC, Compiler, Performance Measurement, multiprocessors and multi computers, Historical Perspective. Machine Instructions and Programs: Basic Input/output Operation, Input/output Organization: Accessing I/O Devices, Interrupts – Interrupt Hardware, Enabling and Disabling Interrupts, Handling Multiple Devices, Controlling Device Requests, Exceptions

UNIT -II **10 Hours**

Direct Memory Access, Buses, Interface Circuits, Standard I/O Interfaces(Introduction) The Memory System: speed-size and cost, cache memories, Performance consideration

UNIT -III **11 Hours**

Virtual Memories, Arithmetic: Addition and Subtraction of signed numbers, Design of Fast Adders, Multiplication of positive Numbers, Signed Operand Multiplication, Fast Multiplication, Integer Division floating –point Numbers and Operations

UNIT– IV **11 Hours**

Basic Processing Unit: Some Fundamental Concepts, Execution of a Complete Instruction, Multiple Bus Organization, Hard-wired Control, Microprogrammed Control, Pipelining: Basic Concepts, Data Hazards, Instruction Hazard

UNIT–V **10 Hours**

Embedded System: Examples of Embedded Systems, Processor Chips for embedded Applications, A simple Microcontroller, Programming considerations, I/O device timing Constraints, Reaction Timer- An example

TEXTBOOKS

- Computer Organization, Carl Hamacher, Zvonko Vranesic, Safwat Zaky, 5th Edition, TMH
- Computer Architecture and Organization, John P. Hayes, 3rd Edition, McGraw-Hill Series

REFERENCE BOOKS

1. Computer Organization & Architecture, William Stallings, 7th Edition, PHI, 2006
2. Computer Systems Design and Architecture, Vincent P. Heuring & Harry F. Jordan, 2nd Edition, Pearson Education, 2004
3. Computer Systems Architecture – M.Moris Mano, IIIrd Edition, Pearson/PHI
4. Computer Organization & Embedded Systems – Car Hamacher, Zvonks Vranesic, afeaZaky, 6th Edition, McGrawHill.

TEACHING METHODS

- Black Board/Power Point
- Presentations Assignments

ASSESSMENT METHODS

Parameter	Marks
Three internals(Average of best of two)	30
Programming Assignments	10
Rubrics for the evaluation of Course Project	10
Total	**50**
Final Exam will be conducted for 100 marks(SEE)	

COURSE OUTCOMES

At the end of the course student will be able to:

COs	Description	Bloom’s Level
CO 1	Identify the importance of computer organization, memory hierarchy, basic input-output mechanisms and interrupt handling circuits.	**L3**
CO 2	Apply algorithms to perform arithmetic and logical operations, solve problems using computer performance equations and relate Hard-wired Control, Micro programmed Control circuits.	**L3**
CO 3	Analyze the logic delay paths, combinational logic circuits and different bus organizations.	**L4**
CO 4	Illustrate pipeline techniques, Embedded system applications and the significance of multiple bus organizations.	**L2**
CO 5	Write programming assignment report and Present effectively.	**L2**

Mapping of Course outcomes (COs) to Program outcomes (POs*)& PSO **															
Course Outcomes mapping to Program Outcomes													PSOs		
POs / COs	1	2	3	4	5	6	7	8	9	10	11	12	PSO1	PSO2	PSO3
CO1		3	2										3	3	
CO2	3	3	2	2									3	3	
CO3	3	3	2										3	3	
CO4		3	2										3	3	
CO5					3		2	3							2

3: Strong, 2: Medium, 1: Weak ** H: Highly related S: Supportive

Department: *Computer Science and Engineering*	***Course Type:*** *Programme Core*
Course Title*: Object Oriented Programming with C++*	***Course Code:*** *18CS36*
L-T-P: *3-0-0*	***Credits:*** *03*
Total Contact Hours: *39 Hours*	***Duration of SEE:*** *3 Hours*
SEE Marks*: 50*	***CIE Marks:*** *50*

COURSE DESCRIPTION

This course provides an understanding of OOP Programming paradigm. The course also provides the knowledge of application development for real-world problems in C++.

PREREQUISITES

- Basic knowledge of C Programming**.**

COURSE OBJECTIVES

- To understand the difference between Procedure Oriented and OO Programming.
- To understand OOP features of C++
- To develop applications in C++

COURSE CONTENTS

UNIT–I **7 Hours**

An Overview of C++ : object –Oriented Programming Principles, The origins of C++, C++ Fundamentals- Introducing C++ Classes.

Classes and Objects : C++ Classes and Structures, Class and object declarations ,Friend Functions, Friend Classes, Inline Functions, Static Class Members, The Scope Resolution Operator, Functions and Objects.

Arrays, Pointers, References, and the Dynamic Allocation Operators: Arrays of Objects, this Pointer, References, C++' s Dynamic Allocation Operators.

UNIT–II **8 Hours**

Function Overloading and Default Arguments: Function Overloading, Constructor types, Overloading Constructor Functions, Default Function Arguments, Function Overloading and Ambiguity

Operator Overloading: Creating a Member Operator Function, Operator Overloading Using a Friend Function, Overloading Some Special Operators, Overloading the Comma Operator

UNIT–III **8 Hours**

Inheritance: Base-Class Access Control, Inheritance and Protected Members, Inheriting Multiple Base Classes, Constructors, Destructors and Inheritance, Granting Access, Virtual Base Classes

Virtual Functions and Polymorphism: Virtual Functions, The Virtual Attribute Is Inherited, Virtual Functions Are Hierarchical, Pure Virtual Functions, Using Virtual Functions, Early vs Late Binding.

UNIT–IV **8 Hours**

Templates: Generic Functions, Applying Generic Functions, Generic Classes

Exception Handling: Exception Handling Fundamentals, Handling Derived-Class Exceptions, Exception Handling Options, Applying Exception Handling.

UNIT–V **8 Hours**

C++ File I/O: <fstream> and File Classes, Opening and Closing a File, Reading and Writing Text Files ,Unformatted and Binary I/O, Detecting EOF, The ignore() Function, Peek() and putback(),flush(),Random Access ,I/O Status, Customized I/O and Files.

TEXTBOOK

1. The Complete Reference C++, Herbert Schildt, 4th Edition, TMH, 2005.

REFERENCE BOOKS

- C++ Primer, Stanley B. Lippman, JoseeLajoie, Barbara E. Moo,4th Edition, AddisonWesley, 2005.
- Object-Oriented Programming with C++, SouravSahay, Oxford University Press, 2006.

TEACHING METHODS

- Lecture using Black board and chalk
- Presentations
- Programming Assignments
- Course Project

ASSESSMENT METHODS

Parameter	Marks
Three internals(Average of best of two)	30
Programming Assignments	10
Rubrics for the evaluation of Programming Assignments	10
Total	**50**
Final Exam will be conducted for 100 marks(SEE)	

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COURSE OUTCOMES

At the end of Course, Student will be able to:

COs	Description	Bloom's Level
CO 1	Design classes for the given application scenarios and apply the concepts of classes and objects, friend functions, friend classes, Inline functions, static class members and this pointer in implementation of solutions to problems.	**L3**
CO 2	Analyze and apply the concepts of function overloading, default arguments, constructors and operator overloading in designing and implementing solutions to given problems.	**L4**
CO 3	Apply the principle of code reusability using Inheritance, use the concept of virtual base classes to prevent the possible ambiguity in multiple inheritance and analyze the benefit of dynamic binding using virtual functions and inheritance.	**L3**
CO 4	Design and use template classes that take generic parameters to support code reusability principle in problem solving, understand and apply the concept of exception handling to prevent run-time abnormal program termination error in applications	**L3**
CO 5	Create text and binary files and use them in the applications to handle voluminous data.	**L3**

Mapping of Course outcomes (COs) to Program outcomes (POs*)& PSO **															
Course Outcomes mapping to Program Outcomes													PSOs		
POs / COs	1	2	3	4	5	6	7	8	9	10	11	12	PSO1	PSO2	PSO3
CO1	3		3					2					3		
CO2	3	2	3					3					3		
CO3	3	2	3										3		
CO4	3		3										3		
CO5	3		3										3		

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Department of Computer Science and Engineering

Department: *Computer Science and Engineering*	***Course Type:*** *Programme Core*
Course Title: *Microprocessor Laboratory*	***Course Code:****18CSL37*
L-T-P: 0*-1-1*	***Credits:*** *1*
Total Contact Hours: *36Hours*	***Duration of SEE:*** *3 Hours*
SEE Marks: *50*	***CIE Marks:*** *50*

COURSE DESCRIPTION

- This course introduces students with various assembly language programs on searching, sorting, arrays, loops, conditional operations, string operations, macros, procedures, logic controllers, Stepper motor and DAC interface.

PREREQUISITES

- Should have knowledge about Basic Electronics and Logic Design.

COURSE CONTENTS

- 8086 Architecture, Addressing Modes, Instruction sets,
- Assembly Language Programming Fundamentals,
- I/O Interfacing of 8086 with 8255 PPI.

List of Programs:

Part A

1. Write an ALP to solve the following arithmetic operations for 8-Bit and 16-Bit numbers:
   I. Addition.
   II. Subtraction.
   III. Division.
   IV. Multiplication.
2. Write an ALP to find a factorial of a number using conditional call operation.
3. Write an ALP to find Fibonacci series for 10 count numbers using arrays concept.
4. Write an ALP to find a greatest/largest number in an array using loop operation.
5. Write an ALP to find a least/smallest number in an array using loop operation.
6. Write an ALP to arrange the array in ascending order using nested loop operation.
7. Write an ALP to arrange the array in descending order using nested loop operation.
8. Write an ALP to reverse a string.
9. Write an ALP to concatenate two different strings.
10. Write an ALP to find whether the given string is palindrome or not.
11. Write an ALP to Display Messages using Macros.
12. Write an ALP to add/subtract two 16 bit numbers using Procedure.

Part B

1. Write an ALP to interface 8086 to a logic controller and check for odd or even parity.
2. Write an ALP to interface stepper motor to 8086 using 8255 Interface controller:
   I. Rotate the motor in Clock-wise direction.
   II. Rotate the motor in Anti-clock-wise direction.
3. Write an ALP to interface DAC to 8086 to generate waveforms:
   I. Square waveform.
   II. Triangle waveform.

Note: Out of the exercises executed in the regular laboratory classes, each student will be allotted one question from Part A and one question from Part B, by blind pick during SEE, and to be executed individually.

REFERENCE BOOKS

- Walter A Triebel and Avtar Singh, The 8088 and 8086 Microprocessors Programming, Interfacing, Hardware, Fourth Edition, Pearson New International Edition.
- Barry B. Brey, The Intel Microprocessors: 8086/8088, 80186, 80286, 80386, and 80486: Architecture, Programming, and Interfacing, Second Edition.

ASSESSMENT METHODS

Parameter	Marks
Experiment Writeup + Execution + Viva	15
Lab Record Wirting	10
Lab Internals Test	15
Surprise Test	10
Total	**50**
Final Exam will be conducted for 100 marks (SEE)	

COURSE OUTCOMES

At the end of the course, students will be able to:

COs	Description	Bloom's Level
CO 1	Develop programs related to Searching, Sorting and Strings	**L3**
CO 2	Implement programs using Macros and Procedure	**L3**
CO 3	Examine Number Generation and Parity checking	**L4**

CO 4	Interface hardware devices to 8086 processor	**L3**

Mapping of Course outcomes (COs) to Program outcomes (POs*)& PSO **															
Course Outcomes mapping to ProgramOutcomes													**PSOs**		
POs COs	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**PSO1**	**PSO2**	**PSO3**
CO1	3			2					3	2	3		3		
CO2		3			2								3	2	
CO3	3		2	2					2		2		3	2	
CO4						3		2	3				2	2	

3: Strong, 2: Medium, 1: Weak ** H: Highly related S: Supportive

Department: *Computer Science and Engineering*	***Course Type:*** *Programme Core*
Course Title*: Data Structures Laboratory*	***Course Code:*** *18CSL38*
L-T-P: *0-0-2*	***Credits:*** *1*
Total Contact Hours: *39 Hours*	***Duration of SEE:*** *3 Hours*
SEE Marks*: 50*	***CIE Marks:*** *50*

COURSE DESCRIPTION

This course introduces students with various data structures and their implementation.

PREREQUISITES

- Students should have basic knowledge of C programming constructs and should be able to write basic C programs

COURSE CONTENTS

Sl No	List of Programs	CO Mapping
1.	• Find sum of N numbers. Allocate the memory dynamically to the numbers. • Find the following for a matrix. Use the concept of pointer to 2D array. • Sum of principal diagonal elements • Sum of secondary diagonal elements iii)sum of all elements	CO1
2.	Using array of pointer concept • Find product of two Matrices • Sort n names in alphabetical order	CO1
3.	Implement and demonstrate the following C functions using pass-by- reference method. i) strCopy( ) ii)strConcat() iii)strcomp() iv)strrev()	CO1
4.	Define an EMPLOYEE structure with members Emp_name, Emp-id, Dept-name and Salary. Read and display data of N employees. Employees may belong to different departments. Write a function to find total salary of employees of a specified department. Use the concept of pointer to structure and allocate the memory dynamically to	CO1

	EMPLOYEE instances	
5.	• Define a recursive factorial function. Evaluate the following series for N terms using a function which takes x in degrees and a pointer to factorial function as parameters. Sin(x)=x-x^3/3!+ x^5/5!- .... • To copy the contents of one file to another, taking file names as command line arguments. Display the contents of target file on the screen.	**CO2**
6.	Write a C program to convert and print a given valid parenthesized infix arithmetic expression to postfix expression. The expression consists of single character operands and binary operators + - * /. Apply the concept of stack data structure to solve this problem	**CO2**
7.	Write a C program to evaluate a valid postfix expression using stack. Assume that the postfix expression is read as a single line consisting of non-negative single digit operands and binary operators. The operators are + - * and /.	**CO2**
8.	Write recursive functions for the following and demonstrate their use. a)Binary Search b)Tower of Hanoi problem.	**CO2**
9.	A Call center phone system has to hold the phone calls from customers and provide service based on the arrival time of the calls. Write a C program to simulate this system using appropriate data structure. Program should have options to add and remove the phone calls in appropriate order for their service.	**CO3**
10.	Write a C program to simulate the working of a circular Queue of integers. Represent circular queue element as a structure and use array of structures as your implementation method. Start and end of the circular queue must be identified by an empty array element.	**CO3**
11.	Write a program to create a singly linked list that maintains a list of names in alphabetical order. Implement the following operations on the list. a. Insert a new name b. Delete a specified name	**CO4**
12.	Write a C program to maintain a stack of integers using linked implementation method.	**CO4**

13.	Write a C program to support the following operations on a doubly linked list. a)Insert a new node to the left of the node whose key value is read as an input. b)Delete a node with given data, if it is found otherwise display appropriate error message.	**CO4**
14.	Write a C program a)To construct a binary search tree (BST) of integers. b)To traverse the tree using inorder, preorder and postorder traversal methods	**CO5**
15.	A list of unordered numbers is given in a file. The file may have duplicate numbers. Read the numbers from the file construct a binary tree of these numbers and display the numbers in ascending order.	**CO5**

ASSESSMENT METHODS

Parameter	**Marks**
Two internals,(Average of two)	15
Lab Record Writing	10
Surprise Test	10
Continuous Evaluation	10
Viva	5
Total	**50**
Final Exam will be conducted for 100 marks(SEE)	

COURSE OUTCOMES

At the end of the course student will be able to:

CO	**Description**	**Bloom's Level**
CO 1	Design and implement C programs on structures, unions, pointers, dynamic memory allocation functions and command line arguments	**L3**
CO 2	Simulate stack and queue operations and implement its applications	**L3**
CO 3	Develop C programs on linked list and its variations	**L3**
CO 4	Construct C programs on Binary search tree and its applications	**L3**
CO 5	Understand the applications of data structure in real time	**L2**

Mapping of Course outcomes (COs) to Program outcomes (POs*)& PSO **															
Course Outcomes mapping to Program Outcomes													PSOs		
POs / COs	1	2	3	4	5	6	7	8	9	10	11	12	PSO1	PSO2	PSO3
CO1	3	2	3						2			1	3		
CO2	3	2	3						2			1	3		
CO3	3	2	3						2			1	3		
CO4	3	2	3						2			1	3		
CO5	3	2	3						2			1	3		

3: Strong, 2: Medium, 1: Weak** * H: Highly related S: Supportive**

Department: *Computer Science and Engineering*	***Course Type:*** *Programme Core*
Course Title: *Design of Analog and Digital Circuits Lab*	***Course Code:****18CSL39*
L-T-P:*0-0-2*	***Credits:****1*
Total Contact Hours: *36 Hours*	***Duration of SEE:*** *3 Hours*
SEE Marks*: 50*	***CIE Marks:****50*

COURSE DESCRIPTION

This course makes students be able to demonstrate programming proficiency using the various logical elements to design practically motivated logical UNITs. Wirte different logical elements, to analyze and demonstrate timing diagrams of the UNITs modeled. Analyze half wave and full wave rectifier. Design clipper clamper circuits.

PREREQUISITES

- Satisfactory completion of understanding of basics of physics course on electricity.
- Ability to describe and transform the simple logical equations.
- Ability to perform simple jobs in wiring logical elements.
- Ability to use a computer to prepare written reports and to perform basic data reduction, graphing, and engineering data presentation.

COURSE CONTENTS

PART A			
1.	Design a circuit for Conversion of BCD to Excess - 3 code	CO1	L5
2.	Design a circuit for realizing the given Boolean Function using MUX	CO 2	L5
3.	Design Asynchronous decade counter and mod n counter.	CO1	L4
4.	Design a Ring Counter and Johnson counter and test the working of both	CO1	L3
5.	Implement a sequence generator and verify the output	CO1	L3

PART B			
1	Design half wave rectifier. Determine ripple factor.	CO4	L5
2	Design full wave rectifier. Determine ripple factor.	CO4	L5
3	Design and implement voltage follower, inverting amplifier and non- inverting amplifier using Op-Amp.	CO4	L5
4	Construct CLIPPER circuits and verify its working.	CO4	L5
5	Construct CLAMPER circuits and verify its working.	CO 4	L5

Note: Out of the exercises executed in the regular laboratory classes, each student will be allotted one question from Part A and one question from part B

ASSESSMENT METHODS

Parameter	Marks
Internals	15
Record and Observation	15
Viva	5
Continuous evaluation	5
Problem solving	10
Total	**50**
Final Exam will be conducted for 100 marks(SEE	

COURSE OUTCOMES

COs	Description	Bloom's Level
CO 1	Implement BCD to excess 3 convertor , synchronous counter , asynchronous counter and ring counter	**L3**
CO 2	Design and implement Comparator, multiplexer, demultiplexer and decoder	**L3**
CO 3	Determine ripple factor for half wave and full wave Rectifier	**L5**
CO 4	Make use of Op-amp to construct Inverting , non-inverting , Clipper and clamper circuits.	**L3**
CO 5	Develop D\A converter	**L3**

Mapping of Course outcomes (COs) to Program outcomes (POs*)& PSO **															
Course Outcomes mapping to Program Outcomes													**PSOs**		
POs / COs	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**PSO1**	**PSO2**	**PSO3**
CO1	3			2				2		2			3	2	2
CO2	3	2							3		3		3	3	2
CO3			3		3					3		2	3	3	2
CO4		2						3					3	3	2
CO5		2						3					3	3	2

3: Strong, 2: Medium, 1: Weak ** H: Highly related S: Supportive

Course Content for IV-Semester of 2018 Scheme

Department: *Computer Science and Engineering*	***Course Type:****Programme Core*
Course Title*: Engineering Mathematics –IV*	***Course Code:*** *18MAT41*
L-T-P: *3-2-0*	***Credits:****4*
Total Contact Hours: *52 Hours*	***Duration of SEE:*** *3 Hours*
SEE Marks*: 50*	***CIE Marks:*** *50*

COURSE DESCRIPTION

This course introduces students with the basics, applications and importance Numerical methods, Random variables, Standard distributions, Sampling and Apply Hypothesis testing

PREREQUISITES

- Basics of Mathematics, Mathematics III

COURSE OBJECTIVES

To understand the basics, applications and importance Numerical methods, Random variables, Standard distributions, Sampling and Apply Hypothesis testing

COURSE CONTENTS

UNIT – I **8 Hours**

Solution of ODE- Taylor's series method, 4^{th} order Runge - Kutta method, Milne's predictor and corrector method.

Solution of PDE – Schmidt method to solve heat equation, explicit method for wave equation, Numerical solution of Laplace equation.

UNIT – II **8 Hours**

Eigen values and Eigen vectors- Largest eigen value by Power method, Rutishauser's method Jacobi method for symmetric matrices, Given's and House Holder's method to reduce symmetric matrix to tridiagonal matrix.

UNIT – III **10 Hours**

Random variable: discrete and continuous, probability distribution- discrete and continuous, probability density function, cumulative density function, mean and variance, expectation.

Joint distribution: discrete and continuous, marginal distribution, expectation, covariance, rank correlation.Binomial, Poisson, Normal distribution.

UNIT – IV **8 Hours**

Sampling theory: Population and sample, sampling with and without replacement, sampling distribution of means, sample variance. Unbiased estimate, reliability, confidence intervals for mean statistical hypothesis, testing of hypothesis, Type I and II errors, one tailed, two tailed tests, test for significance level of large and small samples, t - test, χ^2 – test for goodness of fit.

UNIT-V **8 Hours**

Calculus of Variation: Introduction, Functional, Euler's equation, Solution to Euler's equation, geodesics, isoperimetric problems, Rayleigh Ritz method, Galerkin's method, Hamilton's principle.

TEXT BOOKS

1. Numerical methods for scientific and engg. Computation, 6th edition, by M K Jain, S R K Iyengar, R K Jain, New age, 2012.
2. Introductory methods of numerical analysis, by S SSastry, PHI India.
3. Probability and statistics, by Murray R Spiegel, J Schiller, R AluSrinivasan, Schaum's outline series, second edition
4. Higher engg. Mathematics by Dr. B S Grewal (42nd edition), Khanna publications 2012.

REFERENCE BOOKS

1. Numerical algorithm by Krishnamurthy and Sen, EWP, 2007.
2. Probability and statistics for Science and Engg. By G ShankerRao, Univ Press, 2011

TEACHING METHODS

- Black Board Teaching.
- Power point presentation (If needed).
- Tutorial Classes.

ASSESSMENT METHODS

Parameter	Marks
Three Internals (Average of best of two)	30
Surprise test / Tutorials tests	10
Quiz/ assignment based on practical application	10
Total	**50**
Final Exam will be conducted for 100 marks (SEE)	

COURSE OUTCOMES

At the end of the course students will be able to :

COs	Description	Bloom's Level
CO 1	Understand Concepts of Numerical methods and apply to problem solving, finding Eigen values, solving ODE and PDE	**L2, L3**
CO 2	Model Physical situations and solutions can be obtained by Numerical methods	**L4**
CO 3	Apply Concepts of random variables, probability distributions and sampling to problem solving.	**L3**
CO 4	Test Probability distributions of hypothesis of testing and model situations arising in analysis of data	**L2**
CO 5	Apply the concept of functional and variational.	**L3**

Mapping of Course outcomes (COs) to Program outcomes (POs*)& PSO **															
Course Outcomes mapping to Program Outcomes													**PSOs**		
POs / COs	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**PSO1**	**PSO2**	**PSO3**
CO1	2	2		1											
CO2	2	2		1											
CO3	2	2		2	1										
CO4	2	2		2	1										
CO5	2	2		1	1										

Department: *Computer Science and Engineering*	***Course Type*** *: Programme Core*
Course Title: *Design and Analysis of Algorithms*	***Course Code****: 18CS42*
L-T-P: *3-0-0*	***Credits:*** *03*
Total Contact Hours: *39 Hours*	***Duration of SEE*** *: 3 Hours*
SEE Marks: *50*	***CIE Marks:*** *50*

COURSE DESCRIPTION

This course introduces basic methods for the design and analysis of efficient algorithms emphasizing methods which are useful in practice. The computational problems for sorting, searching, Divide and Conquer, dynamic programming and greedy algorithms, graph algorithms string matching, Backtracking, Branch and Bound, NP completeness are discussed.

PREREQUISITES

- Students should have knowledge of C or C++ language
- Students should know data structures
- Students should know the usage of summation formulae and recurrences in mathematics

COURSE OBJECTIVES

- To understand the basic concepts and notations used in the design and analysis of algorithms.
- To provide theoretical background in the design and analysis of major classes of algorithms.
- To solve problems using appropriate algorithms.
- To analyze and compare the performance of algorithms.

COURSE CONTENTS

UNIT - I **7 Hours**

Introduction: What Is an Algorithm? Fundamentals of Algorithmic Problem Solving, Fundamentals of the Analysis of Algorithm Efficiency: The Analysis Framework, Asymptotic Notations and Basic Efficiency Classes, Mathematical Analysis of Non recursive Algorithms, Mathematical Analysis of Recursive Algorithms, Example: Computing the nth Fibonacci number,

UNIT - II **8 Hours**

Brute Force and Exhaustive Search: Selection Sort and Bubble Sort, Sequential Search and Brute-Force String Matching, Depth-First Search and Breadth-First Search, Exhaustive Search.

Decrease-and-Conquer: Insertion Sort, Topological Sorting, Decrease-by-a-Constant-Factor Algorithms – Binary Search.

UNIT - III **8 Hours**

Divide and Conquer: Mergesort, Quicksort **Transform-and-Conquer:** Balanced Search Trees, AVL trees, 2-3 trees, Heaps and Heapsort, Input Enhancement in String Matching, Horspool's Algorithm, Hashing.

UNIT - IV **8 Hours**

Dynamic Programming: The Knapsack Problem and Memory Functions, Warshall's and Floyd's Algorithms, Greedy technique**:** Prim's Algorithm, Kruskal's Algorithm, Dijkstra's Algorithm, Huffman Trees and Codes.

UNIT - V **8 Hours**

Iterative Improvement: The Maximum-Flow Problem, Limitations of Algorithm Power**:** P, NP, and NP-Complete Problems, Coping with the Limitations of Algorithm Power**:** Backtracking - n-Queens Problem, Subset-Sum Problem, Branch-and-Bound -Knapsack Problem

Note: For SEE, students should answer five questions, selecting at least one question from each unit.

TEXT BOOKS

1. AnanyLevitin, "Introduction to the Design & Analysis of Algorithms", 3rd Edition, 2011, Pearson education.
2. Horowitz E., SartajSahni S.,Rajasekaran S ,"Fundamentals of Computer Algorithms",, 2001, Galgotia Publications

REFERENCE BOOKS

1. H., Cormen, Charles E. Leiserson, Ronal L. Rivest, Clifford Stein Thomas,"Introduction to Algorithms", 2nd Edition, 2006, PHI.

TEACHING METHODS

- Lectures interspersed with discussion
- Power Point Presentations
- Problem Based Teaching
- NPTEL Course

ASSESSMENT METHODS

Parameter	Marks
Three Internals (Average of best of two)	30
Problem based Assignment	10
GATE based Tutorial Test	10
Total	**50**
Final Examination will be conducted for 100 marks (SEE)	

COURSE OUTCOMES

At the end of the course student will be able to:

COs	Description	Bloom's Level
CO 1	Describe the concepts, methods and notations used in the design and analysis of algorithms	L2
CO 2	Design algorithms using brute force, decrease and conquer , divide and conquer approach, dynamic programming, greedy technique and Transform-and-Conquer methods	L5
CO 3	Apply the various problem solving methodologies to get solution to common engineering problems	L3
CO 4	Evaluate the performance of various algorithms.	L3
CO 5	Solve the problems based on Iterative Improvement method, the Maximum-Flow Problem. Use the space state tree to solve Queens, sum subset problems and knapsack problem.	L3

Mapping of Course outcomes (COs) to Program outcomes (POs*)& PSO **

Course Outcomes mapping to Program Outcomes													PSOs		
POs / COs	1	2	3	4	5	6	7	8	9	10	11	12	PSO1	PSO2	PSO3
CO1	3	2	2						1				2		
CO2	3	2	2						1				2	3	
CO3	3	2	2						1				2	3	
CO4	3	2	2						1				2	3	
CO5	3	2	2						1				2	3	

3: Strong, 2: Medium, 1: Weak ** H: Highly related S: Supportive

Department: Computer Science and Engineering	**Course Type:** Programme Core
Course Title: Database Management Systems	**Course Code**: 18CS43
L-T-P:3-0-0	**Credits:** 03
Total Contact Hours: 39 Hours	**Duration of SEE:** 3 Hours
SEE Marks: 50	**CIE Marks:** 50

COURSE DESCRIPTION

This course provides an understanding of Database management systems. The course also provides the knowledge of ER-diagram design, Relational Algebra and RDBMS, SQL for querying the database and Normalization for the good database design.

PREREQUISITES

1. Students should know basics of Discrete Mathematics.
2. Students should know basic programming concepts.

COURSE OBJECTIVES

5. To understand the fundamentals of Relational database management systems.
6. To design database using ER-modeling, Normalization and querying the database using SQL.
7. To understand the fundamentals of transactions, locking mechanisms, database recovery.

COURSE CONTENTS

UNIT-I **9 Hours**

Database and Database Users: Introduction, Example, Characteristics of Database Approach, Actors on the Scene, Workers Behind the Scene, Advantages of Using the DBMS Approach, A Brief History of Database Application. Database System Concepts and Architecture: Data Models, schemas, and Instances: Three-schema architecture and Data Independence, Database Languages and Interfaces, The Database System Environment, Centralized and Client/Server Architecture for DBMS, Classification of Database Management systems. **Data Modeling Using the Entity-Relationship (ER) Model:** Using High - Level Conceptual Data Models for Database Design, An Example Database Application, Entity Types, Entity Sets, Attributes, and Keys, Relationship Types, Relationship Sets, Roles, and Structural Constraints, Weak Entity Types, ER Diagrams, Naming Conventions, and Design Issues.

UNIT-II **9 Hours**

The Relational Data Model and Relational Database Constraints: Relational Model Concepts, Relational Model Constraints and Relational Database Schemas, Update Operations, Transactions and Dealing with Constraint Violations. The Relational Algebra and Relational Calculus: Unary Relational

Operations: SELECT and PROJECT, Relational Algebra Operations from Set Theory, Binary Relational Operations: JOIN and DIVISION, Additional Relational Operations; Examples of Queries in Relational Algebra.

SQL: Schema Definition, Constraints, Queries, and Views: SQL Data Definition and Data Types, Specifying Constraints in SQL, Schema Change Statements in SQL, Basic Queries in SQL, More Complex SQL Queries, Insert, Delete and Update Statements in SQL, Specifying Constraints as Assertion and Trigger, Views (Virtual Tables) in SQL.

UNIT-III **9 Hours**

Introduction to SQL Programming Techniques: Database Programming: Issues and Techniques, Embedded SQL, Dynamic SQL, Database Stored Procedures and SQL / PSM. **Database Design Theory and Methodology:** Informal Design Guidelines for Relation Schemas, Functional Dependencies, Normal Forms Based on Primary Keys, General Definitions of Second and Third Normal Forms, Boyce-Codd Normal Form.

UNIT-IV **6 Hours**

Transaction Processing Concepts: Introduction to Transaction Processing, Transaction and System Concepts, Desirable Properties of Transactions, Characterizing Schedules Based on Recoverability, Characterizing Schedules Based on Serializability, Transaction Support in SQL. **Concurrency Control Techniques: T**wo-Phase Locking Techniques for Concurrency Control, Concurrency Control Based on Timestamp Ordering. **Database Recovery Techniques:** The ARIES Recovery Algorithm. Introduction to NO SQL.

UNIT-V **6 Hours**

Application Design and Development: User Interfaces and Tools, Web Interfaces to Databases, Web Fundamentals, Servlets and JSP, Building Large Web Applications, Triggers, Authorization in SQL, Application Security.

Additional Concepts: ava Scripts/Node JS and Mongodb, JSON and XML
Reference: https://www.simplilearn.com/tutorials/nodejs-tutorial/nodejs-mysql

TEXT BOOKS

1. Elmasri and Navathe: Fundamentals of Database Systems, 7th Edition, Addison-Wesley, 2007
2. Silberschatz, Korth and Sudharshan: Data base System Concepts, 5th Edition, Mc-GrawHill, 2006.
3. Raghu Ramakrishnan and Johannes Gehrke: Database Management Systems, 3rd Edition, McGraw-Hill, 2003.

REFERENCE BOOKS

1. C.J. Date, A. Kannan, S. Swamynatham: A Introduction to Database Systems, 8th Edition, Pearson education, 2006.

TEACHING METHODS

1. Blackboard teaching
2. PowerPoint presentations (if needed)
3. Programming Assignments using SQL

ASSESSMENT METHODS

Parameter	Marks
Three Internals (Average of best of two)	30
Demonstration	10
Assignment	10
Total	**50**
Final Examination will be conducted for 100 marks (SEE)	

COURSE OUTCOMES

At the end of the course students will

COs	Description	Bloom's Level
CO 1	Have a broad understanding of database concepts, Understand the essentials of DBMS and its architectures, Design and Model a real time Scenario using ER-Modeling.	**L1**
CO 2	Convert entity relationship and convert entity relationship diagrams into RDBMS. Design Relational Algebra and SQL queries to analyze on the respective data.	**L3**
CO 3	Be able to design SQL commands to create tables and indexes, insert/ update/ delete data, and query data in a relational DBMS. Demonstrate an understanding of normalization theory and apply such knowledge to the normalization of a database.	**L3**
CO 4	Illustrate the concepts of Transaction Management and Database Recovery Techniques.	**L2**
CO 5	Design and Develop database application using Java Servlets and MYSQL (Web/Windows).	**L4**

Mapping of Course outcomes (COs) to Program outcomes (POs*) & PSO **															
Course Outcomes mapping to Program Outcomes													**PSOs**		
POs / COs	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**PSO1**	**PSO2**	**PSO3**
CO1	3	3	3	2									3	2	
CO2		3	2	3	3								3	3	
CO3		3	3	3									3	2	
CO4	3	2	2										3	2	
CO5		2	3	2									2	2	1

Department: *Computer Science and Engineering*	***Course Type:*** *Programme Core*
Course Title: *Operating Systems*	***Course Code:****18CS44*
L-T-P: *3-0-2*	***Credits:*** *04*
Total Contact Hours: *52 Hours*	***Duration of SEE:*** *3 Hours*
SEE Marks: *50*	***CIE Marks:*** *50*

COURSE DESCRIPTION

This course provides an in-depth knowledge of Process, Threads and resource management.

PREREQUISITES

- Student should have prior basic knowledge on C, C++ and Data structures
- Student should have some basic knowledge on Unix Shell Programming and Windows.

COURSE OBJECTIVES

- To understand the basic functionalities of Operating System, Process and Threads.
- To understand the implementation of memory management and virtual memory.
- To analyze the usage of different Process and Disk scheduling.

COURSE CONTENTS

UNIT – I **10 Hours**

Introduction: What operating systems do; Operating System structure; Operating System operations; **Process Management:** Basic concept; Process scheduling; Operations on processes; Inter process Communication. **Multithreaded Programming:** Overview; Multithreading models; Thread Libraries; threading issues.

UNIT – II **11 Hours**

Process Scheduling: Basic concepts; Scheduling criteria; Scheduling algorithms; **Process Synchronization:** Synchronization, The Critical section problem; Peterson’s solution; Synchronization hardware; Semaphores; Classical problems of synchronization; Monitors.

UNIT – III **11 Hours**

Deadlocks: System model; Deadlock characterization; Methods for handling deadlocks; Deadlock avoidance; Deadlock detection and recovery from deadlock. **Memory Management Strategies:** Basic hardware, Logical Versus Physical Address Space Dynamic Loading; Swapping; Contiguous memory allocation; Paging; Structure of page table; Segmentation.

UNIT – IV **10 Hours**

Virtual Memory Management: Background; Demand paging; Copy-on-write; Page replacement: FIFO, Optimal, LRU Page replacement; Thrashing.

Implementing File System: File Access methods**,** File mounting, File system structure; File system implementation; Directory implementation; Allocation methods; Free space management

UNIT – V **10 Hours**

Secondary Storage Structures, Protection: Mass storage structures; Disk scheduling; **I/O Systems** I/O hardware, Application I/O interface, kernel I/O Subsystem **System Protection:** Goals of protection, Principles of protection, Domain of protection, Access matrix.

TEXT BOOKS

1. Abraham Silberschatz, Peter Baer Galvin, Greg Gagne: Operating System Principles, 7thedition, Wiley-India, 2006.

REFERENCE BOOKS

1. D.M Dhamdhere: Operating systems - A concept based Approach, 2nd Edition, Tata McGraw- Hill,2002.
2. P.C.P. Bhatt: Operating Systems, 2nd Edition, PHI,2006.
3. Harvey M Deital: Operating systems, 3rd Edition, Addison Wesley,1990.

TEACHING METHODS

- Black Board/Power Point Presentations
- Programming Assignments
- NPTEL

ASSESSMENT METHODS

Parameter	Marks
Three Internals (Average of best of two)	30
Programming Assignments	10
Industry Case study	10
Total	**50**
Final Examination will be conducted for 100 marks (SEE)	

COURSE OUTCOMES

At the end of the course students will be able to :

COs	Description	Bloom's Level
CO 1	Define the components of Operating System and its applications.	**L1**
CO 2	Demonstrate the issues related to process management, synchronization Algorithms along with the cause and effect of deadlocks.	**L3**
CO 3	Identify the memory fragmentation problems and summarize the file system Management, I/O systems and protection in Operating System.	**L2**
CO 4	Compare and evaluate the performance of various disk scheduling algorithms, page replacement algorithms	**L3**
CO 5	Design and develop the algorithms for the rudimentary operating system in Windows/Linux Operating System	**L5**

Mapping of Course outcomes (COs) to Program outcomes (POs*)& PSO **

Course Outcomes mapping to Program Outcomes													PSOs		
POs / COs	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**PSO1**	**PSO2**	**PSO3**
CO1	3	3	3	2									3	2	
CO2		3	2	3	3								3	3	
CO3		3	3	3									3	2	
CO4	3	2	2										3	2	
CO5		2	3	2									2	2	1

3: Strong, 2: Medium, 1: Weak ** H: Highly related S: Supportive

Department: *Computer Science and Engineering*	***Course Type:*** *Programme Core*
Course Title: *Application Development using Java*	***Course Code:*** *18CS45*
L-T-P: *3-0-2*	***Credits:*** *04*
Total Contact Hours: *52Hours*	***Duration of SEE:*** *3 Hours*
SEE Marks: *50*	***CIE Marks:*** *50*

COURSE DESCRIPTION

This course provides an in-depth knowledge of Object-Oriented application development using Java programming language. It discusses the programming concepts like multithreading, Interfaces, Exception Handling, GUI development and event Handling in JavaFX and, the advanced concepts like database connectivity and servlet deployment.

PREREQUISITES

- Student should have the prior knowledge of C++ and OOP Concepts
- Student should have the basic knowledge of Databases.

COURSE OBJECTIVES

- To understand the basic Object-Oriented features of Java.
- To understand and apply the concept of Interfaces and Exception Handling
- To develop Multithreaded Java Applications.
- To understand and implement applications with database connectivity and accessing web application.
- To develop and deploy Servlets in java.

COURSE CONTENTS

UNIT – I **10 Hours**

Introduction to Java:

Java Buzz words, Byte Code; Object oriented programming; First Simple Java program, Introducing Classes: Classes Fundamentals; Declaring Objects, Assigning Object Reference Variable; Introducing Methods; **A Closer Look at Methods and Classes**; Inheritance Basics- using Super; Creating Multilevel Hierarchy**,** when constructors are called, method Overriding, Dynamic Method Dispatch, Abstract classes, final with inheritance

UNIT – II **10 Hours**

Packages and Interfaces, Exception handling in Java: Packages, Access Protection, importing packages, Interfaces. Exception Handling Fundamentals, Exception types, uncaught Exception, using try and catch, multi catch clause, nested try catch, throw, throws, finally, creating your own exception subclasses.

UNIT – III **10 Hours**

Multi-Threaded Programming: Java Thread model, the main method, Creating thread, Thread priorities, Synchronization, Inter-thread communication.

Java database Connectivity (JDBC): Introduction, JDBC Driver types, Packages, Loading the JDBC Driver, Connect to Database, Creating and executing SQL Query.

UNIT – IV **11 Hours**

GUI Programming, Java Beans and Event Handling: Introducing JavaFx GUI Programming, Exploring JavaFx controls, Introducing JavaFX Menus, Java Beans with example programs.

Event Handling: Event handling mechanisms, The Delegation Event model.

UNIT – V **11 Hours**

Servlets: Introduction, Life cycle of servlets, Simple servlet program, Deployment of Servlet Application in to Tomcat, Javax.servlet and Javax.servlet.http packages, using cookies, session Tracking.

Note:

Course Project should be carried out on the following domains: ERP, Finance, Energy, Health, Insurance etc. A Report on the project and implementation has to be considered for internal assessment

TEXT BOOKS

1. Herbert Schildt, ―Java – The Complete Reference –, 9th Edition, 2014, Oracle Press.
2. Jim Keogh, ―J2EE – The Complete Reference, 2007, Tata McGraw Hill.

REFERENCE BOOKS

1. Y. Daniel Liang, ―Introduction to JAVA Programming, 6thEdition, 2007, Pearson Education,
2. Stephanie Bodoff et al, ―The J2EE Tutorial, 2nd Edition, 2004, Pearson Education.
3. Head First Java, O‘Reilly Publication, 2005.

TEACHING METHODS

- Black Board/Power Point Presentations
- Demonstration of Applications through IDE using MySQL, Apache Tomcat Servers.

ASSESSMENT METHODS

Parameter	Marks
Three Internals (Average of best of two)	30
Programming Assignments	10
Rubrics for the evaluation of Course Project	10
Total	**50**
Final Examination will be conducted for 100 marks (SEE)	

COURSE OUTCOMES

At the end of the course student will be able to:

COs	Description	Bloom's Level
CO 1	Apply the object oriented principles like Encapsulation, Abstraction inheritance and polymorphism to solve the real-world problems	**L3**
CO 2	Demonstrate with example the usage of Interfaces, packages and Exception handling	**L3**
CO 3	Implement multithreaded Java applications and Illustrate database access in Java.	**L3**
CO 4	Apply concepts of JavaFX for interactive UI development and event handling	**L3**
CO 5	Develop and deploy Java servlets	**L4**

Mapping of Course outcomes (COs) to Program outcomes (POs*)& PSO **

Course Outcomes mapping to Program Outcomes													PSOs		
POs COs	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**PSO1**	**PSO2**	**PSO3**
CO1	3		3						1	1			3		
CO2	2		3						1	1			3		
CO3	2		3		2				1	1			3		2
CO4	2		3		2				1	1			3		2
CO5	2		3		3				1	1			3		2

Department: *Computer Science and Engineering*	***Course Type:*** *Programme Core*
Course Title: *DBMS Laboratory*	***Course Code:*** *18CSL47*
L-T-P: *0-0-2*	***Credits:*** *1*
Total Contact Hours: *36Hours*	***Duration of SEE:*** *3 Hours*
SEE Marks: *50*	***CIE Marks:*** *50*

COURSE DESCRIPTION

This course introduces students to SQL Queries and introduction to MongoDB.

PREREQUISITES

- Basic knowledge of databases, its usage.

COURSE CONTENTS

PART-A

1. Database Schema for a Student Library scenario

Consider that a database named **Student Library** is developed by an application software NMITSoft company. There are 4 tables in the database. Relationship scheme for the tables is as below:

Student(Stud_no : integer,Stud_name: string)
Membership (Mem_no: integer,Stud_no: integer)
Book (book_no: integer, book_name:string, author: string)
Iss_rec (iss_no:integer, iss_date: date, Mem_no: integer, book_no: integer)

For the above schema, perform the following—

a) Create the tables with the appropriate integrity constraints
b) Insert around 10 records in each of the tables
c) List all the student names with their membership numbers
d) List all the issues for the current date with student and Book names
e) Give a count of how many books have been bought by each student
f) Give a list of books taken by student with stud_no as 5
g) Create a view which lists out the iss_no, iss _date, stud_name, book name

2. Create a relational database schema for a Project, described by the following relations.

STUDENT (Rollno: integer, Name: String, Sem: integer, Degree: String, Contact no: integer, Guide_No: integer)

GUIDE (Guide_name: String, Guide_No: integer, Guide_reserach_domain: String, Contat_No: integer, Email_Id: String)
PROJECT (Project_No: Integer, Project_title: String, Project_Area: String, Start_dt, date, Guide_No: integer)
GROUP (Group_Code: integer, Roll_No:integer)

PROJECT_GROUP (Group_Code: integer, Project_No: integer, no_of_students:integer)

For the above schema, perform the following.

a) Create the tables with the appropriate integrity constraints
b) Insert around 10 records in each of the tables
c) Find the list of guide, who are guiding more than two student groups.
d) Find the list of project no, project name & name of guide, in domain of Data Base.
e) Update guide details of a roll no „110011", new guide is „Ram Mohan" & id„112200".
f) Remove the Guide details, guide no is "112211" and assign guide no "133113" to all respective students project group.
g) Create a view as student_project details that lists student name, project name and guide name

3. The following relations keep track of airline flight information:

Flights (flno: integer, from: string, to: string, distance: integer, departs: time, arrives: time, price: integer)

Aircraft (aid: integer, aname: string, cruisingrange: integer)
Certified (eid: integer, aid: integer)
Employees (eid: integer, ename: string, salary: integer)
Note that the Employees relation describes pilots and other kinds of employees as well; every pilot is certified for some aircraft, and only pilots are certified to fly.

For the above schema, perform the following.
a) Create the above tables by specifying primary keys and foreign keys.
b) Insert around 10 records in each of the tables.
c) Find the names of aircraft such that all pilots certified to operate them earn more than 80,000.
d) For each pilot who is certified for more than three aircraft, find the eid and the maximum cruising range of the aircraft that he (or she) is certified for.

e). Find the names of pilots whose salary is less than the price of the cheapest route from Los Angeles to Honolulu.
f) Find the second highest salary of an employee.
g) Create a view which lists out the eid, ename, aid, aname

4. **Consider a relational database schema for a Company database below.**

Employee (F_name: string, L_name: string, Emp_id:integer, Bdate: date, Address:string, Gender:string, Salary: integer, Super_Emp_id: integer, D_no: integer)
Department (D_name: string, D_no: integer, D_Mgr_id:integer, Mgr_start_date: date)
Dept_Location (D_no: integer, D_location:string)
Project (P_name: string, P_number:integer, P_location:string, D_no:integer)
Works_on (Emp_id: integer, P_no: integer, Hours: in)
Dependent(Emp_id:integer,Dependent_name:string,Gender:string,Bdate:date,Relationship:String

For the above schema, perform the following

a) Create the above tables by specifying primary keys and foreign keys.
b) Insert around 10 records in each of the tables.
c) Company decided to give a raise on salaries of every employee, working on the „ProductX" project by 10 percent
d) Find the names and address of all employees who work on same department.
e) List the name and address of all employees who work for the "Research" department.
f) Retrieve a list of employees and the projects they are working on, ordered by department and, within each department, ordered alphabetically by last name, then first name.
g) Create a view Dept_info that gives details of department name, Number of employees and total salary of each employee.

5. **Consider a relational database schema for a Sailors database below**

Sailors (sid: integer, sname: string, rating: integer, age: real);
Boats (bid: integer, bname: string, color: string);
Reserves (sid: integer, bid: integer, day: date).

For the above schema, perform the following.

a) Create the above tables by specifying primary keys and foreign keys.
b) Insert around 10 records in each of the tables.
c) Find the names of sailors who have reserved a red boat, and list in the order of age.

d) Find the names of sailors who have reserved boat 103
e) Find the name and the age of the youngest sailor.
f) Find the average age of sailors for each rating level that has at least two sailors.
g) Find the names and ratings of sailor whose rating is better than some sailor called Horatio.

Mongo DB Programs:

1. Consider the following restaurant database with the following attributes- Name, address- (building, street, area, pincode), id, cuisine, nearby landmarks, online delivery- yes/no, famous for (name of the dish)

Create 10 collections with data relevant to the following questions. Write and execute MongoDB queries:

i. List the name and address of all restaurants in Bangalore with Italian cuisine.
ii. List the name, address and nearby landmarks of all restaurants in Bangalore where north Indian thali is available.

2. Consider the following restaurant table with the following attributes- Name, address- (building, street, area, pincode), id, cuisine, nearby landmarks, online delivery- yes/no, famous for (name of the dish)

Create 10 collections with data relevant to the following questions. Write and execute MongoDB queries:

i. List the name, address and nearby landmarks of all restaurants in Bangalore where Indian thali is available.
ii. List the name and address of restaurants and also the dish the restaurant is famous in Bangalore.

3. Consider the following Tourist places table with the following attributes- place, address- (state), id, tourist attractions, best time of the year to visit, modes of transport (include nearest airport, railway station etc), accommodation, food- what not to miss for sure

Create 10 collections with data relevant to the following questions. Write and execute MongoDB queries:

4. List all the tourist places of Karnataka
5. List the places sorted state wise

4. Consider the following Movie table with the following attributes- Actor_name, Actor_id, Actor_birthdate, Director_name, Director_id, Director_birthdate, film_title, year of production, type (thriller, comedy etc).

Create 10 collections with data relevant to the following questions. Write and execute MongoDB queries:

i. List all the movies acted by John in the year 2018
ii. List only the actors name and type of the movie directed by Ram.

5. Consider the following Movie table with the following attributes- Actor_name, Actor_id, Actor_birthdate, Director_name, Director_id, Director_birthdate, year of production, type (thriller, comedy etc).

Create 10 collections with data relevant to the following questions. Write and execute MongoDB queries:

ii. List all the movies acted by John and Elly in the year 2012

iii. List only the name and type of the movie where Ram has acted sorted by movie names.

Part B

1. Execution of Mini-Project for a Specific DB related project using HTML and MySQL only.

Note: Part-A carries 40 marks and Part-B carries 10 Marks for the SEE.

ASSESSMENT METHODS

Parameter	Marks
Experiment Write up + Execution + Viva	15
Lab Record Writing	10
Lab Internals Test	10
Mini Project	10
Mongo DB execution test	05
Total	**50**
Final Examination will be conducted for 100 marks (SEE)	

COURSE OUTCOMES

Cos	Description	Bloom’s Level
CO 1	Analyze given schema of a database	**L4**
CO 2	Populate and query a database using MySQL DML/DDL commands and complex SQL queries	**L2**
CO 3	Create and execute Queries using Mongo DB	**L3**
CO 4	Implement Mongo DB concepts using Basic Operations such as insert, delete, update, and retrieve.	**L4**
CO 5	Design and implement a database application.	**L5**

Mapping of Course outcomes (COs) to Program outcomes (POs*)& PSO **															
Course Outcomes mapping to Program Outcomes													PSOs		
POs COs	1	2	3	4	5	6	7	8	9	10	11	12	PSO1	PSO2	PSO3
CO1	2	3											3	2	2
CO2	2	3	2										3	3	2
CO3		3	2										3	2	2
CO4		3	2										3	3	2
CO5	2	3	2		2	3				3			3	3	3

3: Strong, 2: Medium, 1: Weak ** H: Highly related S: Supportive

Department: *Computer Science and Engineering*	***Course Type:*** *Programme Core*
Course Title: *Design and Analysis of Algorithms Lab*	***Course Code:*** *18CSL48*
L-T-P: *0-0-2*	***Credits:*** *1*
Total Contact Hours: *39 Hours*	***Duration of SEE:*** *3 Hours*
SEE Marks*: 50*	***CIE Marks:*** *50*

COURSE DESCRIPTION

The course Design and Analysis of Algorithms Lab is designed to introduce basic methods for the design and analysis of efficient algorithms emphasizing methods which are useful in practice. The computational problems include sorting, searching, Divide and Conquer, dynamic programming and greedy algorithms, graph algorithms string matching and Branch and Bound. It also Strengthens the ability to identify and apply the suitable algorithm for the given real-world problem.

PREREQUISITES

- Basic Programming Skills
- Knowledge on data Structures

COURSE CONTENTS

Sl. No.	**LIST OF PROGRAMS**	CO/PO
	PART- A	
1.	"Medplus" is a medical store which needs to maintain medicine detail like medicine ID. Each medicine is identified by the medicine ID. Design a program in C to read the medicine provided in the prescription and search the medicine based on its ID by using linear search method and display the relevant message whether the medicine is available or not in the store. Determine the time required to search for medicine. Repeat the experiment for different values of n and plot a graph of the time taken versus n.(n=no of elements).	CO1/1,4
2.	"Cineplix" a multiplex theatre needs to maintain the details of the seat no in ascending order and display the same to the user. Design and develop a program in C to sort the seat numbers by using bubble sort algorithm, Determine the time required to sort the seat numbers. Repeat the experiment for different values of n and plot a graph of the time taken versus n.(n=no of elements).	CO1/1,4
3.	"Cox and kings" a tourism company needs a better way to travel, in particular it should be easy to plan an optimal route through multiple destinations. Design and develop a program in C for traveling salesman problem and repeat the experiment	CO1/1,4

	for different values of n and plot a graph of the time taken versus n (n=no of cities).	
4.	Digital maps, unlike humans, see cities as a bunch of nodes. We (humans) consider this map as a single entity. a GPS navigation or any other digital map divides it into hundreds of segments, with some only 24 meters long. A map displays n cities and their distances. Design and develop a program in C to print all the cities reachable from a given starting city in a digraph by using BFS method. Repeat the experiment for different values of n and plot a graph of the time taken versus n(n=no of nodes)	CO1//1,4
5.	An **island** is surrounded by water and is formed by connecting adjacent lands horizontally or vertically. You may assume all four edges of the grid are all surrounded by water. Given an m x n 2D binary grid which represents a map of '1's (land) and '0's (water), return *the number of islands* using DFS algorithm. Design and develop a program in C to print all the lands reachable from a given starting land in a digraph by using DFS method. Repeat the experiment for different values of n and plot a graph of the time taken versus n(n=no of nodes)	CO1/1,4
6.	"Digishop" a online shopping website needs to keep track of the product availabilitybased on the product ID. Design a program in C to read the product ID provided by the customer and search for it's availability by using Binary search method and display the relevant message whether the product is in stock or not. Determine the time required to search for the product. Repeat the experiment for different values of n and plot a graph of the time taken versus n. (n=no of elements).	CO2/1,4,9
7.	"Aircel" a mobile network company need to maintain the telephone numbers of its customer in order to call and inform them about the new year offer. They have to sort the contact numbers in ascending order to keep track of the customers whom they called. Design and develop a program in C to sort the phone numbers by using insertion sort algorithm, Input should be generated randomly. Determine the time required to sort the elements. Repeat the experiment for different values of n and plot a graph of the time taken versus n. (n=no of elements).	CO2/1,4,9
8.	"Deloit", a software company needs to maintain its employee details like employeeid, name, address in a record, design and develop a program in C to sort the employee records based on their employee ID by using merge sort algorithm, employee ID should be generated randomly. Determine the time required to sort the elements. Repeat the experiment for different values of n and plot a graph of the time taken versus n. (n=no of elements).	CO2/1,4,9

9.	Assume that NMIT college needs to maintain the student details like USN, name, and contact details in a record. USN should be generated randomly. Design and develop a program in C to sort the records based on USN by using quick sort algorithm, Determine the time required to sort the roll numbers. Repeat the experiment for different values of n and plot a graph of the time taken versus n. (n=no of elements).	CO2/1,4,9
	PART-B	
10.	"Sunshine" a job search portal is looking for engineering graduates, they need to sort the candidate's resume based on their ranking(Average Percentage). Ranking should be generated randomly. Design and develop a program in C to sort the resumes by using heap sort algorithm. Determine the time required to sort the elements. Repeat the experiment for different values of n and plot a graph of the time taken versus n.(n=no of elements).	CO3/1,4,9
11.	Consider the problem of searching for genes in DNA sequences using Horspool's algorithm. A DNA sequence is represented by a text on the alphabet {A, C, G, T}, and the gene or gene segment is the pattern. A gene segment of your chromosome 10 has the pattern TCCTATTCTT . Design and develop a program in C to locate the above pattern in the following DNA sequence by applying Horspool's algorithm. TTATAGATCTCGTATTCTTTTATAGATCTCCTATTCTT. Also compute the number of comparisons using this method as compared to linear search method	CO3/1,4,9
12.	A medical representative has to visit n cities to market a medicine. There are n cities numbered from 0 to n-1. Given the array edges where edges[i]=[from$_i$, to$_i$, distance$_i$] represents a bidirectional and weighted edge between cities from$_i$ and to$_i$, Design and develop a program in C to compute the transitive closure of the given directed graph using Warshall's algorithm. Repeat the experiment for different values of n(cities) and plot a graph of the time taken versus n (n=no of nodes).	CO4/1,4,9
13.	There have been a number of fire outbreak cases recorded in the Florida area that has brought about loss of lives to inhabitants and loss of properties. Some routes within the district can be reconstructed into shortcut routes, so that fire man can traverse through the district in order to prevent fire incidents. The objective is to find the minimum distance and shortest path from the fire station to all the residential layout in Florida area. Write an algorithm by applying Floyd's method to find the solution for the given scenario.	CO4/1,4,9
14.	DMART is providing special offer to its customer on New Year's Eve. Customers can buy anything they want with flat80% discount, but the products they buy should fit into the basket provided by DMART. The objective is to collect the expensive products which fit into the given basket and overall weight of the basket cannot exceed 15kg.Write an algorithm by using knapsack algorithm using dynamic programming to	CO4/1,4,9

	find the best subset for the given scenario.	
15	You have a business with several offices; you want to lease phone lines to connect them up with each other, and the phone company charges different amounts of money to connect different pairs of cities. You want a set of lines that connects all your offices with a minimum total cost. Write an algorithm by applying Prim's method to find the minimum spanning tree for the given scenario	CO4/1,4,9
16.	Bangalore Water supply Board responsibility is to distribute water evenly among all the areas in Bangalore city. A new layout has been developed by Maxworth real estate developers. BWSB should connect the water lines to the new layout with minimum cost. The objective is to connect the water pipes so that it reaches all the houses in new layout with minimum cost. Write an algorithm by applying Kruskal's method to find the minimum spanning tree for the given scenario.	CO4/1,4,9
17.	DigiMap services is a module in G-Maps which is used to find the distance from one place to another or from your location to the nearest desired location. This requires the Shortest Path Algorithm, as there are various routes/paths connecting them but it has to show the minimum distance. . Represent a city/place with a vertex and the route between two cities/places as an edge, then by using Dijkstra's algorithm, find the shortest routes between any two cities/places or from one city/place to another city/place.	CO4/1,4,9
18.	Consider the *n*-queens puzzle in which the goal is to place *N* queens on an *N*×*N* chessboard such that no two queens attack each other. A queen can attack horizontally, vertically, or diagonally. Given an integer *N*, return all distinct solutions to the *N*-queens puzzle. Note: Use Backtracking technique.	CO5/1,4,9
19.	Consider the Subset sum problem in which the objective is to find subset of elements that are selected from a given set whose sum adds up to a given number K. Assume the set contains non-negative values and also the input set is unique (no duplicates are present.). Design and develop a program in C to find the subset of a given set whose sum is equal to a positive integer K and display an appropriate message if the given problem instance does not have the solution. Note : Use Backtracking method.	CO5/1,4,9

ASSESSMENT METHODS

Parameter	Marks
Continuous Internal Evaluation	25
Lab Test	20

Gate Based Test	05
Total	**50**
Final Examination will be conducted for 100 marks (SEE)	

COURSE OUTCOMES

COs	Description	Bloom's Level
CO 1	Understand, analyze the asymptotic notations and design the algorithms using brute force and exhaustive search methods.	**L2**
CO 2	Design and analyze the algorithms using decrease & conquer, divide & conquer methods.	**L5**
CO 3	Design and analyze the algorithms using transform & conquer space& time tradeoff methods.	**L4**
CO 4	Design and analyze the algorithms using dynamic programming & greedy Technique methods.	**L4**
CO 5	Understand and analyze the iterative improvement, limitations of algorithm power and coping with limitations of algorithm power.	**L2**

Mapping of Course outcomes (COs) to Program outcomes (POs*)& PSO **															
Course Outcomes mapping to Program Outcomes													**PSOs**		
POs / COs	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**PSO1**	**PSO2**	**PSO3**
CO1	2			3									3		
CO2	2			3									3		
CO3	2			3									3		
CO4	2			3									3		
CO5	2			3									2		

Course Content for IV-Semester Program Elective – A

Department: *Computer Science and Engineering*	***Course Type****: Program Elective – 1*
Course Title*: Introduction to Embedded Systems.*	***Course Code****: 18CSE461*
L-T-P: *3-0-0*	***Credits****:03*
Total Contact Hours*: 42 Hours*	***Duration of SEE****: 3 Hours*
SEE Marks*:50*	***CIE Marks****: 50*

COURSE DESCRIPTION

In this course, the fundamentals of embedded system hardware and firmware design will be explored. Learning may be supplemented with periodic guest lectures by embedded systems engineers from industry. Depending on the interests of the students, other topics may be covered.

PREREQUISITES

- Excellent understanding of Digital and Electronics.
- Good to intermediate level of understanding of Basics of Analog Electronics.
- Good C Programming skills.
- Understanding of at least one Micro-controller or Micro-processor.

COURSE OBJECTIVES

This course will enable students to

1. Provide a general overview of Embedded Systems
2. Show current statistics of Embedded Systems
3. Design, code, compile, and test real-time software
4. Integrate a fully functional system including hardware and software.

- To introduce the Arduino Embedded-C Concepts
- To learn the Interfacing the Sensors to the Arduino Board/Node MCU using the Arduino IDE.

COURSE CONTENTS

UNIT – I **08 Hours**

What is an Embedded System?, Embedded Systems vs. General Computing Systems, History of Embedded Systems, Classification of Embedded Systems, Major Application Areas of Embedded System.

Elements of an embedded systems, Core of the Embedded System, Memory Onboard communication interface (UART, SPI, and I2C).

UNIT – II **08 Hours**

Atmel Atmega328P microcontroller architecture, Differences between microprocessor and microcontroller, Importance of microcontroller in embedded system, Arduino platforms for programming: Simple programs to blink LEDs, Fade LED using analog Write (), Button Switch interface to Arduino UNO/Node MCU

UNIT – III **08 Hours**

Introduction to Embedded C Programming, Data types: byte, int, long, float, arrays. Structures: setup (), loop (), functions, {} curly braces,; semicolon, /*….*/ block comments, // line comments. Variables: variable declaration, variable scope. Arithmetic: compound assignments, comparison operators, and logical operators. Constants: true/false, high/low, input/output. Flow control: if, if else, for, while, do while.

UNIT – IV **08 Hours**

Introduction to Sensors and actuators, LED, Optocoupler, DHT111 Sensor, LDR, Tilt sensor, Soil Moisture Sensor, ultrasonic and infrared for obstacle.
Communication – Wireless Communication using Bluetooth and Wi-Fi.
Hardware Communication – GSM module and GPS module using UART.

UNIT-V **07 Hours**

Operating systems Basics, Types of OS, Real time OS Vs General purpose OS, Tasks, Process and Treads, Multiprocessing and Multitasking, Task Scheduling, Device drivers, How to choose an RTOS.

TEXT BOOKS

1. Shibu K V, Introduction to Embedded Systems, McGraw Hill Publication.
2. Frank Wahid, Tony Givargis, Embedded System Design: A Unified Hardware / Software, Wiley India

REFERENCE BOOKS

1. Julien Bayle, C Programming for Arduino, **PACKT** Publishing, 2013.
2. Raj Kamal, Embedded Systems: Architecture, Programming & Design, and TMH

TEACHING METHODS

- Black Board/Power Point Presentations
- Programming Assignments
- Practical demonstration using Arduino UNO/Node MCU, sensors and actuators.
- Tinkercad - Online tool to simulate the experiments virtually
- NPTEL

ASSESSMENT METHODS

Parameter	Marks
Three Internals (MSE) - (Average of best of two MSE's)	30
Learning Activity Assignment (LA) – Case study on a particular embedded application	05
Mini Project	15
Total	**50**
Final Examination will be conducted for 100 marks (SEE)	

COURSE OUTCOMES

At the end of course, Student will be able to:

COs	Description	Bloom's Level
CO 1	Describe and Analyze the Salient aspects of differentiation between Real time systems and Data Processing system	**L1**
CO 2	Design basic actuator using Arduino board/Node MCU using Embedded C	**L2**
CO 3	Develop functional data types, parameter data types, arithmetic and logical operators, loop, conditional statements and functions.	**L3**
CO 4	Interface sensors, actuators, Bluetooth model, and Wi-Fi module to a development board.	**L4**
CO 5	Work in Teams to design and demonstrate an embedded system applications to solve Real-time issues	**L5**

Mapping of Course outcomes (COs) to Program outcomes (POs*)& PSO **

Course Outcomes mapping to Program Outcomes													PSOs		
POs / COs	1	2	3	4	5	6	7	8	9	10	11	12	PSO1	PSO2	PSO3
CO1	3	3											3		
CO2	3	3	3		3									2	
CO3		3	3	3	3									2	
CO4	3	3	3	3	3									2	
CO5		2	2	2	2	2	2								1

Department: *Computer Science and Engineering*	***Course Type:*** *Program Elective*
Course Title: *Introduction To Web Application Development*	***Course Code:****18CSE462*
L-T-P: *3-0-0*	***Credits:****03*
Total Contact Hours:*48 Hours*	***Duration of SEE:****3 Hours*
SEE Marks: *50*	***CIE Marks:*** *50*

COURSEDESCRIPTION

This course provides knowledge in scripting languages javascript, php, node JS and Angular js. The course also provides the knowledge of how to use the scripting languages, HTML tags and CSS for developing web pages.

PREREQUISITES

- Students should have prior knowledge of web and internet usage.
- Students should have the prior knowledge of basic html tags.

COURSE OBJECTIVES

- To understand the use of HTML tags and cascading style sheets.
- To understand the basics of scripting languages javascript and its frame works, php, node Js and Angular Js
- To understand how to connect the scripting language with database.

COURSE CONTENTS

UNIT-1 **10 Hours**

FUNDAMENTALS OF WEB: A Brief Introduction to the Internet, the World Wide Web, WebBrowsers,WebServers,Ntierarchitecture,UniformResourceLocators Multipurpose Internet Mail Extensions, The Hypertext Transfer Protocol, Introduction to HTML/XHTML: Basic Syntax, Standard HTML Document Structure, Basic Text Markup, Images, Hypertext Links, Lists, Tables, Forms, Syntactic Differences between HTML and XHTML, Cascading Style Sheets: Levels of Style Sheets, Style Specification Formats, Font, Properties Alignment of Text.

UNIT-II **10 Hours**

JAVASCRIPT: Basics, Overview of JavaScript, Object orientation of JavaScript, General Syntactic characteristics, Primitives, Operations and Expressions, Screen output and keyboard input, Control

Statements, Object creation and modification, Arrays, Functions, Constructor, Pattern matching using regular expressions, Errors in Scripts The JavaScript execution environment ,Handling events from the Body elements, Button elements, Textbox and Password elements.

UNIT-III **10 Hours**

PHP: Introduction to PHP, Origins and uses of PHP, Overview of PHP, General syntactic characteristics, Primitives operation and expressions, output, control statement, arrays,functions,patternmatching,formhandling,files,cookies,Database access with PHP & MySQL.

UNIT-IV **09 Hours**

JqueryandAjax: Introduction, Syntax, Selectors, jQuery effects, jQuery HTML, History of AJAX, Basics of AJAX, The form document, the request and response phase, cross-Browser support, return document forms, JSON, AJAX toolkits, security and AJAX

UNIT-V **09 Hours**

Angularjs: Introduction Angularjs, Basic Angularjs directives and controllers, working with ng-model, working with forms, Angular js services**. Node JS**: Introduction. Node js mudules, node js file system, URL module, node js events, upload files, Emails.

TEXT BOOKS

1. Robert W. Sebesta, Programming the World Wide Web-7thEdition, Pearson Education, 2015.
2. Shyam Sheshadri & Brad Green, Angularjs Up & Running O’Reilly Publications 2015 Second Release.

REFERENCE BOOKS

1. M. Dietel, P.J Deital, A.B.GoldBerg, Internet & World Wide Web How to Program– 5th Edition, Pearson Education, 2009
2. WebprogrammingBuildingInternetApplications–ChrisBates.
3. Stevens Holzner, Ajax a beginners guide, TATA MCGRAW SHILL, 2009
4. Professional Angularjs –Valerikarpo& Diego Netto.

TEACHING METHODS

- Lecture (Power Point presentations/ Blackboardteaching(ifneeded))
- Regularreviewofstudentsbyaskingquestionsbasedontopicscoveredintheclass
- Programming Assignments

ASSESSMENT METHODS

Parameter	Marks
Three Internals (Average of best of two test)	30
Self-Demonstration	10
Assignment	10
Total	**50**
Final Examination will be conducted for 100 marks (SEE)	

COURSE OUTCOME

At the end of course, students will be able to:

COs	Description	Blooms Level
CO 1	Describe and use client-side technologies of the World Wide Web: HTML, XHTML. CSS, and JavaScript.	**L2**
CO 2	Design documents using markup languages and stylesheets. Apply of CSS, JavaScript.	**L5**
CO 3	Create dynamic web applications, client-side and server-side using PHP and MySQL.	**L4**
CO 4	Describe Selectors, jQuery effects, jQuery HTML, jQuery Ajax, Use Ajax to add server-side processing to a Web site.	**L2**
CO 5	Understanding the concepts of angular JS and node JS and able to develop web application.	**L1**

Mapping of Course outcomes (COs) to Program outcomes (POs*)& PSO **

Course Outcomes mapping to Program Outcomes													PSOs		
POs / COs	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**PSO1**	**PSO2**	**PSO3**
CO1	**2**	**2**			**1**	**1**							3		2
CO2		**3**				**2**							3		2
CO3					**3**			**2**					3		2
CO4					**3**			**3**					2	3	
CO5		**3**			**3**								3	2	

Department: *Computer Science & Engineering*	***Course Type:*** *Program Elective*
Course Title: *Introduction To Unix*	***Course Code:*** *18CSE463*
L-T-P: *3-0-0*	***Credits****: 3*
Total Contact Hours: *39 Hours*	***Duration of SEE*****:** *3 HOURS*
SEE Marks :50	***CIE Marks*** *:50*

COURSE DESCRIPTION

This course gives the basic knowledge of Unix Operating System platform and API level introduction to concepts like files & directories, processes, System logging, signals and daemon process in the Unix. Students will learn basic c program execution environment and memory layout of it, and APIs for performing most of the unix command operations like creating file &directory, processes, generating signals etc. The subject also introduces accounting processes and types of users and privileges supported to the users.

PREREQUISITES

- Students should have knowledge of operating system and Unix Shell Programming

COURSE OBJECTIVES

- To understand the fundamental design of the UNIX operating system.
- To become fluent with the systems calls provided in the environment**.**
- To be able to design and build an application/service over the UNIX operating system

COURSE CONTENT

UNIT-I	**10 Hours**

Introduction: Unix Components/Architecture. Features of Unix. The UNIX Environment and UNIX Structure, Posix and Single Unix specification. General features of Unix commands/ command structure. Command arguments and options. Basic Unix commands such as echo, printf, ls, who, date,passwd, cal, Combining commands. Meaning of Internal and external commands. The type command: knowing the type of a command and locating it. The root login. Becoming the super user: su command.

Unix files: Naming files. Basic file types/categories. Organization of files. Hidden files. Standard directories. Parent child relationship. The home directory and the HOME variable. Reaching required files- the PATH variable, manipulating the PATH, Relative and absolute pathnames. Directory commands – pwd, cd, mkdir, rmdir commands. The dot (.) and double dots (..) notations to represent present and parent directories and their usage in relative path names. File related commands – cat, mv, rm, cp, wc and od commands.

UNIT-II **10 Hours**

File attributes and permissions: The ls command with options. Changing file permissions: the relative and absolute permissions changing methods. Recursively changing file permissions. Directory permissions. The shells interpretive cycle: Wild cards. Removing the special meanings of wild cards. Three standard files and redirection. Connecting commands: Pipe. Basic and Extended regular expressions. The grep, egrep. Typical examples involving different regular expressions. Shell programming: Ordinary and environment variables. The .profile. Read and readonly commands. Command line arguments. exit and exit status of a command. Logical operators for conditional execution. The test command and its shortcut. The if, while, for and case control statements. The set and shift commands and handling positional parameters. The here (<<) document and trap command. Simple shell program examples.

UNIT-III **10 Hours**

UNIX File APIs: General File APIs, File and Record Locking, Directory File APIs, Device File APIs, FIFO File APIs, Symbolic Link File APIs. UNIX Processes and Process Control: The Environment of a UNIX Process: Introduction, main function, Process Termination, Command-Line Arguments, Environment List, Memory Layout of a C Program, Shared Libraries, Memory Allocation, Environment Variables, setjmp and longjmp Functions, Process Control: Introduction, Process Identifiers, fork, vfork, exit, wait, waitpid, wait3, wait4 Functions, Race Conditions, exec Functions

UNIT-IV **11 Hours**

Overview of IPC Methods: Changing User IDs and Group IDs, Interpreter Files, system Function, Process Accounting, User Identification, Process Times, I/O Redirection. Overview of IPC Methods: Pipes, popen, pclose Functions, Coprocesses, FIFOs, System V IPC, Message Queues, Semaphores. Shared Memory: Client-Server Properties, Stream Pipes, An Open Server-Version 1, Client-Server Connection Functions.

UNIT-V **11 Hours**

Signals and Daemon Processes: Signals: The UNIX Kernel Support for Signals, signal, Signal Mask, sigaction, The SIGCHLD Signal and the waitpid Function, The sigsetjmp and siglongjmp Functions, Kill, Alarm, Interval Timers. Daemon Processes: Introduction, Daemon Characteristics, Coding Rules, Error Logging.

TEXT BOOKS

1. Sumitabha Das., Unix Concepts and Applications., 4thEdition., Tata McGraw Hill (Chapter 1,2 ,3,4,5,6,8,13,14)
2. W. Richard Stevens: Advanced Programming in the UNIX Environment, 2nd Edition, Pearson Education, 2005 (Chapter 3,7,8,10,13,15)
3. Unix System Programming Using C++ - Terrence Chan, PHI, 1999. (Chapter 7,8,9,10)

REFERENCE BOOKS

1. M.G. Venkatesh Murthy: UNIX & Shell Programming, Pearson Education.
2. Richard Blum , Christine Bresnahan : Linux Command Line and Shell Scripting Bible, 2ndEdition,

DELIVERY METHODS

- Lecture (Power Point presentations/ Black board teaching (if needed))
- Regular review of students by asking questions based on topics covered in the class Programming Assignments

ASSESSMENT METHODS

Parameter	Marks
Three Internals (Average of best of two test)	30
Programming Assignment	10
Quiz	10
Total	**50**
Final Examination will be conducted for 100 marks (SEE)	

COURSE OUTCOMES

At the end of this course students will be able to:

COs	Description	Bloom's Level
CO 1	Explain Unix Architecture, File system and use of Basic Commands	**L4**
CO 2	Illustrate Shell Programming and to write Shell Scripts	**L3**
CO 3	Categorize, compare and make use of Unix System Calls	**L2**
CO 4	Learn process to process communication within a system and between the systems	**L2**
CO 5	Build an application/service over a Unix system.	**L4**

Mapping of Course outcomes (COs) to Program outcomes (POs*)& PSO **

	Course Outcomes mapping to Program Outcomes												PSOs		
POs / COs	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**PSO1**	**PSO2**	**PSO3**
CO1		2	3										3		
CO2		3	2										3		
CO3			3										2		
CO4				3	3								3		
CO5					3								3		

***3: Strong, 2: Medium, 1: Weak   **3: Highly related 2: Supportive**

Department:*Computer Science and Engineering*	***Course Type:*** *Programme Elective*
Course Title: *Introduction to Image Processing*	***Course Code:****18CSE464*
L-T-P:*3-0-0*	***Credits:*** *03*
Total Contact Hours:*39Hours*	***Duration of SEE:****3 Hours*
SEE Marks: *50*	***CIE Marks:*** *50*

COURSE DESCRIPTION

Introduction to theories, algorithms and practical solutions of digital image perception, acquisition, quantization, enhancement, filtering, restoration, analysis, feature extraction, segmentation and morphological transform.

PREREQUISITES

- Fundamental Knowledge of Mathematics

COURSE OBJECTIVES

This course will enable students to

- Explain image fundamentals and mathematical transforms necessary for image processing and to study the image enhancement techniques.
- Demonstrate the image filtering and restoration techniques.
- Demonstrate the image segmentation and representation techniques.
- How image are analyzed to extract features of interest.

COURSE CONTENTS

UNIT - I **8 Hours**

What is a Digital Image? Digital Image Representation; Image Processing, Image Analysis and Image Interpretation, Basic Elements of a Digital Image Processing System; Fundamentals Steps in Digital Image Processing, Image Sensing and Acquisition; Single Sensor; Line Sensor and Array Sensor, Image Formation; Sampling and Quantization, Image Zooming and Shrinking; Digital Image Resolution and Storage; Convolution, Basic relationship between pixels, Histogram Characteristics

UNIT-II **6 Hours**

Image Enhancement in Spatial Domain

Definition, Characteristics, Applications, Categories of Enhancement Methods, Basics of Intensity Transformation and Spatial Filtering, Point Processing, Mask or Neighborhood Processing; Contrast Stretching, Grey Level Slicing, Bit Plane Slicing Histogram Based Image Enhancement: Histogram Equalization,*****Local Enhancement Methods

UNIT - III **10 Hours**

Basics of Spatial Filtering

Linear and Non Linear Spatial Filters, Image Averaging Filter, Mean Filter, Median Filters, Mid-range Filter, Trimmed Mean Filter, Max-Min Filter, Min-Max Filter, Edge Preserving Smoothing Filters, Sharpening Spatial Filters.

Image Restoration: A Model of the Image Degradation/ Restoration Process; Noise Models- Gaussian noise, Rayleigh noise, Erlang (gamma) noise, Exponential noise, Uniform noise, Impulse (salt and pepper) noise; Restoration in the presence of Noise – Spatial Filtering; Periodic Noise Reduction by Frequency Domain Filtering

UNIT IV **6 Hours**

Edge Detection

Mathematical Foundation: First Order and Second order Derivative; Definition of Few Terms, Edge Models: Step, Ramp and Roof Edge; Algorithms - Robert, Sobel, Prewitt, Laplacian; Compass Gradient Mask – Prewitt, Sobel, Laplacian. **Segmentation: Region Based Segmentation, Mean Shift Segmentation. Thresholding:** Manual and Automatic Thresholding;

UNIT V

Feature Extraction **9 Hours**

Introduction, Representation- Boundary, Thinning; Topological Attributes- Connectivity Number, Component Labelling, Component Counting; Geometrical Attributes- Perimeters, Diameter of the Enclosing Circle, Area, Slope,Curvature and Straightness; Convexity, Spatial Moments

TEXT BOOKS

1. Rafel C Gonzalez and Richard E Woods, "Digital Image Processing'', Pearson Education, 3rd Edition, 2009.
2. 2. B. Chanda, D Dutta Majumder, "Digital Image Processing and Analysis'', Prentice-Hall, India, 2002

REFERENCE BOOKS

1. Milan Sonka, Vaclav Hlavac, Roger Boyle, "Digital Image Processing and Computer Vision", Cengage Learning, 2nd Edition 2008

TEACHING METHODS

- Lectures
- Power Point Presentation
- Case Study

ASSESSMENT METHODS

Parameter	Marks
Three Internals (Average of best of two test)	30
Programming Assignment	10
Case Study	10
Total	**50**
Final Examination will be conducted for 100 marks (SEE)	

COURSE OUTCOMES

At the end of the course student will be able to:

COs	Description	Bloom's Level
CO1	Analyse the Image Formation models and to be able to perform Image Interpolation methods	**L4**
CO2	Apply and analyse the Image Enhancement and Filtering Algorithms for specific applications	**L3**
CO3	Derive mathematical model for different edge detection and will be able to apply different edge models	**L3**
CO4	Apply and analyse the Image segmentation and restoration methods.	**L3**
CO5	Extract and analyse different basic features from an image	**L3**

Mapping of Course outcomes (COs) to Program outcomes (POs*)& PSO **															
Course Outcomes mapping to Program Outcomes													PSOs		
POs COs	1	2	3	4	5	6	7	8	9	10	11	12	PSO1	PSO2	PSO3
CO1	3	2													
CO2		3	2		2								2	2	
CO3		3	3		3								2	2	
CO4		3	3		2								2	2	
CO5		3	3		2								2	2	

Department:*Computer Science and Engineering*	***Course Type:*** *Programme Elective*
Course Title: *Introduction to Software Technologies*	***Course Code:****18CSE465*
L-T-P:*3-0-0*	***Credits:*** *03*
Total Contact Hours:*39Hours*	***Duration of SEE:****3 Hours*
SEE Marks: *50*	***CIE Marks:*** *50*

COURSE DESCRIPTION

This course is intended to provide students with the skills required to to design software artifacts by using Latest technologies to create Windows Forms applications in C# by using the .NET Framework, Perl for processing text, MATLAB for doing numerical analysis, Android Frameworks for designing Mobile Apps.

PREREQUISITES

Prior knowledge in programming, Basics of Linear Algebra, Numerical Techniques.

COURSE OBJECTIVES

- Introduce to the software MATLAB for numerical computations
- Develop correct, well-documented programs using the C# programming language
- Learn to use Windows Forms and WPF to create GUI-based programs.
- Understand the syntax and semantics of the Perl language.
- Learn fundamentals of Android programming using the Android SDK.

COURSE CONTENTS

UNIT – I **7 Hours**

Numerical Analysis: MATLAB for numerical programming: Basics of Programming using MATLAB, Getting Started, Scripts, Variables, Data Types, Conditional program flow, Iteration / Looping, Array operations, Functions, Basic Plotting.

UNIT – II **8 Hours**

Introduction to .Net Framework: Microsoft's .Net, .Net Framework, C#, Simple Application in C#, Literals, Variables and Data Types, Formatting Text, Console.write, Console.writeline, Operators and Expressions, decision making & Branching, Strings, Control Statements, Arrays, Structures and Enumerations

UNIT – III **8 Hours**

Graphical User Interface with Windows Forms: Windows forms, event handling, Control properties and layout, labels, textboxes, buttons, checkbuttons, radiobuttons, picture boxes, mouse event handling, Keyboard event handling, examples, Menus, Monthcalendar control, Datetimepicker control, linklabel, list box, Combox, Checkedlistbox, Treview, listview and Tabcontrol control, Multiple Document Interface (MDI), examples.

UNIT – IV **8 Hours**

Scripting Language: Perl Scripting: Origins and uses of Perl, Scalars and their operations, Assignment statements and simple input and output, Control statements, Fundamentals of arrays, Hashes, References, Functions, Pattern matching, File input and output; Examples. The Common Gateway Interface; CGI linkage; Query string format; CGI.pm module; a survey example; Cookies. Database access with Perl and MySQL.

UNIT – V **8 Hours**

Mobile Application Development: Introduction to Mobile Apps, getting started with Android Application Development, Your First App, Deploying your App to a Phone, Extending App- Buttons, Toast, Building Custom UI using XML and logs, Deploying App to Google Play store.

TEXT BOOKS

1. Laurene Fausett, Numerical Methods using MATLAB, 2nd Edition. Prentice-Hall, Inc.
2. P. Deitel, H. Deitel, Visual C# 2012 How to Program, 6/e, Pearson, 2016.
3. Randal L, "Learning Perl", O'Reilly, 6th Edition.
4. Dawn Griffiths, Head First Android Development: A Brain-Friendly Guide, O'Reilly, 2nd Edition

TEACHING METHODS

1. Lecture (PPT).
2. Hands-on-Session using MATLAB, .net framework, Perl Scripting, Android SDK software tools.
3. Seminars.

ASSESSMENT METHODS

Parameter	Marks
Three Internals (Average of best of two test)	30
Programming Assignment	10
Seminar	10
Total	**50**
Final Examination will be conducted for 100 marks (SEE)	

COURSE OUTCOMES

At the end of the course student will be able to:

COs	Description	Bloom’s Level
CO 1	Learn the basics of programming in general and programming MATLAB in particular	**L1**
CO 2	Understand the fundamentals of C# and .Net framework.	**L2**
CO 3	Develop the Windows Forms and apply user controls in Windows Forms applications and Multiple Document Interface (MDI).	**L4**
CO 4	Understand the syntax and semantics of the Perl language	**L2**
CO 5	Learn the basics of Android platform and get to understand the application lifecycle and Communication Skills through Seminar.	**L1**

Mapping of Course outcomes (COs) to Program outcomes (POs*)& PSO **															
Course Outcomes mapping to Program Outcomes													**PSOs**		
POs / COs	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**PSO1**	**PSO2**	**PSO3**
CO1	3		3		3									2	
CO2	3	3													
CO3	3	3											3	2	
CO4			2		3										
CO5			2		3					3					2

3: Strong, 2: Medium, 1: Weak ** H: Highly related S: Supportive

CENTRE FOR ROBOTICS RESEARCH

Department: *Computer Science and Engineering*	***Course Type:***
Course Title: *Robotics Engineering-LEGO Mindstorm & Tetrix*	***Course Code:*** 18CSO39/49
L-T-P: *2-0-3*	***Credits:*** *03*
Total Contact Hours: *60Hours*	***Duration of SEE:*** *3 Hours*
SEE Marks: *50*	***CIE Marks:*** *50*

PREREQUISITES

- Students should have knowledge of Elements of Mechanical, Basics of Electrical & Electronics Engineering and Computer Concepts &‘C’ Programming

COURSE OBJECTIVES

1. To create a true **multidisciplinary learning** environment by bringing students & faculty members together from different engineering disciplines.
2. To provide **Hands-on & Minds-on** training to students on Robotics using LEGO MINDSTORMS, TETRIX & ROBOTC.
3. To indulge students in **active learning** to foster their **creativity & ingenuity**.
4. To inculcate the research culture among young engineering students by encouraging them in **exploration & experimentation**.
5. To reinforce **STEM** (**S**cience **T**echnology **E**ngineering **M**athematics) education among students.

COURSE CONTENTS

UNIT – I **17 Hours**

Mechanical Design: Introduction to Robotics, LEGO Mindstorms, TETRIX, RobotC, Part Identification, Speed/Velocity, Power, Torque, Friction, Traction, DC & Servo Motors, Role of Mechanical Elements such as Linkages, Joints, Structure, Kinematic Pairs, Mechanisms, Degrees of Freedom, Mechanical Power Transmission (Gear & Belt Drives), Drive Train Design. Interfacing Motors to NXT, Basic Motor Control using RobotC, Simple Problems & Building Challenges.

UNIT- II **15 Hours**

Mechanical Design: Introduction to Control system, Open & Closed loop, Microprocessors, Microcontrollers, Difference between Microprocessor & Microcontroller, NXT Brick & TETRIX Hardware Architecture, Interfacing the I/O devices with NXT Brick, System Response-Transient & Steady State, Proportional-Integral-Differential (PID) Control, Encoders, Position & Velocity Control, Sensors: Introduction to measurement system, Mechanical Switches, Light Sensors, Ultrasonic Sensors, Interfacing

Sensor with NXT & Control using Robot C. Simple Challenges Involving Position/Velocity Control & Sensors

UNIT- III **8 Hours**

Advanced Programming: Advanced ROBOTC Syntax with respect to Robot Movement, Advanced Sensing Concepts, Display, Variables & Functions, Programming Challenges

UNIT - IV **8 Hours**

Computer Vision, Machine Learning, AI and ANN: Image Processing to Computer Vision; Image and Video - Processing, Analysis and Interpretation; Machine Learning and Robotics; Artificial Intelligence and Neural Network for Robotics, Introduction to Internet of Robotic Things (IORT)

UNIT V **12 Hours**

Mini Project: Introduction to Project Management, Design & Development of application based robots using LEGO Mindstorm NXT and TETRIX, Students should be encouraged to come up with their own problem statement and solve it to foster their creativity. (Note: More weightage is given to indigenous design developed by students). Each Group is required to give a brief report & presentation on their project at the end of the completion of their project.

TEXT BOOK& REFERENCES

For UNIT I & II

1. Theory of Machines and Mechanisms By John Joseph Uicker, G. R. Pennock, Joseph Edward Shigley, Oxford University Press.
2. “Mechatronics” – W.Bolton, Longman, 2Ed, Pearson Publications, 2007.
3. “Fundamentals of Robotics-Analysis and Control”, Schilling R. J., PHI, 2006
4. “Robotics, Control and Applications”, SaeedNiku.

For UNIT III to UNIT IV- Open Source-Can be downloaded from NET

5. LEGO MINDSTROM NXT-Getting Started (Link)
6. TETRIX- Getting Started (Link)
7. “ROBOTC for LEGO Mindstorms”- Developed by Carnegie Mellon University (Robotics Academy) (Link)

ASSESSMENT METHODS

Parameter	Marks
Mini-Project (UNIT V) (Evaluated using Rubrics: Design, Presentation, Viva-voce etc.)	15
Mid Semester Examination: Mini-Challenge (Group of 2)	15
Surprise Test (Individual)	10
Engineering Journal (Individual)	05
Viva Voce(Individual)	05
Total	**50**
Final Examination will be conducted for 100 marks (SEE)	

COURSE OUTCOMES

COs	Description	Bloom's Level
CO 1	Students will have the fundamental **knowledge** of Mechanical elements, DC & Servo Rotary Actuators, Basic control system, Sensors & Programming with respect to LEGO Mindstorms, TETRIX and RobotC.	**L1**
CO 2	Students will able to **apply** the principles of classical mechanics, control system theory & logic to execute mini challenges using LEGO Mindstorms, TETRIX and RobotC system.	**L3**
CO 3	Students will be able to **examine** the given open-ended challenge, tear down them into mini challenges &**analyze** the various process/system parameters associated with it.	**L4**
CO 4	Students will be able to **synthesize** a robot design, control system & algorithm by **connecting** all the sub systems together to obtain a robot capable of solving the given challenge.	**L3**
CO 5	Students will be able to **evaluate** the various robot design, control system and algorithm capable of solving open ended challenges.	**L5**
CO 6	Students will be able to **design & develop** a robot (In a multidisciplinary group with effective	**L6**
CO 7	Project management skills) capable of solving real world application problems using LEGO Mindstorms, TETRIX & Robot C language.	**L6**

Kindly Note: Students who have undertaken this course can opt to waive-off an elective course in 6th or 7th Semester.

(CO)	Programme Outcomes (PO)											
	1	2	3	4	5	6	7	8	9	10	11	12
CO1												
CO2	3	2			3			1		2		
CO3	3	2	3	3	3	3		1		2	3	
CO4	3	3	3	3	3	3		2		2	3	
CO5	3	3	3	3	3	3	2	2		2	3	
CO6	3	3	3	3	3	3	2	3		2	3	

Course Content for V-Semester of 2018 Scheme

Department: *Computer Science And Engineering*	***Course Type:*** *Programme Core*
Course Title: *Computer Networks*	***Course Code:****18CS51*
L-T-P: *3-2-0*	***Credits:04***
Total Contact Hours:*52 Hours*	***Duration Of SEE:****3 Hours*
SEE Marks: *50*	***CIE Marks:****50*

COURSE DESCRIPTION

This course is aimed to introduce the modern network architectures, Layered models, IP addresses. It also covers all protocols, transmission media and Routing concepts.

PREREQUISITES

- Student should have prior knowledge of computer programming, discrete mathematics structures and data structures.

COURSE OBJECTIVES

- To develop an understanding of modern network architectures from a design and performance perspective.
- To introduce the student to the major concepts involved in wide-area networks (WANs), local area networks (LANs) and wireless-LANs (WLANS).
- To introduce the network programming using socket programming.
- To analyze the MAC and ARQ protocol efficiency and delay.

COURSE CONTENTS

UNIT -I **8 Hours**

Introduction: Overview of the internet- Networks, Network Types, Switching and the Internet, Data Communications. **Networks Model**: Protocol Layering, TCP/IP Protocol suite, The OSI model. (Chapter 1.1, 1.2)

UNIT -II **12 Hours**

Introduction to Physical Layer: Data and Signals Analog and Digital - Transmission Impairment - Data rate and Channel capacity – Performance. **Transmission media**: Guided Media and Unguided media (Chapter 7.1, 7.5)

UNIT -III **12 Hours**

Introduction to Data-Link Layer: Introduction, **Data Link Control (DLC)**: Data-link layer protocols, HDLC, PPP, framing, flow and error control, error detection and correction. **Media Access Control (MAC):** random access, controlled access and channelization. Stop and wait, Go back N, Selective repeat, Bi-directional
(Chapter 5.1 – 5.3, Remaining Topics Ref 1)

UNIT -IV **12 Hours**

Network Layer: Introduction - Network-Layer Services, Packet Switching, Network-Layer Performance, Network Layer Protocols - Datagram format, IPv4 addresses, Forwarding of IP packets, Class-full and Classless addressing (CIDR), Internet Protocol (IP), IPv6 addressing.
(Chapter 4.1.1, 4.1.2, 4.1.3, 4.1.4, 4.2.1, 4.2.2, 4.2.3, 4.5.1, 4.5.2)

UNIT -V **8 Hours**

Unicast Routing: Introduction: general idea, least-cost routing, Routing algorithms, Distance-Vector Routing, Link-State Routing, Path-Vector Routing.
(Chapter 4.3.1, 4.3.2)

ASSIGNMENTS:

Simulation and programming assignment: Problems on CRC block coding, IP addressing, Socket programming using C APIs. Simulation of Packet Tracing using wireshark.

TEXT BOOKS

1. Behrouz A. Forouzan and Firouz Mosharraf: Computer Networks: A top down approach, Special Indian Edition, Tata Mc Graw-Hill.2012.

REFERENCE BOOKS

1. Behrouz A. Forouzan,: Data Communication and Networking, 5th Edition Tata Mc Graw-Hill
2. William Stallings: Data and Computer Communication, 8th Edition, Pearson Education, 2007.
3. Larry L. Peterson and Bruce S. Davie: Computer Networks – A Systems Approach, 4thedition, Elsevier, 2007.
4. Alberto Leon-Garcia and Indra Widjaja, "Communication Networks Fundamental Concepts And Key Architectures", 2nd Edition, Mc Graw-Hill Education

TEACHING METHODS

- Lecture by presentations
- Hands-On Sessions Based Teaching

ASSESSMENT METHODS

Parameters	Marks
Three Internals (Average of best of two)	30
Evaluation of Simulation Assignments with MCQ based on concepts taught in the course	20
Total	**50**
Final Exam will be conducted for 100 marks (SEE)	

COURSE OUTCOMES

At end of the course student will be able to:

COs	Description	Bloom's Level
CO 1	Describe the services and functionalities provided by each layer of the OSI reference model and also understand the need for a layered model.	**L2**
CO 2	Understand the need for addressing at the different layers.	**L2**
CO 3	Understand the need and working of different protocols at each of the layers in the OSI reference model, compare the features offered by different protocols in each layer and choose the optimal one based on the requirement of the Application.	**L2**
CO 4	Analyze and Apply the techniques to detect errors in data transmission, control flow and congestion in the network, forward packets through the network and improve efficiency in data transmission in any network configuration.	**L3**

CO 5	Analysis of Packet Tracing using Wireshark Tool	**L3**

Mapping of Course outcomes (COs) to Program outcomes (POs*)& PSO **

Course Outcomes mapping to Program Outcomes													**PSOs**		
POs / COs	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**PSO1**	**PSO2**	**PSO3**
CO1	3				2							2	3		
CO2	3	3										2	3	3	
CO3	3											2	3		
CO4	3											2	3	3	
CO5	1	2	3		3				2	2		1	3	3	

***3: Strong, 2: Medium, 1: Weak** ****3: Highly Related 2: Supportive**

Department: *Computer Science and Engineering*	***Course Type:*** *Programme Core*
Course Title*: Software Engineering*	***Course Code:****18CS52*
L-T-P:3*-0-0*	***Credits:*** *03*
Total Contact Hours: *39 Hours*	***Duration of SEE:*** *3 Hours*
SEE Marks*: 39*	***CIE Marks:*** *50*

COURSE DESCRIPTION

The course will cover topics regarding the software development other than programming, including testing, bug finding, verification, and validation for constructing robust code. The emphasis is on modern technology for developing reliable software at reasonable cost.

PREREQUISITES

Students must have the knowledge on basic programming and OOP concepts.

COURSE OBJECTIVES

- To introduce software engineering and to explain its importance
- To introduce software development process models.
- To introduce the art of eliciting user requirements and analysis.
- To introduce software design strategies and methodologies.
- To understand the software testing process and tools.
- To understand the process of software Maintenance.

COURSE CONTENTS

UNIT -I **8 Hours**

Introduction to Software Engineering:

Introduction: What is Software Engineering and its history, software crisis, Evolution of a Programming System Product, **Software Development Life Cycles:** Software Development Process, The Waterfall model, The Evolutionary Model, The Incremental Implementation, Prototyping, The Spiral Model, Software Reuse, **An Introduction to Non-Traditional Software Development Process:** Rapid Application Development, Agile Development Process, introduction to DevOps.

UNIT -II **8 Hours**

Requirements: Importance of Requirement Analysis, User needs, Software Features and Software Requirements, **Classes of User Requirements:** Enduring and Volatile, Sub phases of Requirement Analysis, Functional and Nonfunctional requirements, Barriers to Eliciting User requirements, the software requirements document and SRS standards, Requirements Engineering, Case Study of SRS for a Real Time System. **Tools for Requirements Gathering:** Document Flow Chart, Decision Table, Decision Tree.

UNIT -III **8 Hours**

Software Design: Goals of good software design, Design strategies and methodologies, Data oriented software design, **Structured Design:** Structure chart, Coupling, Cohesion, Modular structure, Packaging, Object oriented design, Top-down and bottom-up approach, Design patterns, **Structured Analysis:** DFD, Data Dictionary,

UNIT -IV **8 Hours**

Software Measurement and Metrics: Various Size Oriented Measures: Halstead's software science, Function Point (FP) based measures, **Cyclomatic Complexity Measures:** Control flow graphs. **Development:** Selecting a language, Coding guidelines, writing code, Code documentation.

UNIT -V **7 Hours**

Software Testing: Testing process, Design of test cases, **Functional Testing:** Boundary value analysis, Equivalence class testing, Decision table testing, Cause effect graphing, Structural testing, Path testing, Data flow and mutation testing, Unit testing, Integration and system testing, Debugging, Alpha & beta testing, testing tools & standards.

Software Maintenance: Maintenance process, Regression testing, Software reengineering, Configuration management, documentation.

MINIPROJECT:

A Course project using JAVA/Python Tools needs to be developed by a team of students with a Report on the project and these needs to be considered for internal assessment.

TEXTBOOKS

- Software Engineering: A Practitioner's Approach, R. S. Pressman, McGraw Hill,Seventh Edition, 2010
- Zero Defect Software, G. G. Schulmeyer,McGraw-Hill,1992
- Ian Somerville, "Software Engineering", Pearson 9 th Edition, 2016.

REFERENCE BOOKS

1. An Integrated Approach to Software Engineering, Pankaj Jalote,Narosa Publishing House, 3rd Edition
2. Software Engineering, Course, NPTEL, https://nptel.ac.in/downloads/106105087/#

TEACHING METHODS

- Lecture using presentations
- Case studies.

ASSESSMENT METHODS

Parameter	Marks
Three Internals (Average of best of two)	30
Rubrics evaluation for the Course Project	10
Programming Assignment	10
Total	**50**
Final Exam will be conducted for 100 marks (SEE)	

COURSE OUTCOMES

At the end of the course student will be able to

COs	Description	Bloom’s Level
CO 1	Understand the processes that are used in software development process.	**L1**
CO 2	Understand the requirement analysis process and designing of SRS.	**L2**
CO 3	Use tools and techniques for designing good software.	**L2**
CO 4	Understanding the different software testing process to develop zero defect software	**L2**
CO 5	Understand the importance of software Maintenance.	**L2**

Mapping of Course outcomes (COs) to Program outcomes (POs*)& PSO **															
Course Outcomes mapping to Program Outcomes													PSOs		
POs COs	1	2	3	4	5	6	7	8	9	10	11	12	PSO1	PSO2	PSO3
CO1	2	3		2	2								3	2	
CO2	2	3		2	2	2							2	3	
CO3	2	2	3	3	3	2							2	3	
CO4	2	3	3	3	2	2							2	3	
CO5	2	3	3	3	2	3						2	3	3	

3: Strong, 2: Medium, 1: Weak ** H: Highly related S: Supportive

Department: *Computer Science and Engineering*	***Course Type:*** *Programme Core*
Course Title: *Data Mining*	***Course Code:*** *18CS54*
L-T-P:*3-0-0*	***Credits:*** *03*
Total Contact Hours: *39Hours*	***Duration of SEE:*** *3 Hours*
SEE Marks*: 50*	***CIE Marks:*** *50*

COURSE DESCRIPTION

This course is an introductory course on data mining. It introduces students to the basic concepts, principles, methods, implementation techniques, and applications of data mining.

PREREQUISITES

- Student should have knowledge of DBMS

COURSE OUTCOMES

This course imparts the concepts of data mining which is the necessity in today's huge data processing applications. It includes the concepts of data preprocessing, classification, association analysis and cluster analysis.

COURSE OBJECTIVES

- To understand the concepts of data mining, tasks of data mining and preprocessing techniques.
- To describe the data mining tasks - classification, association analysis and cluster analysis.
- To solve problems based on the different data mining tasks.

COURSE CONTENTS

UNIT -I **7 Hours**

Data Mining: Introduction, KDD Process, Challenges, Data Mining Tasks, Data Mining Trends and Applications.

UNIT -II **8 Hours**

Data, Types of Data, Data Preprocessing, Measures of Similarity and Dissimilarity

UNIT -III **8 Hours**

Classification: Basics, General approach to solve classification problem, Decision Tree Induction, Rule Based Classifiers, Nearest Neighbor classifiers.

UNIT -IV **8 Hours**

Association Analysis: Basic Concepts, Frequent Item set Mining Methods – Apriori Algorithm- Frequent item set generation, Rule Generation, FP Growth Algorithm, Evaluation of Association Patterns

UNIT -V **8 Hours**

Cluster Analysis, Partitioning Methods: k-Means, K-mediods, PAM, CLARA and CLARANS **Hierarchical Methods:** AGNES, DIANA, BIRCH, **Density Based Methods:** DBSCAN, Cluster Evaluation.

TEXT BOOKS

1. Pang-Ning Tan, Vipin Kumar, Michael Steinbach: Introduction to Data Mining, Pearson, 2012.
2. Jiawei Han and Micheline Kamber: Data Mining - Concepts and Techniques, 3rd Edition, Morgan Kaufmann Publisher, 2014

REFERENCE BOOKS

1. G. K. Gupta: Introduction to Data Mining with Case Studies, 3rd Edition, PHI, New Delhi, 2009.

Note: For SEE, students should answer five questions, selecting at least one question from each unit

TEACHING METHODS

1. Lectures interspersed with discussions
2. Lectures using presentations
3. Problem Solving Exercises

ASSESSMENT METHODS

Parameter	Marks
Three Internals (Average of best of two)	30
Evaluation of Problem solving Exercises	10
Implementation of Laboratory based exercises	10
Total	**50**
Final Exam will be conducted for 100 marks (SEE)	

COURSE OUTCOMES

At the end of the course, the student will be able to:

COs	Description	Bloom's Level
CO 1	Outline the data mining tasks, challenges and data mining trends & applications	**L1**
CO 2	Demonstrate the various data preprocessing techniques, measures of similarity and dissimilarity on categorical and numeric data.	**L2**
CO 3	Illustrate the working of Decision tree classifier, Rule based classifier and Nearest neighbor classifier using datasets	**L3**
CO 4	Categorize frequent itemsets from transactional data using FP Growth algorithm and Apriori algorithm	**L3**
CO 5	Illustrate Partitioning Methods and Hierarchical Methods of clustering and evaluate the clusters.	**L3**

Mapping of Course outcomes (COs) to Program outcomes (POs*)& PSO **															
Course Outcomes mapping to Program Outcomes													**PSOs**		
POs / COs	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**PSO1**	**PSO2**	**PSO3**
CO1	3	2											3		
CO2	3	2	2										3	3	
CO3	3	2	2						1	1			3	3	1
CO4	3	2	2						1	1			3	3	1
CO5	3	2	2						1	1			3	2	1

3: Strong, 2: Medium, 1: Weak ** H: Highly related S: Supportive

Department: *Computer Science and Engineering*	***Course Type :****Programme Core*
Course Title: *Artificial Intelligence and Neural Networks*	***Course Code:*** 18CS56
L-T-P: 3-0-0	***Credits:03***
Total Contact Hours: *39Hours*	***Duration of SEE :****3 Hours*
SEE Marks*: 50*	***CIE Marks: 50***

COURSE DESCRIPTION

This course provides an in-depth knowledge of structure if AI agents, search algorithms, uninformed and informed search strategies, game playing algorithms, agents that reason logically, fundamental models of neural networks, perceptron networks, feedback networks, feed forward networks, self-organizing feature map.

PREREQUISITES

- Students should have knowledge of Design and Analysis of Algorithms
- Students should have knowledge of Probability Theory.

COURSEOBJECTIVES

- Understanding AI, Structure of Agents, Idea behind search algorithms, analyzing Uninformed and Informed search.
- Understanding and analyzing game playing algorithms and agents that reason logically.
- Understanding and analyzing Neural Networks, Artificial Neural Networks, Fundamental Models of ANN.
- Understanding and Analyzing Perceptron Networks, Feed Back networks
- Understanding and Analyzing Feed forward Networks, Self-Organizing Feature Map.

COURSE CONTENTS

UNIT - I **8 Hours**

Introduction: Why study AI? What is AI? The Turing test. Rationality. Branches of AI.
Brief history of AI. Challenges for the future. What is an intelligent agent? Doing the right thing (rational action). Performance measure. Autonomy, Environment and agent design, Structure of Agents, Agent types.
Uninformed Search: Depth-first, Breadth-first, Uniform-cost, Depth-limited, Iterative deepening, Examples, and Properties. **Informed search**: Best-first, A* search, Heuristics, Hill climbing, Problem of local extrema.

UNIT – II **7 Hours**

Game Playing: The minimax algorithm, Resource limitations, Alpha-beta pruning, Constraint satisfaction, Node, arc, path, and k-consistency, Backtracking search, Local search using min-conflicts. **Agents that reason logically 1**: Knowledge -based agents, Logic and representation, Propositional (Boolean) logic. **Agents that reason logically 2**: Inference in propositional logic, Syntax, Semantics, Examples.

UNIT-III **8 Hours**

Introduction to Neural Networks: Neural processing, Neural Networks-an overview, the rise of Neurocomputing, **Introduction to Artificial Neural Networks:** Introduction, Artificial Neural Networks, Historical development of neural networks, biological neural networks, comparison between the brain and the computer, comparison between artificial and biological neural network, Basic building blocks of ANN, ANN terminologies.

UNIT – IV **8 Hours**

Fundamental Models of Artificial Neural Networks: Introduction, mCCulloch-Pitts Neuron Model, Learning rules, Hebb Net. **Perceptron Networks:** Single Layer Perceptron, Brief Introduction to Multilayer Perceptron Networks. **Feed Back networks:** Introduction, Discrete Hopfield Net, Continuous HopField net.

UNIT – V **8 Hours**

Feed forward Networks: back propagation Network, Radial basis Function Network. **Self-Organizing Feature Map:** Methods used for determining the Winner, Kohonen Self Organizing feature maps, Learning Vector Quantization, Max Net, Mexican hat, Hamming Net.

TEXT BOOKS

1. Artificial Intelligence-A Modern Approach, Stuart J. Russell and Peter Norvig, Pearson 3rd Edition, Eleventh Impression 2018.
2. Introduction to Neural Networks using MATLAB6.0, S N SIVANANDAM, S SUMATHI, S N DEEPA, The McGraw-Hill Companies - Computer Engineering Series

REFERENCE BOOKS

1. Elaine Rich, Kevin Knight, Shivashanka B Nair: Artificial Intelligence, Tata MCGraw Hill 3rd edition. 2013
2. Nils J. Nilsson: "Principles of Artificial Intelligence", Elsevier, ISBN-13: 9780934613101
3. Laurene Fausett, "Fundamentals of Neural Networks", Pearson Education, 2004.
4. Simon Haykin, "Neural Networks- A comprehensive foundation", Pearson Education, 2003.
5. S. Rajasekharan and G. A. Vijayalakshmi pai, "Neural Networks, Fuzzy logic, Genetic algorithms: synthesis and applications", PHI Publication, 2004.

TEACHING METHODS

1. Lecture using Black board and chalk
2. Lecture using Presentations
3. Seminar on AI topics
4. Quiz

ASSESSMENT METHODS

Parameter	Marks
Three Internals (Average of best of two test)	30
Programming Assignments(AI Algorithms) using Python/Java	10
Programming Assignments(Neural Network) using MATLAB	10
Total	**50**
Final Exam will be conducted for 100 marks (SEE)	

COURSE OUTCOMES

At the end of the course student will be able to

COs	Description	Bloom’s Level
CO 1	Understanding AI, Structure of Agents, Idea behind search algorithms, analyzing Uninformed and Informed search.	**L2,L4**
CO 2	Understanding and analysing game playing algorithms and agents that reason logically.	**L2,L4**
CO 3	Understanding and analysing Neural Networks, Artificial Neural Networks, Fundamental Models of ANN.	**L2,L4**
CO 4	Understanding and Analysing Perceptron Networks, Feed Back networks	**L2,L4**
CO 5	Understanding and Analysing Feed forward Networks, Self-Organizing Feature Map.	**L2,L4**

Mapping of Course outcomes (COs) to Program outcomes (POs*)& PSO **															
Course Outcomes mapping to Program Outcomes													PSOs		
POs / COs	1	2	3	4	5	6	7	8	9	10	11	12	PSO1	PSO2	PSO3
CO1	3	3	3	3	2									3	
CO2		3	3	3										3	
CO3		3	3	3	2									3	3
CO4		3	3	3	2									3	3
CO5		3	3	3	2		3							3	3

3: Strong, 2: Medium, 1: Weak ** H: Highly related S: Supportive

Department of Computer Science and Engineering

***Department**: Computer Science and Engineering*	***Course Type:** Programme Core*
***Course Title:** Formal Languages and Automata Theory*	***Course Code:**18CS57*
***L-T-P:** **3**-2-0*	***Credits:** 4*
***Total Contact Hours:** 52Hours*	***Duration of SEE:** 3 Hours*
***SEE Marks:** 50*	***CIE Marks:** 50*

COURSE DESCRIPTION

This course serves as an introduction to the basic theory of Computer Science and formal methods of computation. Topics include automata theory, formal languages and grammars, Turing machines, computability and computational complexity.

PREREQUISITES

- Knowledge on Mathematics, Discrete Mathematical Structures and programming.

COURSE OBJECTIVES

- Introduction to the concept of finite automaton as a regular language recognizer.
- Design grammars and recognizers for different formal languages
- Designing pushdown automata to recognize any context-free language
- Identify the relation between grammars, languages and recognizers.
- Design and explain the principles and operation of a Turing Machine and its different types

COURSE CONTENTS

UNIT - I **12 Hours**

Introduction to Finite Automata: Introduction to Finite Automata, The central concepts of Automata theory, Deterministic finite automata, Nondeterministic finite automata, an application of finite automata, Finite automata with Epsilon transitions, Regular expressions.

UNIT –II **11 Hours**

Regular Expressions & Regular Languages: Finite Automata and Regular Expressions, Applications of Regular Expressions, Regular languages, Proving languages not to be regular languages, Closure properties of regular languages, Decision properties of regular languages, Equivalence and minimization of automata.

UNIT – III **10 Hours**

Context-Free Grammars and Languages, Push down Automata: Context –free grammars, Parse trees, Applications, Ambiguity in grammars and Languages, Definition of the Pushdown automata, the languages of a PDA.

UNIT – IV **10 Hours**

Pushdown Automata, Properties of Context-Free Languages: Equivalence of PDA's and CFG's, Deterministic Pushdown Automata, Normal forms for CFGs, the pumping lemma for CFGs, Closure properties of CFLs.

UNIT – V **09 Hours**

Turing Machine & Undecidability : The Turing machine, Programming techniques for Turing Machines, Extensions to the basic Turing Machines, A Language that is not recursively enumerable, An Undecidable problem that is RE, Post's Correspondence problem.

TEXT BOOK

1. John E.. Hopcroft, Rajeev Motwani, Jeffrey D.Ullman: Introduction to Automata Theory, Languages and Computation, 3rd Edition, Pearson education, 2007.

REFERENCE BOOKS

1. Raymond Greenlaw, H.James Hoover: Fundamentals of the Theory of Computation, Principles and Practice, Morgan Kaufmann, 1998.
2. John C Martin: Introduction to Languages and Automata Theory, 3rd Edition, Tata McGraw-Hill, 2007.
3. Daniel I.A. Cohen: Introduction to Computer Theory, 2nd Edition, John Wiley & Sons, 2004.
4. Thomas A. Sudkamp : An Introduction to the Theory of Computer Science, Languages and Machines, 3rd Edition, Pearson Education, 2006.

DELIVERY METHODS

- Black board Teaching
- Problem solving
- Tool: JFLAP

ASSESSMENT METHODS

Parameter	Marks
Three Internals (Average of best of two test)	30
Tool based tutorial using JFLAP Tool	10
Test for GATE related questions	10
Total	**50**
Final Exam will be conducted for 100 marks (SEE)	

COURSE OUTCOMES

At the end of the course student will be able to:

COs	Description	Bloom's Level
CO 1	Describe central concepts of automate theory	**L1**
CO 2	Demonstrate the applications of finite state machines and regular expressions	**L2**
CO 3	Construct Automata, and equivalent, Parse Trees and Context Free Grammars.	**L3**
CO 4	Design Pushdown Automata , Turing machines and Post Correspondence problems for real time applications	**L3**
CO 5	Apply Pumping Lemma to prove that languages are not regular, context free	**L4**

Mapping of Course outcomes (COs) to Program outcomes (POs*)& PSO **

Course Outcomes mapping to Program Outcomes													PSOs		
POs / COs	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**PSO1**	**PSO2**	**PSO3**
CO1	3			2		1							3	3	
CO2	1	2	2	2		2							3	3	
CO3	1	2	2	1		2							3	3	
CO4	2			3		2							3	3	
CO5						2			3	3					2

3: Strong, 2: Medium, 1: Weak ** H: Highly related S: Supportive

Department: *Computer Science and Engineering*	***Course Type:*** *Programme Core*
Course Title*: Artificial Intelligence with Python Laboratory*	***Course Code:*** *18CSL58*
L-T-P: *0-0-2*	***Credits:*** *1*
Total Contact Hours: *36Hours*	***Duration of SEE:*** *3 Hours*
SEE Marks*: 50*	***CIE Marks:*** *50*

COURSE DESCRIPTION

This course provides an in-depth knowledge of applying Python Programming Language to Various search strategies and game playing algorithms of Artificial Intelligence and concepts of Neural Networks

PREREQUISITES

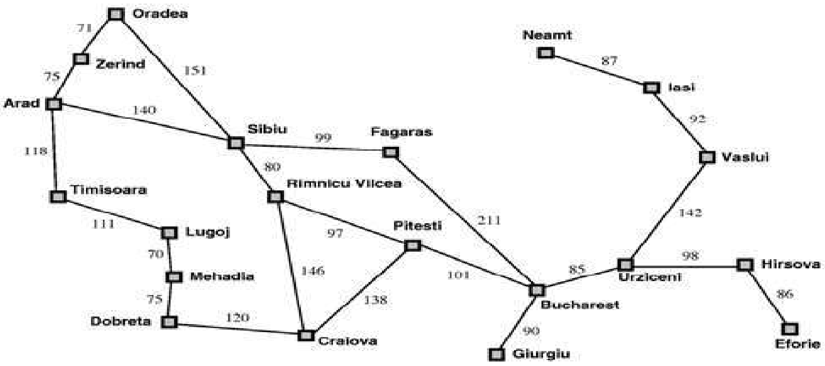
- Students should have knowledge of Design and Analysis of Algorithms.
- Students should have knowledge of Probability Theory.
- Students should have knowledge of Basics of programming.

COURSE OBJECTIVES

- Understanding and analyzing search algorithms.
- Understanding and analyzing game playing algorithms and agents that reason logically.
- Understanding and analyzing Mcculloch-Pitts, Perceptron Networks.
- Understanding and analyzing neural networks with backpropagation.
- Understanding and analyzing Kohonen and Mexican hat Neural Network with fixed weight competitive net

LABORATORY EXERCISES

1. Problems in Search
   - **a.** Problem Statement for A * : ABC has to reach to Mumbai from Bangalore. As there are multiple paths to reach Mumbai help ABC to reach the destination using the shortest path by applying A* Algorithm
   - **b.** Problem Statement for uniform cost search : We have the Map of Romania. In this map, the distance between various places in Romania is given. If we have to reach from one place to another place there exist several paths. Write a Python Program to find the shortest distance between any two places using a uniform cost search.



Straight–line distance to Bucharest	
Arad	366
Bucharest	0
Craiova	160
Dobreta	242
Eforie	161
Fagaras	178
Giurgiu	77
Hirsova	151
Iasi	226
Lugoj	244
Mehadia	241
Neamt	234
Oradea	380
Pitesti	98
Rimnicu Vilcea	193
Sibiu	253
Timisoara	329
Urziceni	80
Vaslui	199
Zerind	374

c. Problem Statement for Depth Limited Search
Design and develop a program in Python to print all the nodes reachable from a given starting node in a graph by using the Depth Limited Search method. Repeat the experiment for different Graphs.

2. Write a program to implement a Minimax decision-making algorithm, typically used in a turn-based, two player games. The goal of the algorithm is to find the optimal next move.

3. Write a program to implement Alpha Beta pruning in Python. The algorithm can be applied to any depth of tree by not only pruning the tree leaves but also the entire subtree. Order the nodes in the tree such that the best nodes are checked first from the shallowest node. Use domain knowledge while finding the best move. Ex: for Chess, try order: captures first, then threats, then forward moves, backward moves.

4. Assume that you are organising a party for N people and have been given a list L of people who, for social reasons, should not sit at the same table. Furthermore, assume that you have C tables (that are infinitly large). Write a function layout(N,C,L) that can give a table placement (ie. a number from 0 . . . C − 1) for each guest such that there will be no social mishaps.
For simplicity we assume that you have a unique number 0 . . . N − 1 for each guest and that the list of restrictions is of the form [(X,Y), ...] denoting guests X, Y that are not allowed to sit together.
Answer with a dictionary mapping each guest into a table assignment, if there are no possible layouts of the guests you should answer False.

5. Implementation of Tic Tac Toe game here ,the player needs to take turns marking the spaces in a 3x3 grid with their own marks,if 3 consecutive marks (Horizontal, Vertical,Diagonal) are formed then the player who owns these moves get won. Noughts and Crosses or Xs and Os abbreviations can be used to play

6. Write a python program to implement The Wumpus world problem.The problem deals with an AI robot navigating its way through a 4x4 puzzle to try and find gold. The robot must safely navigate its way around bottomless pits of death and evil Wumpus creatures to locate the gold hidden on the board. After it has successfully found the gold, it must safely navigate its way back to the starting point. The robot must use its light sensors and the signals sent to it at each square to determine which way to properly navigate to reach its goal.

7. Write a program to implement Mcculloch-Pitts algorithms

8. Implement the Perceptron Learning single layer Algorithm by Initializing the weights and threshold calculate the error of a prediction plot the dataset to see, that they are linearly separable execute the code and check, how many iterations are needed, until all samples are classified right.
9. Write a python program to implement neural networks with backpropagation for xor using one hidden layer.
10. Suppose we have some pattern of arbitrary dimensions, however, we need them in one dimension or two dimensions. Then the process of feature mapping would be very useful to convert the wide pattern space into a typical feature space. Write a program to implement Kohonen algorithm
11. Simulate the Mexican Hat Neural Network with fixed weight competitive net. External signals(S), number of iterations(t_max),Radius of region with positive reinforcement(R1), Radius of region with negative reinforcement(R2),vector of activations (X) are the inputs

REFERENCES

1. Artificial Intelligence-A Modern Approach, Stuart J. Russell and Peter Norvig, Pearson 3rd Edition, Eleventh Impression 2018.
2. Introduction to Neural Networks using MATLAB6.0, S N SIVANANDAM, S SUMATHI, S N DEEPA, The McGraw-Hill Companies - Computer Engineering Series
3. https://www.tutorialspoint.com/index.htm

ASSESSMENTMETHODS

Parameter	Marks
Experiment write up, Execution, Viva & Record writing	30
Lab Internal Test	20
Total	**50**
Final Exam will be conducted for 100 marks (SEE)	

COURSE OUTCOMES

At the end of Course, Students will be able to

CO	Description	Blooms Level
CO 1	Understanding and analyzing various search algorithms.	**L4**
CO 2	Understanding and analyzing game playing algorithms and agents that reason logically.	**L4**
CO 3	Understanding and analyzing Mcculloch-Pitts, Perceptron Networks.	**L4**
CO 4	Understanding and analyzing neural networks with backpropagation.	**L4**
CO 5	Understanding and analyzing Kohonen and Mexican hat Neural Network with fixed weight competitive net.	**L4**

Mapping of Course outcomes (COs) to Program outcomes (POs*)& PSO **

	Course Outcomes mapping to Program Outcomes												**PSOs**		
POs / COs	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**PSO1**	**PSO2**	**PSO3**
CO1	3	3	3	2									3	3	
CO2	3	3	3										3	3	
CO3	3	3	3	2									3	3	
CO4	3	3	3										3	3	
CO5	3	3	3			3							3	3	

3: Strong, 2: Medium, 1: Weak ** H: Highly related S: Supportive

Department: *Computer Science & Engineering*	***Course Type:*** *Program Core*
Course Title: *Computer Networks Lab*	***Course Code:*** *18CSL59*
L-T-P:*0-0-2*	***Credits****: 1*
Total Contact Hours: *36Hours*	***Duration of SEE:*** *3 Hours*
SEE Marks*: 50*	***CIE Marks:*** *50*

COURSE DESCRIPTION

This lab covers an in-depth knowledge about the **Network Simulation** using NS2 and cisco packet tracer – and analyzing the **Network simulation** Performance.

PREREQUISITES

- Knowledge on basic programming

COURSE OBJECTIVES

This **laboratory** exercises are designed to give students ability to design, build, and analyze the Computer Network Protocols.

PART-A

Implement the programs using Network Simulator -2

1. Simulate a point-to-point network with duplex link as follows: n0-n2, n1-n2 and n2-n3. Apply TCP agent between n0-n3 and UDP agent between n1-n3. Apply relevant applications over TCP and UDP agents. Set the queue size to 5 and vary the bandwidth to find number of packets dropped and received by TCP and UDP agents using awk script and grep command.
2. Set up the network topology as shown in fig 1. Simulate different type of internet traffic

Such as traffic using FTP between the nodes n1 – n6 and Telnet between the nodes n2-n5.

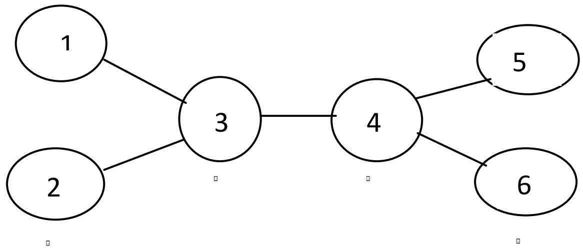


Fig. 1: Network Topology

Plot congestion window for FTP and Telnet, and analyze the throughput.

3. Design networks that demonstrate the working of Distance vector routing protocol. The link between node 1 and 4 breaks at 1.0 ms and comes up at 3.0ms. Assume that the source node 0 transmits packets to node 4. Plot the congestion window when TCP sends packets via other nodes. Assume your own parameters for bandwidth and delay.

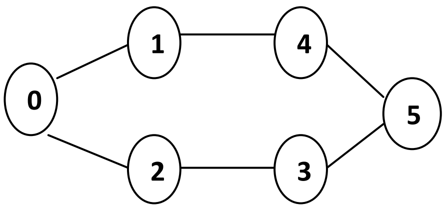


Fig 2: Network Topology

4. Consider a client and a server. The server is running a FTP application over TCP. The client sends a request to download a file of size 10 MB from the server. Write a TCL script to simulate this scenario. Let node n0 be the server and node n1 be the client. TCP packet size is 1500 Bytes.
5. Demonstrate the working of multicast routing protocol. Assume your own parameters for bandwidth and delay.
6. Set up a 2-node wireless network. Analyze TCP performance for this scenario with DSDV as routing protocol.
7. Set up 3-node wireless network with node N1 between N0 and N2. As the nodes N0 and N2 moves towards each other they exchange packets. As they move out of each other's range they drop some packets. Analyze TCP performance for this scenario with AODV routing protocol.
8. Set up a 6-node wireless network; analyze TCP performance when nodes are static and mobile.
9. Write a TCL script to simulate the following scenario. Consider six nodes, (as shown in the figure below) moving within a flat topology of 700m x 700m. The initial positions of nodes are: n0 (150, 300), n1 (300, 500), n2(500, 500), n3 (300, 100), n4(500, 100) and n5(650, 300) respectively. A TCP connection is initiated between n0 (source) and n5 (destination) through n3 and n4 i.e., the route is 0-3-4-5. At time t = 3 seconds, the FTP application runs over it. After time t = 4 seconds, n3 (300,100) moves towards n1 (300, 500) with a speed of 5.0m/sec and after some time the path breaks. The data is then transmitted with a new path via n1 and n2 i.e., the new route is 0-1-2-5. The simulation lasts for 60 secs. In the above said case both the routes have equal cost. Use DSR as the routing protocol andthe IEEE 802.11 MAC protocol.
10. Set up a wireless network with mobile nodes, induce 1 to 10% error to the network using uniform error model. Plot the congestion window for TCP connections. Write your observation on TCP performance as error increases in the network.

PART-B

1. Study of network IP Experiments
   i. Classification of IP address ii. Sub netting iii. Super netting
2. Configure Static and Dynamic Routing information in the router and test the connectivity between two networks.
3. Configure Network Address Translation (NAT) and test Static NAT, Dynamic NAT and PAT.
4. Configuring a Cisco Router as a DHCP Server to dynamically assign IP addres, subnet mask and default gateway to the hosts in the network.
5. Configure and test DNS and Email server in a network.
6. Configure Wireless router to support mobile devices to connect to the internet.

ASSESSMENT METHODS

Parameter	Marks
Experiment write up, Execution, Viva & Record writing	25
Rubrics based the evaluation of Self-study topic	10
Lab Internal Test	15
Total	**50**
Final Exam will be conducted for 100 marks (SEE)	

COURSE OUTCOMES

At the end of the course students will be able to:

COs	Description	Bloom’s Level
CO 1	Understand NS2, NS3 and Cisco Packet tracer environment	**L2**
CO 2	Learn and implement various routing protocols.	**L3**
CO 3	Simulate wired and wireless network scenario.	**L3**
CO 4	Apply NS2 tools to analyse the performance of simulation models.	**L4**
CO 5	Simulate network services like DHCP, DNS and NAT on Packet tracer	**L3**

Mapping of Course outcomes (COs) to Program outcomes (POs*)& PSO **															
Course Outcomes mapping to Program Outcomes													**PSOs**		
POs / COs	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**PSO1**	**PSO2**	**PSO3**
CO1	3											2		1	
CO2	3											2	3		
CO3	2	3	3	3	3				3			2	2	2	
CO4	2	3	3	3	3				3			2	2	3	1
CO5	2	3	3	3	3				3			2	2	3	1

3: Strong, 2: Medium, 1: Weak ** H: Highly related S: Supportive

Department: *Computer Science & Engineering*	***Course Type:*** *Program Core*
Course Title: *Project work-I*	***Course Code:*** *18CSP510*
L-T-P-S: *0-0-0-8*	***Credits***: *0*
Total Contact Hours: *36Hours*	***Duration of SEE:*** *NA*
SEE Marks: *NA*	***CIE Marks:*** *50*

COURSE DESCRIPTION

This course allows students to form a group of maximum four to initiate their final year major project work. The students will have to discuss among themselves and chose their domain for the project work.

PREREQUISITES

- Programming knowledge

COURSE OBJECTIVES

- To allow students work on literature survey to understand the domain of their interest.
- To summarize the literature survey to finalize their project work under selected domain.
- To work effectively in a team, present and prepare the report.

COURSE CONTENT

- Survey and study of published literature on the assigned topic.
- Working out a preliminary Approach to the Problem relating to the assigned topic.
- Preparing a Written Report on the Study conducted for presentation to the Department.
- Final Seminar, as oral Presentation before a Departmental Committee.

ASSESSMENT METHODS

Parameter	Marks
Initial seminar- Formation of team, selection of domain and planning the literature survey	10
Carry out literature survey and preparation of the report	20
Rubrics based the evaluation of seminar in the literature survey	20
Total	**50**

COURSE OUTCOMES

At the end of the course students will be able to**:**

CO	**Description**	**Bloom’s level**
CO 1	Survey and study of published literature on the assigned topic.	**L1**
CO 2	Complete the preliminary approach to the Problem relating to the assigned topic.	**L2**
CO 3	Complete the report on the literature survey.	**L2**
CO 4	Acquire the depth knowledge on the selected domain	**L2**
CO 5	Improve their presentation and writing skills and recognize the importance of team work.	**L2**

3: Strong, 2: Medium, 1: Weak ** H: Highly related S: Supportive

Mapping of Course outcomes (COs) to Program outcomes (POs*)& PSO **															
Course Outcomes mapping to Program Outcomes													**PSOs**		
POs / COs	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**PSO1**	**PSO2**	**PSO3**
CO1	3				2								3		
CO2		2					2							2	
CO3										3					
CO4	3														
CO5						2		3	3	2	2	2	3	3	2

Course Content for V – Semester Program Elective -B

Department: *Computer Science and Engineering*	***Course Type:*** *Programme Elective*
Course Title: *Computer Graphics*	***Course Code:*** *18CSE531*
L-T-P: *2-0-2*	***Credits:*** *03*
Total Contact Hours: *39 Hours*	***Duration of SEE:*** *3 Hours*
SEE Marks: *50*	***CIE Marks:*** *50*

COURSE DESCRIPTION

This course provides an introduction to Computer graphics and aims at giving an insight about basic concepts of 2-D and 3-D modeling and transformations, viewing transformations, projections, rendering techniques, graphics programming, color model, shading, clipping, and hidden surface removal.

PREREQUISITES

- Basic programming knowledge of C/C++
- Linear algebra and Mathematics

COURSE OBJECTIVES

- Have a basic understanding of the core concepts of computer graphics.
- Be capable of using OpenGL to create interactive computer graphics.
- Understand a typical graphics pipeline.

COURSE CONTENTS

UNIT -I: Overview of Computer graphics and open GL: 8 Hours

Basics of computer graphics, Application of Computer Graphics, Video Display Devices: Random Scan and Raster Scan displays, color CRT monitors, Flat panel displays. Raster-scan systems: video controller, raster scan Display processor, OpenGL: Introduction to OpenGL ,coordinate reference frames, specifying two-dimensional world coordinate reference frames in OpenGL, OpenGL point functions, OpenGL line functions, point attributes, line attributes, curve attributes, OpenGL point attribute functions, OpenGL line attribute functions, Line drawing algorithms(DDA, Bresenham's), circle and ellipse generation algorithms (Bresenham's).

UNIT -II : Open GL primitives and attributes 8 Hours

Fill-Area Primitives, Polygon Fill Areas, OpenGL polygon fill-Area Functions, OpenGL vertex arrays, Pixel-array primitives, OpenGL pixel-Array functions, Character primitives, OpenGL character functions, OpenGL display lists, OpenGL state variables, Color and Gray scale, OpenGL color functions.

UNIT - III: 2D and 3D Geometric Transformations **8 Hours**

Basic two-dimensional geometric transformations, Matrix representations and homogeneous coordinates, inverse transformations, Two-dimensional composite transformations, Other two-dimensional transformations, Raster methods for geometric transformations, OpenGL raster transformations, Transformations between two-dimensional coordinate systems, Geometric transformations in three-dimensional space, Three-dimensional translation, Three-dimensional rotation, Three-dimensional scaling, Composite three-dimensional transformations, other three-dimensional transformations, Transformations between three dimensional coordinate systems, Affine transformations, OpenGL geometric-transformation functions.

UNIT -VI: 2D and 3D viewing **8 Hours**

The Two-Dimensional viewing pipeline, The clipping window, Normalization and viewport transformations, Two-dimensional point clipping, Two –dimensional line clipping : Cohen-Sutherland line clipping, Liang-barsky line clipping, polygon fill-area clipping : Sutherland –Hodgeman polygon clipping, Text clipping, Overview of Three-dimensional viewing concepts, The three- dimensional viewing pipeline, Three- dimensional viewing co-ordinate parameters, Transformation from world to viewing co-ordinate, Projection Transformations, Orthogonal Projections-Axonometric and isometric orthogonal projections, Orthogonal projection co-ordinates, Clipping window and orthogonal-projections view volumes, Oblique parallel Projections-Oblique parallel Projections in drafting and design, Perspective Projections: Perspective- Projections Transformation co-ordinates, Perspective- Projections Equations: special cases, Vanishing points for Perspective Projections.

UNIT-5: illumination models and image processing **7 Hours**

3D scan conversion:- A-Buffer method, Scan-line method, Depth-sorting method, BSP-tree method, Light sources, Surface lighting effects, Basic illumination models, OpenGL menu functions, the RGB color model, the HSV color model, Image, filtering, Image processing, convention and computer assisted animation.

TEXT BOOKS

1. D. Hearn and M. Pauline Baker, Computer Graphics (C Version), Pearson Education, 3rd Edition, 2004.
2. J. D. Foley, A. Van Dam, S. K. Feiner and J. F. Hughes, Computer Graphics – Principles and Practice, Second Edition in C, Pearson Education, 2003.

REFERENCE BOOKS

1.Principles of Interactive computer graphics, second edition, William M Newman & Robert F.Sproull, McGraw-Hill International student edition.
2. D. F. Rogers and J. A. Adams, Mathematical Elements for Computer Graphics, 2nd Edition, McGraw-Hill International Edition, 1990.
3. F. S. Hill Jr., Computer Graphics using OpenGL, Pearson Education, 2003.

TEACHING METHODS

- Lecture using Black board and chalk
- Power point presentations
- Course Project Assignment

ASSESSMENT METHODS

Parameter	Marks
Three Internals (Average of best of two test)	30
Rubrics for the evaluation of Course Project component	10
Rubrics for the evaluation of Tool based learning	10
Total	**50**
Final Exam will be conducted for 100 marks (SEE)	

COURSE OUTCOMES (COs):

At the end of the course the student will be able to

COs	Description	Bloom's Level
CO 1	Explain the core concepts of computer graphics, including viewing, projection, perspective, modeling and transformation in two and three dimensions.	**L2**
CO 2	Apply the concepts of color models, lighting and shading models, textures, ray tracing, hidden surface elimination, anti-aliasing, and rendering.	**L3**
CO 3	Construct and apply 3D transforms including translation, rotation, scaling, shearing, and reflection	**L3**
CO 4	Identify algorithms and techniques to understand relationship between 2D and 3D	**L1**
CO 5	Create effective OpenGL programs to solve graphics programming issues.	**L6**

3: Strong, 2: Medium, 1: Weak ** H: Highly related S: Supportive

Mapping of Course outcomes (COs) to Program outcomes (POs*)& PSO **															
Course Outcomes mapping to Program Outcomes													PSOs		
POs COs	1	2	3	4	5	6	7	8	9	10	11	12	PSO1	PSO2	PSO3
CO1		2	3										2	3	2
CO2	2	2											3	3	2
CO3	2	2	3										2	3	2
CO4	2	2	3										2	3	2
CO5	2	3	2										2	3	2

Department: *Computer Science and Engineering*	***Course Type:*** *Programme Elective*
Course Title: *Information Security*	***Course Code:*** *18CSE532*
L-T-P: *9-0-0*	***Credits:*** *03*
Total Contact Hours: *39 Hours*	***Duration of SEE:*** *3 Hours*
SEE Marks: *50*	***CIE Marks:*** *50*

COURSE DESCRIPTION

This course covers the need for security against threats and attacks in the network. The security models, Intrusion detection and prevention systems are also discussed in the course.

PREREQUISITES

- Internetworking with TCP/IP
- Cryptography and Network Security

COURSE OBJECTIVES

- To study Information Security Models, threats and attacks.
- To study Intrusion Detection and Prevention models.
- To understand the implementation of Security Models.

COURSE CONTENTS

UNIT – I **8 Hours**

Introduction to Information Security: Introduction, The history of Information Security, what is security? Critical characteristics of Information, CNSS security model, security in the security systems development life cycle. **The need for security:** Threats and Attacks, deviations in quality of service, software attacks.

UNIT – II **8 Hours**

Planning for Security: Introduction, Information Security planning and governance, Information Security policy, standards and practices, the Information Security blueprint, security education, training and awareness program, contingency strategies.

UNIT – III **8 Hours**

Security Technology: Firewalls and VPNs: Introduction, Physical design, Firewalls, Protecting remote connections.

UNIT – IV **8 Hours**

Security Technology: Intrusion Detection and prevention systems, and other security tools- Introduction Detection and prevention Systems, Honey Pots, Honey nets and padded cell systems, scanning and analysis tools.

UNIT – V **7 Hours**

Implementing Information Security: Introduction, Project Management for information security, Technical and nontechnical aspects of implementation. Information Security Maintenance: Introduction, security management models, the maintenance model.

TEXT BOOKS

1. Principles of Information Security, 6th edition, Michael E Whittman, Herbert J Mattord, CENGAGE Learning, 2018

REFERENCE BOOKS

1. Cryptography and Network security: Behrouz A forouzan, TMH, 2007
2. Cryptography and Information Security: V. K.Pachghare, 2nd Edition, Kindle Edition 2015.

TEACHING METHODS

Lecture using presentations

Black board teaching

ASSESSMENT METHODS

Parameter	Marks
Three Internals (Average of best of two test)	30
Seminars on network tools	10
Case Study	10
Total	**50**
Final Exam will be conducted for 100 marks (SEE)	

COURSE OUTCOMES

CO	Description	Blooms level
CO 1	Understanding the critical characteristics of Information Security	L1
CO 2	Able to plan security and contingency strategies	L2
CO 3	Analyze the various security technologies like firewalls and VPNs	L3
CO 4	Analyze the various security technologies like Intrusion detection, honey pots, honey nets, padded cell systems, etc.	L3
CO 5	Implementing and maintaining Information security	L3

Mapping of Course outcomes (COs) to Program outcomes (POs*)& PSO **															
Course Outcomes mapping to Program Outcomes													PSOs		
POs COs	1	2	3	4	5	6	7	8	9	10	11	12	PSO1	PSO2	PSO3
CO1	3		3	2		3			3				3		
CO2		3		3			2						3		
CO3			3			2			3				3		
CO4				3			2				3		3		
CO5	3	3	3	3	3		3	3	3		3	3	3		

3: Strong, 2: Medium, 1: Weak ** H: Highly related S: Supportive

Department: *Computer Science & Engineering*	***Course Type**: Programme Elective*
***Course Title**:* Internet of Things	***Course Code**: 18CSE533*
***L-T-P:** 2-0-2*	***Credits**: 3*
***Total Contact Hours**: 40 Hours*	***Duration of SEE**: 3 Hours*
***SEE Marks**:50*	***CIE Marks**: 50*

❖ **Infosys approved syllabus**

The explosive growth of the "Internet of Things" is changing the current trends in the world and the rapid drop in price for typical IoT components is allowing people to innovate new designs and products. In this course, students will learn the importance of IoT in society, the current components of typical IoT devices and trends for the future. IoT design considerations, constraints and interfacing between the physical world and your device will also be covered. Addition, students will also learn how to make design trade-offs between hardware and software. This course will also cover key components of networking to ensure that students understand how to connect their device to the Internet.

PREREQUISITES

Students must have basic knowledge on microcontrollers. The students will be requiring to participating actively in creative thinking exercises and be willing to be innovative. Participate in open discussions is a must.

COURSE CONTENTS

UNIT – I Introduction to IoT **8 Hours**

Definition, Characteristics and Architecture of IoT, Physical Design of IoT – IoT Protocols (hardware protocols and software protocols), IoT communication models, IoT Communication APIs, **IoT enabled Technologies :** Wireless Sensor Networks, Cloud Computing, Big data analytics, Communication protocols, IoT Levels and Templates, **Domain Specific IoT's :** Home, City, Environment, Energy, Retail, Logistics, Agriculture, Industry, health and Lifestyle

UNIT – II The IoT Hardware **8 Hours**

Embedded Systems – Introduction, the basics of sensors and actuators, need for ADC & DAC peripherals. Introduction to Arduino, The Arduino UNO development board – architecture and specifications, the Arduino development environment, setting up the IDE, programming the Arduino, basic examples. Communication devices: Bluetooth, BLE, Wi-Fi (ESP8266), GSM, LPWAN (LoRa), LPPAN (6LoPAN, Zigbee). Introduction to RaspberryPi – the RaspberryPi architecture& Hardware overview, RaspberryPi as a gateway device.

UNIT – III The IoT Hardware **8 Hours**

Introduction to Python – Language features of Python, Data types, data structures, Control of flow, functions& loops, modules, packaging, file handling, data/time operations, classes, Exception handling.

UNIT – IV IoT Communication Protocols and Security **8 Hours**

Wired Communication Protocols: UART, I2C, SPI Wireless messaging and communication Protocols: MQTT, CoAP, XMPP, AMQP. Need for IoT security, Overview of Network security, Types of data encryption, data encryption at the node device, and data encryption at the gateway device.

UNIT – V The IoT Cloud and App **8 Hours**

Introduction to Cloud Storage models and communication APIs, Python web application framework, Introduction to NoSQL, IoT dashboard – monitoring and storing sensor data over the cloud. Webservers / Cloud for IoT: Case Studies of some IoT cloud services.

TEXT BOOKS

1. Internet of Things – A Hands-on Approach, ArshdeepBahga and Vijay Madisetti, Universities Press, 2015, ISBN: 9788173719547
2. Getting Started with Raspberry Pi, Matt Richardson & Shawn Wallace, O'Reilly (SPD), 2014, ISBN: 9789350239759

REFERENCES/WEBSITE

1. Designing the Internet of Things , Adrian McEwen & Hakim Cassimally, John Wiley & Sons, ISBN:9781118430620
2. Learning Internet of Things ,PeterWaher, PACKT publishingISBN:9781783553532
3. https://nptel.ac.in/course.php

Course Project: Each student will form a group with 1, but no more than 2, other classmates. The students will have to be able to develop a simple IoT system having a simple three-layer web application (web interface, functionality layer, persistence layer) in any computer language (PHP, Python, etc.) with any database (MySQL, noSQL, etc.) and Hardware(microcontroller/Arduino /Raspberry Pi +gateway).

COURSE DELIVERY METHODS

- Lecturer interspersed with discussion
- Course project
- Supporting laboratory assignments

ASSESSMENT METHODS

Parameter	Marks
Three Internals (Average of best of two test)	30
Rubrics for the course project	20
Total	**50**
Final Exam will be conducted for 100 marks (SEE)	

COURSE OUTCOMES

At the end of subject, the student will be able to:

COs	Description	Bloom’s level
CO 1	Demonstrate the fundamental concepts of the Internet of Things and Its Application and architecture models	**L3**
CO 2	Design the real time applications using Arduino Controller and Sensors	**L3**
CO 3	Apply the python programming concepts to create connection with the hardware Devices for IoTs	**L4**
CO 4	Illustrate the features of IoT Communication Protocols and Need for Security issues in the IoT applications	**L2**
CO 5	Develop an IoT system having a simple three-layer web application	**L3**

Mapping of Course outcomes (COs) to Program outcomes (POs*)& PSO **

Course Outcomes mapping to Program Outcomes													PSOs		
POs / COs	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**PSO1**	**PSO2**	**PSO3**
CO1	3												3		
CO2		2	3												3
CO3			3												3
CO4	3	2												3	
CO5	1	3	3	1					2	2	2	2	3		3

3: Strong, 2: Medium, 1: Weak ** H: Highly related S: Supportive

Department:Computer Science and Engineering	***Course Type:*** Programme Elective
Course Title: Advanced Java Programming	***Course Code:*** 18CSE534
L-T-P:2-0-2	***Credits:*** 03
Total Contact Hours: 39Hours	***Duration of SEE:*** 3 Hours
SEE Marks: 50	***CIE Marks:*** 50

COURSE DESCRIPTION

This course provides an in-depth knowledge of application development using advanced java as the programming language. It discusses advance java concepts and JSP.

PREREQUISITES

- Student should have prior basic knowledge of OOP Concepts and Java Programming
- Student should have basic knowledge of Database.

COURSE OBJECTIVES

- To understand the basic features of JSP.
- To acquire knowledge of implementing concepts of JSP custom tags and Expression language.
- To learn the fundamentals of Struts architecture framework.
- To acquire knowledge of Hibernate Architecture, implementing web application with Hibernate.

COURSE CONTENTS

UNIT -I **08 Hours**

JSP Basics: Introduction to JSP, Lifecycle of JSP, 9 Implicit Objects of JSP, Scripting Elements: Scriplet tag, expression tag, declaration tag, Directives: page, include, tag lib, Standard Actions: jsp:forward ,jsp:include,

UNIT -II **08 Hours**

Custom tags and Expression Languages in JSP: Custom tags: Example of java custom tag, attributes, iterations. Expression languages in JSP: Implicit Objects in EL, Reserve words in EL, EL param example, and JSTL (JSP Standard Tag Library), Advantages of JSTL, JSTL tags

UNIT -III **08 Hours**

Struts2 Framework: what are struts? Struts2 features, Struts2 components, struts2 architecture, example of struts2. Struts validation: input validation

UNIT -IV **08 Hours**

Hibernate: Introduction to Hibernate Architecture, Hibernate example, web Application with Hibernate, Persistence Object Life Cycle, Entity Relationship,

UNIT -V **07 Hours**

Hibernate ORM mappings: ORM-Mappings, Basic mapping. Association Mapping: 121, 12M, M21, M2M Unidirectional & Bidirectional. Queries: HQL, QBC, QBE, Caching.

TEXT BOOKS

1. Herbert Schildt, "Java – The Complete Reference", 9th Edition, 2014, McGrawHill, Oracle Press.
2. Spring and Hibernate by Santhosh Kumar Tata McGraw Hill.
3. Hans Bergsten, Java Server Pages, 3rd Edition, O'Reilly Publication, 2003.

REFERENCE BOOKS

1. Craig D. Knuckles and David S. Yuen, Web Applications: Concepts &Real World Design, John Wiley & Sons, Inc.
2. Robert W Sebesta , Programming world wide web, Sebesta, 6th edition ,Pearson,2010
3. Jim Keogh , "J2EE – The Complete Reference", 2007, Tata McGraw Hill.

TEACHING METHODS

- Black Board teaching
- Demonstrating every concept using Power Point Presentations
-

ASSESSMENT METHODS

Parameter	Marks
Three Internals (Average of best of two test)	30
Phase one project review	10
Phase two project review	10
Total	**50**
Final Exam will be conducted for 100 marks (SEE)	

COURSE OUTCOMES

At the end of the course student will be able to

COs	Description	Bloom's Level
CO 1	Describe JSP Application design using MVC and develop JSP Applications	**L1**
CO 2	Construct a Web application using Java Server Pages	**L3**
CO 3	Design web application using struts framework	**L3**
CO 4	Illustrate the concept of Hibernate use to implement the database application.	**L3**
CO 5	Understand the concept of ORM mappings and association mappings	**L2**

Mapping of Course outcomes (COs) to Program outcomes (POs*)& PSO **

	Course Outcomes mapping to Program Outcomes												PSOs		
POs / COs	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**PSO1**	**PSO2**	**PSO3**
CO1	2	3	3										3		
CO2	2	3	2										3		
CO3	2	3	3										3		
CO4	2	3	3		3								3	2	
CO5	2	2	3		3								3	2	

3: Strong, 2: Medium, 1: Weak ** H: Highly related S: Supportive

Department of Computer Science and Engineering

***Department**: Computer Science and Engineering*	***Course Type:** Programme Elective*
***Course Title**: Advanced Image Processing*	***Course Code:** 18CSE535*
***L-T-P:**3-0-0*	***Credits:** 03*
***Total Contact Hours:** 40 Hours*	***Duration of SEE:** 3 Hours*
***SEE Marks**: 50*	***CIE Marks:** 50*

COURSE DESCRIPTION

Introduction to theories, algorithms, and practical solutions of digital image perception, Enhancement, Morphological Image Processing, Compression, Registration, Color Fundamentals and 3D Images

PREREQUISITES

Fundamental Knowledge of Mathematics.

COURSE OBJECTIVES

This course will enable students to

- Explain image fundamentals and mathematical transforms necessary for image processing and to study the image enhancement techniques.
- Demonstrate different edge detection and segmentation methods
- Study of various image compression methods
- Understand image registration techniques and various color models.
- Understanding 3D Images

COURSE CONTENTS

UNIT - I **8 Hours**

Introduction, Human and Computer Vision, The human vision system, Computer Vision systems, Image formation, Sampling and Quantization, Image Enhancement in Spatial Domain: Intensity Transformation and Spatial Filtering, Histogram Based Image Enhancement: Histogram Equalization

UNIT II **6 Hour**

Morphological Image Processing: Preliminaries, Dilation and Erosion, Opening and Closing, The Hit-or-Miss Transformation, Some Basic Morphological Algorithms. Image Segmentation: Detection of Discontinuities, Edge Linking and Boundary Detection, Thresholding, Segmentation Methods

UNIT - III **8 Hours**

Image Compression: Introduction, Error Criterion, Lossy Compression, Transform Domain Compression, JPEG Compression, Vector Quantization Compression, Lossless Compression-Huffman Coding, Arithmetic Coding, Transformed Coding, Run length coding, Block coding, Quad tree coding, Other Methods

UNIT IV **10 Hours**

Image Registration:Introduction, Geometric Transformation, Registration by Mutual Information Maximization, Stereo Imaging, Other Methods, Color Fundamentals: Color Models, Pseudocolor Image Processing, Basics of Full Color Image Processing, Color Transformations, Smoothing and Sharpening, Color Segmentation, Noise in Color Images, Color Image Compression.

UNIT V **8 Hours**

Sources of 3D Data sets, Slicing the Data set, Arbitrary section planes, The use of color, Volumetric display, Stereo Viewing, Ray tracing, Reflection, Surfaces, Multiply connected surfaces, Image processing in 3D, Measurements on 3D images.

TEXT BOOKS

1. Rafel C Gonzalez and Richard E Woods, "Digital Image Processing'', Pearson Education, 3rd Edition, 2009.
2. B. Chanda, D Dutta Majumder, "Digital Image Processing and Analysis'', Prentice-Hall, India, 2002
3. ArdeshirGoshtaby, "2D and 3D Image registration for Medical, Remote Sensing and Industrial Applications", John Wiley and Sons, 2005.

REFERENCE BOOKS

1. John C. Russ, "The Image Processing Handbook", CRC Press, 2007.
2. Anil K. Jain, "Fundamentals of Digital Image Processing", Pearson Education, Inc., 2002.

TEACHING METHODOLOGY

- Lectures
- Power Point Presentation
- Case Study

ASSESSMENT METHODS

Parameter	Marks
Three Internals (Average of best of two test)	30
Programming Assignment	10
Case Study	10
Total	**50**
Final Exam will be conducted for 100 marks (SEE)	

COURSE OUTCOMES

- After completion of the course, the students will be able to:

CO	DESCRIPTION	Blooms Level
CO1	Apply and analyse the Image Enhancement and Filtering Algorithms for specific applications	**L3,L4**
CO2	Derive mathematical model for different edge detection and will be able to apply different edge models	**L3**
CO3	Apply and analyse the Image segmentation methods	**L3,L4**
CO4	Understand different Image Compression Methods	**L2**
CO5	Understand and apply various Image Compression Methods	**L2,L3**

Mapping of Course outcomes (COs) to Program outcomes (POs*)& PSO **															
Course Outcomes mapping to Program Outcomes													**PSOs**		
POs / COs	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**PSO1**	**PSO2**	**PSO3**
CO1	3	2	2		2								2	2	
CO2	3	2	2		2								2	2	
CO3	3	2	2		2								2	2	
CO4	3	2	2		2								2	2	
CO5	3	2	2		2					2	1	1	2	2	1

3: Strong, 2: Medium, 1: Weak ** H: Highly related S: Supportive

Department: *Computer Science and Engineering*	**Course Type:** *Programme Elective*
Course Title: *Advanced Web Programming-1*	**Course Code:** *18CSE536*
L-T-P:*2-0-2*	**Credits:***03*
Total Contact Hours: *39 Hours*	**Duration of SEE***: 3 Hours*
SEE Marks: *50*	**CIE Marks:** *50*

COURSE DESCRIPTION

The focus in this course is on the Advance Web concepts as a platform for interactive applications. The development of web-based applications requires knowledge about the underlying technology and the formats and standards the web is based upon. This course includes advance concepts like Node.JS and vue.js.

PREREQUISITES

- Student should have prior knowledge of HTML tags and Cascading Style sheets.
- Students should be able to develop a dynamic webpage by the use of Java Script and server side scripts using PHP and Angular js .
- Student should know how to connect the scripting language with database.

COURSE OBJECTIVES

- To learn the fundamentals of Node.js as well as a pragmatic approach to making web applications.
- To learn the concepts of vue.js which is current scripting programming in developing front end applications

COURSE CONTENTS

UNIT -I **08 Hours**

NODE.JS

Introduction to Node.js, Getting Started with Node.js, Using Events, Listeners, Timers, and Call backs in Node.js, Handling Data I/O in Node.js, Accessing the File System from Node.js, Implementing HTTP Services in Node.js,

UNIT -II **08 Hours**

NODE.JS with MongoDB Implementing Socket Services in Node.js. Scaling Applications Using Multiple Processors in Node.js, Getting Started with MongoDB and Node.js, Manipulating MongoDB Documents from Node.js, Accessing MongoDB from Node.js, Building web application using Node.js and Mongo DB.

UNIT –III **08 Hours**

vue.js

Introduction toVue.js, first basic examples, Fundamentals: Installing and Using, explains the behind the scenes of Vue.js, provides theoretical insights in to the architectural pattern, touches nearly all the main Vue.js concepts, Components of vue.js: Understanding and Using , goes deep into components and explains how to rewrite applications using a simple component system and single-file components

UNIT -IV **08 Hours**

vue.js

Reactivity–Binding Data to You Application, contains a detailed explanations other usage of data binding mechanisms in Vue.js, Vuex–Managing State in Your Application, contains detailed introduction to Vuex, a state management system or Vue.js, and explains how to use it in your application in order to achieve a nice, maintainable architecture.

UNIT -V **0 7 Hours**

vue.js Deploying–Time to GoLive!, show to bring your Vue application to the world ,guarantee in gits quality with continuous integration tools. It explains how to connect a GitHub repository to the Travis continuous integration system and to the Heroku cloud deployment platform, Solutions to Exercises

TEXT BOOKS

1. Brad Dayley, Brendan Dayley, Caleb Dayley, "Node.js, MongoDB and Angular Web Development" , 2nd Edition, Addison Wesley publications, 2018.
2. "Learning vue.js 2" Learn how to build amazing and complex reactive web applications by Packt Publishing Ltd 2016.

REFERENCE BOOKS

1. M.Dietel, P. Jdeital, A.B. GoldBerg, "Internet & World Wide Web How to Program", 5th Edition, Pearson Education, 2009.
2. "Learning vue.js" free unaffiliated eBook created from stack overflow contributers.
3. "pro react 16" by Adam freeman published by Apress

Other Sources

- W3Schools online Web Tutorials. Available online: https://www.w3schools.com
- Web Development Technologies Tutorials. Available online: https://www.tutorialspoint.com/vuejs/index.htm

TEACHING METHODS

- Lecture (Power Point presentations/ Black board teaching (if needed))
- Regular review of students by asking questions based on topics covered in the class Programming Assignments

ASSESSMENT METHODS

Parameter	Marks
Three Internals (Average of best of two test)	30
Rubrics evaluation for the Course Project	10
Programming Assignment	10
Total	**50**
Final Exam will be conducted for 100 marks (SEE)	

COURSE OUTCOMES

At the end of the course student will be able to

COs	Description	Bloom's Level
CO 1	Describe the fundamentals of Node.js as well as a pragmatic approach to making web applications.	**L1**
CO 2	Build a web Application using Node.js and MongoDB.	**L3**
CO 3	Apply the basic concepts of vue.js with basic Applications and components of vue.js	**L3**
CO 4	Understand the concepts of reactivity to bind the data to applications.	**L2**
CO 5	Develop the Applications and solutions to exercises.	**L3**

Mapping of Course outcomes (COs) to Program outcomes (POs*)& PSO **

	Course Outcomes mapping to Program Outcomes												PSOs		
POs / COs	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**PSO1**	**PSO2**	**PSO3**
CO1	3	2	2		2								2	2	
CO2	3	2	2		2								2	2	
CO3	3	2	2		2								2	2	
CO4	3	2	2		2								2	2	
CO5	3	2	2		2					2	1	1	2	2	1

3: Strong, 2: Medium, 1: Weak ** H: Highly related S: Supportive

Department: *Computer Science and Engineering*	***Course Type:*** *Programme Elective*
Course Title: *Linux Administration Programming*	***Course Code:*** *18CSE537*
L-T-P:3-0-0	***Credits:***03
Total Contact Hours:39 Hours	***Duration of SEE:***3 Hours
SEE Marks: 50	***CIE Marks:***50

COURSE DESCRIPTION

The Unix/Linux System Administration course is designed to give experienced Unix/Linux users the skills and knowledge needed to be qualified system administrators. The course is presented in the Linux environment, however, examples from other versions of Unix are given throughout the course. The basic ideas and concepts encountered in this course are the same for all flavors of Unix. Participants are introduced to the key procedures of system booting and shutdown, maintaining file systems, backing up the system, maintaining printers, handling software updates, using and configuring NIS, NFS, and more. Hands-on exercises will allow you to experience and solve problems in a learning environment

PREREQUISITES

- Basic knowledge of Linux, including installing Linux and using the command line is helpful but not required.

COURSE OBJECTIVES

- Installing the Linux operating system, configuring peripherals and controlling startup and shutdown processes. Configuring systems for accessing networking services and taking backup and maintaining the data backups.

COURSE CONTENTS

UNIT I **10 Hours**

Introduction, Installation, and Software Management: Technical Summary of Linux Distributions Installing Linux in a Server Configuration - Hardware and Environmental Considerations Server Design Uptime Methods of Installation, Installing Ubuntu Server, Managing Software -The Debian Package Management System apt Software Management in Ubuntu Querying for Information Installing Software in Ubuntu Removing Software in Ubuntu.

UNIT II 07 **Hours**

Single-Host Administration, Managing Users and Groups-user management tools, Pluggable Authentication Modules(PAM).The Command Line, Booting and Shutting Down – bootloader, init process,rc script, enabling and disabling services, File Systems-the makeup of FS, managing disk. Core System Services, The Linux Kernel.

UNIT III **07 Hours**

Networking and Security, TCP/IP for System Administrators, Network Configuration-modules and network configuration, managing routes, a simple router, Linux Firewall (Netfilter), Local Security-sources of risk, picking the right run-level, limited resources, monitoring your system.

UNIT IV **07 Hours**

Internet Services – Domain Naming Services (DNS), File Transfer Protocol (FTP), Apache Web Server (HTTP Server), Simple Mail Transfer Protocol (SMTP), Post Office Protocol (POP) and IMAP, The Secure Shell (SSH).

UNIT V **07 Hours**

Intranet Services - Network File System (NFS), Samba, Distributed File Systems, Network Information Service LDAP, DHCP, Virtualization, Backups.

TEXT BOOKS

1. Linux Administration A Beginner's Guide: Wale Soyinka, 6th edition, MC Graw Hill, 2017

REFERENCES

1. Eleen Frisch, Essential System Administration: Tools and Techniques for Linux and Unix Administration, 3rd Edition, O’Reilly, 2015.
2. Thomas A. Limoncelli, Christina J. Hogan, Strata R. Chalup, The Practice of System and Network Administration, Second Edition, Addison -wesley, Febrary 2012.

TEACHING METHODS

- PPTs
- Hands-on Sessions Based Teaching

ASSESSMENT METHODS

Parameter	Marks
Three Internals (Average of best of two test)	30
Rubrics evaluation for the Course Project	10
Programming Assignment	10
Total	**50**
Final Exam will be conducted for 100 marks (SEE)	

COURSE OUTCOMES

At the end of the course student will be able to:

COs	Description	Bloom's Level
CO 1	Installing the Linux operating system and configuring peripherals	**L3**
CO 2	Performing and modifying startup and shutdown processes	**L3**
CO 3	Configuring and maintaining basic networking services	**L2**
CO 4	Creating and maintaining system users and groups	**L3**
CO 5	Understanding and administering file permissions on directories/regular files	**L2**

3: Strong, 2: Medium, 1: Weak ** H: Highly related S: Supportive

Mapping of Course outcomes (COs) to Program outcomes (POs*)& PSO **															
Course Outcomes mapping to Program Outcomes													**PSOs**		
POs / COs	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**PSO1**	**PSO2**	**PSO3**
CO1	2	3		2	2								3	2	
CO2	2	3		2	2	2							2	3	
CO3	2	2	3	3	3	2							2	3	
CO4	2	3	3	3	2	2							2	3	
CO5	2	3	3	3	2	3						2	3	3	

Course Content for VI - Semester of 2018 Scheme

Department: *Computer Science and Engineering*	***Course Type:*** *Programme Core*
Course Title: *Big Data technologies*	***Course Code:****18CS61*
L-T-P: *4-0-0*	***Credits:*** *4*
Total Contact Hours: 52 Hours	***Duration of SEE:*** *3 Hours*
SEE Marks: *50*	***CIE Marks:*** *50*

COURSE DESCRIPTION

This course provides knowledge on definitions of big data and big data analytics, comparison of conventional data warehouse and big data environment, big data frame works like Hadoop and SPARK frame works, data storage mechanisms for big data.

PREREQUISITES

- Students should have the knowledge of Distributed Systems and Parallel Processing
- Students should have knowledge object oriented and functional programming.

COURSE OBJECTIVES

- Understand the data and categories of the data.
- Understand the data analytic techniques.
- Study the big data framework Hadoop and SPARK
- Analyze the difference between Hadoop and SPARK environments
- Study the NOSQL databases.

COURSE CONTENTS

UNIT -I **10 Hours**

Introduction to Big Data: Types of Digital Data, **Introduction to Big Data**: Characteristics, Evolution, Definition, Challenges, What is Big Data, Other Characteristics, Why Big data, Significance of Big Data, Traditional BI versus Big Data, Data warehouse environment versus Hadoop Environment, Trends in Big data, **Big Data Analytics**: Introduction to Big Data Analytics, Classification of Analytics, Importance of Big Data Analytics, Technologies for Big data, Data Science, Data Scientist, Terminologies Used.

UNIT -II **12 Hours**

Hadoop / Spark /HDFS Overview, Introduction to Scala: Hadoop Over view: Features, Key advantages, Versions, Distributions, Overview of Hadoop Ecosystem, Why Hadoop, why not RDBMS, **HDFS**: Hadoop Distributed File System (HDFS), HDFS Daemons, File Read, File Write, Replica Placement Strategy, HDFS commands, Special features of HDFS & its limitations

Spark Overview: Spark Ecosystems, Advantages of Spark

Scala: Scala Overview, Vals and Variables, basic types, operators, control structures, functions, maps, tuples, Collections - Mappings, Iterators, comprehensions, classes, objects, pattern matching. Functions as a parameter.

UNIT -III **10Hours**

Spark Core: Spark Standalone application, Running on Cluster, Programming with RDD's: Basics, RDD operations, Lineage Graphs, Lazy evaluation, Persistence, Immutability, Fault Tolerance, Performance (Pipelining, Shuffle). Pair RDD's: Transformations and Actions, Partitioning, Accumulators, Broadcast Variables.

UNIT -IV **10Hours**

Spark SQL: Rows, Data frames, Tables and SQL operations on Tables. SparkSession, Creating Data Frame, Parquet files, working with Hive.

Spark Streaming: Introduction to Stream Processing, Architecture of Spark Streaming, Caching and Persistence, Check pointing, Fault tolerance, Structured Streaming-Output Modes, Output sinks, Failure recovery and check pointing

UNIT -V **10Hours**

NoSQL: Definition, Types of NoSQL Databases, Why NoSQL?, Advantages of NoSQL, NoSQL Vendors, Comparison of SQL, NoSQL & NewSQL, comparison with RDBMS.

Introduction to Hive: History of Hive and Recent Releases of Hive, Hive Features, Hive Integration and Workflow, Hive Data Units, Hive Architecture, Hive Data Types, Hive File Format, HiveQuery Language, DDL (Data Definition Language) Statements, DML (Data Manipulation Language) Statements, RC file implementation, SerDe, User-Defined Function.

TEXT BOOKS

1. Seema Acharya and Subhashini C, Big Data and Analytics, Wiley India, 2015 (Chapter 1,2,3,5,9)
2. Muhammad Asif Abbasi, Learning Apache Spark 2, Packt Publishing, 2017 (Chapter 1,2,3,4,5)
3. Cay S. Horstmann, Scala for the Impatient 2nd Edition (Chapter 1to 6, 12 to 14)
4. Andy Konwinski, Holden Karau, MateiZaharia, Patrick Wendell, Learning Spark Lightning-Fast Big Data Analysis, O'Reilly, 2015 (Chapter 1, 2, 3, 4, 6, 7, 8, 9, 10)
5. Tom White, Hadoop: The Definitive Guide, O'Reilly, 2015

DELIVERYMETHODS

- Black board teaching
- Lectures using presentations
- Assignments

ASSESSMENT METHODS

Parameters	Marks
Midterm Test (Avg. of 2 Tests)	30
Case Study	10
Self-Study	10
Total	**50**
Final Exam will be conducted for 100 marks (SEE)	

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COURSE OUTCOMES:

At the end of the course student will be able to

COs	Description	Bloom's Level
CO 1	Understand the big data, big data analytics, big data processing requirements.	**L1**
CO 2	Compare the Hadoop and SPARK framework for big data.	**L2**
CO 3	Illustrate the programming model in scala using basic data types, functions, objects, classes.	**L3**
CO 4	Apply the Knowledge of RDDs, Dataframes to develop SPARK applications.	**L3**
CO 5	Analyze the big data framework used in industry	**L4**

Mapping of Course outcomes (COs) to Program outcomes (POs*)& PSO **

Course Outcomes mapping to Program Outcomes													PSOs		
POs / COs	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**PSO1**	**PSO2**	**PSO3**
CO1	3	3	3										3		
CO2				3	3								3		
CO3															
CO4	3	3	3										3		
CO5				3	3								3	1	

3: Strong, 2: Medium, 1: Weak ** H: Highly related S: Supportive

Department: *Computer Science and Engineering*	***Course Type:*** *Programme Core*
Course Title: *Cryptography and Network Security*	***Course Code:****18CS62*
L-T-P:*4-0-0*	***Credits:*** *4*
Total Contact Hours: *52 Hours*	***Duration of SEE:*** *3 Hours*
SEE Marks*: 50*	***CIE Marks:*** *50*

COURSE DESCRIPTION

This course provides an in-depth knowledge of definitions of cryptography and network security, conventional cryptographic algorithms, block cipher cryptosystems, public cryptosystems, key management systems, authentication techniques to provide secure communication.

PREREQUISITES

- Students should have the knowledge of Computer Networks
- Students should have knowledge of Mathematics and Algorithm Concepts.

COURSE OBJECTIVES

- Understand the basic concepts of cryptography and network security and classify attacks on a network.
- Understand and analyze the different process for hiding the information with conventional cryptographic algorithms.
- Understand various block cipher cryptosystems
- Analyze public cryptosystems and key management Systems
- Understand and apply authentication techniques to provide secure communication

COURSE CONTENTS

UNIT - I **10 Hours**

Introduction: Service mechanisms and attacks, The OSI security architecture, A Model for Network Security. Symmetric Ciphers: Symmetric cipher model, substitution techniques.

UNIT - II **10 Hours**

Symmetric Ciphers: Transposition techniques, Steganography. Block Ciphers and DES : Simplified DES. Block cipher principles, DES, Strength of DES, Block cipher design principles.

UNIT -III **12 Hours**

Block cipher modes of operation. AES Cipher-Substitute Bytes Transformation, Shift Row Transformation, Mix Column Transformation, Add Round Key Transformation, AES key expansion.

UNIT - IV **10 Hours**

Public key cryptography and RSA: Principles of public key cryptosystems, RSA algorithm. Other public key cryptosystems and key management: key management, Diffie-Hellman key exchange. Elliptic Curve Cryptography.

UNIT -V **10 Hours**

Network Security Applications: Authentication Applications: Kerberos, X.509 Authentication Service. Electronic Mail Security: PGP.

SELF STUDY:

Prime Numbers, Fermat's and Euler's Theorem, Testing for Primality, Chinese Reminder Theorem, Discrete Logarithms, Knapsack Cryptosystem, Rabin Cryptosystem, Elgamal Cryptosystem.

Self-Study Evaluation:

1. The Topics are integral part of the course.
2. No formal Lectures will be held for the self-study topics
3. The topics prescribed for the self-study are the part of Learning Assessment-2 (LA2)

TEXT BOOKS

1. Cryptography and Network Security: William Stallings, Pearson Education, 2003
2. Behrouz A Forouzan, Debdeep Mukhopadhyay: Cryptography and Network Security, 2nd Edition, Special Indian edition, Tata McGraw-Hill, 2011.

REFERENCE BOOKS/WEBSITE

1. Cryptography and Network Security, Atul Kahate, TMH, 2003
2. https://nptel.ac.in/course.php

TEACHING METHODS

- Black Board Teaching
- Lectures using presentations
- Videos

ASSESSMENT METHODS

Parameters	Marks
Midterm Test (Avg. of 2 Tests)	30
Programming Assignment	10
Seminar on Self Study syllabus	10
Total	**50**
Final Exam will be conducted for 100 marks (SEE)	

COURSE OUTCOMES

At the end of the course student will be able to

COs	Description	Bloom's Level
CO 1	Understand the basic concepts of cryptography and network security and classify attacks on a network, symmetric ciphers and substitution techniques.	L2
CO 2	Understand and Analyze the different process for hiding the information with conventional cryptographic algorithms, transposition techniques and block ciphers.	L2,L4
CO 3	Illustrate the various block cipher cryptosystems like DES and AES.	L3
CO 4	Analyze public cryptosystems and key management Systems	L4
CO 5	Understand and analyze authentication techniques to provide secure communication.	L2, L4

Mapping of Course outcomes (COs) to Program outcomes (POs*)& PSO **

Course Outcomes mapping to Program Outcomes													PSOs		
POs / COs	1	2	3	4	5	6	7	8	9	10	11	12	PSO1	PSO2	PSO3
CO1	3	3											3		
CO2	3	3	2										3		
CO3	3	3											3		
CO4	3		2										3		
CO5	3													2	

3: Strong, 2: Medium, 1: Weak ** H: Highly related S: Supportive

Department: *Computer Science and Engineering*	***Course Type:*** *Programme Core*
Course Title: *Software Project Management and Finance*	***Course Code:****18CS63*
L-T-P: *3-0-0*	***Credits:*** *03*
Total Contact Hours: *39Hours*	***Duration of SEE:*** *3 Hours*
SEE Marks: *50*	***CIE Marks:*** *50*

COURSE DESCRIPTION

This Course covers the fundamentals of Software Development methodologies, Modern Software Project Management and Software Project Cost Estimation Techniques.

PREREQUISITES

- Knowledge of Software Engineering and basic Programming.

COURSE OBJECTIVES

- To introduce Software development Methodologies.
- To understand the project cost estimation.
- To understand the concept of Software Quality and Process.

COURSE CONTENTS

UNIT -I **8 Hours**

Introduction to Software Project Management, Project Evaluation and Programme Management, Overview of Project Planning

UNIT -– II **8 Hours**

Software Development Methodologies The old way and the new: The principles of conventional software engineering, principles of modern software management, transitioning to an iterative process. Life cycle phases. Software Effort Estimation.

UNIT -III **8 Hours**

Activity planning. Risk Assessment, Resource Allocation

UNIT - IV **8 Hours**

Flows of the process: Software process workflows, Inter-trans workflows. Checkpoints of the Process:

Major Mile Stones, Minor Milestones, Periodic status assessments. Interactive process Planning: Work breakdown structures, planning guidelines, Interaction planning process, Pragmatic planning. Managing People.

UNIT -V **7 Hours**

Managing Teams; Software Quality, Closure of Projects; Process Automation: Automation Building Blocks

TEXT BOOK

1. Bob Hughes, Mike Cotterel, Rajib Mall: Software Project Management, Sixth Edition; McGraw Hill, 2005.

REFERENCE BOOK

1. Walker Royce: Software Project Management, Pearson Education, 2005.

TEACHING METHODS

1. Lecture using Black board and chalk
2. PowerPoint presentations (if needed)
3. Regular review of students by asking questions based on topics covered in the class

ASSESSMENTMETHODS

Parameters	Marks
Midterm Test (Avg. of 2 Tests)	30
Case study	10
Tool Based Learning	10
Total	**50**
Final Exam will be conducted for 100 marks (SEE)	

COURSE OUTCOMES

At the end of the course student will be able to

COs	Description	Bloom's Level
CO 1	Describe the roles and responsibilities by PM process group (initiating, planning, and executing controlling, closing).	L1
CO 2	Articulate the purpose and benefits of project management (PM).	L3
CO 3	Explain quality management and process improvement in the context of software development projects.	L2
CO 4	Work in groups to analyze a project and implement a solution	L4
CO 5	Understand how projects are managed and implemented in real time scenario	L2

Mapping of Course outcomes (COs) to Program outcomes (POs*)& PSO **															
Course Outcomes mapping to Program Outcomes													PSOs		
POs / COs	1	2	3	4	5	6	7	8	9	10	11	12	PSO1	PSO2	PSO3
CO1	2	3											3		
CO2	2	2												2	
CO3	3	3	3		3			1	2	2	2	1			3
CO4	2	2	2	2	2				3			2			3
CO5	2	2			3			2	2	2	2			2	

3: Strong, 2: Medium, 1: Weak ** H: Highly related S: Supportive

Department: *Computer Science and Engineering*	***Course Type:*** *Programme Core*
Course Title: *Big Data Technologies Laboratory*	***Course Code:****18CSL66*
L-T-P:*0-0-2*	***Credits:****1*
Total Contact Hours:*36 Hours*	***Duration of SEE:****3Hours*
SEE Marks: *50*	***CIE Marks:****50*

COURSE DESCRIPTION

In this course you will learn how to program in R and how to use R for effective data analysis and will learn scala and Spark to drive better business decisions and solve real-world problems.

PREREQUISITES

- Basics of Java (preferred), Python or another object-oriented language.

COURSE OBJECTIVES

At the end of the course students will be able to

1. Get a solid understanding of the fundamentals of the language, the tooling, and the development process.
2. Tackle data analysis problems involving Big Data, Scala and Spark.
3. Design and write efficient programs using R to perform routine and specialized data manipulation/management and analysis tasks.
4. Document, share, and collaborate on code development using a suite of Open Source standards and tools.
5. Develop a good application of more advanced features.

LAB EXERCISES

Part A

Implement the following exercises using R

1. **a.** Create three different variables, one that is numeric type and other two are vector of characters. Use these to create data frame of student.(USN, Name, Marks)
   b. Add a new numeric data column to the existing data frame (Age). Provide summary of the data
   c. Display the list of students whose Age is less than 20 and Marks greater than 25.
2. Write a program to create the csv file for storing Employee data, containing the fields (EmpID, EmpName, DOJ,Dept, Desig.)

- **a.** Read the suitable number of employee details from the user.
- **b.** Create a dataframe of Employee
- **c.** Store the dataframe in the csv file
- **d.** Read the data from csv and Display the contents
- **e.** Append a new row into the csv file

3. Exploring Dataset

- **a.** List the data set available in your system using suitable command
- **b.** Select “mtcars” data set, find and display the number of rows and columns in that data set
- **c.** Find are there more automatic (0) *or* manual (1) transmission-type cars in the dataset?
  Hint: 9th column indicates the transmission type
- **d.** Get a scatter plot of ‘hp’ vs ‘weight’.
- **e.** Change ‘am’, ‘cyl’ and ‘vs’ to *integer* and store the new dataset as ‘newmtc’.
- **f.** Extract the cases where cylinder is less than 5

4. Consider “Airquality” dataset

- **a.** Display the dimension ofthe dataset
- **b.** Display the class of each fields in the data set
- **c.** Test the missing values
- **d.** Recode the missing values, as mean ofthe column values
- **e.** Exclude the missing values

Implement the following exercises using Scala

5. Write a program that reads words from a file. Use a mutable map to count how often each word appears.

6. Write a function minmax (values: Array[Int]) that returns a pair containing thesmallest and largest values in the array.

7. Write the menu driven program to implement quick sort algorithm using imperative style and functional style.

8. Write the program to illustrate the use of pattern matching in scala, for the following Matching on case classes. Define two case classes as below:

abstractclassNotification
caseclassEmail(sender: **String**, title: **String**, body: **String**) **extendsNotification**
caseclassSMS(caller: **String**, message: **String**) **extendsNotification**

Define a function showNotification which takes as a parameter the abstract type Notification and matches on the type of Notification (i.e. it figures out whether it’s an Email or SMS).
In the case it’s an Email(email, title, _) return the string: s"You got an email from $email with title: $title“
In the case it’s an SMS return the String: s"You got an SMS from $number! Message: $message“

Part B

Implement the following exercises using Spark

9. WordCount: Here the goal is to count how many times each word appears in a file and write out a list ofwords whose count is strictly greater than 4.

Use the file log.txt accompanying this assignment to count the words.Save the wordcounts in text form in the "wordcountsDir" using the saveAsTextFile RDD method.Examine the contents ofthe above directory, andthe contents ofthe files ofthe directory.

10. Tweet Mining: A dataset with the 8198 reduced tweets, reduced-tweets.json will be provided.The data contains reduced tweets as in the sample below:

```
{"id":"572692378957430785",
"user":"Srkian_nishu :)",
"text":"@always_nidhi @YouTube no idnt understand bti loved of this mve is rocking",
"place":"Orissa",
"country":"India"}
```

A function to parse the tweets into an RDD will be provided. The task is to print the top 10 tweeters.

Self Demonstartion of the below programs

1. IPLTossWinStats: You will be provided with a dataset from the Indian Premier League containing the following files:
   Ball_by_Ball.csv, Match.csv, Player.csv, Player_Match.csv, Season.csv, Team.csv.
   We want to find the percentage of game wins by teams which win the toss.Solets say N games have been played. Let us say there are M games where the team which has won the toss has also won the game. So we are looking for the percentage (M * 100 / N).Perform the task using SQL code only.
2. Streaming Rainfall Averages: Consider the scenario that there are three weather stations in Bangalore which report the rainfall at the respective locations once every 15 minutes. You have to write a Spark Streaming application which will gather the rainfall data from the three stations and print the average rainfall, also once every 15 minutes.
   You will be provided with a scala program, generate Events, which can simulate generation of the rainfall data from the three stations in JSON format as shown below to a folder:{"Creation_Time": 1.536335939694000013E18,"Station": "Bengaluru-1","Rainfall": 100.0} Write a Spark streaming application which reads the files written to the above folder and updates the average rainfall value every 15 minutes and prints the averages to the console.

ASSESSMET METHODS:

Parameters	Marks
Experiment Write up + Execution + Viva	15
Lab Record Writing	10
Lab Internals Test	15
Total	**50**
Final Exam will be conducted for 100 marks (SEE)	

COURSE OUTCOMES

At the end of the course student will be able to

COs	Description	Bloom's Level
CO 1	Apply the concept of R programming for cleansing, imputation, and computation of simple statistical measures on the data.	**L3**
CO 2	Understand the basics of Scala for data analysis.	**L2**
CO 3	Design a Spark code for basic data manipulation and aggregate analysis.	**L4**
CO 4	Implement real time application such as word count, data mining into a set of distributed computations and implement the same in Spark using Scala.	**L3**
CO 5	Implement analytics on higher level data objects like Tables using Spark SQL and analytics on Streaming datasets using Spark Streaming.	**L3**

Mapping of Course outcomes (COs) to Program outcomes (POs*)& PSO **

	Course Outcomes mapping to Program Outcomes												**PSOs**		
POs / COs	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**PSO1**	**PSO2**	**PSO3**
CO1	3	2											2		
CO2	3	3	1			2	2							2	
CO3	3	3	2		2									2	
CO4	3	3	2	3	2									2	
CO5	3	3	3		3	2									2

3: Strong, 2: Medium, 1: Weak ** H: Highly related S: Supportive

Department: *Computer Science and Engineering*	***Course Type:*** *Programme Core*
Course Title: *Mobile Application Development*	***Course Code:***18CSL67
L-T-P:0-0-4	***Credits:*** *2*
Total Contact Hours: *36 Hours*	***Duration of SEE:*** *3 Hours*
SEE Marks: *50*	***CIE Marks:*** *50*

COURSE DESCRIPTION

This laboratory introduces students with Android programming concepts and provides knowledge to create android apps.

PREREQUISITES

- Students should have knowledge on any programming language.

COURSE OBJECTIVES

- To introduce Android platform and its architecture.
- To learn activity creation and Android UI designing.
- To be familiarized with Intent, Broadcast receivers and Internet services.
- To work with SQLite Database and content providers.
- To integrate multimedia, camera and Location based services in Android Application. To explore Mobile security issues.

LAB EXERCISES

PART – A

1. In this lab we will be learning how to use and extend the Android user interface library.
   a. Views, View Groups, Layouts, and Widgets are and how they relate to each other.
   b. How to declare and reference resources in code.
   c. How to navigate between multiple activities.
   d. How to share the data between the activities.
   e. Explore life-cycle methods of an activity.
   f. How to use Events and Event Listeners.
   g. How to create Toast Notifications.
2. You will expand on your knowledge of the Android user interface library.
   a. How to declare layouts statically as an xml resource.
   b. How to create custom Views from scratch to suit a specific need.
   c. How to create Options and Context Menus.

d. How to use List Adapter and Array Adapter to bind data source to a List View.
e. How to create Alert Dialog and progress Dialog in your activity.

3. You will be persisting data using a SQLite Database and preserving the state of an application during its lifecycle.
   a. How to save & restore data as Application Preferences (Shared Preference).
   b. How to save & restore data as Instance State.
   c. How to create and manage a SQLite Database in Android.
   d. How to insert, update, remove, and retrieve data from a SQLite Database.
   e. Display data using Recycler View.
4. Develop an app to capture a photo and store it into SDCard, extend this app to display all the photos capture in the grid view.
   a. How to use the Camera.
   b. How to write data to the SD card.
5. Create an application to demonstrate few key features of the Android framework. In particular, the application demonstrates how to send SMS text messages.
   a. How to send SMS text messages.
   b. How to dial using an in-built dialer
   c. How to send email.
6. Develop an app that include broadcast Receiver to receive the miss calls from the Known number and display it to the user using notification services. This same app should also fetch phone number from the inbuilt contacts using the concept of content provider.
   a. How to use broadcast receiver and notifications.
   b. How to use content providers.
7. Design an android app to fetch the JSON data from the internet and display the data using listView.
   a. Employee data is stored in the internet. (use Async Task)
   b. When app sends the request to the server, the server should provide data injson format.
   c. The client app should fetch this data and display using listview.
8. Develop an android app on Google Map, and should provide following functions.
   a. How to incorporate Google Maps into an application.
   b. How to register for and receive GPS location information.
   c. How to create Google Maps Overlays.
   d. Accept city name from user and marks it on map.
   e. Explore features like Zoom and map types.

PART – B

Student should develop a mini project in a group of three.

ASSESSMENT METHODS

Parameters	Marks
Midterm Test (Avg. of 2 Tests)	30
Course Project	20
Total	**50**
Final Exam will be conducted for 100 marks (SEE)	

COURSE OUTCOMES

COs	Description	Bloom's level
CO 1	Describe Android platform, Architecture and features	L1
CO 2	Design User Interface and develop activity for Android App	L4
CO 3	Use Intent, Broadcast receivers and Internet services in Android App.	L3
CO 4	Design and implement Database Application and Content providers.	L4
CO 5	Use multimedia, camera and Location based services in Android App.	L3

Mapping of Course outcomes (COs) to Program outcomes (POs*)& PSO **

Course Outcomes mapping to Program Outcomes													PSOs		
POs / COs	1	2	3	4	5	6	7	8	9	10	11	12	PSO1	PSO2	PSO3
CO1	3	1	2		2								2	2	
CO2	3	3	2		2								2	2	
CO3	3	2	2		2								2	2	
CO4	3	2	2		2								2	2	
CO5	3	2	2		2								2	2	

3: Strong, 2: Medium, 1: Weak ** H: Highly related S: Supportive

Department: *Computer Science and Engineering*	***Course Type:*** *Programme Core*
Course Title: *Cryptography and Network Security Lab*	***Course Code:****18CSL68*
L-T-P:*0-0-2*	***Credits:*** *1*
Total Contact Hours: *36 Hours*	***Duration of SEE:*** *3 Hours*
SEE Marks*: 50*	***CIE Marks:*** *50*

COURSE DESCRIPTION

This laboratory course focuses on the introduction of network security using various cryptographic algorithms, to understand the basic mathematical foundations of cryptography, and to gain insightful experience by working with fundamental cryptographic applications.

PREREQUISITES

- Students should have the knowledge of Computer Networks.
- Students should have knowledge of Mathematics and Algorithm Concepts.

COURSE OBJECTIVES

· Understand the most common type of cryptographic algorithm
· Understand various block cipher cryptosystems
· Understand various substitution and transposition cipher techniques
· Analyze public cryptosystems and key management Systems
· Develop secure mobile Applications.

PART A LAB EXERCISES

1. Implement Caesar Cipher encryption & Decryption technique which is by replacing each character by another character that will be some fixed number of positions down to it.
2. Demonstrate the playfair cipher, consider the key table 5×5 grid of alphabets that acts as the key for encrypting the plaintext.
3. Implement Data encryption and decryption using Hill Cipher method.
4. Encrypt the plaintext we using a Vigenere table that consists of the alphabet from A to Z written out 26 times in different rows, further each alphabet must be shifted cyclically to the left compared to the previous alphabet.
5. Implement Rail fence cipher technique using the row & Column Transformation.
6. Demonstrate the Data Encryption Standard based on the two fundamental attributes of cryptography: substitution (also called as confusion) and transposition (also called as diffusion).
7. Execute the program for simple RSA algorithm to encrypt and decrypt the data.
8. Implement diffie Hellman (DH) key exchange algorithm as a method for securely exchanging cryptographic keys over a public communications channel.

PART B	COURSE PROJECT

Design an android application for end-to-end encryption of short message service (SMS) using any symmetric/asymmetric Cryptographic technique that can conceal message regarding student's results/notification on placements/Department's updates of Nitte Meenakshi Institute of Technology (NMIT), while on transit to another mobile device using Cryptographic technique on android operating system and implement it for security of mobile SMS.

The objectives to implement are shown below:

i) Develop an android application for the NMIT that will ensure the encryption of every message transmitted within the network of the organization using any symmetric/asymmetric Cryptographic technique. This application will provide security measures whenever information is transmitted from one mobile device to another as it is important to protect the information while it is on transit.

ii) The choice of Cryptographic technique depends on your project's needs. The below is the list of some Cryptographic techniques popular for Android which can be used in your project for the implementation purpose.

- symmetric encryption
- asymmetric encryption
- hashing
- digital signature
- end-to-end encryption
- elliptic-curve cryptography
- HMAC

Expected outputs:

Fig. 1: SMS service Dashboard on Mobile App

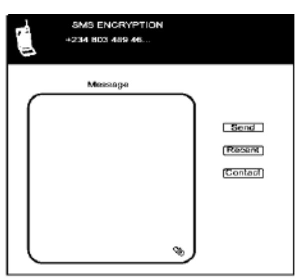

Fig. 2: SMS service to compose message at the sender end

Fig. 3: Display encrypted and Decrypted message at receiver end

Note: The project should include the key objectives however, scope is not limited to mentioned objectives.

ASSESSMENT METHODS

Parameter	Marks
Experiment write up, Execution, Viva & Record writing	20
Course Project	15
Lab Internal Test	15
Total	**50**
Final Exam will be conducted for 100 marks (SEE)	

COURSE OUTCOMES

At the end of the course students will be able to

CO	Description	Blooms level
CO 1	Understand the concepts of different ciphers.	**L2**
CO 2	Illustrate various Public key cryptographic techniques.	**L2**
CO 3	Understand and Analyze the different process for hiding the information with conventional cryptographic algorithms, transposition techniques and block ciphers.	**L2**
CO 4	Analyze public cryptosystems and key management Systems	**L3**
CO 5	Develop Secure Mobile Applications	**L4**

Mapping of Course outcomes (COs) to Program outcomes (POs)															
Course Outcomes mapping to program outcomes-CNS													Program Specific Outcomes (PSOs)		
POs/ COs	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**PSO1**	**PSO2**	**PSO3**
CO1	**3**	**3**											**3**		
CO2	**3**	**3**	**2**										**3**		
CO3	**3**	**3**											**3**		
CO4	**3**		**2**										**3**		

CO5	**3**		**3**		**2**				**1**	**1**			**3**	**1**	**1**

Strong -3, Medium – 2, Weak -1

Department of Computer Science and Engineering

Department: *Computer Science & Engineering*	***Course Type:*** *Program Core*
Course Title: *Project work-II*	***Course Code:*** *18CSP69*
L-T-P:*0-0-2*	***Credits****: 1*
Total Contact Hours: *36Hours*	***Duration of SEE:*** *3 Hours*
SEE Marks*: 50*	***CIE Marks:*** *50*

COURSE DESCRIPTION

This course allows students to continue their final year major project work. The students will discuss with project guides and come up with software requirements and system design.

PREREQUISITES

- Programming knowledge
- Project work-I

COURSE OBJECTIVES

- To allow students analyze the literature survey conducted.
- To develop project planning statement consisting of project problem statement, aim, scope and timeline diagram.
- To understand the requirements gathering, analysis and design of their project.
- To select modern tools corresponding to their project requirements.

COURSE CONTENT

- Planning of the project work consisting of project problem statement, aim, scope and timeline diagram.
- Preparation of the Software Requirements Specifications (SRS) document.
- Preparation of detailed System Design(use-case diagram, class diagram, activity diagram, sequence diagram and data flow diagram)
- Seminar as oral Presentation before a Departmental Committee.

ASSESSMENT METHODS

Parameter	Marks
Preparation of SRS document and Detailed design	20
Rubrics based on evaluation of seminar on SRS and System Design	30
Total Marks	**50**
Final Exam will be conducted for 50 marks(SEE)	

COURSE OUTCOMES

At the end of the course students will be able to:

COs	**Description**	**Bloom's Level**
CO 1	Analyze the gathered requirements pertaining to their project.	**L4**
CO 2	Apply the software engineering process model to complete the SRS document.	**L3**
CO 3	Complete the detailed design document.	**L2**
CO 4	Acquire the depth knowledge on modern tool usage to implement their project	**L2**
CO 5	Improve their presentation and writing skills and recognize the importance of team work	**L2**

Mapping of Course outcomes (COs) to Program outcomes (POs*)& PSO **															
Course Outcomes mapping to Program Outcomes													**PSOs**		
POs / COs	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**PSO1**	**PSO2**	**PSO3**
CO1		3	3										3		
CO2		2	2	2										2	
CO3	2		3	2											
CO4	3				3										
CO5						2		3	3	2	2	2	3	3	2

3: Strong, 2: Medium, 1: Weak ** H: Highly related S: Supportive

Course Content for

VI –Semester

Program Elective – C

Department: *Computer Science and*	***Course Type:*** *Programme Elective*
Course Title: *Advanced Computer Networks*	***Course Code:*** *18CSE641*
L-T-P: *3-0-0*	***Credits:*** *3*
Total Contact Hours: *39Hours*	***Duration of SEE:*** *3 Hours*
SEE Marks*: 50*	***CIE Marks:*** *50*

COURSE DESCRIPTION:

This course is aimed to introduce the various protocols at different layers in the network model

COURSE CONTENTS:

UNIT -I **8 Hours**

Network Layer -2: Delivery and Forwarding of IP Packets**,** Internet Protocol Version 4 (Ipv4), Address Resolution Protocol (ARP), Internet Control Message Protocol Version 4 (ICMPv4)

UNIT -II **8 Hours**

Unicast Routing Protocols (RIP, OSPF and BGP)**,** Multicasting and Multicast Routing Protocols: Multicast Addresses, IGMP (Group management, IGMP messages), Multicast Routing, Routing Protocol, **TCP/IP:** Introduction to Transport Layer: Transport Layer Services

UNIT -III **8 Hours**

User Datagram Protocol: User Datagram, UDP Services, UDP Applications, Transmission Control Protocol: TCP Services, TCP Features, Segment, TCP Connection, Windows in TCP, Flow Control, Error Control, Congestion Control, TCP timers, Options, Stream Control Transmission Protocol (SCTP): SCTP services, SCTP features

UNIT -VI **8 Hours**

Applications: Introduction to Application layer: Client-Server Paradigm, Peer-to-peer Paradigm, DHCP: DHCP operation, DNS: Name Space, Remote Login: Telnet, FTP, TFTP, Electronic Mail: SMTP, POP, IMAP and MIME.

UNIT -V **7 Hours**

Next Generation-IPv6 Address: Address Space Allocation, Global Unicast Addresses, IPv6 protocols: Packet Format, Transition from IPV4 to IPV6.

TEXT BOOKS:

1. Behrouz A. Forouzan, TCP/IP Protocol Suite, 4/e, McGraw-Hill (6,7,8.1-8.2,9.1-9.2,11.1,11.2,11.4,11.6,11.8,12.1-12.5,13,14,15,16.1-16.3,17.1-17.2,18.1-18.2,19.1- 19.2,20.1,23, 26, 27)

REFERENCE BOOKS:

1. Behrouz A. Forouzan,:**Data Communication and Networking**, 5th Edition Tata McGraw-Hill
2. Alberto Leon-Garcia and Indra Widjaja: **Communication Networks - Fundamental Concepts and Key architectures**, 2nd Edition Tata McGraw-Hill, 2004

Webpages

https://www.mikeownage.com/mike/ebooks/TDC463.pdfWebpages

ASSESSMENT METHODS

Parameters	Marks
Midterm Test (Avg of 2 Tests)	30
Problem Solving	10
Programming Assignment	10
Total	**50**
Final Exam will be conducted for 100 marks (SEE)	

COURSE OUTCOMES

At the end of the course student will be able to

COs	Description	Bloom's Level
CO 1	Define the features and operations of various application layer protoco	**L1**
CO 2	Demonstrate the concept of delivery and forwarding of packets in the network layer and understand the performance of IP, ARP and ICMP protocols in the network layer	**L3**
CO 3	Analyze the routing strategies for the network	**L3**
CO 4	Demonstrate the importance of transport layer and providing security to data over the network	**L3**
CO 5	Realize the next generation protocol	**L2**

Mapping of Course outcomes (COs) to Program outcomes (POs*)& PSO **															
Course Outcomes mapping to Program Outcomes													PSOs		
POs / **COs**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**PSO1**	**PSO2**	**PSO3**
CO1	3				2								1		
CO2	3	2											1	2	
CO3	3												1		
CO4	3												1		
CO5	2	2			1								1	2	

3: Strong, 2: Medium, 1: Weak ** H: Highly related S: Supportive

Department :*Computer Science and Engineering*	***Course Type :****Programme Elective*
Course Title: *Advanced Algorithms*	***Course Code:****18CSE642*
L-T-P: *3-0-0*	***Credits:****03*
Total Contact Hours:39 *Hours*	***Duration of SEE :****3 Hours*
SEE Marks*: 50*	***CIE Marks: 50***

COURSE DESCRIPTION

This course is for any student who is interested in pursuing a career which would require algorithm design and implementation. Arguably, algorithm design and implementation is the most fundamental and exciting area of computer science. Even though algorithms for solving most of the problems already exist, it is necessary to continuously evolve better ways of implementing them. New domains are being explored by current researchers which could require development of totally new algorithms. All of these activities require a sound knowledge of Algorithm Design. Sound knowledge implies the ability to prove correctness of an algorithm and to estimate the runtime of the algorithm. This course will cover both aspects of algorithm analysis in addition to introducing some advanced data structures and algorithms.

PREREQUISITES

- Students should have gone through the basic courses on data structures and algorithms.
- Students should have knowledge of C or C++ language

COURSE OBJECTIVES:

To enable the students to

- Analyze the asymptotic performance of algorithms.
- Write rigorous correctness proofs for algorithms.
- Demonstrate a familiarity with major algorithms and data structures.
- Apply important algorithmic design paradigms and methods of analysis.
- Synthesize efficient algorithms in common engineering design situations.

COURSE CONTENTS

UNIT -I Basic Algorithms and DS Review 08Hours

Analyzing Algorithm Complexity: Growth of functions. Asymptotic Upper bound, lower bound, tight bound. Solving Recurrences: Substitution, Recurrence tree and Masters theorem. Review of Tree traversal and Search algorithms. Proving correctness of traversal & search, Review of predecessor & successor algorithms. Algorithm complexity analysis. Hashing review. Hash tables, analysis of hashing with chaining. Hash functions. Blooms filter.

UNIT -II Advanced Data Structures 08 Hours

Amortized Analysis: Aggregate Analysis, The Potential Method. Illustrate using Stack operations. Dynamic Tables: Dynamic Tables, Algorithm design using amortization concepts. Data Structures for Disjoint Sets: Disjoint-set operations, linked-list representation and analysis, Disjoint-set forests (without analysis). Operation on RB trees (Analysis, time permitting). Augmenting data structures: Basics, augmenting AVL trees. Introduction to Tries, Suffix trees.

UNIT -III Graph Algorithms (Network Flows) 08 Hours
Review of BFS and DFS in Graphs. Flow networks and max flows. Ford Fulkerson, and Edmonds-Karp Algorithm (overview only). With Analysis of Correctness and Complexity. Bipartite Graph Matching: reduction to a maximum flow problem. Correctness proof (Time permitting).

UNIT -IV Approximation Algorithms 08 Hours
P/NP: P and NP classes. Polynomial time verification. Reducibility. Some example reductions. Approximate algorithms: vertex-cover, TSP, set covering (overview only). With Complexity Analysis.

UNIT -V Special Topics 07 Hours
Longest Common substring, Longest common subsequences, Multithreaded Algorithms - Basics: Computations DAG's, performance measures, scheduling, analysis. matrix multiplication, merge sort.Stencil based computations.

TEXT BOOKS

1. Introduction to Algorithms, Thomas H., Cormen, Charles E. Leiserson, Ronal L. Rivest, Clifford Stein, 3rd Edition, PHI, 2010.
2. Algorithm Design, John Kleinberg and Eva Tardos, Pearson Publication 2006

DELIVERY METHODS

The course will be delivered through lectures, class room interaction, numerical exercises and self-study components.

ASSESSMENT METHODS

Parameters	Marks
Midterm Test (Avg of 2 Tests)	30
Programming Assignment	20
Total	**50**
Final Exam will be conducted for 100 marks (SEE)	

COURSE OUTCOMES

Having successfully completed the course, student will be able to:

COs	Description	Bloom’s Level
CO1	Analyze algorithm complexity using recurrence relations, asymptotic analysis, aggregate analysis, worst case analysis.	L3
CO2	Prove correctness of algorithms.	L3
CO3	Understand the concepts of advanced data structures such as dynamic tables and AVL trees.	L2
CO4	Derive approximation algorithms for hard problems (NP complete problems).	L3
CO5	Design algorithm for multi-threaded applications.	L4

Mapping of Course outcomes (COs) to Program outcomes (POs*)& PSO **															
Course Outcomes mapping to Program Outcomes													PSOs		
POs COs	1	2	3	4	5	6	7	8	9	10	11	12	PSO1	PSO2	PSO3
CO1	3												1		
CO2		3	3	3										2	
CO3		3	3	3										2	
CO4		3	3	3										2	
CO5		3	3	3										2	

3: Strong, 2: Medium, 1: Weak ** H: Highly related S: Supportive

Department: *Computer Science & Engineering*	***Course Type***: *Programme Elective*
Course Title: *Advanced Computer Architecture*	***Course Code***: *18CSE643*
L-T-P: 3-0-0	***Credits***: *3*
Total Contact Hours: *39 Hours*	***Duration of SEE***: *3 Hours*
SEE Marks:*50*	***CIE Marks***: *50*

COURSE DESCRIPTION

This course provides an in-depth knowledge of fundamentals of Computer Design, Instruction–Level Parallelism, Multiprocessors and Thread–Level Parallelism and MemoryHierarchy.

PREREQUISITES

- Knowledge on Computer Architecture and Operating Systems.

COURSE OBJECTIVES

- To understand the concept of Computer Design
- To understand Instruction–Level Parallelism and its challenges.
- To identify the Performance of symmetric shared–memory multiprocessors; Distributed shared memory

COURSE CONTENTS

UNIT – I **8 Hours**

Fundamentals Of Computer Design: Introduction; Classes of computers; Defining computer architecture; Trends in Technology, power in Integrated Circuits and cost; Dependability; Measuring, reporting and summarizing Performance; Quantitative Principles of computer design. Pipelining: Introduction; Pipeline hazards; Implementation of pipeline; what makes pipelining hard to implement?

UNIT – II **8 Hours**

Instruction–Level Parallelism–1:ILP:Conceptsandchallenges; Basic Compiler Techniques for exposing ILP; Reducing Branch costs with prediction; Overcoming Data hazards with dynamic scheduling; Hardware-based speculation.

UNIT – III **07 Hours**

Instruction–Level Parallelism: Exploiting ILP using multiple issue and static scheduling; Exploiting ILP using dynamic scheduling, multiple issue and speculation; Advanced Techniques for instruction delivery and Speculation;.

UNIT – IV **08 Hours**

Multiprocessors and Thread–Level Parallelism: Introduction; Symmetric shared-memory architectures; Performance of symmetric shared–memory multiprocessors; Distributed shared memory and directory-based coherence; Basics of synchronization; Models of Memory Consistency.

UNIT – V **08 Hours**

Review of Memory Hierarchy: Introduction; Cache performance; Cache Optimizations, Virtual memory. Memory Hierarchy design: Introduction; Advanced optimizations of Cache performance; Memory technology and optimizations; Protection: Virtual memory and virtual machines.

TEXTBOOKS

1. HenneseyandDavidA.Patterson:ComputerArchitecture,AquantitativeApproach,4thdition,Elsevier,2007.(Chapter.1.1to1.9,2.1to2.10,4.1to4.6,AppendixA, AppendixC, AppendixG)

REFERENCE BOOKS/WEBSITE

1. Kai Hwang: Advanced Computer Architecture Parallelism, Scalability, Programability, 2ndEdition, Tata McGraw Hill, 2010.
2. David E. Culler, Jaswinder Pal Singh, Anoop Gupta: Parallel Computer Architecture, Ahardware/Software Approach, Morgan Kaufman, 1999.
3. https://nptel.ac.in/course.php

TEACHING METHODS

- Lecture using Black board and chalk
- Lecture using Presentations
- Problem Solving Assignments

ASSESSMENT METHODS

Parameters	Marks
Midterm Test (Avg of 2 Tests)	30
Case Study	10
Assignment	10
Total	**50**
Final Exam will be conducted for 100 marks (SEE)	

COURSE OUTCOMES (COS)

COs	Description	Bloom's Level
CO1	Understand the importance of classes of computers; Trends in Technology.	L2
CO2	Demonstrate the Compiler Techniques for exposing ILP; Reducing Branch costs with prediction	L3
CO3	Analyze the Symmetric shared-memory architectures; Performance of symmetric shared–memory multiprocessors	L3
CO4	Demonstrate the Advanced optimizations of Cache performance techniques	L3
C05	Evaluate the memory technology and optimizations; Protection, cache ,Virtual memory and virtual machines.	L2

Mapping of Course outcomes (COs) to Program outcomes (POs*)& PSO **															
Course Outcomes mapping to Program Outcomes													PSOs		
POs COs	1	2	3	4	5	6	7	8	9	10	11	12	PSO1	PSO2	PSO3
CO1		3											3		
CO2		2		3				1					2	3	
CO3		3	2		3				1				2	3	
CO4		3	2		3					1			2		
CO5		3		3	3					2			2	2	

3: Strong, 2: Medium, 1: Weak ** H: Highly related S: Supportive

***Department**: Computer Science and Engineering*	***Course Type**: Programme Elective*
***Course Title** Virtual Reality*	***Course Code**:18CSE644*
***L-T-P**:3-0-0*	***Credits**: 03*
***Total Contact Hours**: 39 Hours*	***Duration** of SEE: 3 Hours*
***SEE Marks**: 50*	***CIE Marks**: 50*

COURSE DESCRIPTION

Virtual Reality (VR) Systems Design covers the architecture and design of current generation systems for creating 3D VR environments. Topics included are application/hardware architecture, pipeline development, geometric transformations in a 3D coordinate system, geometry and pixel shading, lighting systems, texturing and VR development. Students will be exposed to current VR technologies and next generation algorithms.

PREREQUISITES

- Students should have knowledge of C or C++, visual Basic or Java language
- Students should have knowledge of mathematics Geometry, Graphs and Matrix
- Students should have knowledge Computer Graphics

COURSE OBJECTIVES

- To learn the basics of VR and all components of VR System
- To understand the modeling of VR Systems
- To introduce students with unity development tool

COURSE CONTENTS

UNIT-I **8 Hours**

Introduction of Virtual Reality: **The three I's of virtual reality, commercial VR technology and the five classic components of a VR system. Input Devices: (Trackers, Navigation, and Gesture Interfaces): Three- dimensional position trackers, navigation and manipulation, interfaces and gesture interfaces. (1.1, 1.3, 1.5, 2.1, 2.2 and 2.3 of Text Book (1)).**

UNIT-II **8 Hours**

Output Devices and Modeling in Virtual Reality: Output Devices: Graphics displays, sound displays & haptic feedback, modeling: Geometric modeling, kinematics modeling, physical modeling, (3.1, 3.2, 3.3, 5.1, and 5.3 of Text Book (1)).

UNIT-III **8 Hours**

Modeling in Virtual Reality and Implementation of VR: behavior modeling, model management, How VR works, Stereoscopic displays, Binocular vision, VR Head mounted displays

UNIT-IV **8 Hours**

Getting started with Unity development: Unity Interface**,** Game objects, Importing assets to Unity, Textures and Materials, Unity Scripting Input and UI Unity, UI Components, Beginner Game play Scripting.

UNIT-V **8 Hours**

Getting started with VR development for Google cardboard using unity: Enabling unity's native VR Integration, Creating a VR scene in unity, Integrating Google VR SDK, Deploying the VR application to Android platform**,** Additional Read on unity VR Development

TEXT BOOKS

1. Virtual Reality Technology, Second Edition, Gregory C. Burdea & Philippe Coiffet, John Wiley & Sons, Inc.,

REFERENCE BOOKS

1. Understanding Virtual Reality, interface, Application and Design, William R.Sherman, Alan Craig, Elsevier (MorganKaufmann).
2. 3D Modeling and surfacing, Bill Fleming, Elsevier(MorganKauffman).
3. 3D Game Engine Design, David H.Eberly, Elsevier.
4. Virtual Reality Systems, John Vince, PearsonEducation

TEACHING METHODS

- Black board teaching
- Lectures using presentations(ppts)
- Assignments

ASSESSMENT METHODS

Parameters	Marks
Midterm Test (Avg of 2 Tests)	30
Tool Based Learning	10
Project	10
Total	**50**
Final Exam will be conducted for 100 marks (SEE)	

COURSE OUTCOMES

COs	Description	Bloom's Level
CO 1	Understand the basis concept and framework of Virtual reality	**L2**
CO 2	Apply VR technologies for multimodel User interaction, perception, Visual, audio, haptic interface and behavior	**L3**
CO 3	Explain the VR system framework and development tools	**L1**
CO 4	Develop application in a given VR environment	**L3**
CO 5	Develop animated images using GUI design principles, Virtual reality	**L3**

Mapping of Course outcomes (COs) to Program outcomes (POs*)& PSO **

	Course Outcomes mapping to Program Outcomes												PSOs		
POs / COs	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**PSO1**	**PSO2**	**PSO3**
CO1	3				3								2		
CO2	3				3								2		
CO3	3				2								2		
CO4	3				3								2		
CO5	3				3								2		

3: Strong, 2: Medium, 1: Weak ** H: Highly related S: Supportive

Department :*Computer Science and Engineering*	***Course Type :****Progamme Elective*
Course Title: *Introduction to C# programming*	***Course Code:*** *18CSE645*
L-T-P: *2-0-2*	***Credits:****03*
Total Contact Hours: 39*Hours*	***Duration of SEE :****3 Hours*
SEE Marks*: 50*	***CIE Marks: 50***

COURSE DESCRIPTION

This course is intended to provide students with the skills required to create Windows Forms applications in C# by using the .NET Framework. The course will cover the major topics for Windows client application programming on the .NET Framework.

PREREQUISITES

- Knowledge on OOP concepts.

COURSE OBJECTIVES

- To learn the basics of .NET framework and C# Programming.
- To develop the Windows Application Development using C#.
- To understand the Web Application Development using ASP .NET.

COURSE CONTENTS

UNIT –- I **8 Hours**

Introduction to .Net &C# Language Fundamentals: Microsoft's .Net, .Net Framework, C#, Simple Application in C#, Literals, Variables and Data Types, Formatting Text, Console.write, Console.writeline, Operators and Expressions, decision making & Branching, Strings, Control Statements, Arrays, Structures and Enumerations

UNIT –- II **8 Hours**

Object Oriented Programming with C#: Base classes and derived classes, Inheritance, Polymorphism, operator overloading, Interfaces, and examples, Delegates and Exceptions handling.

UNIT –- III **8 Hours**

Graphical User Interface with Windows Forms: Windows forms, event handling, Control properties and layout, labels, textboxes, buttons, checkbuttons, radiobuttons, picture boxes, mouse event handling, Keyboard event handling, examples, Menus, Month calendar control, Datetimepicker control, linklabel, list box, Combox, Checkedlistbox, Treview, listview and Tabcontrol control, Multiple Document Interface (MDI), examples.

UNIT -– IV **7 Hours**

Data access with ADO.NET: Introduction to ADO.NET Entity Framework, Creating the ADO.NET Entity Data Model Class Library, Creating a Windows Forms Project and Configuring It to Use the Entity Data Model, Data Bindings Between Controls and the Entity Data Model, Dynamically Binding Query Results, Creating the Display Query ResultsGUI, Coding the Display Query Results Applications.

UNIT -– V **8 Hours**

Introduction to ASP.NET, Web application development with Microsoft's ASP.NET 3.5 technology, Extensible HyperText Markup Language (XHTML), client-side scripting, Web application development using Web Forms, Web controls.

TEXT BOOKS

1. P. Deitel, H. Deitel, Visual C# 2012 How to Program, 6/e, Pearson, 2016
2. E. Balagurusamy: Programming in C#, 2nd Edition, TataMcGraw Hill, 2008.
3. Herbert Schildt: C# The Complete Reference, Tata McGraw Hill, 2004.

DELIVERY METHODS

* Lecture (PPT)
* Tutorials
* **Course Project:** Each student will form a group with 1, but no more than 2, other classmates. Each group will create a different C# Windows application to be completed at the end of the Semester. Specific details on the deliverable will be explained during the term.

ASSESSMENT METHODS

Parameters	Marks
Midterm Test (Avg of 2 Tests)	30
Course Project	20
Total	**50**
Final Exam will be conducted for 100 marks (SEE)	

COURSE OUTCOMES

At the completion of this course, the student will be able to

Cos	Description	Bloom's Level
CO 1:	Understand the fundamentals of C# and .Net framework.	L2
CO 2:	Demonstrate the object inheritance and its use in C#.	L3
CO 3:	Develop the Windows Forms and apply user controls in Windows Forms applications.	L4
CO 4:	Design menus in a Windows Forms application and create Multiple Document Interface (MDI) applications.	L4
CO 5:	Create real applications by using C#, Database andADO.NET.	L4

Mapping of Course outcomes (COs) to Program outcomes (POs*)& PSO **															
Course Outcomes mapping to Program Outcomes													**PSOs**		
POs / COs	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**PSO1**	**PSO2**	**PSO3**
CO1	3	3											3		
CO2	3	3											3		
CO3	3	3	3										3		
CO4	2	2	2	2									3		
CO5		2	2	2	2									2	

3: Strong, 2: Medium, 1: Weak ** H: Highly related S: Supportive

Department: *Computer Science and Engineering*	***Course Type:*** *Programme Elective*
Course Title*: Advanced Operating Systems*	***Course Code:****18CSE646*
L-T-P:*3-0-0*	***Credits:*** *03*
Total Contact Hours: *39Hours*	***Duration of SEE:*** *3 Hours*
SEE Marks*: 50*	***CIE Marks:*** *50*

COURSE DESCRIPTION

This course provides an in-depth knowledge of Operating System, Process, Threads and Kernel. It discusses advance concepts like Real Time Scheduling with security.

PREREQUISITES

- Student should have prior basic knowledge on Operating Systems
- Student should have some basic knowledge on Unix Shell Programming and Windows.

COURSE OBJECTIVES

To understand the basic features of Operating System, Process and Threads.

- To understand the implementation of virtual memory and Real Time Scheduling.
- To familiarize the management of resources by usage of kernels

COURSE CONTENTS

UNIT -– I **07 Hours**

Operating System Overview, Process description control

Operating System Objectives and Functions, The Evolution of Operating Systems, Major Achievements, Developments Leading to Modern Operating Systems, Linux, what is a Process? Process States, Process Description, Process Control, Execution of the Operating System, Security Issues

UNIT -– II **08 Hours**

Threads, SMP and Microkernel, Virtual Memory. Processes and Threads, Symmetric Multiprocessing (SMP), Microkernel's, Solaris Thread and SMP Management, Linux Process and Thread Management, Hardware and Control Structures, Operating System Software, Linux Memory Management.

UNIT – III **08 Hours**

Multiprocessor and Real-Time Scheduling Multiprocessor Scheduling, Real-Time Scheduling, Linux Scheduling, UNIX PreclsSlScheduling, Process Migration, Distributed Global States, Distributed Mutual Exclusion, Distributed Deadlock.

UNIT -– IV **08 Hours**

Embedded Operating System Embedded Systems, Characteristics of Embedded Operating Systems, eCOS, TinyOS, Computer Security Concepts, Threats, Attacks, and Assets, Intruders, Malicious Software Overview, Viruses, Worms, and Bots, Rootkits.

UNIT -– V **08Hours**

Kernel Organization: Using Kernel Services, Daemons, Starting the Kernel, Control in the Machine, Modules and Device Management, MODULE Organization, MODULE Installation and Removal, Process and Resource Management, Running Process Manager, Creating a new Task, IPC and Synchronization, The Scheduler, Memory Manager, The Virtual Address Space, The Page Fault Handler.

Note:

Mini Projects should be carried out on the implementation of rudimentary operating system or critical security algorithms to operating system. Report on the project and implementation this to be considered for internal assessment.

TEXT BOOKS

1. William Stallings: Operating Systems: Internals and Design Principles, 6th Edition, Prentice Hall, 2013.
2. Gary Nutt: Operating Systems, 3rd Edition, Pearson, 2014.
3. Silberschatz, Galvin, Gagne: Operating System Concepts, 8th Edition, Wiley, 2008

REFERENCE BOOKS

1. Andrew S. Tanenbaum, Albert S. Woodhull: Operating Systems, Design and Implementation, 3rdEdition, Prentice Hall, 2006.
2. Pradeep K Sinha: Distribute Operating Systems, Concept and Design, PHI, 2007

TEACHING METHODS

1. Lecture using Black Board/Power Point Presentations
2. Programming Assignments
3. NPTEL

ASSESSMENT METHODS

Parameters	Marks
Three internals (Avg of best of 2 Tests)	30
Programming Assignments	10
Rubrics for the evaluation of Course Project	10
Total	**50**
Final Exam will be conducted for 100 marks (SEE)	

COURSE OUTCOMES

At the end of the course student will be able to:

COs	Description	Bloom's Level
CO 1	Identify and summarize the important aspects of Operating System, Threads and Process	L2
CO 2	Apply the important concepts of symmetric multiprocessing, multiprocessor and microkernel management	L3
CO 3	Describe the security aspects related to Operating System	L2
CO 4	Identify the different features of real time and embedded operating systems	L2
CO 5	Modify existing open source kernels in terms of functionality or features used.	L3

3: Strong, 2: Medium, 1: Weak ** H: Highly related S: Supportive

Mapping of Course outcomes (COs) to Program outcomes (POs*)& PSO **

Course Outcomes mapping to Program Outcomes													**PSOs**		
POs / COs	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**PSO1**	**PSO2**	**PSO3**
CO1		3	3										3	2	
CO2		3	3											3	
CO3		3	3											3	
CO4		3	3										3		
CO5		3	3										3		

Department: *Computer Science and Engineering*	***Course Type:*** *Program Elective*
Course Title: *Advanced Data Base Management Systems*	***Course Code:*** *18CSE647*
L-T-P:*3-0-0*	***Credits:*** *03*
Total Contact Hours: *39 Hours*	***Duration of SEE:*** *3 Hours*
SEE Marks*: 50*	***CIE Marks:*** *50*

PREREQUISITES

- Students should have knowledge of database.
- Students should have knowledge of sql queries.

COURSE DESCRIPTION

This course imparts the concepts of database management system with respect to storage, indexing, optimization, evaluation of queries and operators. It helps to understand and also evaluate database access methods.

COURSE OBJECTIVES

- To understand various file organizations and access methods
- To introduce indexing methods.
- To learn query evaluation and operator evaluation

COURSE CONTENTS

UNIT – I **8 Hours**

Overview of Storage and Indexing, Disks and files: Data on external storage; File organizations and Indexing, Index data structures; Comparison of file organizations; Memory hierarchy: RAID; Disk space management; Buffer manager: Files of records; Page formats and record format.

UNIT – II **7 Hours**

Tree Structured Indexing: Intuition for tree indexes; Indexed sequential access method; B+ trees, Search, Insert, Delete, Duplicates, B+ trees in practice

UNIT – III **8 Hours**

Hash-Based Indexing: Static hashing; Extendible hashing, Linear hashing, Comparisons.

UNIT – IV **8 Hours**

Overview of Query Evaluation, External Sorting: The system catalog; Introduction to operator evaluation; Algorithms for relational operations; Introduction to query optimization; Example.

A simple two-way merge sort; External merge sort.

UNIT – V **8 Hours**

Evaluating Relational Operators: The Selection operation; General selection conditions; The Projection operation; The Set operations; Aggregate operations.

TEXT BOOK

Raghu Ramakrishnan and Johannes Gehrke; Database Management Systems.3rd Edition McGraw-Hill, 2003 (Chapters 8, 9, 10, 11, 12, 13.1to 13.3, 14)

REFERENCE BOOKS:

1. Elmasri and Navathe: Fundamentals of Database Systems 5th Edition, Pearson Education, 2007.
2. Connolly and begg: Database Systems, 4th Edition Pearson Education 2002.

Note: Laboratory components is provided as part of the assignment, students will have to execute them and evaluation will be done by the faculty as a component of the CIE.

TEACHING METHODS

- Lectures interspersed with discussions
- Supporting laboratory assignments

ASSESSMENT METHODS

Parameters	Marks
Three internals (Avg of best of 2 Tests)	30
Rubrics for the evaluation of Laboratory based assignment	20
Total	**50**
Final Exam will be conducted for 100 marks (SEE)	

COURSE OUTCOMES

At the end of Course, Student will be able to

	Course outcomes (COs)	
COs	**Description**	**Bloom's Level**
CO 1	Discuss and compare various file organizations and indexes in DBMS.	**L1**
CO 2	Describe RAID levels and Analyse the need of RAID.	**L2**
CO 3	Understand and Demonstrate Tree based indexing and use it to perform database update operations.	**L2**
CO 4	Understand and compare Hash based indexing methods and use them to perform database update operations.	**L2,L3**
CO 5	Illustrate external sorting techniques.	**L2**

Mapping of Course outcomes (COs) to Program outcomes (POs*)& PSO **															
Course Outcomes mapping to Program Outcomes													PSOs		
POs COs	1	2	3	4	5	6	7	8	9	10	11	12	PSO1	PSO2	PSO3
CO1		3											3		
CO2		3											3		
CO3	2	3											3	3	
CO4	2	3											3	3	
CO5	2	3											3	3	

3: Strong, 2: Medium, 1: Weak ** H: Highly related S: Supportive

Department: *Computer Science and Engineering*	**Course Type:** *Programme Elective*
Course Title: *Advanced Web Programming-II*	**Course Code:***18CSE648*
L-T-P:*3-0-0*	**Credits:***03*
Total Contact Hours: *39 Hours*	**Duration of SEE:** *3 Hours*
SEE Marks: *50*	**CIE Marks**: *50*

COURSE DESCRIPTION

The focus in this course is on the Advance Web concepts as a platform for interactive applications. The development of web-based applications requires knowledge about the underlying technology and the formats and standards the web is based upon. This course includes advance concepts like React.js.

PREREQUISITES

- Student should have prior knowledge of HTML tags and Cascading Style sheets.
- Students should be able to develop a dynamic webpage by the use of Java Script and server side scripts using PHP, Vue.js and Node.js.
- Student should know how to connect the scripting language with database.

COURSE OBJECTIVES

- To learn the concepts of React as well as a pragmatic approach to making web applications.
- To learn the Advance concepts of React which is current web programming in developing applications

COURSE CONTENTS

UNIT -I **08 Hours**

REACT : Introduction to REACT:The Virtual DOM, React Elements, React DOM, Children, Constructing Elements with Data, React, Stateless Functional Components, DOM Rendering, React with JSX, Props.

UNIT -II **08 Hours**

REACT : State, andthe Component Tree- Property Validation, Refs, React State Management, State within the Component Tree. Enhancing components- Components lifecycle, Javascript Library Integration, Higher order components, Flux-Views, Action and Action creators, Dispatcher, stores.

UNIT –III **08 Hours**

Redux-State, Actions, Reducers, Store, Action Creators, Middleware. React Forms- Controlled components - the read-only, **Controlled components** - the read and write input, Controlled components – a simple form, Validation, React Redux.

UNIT -IV **07 Hours**

Testing- Testing Redux, Testing React components, Snapshot Testing, **React Routers**-Incorporating the router, nested routers, Router parameters, React flux, Animations.

UNIT-V **08 Hours**

PrepareYour React Application for Painless Maintenance with Flux-Decoupling concerns with Flux, Refactoring the Stream component, Creating Collection Store, Creating CollectionActionCreators, Refactoring the Collection component, Refactoring the Collection Controls component, Refactoring the CollectionRenameForm component, Refactoring the TweetList component, Refactoring the StreamTweet component

Building any React Application with database (In this unit students can design application using React)

TEXT BOOKS

1. Eve Porcello, Alex Banks, “Learning React: Functional Web Development with React and Redux”, O’Reilly Publications, 1st Edition, 2017.

2. Adam Horton, Ryan Vice, “Mastering React”, Packt Publishing, 1st Edition, 2016.

3. “React.js Essentials”, Afast-paced guide to designing and building scalable and maintainable web apps with React.js by **Artemij Fedosejev** Packt Publishing

REFERENCE BOOKS

1. Pro React 16 by Adam freeman, Apress publications
2. React, Quickstart step-by-step guide to learning react javascript Library by LIONEL LOPEZ

TEACHING METHODS

- Lecture (Power Point presentations/ Black board teaching (if needed))
- Regular review of students by asking questions based on topics covered in the class Programming Assignments

ASSESSMENT METHODS

Parameters	Marks
Three internals (Avg of best of 2 Tests)	30
Rubrics evaluation for the Course Project	10
Programming Assignment	10
Total	**50**
Final Exam will be conducted for 100 marks (SEE)	

COURSE OUTCOMES

- At the end of the course student will be able to

COs	Description	Bloom's level
CO 1	Understand the fundamentals of React with DOM and functional components	**L2**
CO 2	Developing the React applications using states and components trees.	**L3**
CO 3	Understand the basic concepts of Redux and controlled components of React.js	**L2**
CO 4	Apply the application for testing react components and learn react routers	**L3**
CO 5	Design the web application using react components with database	**L3**

Mapping of Course outcomes (COs) to Program outcomes (POs*)& PSO **

Course Outcomes mapping to Program Outcomes													PSOs		
POs / COs	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**PSO1**	**PSO2**	**PSO3**
CO1	3	2	2		2								2	2	
CO2	3	2	2		2								2	2	
CO3	3	2	2		2								2	2	
CO4	3	2	2		2								2	2	
CO5	3	2	2		2								2	2	1

Department: *Computer Science and Engineering*	***Course Type:*** *Programme Elective*
Course Title*: Unix System Programming*	***Course Code:****18CSE649*
L-T-P:3-0-0	***Credits:****03*
Total Contact Hours:	***Duration of SEE:****3 Hours*
SEE Marks*: 50*	***CIE Marks:****50*

PREREQUISITES

- Students should have knowledge of Linux operating system and programming knowledge.

COURSE OBJECTIVES

To understand the fundamental design of the Unix operating system and to become familiar with the systems calls provided on the Unix/Linux environment

COURSE CONTENTS

UNIT I **10 Hours**

UNIX File APIs: General File APIs, File and Record Locking, Directory File APIs, Device File APIs, FIFO File APIs, Symbolic Link File APIs, General File Class, regfile Class for Regular Files, Device File Class, Symbolic Link File Class, File Listing program.

UNIT II **12 Hours**

UNIX PROCESSES: The Environment of a UNIX Process: Introduction, main function, Process Termination, Command-Line Arguments, Environment List, Memory Layout of a C Program, Shared Libraries, Memory Allocation, Environment Variables, setjmp and longjmp Functions, getrlimit, setrlimit Functions, UNIX Kernel Support for Processes.

UNIT III **10 Hours**

PROCESS CONTROL: Introduction, Process Identifiers, fork, vfork, exit, wait, waitpid, waited, wait3, wait4 Functions, Race Conditions, exec Functions, Interpreter Files, system Function, Process Accounting, User Identification, Process Times. Process Relationships: Introduction, Terminal Logins, Network Logins, Process Groups, Sessions, Job Control, Shell Execution of Programs, Orphaned Process Groups.

UNIT – IV **8 Hours**

SIGNALS AND DAEMON PROCESSES: Signals: The UNIX Kernel Support for Signals, signal, Signal Mask, sigaction, The SIGCHLD Signal and the waitpid Function, The sigsetjmp and siglongjmp Functions, Kill, Alarm, Interval Timers, POSIX.lb Timers. Daemon Processes: Introduction, Daemon Characteristics, Coding Rules, Error Logging, Single-instance daemons; Daemon conventions; Client-Server Model.

UNIT-V **8 Hours**

INTER PROCESS COMMUNICATION: Pipe, process pipes, the pipe call, parent and child processes, and named pipes: fifos, semaphores: semget, semop, semctl, message queues: msgget,msgsnd, msgrcv, msgctl, shared memory: shmget, shmat, shmdt, shmctl, ipc status commands.

INTRODUCTION TO SOCKETS: Socket, socket connections - socket attributes, socket addresses, socket, connect, bind, listen, accept, socket communications.

TEXT BOOKS

3. Unix System Programming Using C++ – Terrence Chan – Prentice Hall India, 1999.
4. Stephen A. Rago: Advanced Programming in the UNIX Environment – W.Richard Stevens, 2nd Edition, Pearson Education / PHI, 2005.

REFERENCES

5. Advanced Unix Programming – Marc J. Rochkind:, 2nd Edition, Pearson Education, 2005.
6. The Design of the UNIX Operating System – Maurice.J.Bach:, Pearson Education / PHI, 1987.
7. Unix Internals – UreshVahalia:, Pearson Education, 2001.

TEACHING METHODS

- PPTs
- Hands-on Sessions Based Teaching

ASSESSMENT METHODS

Parameters	Marks
Three internals (Avg of best of 2 Tests)	30
Programming Assignment	10
Programming Assignment	10
Total	**50**
Final Exam will be conducted for 100 marks (SEE)	

COURSE OUTCOMES (COs)

At the end of the course student will be able to:

COs	Description	Bloom's Level
CO 1	Understand the relationship between UNIX Kernel support for files	**L2**
CO 2	Familiar with Kernel support for process creation and termination and memory allocation	**L2**
CO 3	Learn about Process Accounting process UID ,Terminal logins, network logins	**L2**
CO 4	Analyze process control, daemon characteristics, coding rules and error logging	**L3**
CO 5	Learn inter process communication and socket programming.	**L2**

Mapping of Course outcomes (COs) to Program outcomes (POs*)& PSO **															
Course Outcomes mapping to Program Outcomes													PSOs		
POs / COs	1	2	3	4	5	6	7	8	9	10	11	12	PSO1	PSO2	PSO3
CO1	2	3											3	2	
CO2	2	3		2	2								2	3	
CO3	2	2	3	2									2	3	
CO4	2	3	3	3									2	3	
CO5		3	3	3								2	3	3	

3: Strong, 2: Medium, 1: Weak ** H: Highly related S: Supportive

Department: *Computer Science and Engineering*	***Course Type:*** *Programme Elective*
Course Title*: Cyber Physical Systems*	***Course Code:*** 18CSE651
L-T-P *3-0-0*	***Credits:*** *03*
Total Contact Hours: *40 Hours*	***Duration of SEE:*** *3 Hours*
SEE Marks*: 50*	***CIE Marks:*** *50*

COURSE DESCRIPTION

Cyber-physical systems, which consist of physical systems tightly integrated and/or controlled by software, are ubiquitous in many safety critical domains, including automotive, avionics, railways, healthcare, atomic energy, power, and industrial automation

PREREQUISITES

- Students should have knowledge of programming. Knowledge of Real-time Embedded Systems will help.

COURSE OBJECTIVES

- Develop an exposition of the challenges in implementing a cyber-physical system from a computational perspective
- To expose the student to real world problems in this domain and provide a walk through the design and validation problems for such systems.

COURSE CONTENTS

UNIT – I **8 Hours**

Introduction: Motivation & Intro to Cyber Physical Systems (CPS): Key issues in CPS design: timing predictability, verification and certification; integration and composability,modeling and abstraction,COTS components and time-to-market.Introduction to Real-Time Systems: Task model.Quality of service.Interplay between timing properties and digital control. Basic schedulabilityresults.The worst-case execution problem.The end- to-end delay problem.

8 Hours

UNIT – II

Applications of Cyber-Physical Systems: Overview of CPS applications. IMA (Integrated Modular Avionics) design.Issues in ARINC 653.AUTOSAR (Automotive Open System Architecture).Further examples of Medical systems, Power grid control, monitoring applications.

UNIT – III **8 Hours**

Predictable Computer Architectures: Impact of architectural features on predictability. Controllablepipelines.Cachepartitioning strategies.Scratchpadmemories.Busscheduling.Network-on-chips and Real-time Predictable memory controllers.

UNIT – IV **8 Hours**

Predictable OS Abstractions: Overview of Real-Time OS and Hypervisors. Interrupt scheduling. Hierarchical and component-based OS.Predicable task execution.Parallel execution models.Introduction to Timing and Performance Analysis.

UNIT – V **8 Hours**

Timing and Performance Analysis: Overview of static analysis methodologies. Measurement-based techniques.Cache, Bus and memory analyses. Introduction to Models of Computation and Verification for CPS: Tools and architectural description languages.

TEXT BOOKS

1. E. Lee and S. Seshia. Introduction to Embedded Systems - A Cyber-Physical Systems Approach, LeeSeshia.org, 2011
2. G. Buttazzo. Hard Real-Time Computing Systems, Springer, 2011
3. H. Kopetz. Real-Time Systems: Design Principles for Distributed Embedded Applications, Springer, 2011.

ASSESSMENT METHODS

Parameter	Marks
Midterm Test (Avg. of 2 Tests)	30
Research Literature Survey	10
Project / Modelling Assignment	10
Total	**50**
Final Exam will be conducted for 100 marks (SEE)	

COURSEOUTCOMES

CO	Description	Blooms level
CO 1	Understand the principles of Cyber Physical Systems and Real Time System design. Address key factors that contribute to design of "Safe CPS"	**L1**
CO 2	Enable formulation of Functional, Safety and Testability specifications for CPS.	**L2**
CO 3	Understand and Analyze Hardware architectural components and establish criteria for predictable behavior of CPS	**L1,L3**
CO 4	Understand the OS abstractions as applicable to CPS and establish the criteria for ensuring predictable behavior of CPS	**L1**
CO 5	Create high fidelity models of CPS to analyze the real-time behavior and performance of the systems.	**L4**

Mapping of Course outcomes (COs) to Program outcomes (POs)

INTRODUCTION TO CYBER PHYSICAL SYSTEMS													PSO		
POs / COs	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO1	3	1											3		
CO2	3	3	1			2	2							3	
CO3	3	3	2		2									3	
CO4	3	3	2	3	2									3	
CO5	3	3	3		3	2									3

Course Content for VII – Semester 2018 Scheme

VII SEMESTER

Department: Computer Science and Engineering	***Course Type: Program*** *Core*
Course Title: *High Performance Computing*	***Course Code:*** *18CS71*
L-T-P:4-0-0	***Credits:*** *03*
Total Contact Hours: *48 Hours*	***Duration of SEE:*** *3 Hours*
SEE Marks: *50*	***CIE Marks:*** *50*

COURSE DESCRIPTION

This course covers the theoretical principles of massively parallel approach to high-performance computing using multiprocessing systems and/or combination of GPU hardware.

PREREQUISITES

- Knowledge on basics of Computer Organization

COURSE OBJECTIVES

- Provide an overview of existing High-Performance Computing (HPC) software and hardware
- Present basic software design patterns for high performance parallel computing
- Introduce CUDA for parallel computing on the Graphics Processing Unit (GPU)

COURSE CONTENTS

UNIT -I **10 Hours**

Introduction to High Performance Computers, Memory Hierarchy, CPU Design: Reduced Instruction Set Computers, Multiple Core Processors, Vector Processors.

Self-Study: Parallel Semantics, Distributed Memory Programming.

UNIT -II **10 Hours**

Programming Shared Address Space Platforms: Thread Basics, Why Threads? The POSIX Thread API, Thread Creation and Termination, Thread Cancellation
Shared-memory parallel programming with OpenMP: Introduction to OpenMP, Parallel execution, Data scoping , OpenMP worksharing for loops , Reductions , Loop scheduling , Tasking , Efficient OpenMP programming :Profiling OpenMP programs , Performance pitfalls: Ameliorating the impact of OpenMP work sharing constructs , Serialization , False sharing.

Self-Study: OpenMP: A Standard for Directive Based Parallel Programming. Case study : OpenMP-parallel Jacobi algorithm,Parallel sparse matrix-vector multiply

UNIT-III **10 Hours**

Programming using the Message-Passing Paradigm: Principles of Message-Passing Programming, The Building Blocks: Send and Receive Operations, MPI: The Message Passing Interface, Topologies and Embedding, Overlapping Communication with Computation, Collective Communication and Computation Operations.

Self-Study: Groups and Communicators.

UNIT-IV **8 Hours**

Introduction: GPUs as Parallel Computers, Architecture of a Model GPU, Why More Speed or Parallelism? GPU Computing. Introduction to CUDA: Data Parallelism, CUDA Program Structure, A Vector Addition Kernel , Device Global Memory And Data Transfer, Kernel Functions and Threading.

Self-Study: GPUs History of GPU Computing: Evolution of Graphics Pipelines, Parallel Programming Languages and Models, GPU Memory

UNIT-V **10 Hours**

CUDA Threads: CUDA Thread Organization, Mapping Threads To Multidimensional Data, Synchronization and Transparent Scalability, Assigning Resources to Blocks, Thread Scheduling and Latency Tolerance
Self-Study: A Matrix-Matrix Multiplication Example

Self-Study Evaluation:

- The topics are integral part of the course.
- No formal lectures will be held for the self-study topics.
- The course coordinator may provide reading materials for self-study topics (optional).
- The topics prescribed under self-study in curriculum are part of CIE and SEE.

TEXT BOOKS

1. Ananth Grama,Anshul Gupta,Vipin kumar, George Karypis, Introduction to parallel computing, second edition, 2003, Pearson education publishers.
2. David B Reference Books: Wen-mei W. Hwu, "Programming Massively Parallel Processors on Approach", First edition, Elsevier and nvidia publishers 2010.
3. Georg Hager, Gerhard Wellein, Introduction to High Performance Computing for Scientists and Engineers, Taylor and Francis Group, LLC, CRC Press, 2011

REFERENCE BOOKS

1. Thomas Rauber and Gudula Runger Parallel Programming for Multicore and cluster systems, Springer International Edition, 2009.
2. Hennessey and Patterson Computer Architecture: A quantitative Approach, Morgan Kaufman Publishers, 2011.
3. Michael J. Quin "Parallel Programming in C with MPI and Open MP", McGraw Hill.
4. Rubin H Landau, Oregon State University, http://science.oregonstate.edu/ rubin/.

TEACHING METHODS

- Lecture using Black board and chalk
- Presentations
- Problem Solving Assignments

ASSESSMENT METHODS

Midterm Test (Avg. of 2 Tests) – 30 Marks
Course Project -20 Marks

COURSE OUTCOMES

At the end of Course, the student will be able to:

COS	Description	BL
CO 1:	Explain the technologies and architectures used for parallel computing	L1
CO 2:	Design and develop parallel programs using Open-MP programming interface	L3
CO 3:	Elaborate the principles and architecture of message-passing programming paradigm for solving real world problems	L2
CO 4:	Provide an understanding of Graphical Processing Units and their architecture	L1
CO 5:	Analyze the features of GPUs, their functionalities and also Design parallel applications using CUDA-C	L3

Mapping of Course outcomes (COs) to Program outcomes (POs)													PSO1	PSO2	PSO3
CO\PO	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	2	1										1		
CO2	1	2	3												
CO3	3	1	1	2	3										
CO4	1	2	3	1	1								3	1	

CO5	3	3	3	1	3			1	1				3	1	

***3: Strong, 2: Medium, 1: Weak** ****3: Highly related 2: Supportive**

Department : *Computer Science and Engineering*	***Course Type :*** *Programme CORE*
Course Title: Cyber Security	***Course Code: 18CS72***
L-T-P: 3-0-0	***Credits:03***
Total Contact Hours: *39 Hrs*	***Duration of SEE :*** *3 hrs*
SEE Marks*: 50*	***CIE Marks: 50***

COURSE DESCRIPTION

This course provides an in-depth knowledge of Nature and Scope of Cyber Crime, Types of Cyber Crime, Social Engineering, Unauthorized Access to Computers, Computer Intrusions, White collar Crimes, Viruses and Malicious Code, Internet Hacking and Cracking, Virus Attacks, Digital laws and legislation, Law Enforcement Roles and Responses, Digital Forensics, Forensic Software and Hardware, Analysis and Advanced Tools, Forensic Technology and Practices, Forensic Ballistics and Photography, Face, Iris and Fingerprint Recognition, Cyber Crime Investigation, Investigation Tools, eDiscovery, Digital Evidence Collection, Evidence Preservation, E-Mail Investigation, E-Mail Tracking, IP Tracking, E-Mail Recovery, Laws and Ethics, Digital Evidence Controls, Evidence Handling Procedures, Basics of Indian Evidence ACT IPC and CrPC etc.,

COURSE OBJECTIVES

- Understanding and Analysing Nature and Scope of Cyber Crime, Types of Cyber Crime, Social Engineering
- Understanding and analysing Unauthorized Access to Computers, Computer Intrusions, White collar Crimes, Viruses and Malicious Code, Internet Hacking and Cracking, Virus Attacks
- Understanding and analysing Digital Forensics, Forensic Software and Hardware, Analysis and Advanced Tools, Forensic Technology and Practices, Forensic Ballistics
- Understanding and analysing Cyber Crime Investigation, Investigation Tools, eDiscovery, Digital Evidence Collection, Evidence Preservation, E-Mail Investigation, E-Mail Tracking, IP Tracking, E-Mail Recovery,
- Understanding and analysing Laws and Ethics, Digital Evidence Controls, Evidence Handling Procedures, Basics of Indian Evidence ACT IPC and CrPC.

COURSE CONTENTS

UNIT-I **8 hours**

Introduction and Overview of Cyber Crime, Nature and Scope of Cyber Crime, Types of Cyber

Crime, Social Engineering, Categories of Cyber Crime, Property Cyber Crime.

UNIT- II **8 Hours**

Unauthorized Access to Computers, Computer Intrusions, White collar Crimes, Viruses and Malicious Code, Internet Hacking and Cracking, Virus Attacks, Pornography, Software Piracy, Intellectual Property, Mail Bombs, Exploitation ,Stalking and Obscenity in Internet, Digital laws and legislation, Law Enforcement Roles and Responses.

UNIT-III **8 Hours**

Introduction to Digital Forensics, Forensic Software and Hardware, Analysis and Advanced Tools, Forensic Technology and Practices, Forensic Ballistics and Photography, Face, Iris and Fingerprint Recognition, Audio Video Analysis, Windows System Forensics, Linux System Forensics, Network Forensics.

UNIT-IV **8 Hours**

Introduction to Cyber Crime Investigation, Investigation Tools, eDiscovery, Digital Evidence Collection, Evidence Preservation, E-Mail Investigation, E-Mail Tracking, IP Tracking, E-Mail Recovery, Hands on Case Studies, Encryption and Decryption Methods, Search and Seizure of Computers, Recovering Deleted Evidences, Password Cracking.

UNIT – V **7 Hours**

Laws and Ethics, Digital Evidence Controls, Evidence Handling Procedures, Basics of Indian Evidence ACT IPC and CrPC , Electronic Communication Privacy ACT, Legal Policies.

TEXT BOOKS

1. Bernadette H Schell, Clemens Martin, "Cybercrime", ABC – CLIO Inc, California, 2004. "Understanding Forensics in IT ", NIIT Ltd, 2005.
2. Nelson Phillips and EnfingerSteuart, "Computer Forensics and Investigations", Cengage Learning, New Delhi, 2009.

REFERENCE BOOKS

1. Kevin Mandia, Chris Prosise, Matt Pepe, "Incident Response and Computer Forensics ",Tata McGraw -Hill, New Delhi, 2006.
2. Robert M Slade," Software Forensics", Tata McGraw - Hill, New Delhi, 2005.

TEACHING METHODS

1. Lecture using Black board and chalk
2. Presentations

3. Seminar on AI topics
4. Quiz

ASSESSMENT METHOD

- Midterm Test (Avg. of 2 Tests) – 30 Marks
- Seminar on Cyber Forensics Topics (from IEEE/ACM/Journal papers) 10 Marks
- Cyber-Forensics-Tools-Usage-Demonstration 10 Marks

Total = 50 Marks

COURSE OUTCOMES (COS)

At the end of Course, Student will be able to

CO	Description	Blooms Level
CO 1:	Understand and Analyse Nature and Scope of Cyber Crime, Types of Cyber Crime, Social Engineering	L2,L4
CO 2:	Understand and analyse Unauthorized Access to Computers, Computer Intrusions, White collar Crimes, Viruses and Malicious Code, Internet Hacking and Cracking, Virus Attacks	L2,L4
CO 3:	Understand and analyse Digital Forensics, Forensic Software and Hardware, Analysis and Advanced Tools, Forensic Technology and Practices, Forensic Ballistics	L2,L4
CO 4:	Understand and analyse Cyber Crime Investigation, Investigation Tools, eDiscovery, Digital Evidence Collection, Evidence Preservation, E-Mail Investigation, E-Mail Tracking, IP Tracking, E-Mail Recovery,	L2,L4
CO 5:	Understand and analyse Laws and Ethics, Digital Evidence Controls, Evidence Handling Procedures, Basics of Indian Evidence ACT IPC and CrPC	L2,L4

Mapping of Course outcomes (COs) to Program outcomes (POs)

Course Outcomes mapping to program outcomes													Program Specific Outcomes (PSOs)		
POs/ COs	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**PSO 1**	**PSO 2**	**PSO 3**
CO1	**3**				**3**	**3**		**3**				**3**	**3**		3
CO2					**3**	**3**		**3**				**3**	**3**		3
CO3					**3**	**3**		**3**				**3**	**3**		3
CO4					**3**	**3**		**3**				**3**	**3**		3

CO5					**3**	**3**		**3**				**3**	**3**		3
Correlation Level					**3**	**3**		**3**				**3**	**3**		3

Strong -3, Medium – 2, Weak -1

Department: *Computer Science and Engineering*	***Course Type:*** **Programme Core**
Course Title: *Compiler Design*	***Course Code:*** 18CS73
L-T-P: 4-0-0	***Credits:*** *3*
Total Contact Hours: *39 hrs*	***Duration of SEE:*** *3 hrs*
SEE Marks: *50*	***CIE Marks:*** *50*

COURSE DESCRIPTION

This course provides an introduction to Compiler Design and aims at solving problems in designing compilers, besides giving ideas on optimization techniques. Tools for compiler construction, green compilation techniques and also compiling for power optimization are the advanced topics dealt in this course.

Prerequisites: Knowledge of assembly level programming, Formal Languages and Automata Theory is essential.

COURSE OBJECTIVES

- To identify features of phases of compiler, learn the design aspects and tools.
- To design parser automaton, construct parser table and do the program translation
- To apply various optimization techniques on programs and to extend it for green compilation and power optimization.

COURSE CONTENTS

UNIT – I **8 Hours**

Introduction to compilers: Language processors, the structure of a compiler, Lexical Analysis, Syntax analysis, Semantic analysis, Intermediate Code generation, Optimization, Code generation, Compiler construction tools, The Science of building a compiler, Applications of compiler technology, **Lexical Analysis**: The role of lexical analyzer, A simple approach to the design of lexical analyzer, Lex tool.

UNIT – II **8 Hours**

Syntax Analysis & Parsing: Top down parsing. Recursive descent parsing, Computation of FIRST & FOLLOW sets LL(1) grammar,Bottom up parsing- shift reduce parser & conflicts, Simple LR, The canonical collection of LR(0) items, LR Parsing algorithm, Constructing SLR parsing tables, LR(1) items, Constructing canonical LR(1) parsing tables, Constructing LALR parsing tables, efficient construction of LALR parsing table, Using ambiguous grammars – precedence, associativity, dangling else problem, Parser generators, YACC.

UNIT – III **8 Hours**

Syntax Directed Translation& Intermediate code generation: Syntax directed translation schemes & implementations, Intermediate code, Syntax trees, DAG for expressions, Three address code, quadruples, triples, Translation of expressions, Control flow, Backpatching, Switch statements, Intermediate code for procedures.

UNIT – IV **8 Hours**

Runtime Environment and Code generation: Static VS Dynamic storage, stack allocation scheme, Design issues in code generation, Basic blocks and flow graphs; Optimization in the basic blocks; implementation of simple code generator, code generation algorithm; Peep hole optimization; register allocation and assignments; optimal code generation for expressions.

UNIT – V **7 Hours**

Machine Independent Optimization: The sources of optimization, common subexpression, copy propagation, dead code elimination, code motion; Data flow analysis, live variables, constant propagation, partial redundancy elimination; Loops in flow graph, depth first, back edges & reducibility.

TEXT BOOK

1. Alfred V. Aho, Monica S. Lam, Ravi Sethi, Jeffrey D. Ullman, Compilers : Principles, Techniques and Tools, Second Edition, Pearson Education, 2007.

REFERENCE BOOKS

1. Allen I.Holub, Compiler Design in C, PHI, 1990.
2. Jean Paul Tremblay and Paul G. Sorenson, The Theory and Practice of Compiler Writing,BS Publications, 2008.
3. K.C. Louden, Compiler Construction:Principles and Practice,Cengage Publications,2002.
4. Wissam Chedid, Chansu Yu, and Ben Lee, Power Analysis and Optimization Techniques for Energy Efficient Computer Systems, Electrical Engineering &Computer Science Faculty Publications118, 2005, http://engagedscholarship.csuohio.edu/enece_facpub/118
5. Ulrich Kremer, Low Power/Energy Compiler Optimizations, Dept. of Computer Science, Rutgers University, 2005, online https://www.cs.rutgers.edu/~uli/CRC04.pdf .

Other Materials: TEXT BOOK for self-study

1. Leland L. Beck, System Software, 3rd Edition, Addison Wesley, 1997.

TEACHING METHODS

- Lecture using Black board and chalk
- Power point presentations
- Exercises on Problem solving

- Self-study Assignment

ASSESSMENT METHODS

- Three internals – 30 Marks each will be conducted and the Average of best of the two will be considered.
- Rubrics for the evaluation of course project for 10 marks.
- Rubrics for the evaluation of case study for 10 marks.
- Final examination will be conducted for 100 marks and evaluated for 50 Marks.

COURSE OUTCOMES

At the end of Course, Student will be able to

CO	Description
CO 1	Explain Compilers& its phases, lexical analysis and demonstrate use of LEX tool.
CO 2	Compute LR(0), LR(1) and LALR sets of items, construct parse table for a givengrammar and show the use of YACC tool.
CO 3	Perform syntax directed translation and generate intermediate code.
CO 4	Implement runtime procedures and code generation managing optimization in codegeneration phase.
CO 5	Perform machine independent optimizations and develop optimizations for power management.

Mapping of Course outcomes (COs) to Program outcomes (POs)															
Course Outcomes mapping to program outcomes													**Program Specific Outcomes (PSOs)**		
POs/ COs	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**PSO1**	**PSO2**	**PS O3**
CO1	2	2	3		3	1	1						3	2	
CO2	3	3	3		3		1						3	3	
CO3	2	3	3		2		1						2	3	
CO4	2	2	3		2	2	3						3	3	
CO5	3	2	3		3	3	3						3	2	
Correlation Level	2	2	3		3	2	2						3	3	

*3: Strong, 2: Medium, 1: Weak **3: Highly related 2: Supportive

Department: *Computer Science and Engineering*	***Course Type:*** *Programme Elective*
Course Title*: Entrepreneurship Development ,Management and IPR*	***Course Code:****18CSH74*
L-T-P:3*-0-0*	***Credits:****03*
Total Contact Hours:*39 Hours*	***Duration of SEE:****3 Hours*
SEE Marks*: 50*	***CIE Marks:****50*

PREREQUISITES

- Students should have knowledge on the current business trends and technology.

COURSE OBJECTIVES

- To Define the role of supporting agencies, entrepreneurs and IPR
- To Describe the various process involved in establishing start-ups and applying the patents.
- To Demonstrate the knowledge on how to prepare the Project Report.
- To Examine the principles of Intellectual Property Rights
- To Analyse the importance of patents, trademarks and copyrights.

COURSE CONTENTS

UNIT- I **08 Hours**

Introduction to Entrepreneur:

Introduction-meaning and importance of entrepreneurship, entrepreneur, types, characteristics, entrepreneur process, role of entrepreneurs in economic development, problems faced by entrepreneurs, scope in India

UNIT- II **08 Hours**

MSME and Supporting Agencies:

Micro, Small and medium enterprises, Definition of MSMEs as per MSME act, characteristics of small enterprises, need and advantages of small enterprises, Steps in setting up of small enterprises, Institutional support to MSMEs-State supporting agencies-TECSOK, KIADB, KSSIDC, KSFC, National Schemes-MSME-DI, NSIC, SIDBI

UNIT -III **08 Hours**

How to prepare Project report:

Preparation of Project reports, control variables in project, project lifecycle, project report, need, project identification, project selection, components of project report, formulation of report, planning commission guidelines, project appraisal, feasibility study-market, financial, technical and economic, PERT and CPM, errors in report

UNIT -IV **08 Hours**

Introduction to Intellectual Property:

Introduction: Meaning, Relevance, Business Impact, Protection of Intellectual Property, Copyrights, Trademarks, Patents, Designs, Utility Models, Trade Secrets and Geographical Indications Bio-diversity and IPR Competing Rationales for Protection of Intellectual Property Rights, Introduction to the leading International Instruments concerning Intellectual Property Rights: the Berne Convention, Universal Copyright Convention, The Paris Convention, Patent Co-operation Treaty, TRIPS, The World Intellectual Property Organization(WIPO).

UNIT- V **07 Hours**

Introduction to Patents and Trademark:

Patents-What is a patent, history of patent, Criteria for patent, types of patents, Indian patent act, patents for computer software, business models, incremental innovation, patent infringement

Trademarks-role, as a marketing tool, trademark rights, types, use of trademarks, trademark act, trademark registration in India

Copyrights-meaning, copyright protection in India, enforcement measures, copyright.

MINIPROJECT:

A Case study on "Success and Failure of an Entrepreneurs/ Entrepreneurship needs to be presented by a team of students with areport on the Case study and this needs to be considered for internal assessment.

TEXT BOOKS

1. Dynamics of Entrepreneurial Development and Management-Vasanth Desai, Himalaya Publishing
2. Entrepreneurship and Management, S Nagendra and Manjunath VS, Pearson Publications
3. Managing Intellectual Property, Vinod V. Sople, PHI, 3rd Edition, 2012
4. Intellectual Property-Copyrights, trademarks and patents, Richard Stim, Cengage learning, 2011
5. Dr. B. L. Wadhera, Law Relating to Intellectual Property, Universal law Publishing Co. Ltd. 2009.

REFERENCE BOOKS

I. Aswani Kumar Bansal, Law of Trademarks in India.
II. Intellectual Property Rights, Handbook/Notes.
III. Course materials for one year P.G. Diploma in IPR from NLSIU, Bangalore by Mr. T. Ramakrishna.
IV. Case studies from internet sources.

TEACHING METHODS

- PPTs
- Hands-on Sessions Based Teaching

ASSESSMENT METHODS

Parameter	Marks
Three internals(Average of best of two)	30
Rubrics evaluation for the Case Study presentation	10
Seminar will be conducted	10
Total	**50**
Final Exam will be conducted for 100 marks (SEE)	

COURSE OUTCOMES

At the end of the course student will be able to:

COs	Description	Bloom's Level
CO 1	Define the role of supporting agencies, entrepreneurs and IPR in the context of protecting the IPs	**L2**
CO 2	Describe the various process involved in establishing start-ups and applying the patents	**L1**
CO 3	Demonstrate the knowledge on how to prepare the Project Report and other documentations.	**L4**
CO 4	Examine the principles of Intellectual Property Rights and its importance to become a successful entrepreneur.	**L4**
CO 5	Analyse the importance of patents, trademarks and copyrights.	**L4**

Mapping of Course outcomes (COs) to Program outcomes (POs*)& PSO **

	Course Outcomes mapping to Program Outcomes												PSOs		
POs / COs	1	2	3	4	5	6	7	8	9	10	11	12	PSO1	PSO2	PSO3
CO1				2		2	2	3	2	3	2	1			3
CO2				2		2	2	3	2	3	2	1			3
CO3				2		2	2	3	2	3	2	1			3
CO4				2		2	2	3	2	3	2	1			3
CO5				2		2	2	3	2	2	2	1			3

Department: *Computer Science & Engineering*	***Course Type:*** *Program Core*
Course Title: *HPC Lab*	***Course Code:*** *18CSL77*
L-T-P: *0-0-2*	***Credits***: *1*
Total Contact Hours: *36Hours*	***Duration of SEE:*** *3 Hours*
SEE Marks: *50*	***CIE Marks:*** *50*

COURSE DESCRIPTION

The HPC lab is aimed at reinforcing the concepts of Parallel Programming Techniques applicable for the various strains of High-performance architectures: Multicore, Multiprocessor, Message processing based Distributed computing, and Heterogenous processing ensembles.

PREREQUISITES

- Knowledge of Advanced Computer Architectures
- Ability to design and analyse Numerical Processing algorithms, Vector Processing, Searching, Sorting and String functions.

COURSE OBJECTIVES

- Provide systematic and comprehensive treatment to the Highly Integrated development Environments for HPC program development and testing.
- Provide facility with the tools useful in performance analysis of HPC facilities.
- Introduce the concepts of Heterogenous Computing platforms: CPU + GPU architectures.
- Introduce the concepts of program development for Multi-core Shared memory architectures.
- Introduce the concepts of High-Performance Computing as a service on Cloud platforms (utilizing HP computing resources and storage made available through a Cloud platform).

COURSE CONTENTS:

Part -A

1. Given a nxn matrix A and a vector x of length n, their product y=A·x, write a program to implement the multiplication using OpenMP *PARALLEL* directive.

2. Consider a Scenario where a person visits a supermarket for shopping.He purchases various items in different sections such as clothing,gaming,grocery,stationary.Write an

open MP program to process his bill parallely in each section and display the final amount to be paid. (sum of elements parallely).
3. Consider a Person named X on the earth, to find his accurate position on the globe we require the value of Pi. Write a program to compute the value of pi function by Numerical Integration using OpenMP *PARALLEL* section.
4. Using OpenMP, Design and develop a multi-threaded program to generate and print Fibonacci Series. One thread must generate the numbers up to the specified limit and another thread must print them. Ensure proper synchronization.
5. University awards gold medals to the student who has scored highest CGPA. Write a program to find the student with highest CGPA in a list of numbers using OpenMP.
6.Assume you have n robots which pick mangoes in a farm. Write a program to calculate the total number of mangoes picked by n robots parallely using MPI.
7. Design a program that implements application of MPI Collective Communications.
8. Implement Cartesian Virtual Topology in MPI.
9. Design a MPI program that uses blocking send/receive routines and nonblocking send/receive routines.
10. Multiply two square matrices (1000,2000 or 3000dimensions). Compare the performance of a sequential and parallel algorithm using open MP.

Part – B

CUDA is a parallel computing platform and an API model that was developed by Nvidia. Using CUDA one can utilize the power of Nvidia GPUs to perform general computing tasks, such as multiplying matrices and performing other linear algebra operations, instead of just doing graphical calculations. Students write programs in CUDA and understand the efficiency and power of parallelism.

ASSESSMENT METHODS

- **Experiment Write up + Execution + Viva - 15 Marks**
- **Lab Record Writing - 10 Marks**
- **Lab Internals Test - 15 Marks**
- **Surprise Test - 10 Marks**

Total = 50 M

- **Final examination will be conducted for 100 marks and evaluated for 50 Marks.**

COURSE OUTCOMES

Students will be able to

CO	Description
CO 1:	Design and implement high performance versions of standard single threaded algorithms
CO 2:	Demonstrate the architectural features in the GPU and MIC hardware accelerators
CO 3:	Design programs to extract maximum performance in a multicore, shared memory execution environment processor
CO 4:	Develop programs using OPENMP, MPI and CUDA
CO 5:	Design and deploy Parallel programs on Processor clusters, configuring clusters and cloud storage.

Mapping of Course Outcomes (COs) to Program Outcomes (POs*)& PSO **															
Course Outcomes mapping to Program Outcomes													**PSOs**		
PO/CO	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**PSO1**	**PSO2**	**PSO3**
CO1	3	1											3		
CO2	3	3	1		3								3		
CO3	3	3	2		3								3		
CO4	3	3	2	3	3								3		
CO5	3	3	3		3								3		
Correlation Level	3	3	2	3	3								3		

Department: *Computer Science And Engineering*	***Course Type:*** *Programme Core*
Course Title*: Product Development Lab*	***Course Code:****18CSL78*
L-T-P:0-0-2	***Credits:****01*
Total Contact Hours:20 Hours	***Duration Of SEE:****3 Hours*
SEE Marks*: 50*	***CIE Marks:****50*

COURSE DESCRIPTION

This lab aims at teaching students on how to work in open source projects efficiently and gain benefits from it. Students will learn about teamwork, continuous integration and also encourage diversity in open source projects.

COURSE OBJECTIVES

- To develop an understanding in students Free or Open Source Software ecosystem, its history and current practices.
- To enable students to analyze the opportunities and challenges the Free or Open Source Software presents.
- To expand student‘s knowledge and improve their success by providing them with leading edge software required to achieve better academic, career and personal growth.
- To encourage diversity in open source projects.

COURSE OUTCOMES

Students will be able to:

- Understand and appreciate the advantages of using F/OSS in developing projects.
- Compare the different Software tools and Technologies available and choose the one best suited for their project development purpose.
- Develop their skills by sharing their work and critiquing the work done by others.
- Explain to others the nature of open source software, particularly how it differs from proprietary software.
- Become a contributing member of a software development community.
- Choose an appropriate license for open source things in general and to explain what can and cannot be done with software that has a specific license.
- Explain how software licensing works in general, what choices of license exist.

DELIVERABLES

- Documentation as proof towards contributions to open source communities and/or projects.

ASSIGNMENTS NORMALLY INCLUDE

- Survey and study of published literature on the assigned topic;
- Working out a preliminary Approach to the Problem relating to the assigned topic;
- Conducting analysis/Modeling/Simulation/Experiment/Design/Feasibility;

- Implementing the selected topic
- Preparing a Written Report on the Study conducted for presentation to the Department;
- Final Demo and Seminar, as oral Presentation before a Departmental Committee

ASSESSMENT METHODS

Parameter	Marks
Initial Seminar	10
Product Design and Demo	30
Report	10
Total	**50**
Final Exam will be conducted for 100 marks (SEE)	

***Department:** Computer Science And Engineering*	***Course Type:** Programme Core*
***Course Title**: Project Work-III*	***Course Code:**18CSP79*
L-T-P:0-0-0-4	***Credits:**01*
Total Contact Hours:20 Hours	***Duration Of SEE:**3 Hours*
***SEE Marks**: 50*	***CIE Marks:**50*

COURSE DESCRIPTION

The project work will be assigned to the students towards the end of 6th semester and will start working on those projects at the commencement of their 7th semester. The topic of the project will be decided as per the developments taking place in the field of Computer Science and Engineering.

COURSE OBJECTIVES

The objective of Project Work III is to enable the student to take up investigative study in the broad field of Computer Science & Engineering, either fully theoretical/practical or involving both theoretical and practical work to be assigned by the Department on an individual basis or two/three students in a group, under the guidance of a Supervisor. This is expected to provide a good initiation for the student(s) in R&D work.

The assignment to normally include:

- Survey and study of published literature on the assigned topic;
- Working out a preliminary Approach to the Problem relating to the assigned topic;
- Conducting preliminary Analysis/Modelling/Simulation/Experiment/Design/Feasibility;
- Preparing a Written Report on the Study conducted for presentation to the Department;
- Final Seminar, as oral Presentation before a Departmental Committee.

COURSE OUTCOMES

Students will be able to:

- Survey and study of published literature on the assigned topic
- Complete the preliminary approach to the Problem relating to the assigned topic;
- Complete Conducting preliminary Analysis/Modelling/Simulation/Experiment/Design/Feasibility;

ASSESSMENT METHODS

Parameter	Marks
Initial Seminar	10
Product Design and Demo	30
Report	10
Total	**50**
Final Exam will be conducted for 100 marks (SEE)	

Course content for
VII – Semester
Program Elective - D

Department: *Computer Science and Engineering*	***Course Type:*** *Program Elective*
Course Title: Introduction to Machine Learning	***Course Code:18CS751***
L-T-P:3-0-0	***Credits:*** *03*
Total Contact Hours:39 *hrs*	***Duration of SEE:*** *3hrs*
SEE Marks*: 50*	***CIE Marks:*** *50*

COURSE DESCRIPTION

This course imparts the concepts of machine learning which is the necessity is in today's self-learning systems. It includes the concepts of machine learning, types, perceptrons and neural networks, decision tree learning, Bayesian learning and Clustering.

COURSE OBJECTIVES

- To understand the concepts of machine learning. Types of machine learning and preliminaries
- To understand and describe Neural network learning, Bayesian learning, decision tree learning, nearest neighbour learning and clustering.
- To employ machine learning techniques to solve problems

COURSE CONTENTS

UNIT 1 **7 Hours**

Introduction : Machine learning, Types of machine learning, Machine learning process, Supervised learning, Examples of machine learning applications, **Machine learning preliminaries:** Weight space, curse of dimensionality, Testing machine learning algorithms: Overfitting, training, testing, and validation sets, confusion matrix, accuracy metrics, ROC curve, Unbalanced datasets, Measurement precision, **Basic Statistics** : Averages, variance, covariance, Gaussian, Bias, Variance tradeoff.

UNIT 2 **8 Hours**

Neurons, Neural Networks: The brain and the neuron, Neural networks, The Perceptron, Training a perceptron, Learning Boolean functions, Linear Separability,
Multilayer Perceptron : The Multi-layer Perceptron Algorithm, Initialising the Weights , Different Output Activation Functions, Backpropogation algorithm, Sequential and Batch Training, Local Minima, Picking Up Momentum, Minibatches and Stochastic Gradient Descent, Other Improvements

UNIT 3 **8 Hours**

Bayesian Learning : Introduction , Classification, Losses and Risks, Discriminant Functions, Utility Theory, Association Rules, Bayes Optimal Classifier, Naïve Bayes Classifier, Bayesian Belief Networks.

Nearest neighbor methods: k-nearest neighbor learning, Distance – weighted Nearest neighbor algorithm , Examples

UNIT 4 **8 Hours**

Decision trees : Learning with trees, Using decision trees, Univariate Trees, Classification Trees, Regression Trees, Pruning, Rule Extraction from Trees, Learning Rules from Data, Multivariate Trees, ID3, Examples

UNIT 5 **8 Hours**

Unsupervised learning-Clustering : Introduction, Mixture Densities, *k*-Means Clustering, Expectation-Maximization Algorithm, Mixtures of Latent Variable Models, Supervised Learning after Clustering, Hierarchical Clustering, Choosing the Number of Clusters

TEXT BOOKS

1. Stephan Marsland, "Machine Learning, An algorithmic approach", CRC Press Second Edition.
2. Ethem Alpaydin, "Introduction to Machine Learning", 2nd Ed., PHI Learning Pvt. Ltd., 2013

REFERENCE BOOKS

1. Tom M. Mitchell, "Machine Learning", McGraw-Hill Education (INDIAN EDITION), 2013

TEACHING METHODOLOGY

- Lectures, Problem Based Learning
- Discussion
- Demonstration

COURSE OUTCOMES

After completion of the course, the students will be able to:

CO	DESCRIPTION
CO1	Interpret machine learning, types and preliminary concepts related to machine learning
CO2	Describe the working of Perceptron and MLP, Utilize them to solve problems
CO3	Illustrate the working of Bayesian learning and nearest neighbour learning
CO4	Learn to construct and use decision trees.
CO5	Identify the need of unsupervised learning and illustrate Partitioning Methods and Hierarchical Methods of clustering.

CO-PO Mapping

Mapping of Course outcomes (COs) to Program outcomes (POs) & Programme Specific Objectives(PSO)															
Course Outcomes mapping to program outcomes													Program Specific Outcomes (PSOs)		
POs/ COs	1	2	3	4	5	6	7	8	9	10	11	12	PSO1	PSO2	PSO3
CO1	3	2											2		
CO2	3	2	2						1	1			2	2	1
CO3	3	2	2						1	1			2	2	1
CO4	3	2	2						1	1			2	2	1
CO5	3	2	2						1	1			2	2	1

Assessment Method

- **MidSem Exams (Avg. of 2 Exams)** **30 Marks**
- **Laboratory Based Exercises** **20 Marks**

Total **50 Marks**

Final examination, of 100 Marks will be conducted and will be evaluated for 50 Marks.

Department: *Computer Science and Engineering*	***Course Type:*** *Programme Elective*
Course Title*: Introduction to Block Chain Technologies*	***Course Code:*** *18CSE752*
L-T-P:*3-0-0*	***Credits:****03*
Total Contact Hours:*39 Hours*	***Duration of SEE:****3 Hours*
SEE Marks*: 50*	***CIE Marks:****50*

COURSE DESCRIPTION

The widespread popularity of digital crypto-currencies has led to the foundation of Block Chain, which is fundamentally a public digital ledger to share information in a trustworthy and secure way. The concept and applications of Block Chain have now spread from crypto-currencies to various other domains, including business process management, smart contracts, IoT and so on. This covers both the conceptual as well as application aspects of Block Chain. This includes the fundamental design and architectural primitives of Block Chain, the system and the security aspects, along with various application domains.

PREREQUISITES

- Student should have prior basic knowledge on C++ , Data Structures and OOP Concepts
- Students should be able to develop a webpage by the use of Java Script.

COURSE OBJECTIVES

- Understand how Block Chain systems (mainly Bitcoin and Ethereum) work
- Understand emerging abstract concepts of Block Chain Technology.
- Design, build, and deploy smart contracts and distributed applications,
- Attain awareness of security aspects of bit coin and Block Chain technology.

COURSE CONTENTS

UNIT- I **08 Hours**

INTRODUCTION TO BLOCKCHAIN

Classical Block Chain data structure; Foundational technologies: Hashing, Cryptography, Mining, Key Exchange, Smart contracts, Bitcoin Transactions, public vs permissioned. Block Chain data structures: Merkle Tree, Patricia Tree Hashing Applications, Key distribution, Diffie Hellman problems, PKE and RSA algorithms.

UNIT- II **08 Hours**

SOLIDITY AND DAPPS

Ethereum Clients, Go- EthereumClients(geth),Python Ethereum Client (pyethapp), Ethereum Languages, Solidity, TestRPC, Mist Ethereum Wallet,MetaMask,Web3 JavaScript API, Ethereum Accounts.

Smart Contract, Structure of a Contract, Setting up and Interacting with the Contract using Geth client, Compiling and Developing Contract, Transactions and Calls, Interacting with the Contract, Gas ,Logs, Events, Setting up and Interacting with a Contract using Mist Wallet, Compiling and Developing Contract, Interacting with the Contract, Smart Contract Examples.

UNIT -III **08 Hours**

CONSENSUS ALGORITHMS AND CLASSICAL RESULTS

Block Chain Scalability, Double-Spending Problem, Why consensus is harder in Block Chain? Classical Results, Byzantine Fault Tolerance(PBFT in detail), Proof-of-Work Vs Proof-of-Stake, Consistency, Availability & Partition Tolerance (CAP), Turing Completeness, Greedy Heaviest-Observed Sub-Tree (GHOST), Sybil Attack, Mining Pools and Centralization, Zero knowledge Proof(ZeroCoin).

UNIT- IV **08 Hours**

NEXT GENERATION OF BLOCKCHAINS

HyperLedger: Fabric/Sawtooth- Introduction to generic block Chains and smart contracts. Building applications with HyperLedger Fabric/Sawtooth. Comparison between HyperLedger and Ethereum.
IoTA: Introduction to the Tangle. Concepts of Merkle trees to be applied. Path traversal and development using Javascript Libraries.

UNIT -V **07 Hours**

BITCOIN AND BLOCKCHAIN SECURITY

Securing Bit-coin and Block Chain, Security practices for your wallet, Types of wallets, Hardware wallets, Workings of a hardware wallet, Types of physical Bit-coins, The survival of crypto-currencies.

COURSE PROJECT

Students will have to design and build a first Block Chain, create wallets and send signed transactions using Block Chain using any language of their choice. GROUPS: Students need to form a group of 4 students. All members will collectively submit a single copy of all works.

TEXT BOOKS

1. ArshdeepBahga, Vijay Madisetti, "Block Chain Applications- A Hands-on Approach", VPT; 1 Edition, 2017
2. KirankalyanKulkarni, "Learn Bitcoin and Block Chain", Packt Publishing, 2018.
3. Melanie Swan, "Blockchain: Blueprint for a New Economy, 1st Edition , O'Reilly Publications, 2015.

REFERENCE BOOKS

1. Arvind Narayanan, Joseph Bonneau, Edward Felten, Andrew Miller and Steven Goldfeder, Bitcoin and Cryptocurrency Technologies: A Comprehensive Introduction, Princeton University Press (July 19, 2016).
2. Wattenhofer, The Science of the Blockchain
3. Antonopoulos, Mastering Bitcoin: Unlocking Digital Cryptocurrencies
4. Satoshi Nakamoto, Bitcoin: A Peer-to-Peer Electronic Cash System

5. DR. Gavin Wood, “ETHEREUM: A Secure Decentralized Transaction Ledger,”Yellow paper.2014.
6. Nicola Atzei, Massimo Bartoletti, and TizianaCimoli, A survey of attacks on Ethereum smart contracts

TEACHING METHODS

- Lecture (Power Point presentations/ Black board teaching (if needed))
- Regular review of students by asking questions based on topics covered in the class.

ASSESSMENT METHODS

Parameter	Marks
Three internals(Average of best of two)	30
Rubrics evaluation for the Course Project will be conducted	10
Programming Assignment will be conducted	10
Total	**50**
Final Exam will be conducted for 100 marks (SEE)	

COURSE OUTCOMES

At the end of the course student will be able to:

COs	Description	Bloom’s
CO 1	Identify the importance of Cryptocurrency, BlockChain technology and Applications	**L1**
CO 2	Demonstrate the usage of the Ethereum based BlockChain platform	**L3**
CO 3	Setting up and Interacting with the Smart Contracts	**L4**
CO 4	Understand the advanced BlockChain, security concerns of BlockChain Technology, Bitcoins	**L2**
CO 5	Design, build, and deploy a distributed application.	**L6**

Mapping of Course outcomes (COs) to Program outcomes (POs*)& PSO **															
Course Outcomes mapping to Program Outcomes													PSOs		
POs / COs	1	2	3	4	5	6	7	8	9	10	11	12	PSO1	PSO2	PSO3
CO1	3	2	2		2								2	2	
CO2	3	2	2		2								2	2	
CO3	3	2	2		2								2	2	
CO4	3	2	2		2								2	2	
CO5	3	2	2		2					2	1	1	2	2	1

3: Strong, 2: Medium, 1: Weak ** H: Highly related S: Supportive

Course Title: *Building Applications using Microservices Architecture*	***Course Code:*** *18CSE753*
L-T-P: 3-0-0	***Credits:*** 03
Total Contact Hours: 39 Hours	***Duration of SEE :*** *3 Hours*
SEE Marks*: 50*	***CIE Marks: 50***

COURSE DESCRIPTION

This course is intended to provide students with the skills required to create Applications using the concept o f Microservice Architectures.

COURSE CONTENTS

UNIT – I **6 Hours**

Introduction to Microservices Architectures: Brief introduction toMicrosoft’s .Net, .Net Framework, C#, Simple Application in C#, Introduction to Service Oriented Architectures and Microservice Architectures with examples. Comparison of the two types of architectures. Problems with monolithic architectures. Standardization of the .NET stack. Decomposition criteria.

UNIT – II **8Hours**

Implementing Microservices: Standardization of the .NET stack, Problem Scaling, Decomposition criteria, .NET Development platform, Essential qualities of microservices, Domain Driven Design, Isolation of Services, Defining the seam by delimiting functionality,

UNIT – III **8Hours**

Microservices Integration: Collaborative service architecture, Synchronous and Asynchronous communication schemes, Request / Response, Event based techniques, Integration Patterns- API gateway patterns, Event driven patterns, Consistency, Rollback, Competing transactions, Competing Consumers.

UNIT – IV **6Hours**

Testing Microservices: Testing challenges**,** Testing strategies, Testing pyramid, Unit, Service, and Integration testing, contract testing and performance testing, User Interface testing, Test Stubs and Mocks.

UNIT – V **8Hours**

Deployment of Microservices, Introduction to Containers and Dockers, Securing Microservices, Monitoring Microservices, Case study.

TEXT BOOKS

1. Gaurav Aroraa, Building Microservices with .NET Core 2.0 - Second Edition: Transitioning monolithic architectures using microservices with .NET Core 2.0 using C# 7.0, Packt Publishers,
2. Akhil Mittal: Microservices using ASP.NET Core, E-Book.

DELIVERY METHODS

- .... Lecture (PPT)
- .... Tutorials

Course Project: Each student will form a group with 1, but no more than 2, other classmates. Each group will create a different C# Windows application to be completed at the end of the Semester. Specific details on the deliverable will be explained during the term.

ASSESSMENT METHOD

Parameter	Marks
Three internals(Average of best of two)	30
Course Project	20
Total	**50**
Final Exam will be conducted for 100 marks (SEE)	

COURSE OUTCOMES

At the completion of this course, the student will be able to:

Cos	Description	Bloom's Level
CO 1	Understand the fundamentals of Microservices and .Net framework.	**L2**
CO 2	Demonstrate the ability to design Microservice application	**L3**
CO 3	Develop the ability to build cooperating multi-microservice applications.	**L4**
CO 4	Demonstrate the techniques of Integrating and Deploying Microservices	**L3**
CO 5	Discuss issues of Testing and Securing Microservice applications	**L2**

Mapping of Course outcomes (COs) to Program outcomes (POs*)& PSO **

Course Outcomes mapping to Program Outcomes													PSOs		
POs COs	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**PSO1**	**PSO2**	**PSO3**
CO1	3	3											3		
CO2	3	3											3		
CO3	3	3	3										3		
CO4	2	2	2	2									3		
CO5		2	2	2	2									2	

3: Strong, 2: Medium, 1: Weak ** H: Highly related S: Supportive

***Department**: Computer Science and Engineering*	***Course Type**: Programme Elective*
***Course Title:** Game Theory*	***Course Code**:18CSE754*
***L-T-P**:3-0-0*	***Credits**: 03*
***Total Contact Hours**: 39 Hours*	***Duration** of SEE: 3 Hours*
***SEE Marks**: 50*	***CIE Marks**: 50*

COURSE DESCRIPTION

The course will provide the basics: representing games and strategies, the extensive form (which computer scientists call game trees), Bayesian games (modeling things like auctions), repeated and stochastic games, and more. A variety of examples including classic games and a few applications will be included.

PREREQUISITES

- Mathematical thinking.
- Basic probability theory, Calculus

COURSE CONTENTS

UNIT - I **08 Hours**

Introduction: Introduction, overview, uses of game theory, some applications and examples, and formal definitions of: the normal form, payoffs, strategies, pure strategy Nash equilibrium, dominant strategies.

UNIT – II **08 Hours**

Mixed-Strategy Nash Equilibrium: Pure and mixed strategy Nash equilibria. **Alternate Solution Concepts:** Iterative removal of strictly dominated strategies, minimax strategies and the minimax theorem for zero-sum game, correlated equilibria

UNIT-III **08Hours**

Extensive-Form Games: Perfect information games: trees, players assigned to nodes, payoffs, backward Induction, subgame perfect equilibrium, introduction to imperfect-information games, mixed versus behavioral strategies.

UNIT – IV **08 Hours**

Repeated Games

Repeated prisoners dilemma, finite and infinite repeated games, limited-average versus future-discounted reward, folk theorems, stochastic games and learning.

UNIT – V **07 Hours**

Bayesian Games

General definitions, ex ante/interim Bayesian Nash equilibrium. **Coalitional Games:** Transferable utility cooperative games, Shapley value, Core, applications.

TEXT BOOKS

- Essentials of Game Theory, by Kevin Leyton-Brown and YoavShoham; Morgan and Claypool Publishers, 2008.
- A Brief Introduction to the Basics of Game Theory, by Matthew O. Jackson.

REFERENCE BOOKS

1. Osborne, M.J.An Introduction to Game Theory, Oxford University Press, 2004
2. Mas-Colell,A., M.D. Whinston and J.R. Green Microeconomic Theory, Oxford University Press, 1995
3. Gibbons, R.A Primer in Game Theory,Pearson Education, 1992

TEACHING METHODS

1. Lecture using Black board and chalk
2. PowerPoint presentations (if needed)
3. Regular review of students by asking questions based on topics covered in the class

ASSESSMENT METHODS

Parameter	Marks
Three internals(Average of best)	30
Seminar	10
Case Study	10
Total	**50**
Final Exam will be conducted for 100 marks (SEE)	

COURSE OUTCOMES

At the end of the course student will be able to:

COs	Description	Bloom's Level
CO 1	Understand the Gaming basics and its various applications.	L2
CO 2	Solve problems on game theory for pure and mixed strategy under competitive environment.	L3
CO 3	Understand and Apply Perfect Information Game strategies for real world games.	L2
CO 4	Recognize and evaluate the classic “Prisoners' Dilemma” to a variety of real-world problems	L5
CO 5	Apply Bayesian Nash equilibrium strategy for a specific problem.	L3

Mapping of Course outcomes (COs) to Program outcomes (POs*)& PSO **

	Course Outcomes mapping to Program Outcomes												PSOs		
POs / COs	1	2	3	4	5	6	7	8	9	10	11	12	PSO1	PSO2	PSO3
CO1	3	3		2									3		2
CO2	3	3		2									3		2
CO3	3	3		2									3		2
CO4	3	2		2									3		2
CO5	3	2		2									3		2

3 : Strong, 2: Medium, 1: Weak ** H: Highly related S: Supportive

***Department**: Computer Science and Engineering*	***Course Type:** Programme Elective*
***Course Title**: Computer Vision*	***Course Code:**18CSE755*
***L-T-P:**3-0-0*	***Credits:** 03*
***Total Contact Hours:** 40 Hours*	***Duration of SEE:** 3 Hours*
***SEE Marks**: 50*	***CIE Marks:** 50*

COURSE DESCRIPTION

Introduction to Image formation and vision system, representation of image using spatial and frequency transform, finding patterns using edge detection and Texture, Analysis of image using early, mid-level and high level vision techniques.

PREREQUISITES

Fundamental Knowledge of Mathematics.

COURSE OBJECTIVES

This course will enable students to

- Explain image formation, Image model and Vision System
- Study of Early Vision techniques like edge detection and Texture
- Ability to analyse the image in multiple views
- Analysing and representation of images using mid-level vision.
- Analysing and representation of images using high-level vision.

COURSE CONTENTS

UNIT - I **8 Hours**

Image formation and Image model-Components of a vision system-Cameras-Radiometry-Light in space-Light in surface- sources, shadows and shading, Color-Human color perception-Representation of color- A model for image color-Surface color from image color

UNIT II **8 Hours**

Early vision-Linear Filters and Convolution-Shift variant Linear system- Spatial Frequency and Fourier Transforms-Sampling and Aliasing-Filters as Templates-Normalized co relation and finding patterns-Edge detection-Texture Representation ,Analysis and Application

UNIT - III **8 Hours**

Multiple images-The Geometry of multiple views-Stereopsis-Affine structure from motion Elements of Affine Geometry-Affine structure and motion from two images-Affine structure and motion from multiple images-From Affine to Euclidean images.

UNIT IV **8 Hours**

Middle level vision-Segmentation by clustering-Shot Boundary Detection and Background Subtraction-Image segmentation by clustering pixels-Segmentation by Graph-Theoretic clustering- Segmentation by fitting a model-The Hough Transform-Fitting lines-Fitting curves- Fitting as a probabilistic inference problem-Robustness-Segmentation and fitting using probabilistic methods.

UNIT V 8 Hours

High level vision-:Geometric methods-Model based vision-Obtaining hypothesis by pose consistency, pose clustering and using Invariants- Verification-smooth surface and their outlines-Aspect graphs- Range data-Range Data segmentation- Range image Registration and model acquisition-Object Recognition.

TEXT BOOKS

1. Computer vision – A modern Approach , David A forsyth & Jean ponce , Prentice Hall ,2002.
2. “Computer vision and Applications” , Bernd Jahne and Horst HauBecker Academic press ,2000.

TEACHING METHODS

- Lectures
- Power Point Presentation
- Case Study

ASSESSMENT METHODS

Parameter	Marks
Three internals(Average of best of two)	30
Programming Assignment	10
Case Study	10
Total	**50**
Final Exam will be conducted for 100 marks (SEE)	

COURSE OUTCOMES

At the end of the course students will be able to:

CO	DESCRIPTION	Bloom's Level
CO 1	Understand the concepts of Image Formation and Color-Human color perception-Representation of color	L1
CO 2	Able to represent the image in spatial and frequency domain and finding image patterns using Edges and texture representation.	L2
CO 3	Able to analyse the images with in multiple views using affine transformation.	L3
CO 4	Able to apply and analyse the images using midlevel vision techniques	L3
CO 5	Able to apply and analyse the images using high level vision techniques	L4

Mapping of Course outcomes (COs) to Program outcomes (POs*)& PSO **

Course Outcomes mapping to Program Outcomes													PSOs		
POs COs	1	2	3	4	5	6	7	8	9	10	11	12	PSO1	PSO2	PSO3
CO1	3	2												3	2
CO2		2	3	2	2									3	2
CO3		3		2	2									3	2
CO4			3	2	2									3	2
CO5			3	2	2									3	2

3: Strong, 2: Medium, 1: Weak ** H: Highly related S: Supportive

Department: *Computer Science and Engineering*	***Course Type:*** *Programme Elective*
Course Title: *Linux Kernel Programming*	***Course Code:****18CSE756*
L-T-P: 3-0-0	***Credits:*** *03*
Total Contact Hours: *39 Hours*	***Duration of SEE:*** *3 Hours*
SEE Marks: *50*	***CIE Marks:*** *50*

PREREQUISITES

- Students should have studied Systems Programming and Applications Programming like C/C++ programming.
- Students should have studied Operating Systems

COURSE OBJECTIVES

enable students to experiment with a contemporary OS (Linux). Through a series of programming assignments, the students will develop an appreciation in systems programming in general, experience the new open source software development model, and gain necessary skills and experiences to work large system software as complex as an OS kernel.

COURSE CONTENTS

UNIT - I **8 Hours**

roduction to Linux- Linux Versus Other Unix-Like Kernels, Hardware Dependency, Linux Versions, Basic Operating System Concepts. Booting, Compilation, Initialization.

UNIT - II **8 Hours**

Programs, Processes, and Threads - Processes, Lightweight Processes, and Threads, Process Descriptor, Process Switch, Creating Processes, Destroying Processes, Scheduling Policy, The Scheduling Algorithm, Data Structures Used by the Scheduler, Functions Used by the Scheduler.

UNIT - III **8 Hours**

Interrupts and Exceptions - The Role of Interrupt Signals, Interrupts and Exceptions, Nested Execution of Exception and Interrupt Handlers, Initializing the Interrupt Descriptor Table, Exception Handling, Interrupt Handling, Softirqs and Tasklets, Work Queues, Returning from Interrupts and Exceptions.

UNIT – IV **8 Hours**

Memory Management- Page Frame Management, Memory Area Management, Noncontiguous Memory

Area Management, The Process’s Address Space, The Memory Descriptor, Memory Regions, Page Fault Exception Handler, Creating and Deleting a Process Address Space, Managing the Heap.

UNIT- V **7 Hours**

System Calls - POSIX APIs and System Calls, System Call Handler and Service Routines, Entering and Exiting a System Call, Parameter Passing, Kernel Wrapper Routines.

Device Drivers - I/O Architecture, The Device Driver Model, Device Files, Device Drivers, Character Device Drivers.

TEXT BOOKS

1. Understanding the Linux Kernel (ULK), 3rd Edition, by Daniel Bovet and Marco Cesati;
2. Linux Kernel Development (LKD), 3rd Edition, by Robert Love, Addison-Wesley, 2010

REFERENCES

1. Raghu Bharadwaj, Mastering Linux Kernel Development: A Kernel Developer's Reference Manual, packt, 2017.
2. PETERSEN and RICHARD, LINUX: THE COMPLETE REFERENCE, McGraw Hill, 2007.

TEACHING METHODS

- PPTs
- Hands-on Sessions Based Teaching

ASSESSMENT METHODS

Parameter	Marks
Three internals(Average of best of two)	30
Programming Assignment	20
Total	**50**
Final Exam will be conducted for 100 marks (SEE)	

COURSE OUTCOMES

At the end of the course student will be able to:

COs	Description	Bloom’s level
CO 1	Configure, build, and install the Linux kernel.	**L3**
CO 2	Describe and explain the difference programs, processes and threads.	**L2**
CO 3	Learn how to deal with interrupt and exceptions at kernel level.	**L2**
CO 4	Memory management at linux kernel level.	**L3**
CO 5	Gain some basic skills of system programming and device driver.	**L2**

Mapping of Course outcomes (COs) to Program outcomes (POs*)& PSO **															
Course Outcomes mapping to Program Outcomes													PSOs		
POs / COs	1	2	3	4	5	6	7	8	9	10	11	12	PSO1	PSO2	PSO3
CO1	3	2												3	2
CO2		2	3	2	2									3	2
CO3		3		2	2									3	2
CO4			3	2	2									3	2
CO5			3	2	2									3	2

3: Strong, 2: Medium, 1: Weak ** H: Highly related S: Supportive

Department : *Computer Science and Engineering*	***Course Type :*** *Programme Elective*
Course Title: *Building Enterprise Applications*	***Course Code***: *18CSE757*
L-T-P: *3-0-0*	***Credits***: *3*
Total Contact Hours: *39 Hours*	***Duration of SEE***: *3 Hours*
SEEMarks:*50*	***CIE Marks***: *50*

COURSE DESCRIPTION

This course is designed for imparting knowledge on large enterprise application of present and future era. Details on designing, architecture, construction and testing an enterprise application are provided to enhance the skill levels. A case study of easy money bank is dealt throughout this course.

PREREQUISITES

- Students should have prior knowledge of Object Oriented Concepts.
- Students should have the understanding of SDLC.

COURSE OBJECTIVES

- To define, classify and explain Enterprise Application
- To architect and design enterprise application with relevant technology
- To know construction details of the enterprise application.

COURSE CONTENTS

UNIT – I **8 Hours**

Introduction and Incepting to Building Enterprise applications: Enterprise Applications, Software Engineering Methodologies, Life Cycle of Raising Enterprise Applications, Three Key Determinants of Successful Enterprise Applications, Measuring the Success of Enterprise Applications, Enterprise Analysis, Business Modeling, Case Study of EM Bank.

UNIT – II **8 Hours**

Requirement Analysis and Architecting and Designing Enterprise Applications Case Study, Requirement Elicitation and Analysis, Requirements Validation, Planning and Estimation, Architecture, Views and Viewpoints, Enterprise Application, An Enterprise Architecture Perspective, Logical Architecture.

UNIT – III **8 Hours**

Technical, Data and Infrastructure Architecture Case Study, Technical Architecture and Design, Data Architecture and Design, Infrastructure Architecture and Design, Architecture Design and Documentation.

8 Hours

UNIT – IV

Constructing Enterprise Applications Case Study, Construction Readiness, Introduction to Software Construction Map, Constructing the Solution Layers, Code Review, Static Code Analysis, Build Process and UNIT Testing, Dynamic Code Analysis.

UNIT – V **7 Hours**

Testing and Rolling Out Enterprise Applications Case Study, Testing Enterprise Applications, Enterprise Application Environments, Integration Testing, System Testing, User Acceptance Testing, Rolling out Enterprise Applications.

TEXT BOOKS

1.Anubhav Pradhan, Satheesha B. Nanjappa, Senthil K.Nallasamy and Veerakumar Esakimuthu Raising Enterprise Applications, Wiley India, 2010.

REFERENCE BOOKS

1. Inderjeet Singh, Beth Stearns, Mark Johnson and the Enterprise Team,Designing Enterprise Applications with the J2EE Platform, 2nd Edition, Addison Wesley, 2002.

TEACHING METHODS

1. Lecture using Black board and chalk
2. PowerPoint presentations (if needed)
3. Regular review of students by asking questions based on topics covered in the class
4. Case Study using Selenium tool.

ASSESSMENT METHODS

Parameter	Marks
Midterm Test (Average of 2 Tests)	30
Surprise Test	10
Assignment / Case Study / Minor project	10
Total	**50**

COURSE OUTCOMES

At the end of the course the student will be able to

CO	Description	Bloom's level
CO 1	Comprehend the concepts of building Enterprise Applications, methodologies, life cycle and enterprise modeling.	**L2**
CO 2	Perform requirement elicitation and analysis, validation, planning and estimation.	**L2**
CO 3	Design data and infrastructure architecture and prepare related documentation.	**L3**
CO 4	Construct enterprise applications and perform static & dynamic code analysis.	**L3**
CO 5	Develop testing process of enterprise applications, with emphasis on UNIT testing, integration testing, system testing, and user acceptance testing.	**L4**

Mapping of Course outcomes (COs) to Program outcomes (POs*)& PSO **

Course Outcomes mapping to Program Outcomes													PSOs		
POs / COs	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**PSO1**	**PSO2**	**PSO3**
CO1	3	2	3		2	1		1	2	1	1		3	2	2
CO2	3	2	3		2	1	1	1	3	1	3		3	3	2
CO3	2	1	3	2	1			1	2	3	2		3	3	2
CO4	1		3		1			1	3	2	2		3	3	3
CO5	1	2	3	1	2	2	1	1	3	1	2		3	3	2

3: Strong, 2: Medium, 1: Weak ** H: Highly related S: Supportive

Course Content for VII – Semester Open Elective -2

Department: *Computer Science and Engineering*	***Course Type:*** *Open Elective*
Course Title*: Introduction to Cyber Security*	***Course Code:****18CSO761*
L-T-P:3*-0-0*	***Credits:*** *03*
Total Contact Hours: *39 Hours*	***Duration of SEE:*** *3 Hours*
SEE Marks*: 50*	***CIE Marks:*** *50*

COURSEDESCRIPTION

Cyber Security course covers system vulnerabilities, and introduces few network defense and web applications tools. The course also gives a brief introduction about cyber crime and investigation.

PREREQUISITES

Required Knowledge of any Operating System, Networking and Digital Security Issues.

COURSE OBJECTIVES

- Able to identify security risks and take preventive steps
- Investigate cybercrime and collect evidences
- Able to use knowledge of forensic tools and software

COURSE CONTENTS

UNIT – I **08 Hours**

Systems Vulnerability: Scanning Overview of vulnerability scanning, Open Port / Service Identification, Banner / Version Check, Traffic Probe, Vulnerability Probe, Vulnerability Examples, OpenVAS, Metasploit. Networks Vulnerability Scanning - Netcat, Socat, Network Reconnaissance – Nmap, Network Sniffers and Injection tools – Tcpdump and Wireshark, Hping Kismet.

UNIT – II **08 Hours**

Network Defense tools: Firewalls and Packet Filters: Firewall Basics, Packet Filter Vs Firewall, How a Firewall Protects a Network, Packet Characteristic to Filter, Stateless VsStateful Firewalls, Network Address Translation (NAT) and Port Forwarding, the basic of Virtual Private Networks, Linux Firewall.

UNIT – III **08 Hours**

Web Application Tools: Scanning for web vulnerabilities tools: Nikto, W3af, HTTP utilities - Curl, OpenSSL and Stunnel, Application Inspection tools – Zed Attack Proxy, Sqlmap. DVWA, Webgoat, Password Cracking and Brute-Force Tools – John the Ripper, L0htcrack, Pwdump, HTC-Hydra.

UNIT – IV **08 Hours**

Cyber Crime: Introduction to Cyber Crime and law Cyber Crimes, Types of Cybercrime, Hacking, Attack vectors, Cyberspace and Criminal Behavior, Clarification of Terms, Traditional Problems Associated with

Computer Crime, Introduction to Incident Response, Digital Forensics, Computer Language, Network Language, Realms of the Cyber world.

UNIT – V **07 Hours**

Cyber Investigation: Introduction to Cyber Crime Investigation Firewalls and Packet Filters, password Cracking, Key loggers and Spyware, Virus and Warms, Trojan and backdoors, Steganography, DOS and DDOS attack, SQL injection, Buffer Overflow, Attack on wireless Networks.

TEXT BOOKS

1. Anti-Hacker Tool Kit (Indian Edition) by Mike Shema, Publication McGraw Hill
2. Cyber Security Understanding Cyber Crimes, Computer Forensics and Legal Perspectives by Nina Godbole and SunitBelpure, Publication Wiley

REFERENCE BOOKS

1. Marjie T. Britz - Computer Forensics and Cyber Crime: An Introduction - Pearson
2. Chwan-Hwa (John) Wu,J. David Irwin - Introduction to Computer Networks and Cybersecurity - CRC Press
3. Bill Nelson, Amelia Phillips, Christopher Steuart - Guide to Computer Forensics and Investigations - engage Learning.

ASSESSMENT METHODS

Parameter	Marks
Midterm Test (Avg. of 2 Tests)	30
Case study	20
Total	**50**
Final Exam will be conducted for 100 marks (SEE)	

COURSE OUTCOMES

COs	Description	Blooms Level
CO 1	Define and illustrate cyber security concepts and applications	L1
CO 2	Analyze the working of cyber security principles to system design	L4
CO 3	Illustrate appropriate techniques to solve cyber security threats	L2
CO 4	Evaluate and implement cyber security through network security	L4

Mapping of Course outcomes (COs) to Program outcomes (POs*)& PSO **															
Course Outcome mapping to Programme Outcomes													**PSO**		
Pos Cos	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**PSO1**	**PSO2**	**PSO3**
CO1	3		3									3	2	3	
CO2		3	3										3		3
CO3		3	3										3		3
CO4		3	3									3			3
CO5	3		3									3	2	3	

3: Strong, 2: Medium, 1: Weak ** H: Highly related S: Supportive

Department : *Computer Science and Engineering*	***Course Type :*** *Open Elective*
Course Title: *Introduction to Software Testing*	***Course Code:*** *18CSO762*
L-T-P: 3-0-0	***Credits:****03*
Total Contact Hours: 39 *Hours*	***Duration of SEE :*** *3 Hours*
SEE Marks*: 50*	***CIE Marks: 50***

COURSE DESCRIPTION

This course provides an understanding of Software testing. The course also provides the knowledge of White box and Black box testing, Functional and Non-functional testing in real time applications.

PREREQUISITES

- Basic Knowledge of Computer Programming.

COURSE OBJECTIVES

- To understand the fundamentals of Software testing.
- To automate Web applications using Selenium.

COURSE CONTENTS

UNIT – I **08 Hours**

Basics Of Software Testing: Human Errors and Testing; Software Quality; Requirements, Behavior and Correctness; Correctness versus Reliability; Testing and Debugging; Test Metrics, Software and Hardware Testing; Testing and Verification. Defect Management; Execution History; Test generation Strategies, Static Testing. Model-Based Testing and Model Checking ; Control-Flow Graph.

UNIT – II **08 Hours**

Test Generation From Requirements: Introduction, The Test-Selection Problem, Equivalence Partitioning, Boundary Value Analysis, Category-Partition Method, Cause-Effect Graphing.

UNIT – III **08 Hours**

Types Of Testing – 1: White Box Testing, Introduction, Static Testing, Structural Testing, Challenges in Whit box testing, Black Box Testing: Introduction, Testing methods. Integration Testing: Introduction, Integration testing as a Type of Testing, Integration testing as a Phase of Testing, Scenario Testing, Defect Bash

UNIT – IV **08 Hours**

Types of Testing - 2:System and Acceptance Testing, Overview, Functional System Testing, Non-functional Testing, Acceptance Testing; Summary of Testing Phases, Regression Testing: **Test Management and automation**: Introduction, Test planning, Test management, Test process, Test reporting, Test planning checklists, Test plan template.

UNIT – V **07 Hours**

What is Test automation? Terms used in Automation, Skills needed for Automation, what to automate, scope of automation, design and architecture for automation. GUI Testing, Web Application Testing: Introduction to Selenium, Getting Started With the Tools, Selenium IDE Basics, Essential Firefox Add-on's, Testing HTML Forms, Using javascript with Selenium, Introduction to Agile testing.

TEXT BOOKS

1. Aditya P Mathur: Foundations of Software Testing, Pearson Education, 2008.
2. SrinivasanDesikan, Gopalaswamy Ramesh: Software Testing Principles and Practices, 2nd Edition, Pearson Education, 2007.

REFERENCE BOOKS

1. Paul C. Jorgensen: Software Testing, A Craftsman's Approach, 3rd Edition, Auerbach
2. Auerbach Publications, 2008.
3. Mauro Pezze, Michal Young: Software Testing and Analysis – Process, Principles and Techniques, Wiley India, 2009.

Other Reference Materials

1. http://online-selenium-trainings.webs.com/documents/Selenium-Simplified-JUNIT-Preview.pdf
2. **http://www.softwaretestinghelp.com/selenium-tutorial**
3. https://nptel.ac.in/course.php

TEACHING METHODS

1. Lecture using Black board and chalk
2. PowerPoint presentations (if needed)
3. Regular review of students by asking questions based on topics covered in the class
4. Case Study using Selenium tool.

ASSESSMENT METHODS

Parameter	Marks
Three internals(Average of best of two)	30
Rubrics for the evaluation of case study implementation using Selenium	10
Two Surprise test	10
Total	**50**
Final Exam will be conducted for 100 marks (SEE)	

COURSE OUTCOMES

At the end of the course student will be able to

COS	Description	Blooms Level
CO 1	Use terms associated with software testing	**L2**
CO 2	Illustrate various test generation strategies.	**L3**
CO 3	Implement different types of software testing in application development.	**L2**
CO 4	Summarize aspects of functional and nonfunctional testing.	**L2**
CO 5	Apply the usage of test Management and automation in software testing.	**L4**

Mapping of Course outcomes (COs) to Program outcomes (POs*)& PSO **

Course Outcome mapping to Programme Outcomes													**PSO**		
Pos Cos	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**PSO1**	**PSO2**	**PSO3**
CO1	2	2	3										3		
CO2		3	3										2	3	
CO3		3	3										3		
CO4		3	3										2	3	
CO5		3	2		3				3	3			3		3

3: Strong, 2: Medium, 1: Weak ** H: Highly related S: Supportive

Department: *Computer Science and Engineering*	***Course Type***: *Open Elective*
Course Title: *Introduction to Business Intelligence and Its*	***Course Code***: *18CSO763*
L-T-P: *3-0-0*	***Credits***: *3*
Total Contact Hours: *52 Hours*	***Duration of SEE***: *3 Hours*
SEE Marks:*50*	***CIE Marks***: *50*

PREREQUISITES

- Student should have prior knowledge of DBMS
- Student should have queried some database using SQL

COURSE OBJECTIVES

- To get basic knowledge of business intelligence (BI), BI technology, and related concepts.
- To get knowhow on data integration methods, architecture and technology.
- To design multi-dimensional data modelling.
- To gain knowledge of enterprise reporting techniques and to design such reports.

COURSE CONTENTS

UNIT – I **08 Hours**

Introduction to Business Intelligence: Types of digital data; Introduction to OLTP, OLAP and Data Mining; BI Definitions & Concepts; Business Applications of BI; BI Framework, Role of Data Warehousing in BI, BI Infrastructure Components – BI Process, BI Technology, BI Roles & Responsibilities.

UNIT – II **08 Hours**

Basics of Data Integration: Basics of Data Integration (Extraction Transformation Loading); Concepts of data integration; Need and advantages of using data integration; Introduction to common data integration approaches; Introduction to data quality, data profiling concepts and applications.

UNIT – III **08 Hours**

Introduction to Data Integration: Introduction to SSIS Architecture, Introduction to ETL using SSIS; Integration Services objects; Data flow components – Sources, Transformations and Destinations; Working with transformations, containers, tasks, precedence constraints and event handlers.

UNIT – IV **08 Hours**

Introduction to Multi-Dimensional Data: Modeling Introduction to data and dimension modeling, multidimensional data model, ER Modeling vs. Multi-dimensional modeling; Concepts of dimensions, facts, cubes, attribute, hierarchies, star and snowflake schema; Introduction to business metrics and KPIs; Creating cubes using SSAS.

UNIT – V **07 Hours**

Basics of Enterprise Reporting: Introduction to enterprise reporting; Concepts of dashboards, balanced scorecards; Project: Data warehouse creation and designing reports; Introduction to SSRS Architecture, Enterprise reporting using SSRS; Use of Business Intelligence Development Studio (BIDS).

TEXT BOOK

1. R N Prasad and Seema Acharya, Business Analytics & its Applications, Wiley India, 2013.

REFERENCE BOOKS

1.David Loshin, Business Intelligence, 2nd edition , Morgan Kaufmann, 2012.
2.Mike Biere, Business Intelligence for the Enterprise, Prentice Hall Professional, 2003.
3.Larissa Terpeluk Moss and ShakuAtre, Business Intelligence Roadmap, Addison Wesley, 2003.
4.Cindi Howson, Successful Business Intelligence: Secrets to making BI a Killer Applications, Tata McGraw-Hill Edu.Pvt.ltd, 2007.

TEACHING METHODS

- Black board and chalk
- Power Point Presentations
- Problem Solving Assignments

ASSESSMENT METHODS

Parameter	Marks
Midterm Test (Avg. of 2 Tests)	30
Course Project/assignment	20
Total	**50**
Final Exam will be conducted for 100 marks (SEE)	

COURSE OUTCOMES

At the end of the course students will be able to :

COs	Description	Bloom's Level
CO 1	Explain BI concepts, methodologies & BI framework.	**L1**
CO 2	Build Data Warehouse by understanding complete ETL process.	**L3**
CO 3	Illustrate SQL Server Integration Services (SSIS) & SSRS Architectures.	**L2**
CO 4	Describe various Data modelling & Dimensional modelling techniques and design with these.	**L2**
CO 5	Demonstrate Enterprise reporting, Concepts of dashboards & Balanced scorecards.	**L3**

Mapping of Course outcomes (COs) to Program outcomes (POs*)& PSO **															
Course Outcomes mapping to Program Outcomes													PSOs		
POs / COs	1	2	3	4	5	6	7	8	9	10	11	12	PSO1	PSO2	PSO3
CO1	1		3	3							1	3	3		
CO2	1		3	3	2	3					1	3	3		3
CO3	2	3	3	2	3	3		2				3	3		
CO4	2	2	3	3								3	3		
CO5	3	3	3		3			2	3	3		3	2	3	2

Department: *Computer Science and Engineering*	***Course Type:*** *Open Elective*
Course Title: *Introduction to Mobile Computing*	***Course Code:***18CSO764
L-T-P *3-0-0*	***Credits:*** *03*
Total Contact Hours: *39 Hours*	***Duration of SEE:*** *3 Hours*
SEE Marks*: 50*	***CIE Marks:*** *50*

COURSE DESCRIPTION

This course will give an understanding of mobile computer systems particularly in the context of wireless network systems such as 2G/3G/4G mobile telephony, data networks, and other wireless networks and infrastructure.

PREREQUISITES

- Students should have prior knowledge of Computer Networks, basics of programming

COURSE OBJECTIVES

- To understand and learn the basics of mobile devices
- To understand and learn the different types of wireless medium access control
- To understand and learn different broadcast techniques
- To understand and learn how to manage transaction

COURSE CONTENTS

UNIT – I **08 Hours**

Mobile Devices And Systems, Architectures: Mobile phones, Digital Music Players, Handheld Pocket Computers, Handheld Devices, Operating Systems, Smart Systems, Limitations of Mobile Devices, Automotive Systems. GSM – Services and System Architectures, Radio Interfaces, Protocols, Localization, Calling, Handover, General Packet Radio Service.

UNIT – II **08 Hours**

Wireless Medium Access Control AndCdma – Based Communication: Medium Access Control, Introduction to CDMA – based Systems, OFDM, Mobile Ip Network Layer, Mobile Transport Layer: IP and Mobile IP Network Layers Packet Delivery and Handover Management.

UNIT – III **08 Hours**

Location Management, Registration, Tunneling and Encapsulation, Route Optimization, Dynamic Host Configuration Protocol. Indirect TCP, Snooping TCP, Mobile TCP, Other Methods of TCP – layer Transmission for Mobile Networks. Databases: Database Hoarding Techniques, Data Caching, Client – Server Computing and Adaptation.

UNIT – IV **08 Hours**

Transactional Models, Query Processing, Data Recovery Process, Issues relating to Quality of Service. Data Dissemination And Broadcasting Systems: Communication Asymmetry, Classification of Data – Delivery Mechanisms, Data Dissemination Broadcast Models, Selective Tuning and Indexing Techniques.

UNIT – V **07 Hours**

Digital Audio Broadcasting, Digital video Broadcasting. Data Synchronization In Mobile Computing Systems: Synchronization, Synchronization Protocols, SyncML – Synchronization Language for Mobile Computing, Synchronized Multimedia Markup Language (SMIL).

TEXT BOOK

1. Mobile Computing – Raj Kamal, Oxford University Press, 2007.

REFERENCE BOOKS

1. Mobile Computing: Technology, Applications and Service Creation, Asoke K. Talkukder, Roopa R Yavaga, Tata McGraw Hill, 2005.
2. Mobile Computing Principles: Designing and Developing Mobile Applications with UML and XML, Reza B'Far, 5th Edition, Cambridge University press, 2006.
3. Principles of Mobile Computing – UweHansmann, LothatMerk, Martin S Nicklous and Thomas Stober, 2nd Edition, Springer International Edition, 2003.
4. Mobile Communication – Schiller, Pearson Education, 2004.

TEACHING METHODS

- Lecture using presentations (PPT)
- Black board teaching

ASSESSMENTMETHODS

Parameter	Marks
Midterm Test (2 Tests)	30
Course Project	20
Total	**50**
Final Exam will be conducted for 100 marks (SEE)	

COURSE OUTCOMES

CO	Description	Blooms Level
CO 1	Learn the principles of mobile computing technologies	**L1**
CO 2	List different applications that mobile computing offers to people, employees, and businesses	**L2**
CO 3	Describe the possible future of mobile computing technologies and applications	**L2**
CO 4	Learn about traditional and modern network technologies and mobile computing protocols.	**L2**
CO 5	Illustrate digital audio and video broadcasting	**L2**

Mapping of Course outcomes (COs) to Program outcomes (POs*)& PSO **

Course Outcomes mapping to Program Outcomes													PSOs		
POs / COs	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**PSO1**	**PSO2**	**PSO3**
CO1		**3**		**3**									3		
CO2		**3**				**2**				2				3	
CO3				3		**2**									3
CO4		3								3				3	
CO5		3		2		2									3

3: Strong, 2: Medium, 1: Weak ** H: Highly related S: Supportive

Course Content for VIII – Semester 2018 Scheme

Department of Computer Science and Engineering

Department: *Computer Science and Engineering*	***Course Type:*** *Programme Core*
Course Title: *Green Computing*	***Course Code:*** *18CS81*
L-T-P: *3-0-0*	***Credits:*** *03*
Total Contact Hours: *39 Hours*	***Duration of SEE:*** *3 Hours*
SEE Marks: *50*	***CIE Marks:*** *50*

PREREQUISITES

- Environmental Aspects, Enterprise Development and Management, Network Security.

COURSE DESCRIPTION

- Our societal energy usage is rising at an alarming rate and thus it is critical to manage its consumption more efficiently for long term sustainability. This course introduces students to the exciting area of "Green Computing" aiming to help students acquire the knowledge and skills needed to do research in this space.

COURSE CONTENTS

UNIT –I **10 Hours**

Green IT Fundamentals: Business, IT and the Environment, Green computing: carbon foot print, scoop on power, Green IT Strategies: Drivers, Dimensions and Goals, Environmentally Responsible Business: Policies, Practices, and Metrics.

UNIT –II **8 Hours**

Green Assets: Buildings, Data Centers, Networks, and Devices, Green Business Process Management: Modeling, Optimization, and Collaboration, Green Enterprise Architecture, Environmental Intelligence,

UNIT- III **8 Hours**

Virtualizing of IT systems: Green Supply Chains, Green Information Systems, Design and Development Models, Role of electric utilities, Telecommuting, teleconferencing and teleporting, Materials recycling.

UNIT- IV **8 Hours**

Socio-cultural aspects of Green IT, Green Enterprise Transformation Roadmap, Green Compliance: Protocols, Standards, and Audits, Emergent Carbon Issues: Technologies and Future.

UNIT- V **8 Hours**

IT Enabled Smart Buildings: Sensing within Buildings (Occupancy), Sensing within Buildings (Energy and Water), Energy Management in Smart Homes, Security and

Privacy, Case Studies.

TEXT BOOKS

1. BhuvanUnhelkar, "Green IT Strategies and Applications: Using EnvironmentalIntelligence", CRC Press, June 2011, ISBN-13: 978-1439837801
2. Woody Leonhard and Katherrine Murray, "Green Home computing for dummies",August 2009, ISBN: 978-0-470-46745-9.

REFERENCE BOOKS

1. San Murugesan, G R Gangadhran "Harnessing Green IT" Wiley Publication ,2012 Edition.
2. Alin Gales, Michael Schaefer, Mike Ebbers, "Green Data Center: Steps for the Journe",Shoff/IBM Rebook, 2011.
3. John Lamb, "**The Greening of IT: How Companies Can Make a Difference for theEnvironment",** Pearson Education, 2009

TEACHING METHODS

- PPTs

ASSESSMENT METHODS

Parameter	Marks
Three internals(Average of best)	30
Paper Presntation on Recent Developments in Green IT	10
Surprise Test	10
Total	**50**
Final Exam will be conducted for 100 marks (SEE)	

COURSE OUTCOMES (COs):

At the end of the course student will be able to:

CO	Description	Blooms Level
CO 1	Describe awareness among stakeholders and promote green agenda and green initiatives in their working environments leading to green movement	**L2**

CO 2	Understand the Green Assets in green Computing for eco-friendly.	**L1**
CO 3	Illustrate the Socio-cultural aspects of Green IT.	**L2**
CO 4	Use Green IT Strategies and metrics for ICT development.	**L3**
CO 5	Illustrate various green IT services and its roles.	**L2**

Mapping of Course Outcome to Programme Outcome* & PSO**															
Course Outcomes mapping to program outcomes													Program Specific Outcomes (PSOs)		
Pos/ Cos	1	2	3	4	5	6	7	8	9	10	11	12	PSO1	PSO2	PSO3
CO1	**2**	**3**		**2**	**2**								3	2	
CO2	**2**	**3**		**2**	**2**	**2**							2	3	
CO3	**2**	**2**	**3**	**3**	**3**	**2**							2	3	
CO4	**2**	**3**	**3**	**3**	**2**	**2**							2	3	
CO5	**2**	**3**	**3**	**3**	**2**	**3**						**2**	2	2	2

***Department**: Computer Science and Engineering*	***Course Type**: Humanities*
***Course Title**: Fundamentals of Cyber Laws & Ethics*	***Course Code**: 18CS82*
***L-T-P**:3-0-0*	***Credits**: 03*
***Total Contact Hours**: 39 Hours*	***Duration** of SEE: 3 Hours*
***SEE Marks**: 50*	***CIE Marks**: 50*

COURSE DESCRIPTION

This course covers basic laws and ethical behavior associated with network security. Topics include discussions about current common practices used to secure networks as well as test them, and the potential these methods can have in creating a secure network environment.

PREREQUISITES

- Network Security
- Information Security

COURSE OBJECTIVES

- To give an understanding of how ethical issues affect individuals, communities and societies and be able to analyze the consequences of various professional ethical dilemmas.
- To create awareness and understanding of what is morally/ethically at stake in various situations.
- To Apply moral principles and standards of behavior in a workplace setting.
- To Identify concepts such as ethics, morals, character, ethical principles and ethical relativism.
- Identify organizations, laws and regulations related to computer ethics, law, and policy.

COURSE CONTENTS

UNIT- I **08 Hours**

Intellectual property rights, computer software copyrights, copyright in databases and electronic publishing, law of confidence, patent laws, trademarks, designs.

UNIT -II **08 Hours**

Computer contracts, liability for defective hardware and software, contracts for writing software, hardware contracts.

UNIT -III **08 Hours**

Computer crime, computer fraud, hacking, unauthorized modification of information, piracy, computer pornography and harassment.

UNIT- IV **08 Hours**

Understanding Computer, Internet and Cyber laws,IT ACT 2000,Protection ofIPR in Cyber Space

UNIT- V **07 Hours**

Some important offences under the cyber space law and the internet in India International efforts related to cyber space laws.

TEXT BOOKS

1. D. Bainbridge, Introduction to Computer Law, 5/e, Pearson Education, 2004.
2. Harish Chander, Cyber Laws and IT Protection, PHI Learning Private Limited, 2012.

REFERENCES

1. P. Duggal, Cyber law: the Indian Perspective, Saakshar Law Publications, Delhi, 2005.
2. C. P. Fleeger and S. L. Fleeger, Security in Computing, 3/e, Pearson Education, 2003.

TEACHING METHODS

- Black board teaching
- PPTs if needed
- Assignments

ASSESSMENT METHODS

Parameter	Marks
Midterm Test(Aveg of 2 Tests)	30
Case study	20
Total	**50**
Final Exam will be conducted for 100 marks (SEE)	

COURSE OUTCOMES

At the end of the course student will be able to

COs	Description	Bloom's Level
CO1	Recall the importance of Cyber laws and ethics in the field of IPR and IT Act	**L1**
CO2	Demonstrate the IT Act 2000 and Offences for cyber-crimes.	**L2**
CO3	Apply the knowledge of laws and ethics to develop the Hardware and Software Contracts	**L3**
CO4	Analyze the Ethical issues, cyber-crimes and cyber laws in various types of cyber-crimes in Indian and international cyber laws	**L4**
CO5	Justify the Cyber laws for Effective protection and utilization of IPR in cyber space in India	**L3**

Mapping of Course outcomes (COs) to Program outcomes (POs*)& PSO **															
Course Outcomes mapping to Program Outcomes													PSOs		
POs / COs	1	2	3	4	5	6	7	8	9	10	11	12	PSO1	PSO2	PSO3
CO1						3	3	3		2			1	1	3
CO2						3	3	3		2			1	1	3
CO3						3	3	3		2			1	1	3
CO4						3	3	3		2			1	1	3
CO5						3	3	3		2			1	1	3

***3:Strong 2:Medium 1:Weak** ****3:Highly related 2:Supportive**

Department: *Computer Science And Engineering*	***Course Type:*** *Programme Core*
Course Title: *Major Project*	***Course Code:*** *18CSP84*
L-T-P: *0-0-12-20*	***Credits:*** *11*
Total Contact Hours: *44 Hours*	***Duration of SEE:*** *3 Hours*
SEE Marks: *50*	***CIE Marks:*** *50*

COURSE OBJECTIVES

The object of Major Project & Dissertation is to enable the student to extend further the investigative study taken up under Project work- I to III, either fully theoretical/practical or involving both theoretical and practical work, under the guidance of a Supervisor from the Department alone or jointly with a Supervisor drawn from R&D laboratory/Industry.

COURSE CONTENTS

Based on the survey, identify the project requirements and do feasibility study.

- Identify and draw a system level architecture by showing subsystems and their input/output need.
- Implement the programs using step by step for each module.
- Integrate and examine the implementation and test the project scope and the requirements.
- Prepare Project document and the demonstrating their work.
- The evaluation is based on presentation and report.
- The evaluation will be done by the internal guide and panel of examiners twice during the semester.
- Students must do a group presentation and produce documents of system requirements, and system design (during 6th week)
- Final development of product/process, testing, results, conclusions and future directions;
- Preparing a paper for Conference presentation/Publication in Journals, if possible;
- Preparing a Dissertation in the standard format for being evaluated by the Department;
- **Final Evaluation**: At the End of the semester students must do a group presentation, demonstrate the project work and submit the complete report. (during 13th week)

COURSE OUTCOMES

At the end of the course, the students should be able to:

- Review the current state of Art and trends in their area of interest and identify a suitable problem in their chosen subject domain with justification. (PO-1,2,6, 7, 9, 10, 11, PSO-2,3)
- Survey the available research literature/documents for the tools and techniques to be used. (PO-1, 2, 5, 8, 9, 10, 11, 12, PSO-2,3)

- Examine the functional, non-functional, and performance requirements of their chosen problem definition. (PO-1,2,4, 9, 10, 11, 12, PSO-2,3)
- Design system architecture and different components and develop all the system components using appropriate tools and techniques. (PO-1, 2, 3, 4, 5, 6, 8, 9, 10, 11, 12, PSO-2,3)
- Work effectively in a team and use good project management practices and defend the project work as a team(PO-5, 8, 9, 10, 11, 12, PSO-2,3)

Rubrics for Project Evaluation: The rubrics for project evaluation is provided in separate project work book maintained for each project team.

Review No.	**Agenda**	**Assessment**	**Weightage**
Phase- 1	Project Synopsis / Proposal Evaluation	Rubric 1	25%
Phase-2	Mid-Term Project Evaluation (Design Phase)	Rubric 2	25%
Phase-3	Demonstration, Result discussion, Project Dissertation	Rubric 3	50%

Rubric 1: Project Synopsis/Proposal Evaluation

	Level of Achievement				
	Excellent	**Good**	**Average**	**Poor**	**Score**
Identification of Problem Domain and Detailed analysis of Feasibility, Objectives and Methodology of Project Proposal	Detailed and extensive explanation of the purpose and need of the project, Specifications, Limitations of Existing Systems All objectives of the proposed work are well defined; Steps to be followed to solve the defined problem are clearly specified	Good explanation of the purpose and need of the project , study on existing systems Good justification to the objectives; Methodology to be followed is specified but detailing is not done	Average explanation of the purpose and need of the project; Moderate study of the existing systems; Incomplete justification to the objectives proposed; Steps are mentioned but unclear;	Moderate explanation of the purpose and need of the project the limitations of the existing systems not very satisfactory; Only Some objectives of the proposed work are well defined; Steps to be followed to solve the defined problem are not	

				specified properly	

Rubric 2: Mid-term Project Evaluation (Design phase)

Level of Achievement					
	Excellent	**Good**	**Average**	**Poor**	**Score**
Design Methodology	Division of problem into modules and good selection of computing framework ; Appropriate design methodology and properly justification	Division of problem into modules and good selection of computing framework ; design methodology not properly specified	Division of problem into modules but inappropriate selection of computing framework ; Design methodology not defined properly	Partial division of problem into modules and inappropriate selection of computing framework Design methodology not defined properly	
Demonstration and Presentation	Contents of presentations are appropriate and well arranged ; Proper eye contact with audience and clear voice with good spoken language	Contents of presentations are appropriate but not well arranged; Satisfactory demonstration	Contents of presentations are appropriate but not well arranged; Eye contact with few people and unclear voice	Contents of presentations are not appropriate; Demonstration not satisfactory	

Rubric #R3: End Semester Internal Project Evaluation

Level of Achievement					
	Excellent	**Good**	**Average**	**Poor**	**Score**
Project Demonstration And Presentation	All defined objectives are achieved All modules of project are well integrated and system working is accurate Contents of presentations are appropriate and well delivered	All defined objectives are achieved Integration of all modules not done and system working is not very satisfactory Contents of presentations are appropriate and well delivered	All defined objectives are achieved Modules of project are not properly integrated Contents of presentations are appropriate but not well delivered	Only some of the defined objectives are achieved Contents of presentations are not appropriate and not well delivered	
Description of Concepts and Technical Details in Project Report	Project report is according to the specified format ; References and citations are appropriate and well mentioned ; Complete explanation of the key concepts	Project report is according to the specified format ; References and citations are appropriate but not mentioned well	Project report is according to the specified format but some mistakes ; In-sufficient references and citations; Incomplete explanation of the key concepts	Project report not prepared according to the specified format ; References and citations are not appropriate ; Inappropriate explanation of the key concepts	

Course content for

VIII – Semester

Program Elective - E

Department of Computer Science and Engineering

Department : *Computer Science and Engineering*	***Course Type :*** *Programme Elective*
Course Title: *Advanced Artificial Intelligence*	***Course Code:*** *18CSE831*
L-T-P: 3-0-0	***Credits:03***
Total Contact Hours: *39 Hours*	***Duration of SEE :*** *3 Hours*
SEE Marks*: 50*	***CIE Marks: 50***

COURSE DESCRIPTION

This course provides an in-depth knowledge of Classical Planning, Planning and Acting in the Real World, Knowledge Representation. Uncertain Knowledge and Reasoning, Quantifying Uncertainty, Probabilistic Reasoning over time, Learning from examples, Learning probabilistic models, Reinforcement Learning, Natural language processing, Natural language for communication.

COURSE OBJECTIVES

- To understand and analyze the classical planning, planning and acting in the real world.
- To understand and analyze Knowledge Representation, Quantifying Uncertainty.
- To understand and analyze Probabilistic Reasoning over time, Learning.
- To understand and analyze learning probabilistic models, Reinforcement Learning.
- To understand and analyze Natural language processing, Natural language for communication.

PREREQUISITES

- Students should have knowledge of Design and Analysis of Algorithms
- Students should have knowledge of Probability Theory.

COURSE CONTENTS

UNIT - I **08 Hours**

Classical Planning: Definition of Classical Planning, Algorithms for Planning as State-Space Search, Planning Graphs, Other Classical Planning Approaches, Analysis of Planning Approaches.

Planning and Acting in the Real World: Time, Schedules and Resources, Hierarchical Planning, Planning and Acting in Non-Deterministic Domains, Multiagent Planning.

UNIT – II **08 Hours**

Knowledge Representation: Ontological Engineering, Categories and Objects, Events, Mental Events and Mental Objects, Reasoning systems for categories, reasoning with default Information, The Internet shopping world.

Uncertain Knowledge and Reasoning: Quantifying Uncertainty: Acting under uncertainty, basic probability notation, inference using full joint distributions, independence, Baye’s rule and its use.

Probabilistic reasoning: Representing knowledge in an uncertain domain. The semantics of Bayesain networks, efficient representation of conditional distributions, exact inference in Bayesian networks.

UNIT-III **08 Hours**

Probabilistic Reasoning over time: Time and Uncertainty, Inference in temporal models, Hidden Markov Models, Kalman Filters, Dynamic Bayesian networks.

Learning: Learning from examples: Forms of Learning, Supervised learning, Learning decision trees, Evaluating and choosing the best Hypothesis, The theory of learning, Regression and Classification with linear models, artificial neural networks, support vector machines, ensemble learning, practical machine learning.

UNIT – IV **08 Hours**

Learning probabilistic models: Statistical learning, learning with complete data, learning with hidden variables: The EM algorithm.

Reinforcement Learning: Introduction, passive Reinforcement learning, active reinforcement learning, generalization of reinforcement learning, policy search, application of reinforcement learning.

UNIT – V **07 Hours**

Natural language processing: Language models, text classification, information retrieved, information extraction

Natural language for communication: phrase structure grammars, syntactic analysis (parsing), augmented grammars and semantic interpretation, machine translation, speech recognition.

TEXT BOOK

1. Artificial Intelligence-A Modern Approach, Stuart J. Russell and Peter Norvig, Pearson 3rd Edition, eleventh impression 2018.

REFERENCE BOOKS

1. Elaine Rich,Kevin Knight, Shivashanka B Nair:Artificial Intelligence, Tata MCGraw Hill 3rd edition. 2013
2. Nils J. Nilsson: "Principles of Artificial Intelligence", Elsevier, ISBN-13: 9780934613101

TEACHING METHODS

1. Lecture using Black board and chalk
2. Presentations
3. Programming Assignments
4. Seminar on AI topics

ASSESSMENT METHODS

Parameter	Marks
Three internals(Average of best of two)	30
Programming Assignments	10
Seminar on AI topics	10
Total	**50**
Final Exam will be conducted for 100 marks (SEE)	

COURSE OUTCOMES

At the end of Course, Student will be able to

COs	Description	Bloom's Level
CO 1:	To understand and analyze the classical planning, planning and acting in the real world.	**L2,L4**
CO 2:	To understand and analyze Knowledge Representation, Quantifying Uncertainty	**L2,L4**
CO 3:	To understand, and analyze Probabilistic Reasoning over time, Learning	**L2,L4**
CO 4:	To understand, and analyze Learning probabilistic models, Reinforcement Learning.	**L2,L4**
CO 5:	To understand and analyze Natural language processing, Natural language for communication.	**L2,L4**

Mapping of Course outcomes (COs) to Program outcomes (POs*)& PSO **

	Course Outcomes mapping to Program Outcomes												PSOs		
POs / COs	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**PSO1**	**PSO2**	**PSO3**
CO1	3	3	3										3	3	3
CO2	3	3	3										3	3	3
CO3	3	3	3										3	3	3
CO4	3	3	3										3	3	3
CO5	3	3	3										3	3	3

3: Strong, 2: Medium, 1: Weak ** H: Highly related S: Supportive

Department: *Computer Science and Engineering*	***Course Type:*** *Programme Elective*
Course Title*: Agile Software Development*	***Course Code:*** *18CSE832*
L-T-P 4-0-0	***Credits:*** *04*
Total Contact Hours: *52 Hours*	***Duration of SEE:*** *3 Hours*
SEE Marks*: 50*	***CIE Marks:*** *50*

COURSE DESCRIPTION

This course is rapidly becoming the choice for software development where requirements are unpredictable or is expected to change over time. This course will help you gain knowledge on what is agile? Why agile is better suited for these situations? We will also cover some of the most common agile frameworks like scrum and XP in depth.

PREREQUISITES

- Awareness of basics of software engineering concepts and waterfall methodology
- Exposure to any object oriented programming language such as Java, C#.

COURSE OBJECTIVES

1) To learn and demonstrate the ability to participate effectively in agile practices/process for software development.
2) To explain the purpose behind common agile practices.
3) To gain ability to apply agile principles and values to a given situation.
4) To gain ability to identify and address most common problems encountered in adopting Agile methods.

COURSE CONTENTS

UNIT-1 **08 Hours**

Fundamentals of Agile: The Genesis of Agile, Introduction and background, Agile Manifesto and Principles, Overview of Scrum, Extreme Programming, Feature Driven development, Lean Software Development, Agile project management, Design and development practices in Agile projects, Test Driven Development, Continuous Integration, Refactoring, Pair Programming, Simple Design, User Stories, Agile Testing, Agile Tools.

UNIT-I1 **08 Hours**

Agile Scrum Framework: Introduction to Scrum, Project phases, Agile Estimation, Planning game, Product backlog, Sprint backlog, Iteration planning, User story definition, Characteristics and content of user stories, Acceptance tests and Verifying stories, Project velocity, Burn down chart, Sprint planning and retrospective, Daily scrum, Scrum roles – Product Owner, Scrum Master, Scrum Team, Scrum case study, Tools for Agile project management

UNIT-I1I **08 Hours**

Agile Testing: The Agile lifecycle and its impact on testing, Test-Driven Development (TDD), xUNIT framework and tools for TDD, Testing user stories - acceptance tests and scenarios, Planning and managing testing cycle, Exploratory testing, Risk based testing, Regression tests, Test Automation, Tools to support the Agile tester

UNIT-IV **08 Hours**

Agile Software Design and Development: Agile design practices, Role of design Principles including Single Responsibility Principle, Open Closed Principle, Liskov Substitution Principle, Interface Segregation Principles, Dependency Inversion Principle in Agile Design, Need and significance of Refactoring, Refactoring Techniques, Continuous Integration, Automated build tools, Version control

UNIT-V **07 Hours**

Industry Trends: Market scenario and adoption of Agile, Agile ALM, Roles in an Agile project, Agile applicability, Agile in Distributed teams, Business benefits, Challenges in Agile, Risks and Mitigation, Agile projects on Cloud, Balancing Agility with Discipline, Agile rapid development technologies

TEXT BOOKS

1.James shore, , The Art of Agile Development (Pragmatic guide to agile software development, O'Reilly Media, Shroff Publishers & Distributors, 2007

REFERENCE BOOKS

1. Robert C. Martin, Agile Software Development, Principles, Patterns, and Practices, , Prentice Hall; 1st edition, 2002.
2. Craig Larman, “Agile and Iterative Development A Manger’s Guide”, Pearson Education, First Edition, India, 2004.

TEACHING METHODS

- Lecture using Black board and chalk
- Presentations
- Programming Assignments

ASSESSMENT METHODS

Parameter	Marks
Three internals(Average of best of two)	30
Model Based Learning	10
Case study Presentation	10
Total	**50**
Final Exam will be conducted for 100 marks (SEE)	

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COURSE OUTCOMES

At the end of this elective, student will be able to:

COs	Description	Bloom's Level
CO 1	Describe the background and driving forces for taking an Agile approach to software development	**L2**
CO 2	Illustrate the business value of adopting Agile approaches, and the Agile development practices	**L3**
CO 3	Drive development with UNIT tests using Test Driven Development	**L3**
CO 4	Apply design principles and refactoring to achieve Agility	**L3**
CO 5	Deploy automated build tools, version control and continuous integration	**L4**

Mapping of Course outcomes (COs) to Program outcomes (POs*)& PSO **

Course Outcomes mapping to Program Outcomes													**PSOs**		
POs / COs	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**PSO1**	**PSO2**	**PSO3**
CO1	3	3								3	3			3	
CO2		3	3			3								3	
CO3	3	3	3	3		2								3	
CO4		3		3		3				3	3			3	
CO5		3		3			2	2	2	2			3		

3: Strong, 2: Medium, 1: Weak ** H: Highly related S: Supportive

Department: *Computer Science and Engineering*	***Course Type:*** *Programme Elective*
Course Title*: Introduction to Natural Language Processing*	***Course Code:*** *18CSE833*
L-T-P : *3-0-0*	***Credits:*** *03*
Total Contact Hours: *52 Hours*	***Duration of SEE:*** *3 Hours*
SEE Marks*: 50*	***CIE Marks:*** *50*

COURSE DESCRIPTION

This course is about a variety of ways to represent human languages as computational systems, and use the representations to write programs for processing text and speech data, like translation, summarization, extracting information, question answering, natural interfaces to databases, and conversational agents.
This course will include some ideas about discrete classification, probability models and about Linguistics like morphology, syntax, semantics.
The course also covers computational treatments of words, sounds, sentences, meanings, and conversations.

PREREQUISITES

- Data structures and algorithms
- Programming principles and practices

COURSE OBJECTIVES

- Comprehend the techniques in natural language processing.
- Be familiar with the natural language generation and Text Mining.
- Understand the information retrieval techniques and linguistic phenomena.
- Design, analyze and implement NLP algorithms.

COURSE CONTENTS

UNIT – I **08 Hours**

Overview and language modeling: Overview: Origins and challenges of NLP, Language and Grammar, Processing Indian Languages, NLP Applications, Information Retrieval. Language Modeling: Various Grammar- based Language Models, Statistical Language Model.

UNIT – II **08 Hours**

Word level and syntactic analysis: Word Level Analysis: Regular Expressions, Finite-State Automata, Morphological Parsing, Spelling Error Detection and correction, Words and Word classes, Part of Speech Tagging. Syntactic Analysis: Context-free Grammar, Constituency, Parsing, Probabilistic Parsing.

UNIT – III **08 Hours**

Extracting Relations from Text: From Word Sequences to Dependency Paths: Introduction, Subsequence Kernels for Relation Extraction, A Dependency-Path Kernel for Relation Extraction and Experimental Evaluation.

Mining Diagnostic Text Reports by Learning to Annotate Knowledge Roles: Introduction, Domain Knowledge and Knowledge Roles, Frame Semantics and Semantic Role Labeling, Learning to Annotate Cases with Knowledge Roles and Evaluations.
A Case Study in Natural Language Based Web Search: InFact System Overview, The GlobalSecurity.org Experience.

UNIT – IV **08 Hours**
Evaluating Self-Explanations in iSTART: Word Matching, Latent Semantic Analysis, and Topic Models: Introduction, iSTART: Feedback Systems, iSTART: Evaluation of Feedback Systems. Textual Signatures: Identifying Text, Types Using Latent Semantic Analysis to Measure the Cohesion of Text Structures: Introduction, Cohesion, CohMetrix, Approaches to Analyzing Texts, Latent Semantic Analysis, Predictions, Results of Experiments.
Automatic Document Separation: A Combination of Probabilistic Classification and Finite-State Sequence Modeling: Introduction, Related Work, Data Preparation, Document Separation as a Sequence Mapping Problem, Results. Evolving Explanatory Novel Patterns for Semantically Based Text Mining.

UNIT – V
07Hours
INFORMATION RETRIEVAL AND LEXICAL RESOURCES:
Information Retrieval: Design features of Information Retrieval Systems, Classical, Non classical, Alternative Models of Information Retrieval, valuation Lexical Resources: World Net, Frame Net, Stemmers, POS Tagger.

TEXT BOOK

1. TanveerSiddiqui, U.S. Tiwary, “Natural Language Processing and Information Retrieval”, Oxford University Press, 2008.
2. Anne Kao and Stephen R. Poteet , “Natural LanguageProcessing and Text Mining”, Springer-Verlag London Limited 2007.

REFERENCE BOOKS

1. Daniel Jurafsky and James H Martin, “Speech and Language Processing: An Introduction to Natural Language Processing, Computational Linguistics and Speech Recognition”, 2nd Edition, Prentice Hall, 2008.
2. James Allen, “Natural Language Understanding”, 2nd edition, Benjamin/Cummings publishing company, 1995.
3. Gerald J. Kowalski and Mark.T. Maybury, “Information Storage and Retrieval systems”, Kluwer academic Publishers, 2000.

TEACHING METHODS

- Board teaching
- Lecture (PPT)
- Programming practices, assignment & quiz

ASSESSMENTMETHODS

Parameter	Marks
Three internals(Average of best of two)	30
Rubrics for the evaluation of course project	20
Total	**50**
Final Exam will be conducted for 100 marks (SEE)	

COURSE OUTCOMES

The students should be able to:

COs	Description	Bloom's Level
CO 1:	Describe the natural language text.	**L1**
CO 2:	Carry out word level analysis and syntactic analysis.	**L3**
CO 3:	Illustrate the concepts of Text mining and develop applications.	**L2**
CO 4:	Perform the document processing and solve related problems.	**L3**
CO 5:	Apply information retrieval techniques.	**L4**

3: Strong, 2: Medium, 1: Weak ** H: Highly related S: Supportive

Mapping of Course outcomes (COs) to Program outcomes (POs*)& PSO **

	Course Outcomes mapping to Program Outcomes												PSOs		
POs / COs	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**PSO1**	**PSO2**	**PSO3**
CO1		3	3	2								2		3	
CO2		3	3	3								2		3	
CO3		3	3	3	3							3		3	
CO4		3	3	3	3							3		3	
CO5		3	3	3	3							3		3	

Department: *Computer Science and Engineering*	***Course Type:*** *Programme elective*
Course Title*: Pattern Recognition*	***Course Code:****18CSE834*
L-T-P: *3-0-0*	***Credits:****03*
Total Contact Hours: *39 Hours*	***Duration of SEE:****3 Hours*
SEE Marks*: 50*	***CIE Marks:****50*

COURSE DESCRIPTION

This course deals with providing the basic concepts of Pattern Recognition, Clustering and theories such as Bayes classifier, linear discriminate analysis

PREREQUISITES

- Basic knowledge of Programming, Data Structures and Algorithms.
- Knowledge on Data mining Techniques.

COURSE OBJECTIVES

1. Understand basic concepts in pattern recognition
2. Gain knowledge about state-of-the-art algorithms used in pattern recognition research
3. Understand pattern recognition theories, such as Bayes classifier, linear discriminant analysis.
4. Apply pattern recognition techniques in practical problems.

COURSE CONTENTS

UNIT – I **7 Hours**

Introduction: Machine perception, an example; Pattern Recognition System; The Design Cycle; Learning and Adaptation.

UNIT – II **13 Hours**

Bayesian Decision Theory: Introduction, Bayesian Decision Theory; Continuous Features, Minimum error rate, classification, classifiers, discriminant functions, and decision surfaces; The normal density; Discriminant functions for the normal density.

Maximum-likelihood and Bayesian Parameter Estimation: Introduction; Maximum-likelihood estimation; Bayesian Estimation; Bayesian parameter estimation: Gaussian Case, general theory; Hidden Markov Models.

UNIT – III **11 Hours**

Non-parametric Techniques: Introduction; Density Estimation; Parzen windows; k n – Nearest- Neighbor Estimation; The Nearest- Neighbor Rule; Metrics and Nearest-Neighbor Classification.

Linear Discriminant Functions: Introduction; Linear Discriminant Functions and Decision Surfaces; Generalized Linear Discriminant Functions; The Two-Category Linearly Separable case; Minimizing the Perception Criterion Functions; Relaxation Procedures; Non-separable Behavior; Minimum Squared-Error procedures; The Ho-Kashyap procedures.

UNIT – IV **11 Hours**

Stochastic Methods: Introduction; Stochastic Search; Boltzmann Learning; Boltzmann Networks and Graphical Models; Evolutionary Methods.
Non-Metric Methods: Introduction; Decision Trees; CART; Other Tree Methods; Recognition with Strings; Grammatical Methods.

UNIT – V **10 Hours**

Unsupervised Learning and Clustering: Introduction; Mixture Densitiesand Identifiability; Maximum-Likelihood Estimates; Application to Normal Mixtures; Unsupervised Bayesian Learning; Data Description and Clustering; Criterion Functions for Clustering.

TEXT BOOKS

1. Richard O. Duda, Peter E. Hart, and David G.Stork: Pattern Classification, 2 nd Edition, Wiley-Interscience, 2001.

REFERENCE BOOKS

1. Earl Gose, Richard Johnsonbaugh, Steve Jost: Pattern Recognition and Image Analysis, PHI, Indian Reprint 2008.

TEACHING METHODS

- Black board teaching
- Tutorials

ASSESSMENT METHODS

Parameter	Marks
Three internals(Average of best of two)	30
Rubrics for the evaluation of course project	20
Total	**50**
Final Exam will be conducted for 100 marks (SEE)	

COURSE OUTCOMES

COs	Description	Bloom's level
CO 1	Describe classifiers for pattern recognition	**L1**
CO 2	Explain the feature selection and dimensionality reduction techniques	**L2**
CO 3	Classify the data objects and develop template matching module to recognize the patterns.	**L3**
CO 4	Apply unsupervised learning algorithms to data objects.	**L3**
CO 5	Analyze clustering algorithms.	**L4**

Mapping of Course outcomes (COs) to Program outcomes (POs*)& PSO **															
Course Outcomes mapping to Program Outcomes													**PSOs**		
POs / COs	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**PSO1**	**PSO2**	**PSO3**
CO1	2	2	2	1		3	1						3		
CO2		3				2							3		
CO3		3				2							3		
CO4		3				2								3	
CO5		3			3	2	1								3

Department: *Computer Science and Engineering*	***Course Type:*** *Programme Elective*
Course Title*: Quantum Computing*	***Course Code:****18CSE835*
L-T-P:4-0-0	***Credits:*** *03*
Total Contact Hours: *39 Hours*	***Duration of SEE:*** *3 Hours*
SEE Marks*: 50*	***CIE Marks:*** *50*

COURSE DESCRIPTION

This course introduces students to the next revolution in computer science, the quantum computing. The students learn the nuts and bolts of quantum computers, from the basic gates to the proven quantum algorithms like Shor's algorithm. The students will also be exposed to the experimental quantum computers open sourced by IBM. By the end of the course, the students will have basic understanding of the quantum computers and should be able to appreciate the complexity of building one.

PREREQUISITES

1. Basic linear algebra, complex numbers
2. Idea of algorithms and their complexities
3. Idea of classical gates

COURSE OBJECTIVES

- To give the students a basic idea of quantum computing, concepts, complexity and its applications.
- Solve certain problems with vast number of combinations.
- Simulation of quantum processes.

COURSE CONTENTS

UNIT -I
08 Hours Introduction and Mathematical Foundations: What are quantum computers?, Why quantum computers?, Complex numbers, Linear Algebra, Probability

UNIT -II **08 Hours**
Quantum Physics Fundamentals: Quantum Superposition, Quantum Tunneling, Quantum Entanglement, Superconductivity

UNIT -III **08 Hours**
Qubit and Quantum Gates: Leap from Classical to Quantum, Qubits, Bits vs Qubits, Classical Gates, Quantum Gates

UNIT -IV **08 Hours**

Quantum Algorithms: Deutsch’s Algorithm, Shor’s Algorithm, Grover’s Algorithm

UNIT -V **07 Hours**

Experimenting with available online quantum computers and Quantum Computer Applications: Experimenting with IBM-Q Quantum computers, Applications of Quantum computers to cryptography, Other applications

TEXT BOOKS

1. Phillip Kaye, Raymond Laflamme, Michele Mosca, “An Introduction To Quantum Computing”, 1st edition, Oxford University Press, ISBN: 978-0198570004, 2007
2. Eleanor G. Rieffel, Wolfgang H. Polak, “Quantum Computing : A Gentle Introduction”, 1st edition, The MIT Press, ISBN: 978-0262526678, 2014

REFERENCE BOOKS

1. Michael A. Nielsen & Isaac L. Chuang, “Quantum Computation and Quantum Information”, 10th Anniversary Edition, Cambridge University Press, ISBN - 978-1107619197, 2011
2. Chris Bernhardt, “Quantum Computing For Everyone”, 1st edition, The MIT Press, ISBN - 978-0262039253, 2019

TEACHING METHODS

- Lecture using Black board and chalk
- Presentations
- Problem Solving Assignments

ASSESSMENT METHODS

Parameter	Marks
Three internals(Average of best of two)	30
Rubrics for the evaluation of Programming Assignments	10
Problem Solving Test	10
Total	**50**
Final Exam will be conducted for 100 marks (SEE)	

COURSE OUTCOMES

At the end of the course student will be able to

COs	Description	Bloom's Level
CO 1	Understand what and why quantum computing	L2
CO 2	Apply and appreciate the complexity in involved in building a quantum computer.	L3
CO 3	Understand the theory behind the quantum computing.	L2
CO 4	Apply and understand the current quantum algorithms	L3,L2
CO 5	experiment with online quantum computing platforms	L4

Mapping of Course outcomes (COs) to Program outcomes (POs*)& PSO **															
Course Outcomes mapping to Program Outcomes													**PSOs**		
POs **COs**	**3**						2						**3**		
CO1	**3**	**3**	**3**	**3**									**3**	3	
CO2	**3**	**3**				**2**							**2**		
CO3	**3**			**3**									**3**		
CO4	**3**						3		**2**				**3**	**3**	**2**
CO5	**3**						2						**3**		

Department: *Computer Science and Engineering*	***Course Type:*** *Programme Elective*
Course Title: *System Simulation and Modeling*	***Course Code:*** *18CSE836*
L-T-P: *3-0-0*	***Credits:*** *03*
Total Contact Hours: *392 Hours*	***Duration of SEE:*** *3 Hours*
SEE Marks: *50*	***CIE Marks:*** *50*

COURSE DESCRIPTION

This course serves to understand discrete event system simulation, the event scheduling/time advance algorithm, useful statistical models, various distributions, random number generators, random variate generators, input modeling and output analysis for single model.

PREREQUISITES

- Students should have Knowledge of Probability and statistics

COURSE OBJECTIVES

- Analysing the application areas of simulation and different types of models of simulation.
- Illustrate the concept of discrete event simulation and Analyse the statistical models in simulation.
- Analysing the properties of Random-Variate and generation of Random-Number.
- Identifying the distribution, Parameter estimation, Goodness of Fit Tests etc with respect to Input modeling.
- Analyse, verify and validate the simulation models.

COURSE CONTENTS.

UNIT – I **08 Hours**

Introduction: When simulation is the appropriate tool and when it is not appropriate; Advantages and disadvantages of Simulation; Areas of application; Systems and system environment; Components of a system; Discrete and continuous systems; Model of a system; Types of Models; Discrete-Event System Simulation; Steps in a Simulation Study. The basics of Spreadsheet simulation, Simulation example: Simulation of queuing systems in a spreadsheet. Simulation of inventory systems.

UNIT – II **08 Hours**

General Principles, Simulation Software: Concepts in Discrete-Event Simulation: The Event-Scheduling / Time advancAlgorithm, World Views,

Manual simulation Using Event Scheduling.

Statistical Models in Simulation: Review of terminology and concepts;Useful statistical models; Discrete distributions; Continuous distributions; Poisson process; Empirical distributions.

UNIT – III **08 Hours**

Random-Number Generation, Random-Variate Generation: Properties of random numbers; Generation of pseudo-random numbers; Techniques for generating random numbers; Tests for Random Numbers Random-Variate Generation: Inverse transform technique; Acceptance-Rejection technique; Special properties.

.UNIT – IV **08 Hours**

Input Modeling : Data Collection; Identifying the distribution with data; Parameter estimation; Goodness of Fit Tests; Fitting a non-stationary Poisson process; Selecting input models without data; Multivariate and Time-Series input models.

UNIT – V **07 Hours**

Output Analysis for single Model: Types of simulations with respect to output analysis; stochastic nature of output data; Absolute measures of performance and their estimation;
Verification and Validation of simulation Models: Model building,verification and validation; Verification of simulation models; Calibration and validation of models.

TEXT BOOKS

1. Jerry Banks, John S. Carson II, Barry L. Nelson, David M. Nicol: Discrete-Event System Simulation, 5th Edition, Pearson Education, 2010.
   (Listed topics only from Chapters1 to 12)

REFERENCE BOOKS

1. Lawrence M. Leemis, Stephen K. Park: Discrete – Event Simulation: A First Course, Pearson Education, 2006.
2. Averill M. Law: Simulation Modeling and Analysis, 4th Edition, Tata McGraw-Hill, 2007.

TEACHING METHODS

- Blackboard teaching
- PowerPoint presentations
- Problem Solving
- Videos

ASSESSMENT METHODS

Parameter	Marks
Midterm Test (Avg of 2 Tests)	30
Simulation of Programming Assignments	20
Total	**50**
Final Exam will be conducted for 100 marks (SEE)	

COURSE OUTCOMES

COs	Description	BLOOM’S LEVEL
CO 1:	Analysing the application areas of simulation and different types of models of simulation.	**L4**
CO 2:	Illustrate the concept of discrete event simulation and Analyse the statistical models in simulation.	**L4**
CO 3:	Analysing the properties of Random-Variate and generation of Random-Number.	**L4**
CO 4:	Identifying the distribution, Parameter estimation, Goodness of Fit Tests etc with respect to Input modeling.	**L3**
CO 5:	Analyse, verify and validate the simulation models	**L4**

Mapping of Course outcomes (COs) to Program outcomes (POs*)& PSO **															
Course Outcomes mapping to Program Outcomes													**PSOs**		
POs **COs**	**3**	**3**		**2**						**3**			**3**		
CO1	**3**	**3**		**2**						**3**			**3**		
CO2	**3**	**3**		**2**						**3**				**3**	
CO3	**3**	**3**		**2**						**3**				**3**	
CO4	**3**	**3**		**2**						**3**				**3**	
CO5	**3**	**3**		**2**						**3**			**3**		

Department : *Computer Science and Engineering*	***Course Type :*** *Programme Elective*
Course Title: *Introduction to Deep Learning*	***Course Code:*** *18CSE837*
L-T-P: *3-0-0*	***Credits:****03*
Total Contact Hours: *39Hours*	***Duration of SEE :*** *3 Hours*
SEE Marks: *50*	***CIE Marks: 50***

PREREQUISITES

- Students must have basic knowledge of Machine learning algorithms and techniques.
- Students must have very good understanding of Engineering Mathematics and related theories.

COURSE OBJECTIVES

- To get knowledge of artificial neural networks and deep learning methods, deep neural network architectures and optimization techniques.
- To analyse the algorithms for backpropagation, optimization and training of deep neural networks and determine the parameter settings.
- To work with TensorFlow/Keras, design solutions for real life applications and create applications using deep learning neural networks.

COURSE CONTENTS

UNIT – I **08 Hours**

Foundations of Neural Networks and Deep Learning: The relationship between AI and deep learning, Gradient-Based Optimization, Constrained Optimization, Stochastic Gradient Descent. Neural Networks, The Perceptron, Multilayer Feed-Forward Networks, Activation Functions, Loss Functions, Training Neural Networks.

UNIT – II **08 Hours**

Fundamentals of Deep Networks: Common Architectural Principles of Deep Networks – Parameters, Layers, Activation Functions, Loss Functions, Optimization algorithms, Hyper-parameters. Major Architectures of Deep Networks: Unsupervised Pretrained Networks (UPNs), Convolutional Neural Networks (CNNs), Recurrent Neural Networks, Recursive Neural Networks.

UNIT – III **08 Hours**

Deep Networks: Modern Practices: Deep Feedforward Networks, Example: Learning XOR, Gradient-Based Learning, Hidden Units, Architecture Design, Back-Propagation, Regularization for Deep Learning, Optimization for Training Deep Models.

UNIT – IV **08 Hours**

Deep Learning with TensorFlow: Introduction to TensorFlow,Process of coding a Deep learning program in TensorFlow, Basics of Keras&TensorFlow by application, Distributed system architecture.

UNIT – V **07 Hours**

Application domain: Basic classification with MNIST dataset – Hand written digit recognition, Binary Classification of IMDB Dataset – Movie Ratings, Text Classification of IMDB vocabulary using CNN, Text generation using LSTM, Regression application of Boston House Pricing,Deep learning for Computer Vision, Implementing Deep dream, Magenta (AI Music Generation).

TEXT BOOKS

1. Josh Patterson and Adam Gibson, "Deep Learning A Practitioner's Approach", O'Reilly, First Edition, 2017.
2. Ian Goodfellow,YoshuaBengio and Aaron Courville, "Deep Learning", An MIT Press book, 2016.
3. François Chollet, "Deep Learning with Python", Manning Publications Co, First edition, 2018.

OTHER REFERENCES

1. **TensorFlow Tutorial – Deep Learning Using Tensor Flow, online [available]:** https://www.tensorflow.org/tutorials/
2. **Andy, Python TensorFlow Tutorial – Build a Neural Network, online [available]: http://adventuresinmachinelearning.com/python-tensorflow-tutorial/**
3. **Jason Brownlee, 8 Inspirational Applications of Deep Learning, July 2016, online [available]:** https://machinelearningmastery.com/inspirational-applications-deep-learning/

TEACHING METHODS

- Lecture (PPT)
- Programming Assignments/seminar
- Course Project

ASSESSMENT METHODS

Parameter	Marks
Midterm Test (Avg. of 2 Tests)	30
Course Project	10
Seminar	10
Total	**50**
Final Exam will be conducted for 100 marks (SEE)	

COURSE OUTCOMES

At the completion of this course, the student will be able to:

COs	Description	Bloom's Level
CO 1	Explain the concepts of deep learning and Neural Networks.	**L2**
CO 2	Demonstrate the architectural principles of Deep Learning Networks.	**L3**
CO 3	Explore the training and use of deep Learning networks with tools / techniques and modern practices.	**L2**
CO 4	Analyze the development methods of Deep Learning and Neural networks.	**L4**
CO 5	Create the deep learning system to solve real world problems.	**L6**

Mapping of Course outcomes (COs) to Program outcomes (POs) & PSOs															
Program Outcomes*													**PSOs****		
POs **COs**	**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PS O1**	**PS O2**	**PSO3**
CO1	3	3											3		
CO2	3	3											3		
CO3	3	3	3		3							2	3		
CO4	2	2	3	2	3							2	3		
CO5	3	3	3	3	3			3	2	3	3	3	2	2	2

***3: Strong, 2:Medium, 1: Weak**3: Highly related   2: Supportive**

Department: *Computer Science and Engineering*	***Course Type:*** *Programme Elective*
Course Title*: Storage Area Networks*	***Course Code:****18CSE838*
L-T-P:*3-0-0*	***Credits:*** *03*
Total Contact Hours:*39Hours*	***Duration of SEE:*** *3 Hours*
SEE Marks*: 50*	***CIE Marks:*** *50*

COURSE DESCRIPTION

This course provides knowledge about enterprise storage system and protocols related to it. It clearly differentiates between conventional storage system and today's storage system. It also provides brief insight to file systems and standard storage systems.

PREREQUISITES

- Students should have knowledge of DBMS and Computer Network

COURSE OBJECTIVES

- To know storage centric architecture and the advantages over conventional server centric architectures, along with virtualization aspects.
- To identify protocol stack and various storage and virtualization techniques in storage area networks and to extend the design for higher performance.
- To outline various file systems and the tradeoff.

COURSE CONTENTS

UNIT – I **8 Hours**

INTRODUCTION: Server Centric IT Architecture and its Limitations; Storage - Centric IT Architecture and its advantages; Case study: Replacing a server with Storage Networks; The Data Storage and Data Access problem; The Battle for size and access. INTELLIGENT DISK SUBSYSTEMS - 1: Architecture of Intelligent Disk Subsystems

UNIT – II **8 Hours**

Hard disks and Internal I/O Channels, JBOD, Storage virtualization using RAID and different RAID levels; INTELLIGENT DISK SUBSYSTEMS - 1, I/O TECHNIQUES - 1: Caching: Acceleration of Hard Disk Access; Intelligent disk subsystems; Availability of disk subsystems. The Physical I/O path from the CPU to the Storage System; SCSI.

UNIT – III **8 Hours**

I/O TECHNIQUES - 2, NETWORK ATTACHED STORAGE: Fibre Channel Protocol Stack; Fibre Channel SAN; IP Storage. The NAS Architecture, The NAS hardware Architecture, The NAS Software Architecture, Network connectivity, NAS as a storage system.

UNIT – IV **8 Hours**

FILE SYSTEM AND NAS: Local File Systems; Network file Systems and file servers; Shared Disk file systems; Comparison of fibre Channel and NAS.

UNIT – V **7 Hours**

STORAGE VIRTUALIZATION: Definition of Storage virtualization; Implementation Considerations; Storage virtualization on Block or file level; Storage virtualization on various levels of the storage Network; Symmetric and Asymmetric storage virtualization in the Network.

TEXT BOOKS

1. Storage Networks Explained - Ulf Troppens, Wolfgang Muller, Rainer Wolafka, Rainer Erkens and Nils Haustein, John Wiley & Sons, 2009.
2. Storage Networks: The Complete Reference - Robert Spalding, Tata McGraw Hill, 2003.

TEACHING METHODS

- Lecture using Black board and chalk
- Power point presentations

ASSESSMENT METHODS

Parameter	Marks
Three internals Test (Avg. of 2 Tests)	30
Seminar	10
Case Study	10
Total	**50**
Final Exam will be conducted for 100 marks (SEE)	

COURSE OUTCOMES

At the end of the course the student will be able to,

COs	Description	Bloom’s level
CO 1	Identify the details & purpose of Server Centric as well as Storage Centric architectures and also explain the Data Storage, Size and Access problem.	**L1**
CO 2	Analyse the design of Intelligent Disk Subsystems, JBOD, Storage Virtualization using RAID & RAID Levels.	**L2**
CO 3	Describe the fibre channel network protocol & SAN, also design of NAS.	**L2**
CO 4	Analyze the working of File Systems, implementation on fibre channel, compare withNAS Systems.	**L3**
CO 5	Design Storage Virtualization on Various levels of Storage Network	**L4**

Mapping of Course outcomes (COs) to Program outcomes (POs*)& PSO **

Course Outcomes mapping to Program Outcomes													PSOs		
POs / COs	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**PSO1**	**PSO2**	**PSO3**
CO1		3	1										2	3	
CO2		2	3				1						2	3	
CO3		2	3			2	2						3	2	
CO4		1	3		1	2	1						3	2	
CO5		2	3		2	2	1						3	2	

***3: Strong, 2: Medium, 1: Weak** ****3: Highly related 2: Supportive**

Department: *Computer Science and Engineering*	***Course Type:*** *Programme Elective*
Course Title: *Multimedia Computing*	***Course Code:*** *18CSE839*
L-T-P 3-0-0	***Credits:*** *03*
Total Contact Hours: *39 Hours*	***Duration of SEE:*** *3 Hours*
SEE Marks: *50*	***CIE Marks:*** *50*

PREREQUISITES

- Students should have knowledge of C or C++, visual Basic or Java language
- Students should g have knowledge of mathematics geometry , graphs and matrix
- Students should g have knowledge Computer Graphics

COURSE DESCRIPTION

UNIT–I **10 Hours**

Fundamental concepts in Text and Image: Multimedia and hypermedia, World Wide Web, overview of multimedia software tools. Graphics and image data representation graphics/image data types, file formats, Color in image and video: color science, color models in images, color models in video.

UNIT–II **12 Hours**

Fundamental concepts in video and digital audio: Types of video signals, analog video, digital video, digitization of sound, MIDI, quantization and transmission of audio.

UNIT–III **10 Hours**

Multimedia data compression I: Lossless compression algorithm: Run-Length Coding, Variable Length Coding, Dictionary Based Coding, Arithmetic Coding, Lossless Image Compression.

UNIT–IV **10 Hours**

Multimedia data compression II: Lossy compression algorithm: Quantization, Transform Coding, Wavelet-Based Coding, Embedded Zerotree of Wavelet Coefficients Set Partitioning in Hierarchical Trees (SPIHT).

UNIT–V **10 Hours**

Basic Video Compression Techniques: Introduction to video compression, video compression based on motion compensation, search for motion vectors, MPEG, Basic Audio Compression Techniques.

TEXT BOOKS

- Fudamentals of Multimedia by Ze-Nian Li and Mark S. Drew Pearson Education.

REFERENCE BOOKS

- Digital Multimedia, Nigel chapman and jenny chapman, Wiley-Dreamtech
- Macromedia Flash MX Professional 2004 Unleashed, Pearson.
- Multimedia and communications Technology, Steve Heath, Elsevier (Focal Press).
- Multimedia Applications, Steinmetz, Nahrstedt, Springer.
- Multimedia Basics by Weixel Thomson
- Multimedia Technology and Applications, David Hilman , Galgotia

TEACHING METHODS

- Lecture using Black board and chalk
- Power point presentations

ASSESSMENT METHODS

Parameter	Marks
Three internals Test (Avg. of 2 Tests)	30
Seminar	10
Case Study	10
Total	**50**
Final Exam will be conducted for 100 marks (SEE)	

COURSE OUTCOMES

At the end of the course students will be able to:

COs	Description	Bloom's Level
CO 1	Explain the foundation knowledge of multimedia computing, e.g. media characteristics, compression standards, multimedia representation, data formats, multimedia technology development	**L3**
CO 2	Understand How to use alternative mathematical representations of problems as tools to make problem solving simpler.	**L2**
CO 3	Analyze basic algorithms that perform simple signal processing to remove noise, emphasize important features, etc.	**L3**
CO 4	Apply multimedia applications and standards.	**L4**
CO 5	Program multimedia data to design and implement media applications	**L3**

Mapping of Course outcomes (COs) to Program outcomes (POs*)& PSO **															
Course Outcomes mapping to Program Outcomes													PSOs		
POs / COs	1	2	3	4	5	6	7	8	9	10	11	12	PSO1	PSO2	PSO3
CO1	3												3		
CO2	3	3	3										3		
CO3	3	3	3	3									3	3	
CO4	3	2							2				3	2	
CO5	3				3				2			2	3		

THANK YOU

NITTE MEENAKSHI INSTITUTE OF TECHNOLOGY

(AN AUTONOMOUS INSTITUTION, AFFILIATED TO VTU, BELGAUM AND ACCREDITED BY NBA, NEW DELHI)

YELAHANKA, BANGALORE – 560064

KNOWLEDGE CHARACTER UNITY

Department of Computer Science and Engineering

SCHEME AND SYLLABUS

BE PROGRAMME– 2021 BATCH (AUTONOMOUS SCHEME-NEP)

NITTE EDUCATION TRUST

BATCH 2021-25

VISION & MISSION OF THE COLLEGE

Vision

To provide India and the World, technical manpower of the highest academic excellence and World class by shaping our youth through holistic and integrated education of the highest quality.

Mission

To develop Nitte Meenakshi Institute of Technology through Quality, Innovative and State-of-art educational initiatives into a center of academic excellence that will turn out youth with well-balanced personality & commitment to rich cultural heritage of India and who will successfully face the Scientific and Technological challenges in the fast-evolving Global scenario with a high degree of credibility, integrity and ethical standards.

Quality Policy

To bring about constant and Continuous Improvement in the Quality of Education Imparted and Turning out High Quality Professionals with Balanced and Globally Competitive Personality through Regular Monitoring of the Academic/ Administrative Activities of the Institution and Implementing Corrective Actions in the Best Ethical and Transparent Traditions.

1. Vision and Mission of Department

1.1 Vision:

To empower students of Computer Science and Engineering Department to be technologically adept, innovative, self-motivated and responsible global citizen possessing human values and enable them to contribute in the industrial development innovation, high quality technical education and research with the ever-changing world.

1.2 Mission:

The department of Computer Science and Engineering strives to prepare students

- For a challenging professional career and nurture their entrepreneurship ability by grooming their leadership skills and innovative ability, thereby enabling them to serve the engineering profession and society.
- To accomplish higher studies by providing conducive teaching-learning, research environment.

2. Programme Education Objectives (PEOs)

PEO1: Excel in Professional career by acquiring knowledge in basic sciences and Computer Science and Engineering principles.

PEO2: Graduates are capable of pursuing higher education and research.

PEO3: Adapt to technological advancements by engaging in lifelong learning with leadership qualities, professional ethics and soft skills**.**

3. Programme Specific Outcomes (PSO)

PSO 1: Professional Skills: The ability to comprehend, analyze, design and implement and conduct research in the domain of Computing Algorithms, Application Development, Operating System, and Allied Areas, Computer Networks& security, Software Design, Data Mining and Big Data Analytics, Cloud computing, Analog and Digital Circuits.

PSO 2: Problem Solving Skills: Ability to apply the techniques of Data Base Management, Mathematical techniques, and adopt standard software engineering and professional practices to evolve optimal solutions.

PSO 3: Ethics and Career Development: Ability to apply the learned skills for a successful career in the industry based on sound principles of software project management, team work and ethical practices, develop the spirit of entrepreneurship and also nurture the quest for higher levels ofknowledge.

4. Programme Outcomes (POs)

1	**PO1. Engineering knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
2	**PO2. Problem analysis:** Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
3	**PO3. Design/development of solutions**: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
4	**PO4. Conduct investigations of complex problems:** Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
5	**PO5. Modern tool usage**: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
6	**PO6. The engineer and society:** Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
7	**PO7. Environment and sustainability:** Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
8	**PO8. Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
9	**PO9. Individual and team work:** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
10	**PO10. Communication:** Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
11	**PO11. Project management and finance:** Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
12	**PO12. Life-long learning:** Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context oftechnological change.

5. Approach to Curriculum:

The curriculum is framed by keeping in mind the ever-changing industrial trends in technology. The Stakeholders in preparing the curriculum involve the industry experts, Academicians with expertise, Alumni of the department, Parents, Internal Faculty and the Final year students. The suggestions are taken and discussed in the BoS (Board of Studies). After approval from the BoS, the DUGC approval is taken and then the Academic Council approves the final curriculum.

The main objective of framing the curriculum:

- To build a strong technical, analytical and mathematical foundation in students. This will enable the students to be proficient in their technical profession.
- To inculcate in students the good ethical conduct, great team-spirit, excellent leadership qualities and provide a wholesome growth by encouraging Life-long learning which is needed for an excelling career.
- To make the students more competent to face challenges in the outside world.

6. Courses Inclined Towards Cutting Edge Technologies.

Department of CSE offers courses which are inclined towards cutting edge technologies along with the basic fundamental courses.

- Internet Of Things (IoT)
- Deep Learning
- Data Science/Big Data Analytics
- Block Chain Technologies
- Machine Learning
- Artificial Intelligence
- Virtual Reality
- Cloud Computing
- Robotics
- Quantum Computing
- Cyber Security

7. Definitions/Descriptions:

- **Semester Scheme:** Each UG degree is a 4 Academic year Program, each year being divided into 2 semesters. Each semester is for duration of 20 weeks, which includes Course work, CIE (Continuous Internal Evaluation), SEE (Semester End Examination). The CIE is conducted unit-wise on a monthly basis. The SEE is conducted at the end of every semester to evaluate the students' overall performance and achievement.
- **Credit System:** Each unit of a course is assigned *one credit*. The students earn the credits by registering to the respective courses, completing a teaching-learning process which is then followed by CIE and SEE. The CBCS (Choice Based Credit System) helps customizing the course work for a student by including Core Courses and ElectiveCourses.

- **Core Course:** Courses that are declared as mandatory for the students.
- **Electives:** Courses that are offered to the students from which they are allowed to choose.

- **Credit Courses:** Students earn *one credit* by registering for the course,
    - Attending Lecture (L) - *One hour/Week/Semester* Theory courses.
    - Attending Laboratory or Practical (P)/ Tutorials (T) - *Two Hours/Week/Semester.*
- **Course load:** Every student who registers for the courses in a semester for an average total credit of anywhere between (In the new scheme students must earn a total of 160 credits). Typical Course Load in a semester is shown in the Table 1.

Course Load per semester			
No. of Courses	**Credits per Course**	**Total Credits**	**Total contact Hours/ week**
Three Lecture Courses	4:0:0	12	12
One Lecture Course	3:0:0	3	3
One Lecture + One tutorial	3:2:0	4	5
Two Lectures + Practical	3:0:2	8	10
Two Practical courses	0:0:2	2	4

Table 1: Typical Course load

- **Credit Representation:** Credits for different academic activities are represented in the **Table 1.**

Lectures (Hours/Week/Semester)	**Tutorials** (Hours/Week/Semester)	**Practical** (Hours/Week/Semester)	**Credits (L: T:P)**	**Total Credits**
4	0	0	4:0:0	4
3	2	0	3:2:0	4
0	2	0	0:2:0	1
0	0	2	0:0:2	1
2	2	2	2:2:2	4
0	2	2	0:2:2	2

Table 1: Credit Representation

NITTE EDUCATION TRUST | NITTE MEENAKSHI INSTITUTE OF TECHNOLOGY

(An Autonomous Institution, Affiliated to Visvesvaraya Technological University Belagavi, Accredited by NAAC-“A+” Grade, approved by AICTE, New Delhi.Yelahanka,Bangalore-64)

Department of Computer Science and Engineering

2021 SCHEME

SCHEME – I TO VIII SEMESTERS

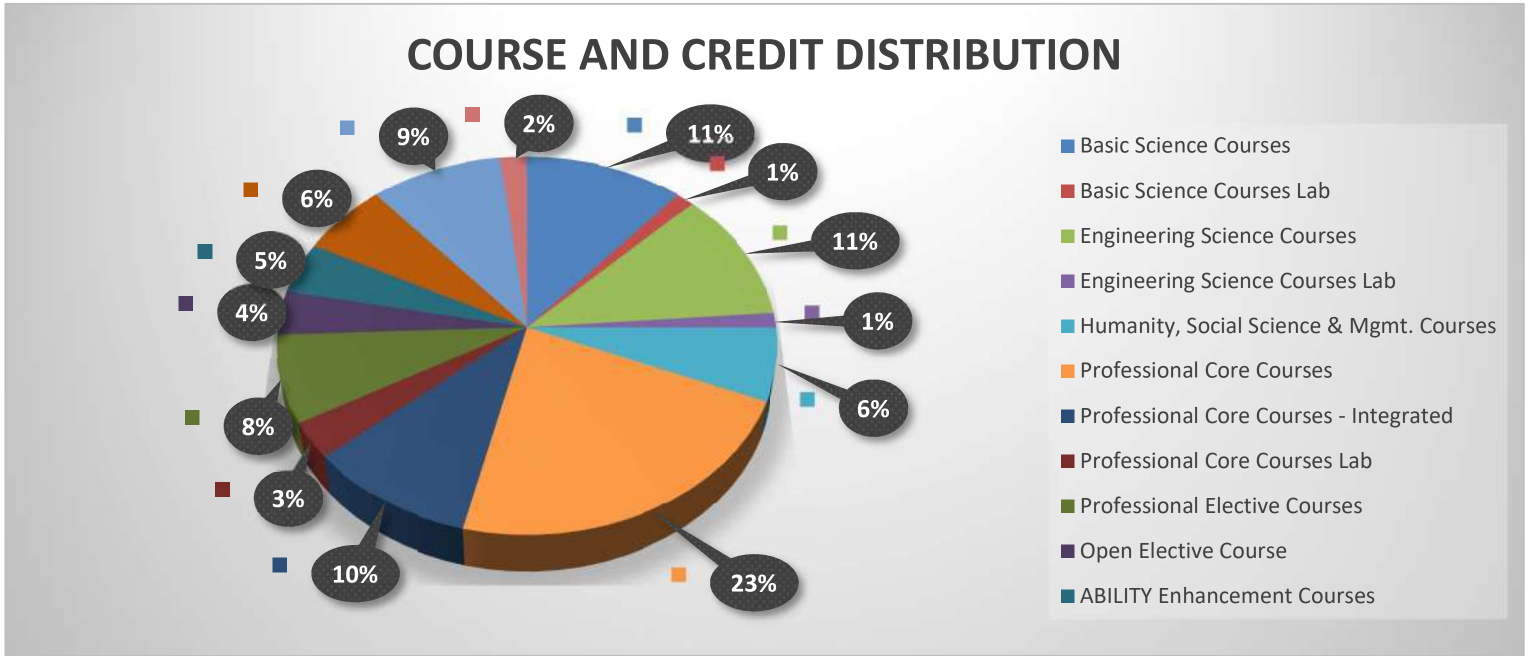
NITTE EDUCATION TRUST | NITTE MEENAKSHI INSTITUTE OF TECHNOLOGY

(An Autonomous Institution, Affiliated to Visvesvaraya Technological University Belagavi, Accredited by NAAC-"A+" Grade, approved by AICTE, New Delhi.Yelahanka,Bangalore-64)

Department of Computer Science and Engineering

Course category	Course (Co) & Credits (Cr) semester wise																	Total Courses	Credits	
	SEM-1		SEM-2		SEM-3		SEM-4		SEM-5		SEM-6		SEM-7		SEM-8					
	Co	Cr	Co	Cr	Co	Cr	Co	Cr	Co	Cr	Co	Cr	Co	Cr	Co	Cr				
Basic Science Courses	2	6	2	6	1	3	1	3									18	6	18	20
Basic Science Courses Lab	1	1	1	1													2	2	2	
Engineering Science Courses	3	9	3	9													18	6	18	20
Engineering Science Courses Lab	1	1	1	1													2	2	2	
Humanity, Social Science & Mgmt. Courses	1	2	1	2	1	1	1	1	1	1	1	3					10	6	10	10
Professional Core Courses					3	9	3	9	2	6	2	6	2	6			36	12	36	57
Professional Core Courses - Integrated					1	4	1	4	1	4	1	4					16	4	16	
Professional Core Courses Lab					1	1	1	1	1	1	1	1	1	1			5	5	5	
Professional Elective Courses					1	3	1	3	1	3	1	3					12	4	12	25
Open Elective Course									1	3			1	3			6	2	6	
ABILITY Enhancement Courses			1	1			1	2	1	2			1	2			7	4	7	
Project													1	4	1	6	10	2	10	25
Internship					1	2					1	3			1	10	15	3	15	
NCMC+UHV	1	1							1	2							3	2	3	3
Total	9	20	9	20	9	23	9	23	9	22	7	20	6	16	2	16	160	60	160	160

CREDIT DISTRIBUTION



Department: Mathematics	***Course Type: Basic Science***
***Course Title**: Integral Transforms, Linear Algebra and Numerical Methods*	***Course Code: 21MAT31A***
L-T-P :3-2-0	***Credits: 3***
Total Contact Hours: 50	***Duration of SEE: 3 Hrs***
***SEE Marks**: 100*	***CIE Marks: 50***

COURSE DESCRIPTION

The course aims at imparting knowledge of Fourier analysis, Integral transforms, numerical methods, basics of linear algebra relevant to the field of Computer Science, Information Science and Artificial Intelligence.

PREREQUISITES

Integration, differentiation, Taylor series, matrices

COURSE OBJECTIVES

- To understand the periodic and harmonic phenomena and to be able to model them using Fourier series and use integral transforms such as Laplace and Fourier transforms,
- To understand the advantages, limitations and applications of different numerical techniques.
- To explore the concepts and applications of Linear algebra.

COURSE CONTENTS

UNIT - I — 08 Hours

Fourier analysis and Integral Transforms

Fourier series: Euler's formulae, Dirichlet's conditions for Fourier series expansion, Even and odd function.

Fourier Transforms: Complex Fourier transforms, Cosine and Sine transforms, Inverse Fourier transforms.

Laplace Transforms: Definition, Transforms of standard functions, Laplace transforms of periodic functions, Inverse Laplace transforms.

Self-Study: Fourier half range series, solutions of 1^{st} and 2^{nd} order ODE using Laplace transforms.

UNIT - II	08 Hours

Numerical Methods-I

Interpolation: Newton's divided difference formulae, Lagrange's formula, Cubic spline. Least square fitting of Fourier series (Harmonic Analysis).
Numerical Differentiation: Newton's forward and backward formulae, Lagrange's formula.
Numerical Integration**:** Trapezoidal, Simpson's1/3rd and 3/8th, Gaussian Quadrature method.
Self-Study: Quadratic spline, Weddle's rule for numerical integration.

UNIT - III	08 Hours

Numerical Methods-II

Numerical solution of ordinary differential equations: Taylor's series method, Runge-Kutta 4th order method - First order and second order Ordinary differential equations, Milne's predictor corrector method. Finite difference method for Boundary value problems

Numerical solution of partial differential equations: Explicit method for heat and wave equations.

Self-Study: Numerical solution of Laplace Equation.

UNIT - IV	08 Hours

Linear Algebra-I

Vector spaces- definition, examples, Linear combinations, subspaces, linear dependence, basis and dimension, linear mapping, linear operator, Kernel and Image of a Linear mapping, matrix representation of linear operator, change of basis.
Self-Study: Row Space and Column space, Rank and nullity theorem

UNIT - V	08 Hours

Linear Algebra-II

Inner product space, Orthogonal Sets and Bases, Gram Schmidt Orthogonalization process Polynomial of matrices, Characteristic polynomial, diagonalization, Eigenvalues and Eigen vectors, diagonalization, Characteristic and minimal polynomial.
Self-Study: Block matrices and Canonical form.

TEXT BOOKS

1. Numerical Methods for Scientific and Engg. Computation, M K Jain, S R K Iyengar, R K Jain, 6th edition, New Age, 2012
2. Linear Algebra, Seymore Lipschutz and Marc Lipson, 3rd edition, Tata McGrawhill, 2005
3. Advanced Engg. Mathematics, Erwyn Kreyzig, 9th edition, Wiley, 2011

REFERENCE BOOKS

1. Fourier Series, Transforms and Boundary Value Problems, J R Hanna, J H Rowland, 2nd edition, Dover, 2008
2. Numerical Algorithms, E V Krishnamurthy, S K Sen, East West press,2007

TEACHING METHODS

- Black Board Teaching.
- Power point presentation
- Tutorial

ASSESSMENT METHODS

Continuous internal Evaluation (CIE) for 50 Marks

Surprise test / Tutorials tests to be conducted for each topic for 10 marks.

Quiz/ assignment based on practical application for 10 marks.

Three mid semester examinations will be conducted each for 30 marks and the average of all the 3 will be taken.

Semester End Examination (SEE) for 50 Marks

Final examination, of 100 Marks will be conducted and will be evaluated for 50 marks.

COURSE OUTCOMES

1. The numerical methods can be applied for fitting the data, find appropriate functions, differentiate and integrate the same
2. The concept of numerical methods can be used to solve differential equations
3. The concept of linear algebra can be adopted to analyze situations arising in engg. Problems
4. The concepts of Fourier analysis, integral transforms and optimization can be applied to engg. Problems
5. The concept of matrices, orthogonality and vector spaces can be adopted to analyze situations arising in engg. Problems.

	PROGRAM OUTCOMES												PSO		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2		2												
CO2	2		2		1										
CO3	2		2												
CO4	2		2		1										
CO5	2		2		1										

Department: *Computer Science and Engineering*	***Course Type:*** *Programme Core*
Course Title*: Design of Analog and Digital Circuits*	***Course Code: 21CS32***
L-T-P : *3-0-0*	***Credits: 3***
Total Contact Hours: *39Hours*	***Duration of SEE:*** *3 Hours*
SEE Marks*: 50*	***CIE Marks: 50***

COURSE DESCRIPTION

The fundamentals of Analog and Digital circuits and their applications are introduced in this course. Topics covered include; Simplification of boolean functions , applications in the analysis and design of combinational and sequential logic circuits applications such as arithmetic circuits.This course introduces the characteristics and applications of few hardware devices and circuits like Op amp, clippers, clampers and Diodes. Emphasis is placed on analysis, selection, biasing, and applications.

PREREQUISITES

- Students should have knowledge of basic concepts of electronics, Binary System.

COURSE OBJECTIVES

To understand the basics of digital and analog electronics and be able to design the simple logic circuits. To prepare students to perform the analysis and design of various digital electronic circuits.

COURSE CONTENTS

UNIT - I 07 Hours

Simplification of Boolean Functions: The Map method, Two and Three variable Maps, Four variable map, Product of Sums Simplification, NAND and NOR Implementation , Don't care conditions, The Tabulation method ,Determination of Prime Implicants, Selection of Prime Implicants.

Introduction to HDL, HDL Implementation models, Implementation of Data Processing Circuits.

Combinational Logic: Code Conversion, Analysis Procedure.

Text 1: Chapter 3(3.1 to 3.6, 3.8 to 3.11) Chapter 4 (4.5,4.6)

Text 2: Chapter 2(2.5), Chapter 3 (3.11), Chapter 4(4.14)

UNIT - II **08 Hours**

Sequential Logic : Introduction ,Flip-Flops ,Triggering of Flip-Flops,Analysis of Clocked sequential circuits,State reduction and assignment,Flip flop excitation table,Design Procedure, Design of counters ,Design with state equations.

Counters: Ripple counters, Synchronous counters (Binary counter, Binary up-down counter ,BCD counter)

HDL implementation of Flip Flops

Text 1 :Chapter 6(6.1 to 6.9) Chapter 7 (7.4,7.5)

Text 2: *Chapter 8(8.12)*

UNIT - III **08 Hours**

Design of sequential Circuits : Model selection , State Transition Diagram, State Synthesis Table, Design Equation and Circuit Diagram, Implementation using Read Only Memory. Algorithmic State Machine. State reduction techniques.Analysis of Asynchronous Sequential circuit , Problems with Asynchronous Sequential circuit , Design of Asynchronous Sequential circuit .

Text 2 :Chapter 11(11.1 to 11.10)

UNIT - IV **08 Hours**

D/A conversion and A/D conversion : Variable, Resistor Networks, Binary Ladders, D/A Converters, D/A Accuracy and Resolution, A/D Converter-Simultaneous Conversion, A/D Converter-Counter Method, Continuous A/D Conversion,A/D techniques, A/D Accuracy and Resolution.

Text 2 :Chapter 12(21.1 to 12.8, 12.10)

UNIT - V **08 Hours**

Diode Theory: Basic idea, Ideal Diode, the second approximation, the third approximation.

Diode Circuits : Clipper and limiters, Clampers.

Operational Amplifier: Introduction to Op amps, The 741 op amp.

Non Linear Op amp circuits :Comparators with zero reference, non zero references, Comparators with hysteresis. Window comparators The integrators. Waveform Conversion , Waveform generation, the differentiator.

Text 3 :Chapter 3(3.1 to 3.4) Chapter 4(4.10 to 4.11) Chapter 18(18.1 to 18.2) Chapter 22(22.1 to 22.7,22.10)

TEXT BOOKS

1. M.Morris Mano , "Digital Logic and Computer Design" ,Pearson Education ,Prentice Hall ,2016

2. Donald P Leach, Albert Paul Malvino&GoutamSaha"Digital Principles and Applications" , 6th Edition, TMH, 2006.
3. Albert Malvino& David J Bates "Electronic Principles" , 7th Edition, TMH, 2007.

REFERENCE BOOKS

1. Charles H. Roth, Jr. "Fundamentals of Logic Design" , 5th Edition, Thomson, 2004.
2. Ronald J. Tocci Neal S. Widmer, Gregory L. Moss"Digital Systems Principles and Applications" 10th Edition, PHI/Pearson Education, 2007.

TEACHING METHODS

- Black Board Teaching.
- Power point presentation (If needed).
- Tutorial Classes.

ASSESSMENT METHODS

Midterm Test	**30 Marks**
VHDL Programming Test	**10 Marks**
Problem Solving Test	**10 Marks**
Total	**50 Marks**

COURSE OUTCOMES

Sl. No.	**COURSE OUTCOMES**	**BL**
CO 1:	Students will be able to Apply knowledge of k map simplification for designing combinational circuits and sequential circuits. Students will be able to Design various synchronous and asynchronous circuits using flip flops, counters.	L3
CO 2:	Students will be able to apply knowledge of VHDL to design combinational circuits and sequential circuits.	L3
CO 3:	Students will be able to Design a sequential circuit using mealy and Moore models, ROM, ASM chart.	L3
CO 4:	Students will be able to analyze the concept of analog to digital and digital to analog convertors.	L4
CO 5:	Students will be able to analyze the concept of Diodes, Op amps, Comparators, Clipper and Clamper circuits	L4

CO-PO MAPPING

	PROGRAM OUTCOMES												PSO		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3		2	3	3							3	3	3
CO2	3	3		2		3							3	3	3
CO3	3	3		2		3							3	3	3
CO4	3	3				3							3	3	3
CO5		3		2		3							3	3	3

Department: Computer Science and Engineering	***Course Type: Professional Core***
***Course Title**: Data Structures with C++*	***Course Code: 21CS33***
L-T-P : 2-0-2	***Credits: 3***
Total Contact Hours: 40 Hours	***Duration of SEE: 3 Hours***
***SEE Marks**: 50*	***CIE Marks: 50***

COURSE DESCRIPTION

This course imparts the concepts of various data structures which is the foundation of computer science. It includes the different data structures namely Arrays, Stacks, Queues, Linked lists and Trees.

PREREQUISITES

Students should have basic knowledge of programming constructs and should be able to understand and write programs in C/C++.

COURSE OBJECTIVES

- To understand and implement various data structures.
- To apply various data structures and solve problems.

COURSE CONTENTS

UNIT - I — 08 Hours

Basic C++ Concepts: Overview: System Life Cycle, Object oriented design, Data Abstraction and Encapsulation, Basics of C++, Algorithm Specification, Standard Template Library, Performance Analysis and Measurement. **Introduction to Data Structures**: Data Structure and its Types.

UNIT - II — 08 Hours

Arrays : Abstract Data Types and C++ Class, Array as an Abstract Data Type, The Polynomial Abstract Data type, Sparse Matrices, Representation of Arrays, String Abstract DataType Operations on Arrays: **Recursion :** Recursive Definition and Processes— factorial function, multiplication of natural numbers. Fibonacci sequence, Binary search.

UNIT - III **08 Hours**

Stacks and Queues: Templates in C++, Stack Abstract Data Type, Queue Abstract Data Type, Subtyping and Inheritance in C++, Evaluation of Expressions, Expression Conversion, Applications of Stacks and Queues

UNIT - IV **08 Hours**

Linked Lists: Singly Linked Lists and Chains, representing chains in C++, Template Class chain, Circular lists, Available Space Lists, Linked Stacks and Queues, Polynomials, Equivalence classes, Sparse Matrices, Doubly Linked Lists, Generalized Lists

UNIT - V **08 Hours**

Trees: Introduction, Binary Trees, Binary Tree traversal and Tree iterators, Binary tree operations, Threaded Binary trees, Binary search trees, Forests

TEXT BOOKS

1. Fundamentals of Data Structures in C++, Ellis Horowitz, Sartaj Sahni, Dinesh Mehta, Universities Press, 2nd Edition

REFERENCE BOOKS

1. Data Structures using C/C++, Aaron M. Tanenbaum, Yedidyah Langsam& Moshe J. Augenstein, Pearson Education/PHI, 2006
2. Data Structures and Algorithm Analysis in C++, Mark Allen Weiss, Pearson Education,3rd Edition
3. Data Structures: A Pseudocode Approach with C++, Richard Gilberg, Behrouz Forouzan

TEACHING METHODS

- Lectures interspersed with discussion
- Power Point Presentations
- Problem Solving

ASSESSMENT METHODS

1. Three Midsem exams – 30 Marks each will be conducted and the Average of all the three tests will be considered.
2. Programming Assignment: 10 Marks
3. Problem Solving based test: 10 marks

COURSE OUTCOMES

Sl. No.	COURSE OUTCOMES	BL
CO1	Understand the basics of Object oriented concepts and use C++ constructs to write programs.	2
CO2	Illustrate arrays and various operations on Arrays using C++	2,3
CO3	Quote the implication of stacks and queues for different problems, propose programming solutions using variations of stacks and queues in C++	2,3
CO4	Apply Linked list to solve problems using C++.	2,3
CO5	Construct binary tree and perform traversal using different tree traversal techniques.	2,3

CO-PO MAPPING

	PROGRAM OUTCOMES												PROGRAM SPECIFIC OUTCOMES		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	3	2										3		
CO2	2	2	3										3	1	
CO3	2	2	3										3	1	
CO4	2	3	2										3	1	
CO5	2	2	3										3	1	
Correlation level	2	2	3										3	1	

Department: Computer Science and Engineering	***Course Type: Professional Core***
Course Title*: Computer Organization & Microprocessor*	***Course Code: 21CS34***
L-T-P: 3-0-0	***Credits: 3***
Total Contact Hours: 40 Hours	***Duration of SEE: 3 Hours***
SEE Marks*: 50*	***CIE Marks: 50***

COURSE DESCRIPTION

The course will work from the understanding the basic concepts of increase the performance of the embedded systems. With a complete understanding of how computer systems execute programs and manipulate data, Topics covered include: data representation, machine-level code, computer arithmetic, elements of code compilation, optimization of memory and runtime performance, and memory organization and management.

PREREQUISITES

- Student should have prior knowledge of Logic Design, Electronic Circuits
- Student should have prior knowledge of Computer Concepts such as memory, I/O Devices, and CPU.

COURSE OBJECTIVES

- Understand basic structure of computers, different memory access types, salient features of a Computer System from the executing program viewpoint: what are the computer system components and how they execute a given program.
- The assembly language level operation of a processor is viewed both in general as well as in operational level using a simple example machine, its (symbolic) assembly language, and simulator that runs assembly language programs developed for that machine. We also look at the operating system role in the program execution.

COURSE CONTENTS

UNIT - I **08 Hours**

Basic Structure of Computers: Computer Types, Functional Units, Basic Operational Concepts, Bus Structures, Performance – Processor Clock, Basic Performance Equation, Pipelining and Superscalar Operation, Clock Rate, Instruction set: CISC and RISC, Compiler, Performance Measurement, multiprocessors and multi computers, Historical Perspective. Machine Instructions and Programs: Basic Input/output Operation, Input/output Organization: Accessing I/O Devices, Interrupts – Interrupt Hardware, Enabling and Disabling Interrupts, Handling Multiple Devices, Controlling Device Requests, Exceptions

UNIT - II	**08 Hours**

Direct Memory Access, Buses, Interface Circuits, Standard I/O Interfaces (Introduction) The Memory System: speed-size and cost, cache memories, Performance consideration, Virtual Memories.

UNIT - III	**08 Hours**

Arithmetic: Addition and Subtraction of signed numbers, Design of Fast Adders, Multiplication of positive Numbers, Signed Operand Multiplication, Fast Multiplication, Integer Division floating –point Numbers and Operations

UNIT - IV	**08 Hours**

Basic Processing Unit: Some Fundamental Concepts, Execution of a Complete Instruction, Multiple Bus Organization, Hard-wired Control, Microprogrammed Control, Pipelining: Basic Concepts, Data Hazards, Instruction Hazard

UNIT - V	**08 Hours**

Microprocessors and Microcontroller: Overview of Microprocessors and Microcontrollers, Processor Chips for embedded Applications, A simple Microcontroller, Programming considerations, I/O device timing Constraints, Reaction Timer- An example

TEXT BOOKS

- Computer Organization, Carl Hamacher, Zvonko Vranesic, Safwat Zaky, 5th Edition, TMH
- Computer Architecture and Organization, John P. Hayes, 3rd Edition, McGraw-Hill Series

REFERENCE BOOKS

1. Computer Organization & Architecture, William Stallings, 7th Edition, PHI, 2006
2. Computer Systems Design and Architecture, Vincent P. Heuring & Harry F. Jordan, 2nd Edition, Pearson Education, 2004
3. Computer Systems Architecture – M.Moris Mano, IIIrd Edition, Pearson/PHI
4. Computer Organization & Embedded Systems – Car Hamacher, Zvonks Vranesic, afeaZaky, 6th Edition, McGrawHill.

TEACHING METHODS

- Black Board/Power Point
- Presentations Assignments

ASSESSMENT METHODS

Parameter	Marks
Three internals (Average of best of two)	30
Programming Assignments	10
Rubrics for the evaluation of Course Project	10
Total	**50**
Final Exam will be conducted for 100 marks (SEE)	

COURSE OUTCOMES

At the end of the course student will be able to:

Sl. No.	COURSE OUTCOMES	BL
CO1	Identify the importance of computer organization, memory hierarchy, basic input-output mechanisms, interrupt handling circuits and pipelining	**L2**
CO2	Apply algorithms to perform arithmetic and logical operations, solve problems using computer performance equations and relate Hard-wired Control, Micro programmed Control circuits.	**L3**
CO3	Analyse the logic delay paths, combinational logic circuits and different bus organizations.	**L4**
CO4	Comprehend Microprocessors & applications and the significance of multiple bus organizations.	**L2**
CO5	Write programming assignment report and Present effectively.	**L2**

CO-PO MAPPING

	PROGRAM OUTCOMES												PSO		
	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO1 0**	**PO1 1**	**PO1 2**	**PSO 1**	**PSO 2**	**PSO 3**
CO1		3	2										3	3	
CO2	3	3	2	2									3	3	
CO3	3	3	2										3	3	
CO4		3	2										3	3	
CO5					3		2	3							2
Correlation level	3	3	2	2	3		2	3					3	3	2

3: Strong, 2: Medium, 1: Weak ** H: Highly related S: Supportive

Department: Computer Science and Engineering	***Course Type: Professional Core - Integrated***
***Course Title**: OOP WITH JAVA*	***Course Code: 21CS35***
L-T-P: 3-0-2	***Credits: 4***
Total Contact Hours: 48Hours	***Duration of SEE: 3Hours***
***SEE Marks**: 50*	***CIE Marks: 50***

COURSE DESCRIPTION

This course provides an in-depth knowledge of Object-Oriented application development using Java programming language. It discusses the programming concepts like multithreading, Interfaces, Exception Handling, GUI development and event Handling in JavaFX and, the use of the Java's Collection framework to solve real-world computing problems.

PREREQUISITES

- Student should have the prior knowledge of C

COURSE OBJECTIVES

- To understand and apply the basic Object-Oriented features of Java.
- To understand and apply the concept of Inheritance, Packages and Interfaces
- To understand and apply Exception Handling and, develop Multithreaded Java Applications.
- To Understand and use Wrapper classes, autoboxing, unboxing and Java Collection Framework.
- To develop GUI using JavaFX.

COURSE CONTENTS

UNIT - I **10Hours**

An Overview of Java --Object-Oriented Programming, Two Paradigms, Abstraction, The Three OOP Principles, A First Simple Program, Entering the Program, Compiling the Program, A Closer Look at the First Sample Program

Introducing Classes: Class Fundamentals, Declaring Objects, A Closer Look at new, Assigning Object Reference Variables, Introducing Methods, Constructors, Parameterized Constructors, The this Keyword, Instance Variable Hiding, Garbage Collection, The finalize( ) Method, A Stack Class.

A Closer Look at Methods and Classes: Overloading Methods, Overloading Constructors, Using Objects as Parameters, A Closer Look at Argument Passing, Returning Objects, Introducing Access Control, Understanding static, Introducing final, Arrays, Exploring the String Class, Using Command-Line Arguments, Varargs: Variable-Length Arguments.

UNIT - II **09 Hours**

Inheritance: Inheritance Basics, Using super, Creating a Multilevel Hierarchy, When Constructors Are Executed, Method Overriding, Dynamic Method Dispatch, Why Overridden Methods? Using Abstract Classes, Using final with Inheritance, The Object Class.

Packages and Interfaces: Packages, Access Protection, Importing Packages, Interfaces, Defining an Interfaces, Default Interface Methods, Use static Methods in an Interface.

UNIT - III **10Hours**

Exception Handling: Exception-Handling Fundamentals, Exception Types, Uncaught Exceptions, Using try and catch, multiple catch Clauses, Nested try Statements, throw, throws, finally. Exception Handling: Java's Built-in exceptions, Creating Your Own Exception Subclasses, Chained Exceptions.

Multi-Threaded Programming:

The Java thread model, The main thread, Creating thread, creating multiple threads, Thread priorities, Synchronization. Interthread Communication.

UNIT - IV **10 Hours**

Type Wrappers: Character, Boolean, Numeric type wrappers. Autoboxing: Autoboxing and Methods, Autoboxing / Unboxing occurs in expressions, Autoboxing/Unboxing Boolean and Character values, Autoboxing / Unboxing helps prevents errors.

The Collections Framework: Collections Overview, The Collection Interfaces: the collection interface, the List interface, the Set interface. The Collection Classes: The ArrayList Class, The LinkedList Class, The HashSet Class. Accessing a Collection via an Iterator -Using an Iterator, The For-Each Alternative to Iterators.

UNIT - V **09 Hours**

GUI Programming and Event Handling: Introducing JavaFx GUI Programming, Exploring JavaFx controls, Introducing JavaFX Menus

Event Handling: Event handling mechanisms, The Delegation Event model.

Lab Program List

1. Create a class namely Account with the data members(Accno : integer, name :String, Phone_No: integer, balance_amt:float), and following methods :

a. CreateAccount() method to create an account.
b. Deposit() method to deposit amount to an account.
c. Withdraw() method which gets the amount to be withdrawn from his/her account.
d. PrintAccount() method to display account details.

2. All the banks operating in India are controlled by RBI. RBI has set a well defined guidelines (e.g. minimum interest rate, minimum balance allowed, maximum withdrawal limit etc) which all banks must follow. For example, suppose RBI has set minimum interest rate applicable to a saving bank account to be 4% annually; however, banks are free to use 4%

interest rate or to set any rates above it. Write a JAVA program to implement bank functionality in the above scenario and demonstrate the dynamic polymorphism concept. Note: Create few classes namely Customer, Account, RBI (Base Class) and few derived classes (SBI, ICICI, PNB etc). Assume and implement required member variables and functions in each class.

3. Write a Java Program that does the following related to Inheritance:

   a. Create an abstract class called Vehicle which contains the year_of_manufacture‟ data memberand two abstract methods "getData()‟ and "putData()‟ with a constructor.

   b. Create two derived classes "TwoWheeler" and "FourWheeler" and implement the abstract methods. Make "FourWheeler" as final class.

   c. Create class "MyTwoWheeler‟ which is a sub-class of "TwoWheeler" and demonstrate the use of super keyword to initialize data members of "MyTwoWheeler".

4. Write a Java program to create an abstract class namely Shape that contains two integers and an empty method named print Area (). Provide three classes named Rectangle, Triangle, and Circle such that each one of the classes extends the class Shape. Each one of the classes contains only the method print Area () that prints the area of the given shape.

5. Write a program to add additional functionals like mod() and squrt() for performing modulus and squreroot operation to an existing class called "Calculator" which performs basic functions like add(), sub(), mul() and div().

   a. Initialize the class's data members by using the parameterized constructor.

   b. Define an overridden method called displayResults() to display the result of mathematical operation.

   c. Demonstrate the use of reusability by extending the existing class.

   d. Demonstrate the concept of Dynamic Method Dispatch (or run time polymorphism)

6. Write a Java program that implements a multi-thread application that has three threads. First thread generates random integer every 1 second and if the value is even, second thread computes the square of the number and prints. If the value is odd, the third thread will print the value of cube of the number.

7. Write a Java program that correctly implements the producer – consumer problem using the concept of inter-thread communication

8. Write a Java program that creates a user interface to perform integer divisions. The user enters two numbers in the text fields, Num1 and Num2. The division of Num1 and Num 2 is displayed in the Result field when the Divide button is clicked. If Num1 or Num2 were not an integer, the program would throw a Number Format Exception. If Num2 were Zero, the program would throw an Arithmetic Exception. Display the exception in a message dialog box.

9. Write a Java program that works as a simple calculator. Use a grid layout to arrange buttons for the digits and for the +, -,*, % operations. Add a text field to display the result. Handle any possible exceptions like divided by zero.
10. Write a Java program that simulates a traffic light. The program lets the user select one of three lights: red, yellow, or green with radio buttons. On selecting a button, an appropriate message with "Stop" or "Ready" or "Go" should appear above the buttons in selected color. Initially, there is no message shown.
11. Write a program to create an ArrayList with the name arrlist and type "String". Add strings "AAA","BBB","CCC","DDD","EEE" to the arrlist. Add another string "XXX" to first position, remove the string "AAA", update "BBB" to "AAA" and display the arrlist.
12. Develop a Java program to create a linked list of 5 names of programming languages using appropriate collection class. Remove the first and last element of the linked list and print the remaining names iterating the list.

TEXT BOOKS

1. Herbert Schildt, —Java – The Complete Reference –, 9th Edition, 2014, Oracle Press.

REFERENCE BOOKS

1. Y. Daniel Liang, —Introduction to JAVA Programming, 6thEdition, 2007, Pearson Education,
2. Stephanie Bodoff et al, —The J2EE Tutorial, 2nd Edition, 2004, Pearson Education.
3. Head First Java, O'Reilly Publication, 2005.

TEACHING METHODS

- Black Board/Power Point Presentations
- Demonstration of Applications through IDE

ASSESSMENT METHODS

Parameter	**Marks**
Three Internals (Average of best of two)	30
Programming Assignment based Test	10
Rubrics for the evaluation of Programming Assignments	10
Total	**50**
Final Examination will be conducted for 100 marks (SEE)	

COURSE OUTCOMES

Sl. No.	COURSE OUTCOMES	BL
CO1	Apply the object-oriented principles like Encapsulation, Abstraction inheritance and polymorphism to solve the real-world problems	L3
CO2	Demonstrate with examples the usage of Inheritance, Interfaces, packages and Exception handling	L3
CO3	Implement multithreaded Java applications, demonstrate exception handling in Java	L3
CO4	Use the Java's Collection framework to solve computing real-world problems.	L4
CO5	Use JavaFX for interactive UI development and event handling	L4

CO-PO MAPPING

	PROGRAM OUTCOMES												PSO		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO1	3		3						1	1			3	2	
CO2	2		3						1	1			3	2	
CO3	2		3						1	1			3	2	
CO4	2		3						1	1			3	2	
CO5	2		3						1	1			3	2	
Correlation level	2		3						1	1			3	2	

Department: CS&E	***Course Type: Professional Core -lab***
***Course Title**: Data Structures Lab using C++*	***Course Code: 21CSL37***
L-T-P: 0-0-2	***Credits: 01***
Total Contact Hours: 26 Hours	***Duration of SEE: 3 Hours***
SEE Marks: 50	***CIE Marks: 50***

COURSE DESCRIPTION

This course imparts the concepts and implementation of various data structures which is the foundation of computer science. It includes the implementation of different data structures namely Arrays, Stacks, Queues, Linked lists, Trees and applications using them.

PREREQUISITES

Students should have basic knowledge of programming constructs and should be able to understand and write programs in C/C++.

COURSE OBJECTIVES

- To understand and implement various data structures.
- To apply various data structures and solve problems.

COURSE CONTENTS

Sl No	List of Programs	CO Mapping
	Design and Implement a C++ Program for the following array operations. a. Creating an array of N Integer Elements b. Display the array Elements with Suitable Headings c. Inserting an Element at a given valid Position d. Deleting an Element at a given valid Position e. Exit.	CO1
	Design a Program in C++ for the following operations on Strings. a. Read a main String (STR), a Pattern String (PAT) and a Replace String (REP) b. Perform Pattern Matching Operation: Find and Replace all occurrences of PAT in STR with REP if PAT exists in STR. Report suitable messages in case PAT does not exist in STR (Note: Do not use built-in functions)	CO1

	Design a C++ program to search for an element in an array using Recursive Binary Search.	CO1
	Create a class BOOK with members ISBN, Title, Author and Price. Write a C++ program to construct a stack data structure for N BOOK objects and write member functions to perform the following operations on it: a) PUSH-To add a new BOOK object to the stack b) POP- To remove a BOOK object from the stack	
	Design a C++ program to convert and print a given valid parenthesized infix arithmetic expression to postfix expression. The expression consists of single character operands and binary operators +, -, *, / and $. Apply the concept of stack data structure to solve this problem.	CO2
	Design a C++ program to evaluate a valid postfix expression using stack. Assume that the postfix expression is read as a single line consisting of non-negative single digit operands and binary operators. The operators are +, -, *, / and $.	CO2
	Design a C++ Program to perform the following operations on Linear Queue of Integers (Array Implementation of Queue with maximum size MAX) a. Insert an Element to a Linear Queue. b. Delete an Element from the Linear Queue. c. Demonstrate Overflow and Underflow situations on Linear Queue d. Display the status of Linear Queue	
	Develop a C++ Program to perform the following operations on Circular Queue of Characters (Array Implementation of Queue with maximum size MAX) a. Insert an Element on to Circular Queue b. Delete an Element from Circular Queue c. Demonstrate Overflow and Underflow situations on Circular Queue d. Display the status of Circular Queue	CO3
	Design a menu driven Program in C++ for the following operations on Singly Linked List of Student Data with the fields: USN, Name, Branch, Sem, PhNo. Perform the following operations on the linked list.	CO4

	a. Insert a student at the front of the list. b. Delete a node with specified student name. c. Display the list and count the number of nodes in it.	
.	Design a menu driven Program in C++ for the following operations on Doubly Linked List (DLL) of Employee Data with the fields: SSN, Name, Dept, Designation and salary. Perform the following operations. Create a double linked list of employees data. Insert a new employee to the left of the node whose key value (employee name) is read as an input. Delete a node with given data, if it is found. Otherwise display appropriate error message	CO4
.	Design a C++ program using Circular single linked list with header nodes to perform the following operations To create a circular linked list to represent unsigned long integers To add two long integers represented by circular linked list and store the result in another circular linked list. Display the resultant circular linked list.	
.	Design a C++ program that uses functions to perform the following: Create a binary search tree of characters. Traverse the above Binary search tree recursively in preorder, in order and post order.	CO5
.	Design a C++ program that uses functions to perform the following: Create a binary search tree of integers. Search for an integer key in the above binary search tree non recursively. Search for an integer key in the above binary search tree recursively.	CO5

ASSESSMENT METHODS

Parameter	Marks
Test (Average of Two tests)	15
Laboratory Record writing	10
Surprise Test	10
Continuous Evaluation	10
Viva	5
Total	**50**

Final SEE will be conducted for 100 marks

COURSE OUTCOMES

At the end of the course the student will be able to

Sl. No.	COURSE OUTCOMES	BL
CO1	Design and Implement operations on arrays and strings using C++.	L3
CO2	Simulate stack operations. Understand and implement its applications in real time.	L3
CO3	Implement basic operations on different types of queue data structures.	L3
CO4	Develop programs on linked lists and its variations.	L3
CO5	Construct C++ programs on Binary search tree and its applications	L3

TEXT BOOKS

1. Fundamentals of Data Structures in C++, Ellis Horowitz, Sartaj Sahni, Dinesh Mehta, Universities Press, 2nd Edition
2. Data Structures using C/C++, Aaron M. Tanenbaum, Yedidyah Langsam& Moshe J. Augenstein, Pearson Education/PHI, 2006

CO-PO MAPPING

	PROGRAM OUTCOMES												**PSO**		
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO1	**3**	**2**	**3**										**3**		
CO2	**3**	**2**	**3**										**3**		
CO3	**3**	**2**	**3**										**3**		
CO4	**3**	**2**	**3**										**3**		
CO5	**3**	**2**	**3**						**2**	**2**			**3**		**2**
Correlation level	**3**	**2**	**3**						**2**	**2**			**3**		**2**

PROGRAM ELECTIVE - 1

Department: *Computer Science and Engineering*	***Course Type:*** *Professional Elective*
Course Title*: Introduction to Embedded Systems*	***Course Code****: 21CSE361*
L-T-P: *3-0-0*	***Credits****: 3*
Total Contact Hours*: 40 Hours*	***Duration of SEE****: 3 Hours*
SEE Marks*:50*	***CIE Marks****: 50*

COURSE DESCRIPTION

In this course, the fundamentals of embedded system hardware and firmware design will be explored. Learning may be supplemented with periodic guest lectures by embedded systems engineers from industry. Depending on the interests of the students, other topics may be covered.

PREREQUISITES

- Excellent understanding of Digital Electronics.
- Good to intermediate level of understanding of Basics of Analog Electronics.
- Good C Programming skills.
- Understanding of at least one Micro-controller or Micro-processor.

COURSE OBJECTIVES

This course will enable students to

- Provide a general overview of Embedded Systems
- Show current statistics of Embedded Systems
- Design, code, compile, and test real-time software
- Integrate a fully functional system including hardware and software.
- To introduce the Embedded C Concepts

COURSE CONTENTS

UNIT – I 8 Hours

Introduction to Embedded Systems: What is an Embedded System?, Embedded Systems vs. General Computing Systems, History of Embedded Systems, Classification of Embedded Systems, Major Application Areas of Embedded System.

Typical Embedded System: Elements / Architecture of an Embedded System.

UNIT – II 08 Hours

Microcontroller Architecture, Differences between microprocessor and microcontroller, type of microcontrollers, Importance of microcontroller in embedded system. Case Studies and applications.

UNIT – III **08 Hours**

Introduction to Embedded C Programming, Data types: byte, int, long, float, arrays. Structures: setup (), loop (), functions, {} curly braces, ; semicolon, /*….*/ block comments, // line comments. Variables: variable declaration, variable scope. Arithmetic: compound assignments, comparison operators, and logical operators. Constants: true/false, high/low, input/output. Flow control: if, if else, for, while, do while.

UNIT – IV **08 Hours**

Introduction to Sensors and actuators, LED, Optocoupler, DHT111 Sensor, LDR, Soil Moisture Sensor, ultrasonic and infrared for obstacle. Communication – Wireless Communication using Bluetooth, Wi-Fi and RF Modules. Communication Controllers – UART, SPI, I2C.

UNIT – V **08 Hours**

RTOS: Real time Operating System, Tasks, Process and Treads, Multiprocessing and Multitasking, Task Scheduling

TEXT BOOKS

1. Shibu K V, Introduction to Embedded Systems, McGraw Hill Publication.
2. Frank Wahid, Tony Givargis, Embedded System Design: A Unified Hardware / Software, Wiley India

REFERENCE BOOKS

1. Julien Bayle, C Programming for Arduino, **PACKT** Publishing, 2013.
2. Raj Kamal, Embedded Systems: Architecture, Programming & Design, and TMH

TEACHING METHODS

- Black Board/PowerPoint Presentations
- Programming Assignments
- NPTEL

ASSESSMENT METHODS

Parameter	Marks
Three Internals (Average of best of two test)	30
Model based Learning	10
Learning Activity Assignment	10
Total	**50**

Final Examination will be conducted for 100 marks (SEE)

COURSE OUTCOMES

At the end of course, Student will be able to:

Sl. No.	COURSE OUTCOMES	BL
CO 1	Describe and Analyze the Salient aspects of differentiation between Real time systems and Data Processing system	**L2**
CO 2	Design embedded systems using Microcontroller and Embedded C	**L5**
CO 3	Conversant with various Sensors, communication protocols used in Embedded applications	**L2**
CO 4	Model RT systems, and Implement aspects of RTs	**L3**
CO 5	Work in Teams to implement applications highlighting Real-time issues	**L2**

CO-PO MAPPING

	PROGRAM OUTCOMES												PSO		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3											3		
CO2	3	3	3		3									2	
CO3		3	3	3	3									2	
CO4	3	3	3	3	3									2	
CO5		2	2	2	2	2	2								1
Correlation level	3	3	3	3	3	2	2						3	2	1

3: Strong, 2: Medium, 1: Weak ** H: Highly related S: Supportive

Department: *Computer Science and Engineering*	***Course Type:*** *Professional Elective*
Course Title*: Introduction to Image Processing*	***Course*** *Code: 21CSE362*
L-T-P : *3-0-0*	***Credits:*** 3
Total Contact Hours: 40 Hours	***Duration of SEE:3 Hours***
SEE Marks*:* 50	***CIE Marks:*** 50

COURSE DESCRIPTION

Introduction to theories, algorithms, and practical solutions of digital image perception, acquisition, quantization, enhancement, filtering, restoration, analysis, feature extraction, segmentation and morphological transform.

PREREQUISITES

Fundamental Knowledge of Mathematics

COURSE OBJECTIVES

This course will enable students to

- Explain image fundamentals and mathematical transforms necessary for image processing and to study the image enhancement techniques.
- Demonstrate the image filtering and restoration techniques.
- Demonstrate the image segmentation and representation techniques.
- Analysis image using various features

COURSE CONTENTS

UNIT - I **08 Hours**

What is a Digital Image? Digital Image Representation; Image Processing, Image Analysis and Image Interpretation, Basic Elements of a Digital Image Processing System; Fundamentals Steps in Digital Image Processing, Image Sensing and Acquisition; Single Sensor; Line Sensor and Array Sensor, Image Formation; Sampling and Quantization, Image Zooming and Shrinking; Digital Image Resolution and Storage; Convolution, Basic relationship between pixels, Histogram Characteristics

UNIT – II **08 Hours**

Image Enhancement in Spatial Domain

Definition, Characteristics, Applications, Categories of Enhancement Methods, Basics of Intensity Transformation and Spatial Filtering, Point Processing, Mask or Neighborhood

Processing; Contrast Stretching, Grey Level Slicing, Bit Plane Slicing Histogram Based Image Enhancement: Histogram Equalization, Local Enhancement Methods

UNIT - III	**08 Hours**

Basics of Spatial Filtering

Linear and Non-Linear Spatial Filters, Image Averaging Filter, Mean Filter, Median Filters, Mid-range Filter, Trimmed Mean Filter, Max-Min Filter, Min-Max Filter, Edge Preserving Smoothing Filters, Sharpening Spatial Filters.

Image Restoration: A Model of the Image Degradation/ Restoration Process; Noise Models- Gaussian noise, Rayleigh noise, Erlang(gamma) noise, Exponential noise, Uniform noise, Impulse (salt and pepper) noise; Restoration in the presence of Noise – Spatial Filtering; Periodic Noise Reduction by Frequency Domain Filtering

UNIT - IV	**08 Hours**

Edge Detection

Mathematical Foundation: First Order and Second order Derivative; Definition of Few Terms, Edge Models: Step, Ramp and Roof Edge; Algorithms - Robert, Sobel, Prewitt, Laplacian; Compass Gradient Mask – Prewitt, Sobel, Laplacian

Segmentation: Region Based Segmentation, Mean Shift Segmentation

Thresholding: Manual and Automatic Thresholding;

UNIT - V	**08 Hours**

Feature Extraction

Introduction, Representation- Boundary, Thinning; Topological Attributes- Connectivity Number, Component Labelling, Component Counting; Geometrical Attributes- Perimeters, Diameter of the Enclosing Circle, Area, Slope, Curvature and Straightness; Convexity, Spatial Moments

TEXT BOOKS

1. Rafel C. Gonzalez and Richard E Woods, "Digital Image Processing'', Pearson Education, 3rd Edition, 2009.
2. B. Chanda, D Dutta Majumder, "Digital Image Processing and Analysis'', Prentice-Hall, India, 2002

REFERENCE BOOKS

Milan Sonka, Vaclav Hlavac, Roger Boyle, "Digital Image Processing and Computer Vision", Cengage Learning, 2nd Edition 2008

TEACHING METHODS

- Lectures
- Power Point Presentation

- Case Study

ASSESSMENT METHODS

Midterm Test (Avg. of 2 Tests) – 30 Marks

- Programming Assignment– 10 Marks.
- Case Study – 10 Marks

COURSE OUTCOMES

Sl. No.	COURSE OUTCOMES	BL
CO1	Analyse the Image Formation models and to be able to perform Image Interpolation methods	L2
CO2	Apply and analyse the Image Enhancement and Filtering Algorithms for specific applications	L3
CO3	Derive mathematical model for different edge detection and will be able to apply different edge models	L3
CO4	Apply and analyse the Image segmentation and restoration methods.	L4
CO5	Extract and analyse different basic features from an image	L4

CO-PO MAPPING

	PROGRAM OUTCOMES												PSO		
	PO1	PO2	PO3	PO4	PO5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2	PSO 1	PSO 2	PSO 3
CO1	3	2													
CO2	2	3	2		2				2	2			2	2	
CO3	2	3	3		3				2	2			2	2	
CO4	2	3	3		2				2	2			2	2	
CO5	2	3	3		2				2	2			2	2	
Correlation level	2	3	3		2				2	2			2	2	

Department: *Computer Science and Engineering*	***Course Type: Professional Elective***
Course Title*: Introduction to Unix*	***Course Code: 21CSE363***
L-T-P: *3-0-0*	***Credits:*** *03*
Total Contact Hours: *39 hrs*	***Duration of SEE:*** *3 hrs*
SEE Marks*: 50*	***CIE Marks:*** *50*

COURSE DESCRIPTION

The course begins by describing simple UNIX architecture, commands usage and scripts to automate frequently executed commands. Course also provides students with the skills to read, write, and debug awk and UNIX shell scripts.

PREREQUISITES

Students should have knowledge of C and C++, Data Structures

COURSE OBJECTIVES

The main objective of this subject is to teach

- The usage of various commands according to the requirement
- To write their own Shell scripts and awk programs to perform the given task.
- To enhance their knowledge in Unix operating System

COURSE CONTENTS

UNIT - I **09 Hours**

The Unix Architecture and command Usage: Introduction: The operating System, UNIX Operating System, Features of UNIX, Architecture of UNIX, Locating Commands, Internal and External Commands, Command Structure, Flexibility of Command Usage, man browsing the manual pages online, understanding the man documentation-man-k, apropos and whatis

General-Purpose Utilities: cal, date, echo, printf, bc, script, mailx, passwd, who, uname, tty, stty. **File System:** The File, File name, Parent-child Relationship, The HOME Variable, pwd, cd, mkdir, rmdir, Absolute Pathnames, Relative Pathnames, ls, UNIX file system.

UNIT - II **08 Hours**

Basic File Attributes: Listing file attributes, Listing Directory attributes, File Ownership, File Permission, Changing File Permissions, Directory Permissions, Changing File Ownership.

Handling Ordinary File: cat, cp, rm, mv, more, lp, file,wc, od, cmp, comm, diff, Converting between DOS and UNIX, Compressing and Archiving Files.
The Shell: Shell offerings, Pattern matching, Escaping and Quoting, Redirection, Pipes, tee command, Command Substitution, Shell variable.

UNIT - III	**08 Hours**

Customizing Environmental Variables: The Shells, Environmental Variables, the common environment variables, aliases.
More File Attributes: File Systems and Inodes, Hard Links, Symbolic Links, The Directory, Default file and Directory Permissions, Modifications and Access Times, Locating Files.
Simple Filters: the sample database, pr, head, tail, cut, paste, sort, uniq, tr command usage with examples.

UNIT - IV	**07 Hours**

Filters using Regular Expressions-grep and sed: Searching for pattern, Basic Regular Expression, Extended Regular Expression, sed: The Stream Editor, Line addressing
Essential Shell Programming: Shell Scripts, read, Command Line Arguments, Exit Status of a Command, The Logical Operators && and ||, if and case conditions, expr, while, for, set and shift, The here document

UNIT - V	**07 Hours**

Awk: Awk – An advanced filter: Simple awk Filtering, splitting a Line in to Fields, printf, the comparison Operators, Number Processing, Variables, The –f option, The BEGIN and END sections, Built-in variables, Arrays.

TEXT BOOKS

1. UNIX – Concepts and Applications, Sumitabha Das, 4th Edition, Tata McGraw Hill, 2006.

REFERENCE BOOKS

1. UNIX and Shell Programming, Behrouz A. Forouzan and Richard F.Gilberg, Thomson, 2005.
2. UNIX & Shell Programming, M.G. Venkateshmurthy, Pearson Education, 2005.
3. Meeta Gandhi, Tilak Shetty, Rajiv Shah, "The 'C' Odyssey Unix – the open boundless C", BPB.
4. Mike Joy, Stephen Jarvis, Michael Luck, "Introducing Unix and Linux", Palgrave Macmillan

TEACHING METHODS

- Black board teaching
- Power Point Presentation

- Regular review of students by asking questions based on topics covered in the class
  Programming Assignments

ASSESSMENT METHODS

Midterm Test (Avg. of 3 Tests) 30 Marks
Surprise Test 10 Marks
Programming Test 10 Marks

Total 50 Marks

COURSE OUTCOMES

Sl. No.	COURSE OUTCOMES	BL
CO1	Understand the fundamental knowledge and concepts of UNIX Operating System.	1,2
CO2	Describe and interpret the working of commands available in UNIX.	2
CO3	Apply suitable commands and filters for file processing on shell.	3
CO4	Analyse the solutions for the text processing problems using Regular expression tools like grep and sed.	4
CO5	Analyse and examine the shell and awk scripts to execute simple tasks	4

CO-PO MAPPING

	PROGRAM OUTCOMES												PSO		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1				3	2								3	2	
CO2				3	2								3	2	
CO3				2	3								3	2	
CO4				3	3								3	2	
CO5				3	3								3	2	
Correlation level				3	3								3	2	

Department: Computer Science and Engineering	***Course Type:***
Course Title: Introduction to Software Technologies	***Course Code: 21CSE364***
L-T-P :3-0-0	***Credits: 3***
Total Contact Hours: 39 Hours	***Duration of SEE: 3 Hours***
***SEE Marks**: 100*	***CIE Marks: 50***

COURSE DESCRIPTION

Software Technology is a general term covering the development methods, programming languages, and tools to support them that may be used in the development of software. Software development is a dynamic field, where programming languages, frameworks, and technologies may live and die within a few years, and job market needs are constantly changing. However, developers remain among the most in-demand tech professionals.

PREREQUISITES

Basic knowledge on Problem solving using programming.

COURSE OBJECTIVES

1. Introduction to the .NET framework and .NET Interoperation services.
2. Building standalone and web applications using .NET Framework
3. Have Broad understanding on recent software technologies.

COURSE CONTENTS

UNIT – I : .Net Framework and Introduction to C# — 8 Hours

.Net Framework Overview- Architecture-.Net Framework class Libraries-CLR-Metadata-Interoperability-Assemblies-the .net Packaging system-CLR-MSIL, Introduction to Visual Studio.Net-C# Programming Concepts-Predefined Types- Value types and reference type, Classes and Objects, Constructors and methods, Conditional statements, loops, arrays, Collection classes: ArrayList, HashTable, Stack, Queue, indexers and properties.

UNIT – II: Windows Event Driven Programming — 8 Hours

Basics of Windows Programming- Event Driven Programming, Windows Forms, Using common controls-Labels, textboxes, buttons, check boxes, radio button, progress bar, combo box, list box. Components-timer, imagelist, Menus, Modal and Modeless Dialog Boxes, MDI, Mouse and keyboard event handling.

UNIT – III: Web Based Programming using ASP.NET 8hours

Introduction to ASP.NET, Web Forms, Web Services, ASP.NET Features, Page Class, Web Forms Life Cycle, Web Forms Event Model, Code-Behind, **ASP.NET and HTTP:** Request/Response Programming, Request/Response Programming, HttpRequest Class, HTTP Collections, HttpResponse Class.

UNIT – IV: Introduction to Java Technology with Database ccess 7Hours

Introducing Swing, JFC, The MVC Architecture, Applet.
Working with JDBC, Introducing JDBC, Exploring JDBC Drivers, Exploring the Features of JDBC,
Describing JDBC APIs, Exploring Major Classes and Interfaces, Exploring JDBC Processes with the java.sql Package, Working with Transactions

UNIT – V: Introduction to Next Generation Software Technologies 08 Hours

Multiexperience, Digital twin technologies, Blockchain, Cloud computing, Progressive web apps. Technologies, libraries and Frameworks, IDE, Versioning Control, Build Tools, Continuous Integration tools, Application and web servers, Enterprise Service bus, Sales force Management.

TEXT BOOKS

1. C# 4.0 the Complete Reference by Herbert Schildt
2. Beginning ASP.NET 4.5 in C# and VB, Wrox, 2012, ISBN-10: 1118311809.
3. JDBC Database access with Java, Graham Hamilton et all, Addison-Wesley ,ISBN-13: 978-0201309959

REFERENCE BOOKS

1. Robert Powel, Richard Weeks, C# and the .NET Framework, Techmedia.
2. The Complete Reference – JAVA, McGraw Hill; Eleventh edition.

TEACHING METHODS

- Lecture using Black board and chalk
- Presentations, Hands-on-Sessions.
- Programming Assignments

ASSESSMENT METHODS

Parameter Marks

Three internals (Average of best of two)	30
Programming Assignments	10
Rubrics for the evaluation of Programming Assignments	10
	Total 50

Final Exam will be conducted for 100 marks (SEE)

COURSE OUTCOMES

Sl. No.	COURSE OUTCOMES	BL
CO1	Students will be able to understand the development and deployment cycles of enterprise applications.	2
CO2	Students will be able to utilize the .NET framework to build standalone and distributed enterprise applications.	3
CO3	Students will be able to understand and implement Server side programming: Web Forms, ASP.NET Web Services,	3
CO4	Students will be able to understand and implement database connectivity using JAVA	3
CO5	Students will have broad knowledge on latest software technologies.	2

CO-PO MAPPING

	PROGRAM OUTCOMES												PSO		
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO1	PSO2	PSO3
CO1		2											2		
CO2		2				2									2
CO3		3											1		
CO4							3				2	2		2	
CO5		2									2	2			2
Correlation level		2				2	3				2	2	2	2	2

IV SEMESTER

Department: Mathematics	***Course Type: Basic Science***
Course Title*: Discrete Mathematics and Probability*	***Course Code: 21MAT41A***
L-T-P : 3-2-0	***Credits: 3***
Total Contact Hours: 50	***Duration of SEE: 3 Hrs***
SEE Marks*: 100*	***CIE Marks: 50***

COURSE DESCRIPTION

The course gives a broad view of Probability theory, Random Process, Discrete mathematical structures and Graph theory.

PREREQUISITES

Combination, permutation, set theory

COURSE OBJECTIVES

To Impart the knowledge and ability to apply basic concepts of Probability, random process, discrete mathematics and graph theory to engg. problems

COURSE CONTENTS

UNIT - I **08 Hours**

Discrete Mathematical structures

Mathematical Logic: Propositional Logic, logical operators, compound propositions - truth values, truth tables, Propositional Equivalences.

Functions: Definition, surjective, injective and bijective functions, Inverse function and composition of functions.

Relations: Definition, Properties, Equivalence, matrix representation, digraphs, partial order -Hasse diagram- Maximal and minimal elements, LUB and GLB.

Self-Study: Rules of Inference.

UNIT - II **08 Hours**

Graph Theory-I

Graph Terminologies, circuits, cycles and connected graphs hand shaking theorem, Degree sequence, path and trail in graphs, Graph isomorphism, Adjacency and Incidence matrices, Euler and Hamiltonian graphs, Shortest path problems-Dijkstra's algorithm for undirected graphs.

Self-Study: Applications such as Job Assignments, Travelling Salesman problem.

UNIT - III **08 Hours**

Graph Theory-II

Trees- Properties, spanning trees, minimum spanning trees- Prim's and Kruskal's algorithm.

Planar graphs, Problems on Euler's formula, Graph coloring – vertex coloring.
Self-Study: Three house and Three utilities problem, Scheduling Problems using Graph coloring,

UNIT - IV **08 Hours**

Probability and Random Variables

Probability: Definition, Axioms of probability, Addition rule, Conditional Probability, Multiplication rule.

Random variable -: Probability distribution- discrete and continuous, probability density function, cumulative density function, mean and variance, expectation.

Joint distribution - discrete joint probability distribution, marginal distribution, expectation, covariance, rank correlation. Binomial, Poisson distribution.

Self-Study: Baye's Theorem, continuous Joint distribution.

UNIT - V **08 Hours**

Probability and sampling Distribution

Probability Distribution: Normal distribution, exponential distribution and uniform distribution.

Sampling and Testing of hypothesis: Introduction, Sampling with and without replacement, Sampling distribution of means and sample variance. Unbiased estimate, confidence intervals for mean, statistical hypothesis, testing of hypothesis of large samples, one tailed and two tailed test, Significance level.

Markov Process: Definition, transition probability matrix, regular stochastic matrix, n – step transitional probabilities, stationary distribution

Self-Study: Poisson's Process, States of Markov process.

TEXT BOOKS

1. Discrete Mathematics and its applications, Kenneth Rosen, 7th edition, Tata McGrawHill, 2011
2. Fundamentals of Statistics, S C Gupta, 6th edition, Himalaya Pub., 2007

REFERENCE BOOKS

1. Introduction to Graph theory, Gary Chartrand, Tata McGrawHill, 2006

2. Probablility and Statistics, M R Spiegel, JJ Schiller, R A Srinivasan, 3rd edition, Mc GrawHill, 2019

TEACHING METHODS

- Black Board Teaching.
- Power point presentation
- Tutorial

ASSESSMENT METHODS

Continuous internal Evaluation (CIE) for 50 Marks

- Surprise test / Tutorials tests to be conducted for each topic for 10 marks.
- Quiz/ assignment based on practical application for 10 marks.
- Three mid semester examinations will be conducted each for 30 marks and the average of all the 3 will be taken.

Semester End Examination (SEE) for 50 Marks

Final examination, of 100 Marks will be conducted and will be evaluated for 50 marks.

COURSE OUTCOMES

1. The concepts of Mathematical logic, functions and relations can be applied to Engg. Problems
2. The concepts of graph theory can be used to model and solve problems
3. The concepts of Graph theory can be applied to Engg. Problems
4. The basic concepts of Probability, random variables, distributions and Sampling can be used for problem solving
5. The testing of hypothesis and distributions can be applied to engg. Problems

	PROGRAM OUTCOMES												PROGRAM SPECIFIC OUTCOMES		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2		2												
CO2	2		2		1										
CO3	2		2												
CO4	2		2		1										
CO5	2		2		1										
Correlation level															

Department: Computer Science and Engineering	***Course Type: Professional Core***
Course Title: Design and Analysis of Algorithms	***Course Code: 21CS42***
L-T-P : 3:0:0	***Credits: 3***
Total Contact Hours: 39 hours	***Duration of SEE: 3 hours***
***SEE Marks**: 50*	***CIE Marks: 50***

COURSE DESCRIPTION

This course introduces basic methods for the design and analysis of efficient algorithms emphasizing methods which are useful in practice. The computational problems for sorting, searching, Divide and Conquer, dynamic programming and greedy algorithms, graph algorithms string matching, Backtracking, Branch and Bound, NP completeness are discussed.

PREREQUISITES

- Students should have knowledge of C or C++ language
- Students should know data structures
- Students should know the usage of summation formulae and recurrences in mathematics

COURSE OBJECTIVES

- To understand the basic concepts and notations used in the design and analysis of algorithms.
- To provide theoretical background in the design and analysis of major classes of algorithms.
- To solve problems using appropriate algorithms.
- To analyze and compare the performance of algorithms

COURSE CONTENTS

UNIT - I **7 Hours**

Introduction: What Is an Algorithm? Fundamentals of Algorithmic Problem Solving, Fundamentals of the Analysis of Algorithm Efficiency: The Analysis Framework, Asymptotic Notations and Basic Efficiency Classes, Mathematical Analysis of Non recursive Algorithms, Mathematical Analysis of Recursive Algorithms, Example: Computing the nth Fibonacci Number.

UNIT – II **8 Hours**

Brute Force and Exhaustive Search: Selection Sort and Bubble Sort, Sequential Search and Brute-Force String Matching, Depth-First Search and Breadth-First Search, Exhaustive Search. **Decrease-and-Conquer:** Insertion Sort, Topological Sorting, Decrease-by-a-Constant-Factor Algorithms – Binary Search.

UNIT - III **8 Hours**

Divide and Conquer: Mergesort, Quicksort, **Transform-and-Conquer:** Balanced Search Trees, Red Black trees, AVL trees, 2-3 trees, Heaps and Heapsort, Input Enhancement in String Matching, Horspool's Algorithm, Hashing

UNIT - IV **8 Hours**

Dynamic Programming: The Knapsack Problem and Memory Functions, Warshall's and Floyd's Algorithms, Greedy technique**:** Prim's Algorithm, Kruskal's Algorithm, Dijkstra's Algorithm, Huffman Trees and Codes.

UNIT - V **8 Hours**

Limitations of Algorithm Power: P, NP, and NP-Complete Problems, **Coping with the Limitations of Algorithm Power:** Backtracking - n-Queens Problem, Subset-Sum Problem, Branch-and-Bound- Assignment problem, Knapsack Problem

TEXT BOOKS

1. Anany Levitin, "Introduction to the Design & Analysis of Algorithms", 3rd Edition, 2011, Pearson education.
2. Horowitz E., Sartaj Sahni S. Rajasekaran" Fundamentals of Computer Algorithms", 2001, Galgotia Publications.

REFERENCE BOOKS

1. H., Cormen, Charles E. Leiserson, Ronal L. Rivest, Clifford Stein Thomas, "Introduction to Algorithms", 2nd Edition, 2006, PHI.

TEACHING METHODS

- Lectures interspersed with discussion
- Power Point Presentations
- Problem Based Teaching

ASSESSMENT METHODS

1. Three Mid-Sem exams – 30 Marks each will be conducted and the Average of all the three tests will be considered.
2. Laboratory Based Exercises: 10 Marks
3. Problem Solving based test: 10 marks

COURSE OUTCOMES

Sl. No.	COURSE OUTCOMES	BL
CO1	Describe the concepts, methods and notations used in the design and analysis of algorithms	3
CO2	Understand different algorithm design techniques	2
CO3	Design algorithms to common engineering problems using different algorithm design techniques.	3
CO4	Solve common engineering problems using different techniques.	3
CO5	Evaluate the performance of various algorithms.	3

CO-PO MAPPING

	PROGRAM OUTCOMES												PROGRAM SPECIFIC OUTCOMES		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2							1				2		
CO2	2	3	2						1				2	3	
CO3	3	2	3						1				2	3	
CO4	3	2	2						1				2	3	
CO5	3	2	2						1				2	3	
Correlation level	3	2	2						1				2	3	

Department: *Computer Science and Engineering*	***Course Type:*** *Professional Core*
Course Title*: Software Engineering*	***Course Code:*** *21CS43*
L-T-P: *3-0-0*	***Credits:*** *03*
Total Contact Hours: *40 Hours*	***Duration of SEE:*** *3 Hours*
SEE Marks*: 50*	***CIE Marks:*** *50*

COURSE DESCRIPTION

The course will cover topics regarding the software development other than programming, including testing, verification, and validation for constructing robust code. The emphasis is on modern technology for developing reliable software at reasonable cost.

PREREQUISITES

Students must have the knowledge on basic programming and object oriented concepts.

COURSE OBJECTIVES

To understand what Software Engineering is and why it is important.

- To understand various software development process models and to select the appropriate model for a particular project.
- To introduce the art of eliciting user requirements and analysis.
- To introduce software design strategies and development methodologies.
- To understand the software testing process and tools.
- To understand the process of software Maintenance.
- To know how to manage people, process and problems during software development project.

COURSE CONTENTS

UNIT - I **08 Hours**

Introduction to Software Engineering:

Introduction: FAQ's about software engineering, IEEE / ACM code of software engineering ethics, Process activities; Requirements gathering and analysis: Software Requirements Specification (SRS), Functional and Non-Functional requirements, User requirements, System requirements, Interface specification, Characteristics and components of SRS, Structure of SRS (IEEE format).

Case study: Develop SRS (IEEE format) for any real world application.

UNIT - II **08 Hours**

Software Development Process Models:

Traditional Process Models: The Waterfall model, The Evolutionary model, The Incremental implementation, Prototyping, Spiral model, Software reuse; Non-Traditional Process Models: Rapid Application Development (RAD), Agile Development Process, Extreme Programming, Introduction to DevOps, DevOps V/s Agile.

Case study: Identify the suitable development model for any real-world problem.

UNIT - III **08 Hours**

System Design and Development:

Architectural Design: Architectural design decisions, Architectural patterns; Interaction Modeling: Use case models, Sequence diagrams; Structural Modeling: Class diagrams; Behavioral Modeling: State diagrams; Functional Modeling: Data flow diagrams; Development: Selecting a language, Coding guidelines, Code documentation.

Case study: Design a real-world application using Design Methodologies.

UNIT - IV **08 Hours**

Software Testing and Maintenance:

Software Testing: Testing process, Design of test cases, Functional Testing: Boundary value analysis, Equivalence class testing, Path testing, Unit testing, Integration and system testing, Debugging, Alpha & beta testing, testing tools & standards; Software Maintenance: Maintenance process, Software reengineering, Configuration management.

Case study: Develop Test Suite for any real-world application and demonstrate using any Software Testing Automation Tools.

UNIT - V **08 Hours**

Software Quality and Management:

Quality Management: Process and product quality, quality assurance and standards, Quality planning and control; Project Management: Management Activities, Project Planning, Project Scheduling, Risk Management.

Case study: Realize project management activities using emerging Project Management tools.

TEXT BOOKS

1. Software Engineering: A Practitioner's Approach, R. S. Pressman, McGraw Hill, 7th Edition, 2010.
2. Zero Defect Software, G. G. Schulmeyer, McGraw-Hill, 1992.
3. Ian Somerville —Software Engineering, Pearson 9th Edition, 2016.

REFERENCE BOOKS

1. Software Engineering, Ian Summerville, 10th Edition, 2015, Pearson Education Ltd, ISBN: 9780133943030.
2. An Integrated Approach to Software Engineering, Pankaj Jalote, 3rd Edition, 2013, Narosa Publishing House, ISBN: 81-7319-702-4.
3. DevOps for Developers, Michael Huttermann, 2012, Apress, ISBN: 978-1-4302-4569-8.

TEACHING METHODS

- Lecture using presentations.
- Case studies.

ASSESSMENT METHODS

Parameter	Marks
Three Internals (MSEs)	30
Rubrics for evaluation of Case Study Presentation (LA-1)	10
Rubrics for evaluation of Case Study Report (LA-2)	10
Total	**50**
Final Examination will be conducted for 100 marks (SEE)	

COURSE OUTCOMES

Sl. No.	COURSE OUTCOMES	BL
CO1	Understand and apply relevant software engineering principles to gather and analyze software requirements for any application.	2
CO2	Identify suitable process model for designing good software.	2
CO3	Analyze various techniques and Identify suitable methodology for designing any software to meet the requirements of an application.	3
CO4	Develop test suits applying appropriate software testing strategies.	3
CO5	Realize the activities involved in software quality and management.	2

CO-PO MAPPING

	PROGRAM OUTCOMES												PSO		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	3		2	2			3	2	3			3	2	3
CO2	2	3		2	2				2	2		3	2	3	
CO3	2	3	3	3	3	2			3	3			2	3	
CO4	2	3	3	3	3	2			3	2	2		2	3	
CO5	2	3			3	3		2	3	2	3	2	3	3	
Correlation level	2	3	3	3	3	2		3	3	2	3	3	2	3	3

3: Strong, 2: Medium, 1: Weak ** H: Highly related S: Supportive

Department: *Computer Science and Engineering*	***Course Type:*** *Professional Core - Integrated*
Course Title*: Database Management Systems*	***Course Code****: 21CS45*
L-T-P:*3-0-2*	***Credits:*** *04*
Total Contact Hours: *48 Hours*	***Duration of SEE:*** *3 Hours*
SEE Marks: *50*	***CIE Marks:*** *50*

COURSE DESCRIPTION

The fundamentals of Analog and Digital circuits and their applications are introduced in this course. Topics covered include; Simplification of Boolean functions, applications in the analysis and design of combinational and sequential logic circuits applications such as arithmetic circuits. This course introduces the characteristics and applications of few hardware devices and circuits like Op amp, clippers, clampers and Diodes. Emphasis is placed on analysis, selection, biasing, and applications.

PREREQUISITES

- Students should have knowledge of basic concepts of electronics, Binary System.

COURSE OBJECTIVES

To understand the basics of digital and analog electronics and be able to design the simple logic circuits.

To prepare students to perform the analysis and design of various digital electronic circuits.

COURSE CONTENTS

UNIT - I **08 Hours**

Database and Database Users: Introduction, Example, Characteristics of Database Approach, Actors on the Scene, Workers Behind the Scene, Advantages of Using the DBMS Approach, A Brief History of Database Application. Database System Concepts and Architecture: Data Models, schemas, and Instances: Three-schema architecture and Data Independence, Database Languages and Interfaces, The Database System Environment, Centralized and Client/Server Architecture for DBMS, Classification of Database Management systems.

UNIT - II **10 Hours**

Data Modeling Using the Entity-Relationship (ER) Model: Using High - Level Conceptual Data Models for Database Design, An Example Database Application, Entity Types, Entity Sets, Attributes, and Keys, Relationship Types, Relationship Sets, Roles, and Structural Constraints, Weak Entity Types, ER Diagrams, Naming Conventions, and Design Issues.

The Relational Data Model and Relational Database Constraints: Relational Model Concepts, Relational Model Constraints and Relational Database Schemas, Update Operations, Transactions and Dealing with Constraint Violations. The Relational Algebra and Relational Calculus: Unary Relational
Operations: SELECT and PROJECT, Relational Algebra Operations from Set Theory, Binary Relational Operations: JOIN and DIVISION, Additional Relational Operations; Examples of Queries in Relational Algebra.

UNIT - III **10 Hours**

SQL: Schema Definition, Constraints, Queries, and Views: SQL Data Definition and Data Types, Specifying Constraints in SQL, Schema Change Statements in SQL, Basic Queries in SQL, More Complex SQL Queries, Insert, Delete and Update Statements in SQL, Specifying Constraints as Assertion andTrigger, Views (Virtual Tables) in SQL.

UNIT - IV **10 Hours**

Database Design Theory and Methodology: Informal Design Guidelines for Relation Schemas, Functional Dependencies, Normal Forms Based on Primary Keys, General Definitions of Second and Third Normal Forms, Boyce-Codd Normal Form.

UNIT - V **10 Hours**

Transaction Processing Concepts: Introduction to Transaction Processing, Transaction and System Concepts, Desirable Properties of Transactions, Characterizing Schedules Based on Recoverability, Characterizing Schedules Based on Serializability. **Concurrency Control Techniques: T**wo-Phase Locking Techniques for Concurrency Control, Concurrency Control Based on Timestamp Ordering. **Database Recovery Techniques:** The ARIES Recovery Algorithm.

LAB PRORGAM LIST

1**.** Database Schema for a Student Library scenario
Consider that a database named Student Library is developed by an application software NMITSoft company. There are 4 tables in the database. Relationship scheme for the tables is as below:
Student(Stud_no : integer,Stud_name: string)
Membership (Mem_no: integer,Stud_no: integer)
Book (book_no: integer, book_name:string, author: string)
Iss_rec (iss_no:integer, iss_date: date, Mem_no: integer, book_no: integer)

For the above schema, perform the following

a) Create the tables with the appropriate integrity constraints
b) Insert around 10 records in each of the tables
c) List all the student names with their membership numbers
d) List all the issues for the current date with student and Book names
e) Give a count of how many books have been bought by each student
f) Give a list of books taken by student with stud_no as 5

2.Create a relational database schema for a Project, described by the following relations.
STUDENT (Rollno: integer, Name: String, Sem: integer, Degree: String, Contact no: integer, Guide_No: integer)
GUIDE (Guide_name: String, Guide_No: integer, Guide_reserach_domain: String, Contact_No:
integer, Email_Id: String)
PROJECT (Project_No: Integer, Project_title: String, Project_Area: String, Start_dt, date, Guide_No: integer)
GROUP (Group_Code: integer, Roll_No:integer)
PROJECT_GROUP (Group_Code: integer, Project_No: integer, no_of_students:integer)

For the above schema, perform the following.
a) Create the tables with the appropriate integrity constraints
b) Insert around 10 records in each of the tables
c) Find the list of guide, who are guiding more than two student groups.
d) Find the list of project no, project name & name of guide, in domain of Data Base.
e) Create a view as student_project details that lists student name, project name and guide name

3. The following relations keep track of airline flight information:
Flights (flno: integer, from: string, to: string, distance: integer, departs: time, arrives: time, price: integer)
Aircraft (aid: integer, aname: string, cruisingrange: integer)
Certified (eid: integer, aid: integer)
Employees (eid: integer, ename: string, salary: integer)
Note that the Employees relation describes pilots and other kinds of employees as well; every pilot is certified for some aircraft, and only pilots are certified to fly.

For the above schema, perform the following.
a) Create the above tables by specifying primary keys and foreign keys.
b) Insert around 10 records in each of the tables.
c) Find the names of aircraft such that all pilots certified to operate them earn more than 80,000.
d) For each pilot who is certified for more than three aircraft, find the eid and the maximum cruising range of the aircraft that he (or she) is certified for.

e)Find the names of pilots whose salary is less than the price of the cheapest route from Los Angeles to Honolulu.
f) Find the second highest salary of an employee.

4. Consider a relational database schema for a Company database below.
Employee (F_name: string, L_name: string, Emp_id:integer, Bdate: date, Address:string, Gender:string,Salary: integer, Super_Emp_id: integer, D_no: integer)
Department (D_name: string, D_no: integer, D_Mgr_id:integer, Mgr_start_date: date)
Dept_Location (D_no: integer, D_location:string)
Project (P_name: string, P_number:integer, P_location:string, D_no:integer)
Works_on (Emp_id: integer, P_no: integer, Hours: in)
Dependent(Emp_id:integer,Dependent_name:string,Gender:string,Bdate:date,Relationship :String)

For the above schema, perform the following
a) Create the above tables by specifying primary keys and foreign keys.
b) Insert around 10 records in each of the tables.
c) Find the names and address of all employees who work on same department.
d) Retrieve a list of employees and the projects they are working on, ordered by department and, within each department, ordered alphabetically by last name, then first name.
e) Create a view Dept_info that gives details of department name, Number of employees and total salary of each employee.

5. Consider a relational database schema for a Sailors database below
Sailors (sid: integer, sname: string, rating: integer, age: real);
Boats (bid: integer, bname: string, color: string);
Reserves (sid: integer, bid: integer, day: date).

For the above schema, perform the following.
a) Create the above tables by specifying primary keys and foreign keys.
b) Insert around 10 records in each of the tables.
c) Find the names of sailors who have reserved a red boat, and list in the order of age.
d) Find the names of sailors who have reserved boat 103
e) Find the name and the age of the youngest sailor.
f) Find the average age of sailors for each rating level that has at least two sailors.

TEXT BOOKS

1. Elmasri and Navathe: Fundamentals of Database Systems, 5th Edition, Addison-Wesley, 2009

REFERENCE BOOKS

1. C.J. Date, A. Kannan, S. Swamynatham: A Introduction to Database Systems, 8th Edition, Pearsoneducation, 2006.

2. Raghu Ramakrishnan and Johannes Gehrke: Database Management Systems, 3rd Edition, McGraw-Hill,2003.

TEACHING METHODS

1. Blackboard teaching
2. PowerPoint presentations (if needed)
3. Programming Assignments using SQL

ASSESSMENT METHODS

Parameter	Marks
Three Internals	30
SQL programming test based on lab programs	10
Mongo DB project	10
Total	**50**
Final Examination will be conducted for 100 marks (SEE)	

COURSE OUTCOMES

At the end of the course students will

COs	Description	Bloom's Level
CO 1	Have a broad understanding of database concepts, Understand the essentials ofDBMS and its architectures.	**L1**
CO 2	Design and Model a real time Scenario using ER-Modeling. Convert entity relationship and convert entity relationship diagrams into RDBMS. Formulate queries using Relational Algebra.	**L2**
CO 3	Design SQL commands to create tables and indexes, insert/ update/ deletedata, and query data in a relational DBMS.	**L3**
CO 4	Demonstrate an understanding of normalization theory and apply such knowledge to the normalization of a database.	**L4**
CO 5	Illustrate the concepts of Transaction Management and Database RecoveryTechniques.	**L2**

Mapping of Course outcomes (COs) to Program outcomes (POs*) & PSO **															
Course Outcomes mapping to Program Outcomes													PSOs		
POs COs	1	2	3	4	5	6	7	8	9	10	11	12	PSO 1	PSO 2	PSO3
CO1	3	2	3												
CO2		3	3	2									3	2	
CO3		3	2	3	3								3	3	
CO4		3	3	3									3	2	
CO5		2	3	2									2	2	1

Department: *Computer Science and Engineering*	***Course Type:*** *Programme Core*
Course Title*: Design and Analysis of Algorithms Lab*	***Course Code:*** *21CSL47*
L-T-P : *0-0-2*	***Credits: 1***
Total Contact Hours: 26 Hours	***Duration of SEE:*** *3 Hours*
SEE Marks*: 50*	***CIE Marks: 50***

COURSE DESCRIPTION

The course Design and Analysis of Algorithms Lab is designed to introduce basic methods for the design and analysis of efficient algorithms emphasizing methods which are useful in practice. The computational problems include sorting, searching, Divide and Conquer, dynamic programming and greedy algorithms, graph algorithms string matching and Branch and Bound. It also Strengthens the ability to identify and apply the suitable algorithm for the given real-world problem.

PREREQUISITES

- Basic Programming Skills
- Knowledge of data Structures

COURSE CONTENTS

Sl. No.	LIST OF PROGRAMS	CO/PO
	PART- A	
1.	Digital maps, unlike humans, see cities as a bunch of nodes. We (humans) consider this map as a single entity. a GPS navigation or any other digital map divides it into hundreds of segments, with some only 24 meters long. A map displays n cities and their distances. Design and develop a program in C to print all the cities reachable from a given starting city in a digraph by using BFS method. Repeat the experiment for different values of n and plot a graph of the time taken versus n(n=no of nodes)	CO1//1,4
2.	An **island** is surrounded by water and is formed by connecting adjacent lands horizontally or vertically. You may assume all four edges of the grid are all surrounded by water. Given an `m x n` 2D binary grid which represents a map of `'1'`s (land) and `'0'`s (water), return *the number of islands* using DFS algorithm. Design and develop a program in C to print all the lands reachable from a given starting land in a digraph by using DFS	CO1/1,4

	method. Repeat the experiment for different values of n and plot a graph of the time taken versus n(n=no of nodes)	
3.	"Digishop" a online shopping website needs to keep track of the product availabilitybased on the product ID. Design a program in C to read the product ID provided by the customer and search for it's availability by using Binary search method and display the relevant message whether the product is in stock or not. Determine the time required to search for the product. Repeat the experiment for different values of n and plot a graph of the time taken versus n. (n=no of elements).	CO2/1,4,9
4.	"Aircel" a mobile network company need to maintain the telephone numbers of itscustomer in order to call and inform them about the new year offer. They have to sort the contact numbers in ascending order to keep track of the customers whom they called. Design and develop a program in C to sort the phone numbers by using insertion sort algorithm, Input should be generated randomly. Determine the time required to sort the elements. Repeat the experiment for different values of n and plot a graph of the time taken versus n. (n=no of elements).	CO2/1,4,9
5.	"Deloit", a software company needs to maintain its employee details like employeeid, name, address in a record, design and develop a program in C to sort the employee records based on their employee ID by using merge sort algorithm, employee ID should be generated randomly. Determine the time required to sort theelements. Repeat the experiment for different values of n and plot a graph of the time taken versus n. (n=no of elements).	CO2/1,4,9
6.	Assume that NMIT college needs to maintain the student details like USN, name, and contact details in a record. USN should be generated randomly. Design and develop a program in C to sort the records based on USN by using quick sort algorithm, Determine the time required to sort the roll numbers. Repeat the experiment for different values of n and plot a graph of the time taken versus n. (n=no of elements).	CO2/1,4,9
7.	"Sunshine" a job search portal is looking for engineering graduates, they need to sort the candidate's resume based on their ranking(Average Percentage). Ranking should be generated randomly. Design and develop a program in C to sort the resumes by using heap sort algorithm. Determine the time required to sort the elements. Repeat the experiment for different values of n and plot a graph of the time taken versus n.(n=no of elements).	CO3/1,4,9
	PART-B	

8.	Consider the problem of searching for genes in DNA sequences using Horspool's algorithm. A DNA sequence is represented by a text on the alphabet {A, C, G, T}, and the gene or gene segment is the pattern. A gene segment of your chromosome 10 has the pattern TCCTATTCTT . Design and develop a program in C to locate the above pattern in the following DNA sequence by applying Horspool's algorithm. TTATAGATCTCGTATTCTTTTATAGATCTCCTATTCTT. Also compute the number of comparisons using this method as compared to linear search method	CO3/1,4,9
9.	There have been a number of fire outbreak cases recorded in the Florida area that has brought about loss of lives to inhabitants and loss of properties. Some routes within the district can be reconstructed into shortcut routes, so that fire man can traverse through the district in order to prevent fire incidents. The objective is to find the minimum distance and shortest path from the fire station to all the residential layout in Florida area. Write an algorithm by applying Floyd's method to find the solution for the given scenario.	CO4/1,4,9
10.	DMART is providing special offer to its customer on New Year's Eve. Customers can buy anything they want with flat80% discount, but the products they buy should fit into the basket provided by DMART. The objective is to collect the expensive products which fit into the given basket and overall weight of the basket cannot exceed 15kg.Write an algorithm by using knapsack algorithm using dynamic programming to find the best subset for the given scenario.	CO4/1,4,9
11.	Bangalore Water supply Board responsibility is to distribute water evenly among all the areas in Bangalore city. A new layout has been developed by Maxworth real estate developers. BWSB should connect the water lines to the new layout with minimum cost. The objective is to connect the water pipes so that it reaches all the houses in new layout with minimum cost. Write an algorithm by applying Kruskal's method to find the minimum spanning tree for the given scenario.	CO4/1,4,9
12.	DigiMap services is a module in G-Maps which is used to find the distance from one place to another or from your location to the nearest desired location. This requires the Shortest Path Algorithm, as there are various routes/paths connecting them but it has to show the minimum distance. . Represent a city/place with a vertex and the route between two cities/places as an edge, then by using Dijkstra's algorithm, find the shortest routes between any two cities/places or from one city/place to another city/place.	CO4/1,4,9
13.	Consider the *n*-queens puzzle in which the goal is to place *N* queens on an *N*×*N* chessboard such that no two queens attack each other. A queen can attack horizontally, vertically, or diagonally. Given an integer *N*,	CO5/1,4,9

	return all distinct solutions to the *N*-queens puzzle. Note: Use Backtracking technique.	
14.	Consider the Subset sum problem in which the objective is to find subset of elements that are selected from a given set whose sum adds up to a given number K. Assume the set contains non-negative values and also the input set is unique (no duplicates are present.). Design and develop a program in C to find the subset of a given set whose sum is equal to a positive integer K and display an appropriate message if the given problem instance does not have the solution. Note : Use Backtracking method.	CO5/1,4,9

ASSESSMENT METHODS

Parameter	Marks
Continuous Internal Evaluation	25
Lab Test	20
Gate Based Test	05
Total	**50**
Final Examination will be conducted for 100 marks (SEE)	

COURSE OUTCOMES

COs	Description	Bloom's Level
CO 1	Design algorithms based on different algorithm design techniques to solve real world problems	**L3**
CO 2	Implement solutions for the problems using different algorithm design techniques	**L3**
CO 3	Validate the results obtained for different inputs	**L4**
CO 4	Analyze the time efficiency of the algorithm	**L4**

Mapping of Course outcomes (COs) to Program outcomes (POs*)& PSO **

Course Outcomes mapping to Program Outcomes													PSOs		
POs COs	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**PSO1**	**PSO2**	**PSO3**
CO 1	3		3	2									3	3	
CO 2	3		3	2									3	3	
CO 3	3	3	3	2									3	3	
CO 4	3	3	3	2									3	3	

PROFESSIONAL ELECTIVE- 2

Department: *Computer Science & Engineering*	***Course Type: Professional Elective***
Course Title: *Web Application Development*	***Course Code: 21CSE461***
L-T-P 3-0-0	***Credits: 03***
Total Contact Hours: 40 Hours	***Duration of SEE: 3 Hours***
SEE Marks: *50*	***CIE Marks: 50***

COURSE DESCRIPTION

- Students should have prior knowledge of web and internet usage.
- Students should have the prior knowledge of basic html tags.

PREREQUISITES

This course provides knowledge in scripting languages javascript, php, node JS and Angular js. The course also provides the knowledge of how to use the scripting languages, HTML tags and CSS for developing web pages.

COURSE OBJECTIVES

- To understand the use of HTML tags and cascading style sheets.
- To understand the basics of scripting languages javascript and its frameworks, php, node Js and Angular Js
- To understand how to connect the scripting language with database.

COURSE CONTENTS

UNIT - I 08 Hours

FUNDAMENTALS OF WEB: Introduction to HTML/XHTML: Basic Syntax, Standard HTML Document Structure, Basic Text Markup, Images, Hypertext Links, Lists, Tables, Forms, Syntactic Differences between HTML and XHTML, Cascading Style Sheets: Levels of Style Sheets, Style Specification Formats, Font, Properties Alignment of Text.

UNIT - II 08 Hours

JAVASCRIPT: Basics, Overview of JavaScript, Object orientation of JavaScript, General Syntactic characteristics, Primitives, Operations and Expressions, Screen output and keyboard input, Control Statements, Object creation and modification, Arrays, Functions, Constructor, Pattern matching using regular expressions, Errors in Scripts The JavaScript execution environment, Handling events from the Body elements, Button elements, Textbox and Password elements.

UNIT - III **08 Hours**

PHP: Introduction to PHP, Origins and uses of PHP, Overview of PHP, General syntactic characteristics, Primitives operation and expressions, output, control statement, arrays, functions, pattern matching, form handling, files, cookies, Database access with PHP & MySQL.

UNIT - IV **08 Hours**

Jquery and Ajax: Introduction, Syntax, Selectors, jQuery effects, jQuery HTML, History of AJAX, Basics of AJAX, The form document, The request and response phase, cross-Browser support, return document forms, JSON, AJAX toolkits, security and AJAX

UNIT - V **08 Hours**

Angularjs: Introduction Angularjs, Basic Angularjs directives and controllers, working with ng-model, working with forms, Angular js services. Node JS: Introduction. Node js mudules, node js file system, URL module, node js events, upload files, Emails.

TEXT BOOKS

1. Robert W. Sebesta, Programming the World Wide Web-7thEdition, Pearson Education, 2015.
2. Shyam Sheshadri & Brad Green, Angularjs Up & Running O'Reilly Publications 2015 Second Release.

REFERENCE BOOKS

1. M. Dietel, P.J Deital, A.B.GoldBerg, Internet & World Wide Web How to Program–5thEdition, Pearson Education,2009
2. WebprogrammingBuildingInternetApplications–ChrisBates.
3. Stevens Holzner, Ajax a beginners guide, TATA MCGRAW SHILL, 2009
4. Professional Angularjs –Valerikarpo& Diego Netto.

TEACHING METHODS

- Lecture (Power Point presentations/ Blackboard teaching (if needed))
- Regularreviewofstudentsbyaskingquestionsbasedontopicscoveredintheclass
- Programming Assignments

ASSESSMENT METHODS

- Three internals–30 Marks each will be conducted and the Average of best of two will be considered.

- Self Demonstration for10 marks.
- Assignment for10 marks.
- Final examination will be conducted for100 marks and evaluated for 50 Marks.

COURSE OUTCOMES

Sl. No.	COURSE OUTCOMES	BL
CO1	Describe and use client-side technologies of the World Wide Web: HTML, XHTML, CSS, and JavaScript.	L3
CO2	Design documents using markup languages and stylesheets. Apply of CSS, JavaScript as scripting tool for developing Web applications.	L4
CO3	Create dynamic web applications, client-side and server-side using PHP and MySQL.	L4
CO4	Describe Selectors, jQuery effects, jQuery HTML, jQuery Ajax, Use Ajax to add server-side processing to a Web site.	L3
CO5	Understanding the concepts of angular JS and node JS and able to develop web application	L3

CO-PO MAPPING

	PROGRAM OUTCOMES												PSO		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	2			1	1							3		2
CO2		3				2							3		2
CO3					3			2					3		2
CO4					3			3					2	3	
CO5		3			3								3	2	
Correlation level	2	3			3	2		3					3	3	2

Department: Computer Science and Engineering	***Course Type: Professional Elective***
***Course Title**: Mobile Application Development*	***Course Code:* 21CSE462**
L-T-P :2-0-2	***Credits: 3***
Total Contact Hours: 39 Hours	***Duration of SEE: 3 Hours***
***SEE Marks**: 100*	***CIE Marks: 50***

COURSE DESCRIPTION

This course is concerned with the development of applications on mobile and wireless computing platforms. Android will be used as a basis for teaching programming techniques and design patterns related to the development of standalone applications and mobile portals to enterprise and m-commerce systems. Emphasis is placed on the processes, tools and frameworks required to develop applications for current and emerging mobile computing devices. Students will work at all stages of the software development life-cycle from inception through to implementation and testing. In doing so, students will be required to consider the impact of user characteristics, device capabilities, networking infrastructure and deployment environment, in order to develop software capable of meeting the requirements of stakeholders.

PREREQUISITES

Basic knowledge on oops concepts and java programming

COURSE OBJECTIVES

- To facilitate students to understand android SDK
- To help students to gain a basic understanding of Android application development
- To inculcate working knowledge of Android Studio development tool

COURSE CONTENTS

UNIT – I — 08 Hours

Introduction to Android: The Android Platform, Android SDK, Eclipse Installation, Android Installation, building your First Android application, Understanding Anatomy of Android Application, Android Manifest file.

UNIT – II — 08 Hours

Android Application Design Essentials: Anatomy of an Android applications, Android terminologies,

Application Context, Activities, Services, Intents, Receiving and Broadcasting Intents, Android
Manifest File and its common settings, Using Intent Filter, Permissions.

UNIT – III **08 Hours**

Android User Interface Design Essentials: User Interface Screen elements, Designing User Interfaces with Layouts, Drawing and Working with Animation.

UNIT – IV **08 Hours**

Testing Android applications, Publishing Android application, Using Android preferences, Managing
Application resources in a hierarchy, working with different types of resources.

UNIT – V **08 Hours**

Using Common Android APIs: Using Android Data and Storage APIs, Managing data using Sqlite,
Sharing Data between Applications with Content Providers, Using Android Networking APIs, Using
Android Web APIs.

TEXT BOOKS

T1. Lauren Darcey and Shane Conder, "Android Wireless Application Development", Pearson
Education, 2nd ed.

REFERENCE BOOKS

1. Reto Meier, "Professional Android 2 Application Development", Wiley India Pvt Ltd
2. Mark L Murphy, "Beginning Android", Wiley India Pvt Ltd
3. Android Application Development All in one for Dummies by Barry Burd, Edition: I.

TEACHING METHODS

- Lecture using Black board and chalk
- Presentations, Hands-on-Sessions.
- Programming Assignments

ASSESSMENT METHODS

Parameter	**Marks**
Three internals (Average of best of two)	30
Programming Assignments	10
Rubrics for the evaluation of Programming Assignments	10

Total 50

Final Exam will be conducted for 100 marks (SEE)

COURSE OUTCOMES

Sl. No.	COURSE OUTCOMES	BL
CO1	Students will be able to understand the development of mobile applications.	2
CO2	Students will be able to utilize the android sdk to build applications.	3
CO3	Students will be able to understand and implement the programming toast	3
CO4	Students will be able to understand and implement database connectivity using JAVA	3
CO5	Students will have broad knowledge on latest mobile application development	2

CO-PO MAPPING

	PROGRAM OUTCOMES												PSO		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1		2											2		
CO2		2				2									2
CO3		3											1		
CO4							3				2	2		2	
CO5		2									2	2			2
Correlation level		2				2	3				2	2	2	2	2

Department: *Computer Science & Engineering*	***Course Type***: *Professional Elective*
Course Title: *Internet of Things*	***Course Code***: *21CSE463*
L-T-P: *2-0-2*	***Credits***: *3*
Total Contact Hours: *40 Hours*	***Duration of SEE***: *3 Hours*
SEE Marks:*50*	***CIE Marks***: *50*

❖ *Infosys approved syllabus*

COURSE DESCRIPTION

The explosive growth of the ‑Internet of Things‖ is changing the current trends in the world and the rapid drop in price for typical IoT components is allowing people to innovate new designs and products. In this course, students will learn the importance of IoT in society, the current components of typical IoT devices and trends for the future. IoT design considerations, constraints and interfacing between the physical world and your device will also be covered. Addition, students will also learn how to make design trade-offs between hardware and software. This course will also cover key components of networking to ensure that students understand how to connect their device to the Internet.

PREREQUISITES

Students must have basic knowledge on microcontrollers. The students will be requiring to participating actively in creative thinking exercises and be willing to be innovative. Participate in open discussions is a must.

COURSE OBJECTIVES

- To understand the basic Characteristics of IoT.
- To acquire knowledge of implementing concepts of IoT using Arduino and raspberry pi.
- To learn the fundamentals of Python programming
- To acquire knowledge on Wired Communication Protocols, Cloud Storage models and communication APIs.

COURSE CONTENTS

UNIT – I **08 Hours**

Introduction to IoT

Definition, Characteristics and Architecture of IoT, Physical Design of IoT – IoT Protocols (hardware protocols and software protocols), IoT communication models, IoT Communication APIs, **IoT enabled Technologies:** Wireless Sensor Networks, Cloud Computing, Big data analytics, Communication protocols, IoT Levels and Templates, **Domain Specific IoT's :** Home, City, Environment, Energy, Retail, Logistics, Agriculture, Industry, health and Lifestyle

UNIT – II	**08 Hours**
The IoT Hardware	

Embedded Systems – Introduction, the basics of sensors and actuators, need for ADC & DAC peripherals. Introduction to Arduino, The Arduino UNO development board – architecture and specifications, theArduino development environment, setting up the IDE, programming the Arduino, basic examples. Communication devices: Bluetooth, BLE, Wi-Fi (ESP8266), GSM, LPWAN (LoRa), LPPAN (6LoPAN, Zigbee). Introduction to RaspberryPi – the RaspberryPi architecture& Hardware overview, RaspberryPi as a gateway device.

UNIT – III	**08 Hours**
The IoT Hardware	

Introduction to Python – Language features of Python, Data types, data structures, Control of flow, functions& loops, modules, packaging, file handling, data/time operations, classes, Exception handling.

UNIT – IV	**08 Hours**
IoT Communication Protocols and Security	

Wired Communication Protocols: UART, I2C, SPI Wireless messaging and communication Protocols: MQTT, CoAP, XMPP, AMQP. Need for IoT security, Overview of Network security, Types of data encryption, data encryption at the node device, and data encryption at the gateway device.

UNIT – V	**08 Hours**
The IoT Cloud and App	

Introduction to Cloud Storage models and communication APIs, Python web application framework, Introduction to NoSQL, IoT dashboard – monitoring and storing sensor data over the cloud. Webservers / Cloud for IoT: Case Studies of some IoT cloud services.

TEXT BOOKS

1. Internet of Things – A Hands-on Approach, ArshdeepBahga and Vijay Madisetti, UniversitiesPress, 2015, ISBN: 9788173719547
2. Getting Started with Raspberry Pi, Matt Richardson & Shawn Wallace, O'Reilly (SPD),2014, ISBN: 9789350239759

REFERENCE BOOKS

1. Designing the Internet of Things , Adrian McEwen & Hakim Cassimally, John Wiley & Sons,ISBN:9781118430620
2. Learning Internet of Things ,PeterWaher, PACKT publishingISBN:978178355353
3. https://nptel.ac.in/course.php

TEACHING METHODS

Course Project: Each student will form a group with 1, but no more than 2, other classmates. The students will have to be able to develop a simple IoT system having a simple three-layer web application (web interface, functionality layer, persistence layer) in any computer language (PHP, Python, etc.) with any database (MySQL, noSQL, etc.) and Hardware(microcontroller/Arduino/Raspberry Pi +gateway).

- Lecturer interspersed with discussion
- Course project
- Supporting laboratory assignments

ASSESSMENT METHODS

Three Internals (Average of best of two test)	30
Rubrics for the course project	20
Total	**50**
Final Exam will be conducted for 100 marks (SEE)	

COURSE OUTCOMES

Sl. No.	COURSE OUTCOMES	BL
CO1	Demonstrate the fundamental concepts of the Internet of Things and Its Application and architecture models	**L3**
CO2	Design the real time applications using Arduino Controller and Sensors	**L3**
O3	Apply the python programming concepts to create connection with the hardware Devices for IoTs	**L4**
CO4	Illustrate the features of IoT Communication Protocols and Need for Security issues in the IoT applications	**L2**
CO5	Develop an IoT system having a simple three-layer web application	**L3**

CO-PO MAPPING

	PROGRAM OUTCOMES												PSO		
	PO 1	PO 2	PO 3	PO4	PO5	PO6	PO7	PO8	PO 9	PO 10	PO 11	PO 12	PSO 1	PS O2	PS O3
CO1	3												3		
CO2		2	3												3
CO3			3												3
CO4	3	2												3	
CO5	1	3	3	1					2	2	2	2	3		3
Correlation level	2	2	3	1					2	2	2	2	3	3	3

*3: Strong, 2: Medium, 1: Weak ** H: Highly related S: Supportive*

Department: Computer Science and Engineering	***Course Type: Professional Elective***
***Course Title**: Cloud Computing-1*	***Course Code**: 21CSE464*
L-T-P:2-0-2	***Credits:** 03*
***Total Contact Hours:** 39 Hours*	***Duration of SEE:** 3 Hours*
***SEE Marks**: 50*	***CIE Marks:** 50*

COURSE DESCRIPTION

This course provides introduction to cloud computing and cloud service providers. This course also provides introduction to Virtualization technology which is the base for cloud computing. The course also discusses various AWS services.

PREREQUISITES

Data Base Management Systems, Basics of Programming.

COURSE OBJECTIVES

- To introduce the cloud computing
- The various services provided by the cloud
- Introduction to virtualization techniques and different type of virtualization
- Application of cloud computing in different fields

COURSE CONTENTS

UNIT -I **08 Hours**

Introduction: Cloud computing, Cloud computing delivery models and services, Ethical issues in Cloud Computing, Cloud vulnerabilities.

Cloud Infrastructure: Cloud computing at Amazon, Cloud computing the Google perspective, Microsoft Windows Azure and online services, Open-source software platforms for private clouds, Service and Compliance-level agreements.

UNIT -II **07 Hours**

Cloud Computing – Applications and Paradigms: Challenges for cloud computing, Architectural styles for cloud applications, Workflows: Coordination of multiple activities, Coordination based on a state machine model: The Zookeeper.

UNIT-III **08 Hours**

Introduction to AWS: Basic AWS concepts, Benefits of using AWS over traditional data center, Accessing AWS services, AWS overview, AWS global infrastructure, Virtualization -

Virtualization types based on virtualization software, virtualization methods, Elasticity versus
scalability, Comparing AWS cloud and on-premises data centers, Creating a new AWS account, Deleting an AWS account, AWS free tier, Root user versus non-root user.

UNIT-IV **08 Hours**

AWS Dashboard: Components of AWS dashboard, Core AWS services, Shared security responsibility model, AWS soft limits, Disaster recovery with AWS.

Identity and Access Management (IAM): Understanding AWS root user, Elements of IAM, Multi-Factor Authentication (MFA), IAM role - Creating roles for AWS service, Policy – Managed and Inline policies, IAM best practices.

UNIT-V **08 Hours**

AWS Services: Introduction to EC2, EC2 instance lifecycle, AMI, Elastic Block Store (EBS), Types of EBS, Snapshots, Introduction to Elastic Load Balancer (ELB), Types of ELB, Features of ELB, Creating a Classic Load Balancer, How ELB works, Monitoring with CloudWatch, How Amazon CloudWatch works, Amazon S3, S3 Storage Classes.

TEXT BOOKS

1. Cloud Computing Theory and Practice, Dan C. Marinescu, Morgan Kaufmann, Elsevier 2013.
2. AWS Certified Developer - Associate Guide, Vipul Tankariya and Bhavin Parmar, Packt Publisher, 2017.

REFERENCE BOOKS

1. Cloud Computing A Practical Approach,Anthony T. Velte,Toby J. Velte.,Robert Elsenpeter, McGraw-Hill Education Edition 2010.
2. Mastering Cloud Computing, Rajkumar Buyya, Christian Vecchiola, S. Thamarai Selvi, McGraw Hill Education, 2013.

TEACHING METHODS

- Lecture using Black board and chalk
- Lecture using Presentations
- Demonstration of Cloud Applications and Instances
- Problem Solving Assignments

ASSESSMENT METHODS

Parameter	Marks
Three Internals (Average of best of two test)	30
Rubrics evaluation for the Course Project	10
Case Study	10

Total	**50**
Final Exam will be conducted for 100 marks (SEE)	

COURSE OUTCOMES

At the end of Course, Student will be able to:

COS	**Description**	**Bloom's Level**
CO 1	Comprehend the fundamentals of Cloud Computing and analyze various Cloud infrastructures.	L2
CO 2	Identify and explain the appropriate architecture and cloud services for a given application.	L2
CO 3	Illustrate Virtualization and basic concepts of AWS and creating an AWS account.	L2
CO 4	Explain the AWS dashboard and Identity and Access Management.	L2
CO 5	Design and develop an application using the various AWS services.	L5
CO 6	Design and develop Cloud computing Course projects.	L4

COURSE MAPPING

Mapping of Course outcomes (COs) to Program outcomes (POs)													**PSO1**	**PSO2**	**PSO3**
CO\PO	1	2	3	4	5	6	7	8	9	10	11	12			
CO1	2	3											3		
CO2		3	3		3								3		
CO3	2	3											3		
CO4		3	3	2	3								3		
CO5		3	3	2	3	2	2							2	
CO6					3	1		3	3	3	1	3			1
Correlation level	2	3	3	2	3	2	2	1	1	1		1	3	2	1

***3: Strong, 2: Medium, 1: Weak** ****3: Highly related 2: Supportive**

Department: *Computer Science and Engineering*	***Course Type:*** *Professional Elective*
Course Title: *Software Testing*	***Course Code:*** *21CSE465*
L-T-P:3-0-0	***Credits:*** *03*
Total Contact Hours:*39 Hours*	***Duration of SEE:*** *3 Hours*
SEE Marks: *50*	***CIE Marks:*** *50*

COURSE DESCRIPTION

This course provides an understanding of Software testing. The course also provides the knowledge of White box and Black box testing, Functional and Non-functional testing in real time applications.

PREREQUISITES

Students should have basic knowledge of software engineering.

COURSE OBJECTIVES

- To understand the fundamentals of Software testing.
- To enable students to write Test cases, Test plan
- To help students, demonstrate the ability to use validation activities (UNIT testing,Integration testing, system testing.

COURSE CONTENTS

UNIT-1 — 7 Hours

Basics Of Software Testing – 1: Human Errors and Testing; Software Quality; Requirements, Behavior and Correctness; Correctness versus Reliability; Testing and Debugging; Test Metrics.

Unit-2 — 8 Hours

Basics of Software Testing – 2: Software and Hardware Testing; Testing and Verification; Defect Management; Test generation Strategies, Static Testing. Types of Testing; the Saturation Effect.

UNIT-3 — 8 Hours

Test Generation from Requirements: Introduction; the Test-Selection Problem; Equivalence Partitioning; Boundary Value Analysis; Category-Partition Method.

UNIT-4 — 8 Hours

Verification Testing: Basic verification methods, getting leverage on verification, verifying documents at different phases, three critical success factors for implementing verification.

Validation Testing: Validation methods, validation activities.

Controlling Validation Costs: Minimizing the cost performing tests, minimizing the cost of maintaining the tests, minimizing validation test ware development costs. Testing Tasks, Deliverables and Chronology: Master test planning, verification testing tasks and deliverables, validation testing tasks and deliverables.

UNIT-5 **8 Hours**

Software Testing Tools: Categorizing testing tools, tool acquisition.
Organizational approach to Testing: structural design elements, approaches to organizing the test functions.
Current practices, Trends, Challenges: GUI's. What is new here, usage testing, tester to develop ratios.

TEXT BOOKS

1. Foundations of Software Testing - Aditya P Mathur, Pearson Education, 2008.
2. Ed Kit: Software Testing in the real world, Addison-Wesley, 1995.
3. Srinivasan Desikan, Gopalaswamy Ramesh: Software Testing Principles and Practices, 2nd Edition, Pearson Education, 2007.

REFERENCE BOOKS

1. Paul C. Jorgensen: Software Testing, A Craftsman's Approach, 3rd Edition, Auerbach Auerbach Publications, 2008.
2. Mauro Pezze, Michal Young: Software Testing and Analysis – Process, Principles and Techniques, Wiley India, 2009.
3. https://nptel.ac.in/course.php

TEACHING METHODS

1. Lecture using Black board and chalk
2. PowerPoint presentations (if needed)
3. Regular review of students by asking questions based on topics covered in the class.

ASSESSMENT METHODS

Parameter	Marks
Three internals (Average of best of two)	30
Rubrics for the evaluation of case study implementation using testing tools	10
Assignment	10
Total	**50**
Final Exam will be conducted for 100 marks (SEE)	

COURSE OUTCOMES

At the end of the course student will be able to

COs	Description	BloomsLevel
CO 1	Apply terms associated with software testing	**L3**
CO 2	Design various test generation strategies.	**L4**
CO 3	Implement different types of software testing in application development.	**L3**
CO 4	Summarize aspects of functional and nonfunctional testing.	**L1**
CO 5	Apply the usage of test Management and automation in software testing.	**L3**

Mapping of Course outcomes (COs) to Program outcomes (POs*)& PSO **															
Course Outcomes mapping to Program Outcomes													**PSOs**		
PO/CO	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**PSO1**	**PSO2**	**PSO3**
CO1	2	2	3										3		
CO2		3	3										2	3	
CO3		3	3										3		
CO4		3	3										2	3	
CO5		3	2		3				3	3			3		3
Correlation level	2	3	3		3				3	3			3	3	3

***3: Strong, 2: Medium, 1: Weak** ****3: Highly related 2: Supportive**

Department: *CS & E*	***Course Type****: Professional Elective*
Course Title: *Computer Graphics and Visualization*	***Course Code:*** *21CSE466*
L-T-P: *3-0-0*	***Credits****: 3*
Total Contact Hours: *39Hours*	***Duration of SEE:*** *3 Hours*
SEE Marks: *50*	***CIE Marks:*** *50*

COURSE DESCRIPTION

Detailed study of computer graphics, 2 D and 3 D transformations, representations and visualization

PREREQUISITES

C, C++, Matrices, Algebra

COURSE OBJECTIVES

This course will introduce the basic principles, concepts, and algorithms in computer graphics and visualization. Students will learn mathematical and computational techniques for modeling, representing, and displaying geometric objects and employing these techniques for visualizing data

COURSE CONTENTS

UNIT - I **08 Hours**

Line generation: Points lines, Planes, Pixels and Frame buffers, vector and character generation. Graphics Primitives with opengl functions: Display devices, Primitive devices, Display File Structure, Display control text

UNIT - II **08 Hours**

Polygon: Polygon Representation, entering polygons, Filling polygons. Segments: Segments table, creating deleting and renaming segments, visibility, image transformations with opengl functions

UNIT - III **08 Hours**

Transformations: Matrices transformation, transformation routines, displays procedure. Three Dimension: 3-D geometry primitives, transformations, projection clipping

UNIT - IV **08 Hours**

Windowing and Clipping: Viewing transformation and clipping, generalize clipping, multiple windowing.2D clipping: A simple visibility algorithm, end point codes. Cohen Sutherland algorithm, midpoint sub division algorithm.

UNIT - V **08 Hours**

Interaction: Hardware input devices handling algorithms, Event handling echoing, Interactive techniques. Hidden Line and Surface: introduction to hidden line methods.

TEXT BOOKS

1. Rogers, "Procedural Elements of Computer Graphics", McGraw Hill
2. Asthana, Sinha, "Computer Graphics", Addison Wesley Newman and Sproul, "Principle of Interactive Computer Graphics", McGraw Hill
3. Donald D. Hearn "Computer Graphics with Open GL", 4th Edition
4. Dave Shreiner, Mason Woo, Jackie Neider, Tom Davis, OpenGL Programming Guide: Th

REFERENCE BOOKS

1. Steven Harrington, "Computer Graphics", A Programming Approach, 2nd Edition
2. Rogar and Adams, "Mathematical Elements of Computer Graphics", McGraw Hill.

TEACHING METHODS

- Black Board/Power Point Presentations
- Model demonstrations
- Creative thinking discussions after completing each chapter

ASSESSMENT METHODS

Parameter	Marks
Three Internals (Average of best of two)	30
Mini project	10
Case study	10
Total	**50**
Final Examination will be conducted for 100 marks (SEE)	

COURSE OUTCOMES

CO	COURSE OUTCOMES	BL
CO1	Comprehend the concepts related to basics of computer graphics and visualization.	L2
CO2	Demonstrate various graphics primitives and 2-D, 3-D geometric transformations and clipping techniques.	L2
CO3	Comprehend the concepts related three-dimensional object representations.	L2
CO4	Implement various hidden surface removal techniques.	L3
CO5	Demonstrate the use of OpenGL to create interactive computer graphics applications.	L2

CO-PO MAPPING

	PROGRAM OUTCOMES												PSO		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO 2	PSO3
CO1	3	2	2	3	3	2									3
CO2	3	2	2	3	3	2									3
CO3	3	2	2	3	3	2									3
CO4	3	2	2	2	2	2									3
CO5	3	2	2		3	3									3
Correlation level	3	2	2	3	3	2									3

NITTE EDUCATION TRUST | NITTE MEENAKSHI INSTITUTE OF TECHNOLOGY

Department of Information Science and Engineering

2018 Scheme Curriculum Handbook

Vision

To build a strong research and teaching environment in the field of Information Technology to meet the ever-evolving global needs and to equip students with the latest knowledge, skills and practical orientation to face challenges in IT profession.

Mission

1. To offer comprehensive educational programs in the field of Information Technology producing highly accomplished graduates.
2. To inculcate among the students, the culture of research and innovation.
3. To encourage students to participate in co-curricular and extra-curricular activities leading to enhancement of their social and professional skills.

Programme Education Objectives (PEOs)

- PEO-1. Graduates will progress in their careers in IT industries of repute.
- PEO-2. Graduates will succeed in higher studies and research.
- PEO-3. Graduates of Information Science and Engineering will demonstrate highest integrity with ethical values, good communication skills, leadership qualities and self-learning abilities.

Programme Specific Outcomes (PSOs)

- PSO-1. Student will be able to understand the architecture and working of computer system with relevant system software and apply appropriate system calls.
- PSO-2. Student will be able to apply mathematical methodologies in modelling real world problems for the development of software applications using algorithms, data structures and programming tools.

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Program Outcomes:

PO-1	Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems. .
PO-2	Problem analysis: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences
PO-3	Design/development of solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations
PO-4	Conduct investigations of complex problems: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
PO-5	Modern tool usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
PO-6	The engineer and society: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
PO-7	Environment and sustainability: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
PO-8	Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice
PO-9	Individual and team work: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
PO-10	Communication: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend

	and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
PO-11	Project management and finance: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
PO-12	Life-long learning: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

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2018 SCHEME

SEMESTER: III

Sl. No	Subject name	Subject code	Teaching Dept.	Teaching Hours			Examination			Credits
				L	T	P	CIE	SEE	Total	
1	ENGINEERING MATHEMATICS-III	18MAT31	MATHS	3	2	0	50	50	100	4
2	DIGITAL DESIGN	18IS32	ISE	4	0	0	50	50	100	4
3	DATA STRUCTURES USING C	18IS33	ISE	4	0	0	50	50	100	4
4	DISCRETE MATHEMATICS	18IS34	ISE	3	2	0	50	50	100	4
5	COMPUTER ORGANIZATION &ARCHITECTURE	18IS35	ISE	4	0	0	50	50	100	4
6	DIGITAL DESIGN LAB	18ISL36	ISE	0	0	2	50	50	100	1
7	DATA STRUCTURES LAB	18ISL37	ISE	0	0	2	50	50	100	1
8	UNIX PROGRAMMING LAB	18ISL38	ISE	0	0	2	50	50	100	1
	TOTAL						400	400	800	23

SEMESTER: IV

Sl. No	Subject name	Subject code	Teaching Dept.	Teaching Hours			Examination			Credits
				L	T	P	CIE	SEE	Total	
1	ENGINEERING MATHEMATICS-IV	18MAT41	MATHS	3	2	0	50	50	100	4
2	ANALYSIS AND DESIGN OF ALGORITHMS	18IS42	ISE	4	0	0	50	50	100	4
3	OBJECT ORIENTED PROGRAMMING WITH C++	18IS43	ISE	3	0	0	50	50	100	3
4	MICROCONTROLLER	18IS44	ISE	4	0	0	50	50	100	4
5	PROGRAM ELECTIVE-A	18ISE45X	ISE	3	0	0	50	50	100	3
6	ANALYSIS AND DESIGN OF ALGORITHMS LAB	18ISL46	ISE	0	0	2	50	50	100	1
7	OBJECT ORIENTED PROGRAMMING WITH C++ LAB	18ISL47	ISE	0	0	2	50	50	100	1
8	MICROCONTROLLER LAB	18ISL48	ISE	0	0	2	50	50	100	1
	TOTAL						400	400	800	21

PROGRAM ELECTIVE-A

Sl. No	Subject Code	Subject Name
1.	18ISE451	PYTHON PROGRAMMING
2.	18ISE452	WEB TECHNOLOGY
3.	18ISE453	GRAPH THEORY
4.	18ISE454	LINEAR ALGEBRA

SEMESTER: V

Sl. No	Subject name	Subject code	Teaching Dept.	Teaching Hours			Examination			Credits
				L	T	P/S	CIE	SEE	Total	
1	DATABASE MANAGEMENT SYSTEM	18IS51	ISE	4	0	0	50	50	100	4
2	OPERATING SYSTEMS	18IS52	ISE	4	0	0	50	50	100	4
3	THEORY OF COMPUTATION	18IS53	ISE	3	2	0	50	50	100	4
4	COMPUTER NETWORKS	18IS54	ISE	4	0	0	50	50	100	4
5	PROGRAM ELECTIVE-B	18ISE55X	ISE	3	0	0	50	50	100	3
6	PROGRAM ELECTIVE-C (MOOC Elective)	18ISM56X	ISE	2	0	0	50	50	100	2
7	DATABASE MANAGEMENT SYSTEM LAB	18ISL57	ISE	0	0	2	50	50	100	1
8	JAVA APPLICATION DEVELOPMENT LAB	18ISL58	ISE	0	2	2	50	50	100	2
9	DOMAIN IDENTIFICATION AND LITERATURE SURVEY (Project Phase-I)	18ISP59	ISE	0	0	2	50	-	50	-
	TOTAL						450	400	850	24

NOTE: Project Phase-I marks will be considered during Project Phase-II

PROGRAM ELECTIVE- B

Sl. No	Subject Code	Subject Name
1.	18ISE551	STATISTICS FOR DATASCIENCE
2.	18ISE552	DIGITAL IMAGE PROCESSING
3.	18ISE553	COMPUTER GRAPHICS
4	18ISE554	INTERNET OF THINGS
5	18ISE555	DISTRIBUTED SYSTEMS
6	18ISE556	UNIX SYSTEM PROGRAMMING
7	18ISE557	ARTIFICIAL INTELLIGENCE
8	18ISE558	UI/UX Design

PROGRAM ELECTIVE-C

Sl. No	Subject Code	Subject Name
1.	18ISM561	
2.	18ISM562	
3.	18ISM563	
4	18ISM564	
5	18ISM565	

SEMESTER: VI

Sl. No	Subject NAME	Subject CODE	Teaching Dept.	Teaching Hours			Examination			Credits
				L	T	P/S	CIE	SEE	Total	
1	SOFTWARE ENGINEERING	18IS61	ISE	4	0	0	50	50	100	4
2	DATAMINING	18IS62	ISE	4	0	0	50	50	100	4
3	CRYPTOGRAPHY AND NETWORK SECURITY	18IS63	ISE	4	0	0	50	50	100	4
4	PROGRAM ELECTIVE-D	18ISE64X	ISE	3	0	0	50	50	100	3
5	OPEN ELECTIVE(MOOC)-A	18ISO65X	ISE	3	0	0	50	50	100	3
6	NETWORK PROGRAMMING LAB	18ISL66	ISE	0	0	2	50	50	100	1
7	WEB PROGRAMMING LAB(Hybrid)	18ISL67	ISE	0	2	2	50	50	100	2
8	BIG DATA LAB(Hybrid)	18ISL68	ISE	0	2	2	50	50	100	2
9	CAPSTONE PROJECT (Project Phase-II)	18ISP69	ISE	0	0	2	50	-	50	1
	TOTAL						450	400	850	24

PROGRAM ELECTIVE- D

Sl. No	Subject Code	Subject Name
1.	18ISE641	CLIENT SERVER COMPUTING
2.	18ISE642	COMPILER CONSTRUCTION
3.	18ISE643	CLOUD COMPUTING
4.	18ISE644	BLOCKCHAIN ESSENTIALS & DAPPS
5.	18ISE645	EXPLORATORY DATA ANALYSIS
6.	18ISE646	ADVANCED JAVA

MOOC OPEN ELECTIVE- A

Sl. No	Subject Code	Subject Name
1.		
2.		

SEMESTER: VII

Sl. No	Subject name	Subject code	Teaching Dept.	Teaching Hours			Examination			Credits
				L	T	P	CIE	SEE	Total	
1	SCALABLE COMPUTING	18IS71	ISE	4	0	0	50	50	100	4
2	MACHINE LEARNING	18IS72	ISE	4	0	0	50	50	100	4
3	SOFTWARE PROJECT MANAGEMENT	18IS73	ISE	3	0	0	50	50	100	3
4	PROGRAM ELECTIVE-E (INDUSTRY DRIVEN)	18ISE74X	ISE	3	0	0	50	50	100	3
5	OPEN ELECTIVE-B	18ISO75X	ISE	3	0	0	50	50	100	3
6	MACHINE LEARNING LAB	18ISL76	ISE	0	0	2	50	50	100	1
7	HYBRID APPLICATION DEVELOPMENT LAB	18ISL77	ISE	0	2	2	50	50	100	2
8	INTERNSHIP/VIRTUAL STARTUP	18ISP78	ISE	0	0	4	50	50	100	2
9	PROJECT PHASE III	18ISP79	ISE	0	0	02	50	-	50	01
	TOTAL						450	400	850	23

PROGRAM ELECTIVE- E (INDUSTRY DRIVEN)

Sl. No	Subject Code	Subject Name
1.	18ISE741	INTRODUCTION TO GAME THEORY
2.	18ISE742	NATURAL LANGUAGE PROCESSING
3.	18ISE743	OBJECT ORIENTED MODELING AND DESIGN
4.	18ISE744	CYBER SECURITY
5.	18ISE745	DEVOPS

OPEN ELECTIVE- B

Sl. No	Subject Code	Subject Name
1.	18ISO751	FUNDAMENTALS OF JAVA
2	18ISO752	INTRODUCTION TO WEB TECHNOLOGY
3	18ISO753	MOBILE APP DEVELOPMENT
4	18ISO754	FUNDAMENTALS OF SOFTWARE SYSTEMS
5	18ISO755	PROGRAMMING WITH PYTHON

SEMESTER: VIII

Sl. No	Subject name	Subject code	Teaching Dept.	Teaching Hours			Examination			Credits
				L	T	P/S	CIE	SEE	Total	
1	VENTURE PROCESS MANAGEMENT& IPR	18ISH81	ISE	3	0	0	50	50	100	3
2	GREEN IT & SUSTAINABILITY	18ISH82	ISE	3	0	0	50	50	100	3
3	PROGRAM ELECTIVE-F	18ISM83X	ISE	3	0	0	50	50	100	3
4	PROJECT PHASE-IV*	18ISP84	ISE	0	0	22	50	50	100	11
	TOTAL						200	200	400	20

* Mandatory to publish/ submit one research article.

PROGRAM ELECTIVE- F

Sl. No	Subject Code	Subject Name
1.	18ISE831	BUSINESS ANALYTICS
2.	18ISE832	NEURAL NETWORKS &DEEP LEARNING
3.	18ISE833	SOFTWARE DEFINED NETWORKS
4.	18ISE834	ADHOC NETWORKS
5.	18ISE835	SOFT COMPUTING

NITTE EDUCATION TRUST | NITTE MEENAKSHI INSTITUTE OF TECHNOLOGY

Course Title: Engg. Mathematics-III	Course Code: 18MAT31
L-T-P: 3-1-1	Credits: 4
Total Contact Hours: 52 hrs	Duration of SEE: 3 hrs
SEE Marks: 50	CIE Marks: 50

Course Outcomes:

Students will be able to

COs	Course Outcomes	Blooms Level
1	Concepts of Fourier theory and transforms can be adopted to problem solving, analysing physical situations relevant to periodic and aperiodic functions	3
2	Fourier theory and transforms can be applied to model engg. Problems and MATLAB simulation can be done.	3
3	Numerical methods can be adopted for solving equations, interpolate and extrapolate data using, finite differences and matrices	3
4	Numerical methods can be adopted to differentiate, integrate functions and solve differential equations	3
5	Numerical methods can be applied to model physical situations, find eigen values and interpret solutions.	3

Teaching Method:

- Black Board Teaching.
- Power point presentation (If needed).
- Tutorial Classes.

Assessment Method:

- Surprise test / Tutorials tests to be conducted for each topic for 10 marks.
- Quiz/ assignment based on practical application for 10 marks. (Assignments for MATLAB)
- Three mid semester examinations will be conducted each for 30 marks and the average of best of two will be taken.
- Final examination, of 100 Marks will be conducted and will be evaluated for 50 marks.

Course Outcome to Programme outcome Mapping:

CO/PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO1	PSO2	PSO3
CO1	2	1		1	1									1	
CO2	2	1		1	1									1	
CO3	2	1		1	1									1	
CO4	2	1			1									1	
CO5	2	1			1									1	
18MAT31	**2**	**1**		**1**	**1**									**1**	

Course Contents

UNIT-I	**10 hrs**
Laplace Transforms: Definition, Transforms of standard functions (derivation and problems), Transforms of $e^{at}f(t)$, $t^n f(t)$, $\frac{f(t)}{t}$, Laplace transforms of derivatives and integrals, Laplace transforms of periodic functions, unit step function (problems only, no derivations), Dirac delta function . Inverse Laplace transforms (use of direct formulae, completing squares, partial fractions and using derivatives), convolution theorem (without proof, problems to find inverse), solutions of 1^{st} and 2^{nd} order ODE using Laplace transforms.	
UNIT-II	**08 hrs**
Fourier series: Euler's formulae, Dirichlet's conditions for Fourier series expansion, change of interval, Even and odd function (no need to define step functions as even and odd), half range series, Practical harmonic analysis (expansion to include constant, 1^{st} and 2^{nd} harmonic, 1^{st} three terms in case of only sine or cosine series). **Fourier Transforms**: Definition, Complex Fourier transforms, Cosine and Sine transforms, Inverse transforms for complex, sine and cosine	
UNIT-III	**08 hrs**
Roots of transcendental equations by Newton Raphson and Secant method Interpolation: Newton's forward and backward formulae, Newton's divided difference formulae and Lagrange's formula for unequal intervals and inverse interpolation by Lagrange's formula, Stirling's and Bessel's central difference formula, Numerical differentiation with Newton's forward and backward difference interpolation.	
UNIT-IV	**08 hrs**
Numerical Integration by Trapezoidal, Simpson's $\frac{1}{3}$ and $\frac{3}{8}$ rule, Weddle's rule, Gaussian Quadrature (3 point and 4 point formulae using Lagrange polynomials, values to be given in the question paper). Numerical solution of ordinary differential equations: Taylor's series method (expansion upto 5 terms or more), Runge-Kutta 4^{th} order method (problems considering single and two steps for calculations), Milne's predictor corrector method (use of predictor formula once and corrector twice)	
UNIT-V	**08 hrs**
Linear algebra: LU decomposition (both $l_{ii} = 1$ and $u_{ii} = 1$ to be considered, problems where the method fails also to be considered), Solution of Tri-diagonal system using Thomas algorithm, Eigen values of symmetric matrix by Jacobi method, Reduction to Tri-diagonal system by Given's method, Largest Eigen value by Power method. (**Sub questions of a question can appear from any topic within the unit)**	

Text Book:

1. Higher Engg. mathematics by Dr. B S Grewal, 42^{nd} Edition.
2. Advanced Engg. Mathematics by Erwin E Kreyszig, Volume-II, Wiley.
3. Introductory methods of numerical analysis, by S S Sastry, PHI India.
4. Numerical methods for scientific and engg. Computation, 6^{th} edition, by Jain, Iyengar, R K Jain, New age, 2012.

Reference books:

1. Advanced Engg. Mathematics by Erwin Kreyszig, 10^{th} edition, Wiley,2011
2. Numerical Algorithms by Sen and Krishnamurthy

Department: *Information Science and Engineering*	***Course Type:*** *Core*
Course Title*: Digital Design*	***Course Code:****18IS32*
L-T-P:*4-0-0*	***Credits:****04*
Total Contact Hours:*52hours*	***Duration of SEE:****03 hours*
SEE Marks*: 50*	***CIE Marks:*** *50*

Pre-requisites:

- Basic Knowledge on Physics and Electronics

Course Outcomes:
Students will be able to:

COs	Course Outcomes	Blooms Level
1	Simplify the combinational logic circuits using Boolean algebra and theorems.	2
2	Apply K-map technique to simplify the complex digital circuits.	3
3	Analyse the operations of Set Reset, Jack Kilby, Data input and Toggle flipflops	4
4	Apply the concepts of flipflops in data transfer and design of counter	3
5	Understand the fundamentals of Analog to Digital and Digital to Analog Converters	2
6	Analyse the digital circuits using VHDL and Verilog programming	4

Teaching Methodology:

i. Black Board Teaching
ii. Power Point Presentation
iii. Tutorial Classes
iv. Assignments

Assessment Methods:

i. Assignments for 10 Marks.
ii. Aptitude Tests for 10 Marks.
iii. Three MSEs for 30 Marks each will be conducted and the Average of best of two will be considered.
iv. Semester End Examination for 100 Marks will be conducted and reduced for 50 Marks.

Course Outcome to Programme Outcome Mapping:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3								1	1		1	3	
CO2	3	2	3						1	1		1	3	
CO3	3	3							1	1		1	3	
CO4	3	2	3						1	1		1	3	
CO5	3								1	1		1	3	
CO6	3	3							1	1		1	3	
18IS32	3	3	3						1	1		1	3	

COURSE CONTENT

UNIT – I	10 hrs
Boolean Algebra and Combinational Networks: Truth Tables, OR Operation with OR Gates, AND Operation with AND Gates ,NOT Operation, Describing Logic Circuits Algebraically, Evaluating Logic-Circuit Outputs ,Implementing Circuits from Boolean Expressions, NOR Gates and NAND Gates, Boolean Theorems, DeMorgan's Theorems, Universality of NAND, Alternate Logic-Gate Representations, Which Gate Representation to Use, Summary of Methods to Describe Logic Circuits	
UNIT – II	**11 hrs**
Simplification of Boolean Expressions: Designing Combinational Logic Circuits: SoP&PoS form, Simplifying Logic Circuits, Algebraic Simplification, Karnaugh Map Method, XOR and XNOR Minimization Circuits, Enable/Disable Circuits Analysis. **Logic Design with MSI Components and Programmable Logic Devices**: Binary adders &Subtractors, Magnitude Comparators, Decoder, Encoder, Multiplexer, Parity Generator and Checker	
UNIT – III	**11 hrs**
Synchronous Sequential Logic: NAND Gate Latch, NOR Gate Latch, Clock Signals and Clocked Flip-Flops, Clocked S-R Flip-Flop, Clocked J-K Flip-Flop, Clocked D Flip-Flop, D Latch(Transparent Latch), Asynchronous Inputs, Master/Slave Flip-Flops,Flip-Flop Conversions, Flip-Flop Applications, Flip-Flop Synchronization, **Registers:** Data Storage and Transfer, Serial Data Transfer: Shift Registers, Frequency Division and Counting	
UNIT – IV	**11 hrs**
Counters&D/A Conversion and A/D Conversion:: Asynchronous (Ripple) Counters, Counters with MOD Numbers, Asynchronous Down Counter, Propagation delay in Ripple Counters, Synchronous (Parallel) Counters, Presettable Counters, The, Synchronous Counter Design.**D/A Conversion and A/D Conversion:** Variable Resistor Networks, Binary Ladders, D/A Converters, D/A Accuracy and Resolution, **A/D Converter**-Counter Method, Continuous A/D Conversion, A/D Conversion using Successive Approximation	
UNIT – V	**09 hrs**
VHDL, VERILOG & FPGA: Introduction to VHDL, Capabilities, Hardware Abstraction, Introduction to Verilog HDL, Major Capabilities. **FPGA:** Introduction, Basic Concepts, Schematics and Logic Symbols, Digital Design and FPGAs. FPGA based System Design.	

Text books:

1. Digital Systems Principles and Applications, Ronald J. Tocci, Neal S. Widmer, Gregory L. Moss 9th Edition, 2013, Pearson Education.
2. Digital Principles and Applications by Donald P Leach, Albert Paul Malvino, GoutamSaha. 7thedition,2012, Tata McGraw-Hill
3. Wayne Wolf FPGA based system design", Pearson education "Electronics Communication Systems", McGraw Hill, first Edition, 2009

Reference books:

1. Digital logic and computer design M. Morris Mano
2. Fundamentals of Logic Design, Charles H. Roth, Jr., 5th Edition, Thomson, 2004.

MoocReferences:

https://onlinecourses.nptel.ac.in/noc18_cs30/preview

NITTE EDUCATION TRUST | NITTE MEENAKSHI INSTITUTE OF TECHNOLOGY

Department: *Information Science and Engineering*	***Course Type:*** *Core*
Course Title*: Data structures using C*	***Course Code:****18IS33*
L-T-P:*4-0-0*	***Credits:****04*
Total Contact Hours:*52hours*	***Duration of SEE:****03 hours*
SEE Marks*: 50*	***CIE Marks:*** *50*

Pre-requisites:

i. Students should have knowledge on C Programming

Course Outcomes:

Students will be able to

Cos	Course Outcome Description	Blooms Level
1	Understand the fundamentals of Linear and Non-linear data structures.	L2
2	Apply stack operations for Infix, Prefix and Postfix conversion for the given problem	L3
3	Develop solutions for the given problem using recursion and queues	L3
4	Apply linked list concepts for solving the given problem	L3
5	Construct binary trees and perform tree traversals	L3
6	Understand the concept of hashing technique	L2

Teaching Methodology:

i. Black board teaching
ii. PowerPoint presentation
iii. GATE Aptitude training during tutorial hours

Assessment Methods:

i. Aptitude test (GATE syllabus) for10 Marks.
ii. Three MSEs for 30 Marks each will be conducted and the Average of best of two will be considered.
iii. Semester End Examination for 100 Marks will be conducted and reduced for 50 Marks.

Course Outcome to Programme Outcome Mapping:

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	PO12	PSO1	PSO2
CO1	**3**											**1**		**3**
CO2	**3**	**2**	**3**									**1**		**3**
CO3	**3**	**2**	**3**									**1**		**3**
CO4	**3**	**2**	**3**									**1**		**3**
CO5	**3**	**2**	**3**									**1**		**3**
CO6	**3**											**1**		**3**
18IS33	**3**	**2**	**3**									**1**		**3**

COURSE CONTENT

UNIT – I	**10**hours
Introduction to data structures: revisit to pointers in C, Implementing one dimensional array. **The stack**: Definition—Primitive operations, **Representing Stacks in C** – Implementing the POP operation, testing for exceptional conditions, implementing the PUSH operation. **Infix, Postfix and Prefix**–Basic Definitions, evaluating a postfix expression, converting an expression from infix to postfix.	
UNIT – II	**10**hours
Recursion: Recursive Definition and Processes—factorial function, multiplication of natural numbers. Fibonacci sequence, binary search **Recursion in C–** factorial, binary search, recursive chains **Writing Recursive Programs–**Towers of Hanoi **Queues: The Queue and its Sequential Representation–**C Implementation of Queues, Insert Operation, Priority Queue, Array Implementation of a Priority Queue.	
UNIT – III	**12** hours
Linked Lists -Inserting and Removing Nodes from a List, Linked Implementation of Stacks, getnode and freenode Operations, Linked Implementation of Queues, Linked List as a Data Structure, List Operations, List Implementation of Priority Queues, Header Nodes, Array Implementation of Lists, and Limitations of the Array Implementation. **Lists in C–**Allocating and Freeing of Dynamic variables, Linked Lists using Dynamic Variables, Queues as List in C, List Operations in C, Non integer and Non homogeneous Lists, Comparing the Dynamic and Array Implementations of Lists, Implementing Header Nodes in linked list.	
UNIT – IV	**10** hours
Other List Structures—Circular Lists, Stack as a Circular List, Queue as a Circular List, Primitive Operations on Circular Lists, Header-nodes, Doubly Linked Lists, **Binary Trees —**Operations on Binary Trees, Applications of Binary Trees.**Binary Tree Representations–**Node Representation of Binary Trees, Internal and External Nodes.	
UNIT – V	**10** hours
Binary Trees: Implicit Array Representation of Binary Trees, Binary TreeTraversal in C, Threaded Binary Trees, Heterogeneous Binary Trees. Representing Lists as Binary Trees, Trees and Their Applications — C Representations of Trees, Tree Traversals, General Expressions as Trees, evaluating an expression tree, constructing a Tree. **Hashing:** Open Addressing, Deleting Items from a Hash Table.	

Text Books:

1. **Data Structure using C**, Aaron M. Tanenbaum, YedidyahLangsam& Moshe J. Augenstein, Pearson Education/PHI, 2006
2. **Introduction to algorithms,** Thomas H cormen, Charles E Leiserson, Ronald L Rivest& Clifford stein, The MIT press, third edition, 2009

Reference Books

i. **The C Programming Language**, Brian W Kernighan and Dennis M Ritchie, Prentice Hall Software Series, 2nd Edition
ii. **Data structures and algorithms analysis in C, Allen Weiss, Second Edition, Pearson IN**
iii. **Data Structures a Pseudocode approach with C,**RichardF.GilbergandBehrouzA.Forouzan, Thomson, 2005.
iv. **Data Structures & Program Design in C,** Robert Kruse&BruceLeung, Pearson.
v. **Foundations of Data Structures, IIT Bombay,** https://www.edx.org/course/foundations-of-data-structures

Department: *Information Science and Engineering*	***Course Type:*** *Core*
Course Title: *Discrete Mathematics*	***Course Code:****18IS34*
L-T-P:*3-2-0*	***Credits:****4*
Total Contact Hours:*39*	***Duration of SEE:****3 hrs*
SEE Marks: *50*	***CIE Marks:*** *50*

Pre-requisites:

Knowledge on Calculus, Number theory and fundamentals of statistics.

Course Outcomes:
Students will be able to:

Cos	Course Outcome Description	Blooms Level
1	Apply Mathematical logic for symbolising the statements and test the validity of premises	3
2	Apply the properties of relations, functions and lattice to solve the given problem	3
3	Construct the circuits using properties of Boolean Algebra	3
4	Apply group theory properties in data encoding, decoding and error detection	3
5	Apply planar, Euler and Hamiltonian graphs to solve network problems	3

Teaching Methodology:

- Black Board Teaching / Power Point Presentation
- Tutorials
- Assignment/Case study

Assessment Methods:

- Rubrics to evaluate Case Study (depends on the course)
- Tutorial Evaluation
- Three internals, 30 Marks each will be conducted and the Average of best of two will be taken.
- Final examination of 100 Marks will be conducted and will be evaluated for 50 Marks.

Course Outcome to Programme Outcome Mapping:

COs	PO 1	PO 2	PO 3	PO 4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	3						2	1		2		2
CO2	3	2	3						2	1		2		2
CO3	3	2	3						2	1		2		2
CO4	3	2	3						2	1		2		2
CO5	3	2	3						2	1		2		2
18IS34	3	2	3						2	1		2		2

COURSE CONTENT

UNIT – I	**8 hours**
Propositional and Predicate Logic Propositional Logic, Propositional Equivalences, Predicates and Quantifiers, Nested Quantifiers, Rules of Inference, Introduction to proofs. Topics (Text Book 1) – Chapter: 1.1 to 1.6.	
UNIT – II	**8 hours**
Relations and digraphs Product sets and partitions, Relations and digraphs, paths in relations and digraphs, Properties of Relations, Equivalence Relations, Operations on Relations, partially ordered Sets, Hasse diagram, Extremal elements of Posets, topological sorting, Lattices. Topics (Text Book 2) - Chapter-4 and Chapter-6 (6.1, 6.2, 6.3)	
UNIT – III	8 hours
Functions Functions, Special types of functions, invertible functions, Growth of Functions, Finite Boolean algebras, Functions on Boolean Algebra, Circuit Designs. Topics (Text Book 2) - Chapter- 5 (5.1, 5.3) Chapter-6 (6.4, 6.5, 6.6)	
UNIT – IV	**8 hours**
Groups and Coding Theory Binary Operations Revisited, Semigroups, Products and Quotients of Semigroups, Groups, Products and Quotients of Groups, Coding of Binary Information and Error Detection, Decoding and Error Correction. Topics (Text Book 2) - Chapter – 9 (9.1 to 9.5) Chapter – (10.1 to 10.2)	
UNIT – V	**7hours**
Introduction to Graph Theory Connected Graphs, Common classes of Graphs, Multigraphs and Digraphs, the Degree of a vertex, Regular Graphs, Degree sequences, Graphs and Matrices, Isomorphism, Eulerian Graphs, Hamiltonian Graphs, Planar Graphs. Topics (Text Book 3) - Chapter-1(1.2-1.4),Chapter-2 (2.1-2.4), Chapter-3 (3.1), Chapter-6(6.1,6.2) and Chapter-9 (9.1) Proofs of Theorems – 1.6, 1.11, 1.12, 6.1, 6.11	

Text books:

4. Discrete Mathematics & its Applications, Keneth H Rosen, 7th Edition, McGraw-Hill.
5. Discrete Mathematical Structures, Kolman, Busby and Ross, 6th Edition, Pearson Education Asia.
6. Introduction to Graph Theory, GraryChartrand and Ping Zhang, Tata McGraw-Hill, 2006.

Reference books:

1. Treatise on Discrete Mathematical Structures, JayanGanguly, Revised Edtion 2012, Pearson.
2. Discrete Mathematics and Combinatorics by T.Sengadir, Pearson publication, 2009.

MoocReferences :

1. http://nptel.ac.in/courses/106106094/
2. http://nptel.ac.in/courses/111106050/

NITTE EDUCATION TRUST | NITTE MEENAKSHI INSTITUTE OF TECHNOLOGY

Department: Information Science and Engineering	**Course Type:** Core
Course Title: **Computer Organization & Architecture**	**Course Code:** 18IS35
L-T-P: 4-0-0	**Credits:** 04
Total Contact Hours: 52 hrs	**Duration of SEE:** 3 hrs
SEE Marks: 50	**CIE Marks:** 50

Pre-requisites:

i. Fundamentals of Computers.
ii. Knowledge on working principles of semiconductor devices like transistor, capacitor and diode.

Course Outcomes:
Students will be able to:

Cos	**Course Outcome Description**	**Blooms Level**
1	Describe the fundamentals of machine instructions, addressing modes and processor clock	L2
2	Understand the internal functional units of a processor to execute instructions and mechanism for generating control signals	L2
3	Analyse internal organization of memory chip and the impact of cache on processor performance	L4
4	Illustrate the approaches involved in achieving communication between Processor and I/O devices	L2
5	Apply Booth algorithm for performing signed integer multiplication, restoring and nonrestoring methods for integer division	L3
6	Understand the classic five stage pipeline and its role in improving the processor performance	L2

Teaching Methodology:

i. Black board teaching

Assessment Methods:

i. Aptitude test (GATE syllabus) for10 Marks.
ii. Assignment for 10 marks.
iii.Three MSEs for 30 Marks each will be conducted and the Average of best of two will be considered.
iv.Semester End Examination for 100 Marks will be conducted and reduced for 50 Marks.

Course Outcome to Programme Outcome Mapping:

PO'S	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	3													3
CO2	3													3
CO3	3	3												3
CO4	3													3
CO5	3	2	3						1	1		1		3
CO6	3	2												3
18IS35	3	3	3						1	1		1		3

COURSE CONTENT

UNIT – I	8hours
Basic Structure of Computers: Computer Types, Functional Units, Basic Operations Concepts, Performance: Processor clock, Basic Performance Equation, clock rate, Performance measurement. **Machine Instructions and Programs**: Memory Locations and Addresses, Memory Operations, Instructions and instruction sequencing: Register Transfer Notation, Assembly Language Notation, Instruction Types, Instruction Execution and straight line sequencing, branching, condition codes, Addressing modes.	
UNIT – II	**12hours**
Basic processing unit: Some Fundamental Concepts: Register Transfers, Performing an Arithmetic or Logic Operation, Fetching a word from Memory, Storing a word in memory; Execution of a complete Instruction: Branch Instructions; Multiple Bus Organization, Hardwired Control: A Complete Processor; Micro programmed Control: Microinstructions;	
UNIT – III	**11hours**
The Memory System: Some basic concepts, Semiconductor RAM Memories: Internal organization of Memory chips, static memories, Asynchronous DRAMS, synchronous DRAMS, Read-Only Memories, Speed size and cost, Cache memories: Mapping functions, Replacement Algorithms, Performance considerations: Interleaving, Hit rate and Miss Penalty, Caches on the processor chips, other enhancements.	
UNIT – IV	**11hours**
I/O Organization: Access of I/O devices, Interrupts, Direct Memory Access,Buses,I/O interfaces **-** Serial port, Parallel port **Arithmetic:** Signed Operand Multiplication: Booth Algorithm; Fast Multiplication: Bit – Pair recoding of Multipliers, Integer Division.	
UNIT – V	**10hours**
Fundamentals of Computer Design: Defining Computer Architecture **-**Instruction Set Architecture **Pipelining:** Basic and Intermediate Concepts: What Is Pipelining?, The Basics of a RISC Instruction Set, A Simple Implementation of a RISC Instruction Set, The Classic Five-Stage Pipeline for a RISC Processor, The Major Hurdle of Pipelining—Pipeline Hazards.	

Text books:

1. ComputerOrganization, Carl Hamacher, ZvonkoVranesic, SafwatZaky, 5th Edition, TMH
2. Computer architecture: A quantitative approach, John L. Hennessy and David. A. Patterson, 4th edition, Elsevier

Reference books:

1. Computer Organization & Architecture, William Stallings, 7thEdition, PHI, 2006.

Department: *Information Science and Engineering*	***Course Type:*** *Core*
Course Title*: Digital Design Lab*	***Course Code:****18ISL36*
L-T-P:*0-0-2*	***Credits: 1***
Total Contact Hours:*26 hours*	***Duration of SEE:****3 hours*
SEE Marks*: 50*	***CIE Marks:*** *50*

Pre-requisites:

i. Basic Knowledge on Physics and fundamentals of Electronics.

Course Outcomes:

Students will be able to:

Cos	**Course Outcome Description**	**Blooms Level**
1	Apply the concepts of Boolean Theorems and K-Maps to realize the combinational logic circuits.	L3
2	Implement sequential circuits using integrated circuits.	L3
3	Implement digital to analog convertor and compare theoretical with experimental values.	L3
4	Simulate combinational and sequential circuits using HDL.	L3

Teaching Methodology:

i. Black Board Teaching

ii. Laboratory experiments

Assessment Methods:

i. Rubrics for continuous evaluation of laboratory experiments for 30 marks.

ii. Two Continuous Internal Evaluations (CIEs) for 20 Marks each will be conducted, and average will be considered.

iii. Semester End Examination (SEE) for 50 Marks will be conducted.

Course Outcome to Programme Outcome Mapping:

COs	**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO1 0**	**PO1 1**	**PO1 2**	**PSO 1**	**PSO 2**
CO1	3	2	3	2					1	1			3	
CO2	3	2	3	2					1	1			3	
CO3	3	2	3	2					1	1			3	
CO4	3	2	3	2	1				1	1			3	
18ISL36	3	2	3	2	1				1	1			3	

Sl No	Experiments	CO
Part A		
1.	Realization of Full Adder & Full Subtractor Using NAND gate	1, 2
2.	Implementation of Full Adder & Full Subtractor using 4 : 1 MUX (IC 74153)	1, 2
3.	Converting Binary Number to Seven Segment Display Using Decoder IC 7747	1, 2
4.	Design & Verify Parity Generator & Checker (Even Parity & Odd Parity)	1, 2
5.	Realization of SR, JK, D and T Flip Flops using NAND gates.	2, 3
6.	Implementation of J.K Master Slave Flip Flop using NAND Gates	2,3
7.	Design and Implement Asynchronous UP, DOWN and UP & DOWN Using IC-7476 (JK)	3
8.	Design and Implementation of MOD-N Synchronous Counter Using IC-7476 (JK)	3
9.	Implementation of Ring Counter & Johnson Counter Shift Register Using 7495	3
10.	Digital Analog Converter (DAC) using R to 2R Ladder Method	4
Part B		
1.	Realize logic gates using HDL.	5
2.	Realize 2 to 4 decoder using HDL	2, 5
3.	Realize8 to 3 (Encoder Without Priority & With Priority)	2, 5
4.	Realize8 to 1 Multiplexer	2, 5
5.	Realize4 bit binary to gray Converter	2, 5
6.	Realize Multiplexer, De-Multiplexer, Comparator	2, 5
7.	Realize Flip flop and Counters	3, 5

Department: *Information Science and Engineering*	***Course Type:*** *Core*
Course Title*: Data Structures Lab*	***Course Code:****18ISL37*
L-T-P:*0-0-2*	***Credits: 1***
Total Contact Hours:*26 hours*	***Duration of SEE:****3 hours*
SEE Marks*: 50*	***CIE Marks:*** *50*

Pre-requisites:

i. Knowledge on C Programming.

Course Outcomes:

Students will be able to:

Cos	Course Outcome Description	Blooms Level
1	Develop programming solutions for the given problems using arrays/pointers/recursion.	L3
2	Design programming solutions for the given problem using stacks and queues.	L3
3	Develop programming solutions for the real time application module using linked list concepts.	L3
4	Design hierarchical based programming solutions using different tree traversal techniques.	L3

Teaching Methodology:

i. Laboratory instruction classes

ii. Laboratory onsite interaction

Assessment Methods:

i. Rubrics for continuous evaluation of laboratory experiments for 30 marks.

ii. Two Continuous Internal Evaluations (CIEs) for 20 Marks each will be conducted and average will be considered.

iii. Semester End Examination (SEE) for 50 Marks will be conducted.

Course Outcome to Programme Outcome Mapping:

	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO1 0**	**PO1 1**	**PO1 2**	**PSO 1**	**PSO 2**
CO1	3	2	3	2					2	1				3
CO2	3	2	3	2					2	1				3
CO3	3	2	3	2					2	1				3
CO4	3	2	3	2					2	1				3
18ISL37	3	2	3	2					2	1				3

COURSE CONTENT

Program No.	Program Title	CO Mapping
1	Design and implement C program to demonstrate advantages/usage of pointers. (E.g. add two Matrices using pointer concept, Functions for string manipulation, String manipulation functions).	1
2	Design and implement a database application in C. (E.g. Student/Faculty information using structures).	1
3	Design and implement a stack (Array implementation/ Linked list implementation) and demonstrate its working with necessary inputs. Display the appropriate messages in case of exceptions.	3
4	Design and implement an algorithm for conversion of an expression from one form to another. Demonstrate its working with suitable inputs.	2
5	Design and implement an algorithm to evaluate an arithmetic expression which may be any form (postfix, prefix, infix), and demonstrate its working with suitable examples.	2
6	Design and implement a given type of (ordinary queue, circular queue) queue in C (array implementation/ Linked list implementation). And demonstrate its working with suitable inputs. Display appropriate messages in case of exceptions.	3
7	Design and implement a dynamic list (Singly linked list/ doubly linked list) to store any information which needs a linear data structure.	3
8	Design and implement binary tree and demonstrate its working	4

NITTE EDUCATION TRUST | NITTE MEENAKSHI INSTITUTE OF TECHNOLOGY

Department: *Information Science and Engineering*	***Course Type:*** *Core*
Course Title: *Unix Programming Lab*	***Course Code:****18ISL38*
L-T-P:*0-0-2*	***Credits:****1*
Total Contact Hours:*26hrs*	***Duration of SEE:****3 hrs*
SEE Marks: *50*	***CIE Marks:*** *50*

Course Outcomes:
Students will be able to:

Cos	**Course Outcome Description**	**Blooms Level**
1	Demonstrate commands of UNIX based computer systems.	L3
2	Develop shell scripts for the given real world problem	L3
3	Design AWK scripts for the given problem	L3
4	Implement programming solutions for a given problem using file API's	L3

Teaching Methodology:

- **i.** Black Board Teaching
- **ii.** Laboratory experiments

Assessment Methods:

- **i.** Rubrics for continuous evaluation of laboratory experiments for 30 marks.
- **ii.** Two Continuous Internal Evaluations (CIEs) for 20 Marks each will be conducted and average will be considered.
- **iii.** Semester End Examination (SEE) for 50 Marks will be conducted.

Course Outcome to Programme Outcome Mapping:

Cos	**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO10**	**PO11**	**PO12**	**PSO 1**	**PSO 2**
CO1	**3**	**2**	**3**						**1**	**1**			**3**	
CO2	**2**	**2**	**3**	**1**					**1**	**1**			**3**	
CO3	**2**	**2**	**3**	**1**					**1**	**1**			**3**	
CO4	**3**	**2**	**3**	**1**					**1**	**1**			**3**	
18ISL38	**3**	**2**	**3**	**1**					**1**	**1**			**3**	

COURSE CONTENT

Sl No	Experiments	CO
	Part A	
1.	List file/directory handling commands.	**1**
2.	Simple shell script for basic arithmetic and logical calculations.	**2**
3.	Shell scripts to check various attributes of files and directories.	**2**
4.	Shell scripts to check and list attributes of processes.	**2**
5.	Write awk script that uses all of its features.	**3**
6.	Write a shell script to display list of users currently logged in.	**2**
	Part B	
7.	Write a C/C++ program to implement the CAT command using general file API.	**4**
8.	Write a C/C++ program to implement the Cp command using general file API's.	**4**
9.	Write a C/C++ program to implement the ln/rename ( )using general file API's.	**4**
10.	Write a C/C++ program to create a file called file1 in blocking read-write mode and show how you can use fcntl api to modify its access control flags to non-blocking read-write mode.	**4**
11.	Write a C/C++ program to duplicate the file descriptor of a file Foo to standard input file descriptor	**4**
12.	Write a C/C++ program to query and display the different attributes associated with a file.	**4**
13.	Write C/C++ program to read and display the last 10 character's of the input file.	**4**
14.	Write a C/C++ program to demonstrate masking of read/write/execute permission of a specified input file for user group and others category.	**4**

Course Title: Engg. Mathematics-IV	Course Code: 18MAT41
L-T-P: 3-1-1	Credits: 4
Total Contact Hours: 52 hrs	Duration of SEE: 3 hrs
SEE Marks: 50	CIE Marks: 50

Course Outcomes:

Students will be able to

COs	Course Outcomes	Blooms Level
1	Concept of linear algebra can be applied to analyse and solve problems	2
2	Physical situations can be modeled using concepts and algorithms of Linear algebra	3
3	Concepts of random variables, probability distributions and sampling can be applied to problem solving	4
4	Probability distributions can be used for testing of hypothesis of testing and model situations arising in analysis of data	3
5	Modelling situations using Markov process and Queueing theory	2

Teaching Method:

- Black Board Teaching.
- Power point presentation (If needed).
- Tutorial Classes.

Assessment Method:

- Assignment / Tutorials tests to be conducted for 10 marks.
- Quiz/ Surprise test based on practical application for 10 marks.
- Three mid semester examinations will be conducted each for 30 marks and the average of best of two will be taken.
- Final examination, of 100 Marks will be conducted and will be evaluated for 50 marks.

Course Outcome to Programme outcome Mapping:

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	1		1										1
CO2	2	1		1	1									1
CO3	2	1		2	1									1
CO4	2	1		2	1									1
CO5	2	1		2	1									1
18MAT41														

Course Contents

UNIT-I	08 hrs
Vector spaces- definition, examples, Linear combinations, subspaces, linear dependence, basis and dimension, linear mapping, linear operator, matrix representation of linear operator, change of basis.	
UNIT-II	**08 hrs**
Polynomial of matrices, Characteristic polynomial, diagonalization, Eigenvalues and eigen vectors, minimal polynomial, inner product space, Jordan canonical form, Orthogonal vectors and subspaces, Gram Schmidt Orthogonalization process	
UNIT-III	**08 hrs**
Random variable - discrete and continuous, probability distribution- discrete and continuous, probability density function, cumulative density function, mean and variance, expectation. Joint distribution - discrete and continuous, marginal distribution, expectation, covariance, rank correlation. Binomial, Poisson, Normal distribution.	
UNIT-IV	**08 hrs**
Sampling theory - Population and sample, sampling with and without replacement, sampling distribution of means, sample variance. Unbiased estimate, confidence intervals for mean, statistical hypothesis, testing of hypothesis, Type I and II errors, one tailed, two tailed tests, test for significance level of large and small samples, t - test, χ^2 – test for goodness of fit.	
UNIT-V	**10 hrs**
Markov process – definition, examples, transition probability matrix, n – step transitional probabilities, regular, ergodic matrices, stationary distribution, classification of states, Markov chain with absorbing states, periodic, transient and recurrent states. Queueing theory - Pure birth process, death process, birth and death process, Queuing system, list of symbols, Kendall's notation, M/M/1:∞/FIFO and M/M/c:∞/FIFO model.	

Text Books:

1. Probability and statistics, by Murray R Spiegel, J Schiller, R Alu Srinivasan, Schaum's outline series, second edition.
2. Operations research by Richard Bronson & Govindasami Nadimuthu, Schaum's outline series, second edition.
3. Linear Algebra by Lipschitz, Schaum's outline series, second edition.

Reference Books

1. Probability and statistics for Science and Engg. By G Shanker Rao, Univ Press, 2011
2. Probability and stochastic processes, Roy D Yates, David J Goodman, second edition, 2012, Wiley

Department: *Information Science and Engineering*	***Course Type:*** *Core*
Course Title*: Analysis and Design of Algorithms*	***Course Code:18IS42***
L-T-P:*4-0-0*	***Credits:****04*
Total Contact Hours: *52hrs.*	***Duration of SEE:*** *3 hrs.*
SEE Marks*: 50*	***CIE Marks:*** *50*

Pre-requisites:

i. Students should have knowledge of ‘C’ Programming concepts
ii. Knowledge of data structures and discrete mathematics.

Course Outcomes:
Students will be able to:

Cos	Course Outcome Description	Blooms Level
1	Understand the fundamentals of algorithms and asymptotic notations	L2
2	Apply brute force / divide & conquer design techniques for solving the given problem	L3
3	Apply decrease & conquer / transform conquer design techniques for solving the given problem	L3
4	Use space and time trade-off techniques for sorting and pattern matching problems	L3
5	Apply dynamic programming techniques for solving transitive closure / shortest path / Knapsack problems	L3
6	Apply greedy and backtracking techniques to solve the given problem.	L3

Teaching Methodology:

i. Black Board Teaching
ii. Power Point Presentation
iii. Tutorials

Assessment Methods:

i. Aptitude Test based on GATE syllabus for 10 Marks.
ii. Online NPTEL course for 10 Marks
iii. Three MSEs for 30 Marks each will be conducted and the Average of best of two will be considered.
iv. Semester End Examination for 100 Marks will be conducted and reduced for 50 Marks.

Course Outcome to Programme Outcome Mapping:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3								1			2		3
CO2	3	2	3						1			2		3
CO3	3	2	3						1			2		3
CO4	3	2	3						1			2		3
CO5	3	2	3						1			2		3
CO6	3	2	3						1			2		3
18IS42	3	2	3						1			2		3

COURSE CONTENT

UNIT – I	**12hours**
Introduction: What is an Algorithm? Fundamentals of algorithmic problem solving, Performance Analysis: Space Complexity. **Fundamentals of Analysis of Algorithm Efficiency:** Analysis Framework: Measuring an input's size, Units for Measuring Running Time, Orders of Growth, Worst-case, Best-Case, and Average Case Efficiencies, Asymptotic Notations and Basic Efficiency Classes: Informal introduction, O-notation, Ώ-notation, θ-notation, Basic Efficiency classes; Mathematical Analysis of Non-recursive and Recursive Algorithms	
UNIT – II	**8 hours**
Brute Force: Brute-Force String Matching, Exhaustive Search: Travelling Salesman Problem, Assignment Problem. **Divide and Conquer:** Merge sort, Quick Sort, Binary tree traversals and related properties, Multiplication of Large Integers and Strassen's Matrix Multiplication.	
UNIT – III	**12 hours**
Decrease and Conquer: Insertion Sort, Depth First Search, Breadth First Search, Topological Sorting, Decrease by a Constant factor algorithms: Josephus Problem. **Transform and Conquer:** Balanced Search Trees, Heaps and Heap sort	
UNIT – IV	**10hours**
Space and Time Trade-offs: Sorting by counting, Input Enhancement in String Matching: Horspools Algorithm, Boyer-Moore. **Dynamic Programming:**Warshall's and Floyd's Algorithms, Knapsack problem and Memory Function.	
UNIT – V	**10hours**
Greedy Technique: Prim's Algorithm, Kruskal's Algorithm, Djikstra's Algorithm, Huffman Trees, **Limitations of Algorithm Power:** Decision trees, P, NP and NP- Complete Problems **Backtracking:** n-Queens Problem, Subset-Sum Problem, Graph coloring.	

Text books:

1. Introduction to the Design & Analysis of Algorithms, Anany Levitin, 2ndEdition, Pearson education, 2007
2. Computer Algorithms, Ellis Horowitz, SartajSahani, SanguthevarRajasekaran, 2nd Edition, Computer Science Press.

Reference books:

1. Computer Algorithms by Horowitz E., SahaniS.,Rajasekaran S., Galgotia Publications, 2001
2. Introduction to Algorithms, Thomas H., Cormen, Charles E. Leiserson, Ronal L. Rivest, Clifford Stein, 2nd Edition, PHI, 2006

Mooc References:

NPTEL online course: https://swayam.gov.in/nd1_noc20_cs10/preview
https://swayam.gov.in/nd1_noc20_cs27/preview

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Department: *Information Science and Engineering*	***Course Type:*** *Core*
Course Title*: Object Oriented Programming with C++*	***Course Code:18IS43***
L-T-P:*3-0-0*	***Credits:****03*
Total Contact Hours: *39hrs.*	***Duration of SEE:*** *3 hrs.*
SEE Marks*: 50*	***CIE Marks:*** *50*

Prerequisite:

- Knowledge of C Programming

Course Outcomes:
Students will be able to:

Cos	Course Outcome Description	Blooms Level
1	Illustrate the basic concepts of object-oriented programming.	L2
2	Design appropriate classes for the given problem	L3
3	Apply the knowledge of compile-time / run-time polymorphism to solve the given problem	L3
4	Use the knowledge of inheritance for developing optimized solutions	L3
5	Apply the concepts of templates and exception handling for the given problem	L3
6	Use the concepts of input output streams for file operations	L3

Teaching Methodology:

i. Blackboard teaching
ii. PowerPoint presentations
iii. Course Project

Assessment Methods:

i. Rubrics to evaluate Course Project for 20 marks
ii. Three MSEs for 30 Marks each will be conducted and the Average of best of two will be considered.
iii. Semester End Examination for 100 Marks will be conducted and reduced for 50 Marks.

Course Outcome to Programme Outcome Mapping:

PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3													3
CO2	3	2	3			1			2	2		1		3
CO3	3	2	3			1			2	2		1		3
CO4	3	2	3			1			2	2		1		3
CO5	3	2	3			1			2	2		1		3
CO6	3	2	3			1			2	2		1		3
18IS43	3	2	3			1			2	2		1		3

COURSE CONTENT

UNIT – I	**08** hours
An Overview of C++ : What is object–Oriented Programming ?,Some C++ Fundamentals, Old Style Vs Modern C++, Introducing C++ Classes, The General Form of a C++ Program. **Classes and Objects :**Classes, Friend Functions, Friend Classes, Inline Functions, Parameterized Constructor , StaticClass Members, When Constructors and Destructors Are Executed, The Scope Resolution Operator, Passing Objects to functions, Returning Objects, Object Assignment	
UNIT – II	**08**hours
Arrays, Pointers, References, and the Dynamic Allocation Operators: Arrays of Objects, Pointers to Objects ,ThethisPointer, Pointers to derived types, Pointers to class members C++' s Dynamic Allocation Operators. **Function Overloading, Copy Constructors, and Default Arguments:** Function Overloading, OverloadingConstructorFunctions ,Copy constructors, Finding the Address of an Overloaded Function ,The overloaded Anachronism, Default Function Arguments, Function Overloading and Ambiguity,	
UNIT – III	**08**hours
Operator Overloading: Creating a Member Operator Function, Operator Overloading Using a Friend Function,Overloading new and delete, Overloading Some Special Operators, Overloading the Comma Operator. **Inheritance: Base-**Class Access Control, Inheritance and Protected Members, Inheriting Multiple Base Classes, Constructors, Destructors, and Inheritance, Granting Access, Virtual Base Classes.	
UNIT – IV	**07** hours
Virtual Functions and Polymorphism: Virtual Functions, The Virtual Attribute Is Inherited, Virtual Functions areHierarchical, Pure Virtual Functions, Using Virtual Functions, Early vs. Late Binding. **Templates:** Generic Functions, Applying Generic Functions, Generic Classes, The typename and export Keywords, The Power of Templates, Fundamentals of STL	
UNIT – V	**08** hours
Exception Handling: Exception Handling Fundamentals, Handling Derived-Class Exceptions, Exception Handling Options, Applying Exception Handling. **The C++ I/O System Basics:** C++ Streams, The C++ Stream Classes, Formatted I/O, Overloading << and >>**C++ File I/O:** <fstream> and File Classes, Opening and Closing a File, Reading and Writing Text Files, Unformatted and Binary I/O: More get() Functions, getline(), Detecting EOF, The ignore(), Peek() and putback(), flush().	

Text Book

1. The Complete Reference C++, Herbert Schildt, 4th Edition, TMH, 2005.

Reference Books

1. C++ Primer, Stanley B. Lippman, JoseeLajoie, Barbara E. Moo,4th Edition, AddisonWesley, 2005.
2. Object-Oriented Programming with C++, SouravSahay, Oxford University Press, 2006.

Department: Information Science and Engineering	**Course Type:** Core
Course Title: Microcontroller	**Course Code:**18IS44
L-T-P:4-0-0	**Credits:**04
Total Contact Hours:52hours	**Duration of SEE:**03 hours
SEE Marks: 50	**CIE Marks:** 50

Pre-requisites:

i. Digital Logic Circuits, Digital Electronics and Programming using C
ii. Computer Organization and Architecture.

Course Outcomes:

Students will be able to:

Cos	Course Outcome Description	Blooms Level
1	Understand the Architecture of 8051microcontroller.	L2
2	Describe the addressing modes and Instruction sets of 8051 microcontrollers	L2
3	Apply Assembly Language and Embedded C for designing Timer/Counter of 8051microcontroller	L3
4	Use interrupts subroutine for designing serial communication of 8051 microcontroller.	L3
5	Develop an Embedded C program for 8051 microcontrollers to interface with peripheral devices	L3

Teaching Methodology:

i. Black Board Teaching
ii. Power Point Presentation

Assessment Methods:

i. Rubrics to evaluate course project for 20 marks.
ii. Three MSEs for 30 Marks each will be conducted and the Average of best of two will be considered.
iii. Semester End Examination for 100 Marks will be conducted and reduced for 50 Marks.

Course Outcome to Programme Outcome Mapping:

COs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	PO12	PSO 1	PSO 2
CO1	3												3	
CO2	3												3	
CO3	3	2	3			2	1		2	2		2	3	
CO4	3	2	3			2	1		2	2		2	3	
CO5	3	2	3			2	1		2	2		2	3	
18IS44	3	2	1	1		2	1		2	2		2	3	

COURSE CONTENT

UNIT – I	12 hrs
Microprocessor and Microcontroller: Introduction, Microprocessor and Microcontrollers, Inside the Computer, Microcontrollers and Embedded Processors, Overview of the 8051 Family. **The 8051 Architecture:** Introduction, 8051 Microcontroller hardware, input / output pins, Ports and circuits, External Memory, Timers, Serial Communication and Interrupts. **Addressing Modes and Operations:** Introduction, Addressing modes, External data moves, Code Memory data moves, PUSH and POP Instructions, Data Exchanges, Example Programs.	
UNIT – II	**11 hrs**
Logical and Arithmetic: Byte level logical operations, Bit level logical operations, Rotate and Swap Operations, Example Programs. **Arithmetic operations:** Flags, Incrementing and decrementing, addition, Subtraction, multiplication and division, decimal arithmetic, Example Programs. **Jump and Call Instructions:** The jump and call Program range, jumps, calls and subroutines. Example Problems.	
UNIT – III	**10hrs**
8051 Programming in C: Data types and time delays in 8051C, I/O programming, logic operations, data conversion programs, accessing code ROM space, data serialization. **Timer / Counter Programming in 8051:** Programming 8051 Timers in C, Counter Programming timers 0 and 1 in 8051 C.	
UNIT – IV	**10hrs**
8051 Serial Communication: Basics of serial Communication, 8051 connections to RS 232, 8051 serial communication Programming, Serial programming in C. **Interrupts Programming:** 8051 Interrupts, Programming timer interrupts, programming external hardware interrupts, Programming the serial communication interrupts, Interrupts priority in the 8051/52, Interrupt programming in C.	
UNIT – V	**09 hrs**
8051 Interfacing and Applications: Interfacing 8051 to LCD,Keyboard, ADC, DAC, stepper motor interfacing and DC motor interfacing and PWM.	

Text books:

1.Muhammad Ali Mazidi and Janice Gillespie Mazidi and Rollin D. McKinlay, “The 8051 Microcontroller and embedded systems – using assembly and C”, Prentice Hall India, Pearson, 2006

2. Kenneth Ayala, “The 8051 Microcontroller”, Thomson Delmar Learning, 3rd Edition

Reference books:

1.Predko,” Programming and customizing the 8051 micro controller”, Tata McGraw Hill

2.Frank Vahid& Tony Givargis, “Embedded System design”, John Wiley, 2002. Michael J. Pont, “Embedded C”, Pearson Education, 2002.

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Department: *Information Science and Engineering*	***Course Type:*** *Core*
Course Title*: Analysis and Design of Algorithms Lab*	***Course Code: 18ISL46***
L-T-P: 0-0-2	***Credits:01***
Total Contact Hours:26 hrs	***Duration of SEE: 3 hrs***
SEE Marks*: 50*	***CIE Marks:*** *50*

Pre-requisites:

i. Knowledge of data structures and discrete mathematics

Course Outcomes:

Students will be able to:

Cos	Course Outcome Description	Blooms Level
1	Apply brute force / divide& conquer / decrease & Conquer techniques to solve the given problem	L3
2	Develop the programs to implement tree traversals using BFS and DFS	L3
3	Implement dynamic programming method to find transitive closure and all pair shortest path.	L3
4	Apply greedy technique for finding minimum spanning tree using Prim's / Kruskal's/ Dijkstra's algorithm.	L3
5	Apply Horspools algorithm / backtracking technique to solve the given problem	L3

Teaching Methodology:

i. Black Board Teaching
ii. Power Point Presentation
iii. Laboratory experiments

Assessment Methods:

i. Rubrics for continuous evaluation of laboratory experiments for 30 marks.
ii. Two Continuous Internal Evaluations (CIEs) for 20 Marks each will be conducted and average will be considered.
iii. Semester End Examination (SEE) for 50 Marks will be conducted.

Course Outcome to Programme Outcome Mapping:

Cos	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	3	2	3	2					1	1				3
CO2	3	2	3	2					1	1				3
CO3	3	2	3	2					1	1				3
CO4	3	2	3	2					1	1				3
18ISL46	3	2	3	2					1	1				3

COURSE CONTENT

Program No.	Program Title	CO Mapping
Note: **1. The following programs can be executed on C/C++/any equivalent tool/language** **2. Find the time and space complexity for every problem statement.**		
1	Design a C program to sort 'n' elements using selection sort in ascending or descending order. Also find its space and time complexity.	1
2	Consider a list of 'n' files numbered using ID's. Write a C program to sort files based on its ID using merge sort. Also find its time and space complexity.	1
3	Write a C program that, for a given digraph outputs all the vertices reachable from a given starting vertex using BFS method. Find its time and space complexity.	2
4	Consider a network having 'n' systems. Design a DFS based program in 'C' which outputs all systems reachable from a given system. Find its time and space complexity	2
15	Suppose you are given a list of students who are assigned IDs. Write a C program to sort these students based on their id's using heapsort. Find its time and space complexity	1
6	Consider the problem of searching for genes in DNA sequences. A DNA sequence is represented by a text using alphabets [A, C, G, T]. Design a 'C' program to locate a pattern in a given DNA sequence using Horsepool's algorithm. Find its time and space complexity.	5
7	Consider a network of 'n' systems represented as a Graph. Write a 'C' program to find the transitive closure of such a network using warshall's algorithm. Find its time and space complexity.	3
8	Suppose in a network of cities, you are interested in finding shortest paths between all cities. Design a 'C' program to implement this using floyd's algorithm. Find its time and space complexity.	3
9	Suppose a travel agent is interested in finding shortest path from a single city to all the other cities in a network of 'n' cities. Write a C program to implement this using Djikstra's algorithm. Find its time and space complexity.	4
10	Consider a Electrical layout where 'n' houses are connected by electrical wires. Design a 'C' program using Prim's algorithm to output a connection with minimum cost. Find its time and space complexity.	4
11	A Government wants to construct a road network connecting 'n' towns. Suppose each road must connect '2' towns and be straight. Write a C program using Kruskal's algorithm to output the least expensive tree of roads. Find its time and space complexity.	4
12	Consider 'n' patients and 'nxn' small rooms. Design a C program to allot the patients to these rooms using nqueen's method such that no two patients are allotted rooms in same row, column or diagonal. Find its time and space complexity.	5

NITTE EDUCATION TRUST | NITTE MEENAKSHI INSTITUTE OF TECHNOLOGY

Department: *Information Science and Engineering*	***Course Type:*** *Core*
Course Title*: Object Oriented Programming with C++ Lab*	***Course Code:****18ISL47*
L-T-P:*0-0-2*	***Credits: 01***
Total Contact Hours:*26 hours*	***Duration of SEE:****03 hours*
SEE Marks*: 50*	***CIE Marks:*** *50*

Pre-requisites:

- Knowledge of C Programming

Course Outcomes:

Students will be able to:

Cos	Course Outcome Description	Blooms Level
1	Design the classes to represent the entities of the given application	L3
2	Develop programs to solve given problem using function overloading and operator overloading concepts	L3
3	Implement programs to solve given problem using Inheritance and Exception handling concepts	L3
4	Develop programs to solve given problem using templates and file systems.	L3

Teaching Methodology:

i. Black Board Teaching
ii. Power Point Presentation
iii. Laboratory experiments

Assessment Methods:

i. Rubrics for evaluating laboratory experiments for 30 marks
ii. Two internals, 20 Marks each will be conducted and average of two internals will be taken.
iii. Final examination of 50 Marks will be conducted.

Course Outcome to Programme Outcome Mapping:

Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	3	1					1	1				3
CO2	3	2	3	1					1	1				3
CO3	3	2	3	1					1	1				3
CO4	3	2	3	1					1	1				3
18ISL47	3	2	3	1					1	1				3

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COURSE CONTENT

Program No.	Program Title	CO Mapping
1	Design a C++ program to implement stack using following functions: a) Push b) Pop c)Display	1
2	a) Design a C++ program to read the data of n employee and compute net salary of each employee using pointer. Given that an employee class contains following:-Data members: Employee no, Employee name, Basic salary, DA, IT, Net salary, gross salary Member functions: To read data, to calculate net salary and to print data[DA = 52% of basic salary, IT = 30% of gross salary, Gross salary = DA + Basic, Net salary = DA + Basic– IT]. b) Design a C++ program to find the largest of three numbers using inline function.	1
3	Design a C++ program to define a student class with data members usn, name and marks of 3 subjects. And member functions to read, display, and to calculate average of best 2 marks. Also find who is the topper among "n" no. of students	1
4	a) Design a C++ program to implement access control to some shared resource used by all objects of a class using a static variable. b) Design a C++ program to keep the track of the number of objects of a particular class type that are inexistence using a static variable.	1
15	Design a C++ program to implement a class which accepts date in different formats (using constructor overloading).	2
6	Design a C++ program to create class called list with member functions to insert an element from front as well as to delete element from front of list. Demonstrate all functions by creating list object.	2
7	Design a C++ program for a hospital to create a database regarding its indoor patients. (Identify the member function). create a base class to store above information, member function should include functions to enter information and display list of all the patients in the database. Create a derived class to store the information about paediatric patients (less than 12yrs age).	3
8	Design a C++ program for exception handling. Create a user defined exception classes for divide by zero and negative number input separately.	3
9	Design a C++ program for sorting names using file handling	4
10	Design a C++ program to implement following operator overloading concept using complex number. + , - ,+ +, -, = =.	2
11	Design a C++ program to convert dollar to rupees, euro to rupees and pound to rupees using pure virtual functions.	
12	Design a C++ program to sort integers and floating point numbers using template.	4
13	a)Write a C++ program to create a file to store Account holdername, account number and alance for given number of customers. Alsoretrieve the values from the file and print it on the standard output. b) Write a C++ program to convert dollar to rupees, euro to rupees andpound to rupees using pure virtual functions. 1 dollar = 54.3 Rs 1 pound = 81.1Rs 1 euro = 70. Rs	4
14	a)Write a C++ program to perform ( ) overloading. b) Write a C++ program to perform -> overloading.	2
15	Sorting using Genric classes	2

NITTE EDUCATION TRUST | NITTE MEENAKSHI INSTITUTE OF TECHNOLOGY

Department: *Information Science and Engineering*	***Course Type:*** *Core*
Course Title: *Microcontroller Lab*	***Course Code:****18ISL48*
L-T-P:*0-0-2*	***Credits: 01***
Total Contact Hours:*26 hours*	***Duration of SEE:****03 hours*
SEE Marks: *50*	***CIE Marks:*** *50*

Pre-requisites:

i. C Programming and Digital Logic Design
ii. Computer Organization and Architecture.

Course Outcomes:

Students will be able to:

Cos	Course Outcome Description	Blooms Level
1	Develop assembly language program to perform Arithmetic and Logical operations using addressing modes of 8051	L3
2	Apply Timer / Counter concepts of 8051 for solving the given problem	L3
3	Design the experiment for transmitting data using serial communication	L3
4	Develop an Embedded C program for 8051 microcontrollers to interface with peripheral devices	L3

Teaching Methodology:

i. Black Board Teaching
ii. Power Point Presentation
iii. Laboratory experiments

Assessment Methods:

i. Rubrics for continuous evaluation of laboratory experiments for 30 marks.
ii. Two Continuous Internal Evaluations (CIEs) for 20 Marks each will be conducted and average will be considered.
iii. Semester End Examination (SEE) for 50 Marks will be conducted.

Course Outcome to Programme Outcome Mapping:

COs	**PO 1**	**PO 2**	**PO 3**	**PO4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO1 0**	**PO1 1**	**PO1 2**	**PSO 1**	**PSO 2**
CO1	3	2	3	1					2	1			3	
CO2	3	2	3	1					2	1			3	
CO3	3	2	3	1					2	1			3	
CO4	3	2	3	1					2	1			3	
18IS L48	3	2	3	1					2	1			3	

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Sl No	**<u>Experiments</u>**	**<u>CO</u>**
	<u>Part A</u>	
1.	Programming in Assembly level code. A. Block Transfer with and without overlapping. B. Exchange of data C. Arrange data in Ascending and Descending order D. To find the largest number in an array. E. To add two 16 bit and 8 bit numbers F. To subtract two 16 bit and 8 bit numbers G. To multiply two 16 bit and 8 bit numbers. H. To divide two8 bit numbers. I. To find the square of two 8 bit numbers J. To find the cube of an 8 bit number K. To logically AND, OR, XOR two 8 bit numbers.	**1**
2.	Write a program in ALP for Code conversion A. BCD – ASCII B. ASCII – Decimal C. Decimal – ASCII D. Hex – Decimal E. Decimal – Hex	**1**
3.	Write a program in ALP for generating delay using Timer.	**1,2**
4.	Write a program in ALP for transmitting data using serial	**2,3**
	<u>Part B</u>	
5.	Alpha Numeric LCD panel to display the Names	**4**
6.	Keyboard Interface	**4**
7.	Stepper motor (clockwise and anticlockwise)	**4**
8.	DC motor (clockwise and anticlockwise)	**4**

Department: *Information Science and Engineering*	***Course Type:*** *Program Elective A*
Course Title*: Python Programming*	***Course Code:*** *18ISE451*
L-T-P:*3-0-0*	***Credits: 03***
Total Contact Hours:*39 hours*	***Duration of SEE:****03 hours*
SEE Marks*: 50*	***CIE Marks:*** *50*

Course Outcomes:
Students will be able to:

Cos	Course Outcome Description	Blooms Level
1	Describe the basic programming concepts of python and Functions	L2
2	Apply appropriate data types/ data structures for the given problem using Lists, Dictionaries, Tuples and Files.	L3
3	Apply Exception handling technique in Python applications for error handling.	L3
4	Apply Python object-oriented concepts to solve real world problems.	L3

Teaching Methodology:

- Blackboard teaching / PowerPoint presentations.
- Programming Assignments
- Certification based learning

Assessment Methods:

- Rubrics to evaluate Programming Assignments for 10 Marks
- Certification based learning for 10Marks
- Three internals, 30 Marks each will be conducted and the Average of best of two will be taken.
- Final examination, of 100 Marks will be conducted and will be evaluated for 50 Marks.

Course Outcome to Programme Outcome Mapping:

Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	**3**													**2**
CO2	**3**	**2**	**3**		**1**				**1**	**1**		**1**		**2**
CO3	**3**	**2**	**3**		**1**				**1**	**1**		**1**		**2**
CO4	**3**	**2**	**3**		**1**				**1**	**1**		**1**		**2**
18ISE451	**3**	**2**	**3**		**1**				**1**	**1**		**1**		**2**

COURSE CONTENT

UNIT – I	**8** hours
The way of the program: The Python programming language, what is a program? , What is debugging, Formal and natural languages, the first program, Debugging. Variables, expressions and statements : Values and types , Variables, Variable names and keywords, Operators and operands, Expressions and statements, Interactive mode and script mode, Order of operations, String operations, Comments, Debugging Functions: Function calls, Type conversion functions, Math functions, Composition, Adding new functions, Definitions and uses, Flow of execution, Parameters and arguments, Variables and parameters are local, Stack diagrams, Fruitful functions and void functions, Why functions?, Importing with from, Debugging.	
UNIT – II	**8** hours
Conditionals and recursion: Modulus operator, Boolean expressions , Logical operators, Conditional execution , Alternative execution, Chained conditionals , Nested conditionals , Recursion , Stack diagrams for recursive functions, Infinite recursion , Keyboard input , Fruitful functions: Return values, Incremental development, Composition , Boolean functions. Iteration: Multiple assignment, Updating variables, the while statement, break, Squareroots, Algorithms.	
UNIT – III	**7** hours
A string is a sequence: len, Traversal with a for loop, String slices, Strings are immutable, Searching, Looping and counting, String methods, the in operator, String comparison. Lists: A list is a sequence, Lists are mutable, Traversing a list , List operations, List slices, List methods, Map, filter and reduce, Deleting elements, Lists and strings, Objects and values, Aliasing, List arguments.	
UNIT – IV	**8** hours
Dictionaries: Dictionary as a set of counters, Looping and dictionaries, Reverse lookup, Dictionaries and lists, Memos, Global variables, Long integers, Debugging. Tuples: Tuples are immutable, Tuple assignment, Tuples as return values, Variable-length argument tuples, Lists and tuples , Dictionaries and tuples, Comparing tuples , Sequences of sequences.	
UNIT – V	**8h**ours
Files: Persistence, Contents, Catching exceptions, Databases, Writing. Classes and objects: User-defined types, Attributes, Rectangles, Instances as return values, Objects are mutable, Copying, Classes and functions: Time, Pure functions, Modifiers, Prototyping versus planning. Classes and methods: Object-oriented features, Printing objects, another example, A more complicated example, The init method, The __str__ method, Operator overloading, Type-based dispatch, Polymorphism.	

Text books:

1. Allen Downey, Think Python(How to Think Like a Computer Scientist), 2nd Edition by O'Reilly Media

Reference Books:

1. Learning Python, Fourth Edition, Mark Lutz, O’Reilly publication

Department: Information Science and Engineering	**Course Type:** Program Elective A
Course Title: Web Technology	**Course Code:** 18ISE452
L-T-P:3-0-0	**Credits: 03**
Total Contact Hours:39 hours	**Duration of SEE:**03 hours
SEE Marks: 50	**CIE Marks:** 50

Pre-requisite:

- Basic conventional Programming practices

Course Outcomes:

Students will be able to:

Cos	Course Outcome Description	Blooms Level
1	Describe the fundamentals of web technology.	L2
2	Design web pages using HTML mark-up language for the given Scenarios.	L3
3	Apply the concepts of Cascading Style Sheets for designing the web pages.	L3
4	Demonstrate the use of JavaScript to develop the dynamic user interface.	L3
5	Understand server-side scripting using PHP and basics of XML	L1

Teaching Methodology:

- Black board teaching
- Power Point presentations
- Regular review of students by asking questions based on topics covered in the class
- Course Project

Assessment Methods:

- Course Project -15Marks
- Case Study – 5 Marks
- Three internals, 30 Marks each will be conducted and the Average of best of two will be taken.
- Final examination, of 100 Marks will be conducted and will be evaluated for 50 Marks.

Course Outcome to Programme Outcome Mapping:

Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3													3
CO2	3	3	3			1			2	2		2		3
CO3	3	3	3			1			2	2		2		3
CO4	3	3	3			1			2	2		2		3
CO5	3	1							2	2		2		3
18ISE452	3	3	3			1			2	2		2		3

COURSE CONTENT

UNIT – I	**8** hours
Internet and web technologies, structuring an HTML document, Exploring Editors and Browsers Supported by HTML5, Creating and saving an HTML document, Validating and Viewing an HTML document, Understanding HTML elements, Describing data types, Formatting text with HTML elements, Arranging text, Exploring the hyperlinks and URL, Creating tables.	
UNIT – II	**10 hours**
HTML Continued **-** Inserting images in a web page, Exploring colours, working with forms, Exploring audio and video formats, Describing the multimedia elements, Defining a multimedia file using the EMBED element. CSS – Overview of CSS, Background and colour gradient in CSS, font and text styles, Creating Boxes and Columns in CSS, Displaying, Positioning and Floating an element, List styles, Table layouts.	
UNIT – III	**10 hours**
Exploring the features of Javascript, Using Javascript in an HTML Document, Programming fundamentals of Javascript, Javascript functions, events, image maps and animations, Objects in Javascript, Working with Browser objects, Working with Document Object, Document Object Model.	
UNIT – IV	**6 hours**
Introduction to PHP: Origins and uses of PHP, Overview of PHP, General syntactic characters, Primitives operations and expressions, output, control statements, Arrays, Functions, Pattern matching, Form handling, Cookies, Session Tracking, comparative study of different technologies and its applications.	
UNIT – V	**5hours**
Introduction to XML: Working with basics of XML – Exploring XML, Comparing XML with HTML, Advantages and disadvantages of XML, Structure of XML document,	

TEXT BOOKS:

1. HTML5 Covers CSS3, JavaScript, XML, XHTML, AJAX, PHP and Jquery Black Book, dreamtech PRESS, ISBN:978-93-5119-907-6, 2019
2. Programming the World Wide Web- Robert W. Sebesta, 7thEdition, Pearson Education, 2014.

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Department: *Information Science and Engineering*	***Course Type:*** *Core*
Course Title*: Graph Theory*	***Course Code:****18ISE453*
L-T-P:*3-0-0*	***Credits:****3*
Total Contact Hours:*39*	***Duration of SEE:****3 hrs*
SEE Marks*: 50*	***CIE Marks:*** *50*

Pre-requisites:
Discrete Mathematics, Basic Knowledge on Graphs

Course Outcomes:
Students will be able to:

Cos	Course Outcome Description	Blooms Level
1	Apply the properties of trees to solve spanning tree problems	L3
2	Use the concepts of connected graphs, graph colouring, and digraphs to solve the given problem	L3
3	Apply different representations of planar graphs to detect graph planarity	L3
4	Formulate and prove central theorems about trees, connectivity, colouring and planar graphs Apply appropriate graph theoretic algorithms to solve shortest path problems	 L3
5	Apply the concepts of distances and dominations to solve the given problem	L3

Teaching Methodology:

i. Black Board Teaching / Power Point Presentation
ii. Assignment
iii. Case study

Assessment Methods:

- Rubrics to evaluate Case Study for 10 marks
- Rubrics to evaluate Assignments for 10 marks
- Three internals, 30 Marks each will be conducted and the Average of best of two will be taken.
- Final examination of 100 Marks will be conducted and will be evaluated for 50 Marks.

Course Outcome to Programme Outcome Mapping:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	3						2	2		2		2
CO2	3	2	3						2	2		2		2
CO3	3	2	3						2	2		2		2
CO4	3	2	3						2	2		2		2
CO5	3	2	3						2	2		2		2
18ISE453	3	2	3						2	2		2		2

COURSE CONTENT

UNIT – I	**8** hours
Trees and Fundamental Circuits Trees, Some Properties of Trees, Pendant Vertices in a Tree, Distance and Centers in a Tree, Rooted and Binary Trees, On Counting Trees, Spanning Trees, Fundamental Circuits, finding all Spanning Trees of a Graph, Spanning Trees in a Weighted Graph. Topics (Text Book 1) – Sections: 3.1 to 3.10	
UNIT – II	**8** hours
Connectivity, Digraphs and Coloring Cut-Vertices, Blocks, Connectivity, Strong Digraphs, Tournaments, Decision Making, The Four Color Problem, Vertex Coloring, Edge Coloring. Topics (Text Book 2) – Sections: 5.1 to 5.3, 7.1 to 7.3, 10.1 to 10.3	
UNIT – III	**8** hours
Planar and Dual Graphs Combinatorial Vs. Geometric Graphs, Planar Graphs, Kuratowski's Two Graphs, Different Representations of a Planar Graph, Detection of Planarity, Geometric Dual, Combinatorial Dual, More on Criteria of Planarity, Thickness and Crossings. Topics (Text Book 1) – Sections: 5.1 to 5.9	
UNIT – IV	**8** hours
Graph Theoretic Algorithms and Computer Programs Algorithms, Computer Representation of a Graph, Shortest Path Algorithms, Depth First Search on Graph, Isomorphism, Other Graph Theoretic Algorithms, Performance of Graph Theoretic Algorithms, Graph Theoretic Computer Languages. Topics (Text Book 1) – Sections: 11.1 to 11.10	
UNIT – V	**7** hours
Distance and Domination The Center of a Graph, Distant Vertices, Channel Assignment, The Domination Number of a Graph, Lights out Topics (Text Book 2) – Sections: 12.1, 12.2, 12.5, 13.1, 13.3	

Text books:

1.NarsinghDeo, Graph Theory with Applications to Engineering and Computer Science. Prentice-Hall.
2.Introduction to Graph Theory, GraryChartrand and Ping Zhang, Tata McGraw-Hill, 2006.

Reference books:

1. Douglas B. West, Introduction to Graph Theory, Prentice Hall of India.
2. Discrete Mathematics & its Applications, Keneth H Rosen, 7th Edition, McGraw-Hill.
3. Frank Harary, Graph Theory, Narosa.
4. R. Ahuja, T. Magnanti, and J. Orlin, Network Flows: Theory, Algorithms, and Applications, Prentice-Hall.

MoocReferences :

1.https://nptel.ac.in/courses/111106050/
2.https://nptel.ac.in/courses/111106102/

Department: *Information Science and Engineering*	***Course Type:*** *Core*
Course Title*: Linear Algebra*	***Course Code:****18ISE454*
L-T-P:*3-0-0*	***Credits:****3*
Total Contact Hours:*39*	***Duration of SEE:****3 hrs*
SEE Marks*: 50*	***CIE Marks:*** *50*

Pre-requisites:
Students should have basic knowledge of solving and factoring algebraic expressions

Course Outcomes:
Students will be able to:

COs	Course Outcome Description	Blooms Level
1	Solve systems of linear equations using Gaussian elimination / LU factorization methods	L3
2	Apply principles of matrix algebra for linear transformations	L3
3	Compute Eigen values and Eigen vectors for diagonalization of matrices	L3
4	Apply Gram-Schmidt process to find orthogonal basis and Singular Value Decomposition in engineering applications	L3

Teaching Methodology:

i. Black Board Teaching / Power Point Presentation
ii. Problem Assignment

Assessment Methods:

- Assignment for 20 marks
- Three internals, 30 Marks each will be conducted and the Average of best of two will be taken.
- Final examination of 100 Marks will be conducted and will be evaluated for 50 Marks.

Course Outcome to Programme Outcome Mapping:

COs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2	PSO 1	PSO 2
CO1	3	2	3						1					2
CO2	3	2	3						1					2
CO3	3	2	3						1					2
CO4	3	2	3						1					2
18ISE454	3	2	3						1					2

COURSE CONTENT

UNIT – I	**8** hours
Linear equations: System of linear equations and its solution sets; elementary row operations and echelon forms; matrix operations; LU- factorization **Application of Linear Equations:** Graph Theory and Computer Graphics	
UNIT – II	**9**hours
Vector Spaces: Vector spaces; bases and dimension; coordinates, summary of row-equivalence; computations concerning subspaces. **Linear Transformations:** Linear transformations; algebra of linear transformations; isomorphism; representation of transformations by matrices; linear functional; transpose of a linear transformation	
UNIT – III	**10**hours
Canonical Forms: Characteristic values; methods for computing eigen Values-Gerschgor in circle method, Jacobi's method, Givens' method, iterative estimates, invariant subspaces; direct-sum decompositions; invariant direct sums; primary decomposition theorem (without proof); cyclic bases; Jordan canonical form.	
UNIT – IV	**6** hours
Inner product spaces: Inner products; inner product spaces; orthogonal sets and projections; Gram-Schmidt process; QR-factorization;	
UNIT – V	**6**hours
Symmetric Matrices and Quadratic Forms: Diagonalization; quadratic forms; constrained optimization; singular valued composition	

Text books:

1. **Introductory Linear Algebra with Applications by** Bernard Kolman and David R.Hill, 7th edition, Pearson Education (Asia)Pte.Ltd.

2. **Theory and problems of linear algebra** from Schaum's outline series, 3rd. edition, Tata McGraw-Hill publications.

Department: Information Science and Engineering	**Course Type**: **Core**
Course Title: Database Management System	**Course Code**: **18IS51**
L-T-P: 4-0-0	**Credits: 04**
Total Contact Hours: 52 hrs	**Duration of SEE: 3 hrs.**
SEE Marks: 50	**CIE Marks: 50**

Pre-requisites:

- Students should have basic programming knowledge.
- General concept of Set theory.

Course outcomes:

Students will be able to

Sl.no	Course outcomes	Blooms Level
1.	Describe the fundamentals of relational database concepts.	L2
2.	Design ER diagram for the given requirement specification.	L3
3.	Apply Normalization concept to eliminate anomalies and achieve consistent database.	L3
4.	Design Relational algebra and SQL Queries for the given schema.	L3
5.	Describe the properties of database transactions and concurrency control Techniques.	L2
6.	Develop Relational Database application.	L4

Teaching Methodology:

- Blackboard teaching
- Hands on approach for SQL
- PowerPoint presentations (if needed)

Assessment Methods:

- Course Project for 20 marks
- Three internals, 30 Marks each will be conducted and the Average of best of two will be taken.
- Rubrics for the evaluation assignment.
- Final examination, of 100 Marks will be conducted and will be evaluated for 50 Marks.

Course Outcome to Programme Outcome Mapping:

PO'S	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO12**
CO1	3													3
CO2	3	2	3											3
CO3	3	2	3											3
CO4	3	2	3											3
CO5	3													3
CO6	3	3	2		3				3	2	2	2		3
18IS51	3	2.25	2.75		3				3	2	2	2		3

COURSE CONTENTS

UNIT I	10 Hours
Advantages of using DBMS approach; Data models, schemas and instances; DBMS component module Three-schema architecture and data independence; Database languages; Classification of Database Management systems Using High-Level Conceptual Data Models for Database Design; An Example Database Application; Entity Types, Entity Sets, Attributes and Keys; Relationship types, Relationship Sets, Roles and Structural Constraints; Weak Entity Types; ER Diagrams, Naming Conventions and Design Issues; Relationship types of degree higher than two	
UNIT II	**12 Hours**
Relational database design using ER to relational mapping; Relational Model Concepts; Relational Model Constraints and Relational Database Schemas; Update Operations, Transactions and dealing with constraint violations; Unary Relational Operations: SELECT and PROJECT; Relational Algebra Operations from Set Theory; Binary Relational Operations: JOIN and DIVISION; Additional Relational Operations; Examples of Queries in Relational Algebra;	
UNIT III	**10 Hours**
Informal Design Guidelines for Relation Schemas; Functional Dependencies: Definition of FD, Inference rules for FD; Normal Forms Based on Primary Keys; General Definitions of Second and Third Normal Forms; Boyce-Codd Normal Form. Multi valued Dependencies and Fourth Normal Form ; Join Dependencies	
UNIT IV	**10Hours**
SQL Data Definition and Data Types; Specifying basic constraints in SQL; Schema change statements in SQL; Basic queries in SQL; More complex SQL Queries .Insert, Delete and Update statements in SQL; Specifying constraints as Assertion and Trigger; Views (Virtual Tables) in SQL	
UNIT V	**10Hours**
Introduction to transaction processing: Transaction and system concepts; Desirable Properties of transactions; Transactions and Schedules; Characterizing schedules based on recoverability; Characterizing schedules based on Serializability; **Concurrency Control Techniques:** 2PL techniques for concurrency control; Recovery Concepts: Write-ahead logging, Checkpoints in the system log, Transaction Rollback; Recovery Techniques based on Deferred Update and Immediate update; Shadow paging; The ARIES recovery algorithm; Database Security: Introduction to database security issues	

Live Demonstration:

i. Installing and connecting to a database management system; Introduction to SQL, Data Definition Commands
ii. SQL data manipulation commands
iii. Simple SQL SELECT queries
iv. Advanced SQL data definition commands and SELECT queries
v. Write procedure and trigger.

Text Books:

1. Elmasri and Navathe: Fundamentals of Database Systems, 5th Edition, Addison-Wesley, 2007

Reference Books:

1. Raghu Ramakrishnan and Johannes Gehrke: Database Management Systems, 3rd Edition, McGraw-Hill, 2003
2. **Silberschatz, Korth and Sudharshan** Data base System Concepts, 5th Edition, Mc- GrawHill, 2006.
3. **C.J. Date, A. Kannan, S. Swamynatham** A Introduction to Database Systems, 8th Edition, Pearson education, 2006

Department: *Information Science and Engineering*	***Course Type:*** *Core*
Course Title**: **Operating Systems	***Course Code:*** 18IS52
L-T-P: *4-0-0*	***Credits:*** *04*
Total Contact Hours: *52 hrs*	***Duration of SEE:*** *3 hrs*
***SEE Marks**: 50*	***CIE Marks:*** *50*

Pre-requisites:

- Fundamental knowledge of Computer Peripheral System and Functional Units
- Knowledge of semiconductor and magnetic memory.

Course Outcomes:

Sl.no	Course outcomes	Blooms Level
1	Describe the basic structure and functionality of Operating System.	**L2**
2	Apply different scheduling algorithms to schedule multiple tasks for execution by the processor and compare their performance trade-offs.	**L3**
3	Describe the need for controlled access to computing resources by co-operative processes.	**L2**
4	Apply deadlock detection and prevention algorithms to solve the given problem	**L3**
5	Illustrate Primary and secondary memory management strategies	**L3**
6	Illustrate operating system principles for achieving protection and security.	**L2**

Teaching Methodology:

Black board Teaching/PowerPoint presentation
Industry driven case study

Assessment Methods:

Case studies ,20 Marks
Three internals, 30Marks each will be conducted and the Average of best of two will be taken.
Rubrics for case study presentation
Final examination, of 100Marks will be conducted and will be evaluated for 50Mark

CO to PO Mapping:

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	PO12	PSO 1	PSO 2
CO1	3												3	
CO2	3	2	3						2	2		2	3	
CO3	3												3	
CO4	3	2	3						2	2		2	3	
CO5	3	2	3						2	2		2	3	
CO6	3												3	
18IS52	3	2	3						2	2		2	3	

Course Content

UNIT I	8Hours
Introduction: What operating systems do; Computer System organization; Computer System architecture; Operating System structure; Operating System operations; Protection and security; Distributed system; Special purpose systems; Virtual machines.Operating system structures: operating system services, user operating system Interface, System calls, Types of system calls, Operating system structure, System boot	
UNIT II	**11Hours**
Process Management: Basic concept; Process scheduling; Operations on processes; Inter process Communication Threads: Overview; Multithreading models; Process scheduling: Basic concepts, Scheduling criteria, scheduling algorithms, multiple processor scheduling, Algorithm evaluation.	
UNIT III	**12Hours**
Process Synchronization: Synchronization, The Critical section problem; Peterson's solution; Synchronizatio hardware; Semaphores; Classical problems of synchronization; Monitors.Deadlocks: System model; Deadlock characterization; Methods for handling deadlocks; Deadlock prevention; Deadlock avoidance; Deadlock detectio and recovery from deadlock.	
UNIT IV	**11Hours**
Memory Management Strategies: Background; Swapping; Contiguous memory allocation; Paging; Structure o page table; Segmentation.Virtual Memory Management: Background; Demand paging; Copy-on write; Pag replacement; Allocation of frames; Thrashing	
UNIT V	**10Hours**
File System: File concept; Access methods; Directory structure; File system mounting; file sharing; Protection.	
Secondary Storage Structures: Disk scheduling; FCFS Scheduling, SSTF scheduling, SCAN,C-SCAN scheduling, Look Scheduling. System Protection: Goals of protection, Principles of protection, Domain of protection, Access matrix, Implementation of access matrix, Access control, Revocation of access rights, Capability-Based systems.	

Text Book:

1. Abraham Silberschatz, Peter Baer Galvin, Greg Gagne Operating System Principles, 8th edition Wiley-India,2011

Reference Books:

1. D.M Dhamdhere Operating systems - A concept based Approach, 2nd Edition, Tata McGraw-Hill, 2002
2. Harvey M Deital Operating systems, 3rd Edition, Addison Wesley, 1990.
3. Operating Systems: Principles and Practice (2nd Edition), by Thomas Anderson and Michael Dahlin.

Department: Information Science and Engineering	**Course Type:** Core
Course Title: Theory of Computation	**Course Code:**18IS53
L-T-P:3-2-0	**Credits:**4
Total Contact Hours:39 hrs	**Duration of SEE:**3 hrs
SEE Marks: 50	**CIE Marks:** 50

Pre-requisites:

- Students should have knowledge of set theory.

Course Outcomes:

At the end of the course, Students will be able to:

Cos	Course Outcome Description	Blooms Level
1	Describe the core concepts in automata theory.	L2
2	Design DFA and NFA for the given regular languages.	L3
3	Apply the concepts of Regular Expression, and Context Free Grammar for the given problem.	L3
4	Design Push down Automata and Turing Machines to solve the complex computation problems	L3
5	Determine the decidability of computational problems.	L4

Teaching Methodology:

- Black Board Teaching
- Tutorials
- Problem solving using JFLAP tool

Assessment Methods:

- Rubrics to evaluate Tutorials for 10 Marks.
- Rubrics to evaluate Problem solving using JFLAP tool for 10 Marks.
- Three internals, 30 Marks each will be conducted and the Average of best of two will be taken.
- Final examination of 100 Marks will be conducted and will be evaluated for 50 Marks.

Course Outcome to Programme Outcome Mapping:

COs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	PO12	PSO 1	PSO 2
CO1	3													3
CO2	3	2	3		2				2	2		2		3
CO3	3	2	3		2				2	2		2		3
CO4	3	2	3		2				2	2		2		3
CO5	3	1	3											3
18IS53	3	2	3		2				2	2		2		3

COURSE CONTENT

UNIT – I	08 hours
Introduction to Finite Automata: Introduction to Finite Automata; The central concepts of Automata theory; Deterministic finite automata; Nondeterministic finite automata, An application of finite automata; Finite automata with Epsilon transitions; Regular expressions;	
UNIT – II	09 hours
Regular Expressions & Regular Languages: Finite Automata and Regular Expressions; Applications of Regular Expressions. Regular languages; Proving languages not to be regular languages; Closure properties of regular languages; Decision properties of regular languages; Equivalence and minimization of automata.	
UNIT – III	08 hours
Context-Free Grammars and Languages Push down Automata: Context -free grammars; Parse trees; Applications; Ambiguity in grammars and Languages. Definition of the Pushdown automata; the languages of a PDA;	
UNIT – IV	07 hours
Pushdown Automata, Properties of Context-Free Languages: **Equivalence of PDA's and CFG's; Deterministic** Pushdown Automata. Normal forms for CFGs; The pumping lemma for CFGs; Closure properties of CFLs	
UNIT – V	07 hours
Turing Machine &Undecidability: The Turing machine, Programming techniques for Turing Machines; Extensions to the basic Turing Machines; A Language that is not recursively enumerable; An Undecidable problem that is RE; Post's Correspondence problem	

Text books:

1. John E. Hopcroft, Rajeev Motwani, Jeffrey Ullman, Introduction to Automata Theory, Languages and Computation, 3rdEdition, Pearson education, 2007

Reference books:

1. Raymond Greenlaw, H.JamesHoover, Fundamentals of the Theory of Computation, Principles and Practice, Morgan Kaufmann, 1998
2. John C Martin: Introduction to Languages and Automata Theory 3rdEdition, Tata McGraw–Hill, 2007.
3. I.A. Cohen Introduction to Computer Theory, 2ndEdition, John Wiley& Sons, 2004.
4. Thomas A. SudkampAnIntroduction to the Theory of Computer Science, Languages and Machines, 3rd Edition, Pearson Education, 2006.

Department: *Information Science and Engineering*	***Course Type:*** *Core*
Course Title*: Computer Networks*	***Course Code:****18IS54*
L-T-P: *4-0-0*	***Credits:*** *4*
Total Contact Hours:*52*	***Duration of SEE:****3 hrs*
SEE Marks*: 50*	***CIE Marks:*** *50*

Pre-requisites:

- Knowledge of digital electronics and Internet usage.

Course Outcomes:

Students will be able to:

Cos	Course Outcome Description	Blooms Level
1	Understand the computer network models, layered architecture, functions and its protocols	L2
2	Apply signal encoding, signal conversion and multiplexing for data transmission in computer networks	L3
3	Apply error detection, flow control, access control and channelization protocols for node-to-node data delivery	L3
4	Apply concepts of sub-networks, routing algorithms and Internet protocols for host-to-host packet delivery	L3
5	Understand the TCP and UDP services, TCP Congestion protocol during data transmission in computer networks	L2
6	Understand the services of Electronic mail and DNS	L2

Teaching Methodology:

- Black Board Teaching / Power Point Presentation
- Assignment
- Case- study

Assessment Methods:

- Rubric based evaluation of case- study for 10 marks.
- Rubric based evaluation of Assignment for 10 marks.
- Three internal evaluation tests of 30 Marks each will be conducted and the Average of best two will be taken.
- Semester End Examination for 100 Marks and calculated to a weightage of 50 Marks.

Mapping of Cos, Pos & PSO's:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3								2	1		1		2
CO2	3	2	3		2				2	1		1		3
CO3	3	2	3		2				2	1		1		3
CO4	3	2	3		2				2	1		1		3
CO5	3				2				2	1		1		3
CO6	3								2	1		1		3
18IS54	3	2	3		2				2	1		1		3

COURSE CONTENTS

UNIT – I: Physical Layer:	**10** hours
TCP/IP Protocol suite, The OSI Model, Data and Signals, Periodic analog signals, Digital signals, Transmission impairments, Data rate limits, Performance, Digital-to-Digital conversion, Analog-to-Digital conversion, Transmission modes, Bandwidth Utilization: Multiplexing	
UNIT – II: Datalink Layer	**11** hours
Introduction, Link layer addressing, Error detection and correction: Introduction, block coding, cyclic codes, checksum, Data link control: DLC services, Data-Link layer protocols, HDLC, Point to Point protocols (PPP), Media Access Control: Random Access, Controlled Access, Channelization.	
UNIT – III: Network Layer	**11** hours
Network layer services, Packet switching, Network-Layer Performance, IPV4 Addressing, Internet protocol (IP), ICMPv4, Routing algorithms, Unicast routing protocols	
UNIT – IV: Network and Transport Layer	**10** hours
IPV6 addressing, The IPV6 Protocols, ICMPV6 Protocol, Transition from IPV4 to IPV6, Transport Layer: Introduction, Transport layer Protocols, User Datagram Protocol (UDP)	
UNIT – V: Transport and Application Layer	**10** hours
Transmission control Protocol: TCP Services, Segment, TCP Connection, Flow control, Error control, TCP Congestion control, Application Layer: Electronic Mail, Domain Name System (DNS)	

Text books:

1. Behrouz A. Forouzan Data Communications and Networking, 4th Edition, Tata McGraw- Hill, 2006.

2. **Alberto Leon-garcia and Indra**Widjaja Communication Networks, Second Edition, TataMcGraw Hill,2004

Reference Books:

1. 1. William Stallings: **Data and Computer Communication, 8th Edition, Pearson Education, 2007.**

2. 2. Larry L. Peterson and Bruce S. David **Computer Networks - A Systems Approach, 4th Edition, Elsevier, 2007.**

3. 3. Wayne Tomasi **Introduction to Data Communications and Networking, Pearson Education, 2005.**

Mooc References :

1. https://nptel.ac.in/courses/106105082/
2. https://nptel.ac.in/courses/106105183/

Department: *Information Science and Engineering*	***Course Type:*** *Core Elective*
Course Title*:* Statistics for Data science	***Course Code:****18ISE551*
L-T-P: 3*-0-0*	***Credits: 3***
Total Contact Hours:39	***Duration of SEE:****3 hrs*
SEE Marks*: 50*	***CIE Marks:*** *50*

Prerequisites

- Mathematics, basics of probability, Elements of permutation and combination

Course Outcome

At the end of the course, students will be able to

Cos	Course Outcome Description	Blooms Level
1	Solve elementary problems on the probability and statistics.	L3
2	Apply discrete probability distribution techniques on given population.	L3
3	Compute population statistic based on the parameters of sampling distribution.	L3
4	Analyse hypothesis to accept/reject alternative hypothesis.	L4
5	Apply ANOVA to infer conclusions about population/sample.	L3

Teaching Methodology

- Black board, Power Point
- Assignment
- Case Study

Assessment Methods:

- Three MSEs of 30 marks of each. The average of best two performances will be considered to award 30 marks.
- Rubrics to evaluate Case Study 10Marks
- Rubrics for evaluating assignment 10 arks.
- SEE for 100 marks will be evaluated for50 marks.

Course Outcome to Programme Outcome Mapping

PO	1	2	3	4	5	6	7	8	9	10	11	12	PSO1	PSO2
CO1	3	2	3		1				1	1		1		2
CO2	3	2	3		1				1	1		1		2
CO3	3	2	3		1				1	1		1		2
CO4	3	3	2		1				1	1		1		2
CO5	3	2	3		1				1	1		1		2
18ISE551	3	2.2	2.8		1				1	1		1		2

COURSE CONTENT

Unit 1	Probability and statistics	7 Hours
Why Study Statistics?, Modern Statistics, Statistics and Engineering, two Basic Concepts—Population and Sample, A Case Study: Visually Inspecting Data to Improve Product Quality, Pareto Diagrams and Dot Diagrams, Frequency Distributions, Graphs of Frequency Distributions, Stem-and-Leaf Displays, Descriptive Measures, Quartiles and Percentiles, calculation of X bar and S, Problems with aggregating data, Sample Spaces and Events, Counting, Probability, The Axioms of Probability, Some Elementary Theorems, Conditional Probability, Bayes' Theorem		
Unit-2	**Probability Distributions**	**8 Hours**
Random Variables, The Binomial Distribution, The Hypergeometric Distribution, The Mean and the Variance of a Probability Distribution, Chebyshev's Theorem, The Poisson Distribution and Rare Events, Poisson Processes, The Geometric and Negative, Binomial Distribution, The Multinomial Distribution, Simulation		
Unit-3	**Probability Densities and Sampling Distributions**	**8 Hours**
Continuous Random Variables, The Normal Distribution, The Normal Approximation to the, Binomial Distribution, Other Probability Densities, The Uniform Distribution, The Log-Normal Distribution, The Gamma Distribution, The Beta Distribution, The Weibull Distribution, Continuous Random Variables, The Normal Approximation to the Binomial Distribution		
Unit-4	**Inferences concerning mean and variance**	**8 Hours**
Statistical Approaches to Making, Generalizations, Point Estimation, Interval Estimation, Maximum Likelihood Estimation, Tests of Hypotheses, Null Hypotheses and Tests of Hypotheses, Hypotheses Concerning One Mean, The Relation between Tests and Confidence Intervals		
Unit-5	**Analysis of Variance – ANOVA**	**8 hours**
Single-Factor ANOVA, Multiple Comparisons in ANOVA, More on Single-Factor ANOVA, Introduction Two-Factor ANOVA with Kij=1, Two-Factor ANOVA with Kij>1, Three-Factor ANOVA.		

Text book

- Miller & freund's Probability and statistics for engineers, ninth edition, Richard a. Johnson,
- Pearson. Devore. J.L., "Probability and Statistics for Engineering and the Sciences", Cengage Learning, New

Reference Book

- Walpole. R.E., Myers. R.H., Myers. S.L. and Ye. K., "Probability and Statistics for Engineers and Scientists", Pearson Education, Asia, 8th Edition, 2007.
- Ross, S.M., "Introduction to Probability and Statistics for Engineers and Scientists", 3rd Edition, Elsevier, 2004.
- Spiegel. M.R., Schiller. J. and Srinivasan. R.A., "Schaum's Outline of Theory and Problems of Probability and Statistics", Tata McGraw Hill Edition, 2004. 4. Griffiths, Dawn. Headfirst statistics. " O'Reilly Media, Inc.", 2008.

MOOC Reference

- Introduction to probability and Statistics, Prof. G. Srinivasan, IIT Madras - https://nptel.ac.in/courses/111/106/111106112/

Department: *Information Science and Engineering*	***Course Type:*** *Core Elective*
Course Title*: Digital Image Processing*	***Course Code:*** *18ISE552*
L-T-P: *3-0-0*	***Credits:*** *03*
Total Contact Hours: *39 hrs*	***Duration of SEE:*** *3 hrs*
SEE Marks*: 50*	***CIE Marks:*** *50*

Pre-requisites:

- Students should have knowledge of mathematics and Programming Concepts.

Course outcomes:

Students will be able to

COs	Course Description	Blooms Level
1	Describe the fundamentals of digital image processing	L2
2	Apply image enhancement methods for the given problems	L3
3	Apply suitable image segmentation algorithm for the given dataset.	L3
4	Understand image restoration techniques	L2
5	Analyse the performance of different image compression algorithms	L4

Teaching Methodology:

- Black Board Teaching / Power Point Presentation
- Programming / Problem solving Assignment

Assessment Methods:

- Rubrics to evaluate Programming assignments using Python and OpenCV. (10 marks)
- Problem solving assignments (10 Marks)
- Three internals, 30 Marks each will be conducted and the Average of best of two will be taken.
- Final examination of 100 Marks will be conducted and will be evaluated for 50 Marks.

Course Outcome to Programme Outcome Mapping:

Po's	Po1	Po2	Po3	Po4	Po5	Po6	Po7	Po8	Po9	Po10	Po11	Po12	Pso1	Pso2
CO1	3													3
CO2	3	2	3		1				1	1				3
CO3	3	2	3		1				1	1				3
CO4	3													3
CO5	3	3	2		1				1	1				3
18ISE552	3	2.3	2.6		1				1	1				3

COURSE CONTENT

UNIT – I	8 Hours
Introduction : What Is Digital Image Processing?, Fundamental Steps in Digital Image Processing, Components of an Image Processing System, Digital Image fundamentals, Brightness Adaptation and Discrimination, A Simple Image Formation Model, Image Sampling and Quantization, Basic Concepts in Sampling and Quantization , Representing Digital Images, Spatial and Gray-Level Resolution, Zooming and Shrinking Digital Images. Some Basic Relationships between Pixels: Neighbors of a Pixel, Adjacency, Connectivity, Regions, and Boundaries, Distance Measures, Image Operations on a Pixel Basis.	
UNIT – II	8Hours
Linear and Nonlinear Operations: Image Enhancement in the Spatial Domain, Some Basic Gray Level Transformations: Image Negatives, Log Transformations, Power-Law Transformations, Piecewise-Linear Transformation Functions, Histogram Processing: Histogram Equalization, Histogram Matching (Specification),Local Enhancement, Use of Histogram Statistics for Image Enhancement, Enhancement Using Arithmetic/Logic Operations, Image Subtraction, Image Averaging ,Basics of Spatial Filtering, Smoothing Spatial Filters: Smoothing Linear Filters, Order-Statistics Filters, Sharpening Spatial Filters: Foundation, Use of Second Derivatives for Enhancement–The Laplacian, Use of First Derivatives for Enhancement—The Gradient, Combining Spatial Enhancement Methods.	
UNIT – III	8Hours
Image Segmentation: fundamentals, Point Detection, Line Detection, Edge Detection: background, detection of isolated points, line detection, edge models, basic edge detection, more advanced techniques for edge detection: Marr-Hildreth edge detector, canny edge detector, Thresholding: Foundation,blosic global thresholding, optimal global thresholding using Otsu's method. Region based segmentation: region growing, region splitting and merging.	
UNIT – IV	8Hours
Image Restoration: A Model of the Image Degradation/Restoration Process - Noise Models, Spatial and Frequency Properties of Noise, Some Important Noise Probability Density Functions, Periodic Noise, Estimation of Noise Parameters, Restoration in the Presence of Noise Only–Spatial Filtering: Mean Filters, Order-Statistics Filters, Adaptive Filters.	
UNIT – V	7Hours
Image Compression: fundamentals, Coding Redundancy, spatial and temporal redundancy, irrelevant information, Fidelity Criteria, Some basic compression models: Huffman coding, LZW Coding, run length coding, Bit-Plane Coding, Lossless Predictive Coding.	

Text books:

1. Digital Image Processing by Rafael C Gonzalez &Richard E Woods, 3rd Edition

Reference books:

1. Digital Image Processing & Analysis, B. Chnada & D. Datta Majumder, 2/E 2nd Edition

Department: Information Science and Engineering	**Course Type**: Elective Core A
Course Title: Computer Graphics	**Course Code:** 18ISE553
L-T-P: 3-0-0	**Credits: 03**
Total Contact Hours: 39hrs	**Duration of SEE:** 3 hrs
SEE Marks: 50	**CIE Marks: 50**

Pre-requisite:

- Computer Concepts and C Programming
- Object Oriented Programming

Course Outcomes:

Student will be able to:

Cos	Course Outcomes Description	Blooms Level
1	Understand the concepts of 2D and 3D transformations, projection and viewing using OpenGL-L	L2
2	Design and implement the geometrical objects using graphics language OpenGL	L3
3	Apply the knowledge of geometrical transformations and projection matrix for handling multiple objects	L3
4	Apply the concepts of clipping algorithms and graphics pipeline in solving the given problems	L3

Teaching Methodology:

- Blackboard teaching
- PowerPoint presentations
- Course Project

Assessment Methods:

- Rubrics for evaluating course project-20Marks
- Three internals, 30 Marks each will be conducted and the Average of best of two will be taken.
- Final examination, of 100 Marks will be conducted and will be evaluated for 50 Marks.

CO-PO Mapping:

PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3													2
CO2	3	2	3						2	2	1	2		2
CO3	3	2	3	1	2				2	2	1	2		2
CO4	3	2	3	1	2				2	2	1	2		2
18ISE553	3	2	3	1	2				2	2	1	2		3

Course Content

UNIT – I	**8 Hours**
OVERVIEW: COMPUTER GRAPHICS GRAPHS AND CHARTS, COMPUTER-AIDED DESIGN, VIRTUAL-REALITY ENVIRONMENTS, DATA VISUALIZATIONS, EDUCATION AND TRAINING, COMPUTER ART. ENTERTAINMENT, IMAGE PROCESSING, GRAPHICS USER INTERFACES. VIDEO DISPLAY DEVICES, RASTER SCAN SYSTEMS, INPUT DEVICES, HARD COPY DEVICES, GRAPHICS SOFTWARE	
UNIT – II	7Hours
GRAPHICS LANGUAGE OVERVIEW: INTRODUCTION OF OPEN GL, COORDINATE REFERENCE FRAMES, SPECIFYING A TWO-DIMENSIONAL WORLD-COORDINATE REFERENCE FRAME IN OPEN GL, OPENGL POINT FUNCTIONS, OPENGL LINE FUNCTION, LINE –DRAWING ALGORITHM CIRCLE GENERATING ALGORITHMS.	
UNIT – III	8Hours
OPEN GL PRIMITIVES & ATTRIBUTES FILL-AREA PRIMITIVES, POLYGON FILL AREAS, OPENGL POLYGON FILL, AREA FUNCTIONS, OPENGL VERTEX ARRAYS, PIXEL –ARRAY PRIMITIVES, OPENGL PIXEL ARRAY FUNCTIONS, CHARACTER PRIMITIVES, OPENGL CHARACTER FUNCTIONS, OPEN GL DISPLAY-WINDOW RESHAPE FUNCTIONS; COLOR AND GRAY SCALE, OPENGL COLOR FUNCTIONS, POINT ATTRIBUTES, LINE ATTRIBUTES, CURVE ATTRIBUTES, OPEN GL POINT ATTRIBUTE FUNCTIONS, OPEN GL LINE ATTRIBUTE FUNCTIONS, FILL-AREA ATTRIBUTES	
UNIT – IV	8Hours
GEOMETRIC TRANSFORMATIONS BASIC TWO-DIMENSIONAL GEOMETRIC TRANSFORMATIONS, INVERSE TRANSFORMATIONS, TWO-DIMENSIONAL COMPOSITE TRANSFORMATIONS, OTHER TWO-DIMENSIONAL TRANSFORMATIONS, GEOMETRIC TRANSFORMATIONS IN THREE-DIMENSIONAL SPACE, THREE-DIMENSIONAL TRANSLATION, THREE-DIMENSIONAL ROTATION, THREE-DIMENSIONAL TRANSLATION, OTHER THREE-DIMENSIONAL TRANSLATION, OPEN GL GEOMETRIC-TRANSFORMATION FUNCTIONS	
UNIT – V	8Hours
VIEWING AND INTERACTION THE TWO-DIMENSIONAL VIEWING PIPELINE, THE CLIPPING WINDOW, NORMALIZATION AND VIEW PORT TRANSFORMATION., OPENGL TWO-DIMENSIONAL VIEWING FUNCTIONS, CLIPPING ALGORITHMS, TWO-DIMENSIONAL POINT CLIPPING., TWO-DIMENSIONAL LINE CLIPPING; THE THREE-DIMENSIONAL VIEWING PIPELINE, GRAPHICAL INPUT DATA, LOGICAL CLASSIFICATIONS OF INPUT DEVICES, OPEN GL MENU FUNCTIONS	

Text book

- **Computer Graphics with OpenGL, 3/E** Donald D Hearn & M. Pauline Baker, Publisher: Prentice Hall.
- **http://www.nvidia.com**

Reference books

1. OpenGL Programming Guide, VI edition, Jackie Neider, Tom Davis, Mason Woo. Shreiner, Addison-Wesley Publishing Company
2. Interactive Computer Graphics A Top-Down Approach with OpenGL -Edward Angel, 5th Edition, Addison-Wesley, 2008.

Department: Information Science and Engineering	**Course Type: Program** Elective
Course Title: Internet of Things	**Course Code: 18ISE554**
L-T-P:3-0-0	**Credits:03**
Total Contact Hours:39hrs	**Duration of SEE:3hrs**
SEE Marks: 50	**CIE Marks:** 50

Course Outcomes:
Students will be able to:

Cos	Course Outcome Description	Blooms Level
1	Understand the fundamentals of IoT with a strong knowledge of its architecture	L2
2	Describe the solid fundamentals of IEEE 802.15.4 along with few comparative standards	L2
3	Understand the network layer in the view of IoT along with the application protocol	L2
4	Understand the data and analytics concepts in terms for IoT and Security concerns.	L2
5	Apply IoT concepts using an opensource IoT platform for the given application	L3

Teaching Methodology:
- Lectures/presentations
- Demos whenever required

Assessment Methods:
- Three internals, 30 Marks each will be conducted and the Average of best of two will be taken.
- Rubrics for evaluation of Course Project and Seminar.
    - LA1 – seminar on IoT case studies/ platforms
    - LA2 – presentation **-** a new approach on solving a real time problem
- Final examination, of 100 Marks will be conducted and will be evaluated for 50Marks.

Course Outcome to Programme Outcome Mapping:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3				3		1		3	3		2		2
CO2	3				3		1		3	3		2		2
CO3	3				3		1		3	3		2		2
CO4	3				3		1		3	3		2		2
CO5	3	2	3		3		1		3	3		2		2
18ISE554	3	2	3		3		1		3	3		2		2

COURSE CONTENT

UNIT – I	08 hours
Introduction to IoT, Genesis of IoT, IoT digitization, IoT impact, Converge IT and OT, IoT challenges. IoT Network architecture and design, drivers behind new architecture, comparing IoT architectures, A simplified IoT architecture, Core IoT Functional stack, IoT data management and compute stack.	
UNIT – II	8 hours
Connecting smart things, communications criteria, IoT access technologies, IEEE 802.15.4, IEEE 802.15.4g and IEEE 802.15.4e, IEEE 1901.2a, IEEE 802.11ah, LoRaWAN, NB-IoT	
UNIT – III	8 hours
IP as IoT network layer, The business case for IP, Need for optimization, optimizing IP for IoT, profiles and compliences	
UNIT – IV	08 hours
Application Protocols for IoT, Data Analytic for IoT, Introduction to data analytics for IoT, Machine learning, Big data analytics tools and technology, edge streaming analytics, network analytics.	
UNIT – V	07 hours
Security for IoT, common challenges in OT security, How IT and OT security practices and systems vary, formal risk analysis structures: OTAVE and FAIR, the phased application of security in an operational environment. Case study: Public safety	

Text books:

1. IoT fundamentals by David Hanes, Gonzalo Salgueiro Ciscopress 2019

Reference books:

1. OvidiuVermesan,Peter Friess Internet of Things:Converging Technologies for Smart Environments and Integrated Ecosystems. River Publishers Series in Communication.
2. Designing the Internet of Things, by **Adrian McEwen & Hakim Cassimally** ISBN 978-81-265-5686-1 Wiley Publication.
3. Internet Of Things-A Hands on Approach, by **ArshdeepBahga, Vijay Madisetti** University of Penn, http://www.internet-of-things-book.com/

Department: *Information Science and Engineering*	***Course Type: Core elective***
Course Title*: Distributed systems*	***Course Code:****18ISE555*
L-T-P:*3-0-0*	***Credits:*** *03*
Total Contact Hours:39 *hrs*	***Duration of SEE:*** *3 hrs*
SEE Marks*: 50*	***CIE Marks:*** *50*

Pre-requisites:

- Fundamental knowledge of Computer Organization and Operating System.

Course Outcomes:

Students will be able to:

Cos	Course Outcome Description	Blooms Level
1	Understand the goals and challenges of distributed system	L1
2	Demonstrate the remote invocation techniques for communication	L3
3	Describe the architecture of distributed file systems and name services	L2
4	Apply clock synchronization algorithms to monitor and order the events.	L3
5	Analyse the performance of mutual exclusion, election and consensus algorithms.	L4
6	Illustrate the fundamental concepts and algorithms related to distributed transactions and replication	L2

Teaching Methodology:

- Black Board Teaching / Power Point Presentation
- Programming Assignments

Assessment Methods:

- Rubrics for evaluating Programming Assignments for 20 Marks
- Three internals, 30 Marks each will be conducted and the Average of best of two will be taken.
- Final Examination of 100 Marks will be conducted and will be evaluated for 50 Marks.

Course Outcome to Programme Outcome Mapping:

Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3												3	
CO2	3	2	3						2	2		1	3	
CO3	3												3	
CO4	3	2	3						2	2		1	3	
CO5	3	2	3						2	2		1	3	
CO6	3												3	
18ISE555	3	2	3						2	2		1	3	

COURSE CONTENT

UNIT – I	**07 Hours**
CHARACTERIZATION OF DISTRIBUTED SYSTEMS: Introduction, Focus on resource sharing, Challenges REMOTE INVOCATION: Introduction , Request-reply protocols , Remote procedure call, Introduction to Remote Method Invocation	
UNIT – II	**7 Hours**
DISTRIBUTED FILE SYSTEMS : Introduction ,File service architecture, **NAME SERVICES :** Introduction ,Name services and the Domain Name System ,Directory services	
UNIT – III	**9 Hours**
TIME AND GLOBAL STATES: Introduction , Clocks, events and process states , Synchronizing physical clocks , Logical time and logical clocks , Global states	
UNIT – IV	**9 Hours**
COORDINATION AND AGREEMENT: Introduction, Distributed mutual exclusion, Elections , Coordination and agreement in group communication ,Consensus and related problems	
UNIT – V	**7 Hours**
DISTRIBUTED TRANSACTIONS : Introduction ,Flat and nested distributed transactions , Atomic commit protocols , Concurrency control in distributed transactions , Distributed deadlocks , Transaction recovery REPLICATION : Introduction	

Text books:

1. George Coulouris, Jean Dollimore and Tim Kindberg, "Distributed Systems Concepts and Design", Fifth Edition, Pearson Education, 2012.

Reference Books:

1. Distributed systems: Principles and Paradigms: by Andrew S. Tannenbaum, Maarten van Steen. Second edition. PH
2. Distributed Computing Principles, Algorithms & Systems By Ajay D. Kshemkalyani&MukeshSinghal, Cambridge

Online Materials:

https://nptel.ac.in/courses/106106168/

***Department**: Information Science and Engineering*	***Course Type**: Core Elective*
***Course Title**: Unix System Programming*	***Course Code:** 18ISE556*
***L-T-P:** 3-0-0*	***Credits**: 03*
***Total Contact Hours:** 39 hrs*	***Duration of SEE:** 3 hrs*
***SEE Marks:** 50*	***CIE Marks:** 50*

Prerequisite:

- UNIX AND Shell Programming.
- Fundamentals of operating systems.

Course Outcome:

At the end of the course students will be able to:

Cos	Course Outcome Description	Blooms Level
1	Describe need for Standardizing the UNIX Environment.	L2
2	Apply appropriate UNIX File APIs to solve the given problem.	L3
3	Apply the appropriate Unix APIs for process and job control.	L3
4	Apply signal related APIs to solve the given problem.	L3
5	Demonstrate inter-process communication using different IPC structures.	L3

Teaching Methodology:

- Black board teaching/Power point presentation.
- Programming assignments
- Case studies.

Assessment methods:

- Three internals, 30 Marks each will be conducted and the Average of best of two will be taken.
- Rubrics for evaluation of case studies.
- Rubrics for evaluation of Programming Assignments.
- Final examination, of 100 Marks will be conducted and will be evaluated for 50 Marks.

Course Outcome to Programme Outcome Mapping:

Po's	Po1	Po2	Po3	Po4	Po5	Po6	Po7	Po8	Po9	Po10	Po11	Po12	Pso1	Pso2
CO1	3													
CO2	3	2	3						1	1		1	3	
CO3	3	2	3						1	1		1	3	
CO4	3	2	3						1	1		1	3	
CO5	3	2	3						1	1		1		
18ISE556	3	2	3						1	1		1	3	

Course Content

UNIT I	8Hours
INTRODUCTION: UNIX and ANSI Standards: The ANSI C Standard, Difference between ANSI C and C++, The POSIX Standards, UNIX and POSIX APIs: The POSIX APIs, The UNIX and POSIX Development Environment, API Common Characteristics.UNIX FILES: File Types, The UNIX and POSIX File System, The UNIX and POSIX File Attributes, Inodes in UNIX System V, Application Program Interface to Files, UNIX Kernel Support for Files, Relationship of C Stream Pointers and File Descriptors, Directory Files, Hard and Symbolic Links.	
UNIT II	**8Hours**
UNIX File APIs: General File APIs, File and Record Locking UNIX PROCESSES: The Environment of a UNIX Process: Introduction, main function, Process Termination, Command Line Arguments, Environment List, Memory Layout of a C Program, Memory Allocation, Environment Variables.	
UNIT III	**8Hours**
PROCESS CONTROL: Introduction, Process Identifiers, fork, vfork, exit, wait, waitpid, waited, Race Conditions, exec Functions, Changing User IDs and Group IDs, Interpreter Files, system Function, Process Accounting, User Identification.PROCESS RELATIONSHIPS: Introduction, Terminal Logins, Network Logins, Process Groups, Sessions, Controlling Terminal, tcgetpgrp, tcsetpgrp, and tcgetsid Functions, Job Control.	
UNIT IV	**8Hours**
SIGNALS: Signals: The UNIX Kernel Support for Signals, signal, Signal Mask, sigaction, The SIGCHLD Signal and the waitpid Function, Kill, Alarm.INTERPROCESS COMMUNICATION: Introduction; Pipes, popen, pclose Functions; Coprocesses, FIFOs;	
UNIT V	**7Hours**
DAEMON PROCESSES: Introduction, Daemon Characteristics, Coding Rules.NETWORK IPC: SOCKETS: Introduction, Socket Descriptors, Addressing, Connection establishment, Data transfer.	

Text Books:

1. Terrence Chan UNIX System Programming Using C++, Prentice Hall India, 1999.
2. W.Richard Stevens Advanced Programming in the UNIX Environment, 2nd Edition, Addison-Wesley / PHI, 1992.

Reference Books:

1. Marc J. Rochkind Advanced Unix Programming, 2nd Edition, Pearson Education, 2005.
2. Maurice.J.BachThe Design of the UNIX Operating System, Pearson Education / PHI, 1987.
3. UreshVahalia UNIX Internals, Pearson Education, 2001.

Department: Information Science and Engineering	**Course Type:** Elective
Course Title: Artificial Intelligence	**Course code:** 18ISE557
L-T-P: 3-0-0	**Credits:** 3
Total contact hours: 39 hrs	**Duration of SEE:** 3 hrs
SEE Marks: 50 Marks	**CIE Marks:** 50 Marks

Course Outcomes:

Cos	Course Outcome Description	Blooms Level
1	Understand basics of AI.	L2
2	Understand Heuristic search techniques and Knowledge representation issues.	L2
3	Explain symbolic/statistical reasoning to handle uncertainty.	L2
4	Explain Weak/Strong Slot-and-filter structures.	L2
5	Summarize concepts in Knowledge Representation and Game Playing	L2

Teaching Methodology:
Blackboard teaching / PowerPoint presentations.

Assessment Methods:

- Three MSEs of 30 marks of each. The average of best two performances will be considered to award 30 marks
- Rubrics for evaluating assignment/case study 20 marks.
- SEE for 100 marks will be evaluated for50 marks.

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	2		1										2
CO2	2	2		1										2
CO3	2	2		1										2
CO4	2	2		1										2
CO5	2	2		1										2
18ISE557	2	2		1										2

COURSE CONTENTS

UNIT I	8Hours
What is Artificial Intelligence: The AI Problems, The Underlying assumption, What is an AI Technique? The Level of the model, Criteria for success, some general references, One final word and beyond. Problems, problem spaces, and search: Defining, the problem as a state space search, Production systems, Problem characteristics, Production system characteristics, Issues in the design of search programs	
UNIT II	**8Hours**
Heuristic search techniques: Generate-and-test, Hill climbing, Best-first search, Problem reduction, Constraint satisfaction, Mean-ends analysis. Knowledge representation issues: Representations and mappings, Approaches to knowledge representation, Issues in knowledge representation, The frame problem. Using predicate logic: Representing simple facts in logic, representing instance and ISA relationships, Computable functions and predicates, Resolution, Natural Deduction.	
UNIT III	**8Hours**
Symbolic Reasoning Under Uncertainty: Introduction to nonmonotonic reasoning, Logic for nonmonotonic reasoning, Implementation Issues, Augmenting a problem-solver, Implementation: Depth-first search, Implementation: Breadth-first search.	
UNIT IV	**8Hours**
Statistical Reasoning: Probability and bayes Theorem, Certainty factors and rule-based systems, Bayesian Networks, Dempster-Shafer Theory, Fuzzy logic. Weak Slot-and-filter structures: Semantic Nets, Frames.	
UNIT V	**7Hours**
Strong slot-and –filler structures: Conceptual dependency, scripts, CYC. Knowledge Representation Summary, Game Playing	

Textbook:

1. Elaine Rich,Kevin Knight, Shivashanka B Nair:Artificial Intelligence, Tata CGraw Hill 3rd edition. 2013

Reference book

1. Stuart Russel, Peter Norvig: Artificial Intelligence A Modern Approach, Pearson 3rd edition 2013.

Department: Information Science and Engineering	**Course Type:** Program Elective
Course Title: UI/UX Design	**Course code:** 18ISE558
L-T-P: 3-0-0	**Credits:** 03
Total contact hours: 39 hrs	**Duration of SEE:** 3 hrs
SEE Marks: 50	**CIE Marks:** 50

Pre-requisites:

NA

Course Outcomes:

Students will be able to

Cos	Course Outcomes Description	Blooms Level
1	Understand the principals of UX life cycle,	L2
2	Design user layout using pen and paper	L3
3	Design prototype for the given scenario	L3
4	Evaluate the user flow	L4
5	Understand the UX design guidelines.	L2
6	Design user screens for the given real world problem using SE-UX.	L3

Teaching Methodology:

- Blackboard teaching / PowerPoint presentations.
- Regular review of students by asking questions based on topics covered in the class.
- Design assignments using Figma.

Assessment Methods:

- Three internals, 30 Marks each will be conducted and the Average of best of two will be taken.
- Rubrics for evaluating the assignments -20 Marks.
- Final examination, of 100 Marks will be conducted and will be evaluated for 50 Marks.

CO to PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	03	02							2	2		02		03
CO2	03	02	03						02	02		02		03
CO3	03	02	03						02	02		02		03
CO4	03	02	03						02	02		02		03
18ISE558	03	02.2	2.8						02	02		02		03

Course Content

Unit-1	07 Hours
The Wheel- A Lifecycle Template: Introduction, A UX process lifecycle template, choosing a process instance for your project, the system complexity space, Meet the user interface team, Scope of UX presence within the team, more about UX lifecycles. **Design Thinking, Ideation, and Sketching:** Introduction, Design paradigms, Design thinking, Design perspectives, User personas, Ideation, Sketching, more about phenomenology	
Unit-2	**08 Hours**
UX Goals, Metrics, and Targets: Introduction, UX goals. **UX target tables, Prototyping:** Introduction, Depth and breadth of a prototype, Fidelity of prototypes, Interactivity of prototypes, Choosing the right breadth, depth, level of fidelity, and amount of interactivity, Paper prototypes, Advantages of and cautions about using prototypes, Prototypes in transition to the product, Software tools for prototyping	
Unit-3	**08 Hours**
Rapid Evaluation Methods: Introduction, Design walkthroughs and reviews, UX Inspection, our practical approach to UX Inspection, Questionnaires. **UX Methods for Agile Development:** Introduction, Basics of agile SE methods, Drawbacks of agile SE methods from the UX perspective, what is needed on the UX side, Problems to anticipate, synthesized approach to integrating UX	
Unit-4	**08 Hours**
UX Design Guidelines: Introduction, Using and interpreting design guidelines, Human memory limitations, Selected UX design guidelines and examples, Planning, Translation, Physical actions, Outcomes, Assessment, Overall, Conclusions **Connections with Software Engineering:** Introduction, Locus of influence in an organization, which scenario is right for you?	
Unit-5	**08 Hours**
Foundations for success in SE–UX development, The challenge of connecting SE and UX, The ripple model to connect SE and UX. **Making It Work in the Real World:** Putting it to work as a new practitioner, Be a smart UX practitioner, UX professionalism, Cost-justifying UX, UX within your organization, Parting words	

Text Book:

- Hartson, Rex, and Pardha S. Pyla. The UX Book: Process and guidelines for ensuring a quality user experience. Elsevier, 2012.

Reference Book:

- A Project Guide to UX Design: For user experience designers in the field or in the making (2nd. ed.). Russ Unger and Carolyn Chandler. New Riders Publishing, USA, 2012.
- The Elements of User Experience: User-Centered Design for the Web and Beyond, Second Edition Jesse James Garrett, Pearson Education. 2011.
- The Essential Guide to User Interface Design: An Introduction to GUI Design Principles and Techniques, Third Edition Wilbert O. Galitz , Wiley Publishing, 2007

Department: *Information Science and Engineering*	***Course Type:*** *Core*
Course Title*: Database Management System Lab*	***Course Code:18ISL57***
L-T-P:0-0-2	***Credits:1***
Total Contact Hours:26	***Duration of SEE:3***
SEE Marks*: 50*	***CIE Marks:*** *50*

Pre-requisites:
- Basic knowledge of Set Theory
- Basic Programming knowledge

Course Outcomes:
Students will be able to:

Cos	Course Outcome Description	Blooms Level
1	Implement SQL operations and constraints for the given scenario	L3
2	Implement Effective joins for the schema	L3
3	Develop PL/SQL procedure using suitable control structures	L3
4	Design and Develop Relational Database application	L4

Teaching Methodology:
- Black Board Teaching / Power Point Presentation
- Laboratory experiments

Assessment Methods:
- Rubrics for evaluating laboratory experiments for 30 marks
- Two internals, 20 Marks each will be conducted and average of two internals will be taken.
- Final examination of 50 Marks will be conducted.

Course Outcome to Program Outcome Mapping:

Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	3	2					2	2				3
CO2	3	2	3	2					2	2				3
CO3	3	2	3	2					2	2				3
CO4	3	3	2	2	2				2	2	2	2		3
18ISL57	3	2.25	2.75	2	2				2	2	2	2		3

COURSE CONTENT

DEMONSTRATION OF A Database connection :

A **Database connection** is a facility in computer science that allows client software to talk to database server software, whether on the same machine or not. A **connection** is required to send commands and receive answers, usually in the form of a result set.

Example: How to create a simple JDBC application. This will show you how to open a database connection, execute a SQL query, and display the results or using PHP which provides **MySQL connect** function to open a database connection.

1. TO IMPLEMENT DATA DEFINITION LANGUAGE

1.1. CREATE, ALTER, DROP, TRUNCATE

1.2. TO IMPLEMENT CONSTRAINTS.

1.2.1. (A). PRIMARY KEY, (B).FOREIGN KEY, (C). CHECK, (D). UNIQUE, (E).NULL, (F). NOT NULL , (G) . DEFAULT, (H). ENABLE CONSTRAINTS, (I). DISABLE CONSTRAINTS (J). DROP CONSTRAINTS

2. TO IMPLEMENTATION ON DML, TCL

2.1. (A).INSERT, (B).SELECT, (C).UPDATE, (D).DELETE, (E).COMMIT, (F).ROLLBACK, (G).SAVE POINT, (I). LIKE'%', (J).RELATIONAL OPERATOR. (K) AGGREGATE FUNCTIONS

3. TO IMPLEMENT NESTED QUERIES & JOIN QUERIES

3.1. IMPLEMENTATION OF NESTED QUERIES

3.2. (A) INNER JOIN (B).LEFT JOIN (C).RIGHT JOIN (D).FULL JOIN (E) SELF JOIN

4. TO IMPLEMENT VIEWS

5. TO IMPLEMENT TRIGGER

6. PL/SQL STORED PROCEDURE

A) PARAMETERS B) CURSOR B) PROCEDURES C) FUNCTIONS

7. TO DESIGN THE DATABASE AND IMPLEMENT .(MINI PROJECT).

Department: Information Science and Engineering	**Course Type:** Hybrid
Course Title: Java Application Development Lab	**Course code:** 18ISL58
L-T-P: 0-2-2	**Credits:** 02
Total contact hours: 26 hrs	**Duration of SEE:** 3 hrs
SEE Marks: 50	**CIE Marks:** 50

Pre-requisites:

Knowledge of any Object-oriented Programming concepts is helpful.

Course Outcomes:

Cos	Course Outcomes Description	Blooms Level
1	Illustrate core java programming concepts.	L3
2	Apply concepts of Packages and Exception Handling to implement the given problem.	L3
3	Apply concepts of Multi-Threading and Collection framework concepts for building robust programs.	L3
4	Design applications using AWT, Applets, and Swings; and handle system/user events appropriately.	L3
5	Develop database application using JDBC.	L4

Teaching Methodology:

- Blackboard teaching / PowerPoint presentations.
- Regular review of students by asking questions based on topics covered in the class.
- Course Project.

Assessment Methods:

- Three internals, 30 Marks each will be conducted and the Average of best of two will be taken.
- Rubrics for Course Project (20 Marks).
- Final examination, of 100 Marks will be conducted and will be evaluated for 50 Marks.

CO to PO Mapping:

	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO1 0**	**PO1 1**	**PO1 2**	**PSO 1**	**PSO 2**
CO1	03	02	03	2					2	2		**02**		03
CO2	03	02	03	2					02	02		02		03
CO3	03	02	03	2					02	02		02		03
CO4	03	02	03	2					02	02		02		03
CO5	03	03	02	2					02	02		02		03
18ISL5 8	03	02.2	2.8	2					02	02		02		03

Course Content

Unit-1	
Introduction to Java: Basics of Java, Java Keywords, Java Features, Java Coding conventions, Identifiers, First application, Data types in java, Flow control statements, Variables, Methods, Constructors, Instance blocks, Static blocks, Class, Objects, Inheritance, Polymorphism, Abstraction, Encapsulation, JVM architecture, Modifiers: Public , private , protected ,abstract ,fina l, static, Garbage Collector, Arrays	
Unit-2	
Packages, Interfaces, Wrapper Classes Packages: Predefined packages, User defined packages, importing packages; Interfaces: Interface declarations, Marker interface, Extends vs implements, Nested interface, Adaptor classes, Interface vs inheritance Wrapper Classes: Data types vs Wrapper classes, toStirng(), ParseXXX(), valueOf(), XXXValue().	
Unit-3	
Exception Handling Exception Handling Fundamentals, Exception Types, Uncaught Exceptions, Using try and catch, Displaying a Description of an Exception, Multiple catch Clauses, Nested try Statements, throw, throws, finally, Java's Built-in Exceptions, Creating Your Own Exception Subclasses	
Unit-4	
Multithreaded Programming, Collection Framework The Java Thread Model, Thread Priorities, Synchronization, Messaging, The Thread Class and the Runnable Interface, The Main Thread, Creating a Thread, Implementing Runnable, Extending Thread, Choosing an Approach, Creating Multiple Threads, Using isAlive( ) and join( ), Thread Priorities, Synchronization, Using Synchronized Methods, The synchronized Statement, Interthread Communication, Deadlock, Collections: ArrayList, LinkedList	
Unit-5	
Nested Classes, Swings, Introduction to JDBC: Nested Classes: Introduction Advantages of nested classes Nested classes vs inner classes Swings: Awt vs. swings, Advantages of swings, Different components of Swings(TextField ,Checkbox.etc), Event handling in Swings Introduction to JDBC: The Concept of JDBC; JDBC Driver Types; JDBC Packages; A Brief Overview of the JDBC process; Database Connection; Associating the JDBC/ODBC Bridge with the Database; Statement Objects; Using a Prepared Statement, Parameterized Statements, ResultSet; Metadata, Data types; Exceptions.	

Text Book:

1. Herbert Schildt: JavaTM: The Complete Reference Java, Tata McGraw Hill Publications, 8 edition (1 July 2017), ISBN-10: 1259002462, ISBN-13: 978-1259002465.
2. J2EE - The Complete Reference – Jim Keogh, Tata McGraw Hill, 2017.

Reference book

1. Sierra, Kathy, and Bert Bates. Head First Java: A Brain-Friendly Guide. "O'Reilly Media, Inc."

MOOC Reference

Programming in Java – NPTEL course https://onlinecourses.nptel.ac.in/noc19_cs07/preview

Department: *Information Science and Engineering*	***Course Type:*** *Core*
Course Title*: Software Engineering*	***Course Code:18IS61***
L-T-P:*4-0-0*	***Credits:*** *04*
Total Contact Hours:*52 hrs*	***Duration of SEE:*** *3 hrs*
SEE Marks*: 50*	***CIE Marks:*** *50*

Pre-requisites:

- Students should have knowledge of Programming Fundamentals

Course Outcomes:

Students will be able to:

COs	Course Outcome Description	Blooms Level
1	Understand the process models and Software development lifecycle	L2
2	Analyse the functional and non-functional requirements of the given use cases	L4
3	Illustrate the rapid software development methods for designing the software	L2
4	Develop test cases and validate using different testing strategies	L3
5	Understand the process of software project management	L2

Teaching Methodology:

- Black Board Teaching
- Power Point Presentation
- Case Study

Assessment Methods:

- Rubrics to evaluate Case Study for 20 marks
- Three internals, 30 Marks each will be conducted and the Average of best of two will be taken.
- Final examination of 100 Marks will be conducted and will be evaluated for 50 Marks.

Course Outcome to Programme Outcome Mapping:

Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3								2	2	3	1		3
CO2	3	3	2						2	2	3	1		3
CO3	3								2	2	3	1		3
CO4	3	2	3						2	2	3	1		3
CO5	3								2	2	3	1		3
18IS61	3	2.5	2.5						2	2	3	1		3

COURSE CONTENT

UNIT – I	**12**hours
Introduction: Professional and ethical responsibility. Software Quality Attributes, key challenges facing software engineering. **Socio-Technical systems**: Emergent system properties, systems engineering, organizations, people and computer systems, legacy system. **Software Processes:** Software Processes: Software Development Life Cycle (SDLC) Models, Process iteration, Process activities; The Rational Unified Process; Computer Aided Software Engineering.	
UNIT – II	09hours
Requirements: Software Requirements: Functional and Non-functional requirements; User requirements; System requirements, The software requirements document. Requirements Engineering Processes: Feasibility studies, Requirements elicitation and analysis, Requirements validation, Requirements managements;	
UNIT – III	11 hours
Critical Systems: Simple safety critical system, System dependability, availability and reliability, Safety and Security. **Software Design:** Architectural Design: Architectural design decisions, System organization, Modular decomposition styles, Control styles. **Rapid Software Development**: Agile methods; Extreme programming; Rapid application development, software prototyping.	
UNIT – IV	10 hours
Verification and validation: Planning, verification and validation, software inspections, automated static analysis. **Software Testing:** System testing, Component testing, Test case design, Test automation. **Software cost estimation:** software productivity, estimation techniques, algorithmic cost modelling, project duration and staffing.	
UNIT – V	10 hours
Software Maintenance and Software Project Management: Program evolution dynamics, software maintenance, evolution processes, legacy system evolution. Management activities, project planning, project scheduling, Risk management. **Process Improvement:** Process and Product quality, process classification, process measurement, process analysis and modelling, process change, CMMI process improvement framework.	

Text books:

1. Ian Somerville: Software Engineering, 8th Edition, Pearson Education, 2007

Reference books:

1. Roger.S.Pressman: Software Engineering-A Practitioners approach,7th Edition, McGraw Hill, 2007
2. PankajJalote: An Integrated Approach to Software Engineering, Wiley India, 2009
3. KassemSaleh,"Software Engineering", Cengage Learning
4. Pfleeger, Software Engineering, Macmillan Publication
5. Rajib Mall, Fundamentals of Software Engineering, PHI Publication

Department: *Information Science and Engineering*	***Course Type:*** *Core*
Course Title*: Data Mining*	***Course Code:****18IS62*
L-T-P:*4-0-0*	***Credits:*** *04*
Total Contact Hours:*52 hrs*	***Duration of SEE:*** *3 hrs*
SEE Marks*: 50*	***CIE Marks:*** *50*

Pre-requisites:

- Students should have knowledge of databases and how they are managed.
- Students should have basic knowledge about graphs, trees and mathematical concepts.

Course Outcomes:

Students will be able to:

Cos	Course Outcome Description	Blooms Level
1	Describe the basic concepts, challenges and tasks of data mining	L2
2	Apply proximity measures and classification algorithms on labeled dataset	L3
3	Perform association analysis for extracting patterns and rules from the dataset	L3
4	Apply clustering algorithms for the given problem	L3
5	Understand the applications of data mining	L2

Teaching Methodology:

- Black Board Teaching
- Power Point Presentation
- Programming Assignment

Assessment Methods:

- Open book test for 10 marks
- Rubrics to evaluate Programming Assignment for 10 marks
- Three internals, 30 Marks each will be conducted and the Average of best of two will be taken.
- Final examination of 100 Marks will be conducted and will be evaluated for 50 Marks.

Course Outcome to Programme Outcome Mapping:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3													3
CO2	3	2	3						1	1				3
CO3	3	2	3						1	1				3
CO4	3	2	3						1	1				3
CO5	3													3
18IS62	3	2	3						1	1				3

Course Content

UNIT I	12Hours
Introduction: What is Data Mining? Motivating Challenges; The origins of data mining; Data Mining Tasks. Types of Data; Data Quality, Data Cleaning, Measures of Similarity and Dissimilarity.	
UNIT II	**10Hours**
Classification: Preliminaries; General approach to solving a classification problem; Decision tree induction; Rule-based classifier; Nearest-neighbour classifier.	
UNIT III	**10 Hours**
Association Analysis–1: Problem definition, Frequent itemset generation; Rule Generation; Compact representation of frequent itemsets; Alternative methods for generating frequent item sets.	
UNIT IV	**10Hours**
Association Analysis – 2: FP-Growth algorithm, Evaluation of association patterns, Effect of skewed support distribution, Sequential patterns.	
UNIT V	**10 Hours**
Cluster Analysis: Overview, K-means, Agglomerative hierarchical clustering, DBSCAN, Outlier Analysis, Overview of Cluster Evaluation **Applications:** Data mining applications	

Text Books:

1. **Introduction to Data Mining**-Pang-NingTan, Michael Steinbach,Vipin Kumar, Pearson Education, 2007.
2. **Data Mining–Concepts and Techniques**-Jiawei Han and MichelineKamber, 2nd Edition, Morgan Kaufmann, 2006.

Reference Book

1. **Insight into Data Mining–Theory and Practice-** K.P.Soman, ShyamDiwakar, V.Ajay, PHI, 2006.

Department: Information Science and Engineering	**Course Type:** Core
Course Title: Cryptography and Network Security	**Course Code:**18IS63
L-T-P:4-0-0	**Credits:** 04
Total Contact Hours:52 hrs	**Duration of SEE:** 3 hrs
SEE Marks: 50	**CIE Marks:** 50

Pre-requisites:

- Fundamentals of algorithm design techniques, Computer Networks.

Course Outcomes:

Students will be able to:

Cos	Course Outcome Description	Blooms Level
1	Understand issues, models and devices of secure network and information services	L2
2	Apply Block cipher techniques to provide message confidentiality	L3
3	Apply symmetric and asymmetric key algorithms to preserve message authentication and confidentiality	L3
4	Understand secret key distribution and management techniques for secure data transmission	L2
5	Apply transport and application layer security techniques for secure transfer of data	L3

Teaching Methodology:

- Black Board Teaching
- Power Point Presentation

Assessment Methods:

- Network Security Mini Project considered for 20 marks
- Three internals, 30 Marks each will be conducted and the Average of best of two will be taken.
- Final examination of 100 Marks will be conducted and will be evaluated for 50 Marks.

Course Outcome to Programme Outcome Mapping:

Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3								2	2		2		3
CO2	3	2	3	2	2				2	2		2		3
CO3	3	2	3	2	2				2	2		2		3
CO4	3								2	2		2		3
CO5	3	2	3	2	2				2	2		2		3
18IS63	3	2	3	2	2				2	2		2		3

COURSE CONTENTS

UNIT – I: Introduction to Network Security	**10 hours**
Overview of Network Security: Computer security concepts, The OSI Security architecture, Security attacks, Security services, Security Mechanisms, A Model for Network Security, Intruders: Intrusion Detection, Password Management, Malicious Software, Firewalls: The Need for Firewalls, Firewall Characteristics, Types of Firewalls	
UNIT – II: Classical Encryption Techniques and Block Ciphers	**10 hours**
Classical Encryption Techniques: Symmetric Cipher Model, Substitution Techniques: Caesar Cipher, Monoalphabetic Ciphers, Playfair Cipher, Hill Cipher, Polyalphabetic Ciphers, One-time Pad, Transposition Techniques, Block Ciphers and the data encryption standard: Block Cipher principles, Data Encryption Standard	
UNIT – III: Advanced Encryption Standard and Pubic key cryptosystems	**11 hours**
Message Authentication Requirements, MAC Functions, Message Authentication Codes, Key Management and Distribution: Symmetric Key distribution using Symmetric Encryption, Advanced Encryption Standard: AES Structure, Pubic Key Cryptosystems - The RSA Algorithm,ECC, Diffie-Helman key exchange, SHA-512 Logic	
UNIT – IV: Key Distribution and Certificates	**10 hours**
Symmetric key distribution using asymmetric encryption, simple secret key distribution, secret key distribution with confidentiality and authentication, A hybrid scheme, distribution of public keys, public announcement of public keys, publicly available directory, public key authority. Public keys certificates, X-509 certificates. Certificates, X-509 version 3, public key infrastructure	
UNIT – V: Transport level and Email Security	**11 hours**
Secure Sockets Layer(SSL): SSL Architecture, SSL Record Protocol, Change Cipher Spec Protocol, Transport Layer Security(TLS): Version Number, Message Authentication Code, Pseudorandom Function, Alert Codes, Cipher Suites, Client Certificate Types, Certificate Verify and Finished Messages, Cryptographic Computations, Padding, A Pretty Good Privacy(PGP), S/MIME: RFC 5322 Multipurpose Internet Mail Extensions, S/MIME Messages, Kerberos 4 and 5.	

Textbooks:

- William Stallings: Cryptography and Network Security, Pearson 5th /6th edition, 2014.
- M. E. Whitman and Herbert J. Mattored, Principles of Information Security, Information Security Professional 4th edition, 2011.

Reference books:

- Alfred Basta and Wolf Halton, Computer Security Concepts, Issues and Implementation, Cengage Learning
- V k Pachghare: Cryptography and Information Security, 2008.

Department: *Information Science and Engineering*	***Course Type:*** Core Elective
Course Title*:* Client Server Computing	***Course Code:*** 18ISE641
L-T-P:3*-*0-0	***Credits:*** 03
Total Contact Hours: 39 hrs	***Duration of SEE:****3hrs*
SEE Marks*: 50*	***CIE Marks:*** *50*

Prerequisites:

- Computer networks I
- Computer networks II

Course Outcomes:
Students will be able to:

Cos	**Course Outcome Description**	**Blooms Level**
1	Describe different aspects of client-server-based communication.	L2
2	Design connection oriented and connectionless server-client based systems.	L3
3	Analyze real world problem and design client server software.	L4
4	Execute and demonstrate the functioning of connection oriented and Connectionless server-client based systems.	L3

Teaching Methodology:

- Black board teaching / PowerPoint presentations
- Course Project / Group Discussion / Seminars

Assessment Methods:

- Three internals, 30 Marks each will be conducted and the Average of best of two will be taken.
- Course Project for 20 marks.
- Rubrics for Course Project / Seminars.
- Final examination, of 100 Marks will be conducted and will be evaluated for 50 Marks.

Course Outcome to Programme Outcome Mapping:

Cos	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	**3**								**2**	**2**		**2**		**2**
CO2	**3**	**2**	**3**						**2**	**2**		**2**		**2**
CO3	**3**	**3**	**2**						**2**	**2**		**2**		**2**
CO4	**3**	**2**	**3**						**2**	**2**		**2**		**2**
18ISE641	**3**	**2.3**	**2.6**						**2**	**2**		**2**		**2**

COURSE CONTENT

UNIT – I	**08 hours**
The Clientserver Modeland SoftwareDesign: Introduction, Motivation, Technology and Concepts, Concurrent Processing in Client-Server software: Introduction, Concurrency in Networks, Concurrency in servers, Terminology and Concepts, An example of Concurrent Process Creation, Executing NewCode, ContextSwitching and Protocol Software Design, Concurrency and Asynchronous I/O,ProgramInterface to Protocols: Introduction, Loosely Specified Protocol Software Interface, Interface Functionality, Conceptual Interface Specification, System Calls, Two Basic Approaches toNetwork Communication <theBasic I/O Functions available in UNIXI/O with TCP/IP.	
UNIT – II	**08 hours**
The Socket Interface: Introduction, Berkley Sockets, Specifying a Protocol Interface, The socket Abstraction, Specifying an End Point Address, A Generic Address structure, Major System calls used with Sockets, Utility Routines for Integer Conversion ,Using Socket Calls in a Program, Symbolic Constants for Socket call Parameters, Algorithms and Issues in Client Software Design: Introduction, Learning Algorithms instead of Details, Client Architecture, Identifying the Location of a Server, Passing an Address Argument ,Looking up a Domain Name ,Looking up a well-known Port by Name, Port Numbers and Network Byte Order, Looking up a Protocol by a name, The TCP Client Algorithm, Allocating a Socket, Choosing a Local Protocol Port number,	
UNIT – III	**08 hours**
A fundamentals Problem in choosing a Local IPAddress, Connecting a TCP Socket to a server, Communicating with the Server using TCP <Reading a response from a TCP Connection. Closing a TCP Connection, Programming AUDP Client <Connected And Unconnected UDP Socket, Using Connect with UDP, Communicating with a Server using UDP, Closing a Socket that uses UDP, Partial Close for UDP, A Warning about UDP Unreliability, Example Client Software: Introduction, The Importance of Small Examples, Hiding Details, An Example Procedure Library for Client Programs, Implementation of Connect TCP, Implementation of Connect UDP, A Procedure That Forms, Connections, Using the Example Library, The DAY TIME Service, Implementation of TCP Client for DAY TIME, Reading from a TCP Connection, The Time Service, Accessing the TIME Service, The ECHO Service, A TCP Client for the ECHO Service, A UDP Client for the ECHO Service.	
UNIT – IV	**8 hours**
Algorithms and Issues in Server Software Design: Introduction, The Conceptual Server Algorithm, Concurrent Vs Iterative Servers, Connection Oriented Vs Connectionless, Access, Connection_Oriented Servers, Connection Oriented Vs Connectionless Access, Connection oriented Servers, Connectionless Servers, Failure, Reliability and Statelessness, Optimizing Stateless Servers, Four Basic Types of Servers, Request Processing Time, Interactive Server Algorithms, An/ interactive Connection-Oriented Server Algorithm, Binding to a Well Known Address using INADDR_ANY , Placing the socket in Passive Mode, Accepting Connections and using them. An Interactive Connectionless Server Algorithms, Master and Slave Processes, A Concurrent Connectionless Server Algorithm, A Concurrent Connection-Oriented Server Algorithm, Using separate Programs as Slaves, Apparent Concurrency using a single Process, When to use each Server Types, The Important Problem of Server Deadlock, Alternative Implementations, Iterative, Connectionless Servers(UDP): Introduction, Creating a Passive Socket, Process Structure, An example TIME Server. Iterative, Connection-Oriented Servers(TCP): Introduction, Allocating a Passive TCP Socket for the DAY TIME Service, Process Structure, An Example DAY TIME Server, Closing Connections, Connection Termination and Server Vulnerability.	
UNIT – V	**7 hours**
Concurrent, Connection–Oriented Servers(TCP): Introduction, Concurrent ECHO, Iterative VsConcurrent Implementations, Process Structure . An example Concurrent ECHO Server, Cleaning up Errant Processes.	

Text books:

1. Douglas E. Comer, DavidL. Stevens Internetworking with TCP /Ip–vol3. Client Server programming and Applications ,BSd Socket Version with ANSI c, 2^{nd}Edition ,Pearson 2001.

Department: *Information Science and Engineering*	***Course Type:*** *Core Elective*
Course Title: *Compiler Construction*	***Course Code:*** *18ISE642*
L-T-P*: 3-0-0*	***Credits:*** *03*
Total Contact Hours: *39 hrs*	***Duration of SEE****: 3 hrs*
SEE Marks: *50*	***CIE Marks:*** *50*

Prerequisites by Topic:

- Students should have knowledge of context free grammar and automata theory.
- Students should have knowledge of basic assembly level language instructions

Course Outcomes: At the end of the course, Students will be able to

Cos	Course Outcome Description	Blooms Level
1	Describe the different phases of compiler and working of lexical analyzer.	L2
2	Design the Top-Down and Bottom-Up parser for the given grammar.	L3
3	Apply the concept of Syntax Directed Translations in type checking and Intermediate code generation	L3
4	Describe the role of Runtime Environment in designing the compiler	L2
5	Describe the principles of designing a code generator	L2

Teaching Methodology:

- Black Board Teaching
- Tool based Problematic Assignment (JFLAP)

Assessment Methods

- Rubrics for Tool Based Assignment (20 Marks)
- Three internals, 30 Marks each will be conducted and the Average of best of two will be taken.
- Final examination, of 100 Marks will be conducted and will be evaluated for 50 Marks

Course Outcome to Programme Outcome Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PS02
CO1	3								1	1		2		3
CO2	3	2	3						1	1		2		3
CO3	3	2	3						1	1		2		3
CO4	3								1	1		2		3
CO5	3								1	1		2		3
18ISE642	3	2	3						1	1		2		3

Course Content

UNIT– I	6 Hours
Introduction to compilers: Language Processor, the structure of a compiler, Evolution of Programming language, Science of Building Compiler, Applications of Complier Technology, Programming Language Basics **Lexical Analysis**: **-** The role of lexical analyzer, Input Buffering, Specification of Tokens, Recognition of Tokens, **Syntax Analysis**: Introduction, Context-Free Grammar, Writing a Grammar.	
UNIT– II	**8 Hours**
Syntax Analysis: **Top–Down parsing**: Recursive Descent parsing, Computation of FIRST and FOLLOW, LL(1) Grammar, Non-Recursive Descent parsing, Error Recovery in Predictive Parsing. **Bottom-Up Parsing:** Reductions, Handle Pruning, Shift-Reduce Parsing, Shift-Reduce Parsing Conflicts, Simple LR.	
UNIT– III	**8 Hours**
More Powerful LR Parser: Canonical LR(1) items, Canonical LR(1) Parsing Table, Constructing LALR parsing Tables, Parser Generator. **Syntax – Directed Translation**: Syntax-Directed Definitions, Evaluation Order of SDD's, Application of SDT's	
UNIT– IV	**8 Hours**
Intermediate-Code Generation: Variants of Syntax Tree **,** Three-Address code. **Run-Time Environments**: Storage Organization, Stack Allocation of Space, Access to non-local data on stack, Heap management, Introduction to Garbage Collection	
UNIT– V	**7 Hours**
Code Generation: Issues in the design of code generator, The Target language, Basic blocks & flow graphs, Dag representation of basic blocks, A Simple Code Generator, Peephole optimization. Transformation of basic blocks, **Machine-Independent Optimizations: The principle sources of optimization:** Global common Sub-Expressions, Copy Propagation, Dead-Code Elimination.	

TEXT BOOKS

1. 'Compilers Principles, Techniques and Tools', 2006, Second Edition, Alfred V.Aho, Monica S. Lam, Ravi Sethi, Jeffrey D.Ullman,,Pearson Education/Prentice Hall of India.

REFERENCE BOOKS

1. AllenI.Holub, 'Compiler Design in C', PHI.
2. 'The Theory and Practical of Compiler Writing', Jean-Paul Trembly, Paul G. Sorenson, BS Publications
3. 'Compiler Construction: Principle and Practice 'by Louden, Cengage Publication

Department: Information Science and Engineering	**Course Type:** Program Elective
Course Title: **Cloud Computing**	**Course Code:18ISE643**
L-T-P: 3-0-0	**Credits:** 03
Total Contact Hours: 39hrs	**Duration of SEE:** 3 hrs
SEE Marks: 50	**CIE Marks:** 50

Pre-requisites:

Students are expected to have the following topical knowledge upon entering this course:

- Satisfactory understanding of Networking.
- Satisfactory understanding of Engineering Management.

Course Outcomes:

Students will be able to:

Cos	Course Outcome Description	Blooms Level
1	Understand the fundamental principles of cloud computing.	L2
2	Comprehend the cloud platform architecture	L3
3	Analyse Cloud Programming and Software Environments	L2
4	Understand the features of cloud security	L2
5	Demonstrate available features of cloud environment	L3

Teaching Methodology:

- Black Board Teaching / Power Point Presentation
- Course Project

Assessment Methods:

- Rubrics to evaluate Course Project for 20 marks.
- Three internals, 30 Marks each will be conducted and the Average of best of two will be taken.
- Final examination of 100 Marks will be conducted and will be evaluated for 50 Marks.

Course Outcome to Programme Outcome Mapping:

Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3												3	
CO2	3	2	3		3				2	2			3	
CO3	3												3	
CO4	3								2	2			3	
CO5	3	2	3		3								3	
18ISE643	3	2	3		3				2	2			3	

COURSE CONTENT

UNIT – I Virtual Machines and Virtualization of clusters and Data centres	**08** hours
Implementation Levels of Virtualization, Virtualization Structures/Tools and Mechanisms, Virtualization of CPU, Memory, and I/O Devices, Virtual Clusters and Resource Management, Virtualization for Data-Centre Automation	
UNIT – II Cloud Platform Architecture over Virtualized Data Centres	08 hours
Cloud Computing and Service Models, Data-Centre Design and Interconnection Networks, Architectural Design of Compute and Storage Clouds, Public Cloud Platforms: GAE, AWS, and Azure, Inter-cloud Resource Management, Cloud Security and Trust Management	
UNIT – III Service Oriented Architecture for Distributed Computing	08 hours
Services and Service-Oriented Architecture, Message-Oriented Middleware, Portals and Science Gateways, Discovery, Registries, Metadata, and Databases, Workflow in Service-Oriented Architectures	
UNIT – IV Cloud Programming and Software Environments	08 hours
Features of Cloud and Grid Platforms, Parallel and Distributed Programming Paradigms, Programming Support of Google App Engine, Programming on Amazon AWS and Microsoft Azure, Emerging Cloud Software Environments	
UNIT – V Security Engineering for Cloud	7 hours
Dynamic Security Properties Monitoring Architecture for Cloud Computing, The SeCA Model, Three Misuse Patterns for Cloud Computing, Security Risks in Cloud Computing, A Software Tool to support Risks Analysis about what Should or Should Not go to the Cloud	

Text books:

1. "Distributed and cloud computing" by Kai Hwang, Geoffrey C Fox and Jack J Dongarra
2. Security Engineering for Cloud Computing: Approaches and Tools: Approaches and Tools by Rosado, David G. IGI Global, 2012

Reference books:

1. IBM Bluemix: The Cloud Platform for Creating and Delivering Applications, August 2015, International Technical Support Organization**.**
2. Sultan Ullah, Zheng Xuefeng, "Cloud Computing: a Prologue", School of Computer and Communication Engineering,University of Science and Technology, Beijing China.

Department: Information Science and Engineering	**Course Type:** Core
Course Title: Blockchain Essentials & Dapps	**Course Code**: 18ISE644
L-T-P: 3-0-0	**Credits:** 03
Total Contact Hours: 39 hrs	**Duration of SEE:** 3 hrs
SEE Marks: 50	**CIE Marks:** 50

Prerequisites:

- Fundamentals of Distributed System

Course Outcomes:

Student will be able to

Cos	Course Outcome Description	Blooms Level
1	Illustrate the Blockchain terminologies with its applications	L2
2	Analyse the working principles of Blockchain	L2
3	Comprehend the principles and methodologies used in Bitcoin	L2
4	Create Ethereum Network, Wallets, Nodes, Smart contract & Dapps	L4
5	Develop Blockchain Based Application Architecture using Hyperledger	L3
6	Write the Smart Contract	L3

Teaching Methodology:

- Black board teaching/Power Point Presentations
- Hands-on Training
- Course Projects.

Assessment Methods:

- Three internals, 30Marks each will be conducted and the Average of best of two will be taken.
- Rubrics evaluation for the Case Presentation for 10 marks.
- Rubrics evaluation for the Project for 10 Marks
- Final examination, of 100 Marks will be conducted and will be evaluated for 50 Marks.

CO to PO Mapping:

PO	1	2	3	4	5	6	7	8	9	10	11	12	PSO1	PSO2
CO1	3													2
CO2	3	2												2
CO3	3	2												2
CO4	3	2	3		2		2		2	2		2		2
CO5	3	2	3		2		2		2	2		2		2
CO6	3	2	3		2		2		2	2		2		2
18ISE644	3	2	3		2		2		2	2		2		2

Course Content

UNIT-1	7 Hours
Distributed systems, CAP theorem, Byzantine Generals problem, Consensus. The history of blockchain, Introduction to blockchain, Various technical definitions of blockchains, Generic elements of a blockchain, Features of a blockchain, Applications of blockchain technology, Tiers of blockchain technology, Consensus in blockchain, CAP theorem and blockchain, Benefits and limitations of blockchain	
UNIT-II	**9Hours**
Decentralization using blockchain, Methods of decentralization, Blockchain and full ecosystem decentralization, Smart contract, Decentralized organizations, Decentralized autonomous organizations, Decentralized autonomous corporations, Decentralized autonomous societies Decentralized applications, Platforms for decentralization, Cryptographic primitives : Symmetric cryptography , Asymmetric cryptography , Public and private keys Hash functions: Compression of arbitrary messages into fixed length digest,Easy to compute, Pre-image resistance, Second pre-image resistance,Collision resistance,Message Digest (MD),Secure Hash Algorithms (SHAs), Merkle trees, Patricia trees, Distributed hash tables (DHTs), Digital signatures, Elliptic Curve Digital signature algorithm (ECDSA)	
UNIT-III	**8Hours**
Bitcoin, Bitcoin definition, Transactions, The transaction life cycle, The transaction structure, Types of transaction, The structure of a block , The structure of a block header, The genesis block, The bitcoin network, Wallets, Smart Contracts-History, Definition, Ricardian contracts, Smart contract templates, Oracles, Smart Oracles, Deploying smart contracts on a blockchain, The DAO	
UNIT-IV	**8 Hours**
Ethereum 101, Introduction, Ethereum clients and releases, The Ethereum stack, Ethereum blockchain, Currency (ETH and ETC), Forks, Gas, The consensus mechanism, The world state, Transactions, Contract creation transaction, Message call transaction, Elements of the Ethereum blockchain , Ethereum virtual machine (EVM), Accounts, Block, Ether, Messages, Mining, The Ethereum network Hands-on: Clients and wallets -Geth	
UNIT-V	**7 Hours**
Hyperledger, Hyperledger as a protocol, Fabric, Hyperledger Fabric, Sawtooth lake, Corda	

TEXTBOOKS

1. Imran Bashir. “Mastring BlockChain”, Packt

REFERENCEBOOKS

1. Mastering Bitcoin: Programming the Open Blockchain Paperback – 2017 by Andreas M. O’rielly

Department: *Information Science and Engineering*	***Course Type:*** Core Elective
Course Title: Exploratory Data Analysis	***Course Code:*** 18ISE645
L-T-P: 3-0-0	***Credits:*** 03
Total Contact Hours: 39hrs	***Duration of SEE:****3hrs*
SEE Marks*: 50*	***CIE Marks:*** *50*

Pre-requisites:

- Graduate Mathematics.
- Basic understanding of Probability and Statistics.
- Ability to comprehend and understand relational, and unstructured datasets.

Course Outcomes:

Students will be able to:

Cos	Course Outcome Description	Blooms Level
1.	Apply techniques to format data according to the algorithm/methods.	L3
2.	Generate graphical statistics from the given relational data	L3
3.	Apply a range of visualization techniques to summarize the given data	L3
4.	Calculate the level of correlation in data.	L3
5.	Analyze time-series data for survival calculations.	L3

Teaching Methodology:

- Black Board Teaching
- PowerPoint Presentation.
- Seminar

Assessment Methods:

- Rubrics to evaluate Course Project (depends on the course)
- Three internals, 30 Marks each will be conducted and the Average of best of two will be taken.
- Final examination of 100 Marks will be conducted and will be evaluated for 50 Marks.

CO-PO Mapping Table:

PO	1	2	3	4	5	6	7	8	9	10	11	12	PSO1	PSO2
CO1	3	2	3		2		2		2	2		2		2
CO2	3	2	3		2		2		2	2		2		2
CO3	3	2	3		2		2		2	2		2		2
CO4	3	2	3		2		2		2	2		2		2
CO5	3	2	3		2		2		2	2		2		2
18ISE645	3	2	3		2		2		2	2		2		2

COURSE CONTENT

UNIT I Getting Data Into Shape	08 Hours
Creating a Data Frame, Getting Information About a Data Structure, adding a Column to a Data Frame, Deleting a Column from a Data Frame, Renaming Columns in a Data Frame, Reordering Columns in a Data Frame, Getting a Subset of a Data Frame, Changing the Order of Factor Levels, Changing the Order of Factor Levels Based on Data Values, Changing the Names of Factor Levels, Removing Unused Levels from a Factor, Changing the Names of Items in a Character Vector, Recoding a Categorical Variable to Another Categorical Variable, Recoding a Continuous Variable to a Categorical Variable, Transforming Variables, Transforming Variables by Group, Summarizing Data by Groups, Summarizing Data with Standard Errors and Confidence Intervals, Converting Data from Wide to Long, Converting Data from Long to Wide, Converting a Time Series Object to Times and Values.	
UNIT – II Summarized Data Distributions	**08 Hours**
Making a Basic Histogram, Making Multiple Histograms from Grouped Data, Making a Density Curve, Making Multiple Density Curves from Grouped Data, Making a Frequency Polygon, Making a Basic Box Plot, Adding Notches to a Box Plot, Adding Means to a Box Plot, Making a Violin Plot, Making a Dot Plot, Making Multiple Dot Plots for Grouped Data, Making a Density Plot of Two-Dimensional Data	
UNIT – III Miscellaneous Graphs	**08 Hours**
Making a Correlation Matrix, Plotting a Function, Shading a Subregion Under a Function Curve, Creating a Network Graph, Using Text Labels in a Network Graph, Creating a Heat Map, Creating a Three-Dimensional Scatter Plot, Adding a Prediction Surface to a Three-Dimensional Plot, Saving a Three-Dimensional Plot, Animating a Three-Dimensional Plot, Creating a Dendrogram, Creating a Vector Field, Creating a QQ Plot, Creating a Graph of an Empirical Cumulative Distribution Function, Creating a Mosaic Plot, Creating a Pie Chart, Creating a Map, Creating a Choropleth Map, Making a Map with a Clean Background	
UNIT-IV Relationship between variables, and estimation	**08 hours**
Scatter Plots, Characterizing Relationships, Correlation, Covariance, Pearson's Correlation, Nonlinear Relationships, Spearman's Rank Correlation, Correlation and Causation, The Estimation Game, Guess the Variance, Sampling Distributions, Sampling Bias, Exponential Distributions, Classical Hypothesis Testing, Hypothesis Test, Testing a Difference in Means, Other Test Statistics, Testing a Correlation, Testing Proportions, Chi-Squared Tests, First Babies Again, Power, Replication,	
UNIT – V Survival analysis	**07 hours**
Survival Curves, Hazard Function, Estimating Survival Curves, Kaplan-Meier Estimation, The Marriage Curve, Estimating the Survival Function, Confidence Intervals, Normal Distributions, Sampling Distributions, Representing Normal Distributions, Central Limit Theorem, Testing the CLT, Applying the CLT, Correlation Test, Chi-Squared Test	

Textbooks:

1. Think Stats, 2nd Edition: Exploratory Data Analysis, Allen B. Downey, Year:2014, Pages:226, ISBN 13:978-1-49190-733-7
2. Chang W. R graphics cookbook: practical recipes for visualizing data. O'Reilly Media; 2018 Oct 25.

Reference books:

1. Making sense of Data: A Practical Guide to Exploratory Data Analysis and Data Mining, by Glenn J. Myatt.
2. Making Sense of Data II: A Practical Guide to Data Visualization, Advanced Data Mining Methods, and Applications, Glenn J. Myatt, and Wayne P. Johnson. Print ISBN:9780470222805 |Online ISBN:9780470417409 |DOI:10.1002/9780470417409.

Department: *Information Science and Engineering*	***Course Type:*** Core Elective
Course Title*:* Advanced Java	***Course Code:*** 18ISE646
L-T-P: 3-0-0	***Credits:*** 03
Total Contact Hours: 39hrs	***Duration of SEE:****3hrs*
SEE Marks*: 50*	***CIE Marks:*** *50*

Prerequisites:

- Fundamental knowledge of C++ and Core Java concepts are helpful

Course Outcomes:

Students will be able to:

Cos	Course Outcome Description	Blooms Level
1	Develop Client/Server-side solutions using servlets Competency: Develop the online shop Web Application.	L3
2	Design dynamic Web Pages using Java Server Pages.	L3
3	Apply the APIs related to Java Mail and Application Development to solve the given problem.	L3
4	Design the solutions for a given problem using Hibernate and Struts Framework.	L3
5	Design the solutions for a given application module using Spring Framework Competency: Design the solution using MVC Architecture	L3

Teaching Methodology:

- Blackboard teaching / PowerPoint presentations.
- Course Project

Assessment Methods:

- Three internals, 30 Marks each will be conducted and the Average of best of two will be taken.
- Rubrics for evaluating Course Project (20 Marks).
- Final examination, of 100 Marks will be conducted and will be evaluated for 50 Marks.

Course Outcome to Programme Outcome Mapping:

Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	**3**	**2**	**3**						**2**	**2**		**2**		**2**
CO2	3	2	3						**2**	**2**		**2**		**2**
CO3	3	2	3						**2**	**2**		**2**		**2**
CO4	3	2	3						**2**	**2**		**2**		**2**
CO5	3	2	3						**2**	**2**		**2**		**2**
18ISE646	**3**	**2**	**3**						**2**	**2**		**2**		**2**

COURSE CONTENT

UNIT – I	08 hours
Java Servlet Technology: What is a Servlet, Servlet Life Cycle Events, Handling Errors, Sharing Information, Initializing a Servlet, Writing Service methods, Invoking other web resources, Accessing the web resources, accessing the web context, maintaining client state, finalizing a servlet. Getting started with Web Applications, Web Application Life Cycle, Web Modules, Configuring Web Applications, Accessing Databases from web applications	
UNIT – II	08 **hours**
Implementing Event Handling and Wrappers in Servlets 3.1 ·Introducing Events ·Introducing Event Handling ·Working with the Types of Servlet Events ·Developing the online shop Web Application. Introducing wrappers, working with wrappers. Java Server Pages 2.3 and Expression Language 3.0 ·Introducing JSP Technology ·Listing Advantages of JSP over Java Servlet ·Exploring the Architecture of a JSP Page ·Describing the Life Cycle of a JSP Page.	
UNIT – III	**08 hours**
J2EE Examples Using the JMS API: A J2EE Application That Uses the JMS API with a Session Bean, Writing the Application Components, Creating and Packaging the Application, Deploying the Application, Running the Application Client, A J2EE Application That Uses the JMS API with an Entity Bean, Overview of the Human Resources Application, Writing the Application Components, Creating and Packaging the Application, Deploying the Application, Running the Application Client, An Application Example That Consumes Messages from a Remote J2EE Server, Overview of the Applications, Writing the Application Components, Creating and Packaging the Applications, Deploying the Applications, Running the Application Client	
UNIT – IV	**08 hours**
Working with Hibernate ·Introducing Hibernate ·Exploring the Architecture of Hibernate ·Downloading Hibernate. Exploring HQL ·Understanding Hibernate O/R Mapping ·Working with Hibernate ·Implementing O/R Mapping with Hibernate, Working with Struts 2 ·Introducing Struts 2 ·Understanding Actions in Struts 2 ·Dependency Injection and Inversion of Control.	
UNIT – V	07 **hours**
Introduction to Spring 3.0 ·Overview of Spring 3.0 ·Dependency Injection ·Spring Library ·The Spring Source Tool Suite ·Developing a Spring 3.0 Application ·Summary Spring Configuration ·Spring Containers ·Configuring Beans, Spring Web MVC ·Spring MVC Architecture ·Components of Spring MVC ·Request mapping ·Developing a Simple Spring MVC Application.	

Text books:

1. https://docs.oracle.com/javaee/1.4/tutorial/doc/

2. Core and Advanced Java, Black Book, by Dreamtech Press.

References:

1. Java Platform, Enterprise Edition The Java EE Tutorial Release 7 E39031-01,by Oracle.
2. The Complete Reference, Java seventh Edition, by Herbert Schildt.

Department: *Information Science and Engineering*	***Course Type:*** *Core*
Course Title*: Network Programming Lab*	***Course Code:****18ISL66*
L-T-P:*0-0-2*	***Credits:****1*
Total Contact Hours:*26*	***Duration of SEE:3*** *hrs*
SEE Marks*: 50*	***CIE Marks:*** *50*

Pre-requisite:

- Knowledge on Computer Networks
- NS 3.29 simulator, OS: Ubuntu/ Fedora Core, Wireshark.

Course Outcomes:
Students will be able to:

Cos	Course Outcome Description	Blooms Level
1	Apply Point-to-Point protocol in networks with a client and a server, many clients and a server, in star topology and bus topology.	L3
2	Apply NetAnim software to demonstrate the graphical scenario of the network models.	L3
3	Analyze packet parameters by creating trace file using Ascii trace metrics.	L4
4	Analyze the network performance by running Wireshark software with NS3.29 simulator.	L4
5	Analyse, by simulating the performance of UDP, TCP, Congestion avoidance and Congestion control protocols.	L4

Teaching Methodology:

i. Instruction classes
ii. Demonstrations

Assessment Methods:

i. Rubrics for evaluating the regular laboratory classes for 30 marks.
ii. Two internal assessment tests of 20 marks each and average of the two will be taken.
iii. Final examination is for 50 Marks.

Course Outcome to Programme Outcome Mapping:

Cos	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	PO12	PSO 1	PSO 2
CO1	3	2	3	2	3				1			2		2
CO2	3	2	3	2	3				1			2		2
CO3	3	2	3	2	3				1			2		2
CO4	3	3	2	2	3				1			2		2
CO5	3	3	2	2	3				1			2		2
18ISL66	3	2.4	2.6	2	3				1			2		2

The following experiments shall be conducted using NS3.29 built on Ubuntu /Fedora Core Operating System.

(1) Simulate peer-to-peer communication between a client and a server using Point-to-Point protocol. Apply NetAnim software to demonstrate the scenario graphically. Analyze packet parameters by creating trace file using Ascii trace metrics.

(2) Simulate peer-to-peer communication connecting three nodes considering one node as a central node acts as a server using Point-to-Point protocol. Apply NetAnim software to demonstrate the scenario graphically. Analyze packet parameters by creating trace file using Ascii trace metrics.

(3) Simulate to implement the star topology using Point-to-Point protocol. Apply NetAnim software to demonstrate the scenario graphically. Analyze packet parameters by creating trace file using Ascii trace metrics.

(4) Simulate to implement a bus topology using Point-to-Point protocol. Apply NetAnim software to demonstrate the scenario graphically. Analyze packet parameters by creating trace file using Ascii trace metrics.

(5) Simulate to implement the connection of 2 nodes and 4 router such that the extremes nodes act as client and server using Point-to-Point protocol. Apply NetAnim software to demonstrate the scenario graphically. Analyze packet parameters by creating trace file using Ascii trace metrics.

(6) Simulate peer-to-peer communication between a client and a LAN with 4 nodes. The LAN use CSMA during packet transmission. Apply NetAnim software to demonstrate the scenario graphically. Analyze packet parameters by creating trace file using Ascii trace metrics. Analyze the packet parameters using Wireshark software.

(7) Simulate packet flow in a network for UDP protocol. Apply NetAnim software to demonstrate the scenario graphically. Analyze packet parameters by creating trace file using Ascii trace metrics. Analyze the packet parameters using Wireshark software.

(8) Simulate TCP congestion control protocol. Analyze the congestion the congestion window for slow start phase, congestion avoidance phase and congestion detection phase.

Department: Information Science and Engineering	**Course Type: Laboratory**
Course Title: WEB PROGRAMMING LAB	**Course Code:**18ISL67
L-T-P: 0-2-2	**Credits: 2**
Total Contact Hours: 26 hrs	**Duration of SEE:**3 hrs
SEE Marks: 50	**CIE Marks:** 50

Pre-requisites:

- HTML, CSS

Course Outcomes:

Students will be able to:

Cos	Course Outcome Description	Blooms Level
1	Understand the core concepts of javascript and nodejs	L2
2	Apply appropriate features of javascript for building the web application	L3
3	Implement the web application using MVC architecture.	L3
4	Develop the fully functional real-time applications	L3

Teaching Methodology:

- Hands on training
- Capstone Projects
- Assignment

Assessment Methods:

- Rubric based evaluation of case- study for 10 marks.
- Rubric based evaluation of Assignment for 10 marks.
- Three internal evaluation tests of 30 Marks each will be conducted and the Average of best two will be taken.
- Semester End Examination for 100 Marks and calculated to a weightage of 50 Marks.

Mapping of Cos, Pos & PSO's:

Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3								2	2				2
CO2	3	2	3	2					2	2				2
CO3	3	2	3	2					2	2				2
CO4	3	2	3	2					2	2				2
18ISL67	3	2	3	2					2	2				2

COURSE CONTENTS

Module – I: Basics	
Introduction to ECMAScript, JavaScript basics, JavaScript first steps, JavaScript building blocks, Introducing JavaScript objects	
MODULE – II: Fundamentals	
Introduction, Grammar and types, Control flow and error handling, Loops and iteration, Functions, Expressions and operators, Numbers and dates, Text formatting, Regular expressions, Indexed collections, Keyed collections, Working with objects, Details of the object model, Using promises	
MODULE – III: Intermediate level	
Client-side web APIs**,** JavaScript data structures, Equality comparisons and sameness, Closures, Classes and object oriented feature	
MODULE – IV: NODEJS	
Introduction to Nodejs, Basic CRUD operations, REST API	
MODULE – V : PROJECT	
One capstone project (detailed) with few other real time applications in demo	

Reference:
https://developer.mozilla.org/en-US/docs/Web/JavaScript
Exploring ES6 – https://exploringjs.com/es6/
Eloquent JavaScript: 3rd Edition
https://eloquentjavascript.net/

Department: *Information Science and Engineering*	***Course Type: Laboratory***
Course Title*: Big Data Lab*	***Course Code:****18ISL68*
L-T-P:*0-2-2*	***Credits:****2*
Total Contact Hours: 26 *Hrs*	***Duration of SEE:****3 Hrs*
SEE Marks*: 50*	***CIE Marks:*** *50*

Course Outcomes:

Students will be able to:

Cos	Course Outcome Description	Blooms Level
1	Use MongoDB commands to implement given application.	L3
2	Apply commands to perform file operations on HDFS	L3
3	Develop map/reduce programs to perform basic operations on the given data set	L3
4	Use HiveQL to filter and aggregate the given data	L3

Teaching Methodology:

- Black Board Teaching / Power Point Presentation
- Laboratory experiments
- Hands On session
- Video Lecturing

Assessment Methods:

- Rubrics for evaluating laboratory experiments for 30 marks
- LA1 mini project on Mongodb for 10 Marks
- LA2 Programming assignment on Hadoop for 10Marks (Rubrics Based Evaluation)
- Final examination of 50 Marks will be conducted.

Course Outcome to Programme Outcome Mapping:

Cos	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	PO12	PSO 1	PSO 2
CO1	3	2	3	1	1				2	2	2			3
CO2	3	2	3	1	1				2	2				3
CO3	3	2	3	1	1				2	2	1			3
CO4	3	2	3	1	1				2	2				3
18ISL68	3	2	3	1	1				2	2	1			3

COURSE CONTENT

Execrcise-1: Mongo DB Use The mongo dB database to Exercise NOSQL Queries to Demonstrate the following with an USECASE 1) Create database 2) Basic CRUD operations 3) Aggregate functions 4) Pipeline 5) MapReduce	**CO1**
Execrcise-2: Map/Reduce Job Submission Start by reviewing HDFS. It found that the composition of HDFS is similar to your local Linux file system. Use the ***hadoopfs*** command while interacting with HDFS. 1. Review the commands available for the Hadoop Distributed File System: 2. Copy file foo.txt from local disk to the user's directory in HDFS 3. Get a directory listing of the user's home directory in HDFS 4. Get a directory listing of the HDFS root directory 5. Display the contents of the HDFS file user/fred/bar.txt 6. Move that file to the local disk, named as baz.txt 7. Create a directory called input under the user's home directory 8. Delete the directory input old and all its contents 9. Verify the copy by listing the directory contents in HDFS:	**CO2**
Execrcise-3: Map Reduce (Programs) Use the Hadoop framework to write a custom MapReduce program to perform word count operation on a custom data set .	**CO3**
Execrcise-4: Map Reduce (Programs) Use the Hadoop framework to write a MapReduce program to read a .csv file into a single node Hadoop cluster containing following fields Sl. No. CARD name UserName Amount withdrawn Implement the following, 1. Count the Number of transactions done by each user 2. Find the total amount of money transacted by each user	**CO3**
Execrcise-5: Extract facts using Hive : 1)Create and Drop Databases 2)Create, Alter , Drop Table 3)Built-in Operators 4)Built-in function 5)Views and Index 6)HIVEQL(select where , Select Order by, Select group by , Select Joins)	**CO4**

Department: Information Science and Engineering	**Course Type:** Core
Course Title: Scalable computing	**Course Code:18IS71**
L-T-P: 4-0-0	**Credits:** 04
Total Contact Hours: 52 hrs	**Duration of SEE:**3hrs
SEE Marks: 50	**CIE Marks:** 50

Pre-requisite:

- C/C++ programming
- Linux Development Environment
- Computer Organization & Architecture
- An introduction to database systems, covering SQL and related programming systems

Course Outcomes:
Students will be able to:

Cos	Course Outcome Description	Blooms Level
1	Describe the parallel computation, systems & Programming.	L2
2	Apply MPI programming models to build parallel applications.	L3
3	Develop parallel application using OpenMP programming directives.	L3
4	Design GPU based parallel application using OpenCL	L3
5	Design Big Data Application on SPARK cluster computing framework.	L3

Teaching Methodology:

- Black board teaching/Power Point Presentations
- Programming Assignment/ Course Project

Assessment Methods:

- Three internals, 30Marks each will be conducted and the Average of best of two will be taken.
- Rubrics for Programming assignment for 10 Marks
- Rubrics for Course Project for 10 Marks
- Final examination, of 100 Marks will be conducted and will be evaluated for 50 Marks.

Course Outcome to Programme Outcome Mapping:

Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3												3	
CO2	3	2	3						2	2		1	3	
CO3	3	2	3						2	2		1	3	
CO4	3	2	3						2	2		1	3	
CO5	3	3	2						2	2		1	3	
18IS71	3	2.25	2.75						2	2		1	3	

COURSE CONTENT

UNIT – I FOUNDATION	12 hours
Need of parallel programming, Overview of parallel systems – History of parallel computing, systems and programming, Modelling parallel computation, Multiprocessor models, The impact of communication, Parallel computational complexity, Laws and theorems of parallel computation.	
UNIT – II PROGRAMMING – MPI	**12 hours**
MPI processes and messaging – Distributed memory computers can execute in parallel, Programmer's view, Message passing interface, Basic MPI operations, Process-to-process communication, Collective MPI communication, Communication and computation overlap, How effective are your MPI programs?	
UNIT – III PROGRAMMING – OpenMP	**11 hours**
Shared memory programming model, Using OpenMP to write multithreaded programs-Compiling and running an OpenMP program, Monitoring an OpenMP program, Parallelization of loops- Parallelizing loops with independent iterations, Combining the results of parallel iterations, distributing iterations among threads, The details of parallel loops and reductions, Parallel tasks – Running independent tasks in parallel, Combining the results of parallel tasks.	
UNIT – IV PROGRAMMING – CUDA	**9 hours**
Introduction: The Benefits of Using GPUs, CUDA: A General-Purpose Parallel Computing Platform and Programming Model, A Scalable Programming Model. Programming Model: Kernels, Thread Hierarchy, Memory Hierarchy, Heterogeneous Programming, Asynchronous SIMT Programming Model, Compute Capability. CUDA Parallel Programming: Summing two vectors (CPU-GPU), Dot Product optimized.	
UNIT – V SPARK	**9 hours**
In-Memory Computing with Spark: Spark Basics, The Spark Stack, Resilient Distributed Datasets, Programming with RDDs, Interactive Spark Using Spark, Writing Spark Applications, Visualizing Airline Delays with Spark.	

Text books:

1. Trobec, R., Slivnik, B., Bulić, P., Robič, B, "Introduction to Parallel Computing" From Algorithms to Programming on State-of-the-Art Platforms, Springer, ISSN 1863-7310, ISBN 978-3-319-98832-0 https://www.springer.com/in/book/9783319988320
2. Bengfort, Benjamin, and Jenny Kim. Data analytics with Hadoop: an introduction for data scientists. " O'Reilly Media, Inc.", 2016. Data Analytics with Hadoop: An Introduction for Data Scientists | Benjamin Bengfort, Jenny Kim | download (1lib.in)
3. Programming Guide: CUDA Toolkit Documentation (nvidia.com)
4. CUDA by Example: An Introduction to General-Purpose GPU Programming (unimi.it)

Department: Information Science and Engineering	**Course Type**: Core
Course Title: Machine Learning	**Course Code:** 18IS72
L-T-P:4-0-0	**Credits:**04
TotalContactHours:52 hrs	**Duration of SEE:**3hrs
SEE Marks:50	**CIE Marks:**50

Prerequisite:

- Linear Algebra, Calculus, Data Mining
- Any programming language like Python, Java.

Course Outcomes:

After the course completion, students will be able to:

Cos	Course Outcome Description	Blooms Level
1	Understand the fundamental concepts of machine learning.	L2
2	Design a simple Learning System using Find-S and Candidate elimination algorithms.	L3
3	Apply Linear & Logistic regression to solve continuous and binary classification problems.	L3
4	Understand the working of Artificial Neural Networks, Support Vector Machine, and Ensemble methods for classification.	L2
5	Apply Bayesian probabilistic models for classification tasks.	L3
6	Apply Principal Component Analysis for dimensionality reduction	L3

Teaching Methodology:

- Black board teaching
- Power Point presentations
- Executable Codes/ Live Demonstration

Assessment Methods:

- Programming assignment for 20 marks.
- Three internals, 30 Marks each will be conducted and the Average of best of two will be taken.
- Final examination, of 100 Marks will be conducted and will be evaluated for 50 Marks.

Course Outcome to Programme Outcome Mapping:

PO	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**PSO1**	**PSO2**
CO1	3													3
CO2	3	2	3											3
CO3	3	2	3											3
CO4	3													3
CO5	3	2	3											3
CO6	3	2	3											3
18IS72	3	2	2	1	1	1			1	1		1		3

COURSE CONTENTS

UNIT – I	10 hours
Introduction: Learning problems, Designing a learning system, perspectives and issues in Machine Learning. Concept Learning Task, Concept Learning as search, (Chapters 1.1, 1.2, 1.3, 2.1, 2.2, 2.3 from TextBook-1) Model Evaluation: Model Evaluation Techniques: Holdout, Cross-Validation; Model Evaluation Metrics: Classification Evaluation: Confusion Matrix, Accuracy, Sensitivity, Specificity Gain, Lift, K-S, and ROC Charts. Area Under the Curve. Regression Evaluation: Root Mean Square Error, RSE, MAE, RAE, R2 (TextBook-2). Feature Engineering for Machine Learning: Machine Learning Pipeline, Binarization, Quantization/Binning, Log Transformation, Feature Scaling/Normalization, Interaction features, and feature selection. (Chapter-2 from TextBook-3)	
UNIT – II	**12 hours**
Introduction to Linear Regression **(Textbook-4)**. Introduction to logistic regression: Logistic regression. Cost function. (**Textbook-5).** Artificial neural networks: Biological Motivation, Artificial Neural Networks representations, appropriate problems for neural network learning, Perceptron's: Representational power of Perceptron's, The Perceptron training rule. **(Chapters 4.1, 4.2, 4.3, 4.4.1, 4.4.2 from Texbook-1)**	
UNIT – III	**11 hours**
Bayesian Learning: Introduction, Bayes theorem – An Example; Bayes theorem and concept learning: Brute-Force Bayes Concept Learning, MAP Hypotheses and Consistent Learners; Bayes optimal classifier; naive Bayes classifier. **(Chapters 6.1, 6.2, 6.3, 6.7, 6.9 from Textbook-6)** Bayesian belief networks – Model Representation, Model Building, Example, Characteristics. **(Chapters 5.3.5 from Textbook-6)**	
UNIT – IV	**10 hours**
Principal Component Analysis: Introduction, Properties of Principal Component, Implementing PCA on a 2-D Dataset, Applications of PCA. (Textbook-7)Support Vector machine: Maximum margin hyperplanes: Rationale for Maximum Margin Linear SVM: Separable Case: Linear Decision Boundary, Margin of a Linear Classifier. Nonlinear SVM: Attribute Transformation, Kernel Trick, Characteristics of SVM. (Chapters 5.5 from Texbook-6)	
UNIT – V	**8 hours**
Ensemble Methods: Rationale for Ensemble Method, Methods for constructing an Ensemble Classifier, Bias Variance Decomposition, Bagging, Boosting, Random Forest. **(Chapters 5.6 from Texbook-6)**	

Textbooks:

1. Tom M. Mitchell, "Machine Learning", by McGraw Hill, 2013.
2. https://www.saedsayad.com/model_evaluation.htm (Model Evaluation)
3. Amanda Casari, Alice Zheng, "Feature Engineering for Machine Learning", O'Reilly, 2018. (Feature Engineering)
4. Linear Regression OnlineStatBook by David M. Lane http://onlinestatbook.com/2/regression/intro.html
5. Logistic regression, online material, available at https://www.analyticsvidhya.com/blog/2015/11/beginners-guide-on-logistic-regression-in-r/
6. Introduction to Data Mining-Pang-Ning Tan, Michael Steinbach, Vipin Kumar, Pearson Education, 2007.
7. Tutorial on Principal Component Analysis, Online material available at https://www.dezyre.com/datascience-in-python-tutorial/principal-component-analysis-tutorial

Reference Books:

1. Gareth James, Daniela Witten, Trevor Hastie and Robert Tibshirani, "An Introduction to Statistical Learning: with Applications in R", Springer, 2016.
2. Trevor Hastie, Robert Tibshirani and Jerome Friedman, "The Elements of Statistical Learning: Data Mining, Inference, and Prediction", Springer, 2016
3. Andreas Muller, "Introduction to Machine Learning with Python: A Guide for Data Scientists", Shroff/O'Reilly; First edition (2016)

Department: Information Science and Engineering	**Course Type: Core**
Course Title: Software Project Management	**Course Code:** 18IS73
L-T-P: 3-0-0	**Credits:** 03
Total Contact Hours: 39 hrs	**Duration of SEE:**3hrs
SEE Marks: 50	**CIE Marks:** 50

Pre-requisite:

- Software concepts
- Programming languages such as C/C++ and software engineering

Course Outcomes:

Students will be able to:

Cos	Course Outcome Description	Blooms Level
1	Understand software project management issues and learn project planning.	L2
2	Identify the critical path and critical activities using activity-on-arrow networks to estimate the cost of the project.	L3
3	Analyse risks associated with the given project using PERT technique.	L3
4	Understand the techniques for resources allocation and cost monitoring.	L2
5	Describe the techniques of software configuration management and quality assurance policies for a project.	L2

Teaching Methodology:

- Blackboard teaching
- PowerPoint presentations (if needed)
- Case Study

Assessment Methods:

- Three internals, 30Marks each will be conducted and the Average of best of two will be taken
- Rubrics for Case Study-20marks
- Final examination, of 100 Marks will be conducted and will be evaluated for 50 Marks.

Course Outcome to Programme Outcome Mapping:

Cos	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2	PSO 1	PSO 2
CO1	3								2	2	3	1		3
CO2	3	3	2						2	2	3	1		3
CO3	3	3							2	2	3	1		3
CO4	3								2	2	3	1		3
CO5	3								2	2	3	1		3
18IS73	3	2.5	2.						2	2	2.4	1		3

COURSE CONTENT

UNIT – I	8 hours
Introduction to software project management: Introduction, Why is software project management important?, What is a project? , Software projects versus other types of project, Contract management and technical project management, Activities covered by software project management, Plans, methods and Methodologies, Some ways of categorizing software projects, Stakeholders, Setting objectives, The business case, Project success and failure, What is management?, Management control. Selection of an appropriate project approach: Introduction , Build or buy?, Choosing methodologies and Technologies, Choice of process models, Structure versus speed of delivery, The waterfall model, The spiral model, Software prototyping, Other ways of categorizing, Prototypes, Incremental delivery, Agile methods, Atern/Dynamic Systems, Development Method, Extreme programming (XP), Managing iterative processes, Selecting the most appropriate process model.	
UNIT – II	8 **hours**
Project Evaluation – A business case , project portfolio management, Evaluation of individual projects, Cost-benefit evaluation techniques .Software effort estimation: Introduction, Where are estimates done? , Problems with over- and underestimates, the basis for software estimating, Software effort estimation techniques, bottom -up estimating, the top-down approach and parametric models, Expert judgment, estimating by analogy. Activity planning: Introduction, The objectives of activity planning, When to plan, Project schedules, Projects and activities, Sequencing and scheduling activities, Network planning models, Formulating a network model, Adding the time dimension, The forward pass, The backward pass, Identifying the critical path, Activity float, Shortening the project duration, Identifying critical activities, Activity-on-arrow networks.	
UNIT – III	8 **hours**
Risk management: Introduction, Risk, Categories of risk, A framework for dealing with risk, Risk identification, Risk assessment, Risk planning, Risk management, Evaluating risks to the schedule, Applying the PERT technique, Monte Carlo simulation, Critical chain concepts. Resource allocation: Introduction, The nature of resources, Identifying resource requirements, Scheduling resources, Creating critical paths, Counting the cost, Being specific, Publishing the resource schedule, Cost schedules, The scheduling sequence.	
UNIT – IV	**7 hours**
Monitoring and control: Introduction, Creating the framework, Collecting the data, Visualizing progress, Cost monitoring, Earned value analysis, Prioritizing monitoring, Getting the project back to target, Change control. Quality management: Quality concepts, software quality assurance, software reviews, formal technical reviews, formal approaches to software quality assurance, statistical software quality assurance, software reliability, The ISO 9000 quality standards, The SQA plan.	
UNIT – V	8 **hours**
Software configuration management: SCM scenario, elements of configuration management system, baselines, software configuration items, The SCM repository- the role of the repository, general features and content, SCM features, the SCM process- identification of objects in the software configuration, version control, change control, configuration audit, status reporting, configuration management for WebApps- dominant issues, WebApp configuration objects, content management, change management, version control, auditing and reporting. Reengineering: Business process reengineering, software reengineering, reverse engineering, restructuring, forward engineering, the economics of reengineering.	

Text books:

1. Bob Hughes and Mike Cotterell, Software project management, 5th edition, McGraw-Hill Higher Education, 2010,
ISBN-13:978-0-0-070653.
2. Roger S Pressman, Software Engineering: A Practitioner's Approach, 7th edition , McGraw-Hill Higher Education, ISBN:0072496681

Reference books:

1. Walker Royce, Software project management- A unified framework, 7th edition, 2012 by Pearson education,
ISBN 978-81-7758-378-6.
2. Bob Hughes and Mike Cotterell, Software Project Management, 2nd edition, McGraw-Hill Higher Education

Department: Information Science and Engineering	**Course Type**: Program Elective
Course Title: Introduction to Game Theory	**Course Code:** 18ISE741
L-T-P:3-0-0	**Credits:**03
TotalContactHours:39 hrs	**Duration of SEE:**3hrs
SEE Marks:50	**CIE Marks:**50

Pre-requisite:

- Software concepts
- Programming languages such as C/C++ and software engineering

Course Outcomes:

Students will be able to:

Cos	Course Outcome Description	Blooms Level
1	Understand the basic principles of game theory.	L2
2	Identify strategic situations and represent them as games	L3
3	Solve simple games using various techniques	L3
4	Analysis of situations from the perspective of strategic interaction	L4
5	Ability to apply basic mathematical concepts of Game Theory to the real-world problems.	L4

Teaching Methodology:

• Black board teaching

• Power point presentation

• Practical component

Assessment Methods:

• Three internals, 30 Marks each will be conducted and the Average of best of two will be taken.

• Rubrics for evaluation of Course Project.

• LA1 and LA2 – Course Project

• Final examination, of 100 Marks will be conducted and will be evaluated for 50Marks.

Course Outcome to Programme Outcome Mapping:

Cos	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2	PSO 1	PSO 2
CO1	**3**													**2**
CO2	**3**	**3**												**2**
CO3	**3**	**3**	**3**	**2**	**1**				**2**	**1**		**1**		**2**
CO4	**3**	**3**	**3**	**2**	**1**				**2**	**1**		**1**		**2**
CO5	**3**	**3**	**3**	**2**	**1**				**2**	**1**		**1**		**2**
18ISE7 41	**3**	**3**	**3**	2	1				**2**	**2**		**1**		**2**

COURSE CONTENTS

UNIT – I	08 hours
Introduction: What is game theory? An outline of the history of game theory, John von Neumann, the theory of rational choice, Coming attractions, Nash Equilibrium: Theory: Strategic games, the Prisoner's Dilemma, Bach or Stravinsky? Matching Pennies, the Stag Hunt, Nash equilibrium, Examples of Nash equilibrium, best response functions, Dominated actions, Equilibrium in a single population: symmetric games and symmetric equilibria.	
UNIT – II	**08 hours**
Mixed Strategy Equilibrium: Introduction, Strategic games in which players may randomize, Mixed strategy Nash equilibrium, dominated actions, Pure equilibria when randomization is allowed, Illustration: expert diagnosis, Equilibrium in a single population, Illustration: reporting a crime, The formation of players' beliefs, Extension: Finding all mixed strategy Nash equilibria, Extension: Mixed strategy Nash equilibria of games in which each player has a continuum of actions.	
UNIT – III	**08 hours**
Extensive Games with Perfect Information: Introduction, Extensive games with perfect information, Strategies and outcomes, Nash equilibrium, Subgame perfect equilibrium, Finding subgame perfect equilibria of finite horizon games: backward induction, The ultimatum game and the holdup game, Experiments on the ultimatum game, Stackelberg's model of duopoly, Buying votes, A race, Allowing for simultaneous moves, More experimental evidence on subgame perfect equilibrium.	
UNIT – IV	**8 hours**
Coalitional Games and the Core: Coalitional games, The core, Illustration: ownership and the distribution of wealth, Illustration: exchanging homogeneous horses, Illustration: exchanging heterogeneous houses, Illustration: voting, Illustration: matching, Matching doctors with hospitals, Bayesian Games: Introduction, Motivational examples, General definitions, Two examples concerning information, Illustration: Cournot's duopoly game with imperfect information, Illustration: auctions, Auctions of the radio spectrum, Illustration: juries.	
UNIT – V	**7 hours**
Repeated games: The Prisoner's Dilemma, The main idea, Preferences, Infinitely repeated games Strategies, Some Nash equilibria of the infinitely repeated Prisoner's Dilemma, Nash equilibrium payoffs of the infinitely repeated Prisoner's Dilemma when the players are patient, Subgame perfect equilibria and the one-deviation property, Some subgame perfect equilibria of the infinitely repeated Prisoner's Dilemma, Nash equilibria of general infinitely repeated games, Subgame perfect equilibria of general infinitely repeated games, Finitely repeated games.	

Text book:

- Osborne, Martin J. An introduction to game theory. Vol. 3, no. 3. New York: Oxford university press, 2004.

Department: Information Science and Engineering	**Course Type:** Program Elective
Course Title: Natural Language Processing	**Course Code:18ISE742**
L-T-P:3-0-0	**Credits:** 03
Total Contact Hours:39 hrs	**Duration of SEE:** 3 hrs
SEE Marks: 50	**CIE Marks:** 50

Pre-requisites:

- Intermediate proficiency in Python programming
- Basics of machine learning

Course Outcomes:
Students will be able to:

Cos	Course Outcome Description	Blooms Level
1	Understand the wide spectrum of problem statements, tasks, and solution approaches within NLP	L2
2	Gain experience in implementing and evaluating different NLP applications and applying machine learning and deep learning methods for this process.	L3
3	Evaluate various algorithms and approaches for the given task, dataset, and stage of the NLP product.	L3
4	Understand the BERT Model	L2

Teaching Methodology:

- Power Point Presentation / Demos
- Course Project

Assessment Methods:

- Rubrics to evaluate Course Project for 20 marks
- Three internals, 30 Marks each will be conducted and the Average of best of two will be taken.
- Final examination of 100 Marks will be conducted and will be evaluated for 50 Marks.

Course Outcome to Programme Outcome Mapping:

Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2												3
CO2	3	2		1									2	3
CO3	3	2	2	1	2			2	1				2	3
CO4	3	3		2		2	2	2	1	1			2	3
18ISE742	3	2	2	2	2	2	2	2	1	1			2	3

COURSE CONTENT

UNIT – I	**08** hours
NLP: A Primer, NLP in the Real World, NLP Tasks, What Is Language?, Building Blocks of Language, Why Is NLP Challenging?, Machine Learning, Deep, Learning, and NLP: An Overview, Approaches to NLP, Heuristics-Based NLP, Machine Learning for NLP, Deep Learning for NLP, Why Deep Learning Is Not Yet the Silver Bullet for NLP, NLP Pipeline	
UNIT – II	08 hours
Text Representation, Vector Space Models, Basic Vectorization Approaches, One-Hot Encoding, Bag of Words, Bag of N-Grams, TF-IDF, Distributed, Representations, Word Embeddings, Going Beyond Words, Distributed, Representations Beyond Words and Characters, Universal Text Representations, Visualizing Embeddings, Handcrafted Feature Representations	
UNIT – III	07 hours
Text Classification, Applications, A Pipeline for Building Text Classification Systems, One Pipeline, Many Classifiers, Using Neural Embeddings in Text Classification, Deep Learning for Text Classification, Interpreting Text Classification Models, Learning with No or Less Data and Adapting to New Domains	
UNIT – IV	08 hours
Information Extraction, IE Applications, IE Tasks, The General Pipeline for IE, Keyphrase Extraction, Implementing KPE, Practical Advice, Named Entity Recognition, Building an NER System, NER Using an Existing Library, NER Using Active Learning, Practical Advice, Named Entity Disambiguation and Linking, NEL Using Azure API, Relationship Extraction, Approaches to RE, RE with the Watson API, Other Advanced IE Tasks, Temporal Information Extraction, Event Extraction, Template Filling, Chatbots	
UNIT – V	08 hours
Section 1 - Starting Off with BERT, A Primer on Transformers, Understanding the BERT Model, Getting Hands-On with BERT	

Text books:

- **Practical Natural Language Processing**

  A Comprehensive Guide to Building Real-World NLP Systems - 2020

  Sowmya Vajjala, Bodhisattwa Majumder, Anuj Gupta, and Harshit Surana

  - Getting Started with Google BERT

  Build and train state-of-the-art natural language processing models using BERT
  Sudharsan Ravichandiran

Reference books:

1. Tanveer Sidiqui, U.S Tiwary, "Natural Language Processing & Information Retrieval", Oxford University Press, 2008
2. Anne Kao & Stephen R Poteel, "Natural Language & Text Mining", Springer- Verlag , 2007

Department: Information Science and Engineering	**Course Type:** Program Elective
Course Title: Object Oriented Modelling and Design	**Course Code:18ISE743**
L-T-P:3-0-0	**Credits:** 03
Total Contact Hours:39 hrs	**Duration of SEE:** 3 hrs
SEE Marks: 50	**CIE Marks:** 50

Pre-requisites:

1. Programming Fundamentals
2. Object Oriented Programming languages

Course outcomes:

Students will be able to:

Cos	Course Outcome Description	Blooms Level
1	Apply advanced structural and behavioural UML modeling to solve software intensive problems	L3
2	Model the OOAD aspects through Unified Modeling Language (UML) for the given problem.	L3
3	Analyse the requirements of the problem and design solutions to complex problems Using UML notations	L4
4	Understand the concepts of Design patterns	L2

Teaching Methodology:

- Blackboard teaching
- PowerPoint presentations (if needed)
- Regular review of students by asking questions based on topics covered in the class
- Case Study

Assessment Methods:

- Two programming assignments 10 Marks each.
- Three internals, 30 Marks each will be conducted and the Average of best of two will be taken.
- Rubrics for programming assignments
- Final examination, of 100 Marks will be conducted and will be evaluated for 50 Marks.

Course Outcome to Programme Outcome Mapping:

PO	PO 1	PO 2	PO3	PO 4	PO 5	PO6	PO 7	PO8	PO 9	P O 10	PO1 1	PO 12	PSO 1	PS O2
CO1	**3**	**3**	**3**		**2**				**2**	**1**		**1**		**3**
CO2	**3**	**3**	**3**		**2**				**2**	**1**		**1**		**3**
CO3	**3**	**3**	**3**		**2**				**2**	**1**		**1**		**3**
CO4	**3**													**3**
18ISE743	**3**	**3**	**3**		**2**				**2**	**1**		**1**		**3**

Course Content

UNIT – I	08 hours
Introduction: Modeling Concepts, What is Object Orientation? What is OO development? OO themes; Evidence for usefulness of OO development; OO Behavior history. Modeling as Design Technique: Modeling; abstraction; The three models Class Modeling Class Modeling: Object and class concepts; Link and associations concepts; Generalization and inheritance; A sample class model; Navigation of class models. Advanced object and class concepts; Association ends; N-ary associations; Aggregation; Abstract classes; Multiple inheritance; Metadata; Reification; Constraints; Derived data; Packages.	
UNIT – II	**08 hours**
State Modeling: Events, States, Transitions and Conditions; State diagrams; State diagram behavior; Practical tips. Advanced State Modeling: Nested state diagrams; Nested states; Signal generalization; Concurrency; A sample state model; Relation of class and state models; Practical tips. Interaction Modeling: Use case models; Sequence models; Activity models; Use case relationships; Procedural sequence models; Special constructs for activity models.	
UNIT – III	**08 hours**
Overview of system design; Estimating performance; Making a reuse plan; Breaking a system in to sub-systems; Identifying concurrency; Allocation of sub-systems; Management of data storage; Handling global resources; Choosing a software control strategy; Handling boundary conditions; Setting the trade-off priorities; Common architectural styles; Architecture of the ATM system as the example. Class Design, Implementation Modeling:- Class Design: Overview of class design; Bridging the gap; Realizing use cases; Designing algorithms; Recursing downwards, Refactoring; Design optimization; Reification of behavior; Adjustment of inheritance; Organizing a class design	
UNIT – IV	**08 hours**
Implementation Modeling: Overview of implementation; Fine-tuning classes; Fine-tuning generalizations; realizing associations. Design Patterns what is a pattern and what makes a pattern? Pattern categories; Relationships between patterns; Pattern description. Structural Decomposition: Whole-Part; Organization of Work: Master-Slave; Management: Command processor; View handler; Communication: Forwarder-Receiver; Client-Dispatcher-Server; Publisher-Subscriber.	
UNIT – V	**07 hours**
Patterns and software architecture: Introduction to Idioms, Idioms style, pattern classification , pattern selection, Pattern Systems as Implementation Guidelines, Patterns in Software Architecture, Enabling Techniques for Software Architecture, Non-functional Properties of Software Architecture, Pattern-Mining, Pattern Organization and Indexing, Formalizing Patterns	

Text Books

1. Michael Blaha, James Rumbaugh: Object-Oriented Modeling and Design with UML, 2nd Edition, Pearson Education, 2005.
2. Frank Buschmann, Regine Meunier, Hans Rohnert, Peter Sommerlad, Michael Stal: Pattern-Oriented Software Architecture, A System of Patterns, Volume 1, John Wiley and Sons, 2006

Reference books

1. Grady Booch et al: Object-Oriented Analysis and Design with Applications, 3rd Edition, Pearson, 2007.
2. Mark Priestley: Practical Object-Oriented Design with UML, 2nd Edition, Tata McGraw-Hill, 2003.
3. K. Barclay, J. Savage: Object-Oriented Design with UML and JAVA, Elsevier, 2008. 4. Booch, G., Rumbaugh, J., and Jacobson, I.: The Unified Modeling Language User Guide, 2nd Edition, Pearson, 2005

Department: Information Science and Engineering	**Course Type:** Core Elective
Course Title: Cyber Security	**Course Code:** 18ISE744
L-T-P: 3-0-0	**Credits:** 03
Total Contact Hours: 39hrs	**Duration of SEE:**3hrs
SEE Marks: 50	**CIE Marks:** 50

Prerequisites:

- Required Knowledge of any Operating System, Networking and Digital Security Issues

Course Outcomes:

Students will be able to:

Cos	Course Outcome Description	Blooms Level
1	Understand the basic concepts of Cybersecurity, Cryptography and Firewalls.	L2
2	Analyse the attacker motivation and techniques employed to exploit vulnerabilities in cyberspace.	L4
3	Apply the mitigation techniques to solve the threats posed by cybersecurity attacks.	L3
4	Design a cyber strategy to prevent and recover from cybersecurity attacks.	L3

Teaching Methodology:

- Blackboard teaching / PowerPoint presentations.
- Case study/Mini Project

Assessment Methods:

- Three internals, 30 Marks each will be conducted and the Average of best of two will be taken.
- Rubrics for evaluating cybersecurity tool installation and demonstartion 10 Marks.
- Rubrics for evaluating cybersecurity case study 10 Marks
- Final examination, of 100 Marks will be conducted and will be evaluated for 50 Marks.

Course Outcome to Programme Outcome Mapping:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	**3**	**1**											**1**	**3**
CO2	**3**	**1**											**2**	**3**
CO3	**3**	**3**	**3**	**1**	**2**			**2**	**2**	**3**		**3**	**1**	**2**
CO4	**3**	**3**	**3**	**1**	**3**			**2**	**2**	**3**		**3**	**1**	**2**
18ISE744	**3**	**3**	**3**	**1**	**3**			**2**	**2**	**3**		**3**	**1**	**2**

COURSE CONTENT

UNIT – I	7 Hours
CYBER SECURITY FUNDAMENTALS: Network and Security Concepts, Information Assurance Fundamentals, Basic Cryptography, Symmetric Encryption, Public Key Encryption, The Domain Name System (DNS), Firewalls, Virtualization, Radio-Frequency Identification, **UNDERSTANDING THE CYBERSECURITY LANDSCAPE:** The State of Today's Intrusions, The Changing Face of Cyber Criminals, The Lifecycle of an Advanced Attack	
UNIT-II	**8 Hours**
ATTACKER TECHNIQUES AND MOTIVATIONS: How Hackers Cover Their Tracks (Anti-forensics), How and Why Attackers Use Proxies, Tunneling Techniques, Fraud Techniques, Phishing, Smishing, Vishing and Mobile Malicious Code, Rogue Antivirus, Click Fraud, Threat Infrastructure, Botnets, Fast-Flux, Advanced Fast-Flux	
UNIT – III	**8 Hours**
EXPLOITATION: Techniques to Gain a Foothold, Shellcode, Integer Overflow, Vulnerabilities, Stack-Based Buffer Overflows, Format-String Vulnerabilities, SQL Injection, DoS Conditions, Brute-Force and Dictionary Attacks, Misdirection, Reconnaissance and Disruption Methods, Cross-Site Scripting (XSS), Social Engineering, DNS Amplification Attacks	
UNIT – IV	**8 Hours**
MALICIOUS CODE: Self-Replicating Malicious Code, Worms, Viruses, Evading Detection and Elevating Privileges, Obfuscation ,Virtual Machine Obfuscation ,Persistent Software Techniques, Rootkits, Spyware, Attacks against Privileged User Accounts and Escalation of Privileges, Virtual Machine Detection, Stealing Information and Exploitation, Form Grabbing, DLL Injection, Browser Helper Objects.	
UNIT – V	**8 Hours**
DEFENSE AND ANALYSIS TECHNIQUES: Memory Forensics, Why Memory Forensics Is Important, Capabilities of Memory Forensics, Memory Analysis Frameworks, Dumping Physical Memory ,Installing and Using Volatility, Finding Hidden Processes, Volatility Analyst Pack, Honeypots, Intrusion Detection Systems Ten Best Practices for Controlling APTs: Ensure Visibility into All Traffic, Restrict High-Risk Applications, Selectively Decrypt and Inspect SSL Traffic, Sandbox Unknown Files, Block URLs That Are Known to Host Malware and Exploits, Enforce Drive-by-Download Protection, Block Known Exploits and Malware, Limit Traffic for Common Applications to Default Ports, Evaluate Network and Application Events in Context, Investigate Unknowns.	

Text Books:

1. James Graham, Richard Howard, Ryan Olson- "Cyber Security Essentials" CRC Press.
2. Lawrence C. Miller, "Cyber Security for Dummies" Palo Alto Networks® Edition.

REFERENCE BOOKS:

1. James A. Lewis, security: turning national solutions into international cooperation
2. Dan Shoemaker, Ph.D., William Arthur Conklin, Wm Arthur Conklin, security: The Essential Body of Knowledge
3. John Rittinghouse, PhD, William M. Hancock, PhD, security Operations Handbook

Department: Information Science and Engineering	**Course Type:** Core Elective
Course Title: DevOps	**Course Code:**18ISE745
L-T-P 3-0-0	**Credits:** 03
Total Contact Hours:39 hrs	**Duration of SEE:** 3 hrs
SEE Marks: 50	**CIE Marks:** 50

Pre-requisites:

Concepts of Computer Networks, Operating System, Network Security, Cloud Computing

Course Outcomes:
Students will be able to:

Cos	Course Outcome Description	Blooms Level
1	Understand the different application managed service options in the cloud.	L2
2	Demonstrate DevOps workflow with GitLab and Terraform	L2
3	Discover practical skills of Cloud to improve the speed, stability, availability and security for software delivery capability	L4
4	Apply practical skills needed for integrating container orchestration into their own workflow	L3
5	Discover a variety of managed big data services in the cloud.	L4

Teaching Methodology:

- Black Board Teaching
- Power Point Presentation

Assessment Methods:

- Project/ Programming assignment will be considered for 20 marks
- MCQs for 10 Marks
- Two lab internals, 20 Marks each will be conducted, and the Average will be considered
- Final lab examination of 50 Marks.

Course Outcome to Programme Outcome Mapping:

Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3								2	2		2		3
CO2	3	2	3	3	2				2	2		2		3
CO3	3	2	3	3	2				2	2		2		3
CO4	3	2	3	3	2				2	2		2		3
CO5	3	2	3	3	2				2	2		2		3
18ISE745	3	2	3	3	2				2	2		2		3

COURSE CONTENTS

UNIT – I: Cloud automation and Management Tools	**08 hours**
Introduction to Infrastructure as Code, Cloud Deployment Manager, Public and private IP address basics, Monitoring and managing your services, applications, and infrastructure, Stackdriver, Introduction to big data managed services in the cloud, Leverage big data operations with Cloud Dataproc, Build Extract, Transform, and Load pipelines using Cloud Dataflow, BigQuery, Google's Enterprise Data Warehouse.	
UNIT – II: GIT – A version Control Tool	**07 hours**
Uses of GIT in Industry, how to setup GIT, working with commands in GIT, recording changes to the repository, Automating DevOps workflows with GitLab and Terraform	
UNIT – III: Kubernetes In Cloud	**08 hours**
Introduction to Docker, Kubernetes Engine: Qwikstart, Orchestrating the cloud with Kubernetes, Managing Deployments using Kubernetes Engine, Continuous delivery with Jenkins in Kubernetes Engine	
UNIT – IV: DevOps Essentials	**08 hours**
Accelerate the state of DevOps, Cloud source Repositories: Start, Managing Deployments using Kubernetes Engine, Deploy Kubernetes Load Balancer Service with Terraform, Site Reliability Trouble shooting with Cloud Monitoring APM, Continuous Delivery pipelines with Spinnaker and Kubernetes Engine	
UNIT – V: ML in Cloud	**08 hours**
Introduction to machine learning in the cloud, Building bespoke machine learning models with AI Platform, Cloud AutoML, Google's pre-trained machine learning APIs.	

Textbooks:

Google Cloud Teaching Resources

Reference books:

- Practical DevOps – Joakim Verona, PACKT Publisher
- DevOps for Developers – Michael Huttermann, APress

Department: Information Science and Engineering	**Course Type**: Open Elective
Course Title: Fundamentals of Java	**Course code**: 18ISO751
L-T-P: 3-0-0	**Credits**: 03
Total contact hours: 39 hrs	**Duration of SEE**: 3 hrs
SEE Marks: 50	**CIE Marks**: 50

Pre-requisites:

Knowledge of any Object-oriented Programming concepts is helpful.

Course Outcomes:

The students would be able to:

Cos	Course Outcome Description	Blooms Level
1	Understand the fundamental object-oriented methodology of Java programming	L2
2	Apply the Java programming concepts to implement the real-world problem.	L3
3	Understand knowledge of Packaging and interfaces.	L2
4	Analyse usage of Multi-Threading and Exception Handling.	L4

Teaching Methodology:

- PowerPoint presentations.
- Regular review of students by asking questions based on topics covered in the class.
- Course Project.

Assessment Methods:

- Three internals, 30 Marks each will be conducted and the Average of best of two will be taken.
- Rubrics for Course Project. 20 Marks
- Final examination, of 100 Marks will be conducted and will be evaluated for 50 Marks

Course Outcome to Programme Outcome Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3											
CO2	3	2	3						2	2		
CO3	3											
CO4	3	3	2						2	2		
18ISO751	3	2.5	2.5						2	2		

Course Contents

UNIT – I	08 hours
The History and Evolution of Java: The Birth of Modern Programming: C. C++: The Creation of Java. How Java Changed the Internet. Java Applets, Security and Portability. Java's Magic: The Bytecode. Servlets: Java on the Server-Side **Object-Oriented Programming**. Two Paradigms Abstraction the Three OOP Principles. A First Simple Program Entering the Program. First Sample Program. Second Short Program **Java Is a Strongly Typed Language**. The Primitive Types Integers. Floating-Point Types Characters, Booleans. A Closer Look at Literals. Variables Declaring a Variable. Type Conversion and Casting. Automatic Type Promotion in Expressions Arrays. One-Dimensional Arrays. Multidimensional Arrays Alternative Array Declaration Syntax.	
UNIT – II	**08 hours**
Operators Arithmetic Operators the Bitwise Operators Relational Operators Boolean Logical Operators The Assignment Operator. The? Operator Precedence. Using Parentheses **Control Statements** Java's Selection Statements. Java's Selection Statements. Iteration Statements. Jump Statements. Introduction **to Classes.** Class Fundamentals Declaring Objects Assigning Object Reference Variables. Introducing Methods. Constructors. This Keyword. Garbage Collection. The finalize () Method.	
UNIT – III	**08 hours**
A Closer Look at Methods and Classes Overloading Methods Overloading Constructors Using Objects as Parameters. A Closer Look at Argument Passing Returning Objects. Recursion Introducing Access Control. Understanding static. Introducing final **Inheritance Inheritance** Basics. Member Access and Inheritance. Using super. Creating a Multilevel Hierarchy When Constructors Are Called Method Overriding Dynamic Method Dispatch. Why Overridden Methods?	
UNIT – IV	**07 hours**
Applying Method Overriding Using Abstract Classes Using final with Inheritance Using final to Prevent Overriding Using final to Prevent Inheritance the Object Class. **Packages and Interfaces.** Packages. Access Protection. Importing Packages. Interfaces Defining Interface, Implementing Interface, Nested Interfaces, Applying interfaces, Variables in Interfaces and Interface extension.	
UNIT – V	**08 hours**
Exception Handling Exception-Handling Fundamentals Exception Types Uncaught Exceptions Using try and catch Displaying a Description of an Exception. Multiple catch Clauses. Nested try Statements. Throw, throws, finally. Java's Built-in Exceptions Creating Your Own Exception Subclasses. Chained Exceptions Using Exceptions **Multithreaded Programming** the Java Thread Model Thread Priorities Synchronization Messaging The Thread Class and the Runnable Interface The Main Thread Creating a Thread. Implementing Runnable Extending Thread Choosing an Approach Creating Multiple Threads Using is Alive () and join() Thread Priorities	

Text Book:
Complete Reference of Java 7th Edition by **Herbert Schildt**

Department: Information Science and Engineering	**Course Type:** Open-Elective
Course Title: Introduction to Web Technology	**Course Code:** 18ISO752
L-T-P:3-0-0	**Credits:**03
TotalContactHours:39hrs	**DurationofSEE:**3hrs
SEEMarks:50	**CIEMarks:**50

Course outcomes:
Student will be able to

Cos	Course Outcome Description	Blooms Level
1	Describe the fundamentals of web technology.	L2
2	Design web pages using HTML mark-up language for the given Scenarios.	L3
3	Apply the concepts of Cascading Style Sheets for designing the web pages	L3
4	Demonstrate the use of JavaScript to develop the dynamic user interface.	L3
5	Understand server-side scripting using PHP	L2

Teaching methodology:

- Hands-on teaching using Power Point presentations
- Regular review of students by asking questions based on topics covered in the class
- Course Project

Assessment methods:

- Course Project -20 Marks
- Three internals, 30 Marks each will be conducted and the Average of best of two will be taken.
- Final examination, of 100 Marks will be conducted and will be evaluated for 50 Marks.

Course Outcome to Programme Outcome Mapping:

PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3											
CO2	3	3	3			1			2	2		2
CO3	3	3	3			1			2	2		2
CO4	3	3	3			1			2	2		2
CO5	3	1							2	2		2
18ISO752	3	3	3			1			2	2		2

Course Content

UNIT – I	8 hours
Introduction to web technologies, structuring an HTML document, Understanding HTML elements, Describing Character Entities, Horizontal rules, Line Breaks, Paragraph, citations, Quotations, Definitions and Comments, Formatting text with HTML elements, Arranging text: Word breaks, PRE, DIV, SPAN, Exploring the hyperlinks and URL, Inserting images in a web page.	
UNIT – II	**9 hours**
HTML Continued **-** Creating tables, exploring colours, working with forms, Exploring audio and video formats. **CSS –** Overview of CSS, Background Properties; color, image, repeat, position, attachment and colour properties; opacity, RGBA, font and text styles, Creating Boxes and Columns in CSS.	
UNIT – III	**8 hours**
CSS: Displaying, Positioning and Floating an element, List styles, Table layouts. JavaScript: Exploring the features of JavaScript, Using JavaScript in an HTML Document, Programming fundamentals of JavaScript, JavaScript functions, events, Objects in JavaScript, Exploring Standard or built-in JavaScript Objects.	
UNIT – IV	**8 hours**
JavaScript: Form Validation, Working with Document Object: Collections, Properties and Methods, Document Object Model: Understanding DOM nodes, DOM level1, DOM level 2, DOM level 3	
UNIT – V	**6 hours**
Introduction to PHP: Origins and uses of PHP, Overview of PHP, General syntactic characters, Primitive's operations and expressions, output, control statements, Arrays, Functions, Pattern matching, Form handling, Cookies, Session Tracking, comparative study of different technologies and its applications.	

TEXT BOOKS:

1. **HTML5 Covers CSS3, JavaScript, XML, XHTML, AJAX, PHP and Jquery Black Book, dreamtech PRESS, ISBN:978-93-5119-907-6, 2019**
2. **Programming the World Wide Web- Robert W. Sebesta, 7th Edition, Pearson Education, 2014.**

Department: Information Science and Engineering	**Course Type:** Open-Elective
Course Title: Mobile App Development	**Course Code:** 18ISO753
L-T-P:3-0-0	**Credits:**03
TotalContactHours:39hrs	**DurationofSEE:**3hrs
SEEMarks:50	**CIEMarks:**50

Pre-requisites:

- Students should have completed least one programming language course on Object Oriented Programming (Preferably C++, Java, or C#).

Course Outcomes:

CO's	Course Learning Outcomes	BL
1	Describe basic concepts of mobile development environment.	L2
2	Design a rich user interface for mobile application through using XML code and WYSIWYG editor.	L3
3	Apply SQLite Open Helper features to build a mobile application which uses relational database.	L3
4	Develop programs to read the values of various sensors in mobile phone.	L3
5	Create a developer account and publish application on online marketplace such as Google Play.	L2

Teaching Methodology:

- Blackboard Teaching
- PPT.
- Course Project

Assessment Methods:

- Three internals, 30 Marks each will be conducted and the Average of best of two will be taken.
- Rubrics for evaluating Course Project -20Marks
- Final examination, of 100 Marks will be conducted and will be evaluated for - 50 Marks.

Course Outcome to Programme Outcome Mapping:

COs	PO1	PO 2	PO 3	PO 4	PO5	PO 6	PO7	PO8	PO 9	PO10	PO11	PO12
CO1	3											
CO2	3	2	3		1				2	2		
CO3	3	2	3		1				2	2		
CO4	3	2	3		1				2	2		
CO5	3	2	3		1				2	2		
18ISO753	3	2	3		1				2	2		

Course Contents

Unit 1	08Hours
Mobility and Android, Introduction, Mobility Panorama, Mobile Platforms, App Development Approaches, Android Overview, Getting Started with Android, setting up Development Environment, Saying Hello to Android, Traversing an Android App Project Structure, Logical Components of an Android App, Android Tool Repository, Installing and Running App Devices Learning with an Application, Mobile App Development Challenges, Tenets of a Winning App.	
Unit 2:	**08 Hours**
Building Blocks, App User Interface, Activity, UI Resources, UI Elements and Events, Interaction among Activities, Fragments, Action Bar, App Functionality - Beyond UI: Threads, Async Task, Service, Notifications, Intents and Intent Resolution	
Unit 3:	**08 Hours**
App Data - Persistence and Access, Flat Files, Shared Preferences, Relational Data, Data Sharing Across Apps, Enterprise Data, Location Services and Maps, Google Play Services, Location Services	
Unit 4:	**08 Hours**
Sensors: Sensors in Android, Android Sensor Framework, Motion Sensors, Position Sensors, Environment Sensors.	
Unit 5:	**07 Hours**
Moving to Market: Testing Android Apps, Testing Android App Components, App Testing Landscape Overview, Publishing Apps, Groundwork, Configuring, Packaging, Distributing.	

TEXTBOOKS:

- Composing Mobile Apps: Learn, Explore, apply using Android, 1st Edition, Anubhav Pradhan, Anil V Deshpande, Wiley Publication 2017.

REFERENCE BOOKS:

- Google Developer Training, "Android Developer Fundamentals Course – Concept Reference", Google Developer Training Team, 2017. https://www.gitbook.com/book/google-developer-training/android-developerfundamentals- course-concepts/details (Download pdf file from the above link)
- Android Developer Tools Essentials by Mike Wolfson - O'Reilly Media Publications
- Learn Java for Android Development, 2nd Edition - Jeff Friesen - Apress Publications
- Learn Android Studio - Adam Gerber, Clifton Craig, Apress Publications.

MOOC

- https://in.udacity.com/course/new-android-fundamentals--ud851
- https://in.udacity.com/course/advanced-android-app-development--ud855

Department: Information Science and Engineering	**Course Type:** Open-Elective
Course Title: Fundamentals of Software Systems	**Course Code:** 18ISO754
L-T-P:3-0-0	**Credits:**03
TotalContactHours:39hrs	**DurationofSEE:**3hrs
SEEMarks:50	**CIEMarks:**50

Pre-requisites:

1. Programming Fundamentals

Course outcomes:

COs	Course Outcome Description	Blooms Level
1	Understand the different process models and Software development lifecycle	L2
2	Analyse the functional and non-functional requirements of the given use cases	L4
3	Design solutions to complex problems Using UML notations	L3
4	Illustrate the rapid software development methods for designing the software	L2
5	Develop test cases and validate using different testing strategies	L3
6	Understand the process of software Maintenance and project management	L2

Teaching Methodology:

- Blackboard teaching
- PowerPoint presentations (if needed)

Assessment Methods:

- Two programming assignments 10 Marks each.
- Three internals, 30 Marks each will be conducted and the Average of best of two will be taken.
- Rubrics for Programming assignments
- Final examination, of 100 Marks will be conducted and will be evaluated for 50 Marks.

Course Outcome to Programme Outcome Mapping:

PO	1	2	3	4	5	6	7	8	9	10	11	12
CO1	3											
CO2	3	3	2						1	1		
CO3	3	2	3						1	1		
CO4	3											
CO5	3	2	3						1	1		
CO6	3											
18ISO754	3	2.3	2.6						1	1		

Course Contents

UNIT – I	8 hours
Introduction: Professional and ethical responsibility. Software Quality Attributes, key challenges facing software engineering. **Software Processes:** Software Processes: Software Development Life Cycle (SDLC) Models, Process iteration, Process activities; The Rational Unified Process; Computer Aided Software Engineering	
UNIT – II	**8 hours**
Requirements: Software Requirements: Functional and Non-functional requirements; User requirements; System requirements, The software requirements document. Requirements Engineering Processes: Feasibility studies, Requirements elicitation and analysis, Requirements validation, Requirements managements;	
UNIT – III	**9 hours**
Modelling as a Design Technique: Modelling, abstraction, the three models. Class Modelling: Object and class concepts, Link and associations concepts, Generalization and inheritance, a sample class model. State Modelling: events, states, Transitions and conditions, sample state diagram. Interaction modelling: Use case models, sequence models and Activity models.	
UNIT – IV	**8 hours**
Rapid Software Development: Agile methods; Extreme programming; Rapid application development, software prototyping. Software Testing: System testing, Component testing, Test case design, Test automation.	
UNIT – V	**6 hours**
Software Project Management: Management activities, project planning, project scheduling, Risk management.	

Text Books:

1. Ian Somerville: Software Engineering, 8th Edition, Pearson Education, 2007.
2. Michael Blaha, James Rumbaugh: Object-Oriented Modeling and Design with UML, 2nd Edition, Pearson Education, 2005.

Reference Books:

1. Roger.S.Pressman: Software Engineering-A Practitioners approach,7th Edition, McGraw Hill, 2007.
2. Pankaj Jalote: An Integrated Approach to Software Engineering, Wiley India, 2009.
3. . Frank Buschmann, Regine Meunier, Hans Rohnert, Peter Sommerlad, Michael Stal: Pa00000ttern-Oriented Software Architecture, A System of Patterns, Volume 1, John Wiley and Sons, 2006
4. Grady Booch et al: Object-Oriented Analysis and Design with Applications, 3rd Edition, Pearson, 2007.

Department: Information Science and Engineering	**Course Type: Open Elective**
Course Title: Programming with Python	**Course Code:** 18ISO755
L-T-P:3-0-0	**Credits: 03**
Total Contact Hours:39 hours	**Duration of SEE:**03 hours
SEE Marks: 50	**CIE Marks:** 50

Course Outcomes:
Students will be able to:

Cos	Course Outcome Description	Blooms Level
1	Describe the basic programming concepts of python and Functions	L2
2	Apply appropriate data types/ data structures for the given problem using Lists, Dictionaries, Tuples and Files.	L3
3	Apply Exception handling technique in Python applications for error handling.	L3
4	Apply Python object-oriented concepts to solve real world problems.	L3

Teaching Methodology:

- Blackboard teaching / PowerPoint presentations.
- Mini Project

Assessment Methods:

- Rubrics to evaluate Mini project for 20 Marks
- Three internals, 30 Marks each will be conducted and the Average of best of two will be taken.
- Final examination, of 100 Marks will be conducted and will be evaluated for 50 Marks.

Course Outcome to Programme Outcome Mapping:

Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	**3**													**2**
CO2	**3**	**2**	**3**		**1**				**1**	**1**		**1**		**2**
CO3	**3**	**2**	**3**		**1**				**1**	**1**		**1**		**2**
CO4	**3**	**2**	**3**		**1**				**1**	**1**		**1**		**2**
18ISO755	**3**	**2**	**3**		**1**				**1**	**1**		**1**		**2**

COURSE CONTENT

UNIT – I	**8** hours
The way of the program: The Python programming language, what is a program? , What is debugging, Formal and natural languages, the first program, Debugging. Variables, expressions and statements : Values and types , Variables, Variable names and keywords, Operators and operands, Expressions and statements, Interactive mode and script mode, Order of operations, String operations, Comments, Debugging Functions: Function calls, Type conversion functions, Math functions, Composition, Adding new functions, Definitions and uses, Flow of execution, Parameters and arguments, Variables and parameters are local, Stack diagrams, Fruitful functions and void functions, Why functions?, Importing with from, Debugging.	
UNIT – II	**8** hours
Conditionals and recursion: Modulus operator, Boolean expressions , Logical operators, Conditional execution , Alternative execution, Chained conditionals , Nested conditionals , Recursion , Stack diagrams for recursive functions, Infinite recursion , Keyboard input , Fruitful functions: Return values, Incremental development, Composition , Boolean functions. Iteration: Multiple assignment, Updating variables, the while statement, break, Squareroots, Algorithms.	
UNIT – III	**7** hours
A string is a sequence: len, Traversal with a for loop, String slices, Strings are immutable, Searching, Looping and counting, String methods, the in operator, String comparison. Lists: A list is a sequence, Lists are mutable, Traversing a list , List operations, List slices, List methods, Map, filter and reduce, Deleting elements, Lists and strings, Objects and values, Aliasing, List arguments.	
UNIT – IV	**8** hours
Dictionaries: Dictionary as a set of counters, Looping and dictionaries, Reverse lookup, Dictionaries and lists, Memos, Global variables, Long integers, Debugging. Tuples: Tuples are immutable, Tuple assignment, Tuples as return values, Variable-length argument tuples, Lists and tuples , Dictionaries and tuples, Comparing tuples , Sequences of sequences.	
UNIT – V	**8h**ours
Files: Persistence, Contents, Catching exceptions, Databases, Writing. Classes and objects: User-defined types, Attributes, Rectangles, Instances as return values, Objects are mutable, Copying, Classes and functions: Time, Pure functions, Modifiers, Prototyping versus planning. Classes and methods: Object-oriented features, Printing objects, another example, A more complicated example, The init method, The __str__ method, Operator overloading, Type-based dispatch, Polymorphism.	

Text books:

2. Allen Downey, Think Python(How to Think Like a Computer Scientist), 2nd Edition by O'Reilly Media

Reference Books:

3. Learning Python, Fourth Edition, Mark Lutz, O’Reilly publication

Department: Information Science and Engineering	**Course Type**: Core
Course Title: Machine Learning Lab	**Course Code:** 18ISL76
L-T-P: 0-0-2	**Credits:**01
Total Contact Hours:26 hours	**Duration of SEE:**3hrs
SEE Marks:50	**CIE Marks:**50

Prerequisite:

- Linear Algebra, Probability & Statistics, Calculus, Data Mining
- Any programming language such as Python, Java

Course Outcomes:

After the course completion, students will be able to:

Cos	Course Outcome Description	Blooms Level
1	Understand the implementation procedures for the machine learning algorithms	L2
2	Design Java/Python programs for various Learning algorithms	L3
3	Apply Machine Learning algorithms to the appropriate data sets	L3
4	Identify and apply Machine Learning algorithms to solve real world problems	L3

Teaching Methodology:

- Black Board Teaching / Power Point Presentation
- Laboratory experiments

Assessment Methods:

- Rubrics for evaluating laboratory experiments for 30 marks
- Two internals, 20 Marks each will be conducted, and average of two internals will be taken.
- Final examination of 50 Marks will be conducted.

Course Outcome to Programme Outcome Mapping:

Cos	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2	PSO 1	PSO 2
CO1	3	3	2		1				2	2				**3**
CO2	3	3	2		1				2	2				**3**
CO3	3	3	2		1				2	2				**3**
CO4	3	3	2		1				2	2				**3**
18ISL76	3	3	2		1				2	2				**3**

Program No.	Title	CO Mapping
Note:	**•** **The programs can be implemented in either Python/Java or any programming language** **•** **For PART-A, programs are to be developed without using the built-in classes or APIs of Java/Python** **•** **Data sets can be taken from standard repositories (https://archive.ics.uci.edu/ml/datasets.html) or constructed by the students** **•** **During Examination Students must execute one program from PART-A and one program from PART-B**	
	PART A	
1.	([115.3, 195.5, 120.5, 110.2, 90.4, 105.6, 110.9, 116.3, 122.3, 125.4]) Use the above array of values and compute the mean, median, mode, Standard deviation, variance min-max normalization and standardization	CO1
2.	Use IRIS data set and perform the PCA on the dataset. Examine the first 2 principal components of X. Create a scatter plot with each of the 150 rows of X projected onto the first two principal components. In other words, the horizontal axis should be first principal component, the vertical axis should be second principal component.	CO1
3.	Given the matrix X whose rows represent different data points, run k-means clustering on this dataset using the Euclidean distance as the distance function. Here k is chosen as 3. The centres of 3 clusters were initialized as µ1 = (6.2, 3.2) (red), µ2 = (6.6, 3.7) (green), µ3 = (6.5, 3.0) (blue). $X = \begin{bmatrix} 5.9 & 3.2 \\ 4.6 & 2.9 \\ 6.2 & 2.8 \\ 4.7 & 3.2 \\ 5.5 & 4.2 \\ 5.0 & 3.0 \\ 4.9 & 3.1 \\ 6.7 & 3.1 \\ 5.1 & 3.8 \\ 6.0 & 3.0 \end{bmatrix}$ • What's the centre of the first cluster (red) after one iteration? (Answer in the format of [x1, x2], round your results to three decimal places, same as problems 2 and 3) • What's the centre of the second cluster (green) after two iteration? • What's the centre of the third cluster (blue) when the clustering converges? • How many iterations are required for the clusters to converge?	CO1
4.	Build a Binary Decision Trees using zoo data available at UCI Zoo Data Set. Generate a confusion matrix and print class wise accuracy, precision and recall in your result.	CO2
5.	Use an appropriate 2-dimensional data set and generate scatter plots of its features. Build a correlation matrix and use linear regression to compute the regression parameters. Also compute the Cost, SSE, SSR, SST and R^2.	CO2
6.	Use an appropriate multi-dimensional data set to perform Logistic regression for multi class classification. Illustrate the gradient descent method and compute the regression parameters. Also demonstrate the effect of feature pre-processing like removal of noise, NAN's, Missing value imputation.	CO2
	PART B	
1.	Implement the Naïve Bayesian classifier on COVID data set to predict whether a patient is covid +ve or not. Compute the accuracy, precision recall F1score ROC curve of the classifier, considering 80% training data .Draw the validation curves of the classifier.	CO3

2.	Use RBF, Polynomial and Sigmoid kernel with SVM and compare the performance of the kernels using suitable multiclass data set.	CO3
3.	Build a Random Forest classifier on any readily available disease dataset to predict the correct disease. Compare the performance of the classifier with decision tree.	CO4

Department: Information Science and Engineering	**Course Type**: Core
Course Title: Hybrid Application Development Lab	**Course Code:** 18ISL77
L-T-P: 0-0-2	**Credits:**02
Total Contact Hours:26 hours	**Duration of SEE:**3hrs
SEE Marks:50	**CIE Marks:**50

Prerequisites

- Fundamentals of object-oriented programming, Logic building skills

Course Outcome

At the end of the course, students will be able to

CO's	Course Learning Outcomes	BL
1	Understand android activity lifecycle and project structure of native/hybrid application	L2
2	Design an application using basic building blocks of android	L3
3	Apply SQLite OpenHelper for building a database application	L3
4	Implement GPS application using Google play Location Services	L3
5	Build Hybrid applications using Google Flutter framework and DART programming language	L3

Teaching Methodology:
1. Hands-on session
2. Tutorial on Lab Programs
3. Course Project

Assessment Methods:
1. Rubrics for evaluating laboratory experiments 20 Marks
2. Rubrics for evaluating course project 20 Marks
3. Lab internals for 10 marks.
4. SEE examination will be evaluated for 50 marks.

Course Outcome to Programme Outcome Mapping

PO	1	2	3	4	5	6	7	8	9	10	11	12	PSO1	PSO2
CO1	3								2	2				3
CO2	3	2	3		2				2	2				3
CO3	3	2	3		2				2	2				3
CO4	3	2	3		2				2	2				3
CO5	3	2	3		2				2	2				3
18ISL77	3	2	3		2				2	2				3

Program No.	Title	CO Mapping
	PART A	
1.	Create an android application to understand android activity lifecycle. Demonstrate uses of at least 5 android UI widgets	CO1
2.	Develop a native application which uses intents to navigate between activities of the application. Demonstrate how to pass data using bundles when the intent is invoked for navigation.	CO2
3.	Develop a native calculator application using LinearLayout and onClickListener interface on buttons.	CO2
4.	Construct a native application for demonstrating database implementing SQLiteOpenHelper class. Demonstrate how to delete, update, and insert entries in the created database.	CO3
5.	Develop a native application that uses GPS location information and display the current coordinates on google maps using google maps API	CO3
	PART B	
1.	Create a media player application that will play media file saved on memory card. Demonstrate application with play, pause, fast forward, and rewind functionality.	CO4
2.	Demonstrate the use of Scaffold, SafeArea, params related to cross axis alignement and Main axis alignment params.	CO4
3.	Implement a hybrid dice rolling application to demonstrate the use of SetState() method for marking part of code as dirty, and refreshing the application code upon marking some part of code as dirty.	CO4
4.	Create a hybrid application using flutter to demonstrate how to use stateless and stateful widgets. Demonstrate building Xylophone app Using Flutter and Dart Packages.	CO4
5.	Create a hybrid application using flutter to demonstrate how to use stateless and stateful widgets. Demonstrate building Xylophone app Using Flutter and Dart Packages.	CO4
6.	Implement a quiz application using flutter. Consisting of two button – true and false. Upon answering one question, the result of the answer should be shown, and the user should be taken to next question. One the number of questions in quiz ends – user should be shown the score and he should be given option to restart the quiz.	CO4

Department: Information Science and Engineering	**Course Type: Core elective**
Course Title: Venture Process Management & IPR	**Course Code:** 18ISH81
L-T-P: 3-0-0	**Credits:** 03
Total Contact Hours: 39 hrs	**Duration of SEE:**3hrs
SEE Marks: 50	**CIE Marks:** 50

Course Outcomes:
Students will be able to:

Cos	Course Outcome Description	Blooms Level
1	Understand the importance of entrepreneurship and its role in economic development.	L2
2	Develop Business strategies for the venture Competency: Develop vision and mission statement for a venture Identify the market challenges Understand the strength and opportunity of SWOT	L3
3	Analyze innovation strategies for a venture	L4
4	Analyze risk and uncertainties of the business	L4
5	Understand Business Ethics	L2
6	Understand the concepts of IP rights.	L2

Teaching Methodology:

- Blackboard teaching
- PowerPoint presentations
- Case Studies

Assessment Methods:

- Three internals, 30Marks each will be conducted and the Average of best of two will be taken.
- Rubrics for Case Study evaluation-20marks
- Final examination, of 100 Marks will be conducted and will be evaluated for 50Marks.

Course Outcome to Programme Outcome Mapping:

COs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	PO12	PSO 1	PSO 2
CO1	1							3			1	1		
CO2	1	2						3	1		1	1		
CO3	1	2						3	1	1	1	1		
CO4	1	2						3	1	1	1	1		
CO5	1	2						3	1	1	1	1		
CO6	1							1				1		
18ISH 81	1	2						3	1	1	1	1		

Course Content

UNIT – I	8 hours
Economic Growth and the Technology-The Entrepreneur's Challenge, The Entrepreneur ,Economics and the Firm , Creative Destruction , Innovation and Technology , Opportunity and the Concept , Opportunity Identification , Trends and Convergence Opportunity Evaluation , The Concept Summary	
UNIT – II	**8 hours**
Vision and the Business Model, The Mission Statement, The Value Proposition, The Business Model, Business Model Innovation in Challenging Markets, Core Competencies, Sustainable Competitive Advantage, Competitive Strategy, Venture Strategy, The Industry and Context for a Firm, Strengths and Opportunities—SWOT	
UNIT – III	**8 hours**
Innovation Strategies, First Movers Versus Followers, Imitation, Creativity and Invention, Types and Sources of Innovation, Technology and Innovation Strategy, New Technology Ventures, Risk and Return, Risk and Uncertainty, Scale and Scope, Network Effects and Increasing Returns.	
UNIT – IV	**7 hours**
What is Business Ethics? The Place of Business Ethics, Is Business Ethics Necessary?, **Employee's Ethics: Getting a Job, Getting a Promotion, Leaving,** The Résumé Introduction, What Am I Worth?, Plotting a Promotion, Looking for a Better Job Outside the Company	
UNIT – V	**8 hours**
Legal Formation and Intellectual Property ,Legal Form of the Firm ,Company Name ,Intellectual Property , Trade Secrets , Patents , Trademarks , Copyrights , Licensing ,Detailed functional Planning Forthe Venture- The Marketing and Sales Plan , Marketing , Marketing Objectives and Customer Target Segments, Product and Offering Description, Market Research, Customer Relationship Management, The Value Chain,Processes and Operations Management	

Text books:

- Technology Ventures: From Idea to Enterprise, 3rd Edition, Dorf, Richard, Byers, Thomas, and Nelson, Andrew, 2013. ISBN 978-0073380186.
- https://2012books.lardbucket.org/pdfs/business-ethics.pdf

Reference books:

New Venture Creation, 6th Edition or 5th Edition, Timmons, Jeffry A; ISBN: 0072498404, January 2004

Department: *Information Science and Engineering*	***Course Type: Core***
***Course Title**:* Green IT & Sustainability	***Course Code:*** 18ISH82
L-T-P: 3-0-0	***Credits:*** 03
Total Contact Hours: 39 hrs	***Duration of SEE:****3hrs*
SEE Marks*: 50*	***CIE Marks:*** *50*

Course Outcome:

Students will be able to:

Cos	Course Outcome Description	Blooms Level
1	Understand the concept of The Emergence of Information and Communication Technologies, The Integrated Circuit (IC) Revolution, New Age of Computer Technology	L2
2	Analyze Service of Data Storage, Multimedia Service, Ecological Measures and Ethical Consideration	L4
3	Understand the concepts of Cloud Computing and Sustainability, Sustainable Applications of Cloud Computing, Technologies Associated with Sustainable Cloud Computing	L2
4	Analyze the concepts of Rationale, Relationship Between Infrastructure as a Service (IaaS) and Power, Network Processes and Power, Need for Thermal-Aware Virtualization, Understanding Sustainability on the Cloud	L4
5	Understand the concepts of Critical Issues for Data Center Energy Efficiency, Introduction, Aim and Objectives, Literature Survey, Green ICT ,Data Centers, Data Center Efficiency	L2

Teaching Methodology:

- Blackboard teaching/PowerPoint presentations
- Case study

Assessment Methods:

- Three internals, 30 Marks each will be conducted and the Average of best of two will be taken.
- Rubrics for evaluating case study 20 Marks.
- Final examination, of 100 Marks will be conducted and will be evaluated for 50 Marks.

Course Outcome to Programme Outcome Mapping:

Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2					2	3	1	1			1		
CO2	2					2	3	1	1			1		
CO3	2					2	3	1	1			1		
CO4	2					2	3	1	1			1		
CO5	2					2	3	1	1			1		
CO6	2					2	3	1	1			1		
18ISH82	2					2	3	1	1			1		

COURSE CONTENT

UNIT – I	8 hours
Green ICT: History, Agenda, and Challenges Ahead Introduction,The Second Industrial Revolution—The Emergence of Information and Communication Technologies, The Integrated Circuit (IC) Revolution ,New Age of Computer Technology, Global Mobile Computing and Its Environmental Impact, The Agenda and Challenges Ahead, Videoconference as an Alternative to Business Travel, Dematerialization of Product Chain, Travel Advice/Road Traffic Control, Saving IT Resources—A Drop in the Ocean?	
UNIT – II	**7 hours**
Measurements and Sustainability Introduction, ICT Technical Measures, Introduction, Service of Data Processing, Service of Data Transport, Service of Data Storage, Multimedia Service, Ecological Measures and Ethical Consideration, Introduction, ICT Impact on Pollution, Resource Efficiency, Ethics in ICT, Systems Engineering for Designing Sustainable ICT-Based Architectures, Introduction, Stakeholder Requirements Definition, System Requirements Analysis, System Requirements Validation and Verification, ICT Expertise and Results, Traceability Matrix, Ecoefficiency Metrics.	
UNIT – III	**8 hours**
The Law of Green IT, General Remarks on Law and the Regulation of Environmental Behavior ,Direct and Indirect Governance of "Green IT" , Norm Addressees and Efficient Regulation, **Sustainable Cloud Computing, Introduction,** Challenges in the Use of Cloud Computing As Green Technology , Cloud Computing and Sustainability, Sustainable Applications of Cloud Computing, Technologies Associated With Sustainable Cloud Computing, Future Prospects of Sustainable Cloud Computing, Reflections on Sustainable Cloud Computing Applications	
UNIT – IV	**8 hours**
Achieving the Green Theme Through the Use of Traffic, Characteristics in Data Centers, Introduction, Green IT and the Cloud, Virtualization Behavior , Rationale, Relationship Between Infrastructure as a Service (IaaS) and Power, Network Processes and Power ,Need for Thermal-Aware Virtualization, Understanding Sustainability on the Cloud ,Current State of Affairs, Achieving Sustainability on the Cloud ,Sustainability with VM Management , Green Cloud as a Network Management Problem, Importance of Virtualization Management, Relationship Between Networking and Power Consumption , Need for Traffic Characterization in Virtualized Environment, Role of Hypervisors in Traffic Characterization , SNMP for Green Cloud Traffic Characterization, SNMP Operation in Context of Green Clouds , A Model for Network Management for Green Cloud, Model Outline, Gathering and Using Statistics, Conclusions and Future Work.	
UNIT – V	**8 hours**
Critical Issues for Data Center Energy Efficiency , Introduction, Aim and Objectives, Literature Survey ,Green ICT ,Data Centers, Data Center Efficiency ,Data Center Efficiency Measurements and Metrics, Methodology, Implementation ,Operation of the Experiment, Assumptions, Results and Discussion , PUE Analysis, Effect of Set Point Temperature ,Effect of a Change in the Cooling System , Immediate Impact, Future Impact, Cloud Computing, Sustainability, and Risk, Introduction, Cloud Architecture and Risk Preferences ,Green Cloud Computing and Risk Management, Risk Appetite and Tolerance.	

Text Book:

http://digilib.stmikbanjarbaru.ac.id/data.bc/100.%20Other/2015%20Green%20Information%20Technology%20A%20Sustainable%20Approach.pdf

Department: Information Science and Engineering	**Course Type:** Elective
Course Title: Business Analytics	**Course Code**:18ISE831
L-T-P: 3-0-0	**Credits:** 03
Total Contact Hours:39 hrs	**Duration of SEE:** 3 hrs
SEE Marks: 50	**CIE Marks**: 50

Course Outcomes: Students will be able to

CO's	Course Learning Outcomes	BL
CO1	Describe the importance of business analytics for creating the successful business.	L2
CO2	Analyse the suitability of different types of statistics for business analytical processing with visualization.	L3
CO3	Apply analytics on data warehouse to derive useful insight	L3
CO4	Apply web and social networking analysis concept on business data for gaining the insights, correlation and customer interests.	L3
CO5	Understand/Summarize the emerging trends and future impacts on business operations.	L2

Teaching Methodology:

- Blackboard Teaching
- Power point presentation
- Case study

Assessment Methods

- Group Discussion for 10 Marks.
- Rubrics to evaluate Case study for 10 Marks.
- Three internals, 30 Marks each will be conducted and the Average of best of two will be taken.
- Final examination, of 100 Marks will be conducted and will be evaluated for 50 Marks.

Course Outcome to Programme Outcome Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3				1				2	2				2
CO2	3	3	2		1				2	2				2
CO3	3	2			1				2	2				2
CO4	3	2	3		1				2	2				2
Co5	3	2			1				2	2				2
18ISE831	3	2	2		1				2	2				2

Course content

Unit – I	8 Hrs
Business Analytics: Why Analytics, Business Analytics: the Science of data driven decision making, Descriptive Analysis, Predictive Analytics, Prescriptive Analytics, Big Data Analytics, Web and Social media Analytics, Machine Learning Algorithms, Framework for data driven decision making, Analytics Capability Building, Roadmap, Challenges, Types (Descriptive, Predictive and Prescriptive).	
Unit – II	**7Hrs**
Descriptive Analytics: Data Types and Scales, Types of Data Measurement Scales, Population and Sample, Measures of Central Tendency, Percentile, Decile, and Quartile, Measures of Variation, Measures of Shape − Skewness and Kurtosis, Data Visualization	
Unit – III	**8 Hrs**
Data warehousing: definition and concepts, data warehousing process overview, data warehousing architecture, data integration and the extraction, transformation, and load processes, Data warehouse development, data warehousing implementation issues, Real time data warehousing, data warehousing administration, security issues, and future trends	
Unit – IV	**8 Hrs**
Text and web analytics: text analytics and text mining overview, Natural language processing, Text mining application, text mining process, Sentiment analysis, web mining overview, search engines, web usage mining, Social analytics	
Unit – V	**8 Hrs**
Emerging Trends and Future Impacts: Location-Based Analytics for Organizations, Geospatial Analytics, Real Time Location Intelligence, Analytics Applications for Consumers, The web 2.0 revolution and online social networking, cloud computing and BI, impact of analysis in organization: An overview, Issues of Legality, Privacy, and Ethics.	

Textbooks:

- U. Dinesh Kumar, “Business Analytics – The Science of Data Driven Decision Making”, Wiley 2017.
- Ramesh Sharda, DursunDelen, Efraim Turban, “Business Intelligence: A Managerial Perspective on Analytics”, Pearson, 3rd edition.

Reference Books:

- Wasserman, S., & Faust, K. (1994). Social Network Analysis: Methods and Applications. A classic, essential textbook on SNA.
- Jesper Thorlund &Gert H.N. Laursen, “Business Analytics for Managers: Taking Business Intelligence Beyond”, Wiley
- Sahil Raj, “Business Analytics”, Cengage
- James R. Evans, “Business Analytics”, Pearson

Department: Information Science and Engineering	**Course Type:** Core
Course Title: Neural Networks & Deep Learning	**Course Code:18ISE832**
L-T-P:3-0-0	**Credits:** 03
Total Contact Hours:39 hrs	**Duration of SEE:** 3 hrs
SEE Marks: 50	**CIE Marks:** 50

Pre-requisites:

- Machine learning-I, Data mining

Course Outcomes:

Students will be able to

CO's	Course Learning Outcomes	BL
CO1	Understand the basic concepts of artificial neural networks	**L2**
CO2	Build Deep Learning architecture-Autoencoders, CNN	**L3**
CO3	Illustrate the working of Recurrent Neural Networks	**L2**
CO4	Apply different parameters on the deep learning networks.	**L3**

Teaching Methodology:

- Blackboard teaching and PPT
- Executable Codes/ Live Demonstration
- Case Study

Assessment Methods

- Model building of any Deep learning Architecture using benchmark datasets -10M
- Case study to be evaluated using rubrics for 10 marks
- Three internals, 30 Marks each will be conducted and the Average of best of two will be taken
- Final examination, of 100 Marks will be conducted and will be evaluated for 50 Marks

Course Outcome to Programme Outcome Mapping

Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	**3**								**2**	**2**		**3**		**2**
CO2	**3**	**3**	**2**						**2**	**2**		**3**		**2**
CO3	**3**								**2**	**2**		**3**		**2**
CO4	**3**	**2**	**3**						**2**	**2**		**3**		**2**
18ISE832	**3**	**3**	**2**						**2**	**2**		**3**		**2**

COURSE CONTENT

Unit – I	**7 Hrs**
Foundations of Neural Networks and Deep Learning: Neural Network, Neuron, Expressing Linear Perceptrons as Neurons, Feed-Forward Neural Networks, Linear Neurons and Their Limitations, Sigmoid, Tanh, and ReLU Neurons, Softmax Output Layers, Training Feed-Forward Neural Networks, Gradient Descent	
Unit – II	**8 Hrs**
Fundamentals of Deep Networks: The Delta Rule and Learning Rates, Gradient Descent with Sigmoidal Neurons, The Backpropagation Algorithm, Stochastic and Minibatch Gradient Descent, Test Sets, Validation Sets, and Overfitting, Common Architectural Principles of Deep Networks, Loss Functions, Optimization Algorithms, Hyperparameters, Building Blocks of Deep Networks, Autoencoders, Variational Autoencoder	
Unit – III	**8 Hrs**
Major Architectures of Deep Networks: Unsupervised Pretrained Networks, Deep Belief Networks, Generative Adversarial Networks, Convolutional Neural Networks (CNNs), CNN Architecture Overview, Input Layers, Convolutional Layers, Pooling Layers, Fully Connected Layers, Other Applications of CNNs	
Unit – IV	**8 Hrs**
Recurrent Neural Networks: Modelling the Time Dimension, 3D Volumetric Input, General Recurrent Neural Network Architecture, LSTM Networks, Domain-Specific Applications and Blended Networks, Recursive Neural Networks, Network Architecture Varieties of Recursive Neural Networks	
Unit – V	**8 Hrs**
Basic Concepts in Tuning Deep Networks: Building Deep Networks, Building Step-by-Step Process, Matching Input Data and Network Architectures, Relating Model Goal and Output Layers, Weight Initialization Strategies, Sparsity Affects the Learning, Applying Methods of Optimization, Using Parallelization and GPUs for Faster Training, Controlling Epochs and Mini-Batch Size, Regularization, Class Imbalance, Methods for Sampling Classes, Dealing with Overfitting	

Textbook:

1. "Fundamentals of Deep Learning: Designing Next-Generation Machine Intelligence Algorithms", by Nikhil Buduma and Nicholas Lacascio, , O'Reilly
2. "Deep Learning A Practitioner's Approach", Josh Patterson and Adam Gibson, O'Reilly, 1st Edition.

Reference Books:

1. Introduction to Artificial Neural Systems, Zurada and Jacek M, 1992, West Publishing Company, ISBN: 9780534954604
2. Ian Goodfellow, Yoshua Bengio and Aaron Courville, Deep Learning, MIT Press, 2016.
3. https://cedar.buffalo.edu/~srihari/CSE676/
4. Neural Networks Design, M T Hagan, H B Demoth, M Beale, 2002, Thomson Learning, ISBN-10: 0-9717321-1-6/ ISBN-13: 978-0-9717321-1-7

Online Materials

1. Deep learning courses by coursera: https://www.coursera.org/courses?query=deep%20learning
2. https://www.classcentral.com/course/coursera-neural-networks-and-deep-learning-9058
3. https://www.classcentral.com/course/coursera-introduction-to-deep-learning-9606
4. https://www.deeplearningbook.org/

NITTE EDUCATION TRUST | NITTE MEENAKSHI INSTITUTE OF TECHNOLOGY

Department: Information Science and Engineering	**Course Type: Core**
Course Title: Software Defined Networks	**Course Code:** 18ISE833
L-T-P: 3-0-0	**Credits:** 03
Total Contact Hours: 39 hrs	**Duration of SEE:**3hrs
SEE Marks: 50	**CIE Marks:** 50

Pre-requisite:

- Knowledge on Computer networks, and Programming languages like PYTHON, JAVA.

Course Outcomes:

Students will be able to:

Cos	Course Outcome Description	Blooms Level
1	understand the architecture, key elements and requirements for building Software defined networks.	L1
2	analyse the technology evolution leading to SDN as well as Open-Source role in SDN.	L4
3	apply techniques that enable applications to control the underlying network using SDN.	L3
4	demonstrate knowledge of software defined networking and its applications, including network programmability and virtualization.	L3
5	understand Network Functions Virtualization components and their roles in SDN	L1

Teaching Methodology:

- Black board teaching
- Power point presentation
- Practical component

Assessment Methods:

- Three internals, 30Marks each will be conducted and the Average of best of two will be taken
- Rubrics for Course Project -20marks
- Final examination, of 100 Marks will be conducted and will be evaluated for 50 Marks.

Course Outcome to Programme Outcome Mapping:

COs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2	PSO 1	PSO 2
CO1	**3**											**1**		**2**
CO2	**3**											**1**		**2**
CO3	**3**											**1**		**2**
CO4	**3**											**1**		**2**
CO5	**3**											**1**		**2**
18ISE833	3											1		2

COURSE CONTENT

UNIT – I ELEMENTS of Modern Networking	8 hours
Network Architectures, Requirements and Technology: Global Network Architecture. Typical Network Hierarchy, Ethernet: Applications of Ethernet, Standards, Ethernet Data Rates, Wi-Fi: Applications of Wi-Fi, Standards, Wi-Fi Data Rates, 4G/5G Cellular: First Generation, Second Generation, Third Generation, Fourth Generation, Fifth Generation. Cloud Computing: Cloud Networking, Cloud Storage Types of Networks and Internet Traffic: Elastic Traffic, Inelastic Traffic Real-Time Traffic Characteristics Demand: Big Data, Cloud Computing, and Mobile Traffic: Big Data, Cloud Computing, Mobile Traffic Requirements: QoS, QoE, Quality of Service, Quality of Experience. Routing: Characteristics, Packet Forwarding, Routing Protocols, Elements of a Router Congestion Control: Effects of Congestion, Congestion Control Techniques, SDN and NFV: Software-Defined Networking, Network Functions Virtualization	
UNIT – II SDN DATA PLANE	8 **hours**
SDN: Background and Motivation. Evolving Network Requirements, Demand Is Increasing, Supply Is Increasing, Traffic Patterns Are More Complex, Traditional Network Architectures are Inadequate. The SDN Approach: Requirements, SDN Architecture, Characteristics of Software-Defined Networking SDN- and NFV-Related Standards: Standards-Developing Organizations, Industry Consortia, Open Development Initiatives Data Plane and OpenFlow: SDN Data Plane, Data Plane Functions, Data Plane Protocols OpenFlow Logical Network Device: Flow Table Structure, Flow Table Pipeline, The Use of Multiple Tables, Group Table.	
UNIT – III SDN CONTROL PLANE	8 **hours**
SDN Control Plane: SDN Control Plane Architecture, Control Plane Functions, Southbound Interface, Northbound Interface. Routing, ITU-T Mode, OpenDaylight , OpenDaylight Architecture , OpenDaylight Helium ,REST, REST Constraints , Example REST API. Cooperation and Coordination among Controllers, Centralized Versus Distributed Controllers, High-Availability Clusters, Federated SDN Networks, Border Gateway Protocol, Routing and QoS Between Domains, Using BGP for QoS Management, IETF SDNi , OpenDaylight SNDi.	
UNIT – IV SDN APPLICATION PLANE	**7 hours**
SDN Application Plane: SDN Application Plane Architecture, Northbound Interface, Network Services Abstraction Layer, Network Applications, User Interface Network Services Abstraction Layer, Abstractions in SDN, Frenetic. Traffic Engineering, PolicyCop Measurement and Monitoring Security, OpenDaylight DDoS Application Data Center Networking, Big Data over SDN, Cloud Networking over SDN, Mobility and Wireless Information-Centric Networking, CCNx, 169 Use of an Abstraction Layer.	
UNIT – V NFV Functionality	8 **hours**
NFV Infrastructure, Container Interface, Deployment of NFVI Containers, Logical Structure of NFVI Domains, Compute Domain, Hypervisor Domain, Infrastructure Network Domain. Virtualized Network Functions, VNF Interfaces, VNFC to VNFC Communication, VNF Scaling NFV Management and Orchestration, Virtualized Infrastructure Manager, Virtual Network Function Manager, NFV Orchestrator, Repositories, Element Management, OSS/BSS NFV Use Cases, Architectural Use Cases, Service-Oriented Use Cases. SDN and NFV.	

Text books:

Foundations of Modern Networking SDN, NFV, QoE, IoT, and Cloud by William Stallings

NITTE EDUCATION TRUST | NITTE MEENAKSHI INSTITUTE OF TECHNOLOGY

Department: Information Science and Engineering	**Course Type**: Core Elective– F
Course Title: Ad hoc Network	**Course Code**: 18ISE834
L-T-P:3-0-0	**Credits:** 03
Total Contact Hours: 39 hrs	**Duration of SEE:** 3 hrs
SEE Marks: 50	**CIE Marks:** 50

Pre-requisites:

Fundamental knowledge on wired and wireless networks and communication.

Course outcomes

At the end of the course, Student will be able to

Cos	Course Outcome Description	Blooms Level
1	Describe the concepts of ad hoc networks.	L1
2	Apply the MAC layer protocols for controlling access to the shared media in ad hoc networks.	L3
3	Get exposure to state of the art in VANETs	L2
4	Understand VANETs which now open new vistas for internet access, distributed gaming and the fast-growing Mobile entertainment industry.	L2
5	Understand VANETs to promote Traffic Safety.	L2

Teaching Methodology

- Blackboard teaching / PowerPoint presentation
- Case Study.

Assessment Methods

- Three internals, 30 marks each, Average of best of two will be taken.
- Case Study – documentation made based on the rubrics- 10 marks.
- Simulation of a VANET Applications for 10 marks.
- Final examination is conducted for 100 marks and evaluated for 50 marks.

Course Outcome to Programme Outcome Mapping

POs/COs	1	2	3	4	5	6	7	8	9	10	11	12	PSO1	PSO2
CO1	3								2	2				2
CO 2	3	2	3						2	2				2
CO 3	3	2							2	2				2
CO 4	3	2	3						2	2				2

CO 5	3	2	3						2	2				2
18ISE834	3	2	3						2	2				2

Course Content

UNIT – I	**6 hours**
Ad Hoc wireless networks: Fundamentals of Wireless Communication Technology, The Electromagnetic Spectrum, Radio Propagation Mechanisms, Characteristics of the Wireless Channel, Modulation Techniques, Multiple Access Techniques, Voice Coding, Error Control, IEEE 802 Network Standards, Introduction to Ad hoc Wireless Networks, Issues in Ad Hoc Wireless Networks, Ad Hoc Wireless Internet.	
UNIT – II	8 **hours**
MAC Protocols for Ad Hoc wireless networks: Introduction, Issues in Designing a MAC Protocol for Ad Hoc Wireless Networks, Design goals of a MAC Protocol for Ad Hoc Wireless Networks, Classifications of MAC protocols, Contention-Based Protocols, Contention-Based protocols with reservation mechanisms, Contention-Based MAC protocols with scheduling mechanisms, MAC protocols that use directional antennas, Other MAC protocols.	
UNIT – III	8 **hours**
Introduction to Vehicular Ad Hoc Networks (VANETs): Traffic Monitoring, Causes of congestion, Traffic Monitoring Data, Common Applications of Traffic Data, commonly used sensor technology, Detection methods **Models for Traffic flow and Vehicle Motion:** Models for Longitudinal Vehicle Movement, Lane changes situations, Simulating Vehicle-to Vehicle and Infrastructure-to-Vehicle Communication.	
UNIT – IV	**8 hours**
Networking Issues: Routing in MANET, Applicability of MANET Routing to Vehicular Environment, Routing protocols for VANET. **Delay-Tolerant Networks in VANETs: Deterministic**/Stochastic Delay-Tolerant Routing, Vehicle Traffic Model, Vehicle- Roadside Data Access, Data Dissemination in VANETs.	
UNIT – V	8 **hours**
Localization in Vehicular Ad-Hoc Networks: Localization-Aware VANET applications, Localization Techniques for VANETs, Data Fusion in VANET Localization Systems **Vehicular Applications:** Safety related vehicular applications, use of Infrastructure in VANETs, Vehicular Network Simulators, Vehicular Mobility Models.	

Text Books:

1. Ad Hoc Wireless Networks Architecture and Protocols: C. Siva Ram Murthy, B. S Manoj, 2nd edition, Pearson education.
2. Stephan Olariu, Michele C. Weigle, "Vehicular Networks from Theory to Practice", CRC Press.
3. Selected Papers about Vehicular Ad Hoc Networks (VANETs).

Reference Books:

1. William Stallings, "Wireless Communications and Networks," Prentice Hall, 2004.
2. Hassnaa Moustafa and Yan Zhang, "Vehicular Networks: Techniques, Standards and Applications," Auerbach Publications, 2009.

Department: Information Science and Engineering	**Course Type:** Core elective
Course Title: ***Soft Computing***	**Course Code:**18ISE835
L-T-P: 3-0-1	**Credits:** 03
Total Contact Hours: 39hrs	**Duration of SEE:** 3hrs
SEE Marks: 50	**CIE Marks:**50

Prerequisites:

- Students should have knowledge of Databases and how they are managed.
- Students should have basic knowledge about graphs, trees and basic mathematical concepts.

Course outcomes:

Cos	Course Outcome Description	Blooms Level
1	Understand Various soft computing techniques/framework and their applications	L2
2	Analyze various neural network architecture	L4
3	Apply fuzzy logic to solve real world problems	L3
4	Understand genetic algorithms concepts and their applications	L2
5	Identify and select a suitable soft computing technology to solve the problem, construct/ implement a soft computing solution	L2

Teaching Methodologies:

- Blackboard teaching
- PowerPoint presentations
- Regular review of students by asking questions based on topics covered in the class
- Course Project / Programming assignment

Assessment Methods:

- Rubrics for evaluating Course Project/ Programming assignment
- 3 internals, 30 Marks each will be conducted and the average of best of two will be taken.
- Final examination, of 100 Marks will be conducted and will be evaluated for 50 Marks.

Course Outcome to Programme Outcome Mapping

PO	1	2	3	4	5	6	7	8	9	10	11	12	PSO1	PSO2
CO1	3													3
CO2	3	2	2	1				1	1	1	1	1		3
CO3	3	2	2	1				1	1	1	1	1		3
CO4	3		2											3
CO5	3	2	2	1				1	1	1	1	1		3
18ISE835	3	2	2	1				1	1	1	1	1		3

COURSE CONTENTS

UNIT – I	7 hours
Introduction: Introduction to soft computing, application areas of soft computing, classification of soft computing techniques, structure & functioning of biological brain & Neuron, and concept of learning/training. Model of an Artificial Neuron, transfer/activation functions, perceptron, perceptron learning model, binary & continuous inputs, linear separability.	
UNIT – II	8 **hours**
Multilayer Neural Networks: Feed Forward network - significance, training, loss function, Back-Propagation algorithm, convergence & generalization, momentum, applications. Feedback network -Hopfield Nets: architecture, energy functions, training algorithms & examples, competitive learning, self-organizing maps. Introduction to CNN and RNN network.	
UNIT – III	8 **hours**
Fuzzy Systems: fuzzy set theory, fuzzy sets and operations, membership functions, concept of fuzzy relations and their composition, concept of fuzzy Measures. Fuzzy logic: fuzzy rules, inferencing. Fuzzy Control system: selection of membership functions, Fuzzification, rule-based design & inferencing, defuzzification, applications of fuzzy system.	
UNIT – IV	**8 hours**
Genetic algorithm: concepts, creation of offspring, working principle, encoding, fitness functions, reproduction, genetic modeling. Generation cycle & convergence of GA, application areas of GA	
UNIT – V	8 **hours**
Advanced soft computing techniques: Rough Set Theory - Introduction, Set approximation, Rough membership, Attributes, optimization. SVM - Introduction, obtaining the optimal hyper plane, linear and nonlinear SVM classifiers. Introduction to Swarm Intelligence, Swarm Intelligence Techniques: Ant Colony Optimization, Particle Swarm Optimization, Bee Colony Optimization etc.	

Text Books:

1. S.N. Sivanandam & S.N. Deepa, Principles of Soft Computing, Wiley Publications
2. S, Rajasekaran & G.A. Vijayalakshmi Pai, Neural Networks, Fuzzy Logic & Genetic Algorithms, Synthesis & applications, PHI Publication
3. Bose, Neural Network fundamental with Graph, Algo. & Appl, TMH Kosko: Neural Network & Fuzzy System, PHI Publication
4. Klir & Yuan, Fuzzy sets & Fuzzy Logic: Theory & Appli., PHI Pub. Hagen, Neural Network Design, Cengage Learning

Reference Books:

1. Mitchell Melanie, "An Introduction to Genetic Algorithm", Prentice Hall, 1998.
2. David E. Goldberg, "Genetic Algorithms in Search, Optimization and Machine Learning", Addison Wesley, 1997.
3. S. N. Sivanandam, S. Sumathi and S. N. Deepa, "Introduction to Fuzzy Logic using MATLAB", Springer, 2007.
4. S.N.Sivanandam · S.N.Deepa, " Introduction to Genetic Algorithms", Springer, 2007.
5. Jacek M. Zurada, "Introduction to Artificial Neural Systems", PWS Publishers, 1992.

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Department of Artificial Intelligence and Data Science

2021 Scheme Curriculum Handbook

3rd and 4th Semesters

Vision

To produce effective and capable engineers, scientists and professionals in Artificial Intelligence and Data Science who can meet the demands of society, industry and universities for decades to come by continually improving teaching and research standards of the department.

Mission

The Dept. of Artificial Intelligence and Data Science Engineering is committed to

- Provide high-quality education to the students to fulfil the requirements of industry and R&D establishments.
- Constantly strive to improve teaching-learning methods to deliver good academic programs.
- Respond to the fast evolving scientific and technological challenges in a highly competitive world.
- Inculcate ethics, integrity, honesty, credibility, social and environmental consciousness

PEOs:

- Graduates will have the ability to Analyze, Develop and Apply Innovative ideas to solve real-world problems using Artificial Intelligence and Data Science techniques.
- Pursue higher studies to carry out research and development in the area of Artificial Intelligence and Data Science.
- Engage in lifelong learning, communicate effectively and exhibit leadership skills and demonstrate sensitivity towards professional ethics.

PSO 1: Apply solutions based on Computer Programming and Artificial Intelligence to societal and technological problems

PSO2: Create innovative solutions , processes, methodologies and products to enable organizations and automated systems to make data-driven decisions

Program Outcomes:

PO-1	Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems. .
PO-2	Problem analysis: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences
PO-3	Design/development of solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations
PO-4	Conduct investigations of complex problems: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
PO-5	Modern tool usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
PO-6	The engineer and society: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
PO-7	Environment and sustainability: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
PO-8	Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice
PO-9	Individual and team work: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
PO-10	Communication: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
PO-11	Project management and finance: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one’s own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
PO-12	Life-long learning: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

Semester 3:

Department: *Mathematics*	***Course Type:*** *Basic Science*
Course Title*:* Mathematics III (*Integral Transforms, Linear Algebra and Numerical Methods)*	***Course Code:*** *21MAT31A*
L-T-P:*3-0-0*	***Credits:****03*
Total Contact Hours: 39 *hours*	***Duration of SEE:****03 hours*
SEE Marks*: 50*	***CIE Marks:*** *50*

Course Description

The course aims at imparting knowledge of Fourier analysis, Integral transforms, numerical methods, basics of linear algebra relevant to the field of Computer Science, Information Science and Artificial Intelligence

Pre-requisites:

Integration, differentiation, Taylor series, matrices

Cos	Course Outcome Description	Blooms Level
1	To apply numerical methods for fitting data, find appropriate functions, differentiate and integrate the same	L3
2	To use the concept of numerical methods to solve differential equations	L3
3	To analyze situations arising in Engineering Problems using concepts of Linear Algebra	L3
4	To apply the concepts of Fourier analysis ,integral transforms and optimization to Engineering Problems	L3
5	To analyze situations arising in Engineering Problems using the concept of matrices, orthogonality and vector spaces	L3

The course objectives are:

To understand the periodic and harmonic phenomena and to be able to model them using Fourier series and use integral transforms such as Laplace and Fourier transforms,

To understand the advantages, limitations and applications of different numerical techniques.

To explore the concepts and applications of Linear algebra.

UNIT – I	**8 HOURS**

Linear Algebra-I
Vector spaces- definition, examples, Linear combinations, subspaces, linear dependence, basis and dimension, linear mapping, linear operator, Kernel and Image of a Linear mapping, matrix representation of linear operator, change of basis.
Self Study: Row Space and Column space, Rank and nullity theorem

UNIT – II	**8 HOURS**

Linear Algebra-II

Inner product space, Orthogonal Sets and Bases, Gram Schmidt Orthogonalization process Polynomial of matrices, Characteristic polynomial, diagonalization, Eigenvalues and Eigen vectors, diagonalization, Characteristic and minimal polynomial, Singular value decomposition

Self-Study:Block matrices and Canonical form.

UNIT - III	**8 HOURS**

Numerical Methods-I
Interpolation: Newton's divided difference formulae, Lagrange's formula, Cubic spline.
Least square fitting of Fourier series (Harmonic Analysis).
Numerical Differentiation: Newton's forward and backward formulae, Lagrange's formula.
Numerical Integration**:** Trapezoidal, Simpson's1/3rd and 3/8th, Gaussian Quadrature method.
Quadratic spline, Weddle's rule for numerical integration.

UNIT – IV	**8 HOURS**

Numerical Methods-II

Numerical solution of ordinary differential equations: Taylor's series method, Runge-Kutta 4th order method - First order and second order Ordinary differential equations, Milne's predictor corrector method. Finite difference method for Boundary value problems
Correlation, Karl Pearson's coefficient, Regression lines
Continuous Optimization: Gradient Descent, Lagrange multipliers
Numerical solution of Laplace Equation, Rank correlation

UNIT – V	**7 HOURS**

Fourier analysis and Integral Transforms
Fourier series: Euler's formulae, Dirichlet's conditions for Fourier series expansion,
Even and odd function.
Fourier Transforms: Complex Fourier transforms, Cosine and Sine transforms, Inverse

Fourier transforms. Laplace Transforms: Definition, Transforms of standard functions, Laplace transforms of periodic functions, Inverse Laplace transforms **Self-Study:** Fourier half range series, solutions of 1st and 2nd order ODE using Laplace transforms.

Text Books:

1. Linear Algebra, Seymore Lipschutz and Marc Lipson, 3rd edition, Tata McGrahill, 2005

2. Numerical Methods for Scientific and Engineering Computation, M K Jain, S R K Iyengar, R K Jain, 6th edition, New Age, 2012
3. Advanced Engineering Mathematics, Erwyn Kreyzig, 9th edition, Wiley, 2011

Reference Books:
1. Linear Algebra for everyone, Gilbert Strang, 2020
2. Fourier Series, Transforms and Boundary Value Problems, J R Hanna, J H Rowland, 2nd edition, Dover, 2008
3. Numerical Algorithms, E V Krishnamurthy, S K Sen, East West press,2007

Teaching Methods:

- Black Board Teaching.
- Power point presentation
- Tutorials

Assessment Methods:

Continuous internal Evaluation (CIE) for 50 Marks

- Surprise test / Tutorials tests to be conducted for each topic for 10 marks.
- Quiz/ assignment based on practical application for 10 marks.
- Three mid semester examinations will be conducted each for 30 marks and the average of all the 3 will be taken.

Semester End Examination (SEE) for 50 Marks

Final examination, of 100 Marks will be conducted and will be evaluated for 50 marks.

CO-PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	03	02	03	1								**02**	**02**	**03**
CO2	03	02	03	1					02	01		**02**	**02**	**03**
CO3	03	02	03	1					02	01		**02**	**02**	**03**
CO4	03	02	03	1					02	01		**02**	**02**	**03**
CO5	03	02	03	1								**02**	**02**	**03**

Semester: 3 **Year: 2022-23**

Department: *Artificial Intelligence & Data Science*	***Course Type:*** *Core*
Course Title*:* Programming using Python	***Course Code:*** *21AD32*
L-T-P:3*-0-0*	***Credits:****03*
Total Contact Hours: 39 *hours*	***Duration of SEE:****03 hours*
SEE Marks*: 50*	***CIE Marks:*** *50*

Pre-requisites:

No programming knowledge is assumed, successful completion of first year course on programming is desirable..

Course Outcomes:

Cos	Course Outcome Description	Blooms Level
1	Describe Python and Libraries with Applications to Data Science	L1
2	Develop Python programs using control statements and functions	L3
3	Develop Python programs using features of Lists, tuples, Dictionaries and Sets with simple applications to Data Science	L3
4	Use Object-oriented features of Python, Exception handling and File handling in Python Programs performing Unit Testing.	L3
5	Develop simple Python programs to perform data analysis	L3

Teaching Methodology:

- Blackboard teaching / PowerPoint presentations.
- Motivation of concepts using Practical Examples.
- Course Project/Assignment.

Assessment Methods:

- Three internal tests, 40,40 and 20 marks will be conducted and the total weightage is 30%.
- Assignments emphasizing design and implementation of applications of the concepts of the course of 20% weightage .
- Final examination, of 100 Marks will be conducted and will be evaluated for 50 Marks(50% weightage).

CO-PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	03			2	2	2	2	1			1		**03**	**03**
CO2	03	02	03	2	2	2	2	1	02	02	1	**02**	**03**	**03**
CO3	03	02	03	2	2	2	2	1	02	02	1	**02**	**03**	**03**
CO4	03	02	03	2	2	2	2	1	02	02	1	**02**	**03**	**03**
CO5	03	02	03	2	2	2	2	1	02	02	1	**02**	**03**	**03**

Course Content

UNIT – I	**6 HOURS**
Introduction to Computers and Python: Object Technology basics, Overview of Python, Python standard library, Data Science libraries, Cloud and the Internet of Things and Big Data. Introduction to Python Programming: Variables and Assignment statements. Arithmetic. Single, double and triple-quoted strings. Getting Input, Decision making, Objects and Dynamic Typing, Basic Descriptive Statistics. Control Statements.	
UNIT – II	**10 HOURS**
Functions, Sequences, Lists and Tuples, Dictionaries and Sets: Functions: Various features and concepts used in developing functions in programming languages and specifically, Python. Lists and Tuples: Unpacking sequences, Sequence slicing, Sorting lists, searching sequences, Simulating Stacks with Lists, List Comprehensions, Generator Expressions, Filter, Map and Reduce, Two dimensional lists, Simple Python programs for Simulations and Static Visualizations. Dictionaries, Sets and Dynamic Visualizations.	
UNIT - III	**8 HOURS**
Arrays, Strings, Files and Exceptions: Array-oriented Programming with NumPy, Strings: A Deeper Look, Files and Exceptions. Introduction to Data Science: pandas Series and Data Frames, Regular expressions and data munging, Working with CSV files.	
UNIT – IV	**8 HOURS**
Object-oriented Programming: Classes, Inheritance, Polymorphism, Operator Overloading, Exceptions, Unit Testing, Namespaces and Scopes, Data Science example program on Time Series and Simple Regression.	

UNIT – V	7 HOURS
Data Analysis using Python: Cleaning and Preparing the Data, Identify and Handle Missing Values, Data Formatting,Data Normalization Sets, Descriptive Statistics, Basics of Grouping, ANOVA, Correlation,Simple and Multiple Linear Regression, Model Evaluation Using Visualization, R-squared and MSE for In-Sample Evaluation	

Text Book:
Python for Programmers by Paul Deitel and Harvey Deitel ,2020, Pearson India.

Websites:
https://www.python.org

Department: *Artificial Intelligence & Data Science*	***Course Type:*** *Core*
Course Title: Programming using Python Lab	***Course Code:*** *21ADL38*
L-T-P:0*-0-2*	***Credits:****01*
Total Contact Hours: 30 *hours*	***Duration of SEE:****03 hours*
SEE Marks*: 50*	***CIE Marks:*** *50*

Cos	Course Outcome Description	Blooms Level
1	Describe Python and Libraries with Applications to Data Science	L1
2	Develop Python programs using control statements and functions	L3
3	Develop Python programs using features of Lists, tuples, Dictionaries and Sets with simple applications to Data Science	L3
4	Use Object-oriented features of NumPy, Exceptions and File handling in Python Programs performing Unit Testing.	L3
5	Develop simple Python Programs to perform data analysis	L3

Assessment:

CIE(Experiments, Record, Viva Voce: 20 marks; Lab Test: 30 marks); SEE: 50 marks

Sl No	**Programs for Laboratory**	**CO**
1.	Design, Develop and Implement Python Programs for the following: a) Input a number , compute and print factorial of the number. b) Print Fibonacci sequence upto the first k elements, input k. c) Enter Python code at the Python shell prompt to illustrate that a Python list is mutable whereas tuples and strings are not. d) Count and print the number of occurrences of a sub string in a string.	**1**

2.	Develop functions to perform the following: 1. Perform sparse matrix addition using an appropriate Python data type 2. Perform addition of two polynomials 3. Search for an element in a list 4. A function that confirms Birthday Paradox.	**2**
3.	Write Python code for the following: 1. Given examples of slicing 2. Checking if a list of parentheses is well-formed 3. Given examples of list comprehensions and generator expressions 4. Given examples of Filter, Map and Reduce 5. Perform multiplication operation on two matrices and display the result.	3
4.	1.Develop Simple Python programs for Simulations and Static Visualizations. 2. 2. Develop simple Python programs for Dynamic Visualizations.	2
5.	1.Develop programs for given Array-oriented problems with NumPy 2.Develop given programs for string manipulation.	2
6.	1.Design and implement Python programs that handle exceptions for the given problem. 2. Use Pandas Series and DataFrame in given data science exercise. 3.Use Regular expressions in given data science exercise. 4. Apply data munging in the given data science application. 5. Read from CSV file and process as per the given data science exercise.	**4**
7.	Design and develop Python classes for the given exercise. Develop methods. Design , develop and run Unit tests.	**5**
8.	1.Design, Develop and Implement a Python class hierarchy using inheritance for the given exercise. Use Polymorphism where applicable. Unit test the class. 2.Develop a Python program for time series and regression.	**5**
9.	Design, develop and test Python programs for the given data science exercise involving Cleaning and Preparing the Data, Identify and Handle Missing Values, Data Formatting,Data Normalization Sets.	**6**
10	Design, develop and test Python programs for the given data science exercise involving Descriptive Statistics, ANOVA, Correlation,Simple and Multiple	**6**

	Linear Regression, Model Evaluation Using Visualization,R-squared and MSE for In-Sample Evaluation.	

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	03			2	2	2	2	1			1		**03**	**03**
CO2	03	02	03	2	2	2	2	1	02	02	1	**02**	**03**	**03**
CO3	03	02	03	2	2	2	2	1	02	02	1	**02**	**03**	**03**
CO4	03	02	03	2	2	2	2	1	02	02	1	**02**	**03**	**03**
CO5	03	02	03	2	2	2	2	1	02	02	1	**02**	**03**	**03**

Semester: 3 **Year: 2022-23**

Department: *Artificial Intelligence & Data Science*	***Course Type:*** *Core*
Course Title*: Computer Organization and Architecture*	***Course Code:*** *21AD33*
L-T-P:3*-0-0*	***Credits:****03*
Total Contact Hours: 39 *hours*	***Duration of SEE:****03 hours*
SEE Marks*: 50*	***CIE Marks:*** *50*

Pre-requisites:

i. Fundamentals of Computers.
ii. Programming.

Course Outcomes:
Students will be able to:

Cos	Course Outcome Description	Blooms Level
1	Describe the fundamentals of Boolean algebra, gates and combinatorial circuits	L2
2	Understand the internal functional units of a processor to execute instructions and mechanism for generating control signals	L2
3	Analyse internal organization of memory chip and the impact of cache on processor performance	L4
4	Illustrate the approaches involved in achieving communication between Processor and I/O devices	L2
5	Apply Booth algorithm for performing signed integer multiplication, restoring and non-restoring methods for integer division	L3
6	Understand the classic five stage pipeline and its role in improving the processor performance	L2

Teaching Methodology:

i. Black board teaching
ii. Motivation of Concepts using relevant Examples

Assessment Methods:

- Three internal tests, 40,40 and 20 marks will be conducted and the total weightage is 30%.
- Assignments emphasizing design and implementation of applications of the concepts of the course of 20% weightage .
- Final examination, of 100 Marks will be conducted and will be evaluated for 50 Marks(50% weightage).

CO-PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	03												**1**	**03**
CO2	03	02	03						02	02		**02**	**1**	**03**
CO3	03	02	03						02	02		**02**	**1**	**03**
CO4	03	02	03						02	02		**02**	**1**	**03**
CO5	03	02	03						02	02		**02**	**1**	**03**
C06	03	02	03						02	02		**02**	**1**	**03**
	03	02	03						02	02		**02**	**1**	**03**

COURSE CONTENT

UNIT – I	**6 hours**
Logic Gates; Boolean Algebra: Basic laws, K-Maps; Combinational Circuits: Adders, Multiplexer, De-Mux, Encoder, Decoder; and Sequential Circuits: characteristic equations and excitation tables of SR, JK, D and T flip-flops,; their role incomputer organization	
UNIT – II	**8 hours**
Basic Structure of Computers: Computer Types, Functional Units, Basic Operations & Concepts, Performance: Processor clock, Basic Performance Equation, clock rate, Performance measurement. **Machine Instructions and Programs**: Memory Locations and Addresses, Memory Operations, Instructions and instruction sequencing: Register Transfer Notation, Assembly Language Notation, Instruction Types, Instruction Execution and straight line sequencing, branching, condition codes, Addressing modes.	
UNIT – III	**9 hours**

The Memory System: Internal organization of Memory chips, Random access memory, Read-Only Memories, Speed size and cost. Cache memories: Mapping functions. Performance considerations: Hit rate and Miss Penalty; Replacement Algorithms: FIFO, LRU and OPTIMAL. **Secondary Storage:** Disk structure, and disk access time.	
UNIT – IV	**7 hours**
Fundamentals of Computer Design: Defining Computer Architecture -Instruction Set Architecture **Pipelining:** The Basics of a RISC Instruction Set, The Classic Five-Stage Pipeline for a RISC Processor, The Major Hurdle of Pipelining—Pipeline Hazards.	
UNIT – V	**9 hours**
Basic processing unit: Performing an Arithmetic or Logic Operation, Fetching a word from Memory, Storing a word in memory; Execution of a complete Instruction:Branch Instructions; Multiple Bus Organization, Hardwired Control: A Complete Processor; Micro programmed Control: Microinstructions; Parallelism: Overview of Instruction Level Parallelism, Data level parallelism and Thread level parallelism.	

Text books:

1.ComputerOrganization, Carl Hamacher, ZvonkoVranesic, Safwat Zaky, ZvonkoVranesic, 5th Edition, TMH, 2017

2. Computer architecture: A quantitative approach, John L. Hennessy and David. A. Patterson, 5th edition, Elsevier

Reference books:

1. Computer Organization & Architecture, William Stallings, 10thEdition, PHI, 2015.

Semester: 3 **Year: 2022-23**

Department: *Artificial Intelligence & Data Science*	***Course Type:*** *Core*
Course Title*:* Artificial Intelligence	***Course Code:*** *21AD34*
L-T-P:3*-0-0*	***Credits:****03*
Total Contact Hours: 39 *hours*	***Duration of SEE:****03 hours*
SEE Marks*: 50*	***CIE Marks:*** *50*

Pre-requisites:

i. A course on Programming.

Course Outcomes:

Cos	Course Outcome Description	Blooms Level
1	Describe the evolution of artificial intelligence along with search methods and applications	L1
2	Apply the principles of search strategies to relevant problems	L3
3	To design algorithms to find optimal paths and apply concepts of A* algorithm in developing applications	L1, L3
4	Describe and apply the principles and steps of Game Playing Algorithms	L3
5	To describe the usage of Prolog in realization of Knowledge base for querying	L1

Teaching Methodology:

- Black board Teaching
- PowerPoint Presentation

Assessment Methods:

- Three internal tests, 40,40 and 20 marks will be conducted and the total weightage is 30%.
- Assignments emphasizing design and implementation of applications of the concepts of the course of 20% weightage .
- Final examination, of 100 Marks will be conducted and will be evaluated for 50 Marks(50% weightage).

CO-PO Mapping:

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	03			2	2	2	2				1			**03**
CO2	03	02	03	2	2	2	2		02	02	1	**02**	**02**	**03**
CO3	03	02	03	2	2	2	2		02	02	1	**02**	**02**	**03**
CO4	03	02	03	2	2	2	2		02	02	1	**02**	**02**	**03**
CO5	03	02	03	2	2	2	2		02	02	1	**02**	**02**	**03**
	03	02	03	2	2	2	2		02	02	1	**02**	**02**	**03**

Course Content

UNIT – I	8hours
Introduction: History, Can Machines think? Turing Test, Winograd Schema Challenge, Language, Philosophy, Mind, Reasoning, Computation, The Chess Saga, Intelligent Agents **Search strategies:** State Space Search: Depth First Search, Breadth First Search, Depth First Iterative Deepening , Heuristic Search: Best First Search, Hill Climbing, Solution Space, Travelling Salesman Problem	
UNIT – II	**8 hours**
Search strategies and A* Algorithm: Escaping Local Optima, Stochastic Local Search, Population based methods, Genetic Algorithms, SAT, TSP, Emergent Systems, Ant Colony Optimization; Finding Optimal Paths: Branch&Bound, A*, Admissibility of A*, Informed Heuristic Functions	
UNIT – III	**7hours**
Results related to Admissibility of A* , Space Saving Versions of A*:Weighted A*, Iterative Deepening A*, Recursive Best First Search, Monotone Condition, Sequence Alignment, Divide and Conquer Beam Stack Search	
UNIT – IV	**9 hours**
Game Playing: Game Theory, Board Games and Game Trees, Algorithm MiniMax, AlphaBeta and SSS*, Automated Planning: Domain Independent Planning, Blocks World, Forward&Backward Search, Goal Stack Planning, Plan Space Planning, Problem Decomposition: Means Ends Analysis, Algorithm Graphplan, Algorithm AO*	
UNIT – V	**7hours**
Rule Based Expert Systems, Knowledge, Reasoning and Planning, First order logic, Knowledge base using Prolog, Concepts of Uncertainty and Knowledge Reasoning	

Text Book:

1. Deepak Khemani, A First Course in Artificial Intelligence, McGraw Hill Education(India) 2013.
2. Russell, S. J., and Norvig, P., 2022, Artificial Intelligence: A Modern Approach, 4th edn.,

Prentice Hall.

Websites:

https://towardsdatascience.com/ai-search-algorithms-every-data-scientist-should-know-ed0968a43a7a

[Popular Search Algorithms in AI - BLOCKGENI]

Semester: 3 **Year: 2022-23**

Department: *Artificial Intelligence & Data Science*	***Course Type:*** *Core*
Course Title*: Data Structures*	***Course Code:*** *21ADG35*
L-T-P:*3-0-2*	***Credits:****04*
Total Contact Hours: 39 theory & 26 lab	***Duration of SEE:****03 hours*
SEE Marks*: 50*	***CIE Marks:*** *50*

Pre-requisites:

Computer concepts and C programming

Course Outcomes:
Students will be able to:

Cos	Course Outcome Description	Blooms Level
1	Understand the fundamentals of Linear and Non-linear data structures.	L2
2	Apply stack operations for given problems	L3
3	Develop solutions for the given problem using recursion	L3
4	Apply Queue operations to solve the real-world problem	L3
5	Apply linked list concepts for solving the given problem	L3
6	Construct binary trees and perform tree traversals	L3

Teaching Methodology:

I. Black board teaching
II. PowerPoint presentation
III. GATE Aptitude training during tutorial hours

Assessment Methods:

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	03			1	2						1		**03**	**03**
CO2	03	02	03	1	2				02	02	1	**02**	**03**	**03**
CO3	03	02	03	1	2				02	02	1	**02**	**03**	**03**
CO4	03	02	03	1	2				02	02	1	**02**	**03**	**03**
CO5	03	02	03	1	2				02	02	1	**02**	**03**	**03**
C06	03	02	03	1	2				02	02	1	**02**	**03**	**03**
	03	02	03	1	2				02	02	1	**02**	**03**	**03**

COURSE CONTENT

UNIT – I	8 hrs
Introduction: Data Structures, Classifications (Primitive & Non-Primitive), Data structure Operations, Dynamic Memory Allocation Functions, dynamically allocated arrays, Representation of 2D Arrays in Memory, Pointers to 2D arrays (Matrix addition, subtraction, multiplication), Multidimensional Arrays, Polynomials and Sparse Matrices.	
UNIT – II	**10 hrs**
Stacks: Definition, Stack Operations, Array Representation of Stacks, Stacks using Dynamic Arrays, Stack Applications: Polish notation, Infix to postfix conversion, evaluation of postfix expression. **Recursion -**Recursive definition and process, Factorial function, Fibonacci Sequence, Binary search, Tower of Hanoi.	
UNIT – III	**10 hrs**
Queues: Definition, Array Representation, Queue Operations, Circular Queues, Circular queues using Dynamic arrays, Dequeues, Priority Queues. Multiple Stacks and Queues. Programming Examples.	
UNIT – IV	**12 hrs**
Linked Lists: Definition, Representation of linked lists in Memory, Memory allocation; Garbage Collection. **Linked list operations:** Traversing, Searching, Insertion, and Deletion. Doubly Linked lists, Circular linked	

lists, and header linked lists. Linked Stacks and Queues. Applications of Linked lists – Polynomials, Sparse matrix representation. Programming Examples	
UNIT – V	**12 hrs**
Trees: Terminology, Binary Trees, Properties of Binary trees, Array and linked Representation of Binary Trees, Binary Tree Traversals - Inorder, postorder, preorder; Additional Binary tree operations. Threaded binary trees, Binary Search Trees – Definition, Insertion, Deletion, Traversal, Searching, Application of Trees-Evaluation of Expression, Programming Examples. Overview of Hashing functions and Tables with applications.	

Text Books:

1. Ellis Horowitz and Sartaj Sahani, Fundamentals of Data Structures in C, 2nd Ed, Universities Press, 2014.
2. Seymour Lipschutz, Data Structures Schaum's Outlines, Revised 1st Ed, McGraw Hill, 2014.

Reference Books:

1. Data Structure using C, Aaron M. Tanenbaum, YedidyahLangsam& Moshe J. Augenstein, Pearson Education/PHI, 2006
2. The C Programming Language, Brian W Kernighan and Dennis M Ritchie, Prentice Hall Software Series, 2nd Edition
3. Data Structures a Pseudocode approach with C,Richard F.Gilberg and Behrouz A .Forouzan, Thomson,2005.
4. Data Structures & Program Design in C, Robert Kruse & Bruce Leung, Pearson.

Sl No	**Programs for Lab**	**CO**
1.	Design, Develop and Implement a menu driven Program in C for the following operations using pointer to 2D arrays e) Read two matrices of order m * n f) Display the elements of the matrices g) Perform addition operation on two matrices and display the sum. h) Perform subtraction operation on two matrices and display the result. i) Perform multiplication operation on two matrices and display the result.	**1**
2.	Design and implement a stack (Array implementation/ Linked list implementation) and demonstrate its working with necessary inputs. Display the appropriate messages in case of exceptions	**2**
3.	Develop a program to demonstrate concept of recursion (Factorial / Binary Search / Fibonacci /Towers of Hanoi)	3
4.	Design and implement an algorithm for conversion of an expression from infix to postfix and infix to prefix form. Demonstrate its working with suitable inputs	2

5.	Design and implement an algorithm to evaluate an postfix and prefix arithmetic expression and demonstrate its working with suitable examples	2
6.	Design and implement a given type of (ordinary queue, circular queue) queue in C (array implementation/ Linked list implementation). And demonstrate its working with suitable inputs. Display appropriate messages in case of exceptions.	**4**
7.	Design, Develop and Implement a menu driven Program in C for the following operations on Singly Linked List (SLL) of Student Data with the fields: USN, Name, Programme, Sem, Phone Number. a) Create a SLL to store details of N Students by using both front insertion and rear insertion. b) Display the details of all the students and count the number of students whose details is stored in the list. c) Demonstrate deletion of student details from both front and rear end of SLL. d) Demonstrate Insertion and deletion of student details at specified position of SLL. (Note: Only few of the operations can be asked in exam)	**5**
8.	Design, Develop and Implement a menu driven Program in C for the following operations on Doubly Linked List (DLL) of Employee Data with the fields: SSN, Name, Dept, Designation, Basic, DA, Income tax(IT). a) Create a DLL to store details of N Employees by using both front insertion and rear insertion. b) Display the details of all the Employees from (both front to back and back to front) and count the number of employees whose details is stored in the list . c) Demonstrate deletion of employee details from both front and rear end of DLL. d) Demonstrate Insertion and deletion of Employee details at specified position of DLL e) Calculate and display the net and gross salary of each employee whose details is stored in the DLL. (gross_sal = Basic + DA) (net_sal = gross_sal - IT) (Note: Only few of the operations can be asked in exam)	**5**
9.	Design, Develop and Implement a menu driven Program in C for the following operations on Binary Search Tree (BST) of Integers . a. Create a BST of N Integers: 6, 9, 5, 2, 8, 15, 24, 14, 7, 8, 5, 2 b. Traverse the BST in Inorder, Preorder and PostOrder c. Search the BST for a given element (KEY) and report the appropriate message d. Exit	**6**
10	Design and implement binary tree and demonstrate its working	**6**

Department: *Artificial Intelligence & Data Science*	***Course Type:*** *Elective*
Course Title*: Statistics using R*	***Course Code:*** *21ADE371*
L-T-P:3*-0-0*	***Credits:****03*
Total Contact Hours: 39 *hours*	***Duration of SEE:****03 hours*
SEE Marks*: 50*	***CIE Marks:*** *50*

Pre-requisites:

- Self-contained (but desirable to have understanding of Calculus)

Course Outcomes:

Students will be able to:

Cos	Course Outcome Description	Blooms Level
1	To apply concepts of probability such as Axioms of Probability, Association Rule Mining and Baye's Theorem, Random variables, mathematical expectation, variance, discrete and continuous distributions.	L3
2	To apply and visualize, using R, concepts of Random variables, distributions such as Binomial, Normal, Poisson, Geometric, Uniform , Exponential, Chi-Square, Student's t-distribution and F-distribution.	L3
3	To apply the concepts of sampling, Central Limit Theorem, Maximum Likelihood Estimation and Confidence Intervals	L3
4	To use Hypothesis Testing	L3
5	To apply ANOVA and correlation analysis	L3

Teaching Methodology:

- Black board teaching
- Power Point presentations
- Handson Sessions

Assessment Methods:

- Three internal tests, 40,40 and 20 marks will be conducted and the total weightage is 30%.
- Assignments emphasizing design and implementation of applications of the concepts of the course of 20% weightage .
- Final examination, of 100 Marks will be conducted and will be evaluated for 50 Marks(50% weightage).

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	03	03	03	02	03	02	02						**02**	**03**
CO2	03	03	03	02	03	02	02		01	02	01	**02**	**02**	**03**
CO3	03	03	03	02	03	02	02		01	02	01	**02**	**02**	**03**
CO4	03	03	03	02	03	02	02		01	02	01	**02**	**02**	**03**
CO5	03	03	03	02	03	02	02		01	02	01	**02**	**02**	**03**
	03	03	03	02	03	02	02		01	02	01	**02**	**02**	**03**

UNIT – I (7 hours)

Overview of Probability Concepts, Random experiment, Sample Space, Event, Probability Estimation, Axioms of Probability, Association Rule Mining as an application, Baye's Theorem. Overview of Programming using R.

UNIT – II (7 hours)

Random Variables, Probability Density Function, Discrete and Continuous distributions, Mathematical expectation, variance of a random varaible. R functions to calculate density functions, expectations and variance.

UNIT – III (8 hours)

Binomial Distribution, Geometric Distribution, Poisson Distribution, Parameters of Continuous Distributions, Uniform Distribution, Exponential Distribution, Normal Distribution. Chi-Square Distribution, Student's t-Distribution, F-Distribution. Examples and demonstrations using R.

UNIT – IV (9 hours)

Sampling and Estimation, Random Sampling, Stratified Sampling, Cluster Sampling, Bootstrap aggregating, Non-probability Sampling, Sampling distribution, Central Limit Theorem, Sampling Size Estimation for the Mean of the Population, Estimation of Parameters, Maximum Likelihood Estimation, Confidence Intervals. Examples and demonstrations using R.

UNIT – V (8 hours)

Introduction Hypothesis Testing, Setting up a Hypothesis Test, One-Tailed and Two-Tailed Test, Type I Error, Type II Error, z-Test, t-Test, non-parametric tests, Chi-Square Goodness of Fit Tests, Analysis of Variance, Correlation Analysis: Pearson Correlation. Examples and demonstrations using R.

TEXT BOOKS:

1. Business Analytics: The Science of Data-driven Decision Making, Dinesh Kumar, 2017, Wiley India, Pvt. Ltd.
2. Probability&Statistics for Engineers & Scientists, Ninth Edition, Ronald E. Walpole,Raymond H.Myers, Sharon L.Meyers, Keying Ye. 2012, Pearson.
3. Ismay, Chester, and Albert Y. Kim. "Statistical inference via data science: A ModernDive into R and the tidyverse". Chapman and Hall/CRC, 2019.

WEBSITES:

1. Probability and Statistics with Examples using R (isibang.ac.in)
2. https://www.overleaf.com/learn/latex/Learn_LaTeX_in_30_minutes (Project report writing using LaTeX)

Semester: 3 **Year: 2022-23**

Department: *Artificial Intelligence & Data Science*	***Course Type:*** *Elective*
Course Title*: Web Technologies*	***Course Code:*** *21ADE372*
L-T-P:3*-0-0*	***Credits:****03*
Total Contact Hours: 39 *hours*	***Duration of SEE:****03 hours*
SEE Marks*: 50*	***CIE Marks:*** *50*

Pre-requisites:

- A Programming course

Course Outcomes:

Students will be able to:

Cos	Course Outcome Description	Blooms Level
1	Design web pages using HTML mark-up language for the given Scenarios.	L3
2	Describe the fundamental concepts of XML	L1
3	Apply the concepts of Cascading Style Sheets for designing the web pages.	L3
4	Demonstrate the use of JavaScript to develop the dynamic user interface.	L3
5	Implement server-side scripting using PHP	L3

Teaching Methodology:

- Black board teaching
- Power Point presentations
- Handson Sessions

Assessment Methods:

- Course Project -20 Marks
- Three internals, 30 Marks each will be conducted and the Average of all three will be taken.
- Final examination, of 100 Marks will be conducted and will be evaluated for 50 Marks.

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	03												**02**	**03**
CO2	03	02	03						02	02		**02**	**02**	**03**
CO3	03	02	03						02	02		**02**	**02**	**03**
CO4	03	02	03						02	02		**02**	**02**	**03**
CO5	03	02	03						02	02		**02**	**02**	**03**
	03	02	03						02	02		**02**	**02**	**03**

COURSE CONTENT UNIT – I 7 hours

Internet and web technologies, structuring an HTML document, Exploring Editors and Browsers Supported by HTML5, Creating and saving an HTML document, Validating and Viewing an HTML document, Understanding HTML elements, Describing data types, Formatting text with HTML elements, Arranging text, Exploring the hyperlinks and URL, Creating tables.

UNIT – II **7 hours**

HTML Continued - Inserting images in a web page, Exploring colours, working with forms, Exploring audio and video formats, Describing the multimedia elements, Defining a multimedia file using the EMBED element.

Introduction to XML: Working with basics of XML – Exploring XML, Comparing XML with HTML, Advantages and disadvantages of XML, Structure of XML document

UNIT – III **8 hours**

CSS – Overview of CSS, Background and colour gradient in CSS, font and text styles, Creating Boxes and Columns in CSS, Displaying, Positioning and Floating an element, List styles, Table layouts.

UNIT – IV **9 hours**

Exploring the features of Javascript, Using Javascript in an HTML Document, Programming fundamentals of Javascript, Javascript functions, events, image maps and animations, Objects in Javascript, Working with Browser objects, Working with Document Object, Document Object Model.

UNIT – V **8 hours**

Introduction to PHP: Origins and uses of PHP, Overview of PHP, General syntactic characters, Primitives operations and expressions, output, control statements, Arrays, Functions, Pattern matching, Form handling, Cookies, Session Tracking.

TEXT BOOKS:

1. HTML5 Covers CSS3, JavaScript, XML, XHTML, AJAX, PHP and Jquery Black Book, dreamtech PRESS, ISBN:978-93-5119-907-6, 2019
2. Programming the World Wide Web- Robert W. Sebesta, 7thEdition, Pearson Education, 2014.

Department: *Artificial Intelligence & Data Science*	***Course Type:*** *Elective*
Course Title*: Software Engineering*	***Course Code:*** *21ADE373*
L-T-P:3*-0-0*	***Credits:****03*
Total Contact Hours: 39 *hours*	***Duration of SEE:****03 hours*
SEE Marks*: 50*	***CIE Marks:*** *50*

Prerequisites:

- A course on programming

COs	Course Outcome Description	Blooms Level
1	Describe the phases of software engineering life cycle	L1
2	Specify requirements for a chosen case study by applying principles of requirements engineering and best practices	L3
3	Create Architecture and detailed design for the chosen case study by applying best practices in architecture and design	L3
4	Develop software for the chosen case study by using appropriate coding guidelines and running unit, integration and system tests	L5
5	Implement changes and bug-fixes to the software of the case study pointing out opportunities for refactoring code besides ensuring correctness	L3

Teaching Methodology:

- Black board teaching
- Power Point presentations
- Handson Sessions

Assessment Methods:

- Course Project -20 Marks
- Three internals, 30 Marks each will be conducted and the Average of all three will be taken.
- Final examination, of 100 Marks will be conducted and will be evaluated for 50 Marks.

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	03				02			2					**02**	**03**
CO2	03	01	03		02			2	02	02		**02**	**02**	**03**
CO3	03	01	03		02			2	02	02		**02**	**02**	**03**
CO4	03	01	03		02			2	02	02		**02**	**02**	**03**
CO5	03	01	03		02			2	02	02		**02**	**02**	**03**
	03	01	03		02			2	02	02		**02**	**02**	**03**

Course Content:

UNIT – I	8 hours
Software Development Life Cycle: History of Software Engineering. Software Development Life Cycle. Process Models. Sample case studies for illustration. Classification of software qualities. Quality requirements.	
UNIT – II	8 hours
Requirements Specification: User Requirement Specifications. Products and Requirements. Use Cases. Sample Case studies for illustration. Development Cost Estimation methods. Principles of Requirements Engineering. Product Line , common and varying requirements. The uses of specifications, specification qualities, verification of specifications, Building and using specifications in practice.	
UNIT – III	8 hours
Architecture and Design: Separation of concerns, Modularity, Abstraction, Anticipation of change, Generality and incrementality. Case studies illustrating software engineering principles. Software Design activity and its objectives. Modularization techniques. Handling anomalies. Object-oriented design. architecture and components.	
UNIT – IV	8 hours
Implementation and Validation: Alpha, Beta and Revenue Release milestones. Coding guideline standards. Development of code in conformance with coding guidelines. Case studies. White-box and Black-box testing methods. Unit , integration and system testing.	
UNIT – V	7 hours
Making Changes to Software: Importance of software process models. Dealing with Legacy software. Organizing the Process. Organizing Artifacts. Configuration Management Standards.	

Text Books:

5. Carlo Ghezzi, Mehdi Jazayeri, Dino Mandrioli. Fundamentals of Software Engineering, 2nd edition, 2003, Prentice-Hall of India.
6. Roger Pressman, Bruce Maxim. Software Engineering A Practitioner's Approach. Ninth Edition, 2019. Mc-Graw Hill Education.

Semester: 3 **Year: 2022-23**

Department: *Artificial Intelligence & Data Science*	***Course Type:*** *Elective*
Course Title: *Software Engineering*	***Course Code:*** *21ADE373*
L-T-P:3-0-0	***Credits:****03*
Total Contact Hours: 39 *hours*	***Duration of SEE:****03 hours*
SEE Marks*: 50*	***CIE Marks:*** *50*

Department: *Artificial Intelligence & Data Science*	***Course Type:*** *Elective*
Course Title*: Internship-I*	***Course Code:*** *21ADI39*
L-T-P:	***Credits:****02*
Total Contact Hours:	***Duration of SEE:****as required for presentation/Viva Voce*
SEE Marks*: 50*	***CIE Marks:*** *50*

Course Outcomes:

1. Students gain practical experience in software design, development and testing
2. Students learn how to work in teams and integrate their work
3. Students learn about technical report writing
4. Students learn how to present OR explain their work to others
5. Students learn about best practices or right usage of programming constructs

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	03	03	2	2	03	2	2	2	3	2	3	**3**	**03**	**03**
CO2	02	02	02	2	02	2	2	2	03	02	3	**02**	**02**	**02**
CO3	03	03	02	02	02	02	2	2	03	03	2	**02**	**02**	**02**
CO4	02	02	02	02	02	02	02	2	03	03	02	**02**	**02**	**02**
CO5	02	02	03	2	03	2	1	1	03	03	3	**03**	**03**	**03**
	2.4	2.4	2.2	2	2.4	2	1.8	1.8	03	2.6	2.6	**2.4**	**02**	**03**

Assessment:

Students need to submit a report on project work carried out (50% weightage) and present or undergo a Viva Voce (50% weightage).

Course Content:

Students perform projects of their choice or assigned ones that shall have specified course outcomes. Typically, students develop software and co-ordinate with a small team learning project management issues in addition to resolving technical challenges.

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Semester 4:

Department: Mathematics	*Course Type: Basic Science*
***Course Title**: Mathematics IV* *(Probability and Discrete mathematics)*	***Course Code: 21MAT41A***
L-T-P : 3-0-0	***Credits: 3***
Total Contact Hours: 39	***Duration of SEE: 3.00hrs***
***SEE Marks**: 100*	***CIE Marks: 50***

COURSE DESCRIPTION

The course gives a broad view of Probability theory, Random Process, Discrete mathematical structures and Graph theory.

PREREQUISITES

Concepts of Combinations, Permutation and Set theory

COURSE OBJECTIVES

To Impart the knowledge and ability to apply basic concepts of Probability, random process, discrete mathematics and graph theory to engineering problems

COURSE CONTENTS

UNIT - I 08 Hours

Probability and Random Variables

Probability: Definition, Axioms of probability, Addition rule, Conditional Probability, Multiplication rule.

Random variable -: Probability distribution- discrete and continuous, probability density function, cumulative density function, mean and variance, expectation.

Joint distribution - discrete joint probability distribution, marginal distribution, expectation, covariance, rank correlation.

Binomial, Poisson distribution, Gaussian distribution

Baye's Theorem, continuous Joint distribution

UNIT - II 08 Hours

Probability and sampling Distribution

Probability Distribution: Normal distribution, exponential distribution and uniform distribution.

Sampling and Testing of hypothesis: Introduction, Sampling with and without replacement, Sampling distribution of means and sample variance. Unbiased estimate, confidence intervals for mean, statistical hypothesis, testing of hypothesis of large samples, one tailed and two tailed test, Significance level.

Markov Process: Definition, transition probability matrix, regular stochastic matrix, n – step transitional probabilities, stationary distribution

Self-Study: Poisson's Process, States of Markov process.

.

UNIT - III 08 Hours

Discrete Mathematical structures

Mathematical Logic: Propositional Logic, logical operators, compound propositions - truth values, truth tables, Propositional Equivalences.

Functions: Definition, surjective, injective and bijective functions, Inverse function and composition of functions.

Relations: Definition, Properties, Equivalence, matrix representation, digraphs, partial order -Hasse diagram-Maximal and minimal elements, LUB and GLB.

Self-Study: Rules of Inference.

UNIT - IV 08 Hours

Graph Theory-I

Graph Terminologies, circuits, cycles and connected graphs hand shaking theorem, Degree sequence, path and trail in graphs, Graph isomorphism, Adjacency and Incidence matrices, Euler and Hamiltonian graphs, Shortest path problems-Dijkstra's algorithm for undirected graphs.

Applications such as Job Assignments, Travelling Salesman problem

UNIT - V 07 Hours

Graph Theory-II

Trees- Properties, spanning trees, minimum spanning trees- Prim's and Kruskal's algorithm.

Planar graphs, Problems on Euler's formula, Graph coloring – vertex coloring.

Self-Study: Three house and Three utilities problem, Scheduling Problems using Graph coloring,

TEXT BOOKS

1. Fundamentals of Statistics, S C Gupta, 6th edition, Himalaya Pub., 2007
2. Discrete Mathematics and its applications, Kenneth Rosen, 7th edition, Tata McGrawHill, 2011

REFERENCE BOOKS

1. Introduction to Graph theory, Gary Chartrand, Tata McGrawHill, 2006
2. Probablility and Statistics, M R Spiegel, JJ Schiller, R A Srinivasan, 3rd edition, Mc GrawHill, 2019

TEACHING METHODS

- Black Board Teaching.
- Power point presentation
- Tutorial

ASSESSMENT METHODS

Continuous internal Evaluation (CIE) for 50 Marks

- Surprise test / Tutorials tests to be conducted for each topic for 10 marks.
- Quiz/ assignment based on practical application for 10 marks.
- Three mid semester examinations will be conducted each for 30 marks and the average of all the 3 will be taken.

Semester End Examination (SEE) for 50 Marks

Final examination, of 100 Marks will be conducted and will be evaluated for 50 marks.

COURSE OUTCOMES

1. The concepts of Mathematical logic, functions and relations can be applied to Engineering. Problems
2. The concepts of graph theory can be used to model and solve problems
3. The concepts of Graph theory can be applied to Engineering Problems
4. The basic concepts of Probability, random variables, distributions and Sampling can be used for problem solving
5. The testing of hypothesis and distributions can be applied to engineering problems

Mapping of CO-PO:

PO	1	2	3	4	5	6	7	8	9	10	11	12	PSO1	PSO2
CO1	3	2	2	2	1	2	2		1	2		2	1	2
CO2	3	2	2	2	1	2	2		1	2		2	1	2
CO3	3	2	2	2	1	2	2		1	2		2	1	2
CO4	3	3	2	2	1	2	2		1	2		2	1	2
CO5	3	2	2	2	1	2	2		1	2		2	1	2
	3	2.2	2	2	1	2	2		1	2		2	1	2

Department: *Artificial Intelligence & Data Science*	***Course Type: Core***
Course Title: *Data Mining*	***Course Code:*** *21AD42*
L-T-P:3-0-0	***Credits:****03*
Total Contact Hours: 39 *hours*	***Duration of SEE:****03 hours*
SEE Marks*: 50*	***CIE Marks:*** *50*

Prerequisites

- Data Mining shall be a self-contained course, mathematical preliminaries such as probability theory are helpful.

Course Outcomes:

At the end of the course, students will be able to

Cos	Course Outcome Description	Blooms Level
1	Describe methods for data cleaning	L1
2	Explain methods of frequent pattern mining	L2
3	Apply techniques for classification of data	L3
4	Analyse given data using classification and clustering algorithms	L4
5	Synthesise and solve data mining problems of practical importance using theoretical analysis and software tools	L3

Teaching Methodology

- Black board, Power Point
- Assignment
- Case Study

Assessment Methods:

- Three MSEs of 30 marks of each. The average of all three performances will be considered to award 30 marks.
- Rubrics to evaluate Case Study 10Marks
- Rubrics for evaluating assignment 10 Marks.
- SEE for 100 marks will be evaluated for50 marks.

Course Outcome to Programme Outcome Mapping

PO	1	2	3	4	5	6	7	8	9	10	11	12	PSO1	PSO2
CO1	3	2	3	2	3	2	2	1	1	2	2	2	2	2
CO2	3	2	3	2	3	2	2	1	1	2	2	2	2	2
CO3	3	2	3	2	3	2	2	1	1	2	2	2	2	2
CO4	3	3	2	2	3	2	2	1	1	2	2	2	2	2
CO5	3	2	3	2	3	2	2	1	1	2	2	2	2	2
	3	2.2	2.8	2	3	2	2	1	1	2	2	2	2	2

COURSE CONTENT

Unit 1(Introduction to Data mining): Data mining, kinds of data mining, patterns, technologies. Getting to know your data. Description of data, data visualization, measuring the similarity and dissimilarity. Data Pre-processing: An overview of data pre-processing, data cleaning, integration, reduction, transformation and discretization. (8 Hours)

Unit 2 (Mining Frequent Patterns): Mining Frequent Patterns, Associations, and Correlations: Basic Concepts and Methods, Market Basket Analysis, Data Warehousing and Online Analytical Processing, Data Cube Technology (8 Hours)

Unit 3 (Classification): Basic Concepts, Decision Tree Induction, Bayes Classification Methods, Rule-Based Classification, Model Evaluation and Selection, Techniques to Improve Classification Accuracy. (8 Hours)

Unit 4 (Clustering): Basic Concepts and Methods, Cluster Analysis, Partitioning Methods, Hierarchical Methods, Density-Based Methods, Grid-Based Methods and Evaluation of Clustering. (8 Hours)

Unit 5 (Outlier and data mining Applications): Outliers and Outlier Analysis, Outlier Detection Methods, Statistical Approaches, Proximity-Based Approaches, Clustering-Based Approaches, Classification-Based Approaches, Mining Contextual and Collective Outliers.

Case studies from text mining, recommender systems, image and video processing, data warehousing. Data Mining Trends and Research Frontiers: Data Mining Applications, Graph Mining and Social Network Analysis.

(7 Hours)

Text books

Jiawei Han, Kamber Jian Pei Simon (2019), Data Mining Concepts and Techniques, Third Edition. Morgan Kaufmann Publishers

References:

Pang-Ning Tan, Michael Steinbach and Vipin Kumar, Introduction to Data Mining ,

Pearson,2016.

Websites:

Data mining - Wikipedia

Semester: 4 **Year: 2022-23**

Department: *Artificial Intelligence & Data Science*	***Course Type: Core***
Course Title: *Database Management Systems*	***Course Code:*** *21AD43*
L-T-P:*3-0-0*	***Credits:****03*
Total Contact Hours: 39 *hours*	***Duration of SEE:****03 hours*
SEE Marks*: 50*	***CIE Marks:*** *50*

Pre-requisite:

- Students should have knowledge of data structures.

Course Outcomes:

Students will be able to:

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Cos	Course Outcome Description	Blooms Level
1	Describe the concepts, design and applications of database systems	L1
2	Explain the principles of data modelling, querying, SQL programming techniques of database systems.	L2
3	Design and implement queries using query languages for a given database system.	L3
4	Analyse given schema and use appropriate normalization techniques for relational databases.	L4
5	Explain the principles of storage, transactions and optimization of database systems	L2
6	Design and implement an efficient database system and interface it with a given application	L3

Teaching Methodology:

- Black board teaching
- Power Point presentations
- Hands on Sessions

Assessment Methods:

- Course Project /Assignment-20 Marks
- Three internals, 30 Marks each will be conducted and the Average of all three will be taken.

- Final examination, of 100 Marks will be conducted and will be evaluated for 50 Marks.

Course Outcome to Programme Outcome Mapping:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	2	2	2	2	3	2	2	1			2	2	3	3
2	2	2	2	2	3	2	2	1	2	2	2	2	3	3
3	2	2	2	2	3	2	2	1	2	2	2	2	3	3
4	2	2	2	2	3	2	2	1	2	2	2	2	3	3
5	2	2	2	2	3	2	2	1	2	2	2	2	3	3
6	2	2	2	2	3	2	2	1	2	2	2	2	3	3
	2	2	2	2	3	2	2	1	2	2	2	2	3	3

Course Content:

Unit 1 (Introduction to Database Systems and Entity Relationship Model): Purpose of database systems, characteristics of database approaches, history of database applications, classification of DBMS, database users, architectures for DBMS, recent database applications, data models, schemas, data independence, database design and implementation process.

E-R diagrams, entities, attributes, relationships, roles and constraints, Enhanced Entity-Relationship (EER) diagrams, sub classes and super classes, specialization and generalization.

11 HOURS

Unit 2 (Relational Data models and Query Languages): Relational schema, relational model constraints, keys, relational database design, relational algebra, relational calculus.

SQL- data definition and data types, query formulation, constraints in SQL, basic queries in SQL, complex queries in SQL, QBE, query processing, database programming - techniques and issues, embedded SQL, using JDBC, database stored procedures.

8 hours

Unit 3 (Normalization) : Functional dependency, normal forms, decomposition of a schema, multivalued dependencies, join dependencies, dependency preservation, inclusion dependencies.

6 hours

Unit 4 (File Structures)

Basic file structure, RAID technology, hashing techniques, indexing structures, types of single level ordered indexes, multi-level indexes, B+ trees

7 hours

Unit 5 (Transaction Processing)

Transaction processing systems, transaction states, ACID properties, characterizing schedules, recoverability and serializability of schedules, concurrency control, locking techniques, time stamp ordering, database recovery techniques, shadow pages, ARIES recovery algorithm, database security and authorization.

7 hours

Text Book:

1. Elmasri, R., and Navathe, S.B., 2017, Fundamentals of Database Systems, 7th ed., Pearson Education.

Websites:

[Database - Wikipedia]

Department: *Artificial Intelligence & Data Science*	***Course Type: Core***
Course Title: *Design and Analysis of Algorithms*	***Course Code:*** *21AD44*
L-T-P:3*-0-0*	***Credits:****03*
Total Contact Hours: 39 *hours*	***Duration of SEE:****03 hours*
SEE Marks*: 50*	***CIE Marks:*** *50*

This course introduces basic methods for the design and analysis of efficient algorithms emphasizing methods which are useful in practice. The computational problems for sorting, searching, Divide and Conquer, dynamic programming and greedy algorithms, graph algorithms string matching, Backtracking, Branch and Bound, NP completeness are discussed.

Pre-requisites:

- Self-contained , however, desirable for student to have successfully completed first year programming course and have knowledge of mathematical preliminaries such as probability theory.

Course Outcomes:
Students will be able to:

Cos	Course Outcome Description	Blooms Level
1	Describe Algorithmic problem solving approaches , important problem Types and Analysis of Algorithm efficiency	L1
2	Design various algorithms for Search, and Sort including Depth First and Breadth First approaches	L3
3	Design algorithms using Divide and Conquer approach, Transform and Conquer and Dynamic Programming	L3
4	Design algorithms using Greedy technique, iterative improvement,	L3
5	Analyse with respect to space time tradeoffs	L4

Teaching Methodology:

- Black board teaching
- Power Point presentations
- Hands on Sessions

Assessment Methods:

- Course Project/Assignment -20 Marks
- Three internals, 30 Marks each will be conducted and the Average of all three will be taken.
- Final examination, of 100 Marks will be conducted and will be evaluated for 50 Marks.

Course Outcome to Programme Outcome Mapping:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	3	2	2	2	3	1	2	1			1	3	3	3
2	3	2	2	2	3	1	2	1	2	2	1	3	3	3
3	3	2	2	2	3	1	2	1	2	2	1	3	3	3
4	3	2	2	2	3	1	2	1	2	2	1	3	3	3
5	3	2	2	2	3	1	2	1	2	2	1	3	3	3
	3	2	2	2	3	1	2	1	2	2	1	3	3	3

COURSE CONTENT UNIT – I	8 hours
Fundamentals of Algorithmic Problem Solving, Algorithm Design techniques, Design an Algorithm and Data Structures, Analyzing an Algorithm, Coding an Algorithm, Important Problem Types, Fundamental data structures. Analysis Framework. Asymptotic notations and basic efficiency classes.	
UNIT – II	**9 hours**
Bruteforce and exhaustive search, Selection Sort and Bubble Sort, Sequential Search and Brute-force String matching, Closest Pair and Convex-Hull problems by Brute force, Exhaustive Search, Depth-first search and Breadth-first search.	
UNIT – III	**8 hours**
Decrease-and Conquer, Insertion Sort, Topological Sorting, Algorithms for generating Combinatorial Objects, Decrease by a constant factor algorithms, Variable size decrease algorithms,	
UNIT – IV	**7 hours**
Divide and Conquer, Mergesort, Quicksort, Binary Tree Traversals, Multiplication of large integers, Strassen's matrix multiplication, closest-pair and Convex-Hull problems by Divide and Conquer.	
UNIT – V	**7 hours**
Transform and conquer, Gaussian elimination, Balanced search trees, Hashing, B-Trees, Dynamic Programming, Greedy Algorithms. Overview of P,NP,NP-Complete Problems.	

TEXT BOOKS:

3. Anany Levitin: Introduction to the Design and Analysis of Algorithms, Pearson 3rd edition 2017.

Reference BOOKS:

1.Introduction to Algorithms, Eastern Economy Edition, Feb 2010, Thomas H.Cormen, Charles E.Leiserson, Ronals L.Rivest and Clifford Stein

Department: *Artificial Intelligence & Data Science*	***Course Type: Core***
Course Title: AI Case Studies using Python	***Course Code:*** *21ADG45*
L-T-P: *3-0-2*	***Credits:*** *04*
Total Contact Hours: 39 *hours theory & 26 Hours Lab*	***Duration of SEE:*** *04 hours*
SEE Marks: *50*	***CIE Marks:*** *50*

Course Outcomes:
Students will be able to:

Sl. No.	Course Outcome Description	Blooms Level
1	To apply rich features of Python in Machine Learning and Data Science Applications	L3
2	To develop simple Python programs for Natural Language Processing, Twitter data based sentiment analysis understanding basic necessary concepts	L3
3	To develop simple programs based on Time series and linear regression	L3
4	To develop simple programs for classification, clustering and regression understanding basic necessary concepts	L3
5	To explain NoSQL databases and use MongoDB.	L2

Teaching Methodology:

- Blackboard teaching / PowerPoint presentations.
- Programming Assignments

Assessment Methods:

- Theory:Rubrics to evaluate Course Project for 20 Marks
- Theory:Three internals, 30 Marks each will be conducted and the Average of all three will be taken.
- Theory:Final examination, of 100 Marks will be conducted and will be evaluated for 50 Marks.
- Lab: CIE(Experiments, Viva Voce, Record: 20 marks; Lab Test: 30 marks); SEE:50 marks

Course Outcome to Programme Outcome Mapping:

Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO 1	3	2	3	3	3	2	2	1		2	2	3	3	2
CO 2	3	2	3	3	3	2	2	1	2	2	2	3	3	2
CO 3	3	2	3	3	3	2	2	1	2	2	2	3	3	2
CO 4	3	2	3	3	3	2	2	1	2	2	2	3	3	2
CO 5	3	2	3	3	3	2	2	1	2	2	2	3	3	2

COURSE CONTENT

Unit1(Python for Data Science): Sample usage of numpy, scipy and Pandas. Introduction to Data Science, Basic Descriptive Statistics, Measures of central tendency, Measures of dispersion, Simulation and Static Visualization, Dynamic Visualizations, Pandas series and data frames, Pandas regular expressions and data munging, Working with CSV files, Time Series and Simple Linear regression.

8 hours

Unit2(Simple program for NLP and Data Mining Twitter): TextBlob, Visualizing word frequencies with bar charts and word clouds, Readability Assessment with Textatistic, Named entity recognition with spaCy, Other NLP libraries and Tools,

7 hours

Unit 3(Machine Learning and Data Mining for Twitter)

Machine Learning and Deep learning Natural Language Applications, Natural Language Datasets. Overview of the Twitter APIs and their usage as in, for example, creating a Twitter account, Authentication, Searching recent Tweets. Tweet Sentiment Analysis.

8 hours

Unit4(Programs for Classification, Regression and Clustering): Introduction to Machine learning , Scikit-Learn, Program development for Classification with k-Nearest Neighbours, Time Series and Simple Linear Regression, Multiple Linear Regression, Unsupervised Machine Learning, Deep Learning Applications, Keras, Neural Networks, Tensors.

9 hours

Unit5(Big Data: Hadoop, NoSQL): Overview of Relational Databases and SQL, Overview of NOSQL and NewSQL Big-Data Databases, MongoDB JSON Document Database, Hadoop. IoT and Publish-Subscribe Model.

7 hours

Laboratory Exercises:

Text Book:

Python for Programmers by Paul Deitel and Harvey Deitel ,2020, Pearson India.

Laboratory:

7. Exercises to work with CSV files using Python
8. Exercises to work with concepts of Time series and Linear Regression
9. Exercises with TextBlob and NLP applications
10. Exercises on Data Mining Twitter
11. Exercises in Machine Learning(classification, regression and clustering)
    - Classification with k-Nearest Neighbours
    - Dimensionality Reduction
    - K-Means clustering
12. Deep learning applications
13. Deep Learning Applications
14. Exercises with BigData databases
15. Exercises with BigData databases
16. Exercises with Data Science libraries NumPy, Pandas, SciPy, NLTK, TexBlob, Tweepy, Matplotlib, Seaborn, Folium

Department: *Artificial Intelligence & Data Science*	***Course Type: Core***
Course Title: *Database Management Systems Lab*	***Course Code:*** *21ADL48*
L-T-P:0*-0-2*	***Credits:****03*
Total Contact Hours: 30 *hours*	***Duration of SEE:****03 hours*
SEE Marks*: 50*	***CIE Marks:*** *50*

At the end of the course, a student shall be able to:

Sl. No.	Course Outcome Description	Blooms Level
1	Describe the components of database systems	L1
2	Explain the principles of database design and implementation	L2
3	Design a database system for a given application	L3
4	Implement a database using DBMS and interface it with an application	L3
5	Test and validate the developed database system	L3

Course Content of Database Management Systems Lab course:

Exercises in the specified problems shown below will be performed by students.

- Analyze and perform data modeling for a given application
- Convert the data model into a relational model
- Use DDL and DML commands in SQL queries
- Develop SQL commands to create and maintain database structure
- Interface application to the developed database system
- Multidimensional data modelling

Assessment:

CIE(Experiments, Record, Viva Voce: 20 marks; Lab Test: 30 marks); SEE: 50 marks

Course Outcome to Programme Outcome Ma50pping

Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO 1	3	2	3	3	3	2	2	1		2	2	3	3	2
CO 2	3	2	3	3	3	2	2	1	2	2	2	3	3	2
CO 3	3	2	3	3	3	2	2	1	2	2	2	3	3	2
CO 4	3	2	3	3	3	2	2	1	2	2	2	3	3	2
CO 5	3	2	3	3	3	2	2	1	2	2	2	3	3	2

Semester: 4 **Year: 2022-23**

Semester: 4 **Year: 2022-23**

Department: *Artificial Intelligence & Data Science*	***Course Type: Elective***
Course Title*: Object-oriented* Programming using Java	***Course Code:*** *21ADE473*
L-T-P:3*-0-0*	***Credits:****03*
Total Contact Hours: 39 *hours*	***Duration of SEE:****03 hours*
SEE Marks*: 50*	***CIE Marks:*** *50*

Pre-requisites:

No programming knowledge is assumed, successful completion of first year course on programming is desirable..

Course Outcomes:

Cos	Course Outcome Description	Blooms Level
1	Describe main features of Object-oriented programming and associate them with features of Java	L1
2	Develop Java programs using features of classes, methods and control structures of Java	L3
3	Develop Java programs involving classes , inheritance and polymorphism using exception handling where necessary	L3
4	Use advanced features of Java such as generics, functional programming and threads	L3

Teaching Methodology:

- Blackboard teaching / PowerPoint presentations.
- Regular review of students by asking questions based on topics covered in the class.
- Course Project.

Assessment Methods:

- Three internals, 30 Marks each will be conducted and the Average of all three will be taken.
- Rubrics for Course Project (20 Marks).
- Final examination, of 100 Marks will be conducted and will be evaluated for 50 Marks.

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	02	02	02	2	3	2	2	1	01	02	02	**02**	**03**	**03**
CO2	02	02	02	2	3	2	2	1	02	02	02	**02**	**03**	**03**
CO3	02	02	02	2	3	2	2	1	02	02	02	**02**	**03**	**03**
CO4	02	02	02	2	3	2	2	1	02	02	02	**02**	**03**	**03**

Course Content

Unit1(Internet and Java):

Object Technology basics, Overview of Java, Operating Systems on which Java implementations are available, Java Development Environment, Internet and World Wide Web, Software Technologies. (4 Hours)

Unit2(Control Structures, Operators, Arrays in Java): Decision making, Relational operators, Instance variables, constructors, primitive types, Reference types, A simple GUI, Control Statements, Assignment and operators, logical operators, Methods, parameters, call stack, Method overloading, Arrays and Array Lists. (10 Hours)

Unit3(Object-oriented Programming): Controlling Access to Members of objects, this Reference, Overloaded Constructors, Default and No-Argument Constructors, Set and Get methods, Composition, enum types, Garbage collection, static Class Members, final Instance Variables, Package Access, Superclasses and subclasses. Protected members, constructors in subclasses, Class Object, Composition vs Inheritance. Polymorphism and Interfaces, Abstract Classes and Methods.Case study using polymorphism. (12 Hours)

Unit4(Advanced features of Java and Unit Testing): Classes, Inheritance, Polymorphism, Operator Overloading, Exceptions, Unit Testing, Namespaces and Scopes, Overview of Generic Collections, Lambdas and Streams. Java Threads. (9 Hours)

Unit 5(Accessing Databases with JDBC):

Setting Up a database, connecting to and querying a database. (4 Hours)

Texbook:

Java How to Program Early Objects 11th edition, Paul Deitel and Harvey Deitel, March 2022.

Website:

https://plugins.jetbrains.com/plugin/14014-spotbug

Department: *Artificial Intelligence & Data Science*	***Course Type: Elective***
***Course Title**: Software Design Patterns*	***Course Code:*** *21DSE472*
L-T-P:3*-0-0*	***Credits:****03*
Total Contact Hours: 39 *hours*	***Duration of SEE:****03 hours*
SEE Marks*: 50*	***CIE Marks:*** *50*

Pre-requisites:

Successful completion of first year course on programming and knowledge of object-oriented programming is desirable.

Cos	Course Learning Outcomes	BL
1	To describe the purpose of design patterns in software development and data science applications	L2
2	To use relevant structural patterns in application development	L3
3	To use behavioural patterns in software development	L3
4	To apply patterns relevant for data science	L3

Teaching Methodology:

- Blackboard teaching / PowerPoint presentations.
- Regular review of students by asking questions based on topics covered in the class.
- Course Project.

Assessment Methods:

- Three internals, 30 Marks each will be conducted and the Average of all three will be taken.
- Rubrics for Course Project (20 Marks).
- Final examination, of 100 Marks will be conducted and will be evaluated for 50 Marks.

COURSE CONTENT UNIT – I	8 hours
Motivation for using design patterns, Overview of design patterns, structural and behavioural patterns	
UNIT – II	**9 hours**
Structural Patterns : Creational Patterns with examples, Adapter and Decorator Patterns, Bridge and Façade Patterns, Model-View Controller and Proxy Patterns.	
UNIT – III	**10 hours**
Behavioural Patterns: Chain of Responsibility, Command and Observer Patterns, State and other behavioural patterns with examples and discussion on applications.	
UNIT – IV	**12 hours**
Data Science Patterns: Map Reduce Patterns and other patterns relevant for data science applications with examples.	

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	02	02	02	01	03	01	02	01	02	02	02	**02**	**03**	**03**
CO2	02	02	03	01	03	01	02	01	02	02	02	**02**	**03**	**03**
CO3	02	02	03	01	03	01	02	01	02	02	02	**02**	**03**	**03**
CO4	02	02	03	01	03	01	02	01	02	02	02	**02**	**03**	**03**

Textbooks:

Mastering Python Design Patterns, 2nd edition, Kamon Ayeva and Sakis Kesampalis, 2018, Packt Publishing.

References:

Design Patterns: Elements of Reusable Object-oriented Software , Erich Gamma, John Vlissides, Ralph Johnson, Richard helm, Addison-Wesley,

Department: *Artificial Intelligence & Data Science*	***Course Type: Ability Enhancement***
Course Title: Cloud Computing and Distributed Systems	***Course Code:*** *21DSE471*
L-T-P:2-0-0	***Credits:****02*
Total Contact Hours: 39 *hours*	***Duration of SEE:****03 hours*
SEE Marks*: 50*	***CIE Marks:*** *50*

Pre-requisites:

Successful completion of the course on data structures.

Course Outcomes:

Cos	Course Learning Outcomes	BL
1	To discuss basic concepts of operating systems and network concepts necessary for distributed systems	L2
2	To discuss clouds, virtualization and virtual machine	L2
3	To apply Leader Election Algorithm and classical distributed algorithms in Cloud and Distributed Systems	L3
4	To discuss Consensus, Paxos and Recovery in clouds	L2
5	To discuss concepts of cloud storage and implement cloud applications	L2, L3

Teaching Methodology:

- Blackboard teaching / PowerPoint presentations.
- Regular review of students by asking questions based on topics covered in the class.
- Course Project.

Assessment Methods:

- Three internals, 30 Marks each will be conducted and the Average of all three will be taken.
- Rubrics for Course Project (20 Marks).
- Final examination, of 100 Marks will be conducted and will be evaluated for 50 Marks.

COURSE CONTENT UNIT – I	8 hours
Overview of Operating System and Network Concepts; Introduction to clouds, virtualization and virtual machine; Features of Clouds; Data-intensive computing; Hypervisor; Types of virtualization; Hotspot mitigation for Virtual Machine migration	
UNIT – II	**9 hours**
Network Virtualization and Geo-distributed clouds; Server Virtualization, Software Defined Network; Geo-distributed Cloud Data Centres; Leader Election in Cloud, Distributed Systems.	

UNIT – III	**10 hours**
Classical Distributed Algorithms; Time and Clock Synchronization in Cloud Data Centres; Global State and Snapshot Recording Algorithms; Distributed Mutual Exclusion;	
UNIT – IV	**12 hours**
Consensus, Paxos and Recovery in Clouds;Cloud Storage; Key Value Stores/NoSQL; P2P Systems and their use; Cloud Applications; Map Reduce, Spark and Apache Kafka	

PO	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**PSO1**	**PSO2**
CO1	3	2	2	2	3	2	2	1	1	2	2	2	2	2
CO2	3	2	3	2	3	2	2	1	1	2	2	2	2	2
CO3	3	2	3	2	3	2	2	1	1	2	2	2	2	2
CO4	3	2	2	2	3	2	2	1	1	2	2	2	2	2
CO5	3	2	3	2	3	2	2	1	1	2	2	2	2	2
	3	2	2.6	2	3	2	2	1	1	2	2	2	2	2

Text Books:

1. Distributed and Cloud Computing From Parallel Processing to the Internet of Things- Kai Hwang, Jack Dongarra, Geoffrey Fox

2. Cloud Computing: Principles and Paradigms, Editors: Rajkumar Buyya, James Broberg, Andrzej M. Goscinski, Wile, 2011

References:

1.Distributed Algorithms-Nancy Lynch
2.Cloud Computing Bible, Barrie Sosinsky, Wiley-India, 2010
3.Cloud Computing: Principles, Systems and Applications, Editors: Nikos Antonopoulos, Lee Gillam, Springer, 2012

Department: *Artificial Intelligence & Data Science*	***Course Type: Ability Enhancement***
Course Title: Business Analytics	***Course Code:*** *21ADA491*
L-T-P:2-0-0	***Credits:****02*
Total Contact Hours: 26 *hours*	***Duration of SEE:****03 hours*
SEE Marks*: 50*	***CIE Marks:*** *50*

Course Outcomes:

Cos	Course Learning Outcomes	BL
1	To understand the concepts of Business Analytics as the science of data-driven decision making	L2
2	To apply concepts of descriptive analytics	L3
3	To understand the concepts of Stochastic Models and use them in predictive analytics	L2
4	To apply concepts of predictive analytics	L3
5	To apply concepts of prescriptive analytics	L3

Course Content:

UNIT I Overview_: Overview of Business Analytics, Motivation and Examples.Web and Social Media Analytics, Framework and challenges in data-driven decision making (1 hour)
UNIT II Descriptive Analytics: Data types and Scales, Types of data measurement scales, Population and Sample, Measures of Central Tendency, Percentile, Decile and Quartile, Measures of Variation, Skewness and Kurtosis, Data Visualization (2 hours)

UNIT III Predictive Analytics: Simple Linear Regression, Multiple Linear Regression, Logistic Regression, Decision Tree Learning and Forecasting Techniques (12 hours)

UNIT IV Prescriptive Analytics: Linear Programming, Integer Programming and Goal Programming (6 hours)

UNIT V Stochastic Models: Stochastic Process, Compound Poisson Process, Markov Chains, Using Markov Chains in Predictive Analytics (5 hours)

Teaching Methodology:

- Blackboard teaching / PowerPoint presentations.
- Regular review of students by asking questions based on topics covered in the class.

Assessment Methods:

- Two internals, 30 Marks each will be conducted and the Average of two will be taken.
- Course Seminar (20 Marks).
- Final examination, of 100 Marks will be conducted and will be evaluated for 50 Marks.

CO – PO Mapping:

PO	1	2	3	4	5	6	7	8	9	10	11	12	PSO1	PSO2
CO1	3	2	3	2	3	2	2	1	1	2	2	2	2	2
CO2	3	2	3	2	3	2	2	1	1	2	2	2	2	2
CO3	3	2	3	2	3	2	2	1	1	2	2	2	2	2
CO4	3	3	2	2	3	2	2	1	1	2	2	2	2	2
CO5	3	2	3	2	3	2	2	1	1	2	2	2	2	2
	3	2.2	2.8	2	3	2	2	1	1	2	2	2	2	2

Text Book:

Business Analytics: The Science of Data-driven Decision Making , U Dinesh Kumar, Wiley, 2017.

Department: *Artificial Intelligence & Data Science*	***Course Type: Ability Enhancement***
Course Title*: SQL for Data Science*	***Course Code:*** *21ADA492*
L-T-P:2*-0-0*	***Credits:****02*
Total Contact Hours: 26 *hours*	***Duration of SEE:****03 hours*
SEE Marks*: 50*	***CIE Marks:*** *50*

Course Outcomes:

Cos	Course Learning Outcomes	BL
1	To discuss concepts of Data Life Cycle and Relational Data	L2
2	To apply concepts of data cleaning and pre-processing using SQL	L3
3	To use various features of SQL for addressing requirements of data life cycle	L2
4	To apply concepts of data analysis and implement them using SQL queries	L3

Course Content:

Unit1: Data Life Cycle; Sequence of stages from data acquisition to archiving; Data Loading, Cleaning and pre-processing Relational Databases ; Usage of MySQL and Postgres

(8 hours)

Unit2: SQL queries, implementation of data analysis tasks such as data exploration, cleaning and Transformation; implementation of sample analyses; Lab exercises/demonstrations (8 hours)

Unit 3: Additional SQL features for Data Analysis ; implementation of sample analyses; Practical demonstrations; addressing various requirements of Data Life Cycle using SQL

(8 hours)

Unit 4: Using SQL from with R and Python (2 Hours)

Teaching Methodology:

- Blackboard teaching / PowerPoint presentations.
- Regular review of students by asking questions based on topics covered in the class.

Assessment Methods:

- Two internals, 30 Marks each will be conducted and the Average of two will be taken.
- Course Seminar (20 Marks).
- Final examination, of 100 Marks will be conducted and will be evaluated for 50 Marks.

PO	1	2	3	4	5	6	7	8	9	10	11	12	PSO1	PSO2
CO1	3	2	2	2	3	2	2	1	1	2	2	2	2	2
CO2	3	2	2	2	3	2	2	1	1	2	2	2	2	2
CO3	3	2	2	2	3	2	2	1	1	2	2	2	2	2
CO4	3	2	2	2	3	2	2	1	1	2	2	2	2	2
	3	2	2	2	3	2	2	1	1	2	2	2	2	2

Text Book:

Antonio Badia, SQL for Data Science: Data Cleaning, Wrangling and Analytics with Relational Databases, Springer, 2020.

Department: *Artificial Intelligence & Data Science*	***Course Type: Ability Enhancement***
Course Title: *Habits for Highly Effective People*	***Course Code:*** *21ADA493*
L-T-P:2-0-0	***Credits:****02*
Total Contact Hours: 26 *hours*	***Duration of SEE:****03 hours*
SEE Marks*: 50*	***CIE Marks:*** *50*

Course Outcomes:

Cos	Course Learning Outcomes	BL
1	To apply and practise relevant habits to enhance individual professional performance	L3
2	To apply relevant habits to promote teamwork	L3
3	To develop innovative solutions as a part of a team	L3

Teaching Methodology:

- Blackboard teaching / PowerPoint presentations.
- Regular review of students by asking questions based on topics covered in the class.

Assessment Methods:

- Two internals, 30 Marks each will be conducted and the Average of two will be taken.
- Course Seminar (20 Marks).
- Final examination, of 100 Marks will be conducted and will be evaluated for 50 Marks.

Course Content:

Unit 1:

Habits 1 & 2**:** Be Proactive; Begin with the end in mind (8 Hours)

Unit 2:

Habits 3 & 4: Put First Things First; Think win-win (8 Hours)

Unit 3:

Habits 5,6 & 7: Seek First to Understand then to be Understood; (10 Hours)
Synergize;
Sharpen the Saw

Course Outcomes:

PO	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**PSO1**	**PSO2**
CO1	1	1	1	1	1	1	1	3	3	3	3	3	2	2
CO2	1	1	1	1	1	1	1	3	3	3	3	3	2	2
CO3	1	1	1	1	1	1	1	3	3	3	3	3	2	2
	1	1	1	1	1	1	1	3	3	3	3	3	2	2

Text Book:

Stephen Covey, The 7 Habits of Highly Effective People, Simon & Schuster; 12th edition (1 January 2019)..

NITTE MEENAKSHI INSTITUTE OF TECHNOLOGY

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YELAHANKA, BANGALORE–560064

KNOWLEDGE CHARACTER UNITY

Department of Artificial Intelligence and Machine Learning

SCHEME AND SYLLABUS

BE PROGRAMME–2021 BATCH (AUTONOMOUS SCHEME)

NITTE EDUCATION TRUST

Academic Year 2021-22

CONTENTS

VISION & MISSION OF THE COLLEGE

Vision

To provide India and the World, technical manpower of the highest academic excellence and World class by shaping our youth through holistic and integrated education of the highest quality.

Mission

To develop Nitte Meenakshi Institute of Technology through Quality, Innovative and State-of-art educational initiatives into a Centre of academic excellence that will turn out youth with well-balanced personality & commitment to rich cultural heritage of India and who will successfully face the Scientific and Technological challenges in the fast-evolving Global scenario with a high degree of credibility, integrity and ethical standards.

Quality Policy

To bring about constant and Continuous Improvement in the Quality of Education Imparted and Turning out High Quality Professionals with Balanced and Globally Competitive Personality through Regular Monitoring of the Academic/ Administrative Activities of the Institution and Implementing Corrective Actions in the Best Ethical and Transparent Traditions.

1. Vision and Mission of Department

1.1 Vision:
To empower students of Artificial Intelligence and Machine Learning Department is to be technologically adept, innovative, self-motivated and responsible global citizen possessing human values and enable them to contribute in the industrial development innovation, high quality technical education and research with the ever-changing world.

1.2 Mission:

The department of Artificial Intelligence and Machine Learning strives to prepare students

- For a challenging professional career and nurture their entrepreneurship ability by grooming their leadership skills and innovative ability, thereby enabling them to serve the engineering profession and society.

- To accomplish higher studies by providing conducive teaching-learning, research environment.

2. Programme Education Objectives (PEOs)

PEO1: Excel in Professional career by acquiring knowledge in Artificial Intelligence and Machine Learning.

PEO2: Graduates are capable of pursuing higher education and research.

PEO3: Adapt to technological advancements by engaging in life long learning with leadership qualities, professional ethics and soft skills**.**

3. Programme Specific Outcomes (PSO)

PSO 1: Professional Skills: The ability to comprehend, analyze, design, implement and conduct research in the domain of Artificial Intelligence and Machine Learning, and their application in several fields like disease prediction, stock market prediction, computer vision, understanding of several supervised and unsupervised models, big data analytics, data science etc.

PSO 2: Problem Solving Skills: Ability to apply the machine learning and AI techniques in computer vision and Natural Language processing and adopt standard software engineering and professional practices to evolve optimal solutions.

PSO 3: Ethics and Career Development: Inculcate skills for a successful career in the industry based on sound principles of software project management, team work and ethical practices, develop the spirit of entrepreneurship and also nurture the quest for higher levels of knowledge.

4. Programme Outcomes (POs)

1	**PO1. Engineering knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
2	**PO2. Problem analysis:** Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
3	**PO3. Design/development of solutions**: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
4	**PO4. Conduct investigations of complex problems:** Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
5	**PO5. Modern tool usage**: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
6	**PO6.Theengineer and society:** Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
7	**PO7. Environment and sustainability:** Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
8	**PO8.Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
9	**PO9.Individual and teamwork:** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
10	**PO10. Communication:** Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
11	**PO11. Project management and finance:** Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a Member and leader in a team, to manage projects and in multidisciplinary environments.
12	**PO12. Life-long learning:** Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

5. Approach to Curriculum:

The curriculum is framed by keeping in mind the ever-changing industrial trends in technology. The Stakeholders in preparing the curriculum involve the industry experts, Academicians with expertise, Alumni of the department, Parents, Internal Faculty and the Final year students. The suggestions are taken and discussed in the BoS (Board of Studies). After approval from the BoS, the DUGC approval is taken and then the Academic Council approves the final curriculum.

The main objective of framing the curriculum:

- To build a strong technical, analytical and mathematical foundation in students. This will enable the students to be proficient in their technical profession.
- To inculcate in students the good ethical conduct, great team-spirit, excellent leadership qualities and provide a wholesome growth by encouraging Life-long learning which is needed for an excelling career.
- To make the students more competent to face challenges in the outside world.

6. Courses Inclined Towards Cutting Edge Technologies.

Department of AI&ML offers courses which are inclined towards cutting edge technologies along with the basic fundamental courses.

- Computer Vision
- Deep Learning
- Data Science/ Big Data Analytics
- Block Chain Technologies
- Machine Learning
- Artificial Intelligence
- Virtual Reality
- Cloud Computing
- Robotics
- Quantum Computing
- Cyber Security

7. Definitions/ Descriptions:

- **Semester Scheme:** Each UG degree is a 4 Academic year Program, each year being divided into 2 semesters. Each semester is for duration of 20 weeks, which includes Course work, CIE (Continuous Internal Evaluation), SEE (Semester End Examination). The CIE is conducted unit-wise on a monthly basis. The SEE is conducted at the end of every semester to evaluate the students' overall performance and achievement.
- **Credit System:** Each unit of a course is assigned *one credit*. The students earn the credits by registering to the respective courses, completing a teaching-learning process which is then followed by CIE and SEE. The CBCS (Choice Based Credit System) helps customizing the course work for a student by including Core Courses and Elective Courses.

- **Core Course:** Courses that are declared as mandatory for the students.
- **Electives:** Courses that are offered to the students from which they are allowed to choose.

- **Credit Courses:** Students earn *one credit* by registering for the course,
  - Attending Lecture (L)-*One hour/Week/Semester* Theory courses.
  - Attending Laboratory or Practical (P)/Tutorials (T)-*Two Hours/Week/Semester*.
- **Course load:** Every student who registers for the courses in a semester for an average total credit of anywhere between 23 to 26 credits if the student is registered under the scheme of earning a total of 200 credits by the end of the UG degree (In the new scheme students must earn a total of 175 credits). The permissible contact hours are maximum 35 Hours/week. Typical Course Load in a semester is shown in the Table 1.

Course Load per semester			
No. of Courses	**Credits per Course**	**Total Credits**	**Total contact Hours/ week**
Three Lecture Courses	4:0:0	12	12
One Lecture Course	3:0:0	3	3
One Lecture + One tutorial	3:2:0	4	5
Two Lectures + Practical	3:0:2	8	10
Two Practical courses	0:0:2	2	4

Table1: Typical Courseload

- **Credit Representation:** Credits for different academic activities are represented in the **Table1.**

Lectures (Hours/Week/Semester)	**Tutorials** (Hours/Week/Semester)	**Practical** (Hours/Week/Semester)	**Credits (L:T:P)**	**Total Credits**
4	0	0	4:0:0	4
3	2	0	3:1:0	4
0	2	0	0:1:0	1
0	0	2	0:0:1	1
2	2	2	2:1:1	4
0	2	2	0:1:1	2

Table1: Credit Representation

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Department of Artificial Intelligence and Machine Learning

2021 SCHEME

SCHEME–I TO VIII SEMESTERS

Department of Artificial Intelligence and Machine Learning

Typical Curriculum Structure for UG AI & ML Degree Programmes

Sl. No.	Course Components	SEMESTERS							Total Credits
		I/II	III	IV	V	VI	VII	VIII	
1	Humanities (HU)						3	3	6
2	Basic Science Core (BS)	16	4	4					24
3	Basic Engineering Core (BE)	24							24
4	Engineering Core Subject (PC)		19	16	19	15	12	3	84
5	Core Electives (PE)			3	5	3	3	3	17
6	Open Electives (OE)					3	3		6
7	Project/Internship					1	2	11	14
TOTAL		**40**	**23**	**23**	**24**	**22**	**23**	**20**	**175**

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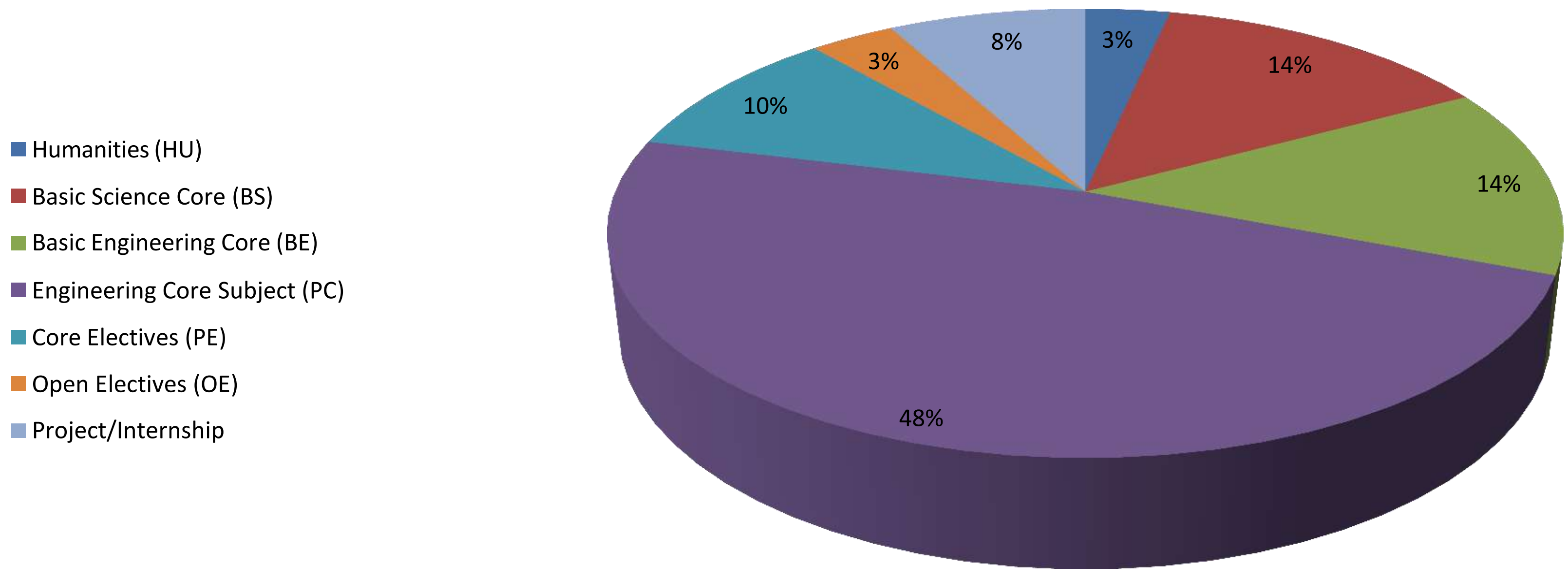

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Department of Artificial Intelligence and Machine Learning

SEMESTER: I (PHYSICS CYCLE)

SL. NO.	COURSE CODE	COURSE NAME	COURSE TYPE	TEACHING DEPT.	TEACHING HOURS/WEEK			EXAMINATION			CREDITS
					L#	T#	P#	CIE*	SEE**	TOTAL	
1	18MAT11	ENGINEERING MATHEMATICS-I	BS^	MATHS	3	1	0	50	50	100	4
2	18PHY12	ENGINEERING PHYSICS	BS^	PHY	3	0	0	50	50	100	3
3	18CP13	C-PROGRAMMING-I	EC$	AIML	0	0	4	50	50	100	2
4	18ELN14	BASIC ELECTRONICS ENGINEERING	EC$	EC	3	1	0	50	50	100	4
5	18CED15	COMPUTER AIDED ENGINEERING DRAWING	EC$	ME	2	0	2	50	50	100	3
6	18CIV16	ENGINEERING MECHANICS	EC$	CIV	3	1	0	50	50	100	4
7	18PHL17	ENGINEERING PHYSICS LAB	BS^	PHY	0	0	2	50	50	100	1
8	18CIV18	CO NSTITUTION OF INDIA AND PROFESSIONAL ETHICS	HU@	HU	2	0	0	100	0	100	-
TOTAL								450	350	800	21

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Department of Artificial Intelligence and Machine Learning

SEMESTER: I (CHEMISTRYCYCLE)

SL. NO.	COURSE CODE	COURSE NAME	COURSE TYPE	TEACHING DEPT.	TEACHING HOURS/WEEK			EXAMINATION			CREDITS
					L$^{\#}$	T$^{\#}$	P$^{\#}$	CIE*	SEE**	TOTAL	
1	18MAT11	ENGINEERING MATHEMATICS-I	BS$^{\wedge}$	MATHS	3	1	0	50	50	100	4
2	18CHE12	ENGINEERING CHEMISTRY	BS$^{\wedge}$	CHE	3	0	0	50	50	100	3
3	18CP13	C-PROGRAMMING-I	EC$^{\$}$	AIML	0	0	4	50	50	100	2
4	18ELE14	BASIC ELECTRICAL ENGINEERING & ELECTRICAL LAB	EC$^{\$}$	EEE	3	1	2	50	50	100	5
5	18EME15	ELEMENTS OF MECHANICAL ENGINEERING & WORKSHOP	EC$^{\$}$	ME	3	0	2	50	50	100	4
6	18CHL16	ENGINEERING CHEMISTRY LAB	BS$^{\wedge}$	CHE	0	0	2	50	50	100	1
7	18ENG17	COMMUNICATIVE ENGLISH	HU$^{@}$	ENG	2	0	0	100	0	100	-
8	18CIV18	ENVIRONMENTAL STUDIES	HU$^{@}$	HU	2	0	0	100	0	100	-
							TOTAL	**500**	**300**	**800**	**19**

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Department of Artificial Intelligence and Machine Learning

SEMESTER: II(PHYSICSCYCLE)											
SL. NO.	COURSE CODE	COURSE NAME	COURSE TYPE	TEACHING DEPT.	TEACHING HOURS/WEEK			EXAMINATION			CREDITS
					L#	T#	P#	CIE*	SEE**	TOTAL	
1	18MAT21	ENGINEERING MATHEMATICS-II	BS^	MATHS	3	1	0	50	50	100	4
2	18PHY22	ENGINEERING PHYSICS	BS^	PHY	3	0	0	50	50	100	3
3	18CP23	C-PROGRAMMING-II	EC$	AIML	0	0	4	50	50	100	2
4	18ELN24	BASIC ELECTRONICS ENGINEERING	EC$	EC	3	1	0	50	50	100	4
5	18CED25	COMPUTER AIDED ENGINEERING DRAWING	EC$	ME	2	0	2	50	50	100	3
6	18CIV26	ENGINEERING MECHANICS	EC$	CIV	3	1	0	50	50	100	4
7	18PHL27	ENGINEERING PHYSICS LAB	BS^	PHY	0	0	2	50	50	100	1
8	18CIV28	CONSTITUTION OF INDIA AND PROFESSIONAL ETHICS	HU@	HU	2	0	0	100	0	100	-
TOTAL								450	350	800	21

Department of Artificial Intelligence and Machine Learning

SEMESTER: II(CHEMISTRYCYCLE)

SL. NO.	COURSE CODE	COURSE NAME	COURSE TYPE	TEACHING DEPT.	TEACHING HOURS/WEEK			EXAMINATION			CREDITS
					L#	T#	P#	CIE*	SEE**	TOTAL	
1	18MAT21	ENGINEERING MATHEMATICS-II	BS^	MATHS	3	1	0	50	50	100	4
2	18CHE22	ENGINEERING CHEMISTRY	BS^	CHE	3	0	0	50	50	100	3
3	18CP23	C-PROGRAMMING-II	EC$	AIML	0	0	4	50	50	100	2
4	18ELE24	BASIC ELECTRICAL ENGINEERING & ELECTRICAL LAB	EC$	EEE	3	1	2	50	50	100	5
5	18EME25	ELEMENTS OF MECHANICAL ENGINEERING & WORKSHOP	EC$	ME	3	0	2	50	50	100	4
6	18CHL26	ENGINEERING CHEMISTRY LAB	BS^	CHE	0	0	2	50	50	100	1
7	18ENG27	COMMUNICATIVE ENGLISH	HU@	ENG	2	0	0	100	0	100	-
8	18CIV28	ENVIRONMENTAL STUDIES	HU@	HU	2	0	0	100	0	100	-
TOTAL								**500**	**300**	**800**	**19**

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Department of Artificial Intelligence and Machine Learning

SEMESTER: III												
SL NO	**COURSE CODE**	**COURSE NAME**	**COURSE TYPE**	**TEACHING DEPT.**	**TEACHINGHOURS/WEEK**				**EXAMINATION**			**CREDITS**
					L#	**T#**	**P#**	**S#**	**CIE***	**SEE****	**Total**	
1	21MAT31A	INTEGRAL TRANSFORMS, LINEAR ALGEBRA AND NUMERICAL METHODS	BSC	Mat	3	0	0	-	50	50	100	3
2	21AI31	INTRODUCTION TO ARTIFICIAL INTELLIGENCE	PC	AIML	3	-	-	-	50	50	100	3
3	21AI32	DATA STRUCTURES INTEGRATED	PC	AIML	3	-	2	-	50	50	100	4
4	21AI33	SOFTWARE ENGINEERING	PC	AIM L	3	-	-	-	50	50	100	3
5	21MAT32	STATISTICS FOR AI	PC	AIM L	3	-	-	-	50	50	100	3
6	21AIE35X	PROFESSIONAL ELECTIVE COURSE 1	PE	AIM L	3	-	-		50	50	100	3
7	21AIL34	INTRODUCTION TO ARTIFICIAL INTELLIGENCE LAB	PC	AIML	-	-	2	-	50	50	100	1
8	21INT36	INTERNSHIP-I	INT	Completed during the vacation of II and III semesters. Lateral entry students have to attend the internship during the vacation of III & IV semester					50	50	100	2

9	21KAK38/21KBK38	MANDATORY COURSES (Govt. of Karnataka)/ Adalitha Kannada or Balake Kannada	HU	HU	1	-	-	-	50	50	100	1
	OR											
	21CIP38	CONSTITUTION OF INDIA, PROFESSIONAL ETHICS										
								TOTAL	**450**	**450**	**900**	**23**

Department of Artificial Intelligence and Machine Learning

PROFESSIONAL ELECTIVE COURSE–I					
SL.NO	**COURSE CODE**	**COURSE NAME**	**L#**	**T#**	**P#**
1.	21AIE351	INTRODUCTION TO AI IN VIRTUAL REALITY	3	-	-
2.	21AIE352	INTRODUCTION TO DATA SCIENCE	3	-	-
3.	21AIE353	INTRODUCTION TO BUSINESS INTELLIGENCE	3	-	-
4.	21AIE354	INTRODUCTION TO HUMAN COMPUTER INTERACTION	3	-	-

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Department of Artificial Intelligence and Machine Learning

SEMESTER: IV

SL NO	COURSE CODE	SUBJEC TNAME	COURSE TYPE	TEACHING DEPT.	TEACHING HOURS/WEEK				EXAMINATION			CREDITS
					L#	T#	P#	S#	CIE*	SEE**	TOTAL	
1	21MAT41A	PROBABILITY AND DISCRETE MATHEMATICS	BS	MAT	3	-	-	-	50	50	100	3
2	21AI41	DESIGN AND ANALYSIS OF ALGORITHMS	PC	AIML	3	-	-	-	50	50	100	3
3	21AI42	DATABASE MANAGEMENT SYSTEMS INTEGRATED	PC	AIML	3	-	2	-	50	50	100	4
4	21AI43	INTRODUCTION TO MACHINE LEARNING	PC	AIML	3	-	-	-	50	50	100	3
5	21AI45	COMPUTER ORGANIZATION AND ARCHITECTURE	PC	AIML	3	-	-	-	50	50	100	3
6	21AIE44X	PROFESSIONAL ELECTIVE COURSE II	PE	AIML	3	-	-	-	50	50	100	3
7	21AIL46	APPLICATIONS OF MACHINE LEARNING LAB	PC	AIML	-	-	2	-	50	50	100	1
8	21KAK38/21KBK38	MANDATORY COURSES (Govt. of Karnataka)/ Adalitha Kannada or Balake Kannada	HU	HU	1	-	-	-	50	50	100	1
	OR											

8	21CIP38	CONSTITUTION OF INDIA, PROFESSIONAL ETHICS										
9	21AI49X	ABILITY ENHANCEMENT COURSES-I	AEC	AIML	1	-	2	-	50	50	100	2
TOTAL									**450**	**450**	**900**	**23**

Department of Artificial Intelligence and Machine Learning

ABILITY ENHANCEMENT COURSES-I					
SL. NO	**COURSE CODE**	**COURSE NAME**	**L#**	**T#**	**P#**
1.	21CS491	BIOLOGY FOR ENGINEERS	2	-	-
2.	21AII471	APPLICATION DEVELOPMENT USING JAVA	1	-	2
3.	21AII472	APPLICATION DEVELOPMENT USING PYTHON	1	-	2
4.	21AII473	APPLICATION DEVELOPMENT USING C++	1	-	2
5.	21AII474	APPLICATION DEVELOPMENT USING C#	1	-	2
6.	21AII475	WEB APPLICATION DEVELOPMENT	1	-	2

PROFESSIONAL ELECTIVE COURSE–II					
SL.NO	**COURSE CODE**	**COURSE NAME**	**L#**	**T#**	**P#**
1.	21AIE441	ML APPLICATIONS FOR WIRELESS COMMUNICATIONS	3	-	
2.	21AIE 442	PATTERN RECOGNITION FOR AI	3	-	

3.	21AIE 443	IMAGE PROCESSING FOR AI	3	-	
4.	21AIE 444	BIG DATA TECHNOLOGIES	3	-	
5.	21AIE 445	PARALLEL & DISTRIBUTED PROGRAMMING	3	-	-

Department of Artificial Intelligence and Machine Learning

SEMESTER: V											
COURSE CODE	COURSE NAME	COURSE TYPE	TEACHING DEPT.	TEACHING HOURS/WEEK				EXAMINATION			CREDITS
				L#	T#	P#	S#	CIE*	SEE**	TOTAL	
21AI52	OPERATING SYSTEMS	PC	AIM L	3	-	-	-	50	50	100	3
21AI54	NEURAL NETWORKS	PC	AIML	3	-	-		50	50	100	3
21AI53	DATA ANALYTICS INTEGRATED	PC	AIM L	3	-	2	-	50	50	100	4
21AIL55	NEURAL NETWORKS LAB	PC	AIM L	-	-	2	-	50	50	100	1
21AIOE51X	OPEN ELECTIVE I	OE	ANY DEPT.	3	-	-	-	50	50	100	3
21AII56X	ABILITY ENHANCEMENT COURSES-II	AEC	AIM L					50	50	100	2
21AIE54X	PROFESSIONAL ELECTIVE COURSE III	PE	AIM L	3	-	2	-	50	50	100	3
21CIV58	ENVIRONMENTAL STUDIES	HU	CIV	2	-	-	-	50	50	100	1
21UHV58	CYBER LAWS AND PROFESSIONAL ETHICS	HU	HU						-	-	2
TOTAL								**400**	**400**	**800**	**22**

ABILITY ENHANCEMENT COURSES-II					
SL.NO	COURSE CODE	**COURSE NAME**	**L#**	**T#**	**P#**
1	21AII561	LINUX ADMINISTRATION	-	-	2
2	21AII562	WEB APPLICATION DEVELOPMENT-II	-	-	2
3	21AII563	MOBILE APPLICATION DEVELOPMENT-II	-	-	2
4	21AII564	APTITUDE SKILLS ENHANCEMENT	2	-	-
OPEN ELECTIVE I (MOOC)					
1	21AIOE511	MOOC COURSE1	-	-	-
2	21AIOE512	MOOC COURSE2	-	-	-
3	21AIOE513	MOOC COURSE3			

Department of Artificial Intelligence and Machine Learning

PROFESSIONAL ELECTIVE COURSE–III					
SL.NO	COURSE CODE	COURSE NAME	L #	T #	P#
1	21AIE541	COMPUTER GRAPHICS for AI & ML	3	-	-
2	21AIE542	SPEECH RECOGNITION for AI & ML	3	-	-
3	21AIE543	ADVANCED IMAGE PROCESSING	3	-	-
4	21AIE544	SOFT COMPUTING	3	-	-
5	21AIE545	CONVERSATIONAL AI	3		

Students are advised to select coursesofferedbyNPTEL/SWAYAMduringthesemester.Notrestrictedtotheabovelistedcourses.Titlesofthecourseschosen under MOOC should not match with any of the **course titles in the curriculum (Core or Elective) from the 1st semester to the 8th semester.

Department of Artificial Intelligence and Machine Learning

SEMESTER:VI

SL. NO.	COURSE CODE	COURSE NAME	COURSE TYPE	TEACHINGDEPT.	TEACHING HOURS/WEEK				EXAMINATION			CREDITS
					L#	T#	P#	S#	CIE*	SEE**	TOTAL	
1.	21AI61	SOFTWARE PROJECT MANAGEMENT	PC	AIML	3	-	-	-	50	50	100	3
2.	21AI63	NATURAL LANGUAGE PROCESSING	PC	AIML	3	-	-	-	50	50	100	3
3.	21AI65	DATA VISUALIZATION	PC	AIML	3	-	-	-	50	50	100	3
4.	21AI62	DEEP LEARNING INTEGRATED	PC	AIML	3	-	2	-	50	50	100	4
5.	21AIE64X	PROFESSIONAL ELECTIVE COURSE – IV	PE	AIML	3	-	-	-	50	50	100	3
6.	21AIL66	NATURAL LANGUAGE PROCESSING LAB	PC	AIML	-	-	2	-	50	50	100	1
7.	21INT67	INTERNSHIP-II	INT	AIML	-	-	-	12	50	50	100	3
TOTAL									350	350	750	20

PROFESSIONAL ELECTIVE COURSE–IV					
SL.NO	**COURSE CODE**	**COURSE NAME**	**L#**	**T#**	**P#**
1.	21AI71	HIGH PERFORMANCE COMPUTING	3	-	-
2.	21AIE642	EVOLUTIONARY COMPUTING	3	-	-
3.	21AIE643	BIG DATA ANALYTICS	3	-	-
4.	21AIE644	INTRODUCTION TO RECOMMENDATION SYSTEMS	3	-	-
5.	21AIE645	IOT & AI	2	-	2
ABILITY ENHANCEMENT COURSES-III					
6.	21AII681	DOCKERS AND CONTAINERS	3	-	-
7.	21AII682	ADVANCED WEB APPLICATIOND EVELOPMENT	3	-	-
8.	21AII683	ADVANCED MOBILE APPLICATION DEVELOPMENT	3	-	-
9.	21AII684	TECHNICAL SKILLS ENHANCEMENT	3	-	-
10.	21AII685	INTRODUCTION TO OPEN-SOURCE SOFTWARE AND OPEN STANDARDS			

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SEMESTER: VII

SL. NO.	COURSE CODE	COURSE NAME	COURSE TYPE	TEACHING DEPT.	TEACHING HOURS/WEEK				EXAMINATION			CREDITS
					L#	T#	P#	S#	CIE*	SEE**	TOTAL	
1.	21AIE641	REINFORCEMENT LEARNING	PC	AIML	3	-	-	-	50	50	100	3
2.	21AI72	COMPUTER VISION	PC	AIML	2	-	2	-	50	50	100	3
3.	21AIOE75X	OPEN ELECTIVE II (MOOC)	PC	AIML	3	-	-	-	50	50	100	2
4.	21AIL73	COMPUTER VISION LAB	PE	AIML	-	-	2	-	50	50	100	1
5	21AIXX	ENGINEERING RESEARCH METHODOLOGY	PC	AIML	1	-	-	-	50	50	100	1
6.	21AI76	ABILITY ENHANCEMENT COURSES-III	AEC	AIML	2	-	-	-	50	50	100	2
7.	21AI74	PROJECT PHASE - 1	PC	AIML	3	-	-	-	50	50	100	4
TOTAL									**350**	**350**	**700**	**16**

Department of Artificial Intelligence and Machine Learning

OPEN ELECTIVE II					
SL.NO	**COURSE CODE**	**COURSE NAME**	**L#**	**T#**	**P#**
1	21AIOE751	MACHINE LEARNING USING PYTHON	-	-	2
2	21AIOE752	MACHINE LEARNING SERVICES IN CLOUD PLATFORMS	-	-	2

ABILITY ENHANCEMENT COURSE III					
SL.NO	**COURSE CODE**	**COURSE NAME**	**L#**	**T#**	**P#**
1	21AII681	DOCKERS AND CONTAINERS	2	-	-
2	21AII682	ADVANCED WEB APPLICATIOND EVELOPMENT	2	-	-
3	21AII683	ADVANCED MOBILE APPLICATION DEVELOPMENT	2	-	-
4	21AII684	TECHNICAL SKILLS ENHANCEMENT	2	-	-
5	21AII685	INTRODUCTION TO OPEN-SOURCE SOFTWARE AND OPEN STANDARDS	2	-	-

Department of Artificial Intelligence and Machine Learning

SEMESTER: VIII

SL NO	COURSE CODE	COURSE NAME	COURSE TYPE	TEACHING DEPT.	TEACHING HOURS/WEEK				EXAMINATION			CREDITS
					L#	T#	P#	S#	CIE*	SEE**	TOTAL	
1	21INT81	RESEARCH/ INDUSTRY INTERNSHIP*	PC	AIML	-	-	-	-	100	100	200	10
	21AI82	PROJECT PHASE - II	PC	AIML	-	-	-	-	100	100	200	6
TOTAL									**200**	**200**	**400**	**16**

$-TOBECOMPLETEDDURINGANYONEOFTHESUMMERVACATIONFORABOUT6WEEKS.

NOTE: PAPER PUBLICATION IS MANDATORY FOR INTERNSHIP ANDPROJECT SUBMISSION.

^-GUIDE, ^^-DEPARTMENTAL COMMITTEE

NOTE: STUDENTS ARE FREE TO CHOOSE ANY MOOC BASED COURSE, EITHE RFROM THE LIST GIVEN BELOW OR ANY OF THEIR CHOICE; PROVIDED THE COURSE WAS NOT OFFERED TO THEM IN ANY OF THEIR PREVIOUS SEMESTERS.

NOTE *- EVALUATION FORTHE INTERNAL MARKS WILL BE BASED ON PRACTICAL ORIENTED ASSIGNMENTS / COURSE PROJECT / MINIPROJECT / TESTS. IN ADDITION, AS A COMPONENT OF TEACHING METHODS THE COURSE CONTENT WILL BE DELIVERED BY DEMOS AND OR ACTUAL HANDSON ACTIVITY BY THE STUDENTS IN THE LAB/CLASSROOM.

****Integrated Course:** This course contains 60% of hands-on/practical sessions and 40% of theory. Continues Internal Evaluation (CIE) conducted for 50 Marks theory (70% of theory: Mid Semester Evaluation + Learning Assessment1+Learning Assessment2) and 50 Marks Laboratory (30% of Practical: Record Writing + Observation +Experiment Conduction +Mid Semester Evaluation). To appear in SEE Students should score minimum of 20 Marks in CIE.
Semester End Examination (SEE)evaluationhasTheoryexaminationconductedfor100Marksandthenreducedto50Marks, there is no Semester End Examination for Laboratory. Final Marks of the course is the combination of CIE+SEE.

^BS- BASIC SCIENCE, $EC- ENGG. CORE, @HU-HUMANITIES,
***CONTINUOUS INTERNAL EVALUATION, **SEMESTER END EXAMINATION,**
#L-LECTURE, T-TUTORIAL, P-PRACTICALNOTE:ONE HOUR OF LECTURE = 1 CREDIT, TWO HOURS OF TUTORIALS = 1 CREDIT, TWO HOURS OF PRACTICALS = 1 CREDIT, FOUR HOURS OF SELF-STUDY = 1 CREDIT.

NITTE EDUCATION TRUST | NITTE MEENAKSHI INSTITUTE OF TECHNOLOGY

(An Autonomous Institution, Affiliated To Visvesvaraya Technological University Belagavi, Accredited by NAAC-"A+" Grade, approved by AICTE, New Delhi.Yelahanka,Bangalore-64)

Department of Artificial Intelligence and Machine Learning

Course Content for III –Semester 2021 Scheme

Department of Artificial Intelligence and Machine Learning

Department: *Mathematics*	***Course Type: Basic Science***
Course Title*: Integral Transforms, Linear Algebra and Numerical Methods*	***Course Code: 21MAT31A***
L-T-P: 2-2-0	***Credits:****3*
Total Contact Hours: *50 Hours*	***Duration of SEE:*** *3 Hours*
SEE Marks*: 50*	***CIE Marks:****50*

COURSE DESCRIPTION

The course aims at imparting knowledge of Fourier analysis, Integral transforms, numerical methods, Basics of linear algebra relevant to the field of Computer Science, Information Science and Artificial Intelligence

PREREQUISITES

Integration, differentiation, Taylor series, matrices

COURSE OBJECTIVES

To understand the periodic and harmonic phenomena and to be able to model them using Fourier series and use integral transforms such as Laplace and Fourier transforms,

To understand the advantages, limitations and applications of different numerical techniques.

To explore the concepts and applications of Linear algebra.

COURSE CONTENTS

UNIT-I

Linear Algebra-I **08 Hours**

Vector spaces- definition, examples, Linear combinations, subspaces, linear dependence, basis and dimension, linear mapping, linear operator, Kernel and Image of a Linear mapping, matrix representation of linear operator, change of basis.

Self-Study: Row Space and Column space, Rank and nullity theorem

UNIT-II

Linear Algebra-II **08 Hours**

Inner product space, Orthogonal Sets and Bases, Gram Schmidt Orthogonalization process Polynomial of matrices, Characteristic polynomial, diagonalization, Eigenvalues and Eigen vectors, diagonalization, Characteristic and minimal polynomial, Singular value decomposition

Self-Study: Block matrices and Canonical form.

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UNIT–III

Numerical Methods-I **8 Hours**

Interpolation: Newton's divided difference formulae, Lagrange's formula, Cubic spline.
Least square fitting of Fourier series (Harmonic Analysis).
Numerical Differentiation: Newton's forward and backward formulae, Lagrange's formula.
Numerical Integration: Trapezoidal, Simpson's1/3rd and 3/8th, Gaussian Quadrature method.
Self-Study: Quadratic spline, Weddle's rule for numerical integration.

UNIT–IV

Optimization and Numerical Methods **8 Hours**

Continuous Optimization: Gradient Descent method, Un constrained optimization- single variable function, condition for local minima and maxima, Multivariable function, Constrained optimization, Lagrange multipliers, Kuhn-Tucker necessary and sufficient conditions.
Numerical solution of ordinary differential equations: Taylor's series method, Runge-Kutta 4th order method - First order and second order Ordinary differential equations,
Self-Study: Correlation and regression

UNIT–V

Fourier analysis and Integral Transforms **8 Hours**

Fourier series: Euler's formulae, Dirichlet's conditions for Fourier series expansion, Even and odd function.
Fourier Transforms: Complex Fourier transforms, Cosine and Sine transforms, Inverse Fourier transforms.
Laplace Transforms: Definition, Transforms of standard functions, Laplace transforms of periodic functions, Inverse Laplace transforms
Self-Study: Fourier half range series, solutions of 1st and 2nd order ODE using Laplace transforms.

TEXT BOOKS

1. Linear Algebra, Seymore Lipschutz and Marc Lipson, 3rd edition, Tata McGrawhill, 2005
2. Numerical Methods for Scientific and Engg. Computation, M K Jain, S R K Iyengar, R K Jain, 6th edition, New Age, 2012
3. Advanced Engg. Mathematics, Erwyn Kreyzig, 9th edition, Wiley, 2011

REFERENCE BOOKS

1. Linear Algebra for everyone, Gilbert strang, 2020
2. Fourier Series, Transforms and Boundary Value Problems, J R Hanna, J H Rowland, 2nd edition, Dover, 2008
3. Numerical Algorithms, E V Krishnamurthy, S K Sen, East West press,2007

TEACHING METHODS

- Black Board Teaching.
- Power point presentation (If needed).
- Tutorial Classes.

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ASSESSMENT METHODS

Continuous internal Evaluation (CIE) for 50 Marks

- Surprise test / Tutorials tests to be conducted for each topic for 10marks.
- Quiz/ assignment based on practical application for 10 marks.
- Three mid semester examinations will be conducted each for 30 marks and the average of all the 3 will be taken.

Semester End Examination (SEE) for 50 Marks

Final examination, of 100 Marks will be conducted and will be evaluated for 50 marks.

COURSE OUTCOMES

1. The numerical methods can be applied for fitting the data, find appropriate functions, differentiate and integrate the same
2. The concept of numerical methods can be used to solve differential equations
3. The concept of linear algebra can be adopted to analyze situations arising in engg. Problems
4. The concepts of Fourier analysis, integral transforms and optimization can be applied to engg. Problems
5. The concept of matrices, orthogonality and vectors paces can be adopted to analyze situations arising in engg. Problems

Course Outcome to Programme outcome Mapping:

CO	Pos												PSO1	PSO2
	1	2	3	4	5	6	7	8	9	10	11	12		
1	3		2											
2	3		2		1									
3	3		2											
4	3		2		1									
5	3		2		1									

Department of AIML

Department: Artificial Intelligence and Machine Learning	***Course Type: Core***
Course Title: Data Structures Integrated	***CourseCode:21AI32***
L-T-P: 4:2:0	***Credits:4***
TotalContactHours:52hours	***DurationofSEE:3hours***
SEE Marks*: 50*	***CIE Marks: 50***

COURSE DESCRIPTION

This course provides the usage and application of pointers and dynamic memory allocation in C. It deals with different data structures such as Stacks, Queues, Linked List, Trees and their applications in solving real world problems.

PREREQUISITES

Computer Concepts and C programming

COURSE OBJECTIVES

- To understand the concept of pointers and allocate and deallocate memory dynamically.
- To understand the working principle of different types of data structures.
- To identify and apply the appropriate data structure to solve real world problem.

COURSE CONTENTS

UNIT-I 08 Hours

Pointers: Introduction, Understanding Pointers, Accessing the Address of a Variable, Declaring Pointer Variables, Initialization of Pointer Variables, Accessing a Variable through the Pointer, Chain of Pointers, Pointer Expressions, Pointer Increments and Scale Factor, Pointers and Arrays, Pointers and Character Strings, Array of Pointers, Pointer as Function Arguments, Functions Returning Pointers, Pointers to Functions, Pointers and Structures

Dynamic Memory Allocation: Introduction, Dynamic Memory Allocation, Allocating a Block of Memory: Malloc, Allocating a Multiple Blocks of Memory: Calloc, Releasing the Used Space: Free, Altering the size of Block: Realloc

UNIT-II **08Hours**

The Stack: Definition and Examples—Primitive operations, examples

Representing Stacks in C: Implementing the POP operation, testing for exceptional conditions, implementing the PUSH operation An Example: Infix, Postfix, and Prefix – Basic definitions and examples, Stack Applications---Evaluating a postfix expression, program to evaluate a postfix expression, Converting an expression from infix to postfix, program to convert an expression from infix to postfix

Recursion (Applications of Stack): Recursive Definition and Processes—factorial function, multiplication of natural numbers. Fibonacci sequence, binary search

Recursion in C – factorial, Fibonacci numbers, binary search, recursive chains, Writing Recursive Programs – Towers of Hanoi, Binary Search

UNIT-III **08 Hours**

Queues:

The Queue and its Sequential Representation: C Implementation of Queues, Insert Operation, Priority Queue, Array Implementation of a Priority Queue.

Linked Lists: Inserting and Removing Nodes from a List, Linked Implementation of Stacks, getnode and freenode Operations, Linked Implementation of Queues, Linked List as a Data Structure, Examples of List Operations, List Implementation of Priority Queues, Header Nodes

Lists in C: Array Implementation of Lists, Limitations of the Array Implementation, Allocating and Freeing of Dynamic variables, Linked Lists using Dynamic Variables, Queues as List in C, Examples of List Operations in C, Noninteger and Nonhomogeneous Lists, Comparing the Dynamic and Array Implementations of Lists, Implementing Header Nodes

UNIT-IV **08 Hours**

Other List Structures: Circular Lists, Stack as a Circular List, Queue as a Circular List, Primitive Operations on Circular Lists, Header nodes, Addition of Long Positive Integers Using Circular Lists, Doubly Linked Lists, Addition of Long Integer Using Doubly Linked Lists

Binary Trees: operations on Binary Trees, Applications of Binary Trees

UNIT-V **08 Hours**

Binary Tree Representations: Node Representation of Binary Trees, Internal and External Nodes, Implicit Array Representation of Binary Trees, Choosing a Binary Tree Representation, Binary Tree Traversal in C, Threaded Binary Trees.

Representing Lists as Binary Trees: Finding the k^{th} Element, Deleting an Element, Implementing Tree-Represented Lists in C, Constructing a Tree-represented List

Trees and Their Applications: C Representations of Trees, Tree Traversals, General Expressions as Trees, evaluating an expression tree, constructing a Tree.

TEXT BOOKS

1. Programming in ANSI C: E Balagurusamy, Third edition, TATA McGraw HILL
2. Data Structures using C, Aaron M. Tanenbaum, Yedidyah Langsam & Moshe J. Augenstein, Pearson Education/PHI, 2006

REFERENCE BOOKS

1. The C Programming Language, Brian W Kernighan and Dennis M Ritchie, Prentice Hall Software Series, 2nd Edition.
2. Data Structures A Pseudocode approach with C, Richard F. Gilberg and BehrouzA. Forouzan, Thomson, 2005.
3. Data Structures & Program Design in C, Robert Kruse & Bruce Leung, Pearson Education, 2007.
4. Fundamentals of Data Structures in C, Horowitz, Sahani, Anderson, Freed, Second edition, 2008.

Laboratory Based Exercises

1. a) Find sum of N numbers. Allocate the memory dynamically to the numbers.
   b) Find the following for a matrix. Use the concept of pointer to 2D array.
      i) Sum of principal diagonal elements
      ii)Sum of secondary diagonal elements
      iii)Sum of all elements

2. Using array of pointer concept
   a) Find product of two Matrices
   b) Sort n names in alphabetical order

3. Implement and demonstrate the following C functions using pass-by-reference method.
   i)StrCopy()
   i) StrConcat()
   iii)Strcomp()
   iv)Strrev()

4. Define an EMPLOYEE structure with members Emp_name, Emp-id, Dept-name and Salary. Read and display data of N employees. Employees may belong to different departments. Write a function to find total salary of employees of a specified department. Use the concept of pointer to structure and allocate the memory dynamically to EMPLOYEE instances.

5. Define a structure BOOK with members ISBN, Title and price. Write a C program to construct a stack data structure of N BOOK objects and to perform the following operations on it:
    a) PUSH—To add a new book to the stack
    b) POP To remove a book from the stack

6. Write a C program to convert and print a given valid parenthesized infix arithmetic expression to postfix expression. The expression consists of single character operands and binary operators + - * /. Apply the concept of stack data structure to solve this problem.

7. Write a C program to evaluate a valid postfix expression using stack. Assume that the postfix expression is read as a single line consisting of non-negative single digit operands and binary operators. The operators are + - * and/.

8. Write recursive functions for the following and demonstrate their use.
    a) Binary Search
    b) Tower of Hanoi problem.

9. A Call center phone system has to hold the phone calls from customers and provide service based on the arrival time of the calls. Write a C program to simulate this system using appropriate data structure. Program should have options to add and remove the phone calls in appropriate order for their service.

10. Write a C program to simulate the working of a circular Queue of integers. Represent circular queue element as a structure and use array of structures as your implementation method. Start and end of the circular queue must be identified by an empty array element.

11. Write a program to create a singly linked list that maintains a list of names in alphabetical order. Implement the following operations on the list.
    a) Insert a new name
    b) Delete a specified name

12. Write a C program to maintain a stack of integers using circularly linked implementation method.

13. Write a C program to support the following operations on a doubly linked list
    a) Insert a new node to the left of the node whose key value is read as an input.
    b) Delete a node with given data, if it is found. otherwise display appropriate error message.

14. Write a C program
    a) To construct a binary search tree (BST) of integers.
    b) To traverse the tree using inorder, preorder and postorder traversal methods

TEACHING METHODS

- Lectures interspersed with discussion
- Power Point Presentations
- Problem Based Teaching
- Demonstration and Implementation

ASSESSMENT METHODS

1. Three Midsem exams – 30 Marks each will be conducted and the Average of all the three tests will be considered.
2. LaboratoryBasedExercices:20Marks

COURSE OUTCOMES

Sl. No.	COURSEOUTCOMES	BL
CO1	Identify the purposes of dynamic memory in applications, Illustrate arrays and Structures with programming solutions for real world problems	3
CO2	Quote the implication of stacks and queues for different problems, Propose Programming solutions using variations of stacks and queues	3
CO3	Manage dataset operations using variations of linked list	3
CO4	Appraise the purposes of Trees to represent datasets, Devise application to solve Tree oriented problems	3
CO5	Develop solutions to given problems based on the application of various data structure	3

CO-PO MAPPING

	PROGRAMOUTCOMES												PSO		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	3	2										3		

-

CO2	2	2	3										3		
CO3	2	2	3										3		
CO4	2	3	2										3		
CO5	2	2	3						1	1			3		2

Department of Artificial Intelligence and Machine Learning

Department: Artificial Intelligence and Machine Learning	***Course Type: Program Core***
Course Title: Introduction to Artificial Intelligence	***CourseCode:21AI31***
L-T-P:3-0-0	***Credits: 03***
Total Contact Hours:39 Hours	***DurationofSEE:3Hours***
***SEE Marks**: 100*	***CIE Marks: 50***

COURSE DESCRIPTION

This course provides an in-depth knowledge of structure of Artificial agents, search algorithms, uninformed and informed search strategies, game playing algorithms, agents that reason logically.

PREREQUISITES

Student should have knowledge on the concepts of programming

COURSE OBJECTIVES

Theobjectiveofthecourseistofamiliarizestudentswithworkingofartificialagents

- Understanding AI, Structure of Agents, Idea behind search algorithms, analyzing Uninformed and Informed search.
- Understanding and analyzing game playing algorithms and agents that reason logically.

COURSE CONTENTS

UNIT-I 08 Hours

Introduction. Why study AI? What is AI? The Turing test. Rationality. Branches of AI. Brief history of AI. Challenges for the future. What is an intelligent agent? Doing the right thing (rational action). Performance measure. Autonomy. Environment and agent design. Structure of Agents. Agent types. Solving Problems by Searching - **Uninformed Search** - Depth-first. Breadth-first. Uniform-cost. Depth-limited. Iterative deepening. Examples. Properties. **Informed search** –Best-first. A* search. Heuristics. Hill climbing. Problem of local extrema.

UNIT-II **08Hours**

Beyond Classical Search Local Search Algorithms and Optimization Problems, Local Search in continuous Spaces, Searching with Nondeterministic Actions, Searching with Partial Observations, Online Search Agents and Unknown Environments. **Adversarial Search** Games, Optimal Decisions in Games, Alpha–Beta Pruning, Stochastic Games. **Constraint Satisfaction Problems** Defining Constraint Satisfaction Problems, Constraint Propagation: Inference in CSPs, Backtracking Search for CSPs, Local Search for CSPs, The Structure of Problems

UNIT-III **07 Hours**

Knowledge, reasoning, and planning Logical Agents Knowledge-Based Agents, The Wumpus World, Logic, Propositional Logic: A Very Simple Logic, Propositional Theorem Proving, Effective Propositional Model Checking **First-Order Logic** Representation Revisited, Syntax and Semantics of First-Order Logic, Using First-Order Logic, Knowledge Engineering in First-Order Logic

UNIT-IV **08 Hours**

Inference in First-Order Logic Propositional vs. First-Order Inference, Unification and Lifting, Forward Chaining, Backward Chaining, Resolution. **Classical Planning** Definition of Classical Planning, Algorithms for Planning as State-Space Search, Planning Graphs, Other Classical Planning Approaches, Analysis of Planning Approaches. **Planning and Acting in the Real-World** Time, Schedules, and Resources, Hierarchical Planning, Planning and Acting in Nondeterministic Domains, Multiagent Planning

UNIT-V **08 Hours**

Learning from Examples Forms of Learning, Supervised Learning, Learning Decision Trees, Evaluating and Choosing the Best Hypothesis, The Theory of Learning, Regression and Classification with Linear Models, Artificial Neural Networks, Nonparametric Models, Support Vector Machines, Ensemble Learning, Practical Machine Learning **Knowledge in Learning** A Logical Formulation of Learning, Knowledge in Learning, Explanation-Based Learning, Learning Using Relevance Information , Inductive Logic Programming

TEXT BOOKS

1.Artificial Intelligence A Modern Approach, Stuart J. Russell and Peter Norvig, Pearson (4thEdition)

REFERENCE BOOKS

1. Elaine Rich, Kevin Knight, Shivashanka B Nair: Artificial Intelligence, Tata MCGraw Hill 3rd edition. 2013
2. Nils J. Nilsson: "Principles of Artificial Intelligence", Elsevier, ISBN-13: 9780934613101

TEACHING METHODS

Black board teaching
Lecture using presentation

ASSESSMENT METHODS

Programming Assignments
Seminar

COURSE OUTCOMES

Sl. No.	COURSEOUTCOMES	BL
CO1	Understand the artificial intelligence and intelligent agents	L1, L2
CO2	Finding the solution using uninformed and informed search	L2, L3
CO3	Analyze the knowledge representation language	L3
CO4	Develop the plan of action for the real-world problems	L4
CO5	Understand and analyze the learning mechanisms	L2

CO-PO MAPPING

	PROGRAMOUTCOMES												PSO		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1		2	2	2										2	
CO2	3	3	3											3	
CO3		3	3	3	3									3	
CO4	3	3	3	3	3									2	2

CO5	3	2	2	2	2									2	2

Department of Artificial Intelligence and Machine Learning

Department: *Artificial Intelligence and Machine Learning*	***Course Type:*** *Program Elective*
Course Title*: Introduction to AI in virtual reality*	***Course Code:*** *21AIE351*
L-T-P : *3-1-0*	***Credits:*** *03*
Total Contact Hours: 40 hours	***Duration of SEE:*** *3 hours*
SEE Marks*: 50*	***CIE Marks:*** *50*

COURSE DESCRIPTION

This course is designed to provide students with an overview of the basic principles of virtual reality (VR) and virtual environment technology (VET). There is a strong emphasis on the use of AI technology as a tool for conducting scientific research and as a platform for real-world applications. The goal is to learn enough about the strengths and limitations of VR technology in order to be able to construct simple immersive environments as well as to understand the human factors and cognitive issues that should be considered when using this medium.

PREREQUISITES

Basics of statistics, Basics of Programming, Numerical Techniques

COURSE OBJECTIVES

- Understand the basics of Virtual reality
- Learn geometry of virtual world, which is needed to make Virtual Reality models
- Understand how the design of VR technology relates to human perception and cognition.
- Learn to design own VR application or game

COURSE CONTENTS

UNIT-I — 08 Hours

Introduction of Virtual Reality: Definition of VR, modern experiences, historical perspective. Hardware, sensors, displays, software, virtual world generator, game engines, human senses, perceptual psychology, psychophysics.

UNIT-II — 08 Hours

Geometry of virtual world: Geometric modelling, transforming rigid bodies, yaw, pitch, roll, axis-angle representation, quaternions, 3D rotation inverses and conversions, homogeneous transforms, transforms to displays, look-at and eye transforms, canonical view and perspective transforms, viewport transforms.

Light and Optics: Light propagation, lenses and images, diopters, spherical aberrations, optical distortion; more lens aberrations; spectral properties; the eye as an optical system; cameras; visual displays.

UNIT-III — 08Hours

The Physiology of Human Vision: Parts of the human eye, photoreceptors and densities, scotopic and photopic vision, display resolution requirements, eye movements, neural vision structures, sufficient display resolution, other implications of physiology on VR.

Visual Perception: Depth perception, motion perception, stroboscopic apparent motion, color perception, combining information from multiple cues and senses, implications of perception on VR.

UNIT-IV — 08 Hours

Computing Architectures For VR: The Rendering Pipeline, PC Graphics Architecture, Workstation-Based Architectures, Distributed VR Architectures.

Modelling: Geometric Modelling, Kinematics Modelling, Physical Modelling, Behaviour Modelling, Model Management

UNIT-V **08 Hours**

Human Factors in VR: Methodology and Terminology, User Performance Studies, VR Health and Safety Issues

Emerging Applications of VR: VR Applications in Manufacturing, Applications of VR in Robotics, Information Visualization

TEXT BOOKS

1. Virtual Reality Steven M. LaValle Cambridge University Press, 2016
2. Virtual Reality Technology, 2nd Edition Grigore C. Burdea, Philippe Coiffet June 2003 Wiley-IEEE Press.

REFERENCE BOOKS

1. Developing Virtual Reality Applications: Foundations of Effective Design, Alan B Crai, Alan B Craig, William R Sherman and Jeffrey D Will, Morgan Kaufmann, 2009.
2. Virtual Reality Technology Burdea, Grigore C and Philippe Coiffet Wiley Interscience, India, 2003.
3. Understanding virtual reality: Interface, application, and design. Sherman, William R., and Alan B. Craig., Morgan Kaufmann, 2018
4. Virtual reality: applications and explorations, Wexelblat, Alan, Academic Press, 2014.

- Black Board Teaching.
- Power point presentation

ASSESSMENT METHODS

1. **Continuous internal Evaluation (CIE) for 50 Marks**
   1. Case studies and Assignments based on practical application for 20 marks.
   2. Three mid semester examinations will be conducted each for 30 marks and the average of all the 3 will be taken.
2. **Semester End Examination (SEE) for 50 Marks**
   1. Final examination, of 100 Marks will be conducted and will be evaluated for 50 marks.

COURSE OUTCOMES(COs)

Sl. No.	COURSE OUTCOMES	BL
CO1	Introduction of Virtual Reality:	L1
CO2	Geometry of virtual world:	L1
O3	The Physiology of Human Vision, Visual Perception	L2
CO4	Computing Architectures For VR, Modelling	L3
CO5	Human Factors in VR, Emerging Applications of VR	L3

CO-PO MAPPING

	PROGRAM OUTCOMES												PSO		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3											2	2		
CO2													3		
CO3		3												2	
CO4					3										2
CO5			2				2	2		3		2			2

Department of Artificial Intelligence and Machine Learning

Department: *Artificial Intelligence and Machine Learning*	***Course Type: Professional Elective Course***
Course Title*: Introduction to Data Science*	***Course Code: 21AIE352***
L-T-P: 3-0-0	***Credits:3***
Total Contact Hours: 39	***Duration of SEE: 3hrs***
SEE Marks*:100*	***CIE Marks: 50***

COURSE DESCRIPTION

The course introduces basic techniques and tools commonly applied in data science for extracting meaningful information from data. The concepts to deal with various facets of data science practice, including data collection and management, data wrangling and visualization, predictive modelling using statistical learning and machine learning algorithms and effective communication.

PREREQUISITES

Basic Mathematics

COURSE OBJECTIVES

To Impart the knowledge and ability to understand and apply the fundamental concepts of data science to real world scenarios.

COURSE CONTENTS

UNIT-I — 08 Hours

Introduction to Data Science: The data science process, The roles in a data science project, Project roles, Stages of a data science project, Defining the goal, Data collection and management, Modeling, Model evaluation and critique, Presentation and documentation, Model deployment and maintenance, Setting expectations, Determining lower bounds on model performance, **Starting with R and data**.

UNIT-II — 07Hours

Exploring data: Using summary statistics to spot problems, Spotting problems using graphics and visualization, **Managing data:** Cleaning data, Data transformations, Normalization, Sampling for modelling and validation.

UNIT-III — 08Hours

Data engineering and data shaping: Data selection, Basic data transforms, Aggregating transforms, Multitable data transforms, Reshaping transforms, **Modeling methods: Choosing and evaluating models:** Mapping problems to machine learning tasks, Evaluating models.

UNIT-IV — 07Hours

Modeling methods: Linear and logistic regression: Understanding linear and logistic regression, Building a linear and logistic regression model, Making predictions, Finding relations and extracting advice, the models summary and characterizing coefficient quality, Linear and logistic regression models – key takeaways

UNIT-V — 08 Hours

Unsupervised methods: Cluster analysis, Distances, Preparing the data, Hierarchical clustering, The k-means algorithm, Assigning new points to clusters, Association rules

TEXT BOOKS

1. Nina Zumel and John Mount (2019), Practical Data Science with R, Second Edition, Manning Publications, NY, ISBN 9781617295874
2. Benjamin S. Baumer, Daniel T. Kaplan, and Nicholas J. Horton (2017), Modern Data Science with

R,1st Edition, CRC Press, Taylor & Francis Group, ISBN-13:978-1-4987-2448-7

REFERENCE BOOKS

1. Hadley Wickham and Garrett Grolemund (2016), R for Data Science, O'Reilly Media, Inc,ISBN:978-1-491-91039-9
2. The Analytics Edge, MIT Course Number 15.071, MIT open courseware (https://ocw.mit.edu/courses/sloan-school-of-management/15-071-the-analytics-edge-spring-2017/index.htm)

Data Science: R Basics, Harvard online learning, HarvardX: PH125.1x (https://online-learning.harvard.edu/course/data-science-r-basics?delta=1)

- Black Board Teaching.
- Power point presentation

ASSESSMENT METHODS

Continuous internal Evaluation (CIE) for 50 Marks

- Assignment/Project based on the practical application for 20 marks.
- Three mid semester examinations will be conducted each for 30 marks and the average of all the 3 will be taken.

Semester End Examination (SEE) for 50 Marks

Final examination, of 100 Marks will be conducted and will be evaluated for 50 marks.

COURSE OUTCOMES (COs)

After completion of the course, the students will be able to:

CO	Description	Bloom'sLevel
1	Understand the key concepts in data science	L1
2	Pre-process data for statistical Learning	L2
3	Apply statistical methods for description, explanation, and Prediction	L3
4	Interpret the results of data Processing	L3
5	Prepare report for technical and non-technical audiences	L3

Course Outcome to Programme Outcome Mapping

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3					2			2	2		1	2	2
CO2	3	2	2			2			2	2		1	2	2
CO3	3	2	2		2	2			2	2		1	2	2
CO4	3	2	2	2	2	2			2	2		1	2	2

CO5	3	2	2	2	2	2			2	2		1	2	2

3: Strong, 2: Medium, 1: Weak H: Highly related S: Supportive**

Department of Artificial Intelligence and Machine Learning

***Department:** Artificial Intelligence & Machine Learning*	***Course Type: Programme Core***
Course Title: Introduction to Business Intelligence	***Course Code: 21AIE353***
L-T-P 3-0-0	***Credits: 3***
Total Contact Hours: 40	***Duration of SEE: 3 Hours***
SEE Marks: 50	***CIE Marks: 50***

COURSE DESCRIPTION

Business Intelligence (BI) refers to technologies, applications, and practices for the collection, integration, analysis, and presentation of business information. The purpose of business intelligence is to support better business decision making. This course provides an overview of the technology of BI and the application of BI to an organization's strategies and goals.

PREREQUISITES

- Student should have prior knowledge of DBMS
- Student should have queried some database using SQL

COURSE OBJECTIVES

- To get basic knowledge of business intelligence (BI), BI technology, and related concepts.
- To get knowhow on data integration methods, architecture and technology.
- To design multi-dimensional data modelling.
- To gain knowledge of enterprise reporting techniques and to design such reports.

COURSE CONTENTS

UNIT-I — 08 Hours

Introduction to Business Intelligence
Types of digital data; Introduction to OLAP and OLAP, BI Definitions & Concepts, Business Applications of BI, BI Framework, Role of Data Warehousing in BI, BI Infrastructure Components BI Process, BI Technology, BI Roles & Responsibilities.

UNIT-II — 08 Hours

Basics of Data Integration (Extraction Transformation Loading) Concepts of data integration need and advantages of using data integration, introduction to common data integration approaches, Introduction to data quality, data profiling.

UNIT-III **08Hours**

Introduction to Data Integration: Introduction to SSIS Architecture, Introduction to ETL using SSIS; Integration Services objects; Data flow components – Sources, Transformations and Destinations; Working with transformations, containers, tasks, precedence constraints and event handlers.

UNIT-IV **08 Hours**

Introduction to Multi-Dimensional Data Modeling
Introduction to data and dimension modeling, multidimensional data model, ER Modeling VS. Multi-dimensional modeling. Concepts of dimensions, facts, cubes, attributes, hierarchies, star and snowflake schema, introduction to business metrics and KPIs, Creating cubes using SSAS.

UNIT-V **08 Hours**

Basics of Enterprise Reporting
Introduction to enterprise reporting, concepts of dashboards, balanced scorecards, introduction to SSRS architecture, enterprise reporting using SSRS.

TEXT BOOKS

1. R N Prasad and Seema Acharya, Business Analytics & its Applications, Wiley India,2013

REFERENCE BOOKS

1. David Loshin, Business Intelligence, 2nd edition, Morgan Kaufmann,2012.
2. Mike Biere, Business Intelligence for the Enterprise, Prentice Hall Professional, 2003.
3. Larissa Terpeluk Moss and Shaku Atre, Business Intelligence Roadmap, Addison Wesley, 2003.
4. Cindi Howson, Successful Business Intelligence: Secrets to making BI a Killer Applications, Tata McGraw-Hill Edu. Pvt. ltd, 2007.

TEACHING METHODS

- Black board and chalk
- Power Point Presentations
- Problem Solving Assignments

ASSESSMENT METHODS

Parameter	**Marks**
Midterm Test	30
Case Study/ Assignment	20
Total	**50**
FinalExamwillbeconductedfor100marks (SEE)	

COURSE OUTCOMES

Sl.No.	COURSEOUTCOMES	BL
CO1	Explain BI concepts, methodologies & BI framework.	L2
CO2	Build Data Warehouse by understanding complete ETL process.	L3
O3	Illustrate SQL Server Integration Services (SSIS) & SSRS Architectures.	L2
CO4	Describe various Data modelling & Dimensional modelling techniques and design with these.	L3
CO5	Demonstrate Enterprise reporting, Concepts of dashboards & Balanced scorecards. .	L3

CO-PO MAPPING

	PROGRAMOUTCOMES												PSO		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	1		3	3							1	3	3		
CO2	1		3	3	2	3					1	3	3		3
CO3	2	3	3	2	3	3						3	3		
CO4	2	2	3	3								3	3		
CO5				2	3	3		3					3		2

Department of Artificial Intelligence and Machine Learning

Department: *Artificial Intelligence and Machine Learning*	***Course Type: Professional Core Course***
Course Title*: Statistics for AI*	***Course Code: 21MAT32***
L-T-P: 3-0-0	***Credits: 3***
Total Contact Hours: 39	***Duration of SEE: 3hrs***
SEE Marks: 100	***CIE Marks: 50***

COURSE DESCRIPTION

This course focuses on the statistitcal Inferences required for Artificial Intelligence and Machine Learning. It covers topics on parametric and non parametric models, Hypothesis testing, Bayes Inferences, Statistical decision theory , supervised learning-classification, linear and logistic regression, multivariate models, non parametric curve estimation.

PREREQUISITES

Basic Mathematics

COURSE OBJECTIVES

To Impart the knowledge and ability to apply basic concepts of statistical inferences in the field of Artificial Intelligence and Machine Learning.

COURSE CONTENTS

UNIT-I — 07 Hours

Statistical Inference: **Models, Statistical Inference and Learning**: Statistical Learning-Introduction, Parametric and Nonparametric Models, Fundamental Concepts in Inference, **Estimating the CDF and Statistical Functionals, The Bootstrap, Parametric Inference:** Parameter of Interest, The Method of Moments, Maximum Likelihood, Properties of Maximum Likelihood Estimators, Consistency of Maximum Likelihood Estimators, Equivariance of the MLE, Computing Maximum Likelihood Estimates.

UNIT-II — 07Hours

Hypothesis Testing and p-values: The Wald Test, p-values, The X_2 Distribution, Pearson's X_2 Test For Multinomial Data, The Permutation Test, The Likelihood Ratio Test, Multiple Testing, Goodness-of-fit Tests, The t-test, **Bayesian Inference:** The Bayesian Philosophy, The Bayesian Method, Functions of Parameters, Simulation, Large Sample Properties of Bayes' Procedures, Flat Priors, Improper Priors, and Noninformative Priors, Multiparameter Problems, Bayesian Testing , Strengths and Weaknesses of Bayesian Inference

UNIT-III — 10Hours

Statistical Decision Theory: Preliminaries, Comparing Risk Functions, Bayes Estimators, Minimax Rules, Maximum Likelihood, Minimax, and Bayes, Admissibility, Stein's Paradox, **Statistical Models and Methods: Overview of Supervised Learning, Linear and Logistic Regression**, **Multivariate Models**

UNIT-IV — 07Hours

Non parametric Curve Estimation: The Bias-Variance Tradeoff, Histograms, Kernel Density Estimation, Nonparametric Regression, **Smoothing Using Orthogonal Functions:** Orthogonal Functions and L2 Spaces, Density Estimation, Regression, Wavelets

UNIT-V — 09 Hours

Classification: Introduction, Error Rates and the Bayes Classifier, Gaussian, and Linear Classifiers
Linear Regression and Logistic Regression, Relationship Between Logistic Regression and LDA,
Density Estimation and Naive Bayes, Trees, Assessing Error Rates and Choosing a Good Classifier, Support Vector Machines, Kernelization, Other Classifiers.

TEXT BOOKS

1. All of statistics, A concise course in statistical inference, Larry Wasserman, (Springer Series in Statistics), 2004.
2. The Elements of Statistical Learning, Trevor Hastie, Robert Tibshirani, Jerome Friedman, (Springer Series in Statistics) , Second Edition, February 2009.

REFERENCE BOOKS

1. Empirical Methods for Artificial Intelligence, Paul Rcohen, The MIT Press September1995.
2. Naked Statistics: Stripping the Dread from the Data, Charles Wheelan, W. W. Norton Company, February 2014.

TEACHING METHODS

- Black Board Teaching.
- Power point presentation

ASSESSMENT METHODS

Continuous internal Evaluation (CIE) for 50 Marks

- Case studies and Assignments based on practical application for20 marks.
- Three mid semester examinations will be conducted each for 30 marks and the average of all the 3 will be taken.

Semester End Examination (SEE) for 50 Marks

Final examination, of 100 Marks will be conducted and will be evaluated for 50 marks.

COURSE OUTCOMES (COs)

After completion of the course, the students will be able to:

CO	Description	Bloom'sLevel
1	Understand statistical inference	L1
2	Describe models, methods in statistics	L2
3	Solve elementary problems in statistics.	L3
4	Apply parametric and non-parametric Models	L3
5	Analyze hypothesis to accept/reject Alternative hypothesis.	L4

Course Outcome to Programme Outcome Mapping

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3								2	2		1	1	
CO2	3								2	2		1	1	
CO3	3	3	3		2				2	2		1	2	2
CO4	3	3	3		2				2	2		1	2	2
CO5	3	3	3		2				2	2		1	2	2

3: Strong, 2: Medium, 1: Weak **H: Highly related S: Supportive

Department of Artificial Intelligence and Machine Learning

Department: *Artificial Intelligence and Machine Learning*	***Course Type:*** *Program Core*
Course Title*: Artificial Intelligence with Python Laboratory*	***Course Code:***
L-T-P: 0-0-2	***Credits: 01***
Total Contact Hours: 36 Hours	***Duration of SEE:*** *3 Hours*
SEE Marks: 50	***CIE Marks: 50***

COURSE DESCRIPTION

This course provides an in-depth knowledge of applying Python Programming Language to Various search strategies and game playing algorithms of Artificial Intelligence and Design and Analysis of Algorithms.

PREREQUISITES

- Students should have knowledge of Design and Analysis of Algorithms.
- Students should have knowledge of Probability Theory.
- Students should have knowledge of Basics of programming

COURSE OBJECTIVES

Theobjectiveofthecourseistofamiliarizestudentswithworkingofartificialagents

- Understanding AI, Structure of Agents, Idea behind search algorithms, analyzing Uninformed and Informed search.
- Understanding and analyzing game playing algorithms and agents that reason logically.

LABORATORY EXERCISES

1. Write a program in python to implement simple arithmetic operations.
2. Write a program to implement a vacuum cleaner agent with basic functions.
3. Write a Python Program to find the shortest distance between any two places using a A* search algorithm. Repeat the experiment for different Graphs.
4. Write a program to implement a Minimax decision-making algorithm, typically used in a turn-based, two player games. The goal of the algorithm is to find the optimal next move.
5. Write a program to implement Alpha Beta pruning in Python. The algorithm can be applied to any depth of tree by not only pruning the tree leaves but also the entire subtree. Order the nodes in the tree such that the best nodes are checked first from the shallowest node.
6. Write a program to solve 4 Queens Problem.
7. Implementation of Tic Tac Toe game here, the player needs to take turns marking the spaces in a 3x3 grid with their own marks, if 3 consecutive marks (Horizontal, Vertical, Diagonal) are formed then the player who owns these moves get won. Noughts and Crosses or X's and O's abbreviations can

be used to play.
8. Implement unification in first order logic.
9. Write a program to implement a knowledge base consisting of first order logic statements and prove the query using forward reasoning.

REFERENCES

1. Artificial Intelligence- A Modern Approach, Stuart J. Russell and Peter Norvig, Pearson 3rd Edition, Eleventh Impression 2018.
2. Introduction to Neural Networks using MATLAB6.0, S N SIVANANDAM, S SUMATHI, S N DEEPA, The McGraw-Hill Companies -Computer Engineering Series
3. https://www.tutorialspoint.com/index.htm

TEACHING METHODS

- Black Board/ Power Point Presentations
- Programming Assignments
- NPTEL

ASSESSMENT METHODS

Parameter	Marks
Experiment writeup, Execution, Viva & Record writing	30
Lab Internal Test	20
Total	**50**
Final Exam will be conducted for 100 marks (SEE)	

COURSE OUTCOMES

At the end of the course student will be able

Cos	Description	Bloom's Level
CO1	To understand the basic intelligent agents in artificial intelligence	**L4**
CO2	Understanding and analyzing various search algorithms.	**L4**
CO3	Understanding and analyzing game playing algorithms and agents that reason logically.	**L4**
CO4	Understanding and analyzing the knowledge base system using knowledge-based system	**L4**
CO5	Ability to design a reasoning system for a given requirement	**L4**

CO-PO MAPPING

Mapping of Course outcomes (COs) to Program outcomes (POs*) & PSO **															
Course Outcomes mapping to Program Outcomes													PSOs		
POs COs	1	2	3	4	5	6	7	8	9	10	11	12	PSO 1	PSO 2	PSO 3
CO1	3	3	3	2									3	3	
CO2	3	3	3										3	3	
CO3	3	3	3	2									3	3	
CO4	3	3	3										3	3	
CO5	3	3	3			3							3	3	

Department of Artificial Intelligence and Machine Learning

Department: *Artificial Intelligence and Machine Learning*	***Course Type:*** *Programme Core*
Course Title*: Software Engineering*	***Course Code:*** *21AI33*
L-T-P: 3-0-0	***Credits: 03***
Total Contact Hours: 40 Hours	***Duration of SEE:*** *3 Hours*
SEE Marks: 50	***CIE Marks: 50***

COURSE DESCRIPTION

The course will cover topics regarding the software development other than programming, including testing, verification, and validation for constructing robust code. The emphasis is on modern technology for developing reliable software at reasonable cost.

PREREQUISITES

Students must have the knowledge on basic programming and object-oriented concepts.

COURSE OBJECTIVES

- To understand what Software Engineering is and why it is important.
- To understand various software development process models and to select the appropriate model for a particular project.
- To introduce the art of eliciting user requirements and analysis.
- To introduce software design strategies and development methodologies.
- To understand the software testing process and tools.
- To understand the process of software Maintenance.
- To know how to manage people, process and problems during software development project.

COURSE CONTENTS

UNIT-I — 08 Hours

Introduction to Software Engineering:

Introduction: FAQ's about software engineering, IEEE/ ACM code of software engineering ethics, Process activities; Requirements gathering and analysis: Software Requirements Specification (SRS), Functional and Non-Functional requirements, User requirements, System requirements, Interface specification, Characteristics and components of SRS, Structure of SRS (IEEE format).

Case study: Develop SRS (IEEE format) for any real-world application.

UNIT-II	08 Hours

Software Development Process Models:
Traditional Process Models: The Waterfall model, The Evolutionary model, The Incremental implementation, Prototyping, Spiral model, Software reuse; Non-Traditional Process Models: Rapid Application Development (RAD), Agile Development Process, Extreme Programming, Introduction to DevOps, DevOps V/s Agile.
Case study: Identify the suitable development model for any real-world problem.

UNIT-III	08 Hours

System Design and Development:
Architectural Design: Architectural design decisions, Architectural patterns; Interaction Modeling: Use case models, Sequence diagrams; Structural Modeling: Class diagrams; Behavioral Modeling: State diagrams; Functional Modeling: Data flow diagrams; Development: Selecting a language, Coding guidelines, Code documentation.
Case study: Design a real-world application using Design Methodologies.

UNIT-IV	08 Hours

Software Testing and Maintenance:
Software Testing: Testing process, Design of test cases, Functional Testing: Boundary value analysis, Equivalence class testing, Path testing, Unit testing, Integration and system testing, Debugging, Alpha & beta testing, testing tools & standards; Software Maintenance: Maintenance process, Software reengineering, Configuration management.
Case study: Develop Test Suite for any real-world application and demonstrate using any Software Testing Automation Tools.

UNIT-V	08 Hours

Software Quality and Management:
Quality Management: Process and product quality, quality assurance and standards, Quality planning and control; Project Management: Management Activities, Project Planning, Project Scheduling, Risk Management.
Case study: Realize project management activities using emerging Project Management tools.

TEXT BOOKS

1. Software Engineering: A Practitioner's Approach, R. S. Pressman, McGraw Hill, 7th Edition, 2010.
2. Zero Defect Software, G.G.Schulmeyer, McGraw-Hill,1992.

3. Ian Somerville—Software Engineering, Pearson 9th Edition,2016.

REFERENCE BOOKS

1. Software Engineering, Ian Summerville,10thEdition, 2015, Pearson Education Ltd, ISBN: 9780133943030.
2. An Integrated Approach to Software Engineering, Pankaj Jalote,3rdEdition,2013, Narosa Publishing House, ISBN: 81-7319-702-4.
3. DevOps for Developers, Michael Huttermann, 2012, Apress, ISBN:978-1-4302-4569-8.

TEACHING METHODS

- Lecture using presentations.
- Case studies.

ASSESSMENT METHODS

Parameter	Marks
Three Internals (MSEs)	30
Rubrics for evaluation of Case Study Presentation (LA-1)	10
Rubrics for evaluation of Case Study Report (LA-2)	10
Total	**50**
Final Examination will be conducted for100marks (SEE)	

COURSE OUTCOMES

Sl.No.	COURSEOUTCOMES	BL
CO1	Understand and apply relevant software engineering principles to gather and analyse software requirements for any application.	2
CO2	Identify suitable process model for designing good software.	2
CO3	Analyse various techniques and identify suitable methodology for designing any software to meet the requirements of an application.	3
CO4	Develop test suits applying appropriate software testing strategies.	3
CO5	Realize the activities involved in software quality and management.	2

CO-PO MAPPING

	PROGRAMOUTCOMES												PSO		
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO1	2	3		2	2			3	2	3			3	2	3
CO2	2	3		2	2				2	2		3	2	3	
CO3	2	3	3	3	3	2			3	3			2	3	
CO4	2	3	3	3	3	2			3	2	2		2	3	
CO5	2	3			3	3		2	3	2	3	2	3	3	

3: Strong, 2: Medium, 1: Weak ** H: Highly related S: Supportive

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Department of Artificial Intelligence and Machine Learning

Course Content for

IV – Semester

2021 Scheme

Department of Artificial Intelligence & Machine Learning

Department: *Artificial Intelligence and Machine Learning*	***Course Type: Programme Core***
Course Title: Introduction to Machine Learning	***Course Code: 21AI43***
L-T-P 3-0-0	***Credits: 3***
Total Contact Hours:40	***Duration of SEE: 3 Hours***
SEE Marks: 50	***CIE Marks: 50***

COURSE DESCRIPTION

This course focuses on the theory of learning machines, which are important techniques underlying data mining and many AI applications. The topics include concepts of Machine Learning, types, supervised learning and unsupervised learning

PREREQUISITES

Probability, Statistics, Data structures

COURSE OBJECTIVES

- To introduce the basic concepts and techniques of Machine Learning
- To be familiar with a set of well-known supervised and unsupervised learning algorithms
- To employ machine learning techniques to solve problems

COURSE CONTENTS

UNIT-I 06 Hours

Introduction: Machine learning, Types of machine learning, Machine learning process, Supervised learning, Examples of machine learning applications, **Machine learning preliminaries:** Weight space, curse of dimensionality, Testing machine learning algorithms: Overfitting, training, testing, and validation sets, confusion matrix, accuracy metrics, ROC curve, Unbalanced datasets, Measurement precision, **Basic Statistics**: Averages, variance, covariance, Gaussian, Bias, Variance tradeoff

UNIT-II 08Hours

Neurons, Neural Networks: The brain and the neuron, Neural networks, The Perceptron, Training a perceptron, Learning Boolean functions, Linear Separability, **Multilayer Perceptron** : The Multi-layer Perceptron Algorithm, Initializing the Weights , Different Output Activation Functions, Backpropagation algorithm, Sequential and Batch

UNIT-III 08Hours

Bayesian Learning: Introduction, Classification, Losses and Risks, Discriminant Functions, Utility Theory, Association Rules, Bayes Optimal Classifier, Naïve Bayes Classifier, Bayesian Belief Networks. **Nearest neighbor methods**: k-nearest neighbor learning, Distance–weighted Nearest neighbor algorithm , Examples

UNIT-IV 10 Hours

Decision trees: Learning with trees, Using decision trees, Univariate Trees, Classification Trees, Regression Trees, Pruning, Rule Extraction from Trees, Learning Rules from Data, Multivariate Trees, ID3, Examples **Support Vector Machines**: Optimal Separation, Kernels, SVM Algorithm, Multiclass Classification, SVM Regression

UNIT-V **08Hours**

Unsupervised learning-Clustering: Introduction, Mixture Densities, *k*-Means Clustering, Expectation-Maximization Algorithm, Mixtures of Latent Variable Models, Supervised Learning after Clustering, Hierarchical Clustering, Choosing the Number of Clusters

TEXT BOOKS

1. Stephan Marsland, Machine Learning, An algorithmic Perspective, CRC Press Second Edition, 2015.
2. Ethem Alpaydin, Introduction to Machine Learning, 2ndEd., PHI Learning Pvt.Ltd.,2013.

REFERENCE BOOKS

1. Tom M. Mitchell, Machine Learning, McGraw-Hill Education (INDIAN EDITION), 2013
2. T. Hastie, R. Tibshirani, J. H. Friedman, The Elements of Statistical Learning, Springer, First Edition, 2001.
3. K. Murphy, Machine Learning: A Probabilistic Perspective, MIT Press, 2012.
4. Wes McKinney, Python for Data Analysis, O'Reilly Media, Inc., First Edition,2013.
5. Ian H. Witten, Eibe Frank, Mark A. Hall, Data Mining Practical Machine Learning Tools and Techniques, Morgan Kaufmann, Third Edition,2011

TEACHING METHODS

- Black board and chalk
- Power Point Presentations
- Problem Solving Assignments

ASSESSMENT METHODS

Parameter	**Marks**
Midterm Test	30
Practical Assignments	20
Total	**50**
Final Examwillbeconductedfor100marks (SEE)	

COURSE OUTCOMES

Sl. No.	**COURSEOUTCOMES**	**BL**
CO1	Describe the concepts related to machine learning	L2
CO2	Recognize the characteristics of machine learning techniques that are useful to Solve real-world problems	L2

CO3	Implement and apply supervised machine learning algorithms	L3
CO4	Implement and apply Unsupervised machine learning algorithms	L3
CO5	Select appropriate algorithms for solving a chosen real-world problem	L5

CO-PO MAPPING

	PROGRAMOUTCOMES												PSO		
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO1	3	2	2										1	2	
CO2	3	2	2									2	1	2	
CO3	3	2	2	2	2					3	2	2	1	2	
CO4	3	2	2	2	2					2	2	2	1	2	
CO5	3	2	2	2	2					2	2	2	1	2	

Department of AI and ML

Department: *Artificial Intelligence and Machine Learning*	***Course Type:***
Course Title**: **PATTERN RECOGNITION FOR AI	***Course Code: 21AIE442***
L-T-P :2-0-1	***Credits: 2***
Total Contact Hours: 40	***Duration of SEE: 3Hours***
SEE Marks: 100	***CIE Marks: 50***

COURSE DESCRIPTION

The primary objective of this course is to equip students with mathematical and statistical techniques used in pattern recognition and enable students to develop machine learning algorithms for real life problems

PREREQUISITES

Basic knowledge of Introduction to Artificial Intelligence

COURSE OBJECTIVES

- Understand what a pattern is and how to make pattern recognition and machine learning algorithms and how they can be used.
- Understand how to extract features, evaluate features, and connect research in the field of pattern recognition.
- Understand and use both supervised and unsupervised classification methods to build a PR system that works with real-world data.
- Make use of pattern-recognition techniques to solve real-world problems, such as finding and recognizing objects in the real world.
- To make simple pattern classifiers, combination classifiers, and structural pattern recognizers.

COURSE CONTENTS

UNIT–I 08 Hours

Introduction to Pattern Recognition- Tree Classifiers Getting our feet wet with real classifiers- Decision Trees: CART, C4.5, ID3- Random Forests

UNIT–II 08 Hours

Bayesian Decision Theory Grounding our inquiry- Linear Discriminants Discriminative Classifiers: The Decision Boundary, Separability, Perceptrons, Support Vector Machines.

Parametric Techniques Generative Methods grounded in Bayesian Decision Theory, Maximum Likelihood Estimation- Bayesian Parameter Estimation.

UNIT–III **08 Hours**

Non-Parametric Techniques- Kernel Density Estimators- Nearest Neighbor Methods - Unsupervised Methods Exploring the Data for Latent Structure - Component Analysis and Dimension Reduction

UNIT–IV **08 Hours**

The Curse of Dimensionality, Principal Component Analysis, Fisher Linear Discriminant, Locally Linear Embedding

UNIT–V **08 Hours**

Clustering, K-Means. Expectation Maximization, Mean Shift, Classifier Ensembles, Bagging, Boosting / AdaBoost.

TEXT BOOKS

1. Duda, Hart and Stork, Pattern Classification, Second Edition, Wiley,2001.

REFERENCE BOOKS

1.T. M. Mitchell, Machine learning, McGraw-Hill, NewYork,1997.
2.S. Theodoridis, K. Koutroumbas, Pattern Recognition, Academic Press, 1999

TEACHING METHODS

- Lecture using Blackboard and chalk
- Presentations
- Programming Assignments
- Course Project

ASSESSMENT METHODS

Parameter Marks

Three internals (Average of best of two)	30
Programming Assignments	10
Rubrics for the evaluation of Programming Assignments	10
	Total 50
Final Exam will be conducted for 100 marks (SEE)	

COURSE OUTCOMES

Sl. No.	COURSEOUTCOMES	BL
CO1	Understand the concept of a pattern and the basic approach to the development of pattern recognition and machine intelligence algorithms and applications of PR system	3
CO2	Understand the basic methods of feature extraction, feature evaluation, analyse and relate research in the pattern recognition area	4
CO3	Understand and apply both supervised and unsupervised classification methods to develop PR system in real-world data.	3
CO4	Apply pattern recognition techniques to real-world problems such as object detection and recognition.	3
CO5	To implement simple pattern classifiers, classifier combinations, and structural pattern recognizers.	3

CO-PO MAPPING

	PROGRAMOUTCOMES												PSO		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3											3		
CO2	3	2												2	
CO3	3	3	3		3			1	2	2	2	1			3
CO4	1	3	3	2	2				3			2			3
CO5	1	3	3		3			2	2	2	2			2	

Department of Artificial Intelligence & Machine Learning

Department: *Artificial Intelligence and Machine Learning*	***Course Type:*** *Programme Core*
Course Title: Design and Analysis of Algorithms	***Course Code:*** 21AI41
L-T-P: 3-0-0	***Credits: 3***
Total Contact Hours: 39Hours	***Duration of SEE:*** *3 Hours*
SEE Marks: 50	***CIE Marks: 50***

COURSE DESCRIPTION

This course introduces basic methods for the design and analysis of efficient algorithms emphasizing methods which are useful in practice. The computational problems for sorting, searching, Divide and Conquer, dynamic programming and greedy algorithms, graph algorithms string matching, Backtracking, Branch and Bound, NP completeness are discussed.

PREREQUISITES

- Students should have knowledge of C or C++ language
- Students should know data structures
- Students should know the usage of summation formulae and recurrences in mathematics

COURSE OBJECTIVES

- To understand the basic concepts and notations used in the design and analysis of algorithms.
- To provide theoretical background in the design and analysis of major classes of algorithms.
- To solve problems using appropriate algorithms.
- To analyze and compare the performance of algorithms.

COURSE CONTENTS

UNIT-I 07 Hours

Introduction: What Is an Algorithm? Fundamentals of Algorithmic Problem Solving, Fundamentals of the Analysis of Algorithm Efficiency: The Analysis Framework, Asymptotic Notations and Basic Efficiency Classes, Mathematical Analysis of Non recursive Algorithms, Mathematical Analysis of Recursive Algorithms, Example: Computing the nth Fibonacci number.

UNIT-II **08Hours**

Brute Force and Exhaustive Search: Selection Sort and Bubble Sort, Sequential Search and Brute-Force String Matching, Depth-First Search and Breadth-First Search, Exhaustive Search.
Decrease-and-Conquer: Insertion Sort, Topological Sorting, Decrease-by-a-Constant-Factor Algorithms, Binary Search.

UNIT-III **08 Hours**

Divide and Conquer: Merge sort, Quicksort Transform-and-Conquer: Balanced Search Trees, AVL trees,2-3 trees, Heaps and Heap sort, Input enhancement in string matching, Horspools algorithm, Hashing.

UNIT-IV **08 Hours**

Dynamic Programming: The Knapsack Problem and Memory Functions, Warshall's and Floyd's Algorithms, Greedy technique**:** Prim's Algorithm, Kruskal's Algorithm, Dijkstra's Algorithm, Huffman Trees and Codes.

UNIT-V **08 Hours**

Iterative Improvement: The Maximum-Flow Problem, Limitations of Algorithm Power**:** P,NP, and NP-Complete Problems, Coping with the Limitations of Algorithm Power**:** Backtracking - n-Queens Problem, Subset-Sum Problem ,Branch-and-Bound -Knapsack Problem

TEXT BOOKS

1. Anany Levitin, "Introduction to the Design & Analysis of Algorithms", 3rd Edition, 2011, Pearson education.
2. Horowitz E., Sartaj Sahni S., Rajasekaran S," Fundamentals of Computer Algorithms", 2001, Galgotia Publications

REFERENCE BOOKS

1. H., Cormen, Charles E. Leiserson, Ronal L. Rivest, Clifford Stein Thomas," Introduction to Algorithms", 2nd Edition, 2006, PHI.

TEACHING METHODS

- Lectures interspersed with discussion
- Power Point Presentations
- Problem Based Teaching
- NPTEL Course

ASSESSMENT METHODS

Midterm Test	**30 Marks**
Problem based Assignment	**10 Marks**
GATE based Tutorial Test	**10 Marks**
Total	**50 Marks**

COURSE OUTCOMES

Sl. No.	COURSEOUTCOMES	BL
CO1	Describe the concepts, methods and notations used in the design and analysis of algorithms	L3
CO2	Design algorithms using brute force, decrease and conquer, divide and conquer approach, dynamic programming, greedy technique and Transform-and-Conquer methods	L3
CO3	Apply the various problem-solving methodologies to get solution to common engineering problems	L4
CO4	Evaluate the performance of various algorithms.	L4
CO5	Solve the problems based on Iterative Improvement method, the Maximum-Flow Problem, Use the space state tree to solve Queens, sum subset problems and knapsack problem.	L4

CO-PO MAPPING

	PROGRAMOUTCOMES												PSO		
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO1	3	2	2						1				2		
CO2	3	2	2						1				2	3	
CO3	3	2	2						1				2	3	
CO4	3	2	2						1				2	3	
CO5	3	2	2						1				2	3	

Department of Artificial Intelligence and Machine Learning

Department: *Artificial Intelligence and Machine Learning*	***Course Type:*** *Programme Core*
Course Title*: BIG DATA TECHNOLOGIES*	***Course Code: 21AIE444***
L-T-P :2-0-0	***Credits: 2***
Total Contact Hours:	***Duration of SEE: 3 Hours***
SEE Marks*: 50*	***CIE Marks: 50***

COURSEDESCRIPTION

This course provides knowledge on definitions of big data and big data analytics, big data frameworks like Hadoop and SPARK, messaging paradigm such as Kafka and data storage mechanisms for big data.

PREREQUISITES

- Experience of one Programming language like Python/Java/Scala required.
- SQL and Data knowledge preferred

COURSEOBJECTIVES

1. Understand the data and categories of the data.
2. Study the big data framework Hadoop and SPARK
3. Study messaging paradigms such as Kafka.
4. Analyze the difference between Hadoop and SPARK environments
5. Study the NOSQL databases.

COURSECONTENTS

UNIT-I — 08 Hours

Introduction to Big Data: Characteristics of Data, Evolution of Big Data, Definition, Challenges, What is Big Data Analytics, Classification of Analytics, Need of Big Data Analytics, CAP and Base Theorem, Introduction to No SQL.

UNIT-II — 08 Hours

MapReduce: Distributed File Systems, MapReduce, Algorithms Using MapReduce, Extensions to MapReduce. MapReduce Basics: Functional Programming Roots, Mappers and Reducers, The Execution Framework, Partitioners and Combiners, Hadoop Cluster Architecture, Hadoop Example: Word Count.

UNIT-III — 08Hours

Introduction to Kafka: Kafka, Publish/Subscribe Messaging, Messages and Batches, Producers and Consumers, Brokers and Clusters, Multiple Clusters, Why Kafka, Multiple Producers, Multiple Consumers, The Data Ecosystem, Use Cases, LinkedIn's Problem, The Birth of Kafka.
Kafka Producers: Writing Messages to Kafka, Kafka Consumers: Reading Data from Kafka.

UNIT-IV **08Hours**

Introduction to Apache Spark: The Genesis of Spark, What Is Apache Spark, Apache Spark's Structured APIs, Structuring Spark, The Data Frame API, Spark's Basic Data Types, Schemas and Creating Data Frames , Typed Objects, Untyped Objects, Creating Datasets, Dataset Operations , Spark SQL and Data Frames: Introduction to Built-in Data Sources, Using Spark SQL in Spark Applications, Basic Query Examples, SQL Tables and Views, Creating SQL Databases and Tables, Reading Tables into Data Frames, Data Sources for Data Frames and SQL Tables.

UNIT-V **08Hours**

Introduction to Hive: what is Hive, Hive architecture, Data types, File Formats, Hive Query Language, RCfile implementation, SerDe, User Defined Functions.

TEXT BOOKS

1. Seema Acharya and Subhashini C, Big Data and Analytics, Wiley India, 2015.
2. Jules S. Damji, Brooke Wenig, Tathagata Das and Denny Lee, Learning Spark,2nd Edition, O'Reilly, 2015.
3. Neha Narkhede, Gwen Shapira & Todd Palino, Kafka The Definitive Guide, O'Reilly,2017.
4. Jure Leskovec, Anand Rajaraman and Jeff Ullman, Mining of Massive Datasets, 3rd edition, Cambridge University Press.
5. Jimmy Lin and Chris Dyer, Data-Intensive Text Processing with MapReduce, University of Maryland, College Park,2010.

REFERENCE BOOKS

1. Muhammad Asif Abbasi, Learning Apache Spark 2, Packt Publishing, 2017.
2. Cay S. Horstmann, Scala for the Impatient 2nd Edition.
3. Andy Konwinski, Holden Karau, Matei Zaharia, Patrick Wendell, Learning Spark Lightning-Fast Big Data Analysis, O'Reilly, 2015.
4. Tom White, Hadoop: The Definitive Guide, O'Reilly, 2015.

TEACHING METHODS

Black board teaching.
Lectures using presentations.
Assignments

ASSESSMENT METHODS

Parameters	Marks
Midterm Test (Avg. of 2 Tests)	30
Case Study	10
Programming Assignment	10
Total	**50**
Final Exam will be conducted for 100 marks (SEE)	

COURSE OUTCOMES

Sl. No.	COURSE OUTCOMES	BL
CO1	Understand the big data, big data analytics, big data processing requirements.	L1
CO2	Compare the Hadoop and SPARK framework for big data.	L2
CO3	Learn, Apply and Analyze how Apache Kafka works in comparison with other publish/subscribe messaging queues	L3
CO4	Apply the Knowledge of RDDs, Data frames to develop SPARK applications.	L3
CO5	Analyze the big data framework used in industry	L4

CO-PO MAPPING

	PROGRAM OUTCOMES												PSO		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	3										3		
CO2				3	3								3		
CO3	3	3	3												
CO4	3	3	3												
CO5				3	3								3		

Department of Artificial Intelligence and Machine Learning

Department: *Artificial Intelligence and Machine Learning*	***Course Type: Professional Elective Course***
Course Title*: Biology for Engineers*	***Course Code:*** *21AI45*
L-T-P 3-0-0	***Credits: 3***
Total Contact Hours: 39	***Duration of SEE:*** 3 hrs
SEE Marks: 100	***CIE Marks: 50***

COURSE DESCRIPTION

This course provides an overall concept of basic biology, biochemistry, microbiology and how to predict a disease using AI and machine learning algorithm.

PREREQUISITES

Students should have knowledge of the basics of AI.

COURSE OBJECTIVES

The main objective of this course is

1. To introduce students to basic cell level biology.
2. To introduce students to biochemistry and gene technology.
3. To introduce students some concepts of microbiology and the use of microscopy.
4. To introduce students Computer Assisted diagnosis by using AI, disease prediction

COURSE CONTENTS

UNIT-I **08 Hours**

Introduction to Biology: Cellular Level

Introduction to cells, basic properties of cell, Prokaryotic cells, Eukaryotic cells, cell cycles and cell division, M-Phase, Meiosis, Cell differentiation.

UNIT-II **08 Hours**

Biochemistry: Chemical composition of living forms, Carbohydrates, Amino acids and Proteins, Nucleic acids, lipids, Enzymes, Importance of enzymes, brief introduction to metabolism, metabolic basis for living- Anabolic and Catabolic Pathways, photosynthesis, glycolysis etc.

UNIT-III **08Hours**

Genetics: Mendelian law, Mende's Law of inheritance, Gene interactions, multiple alleles, chromosomal theory of inheritance, linkage, Chromosome mapping, genetic disorder, replication of DNA, Types of RNA, genetic code, transcription, translation, regulation of Gene expression.

UNIT-IV **08 Hours**

Microbiology: Microorganisms, growth kinetics, sterilization, microscopy, application of microbiology, immunology and immunity, pathology, histopathology, cytopathology, cancer biology, Cancer in multiple organs, Stem cells.

Radiology: What are X-Rays? How are X-Rays used to produce images, Chest X-Rays, abdominal X-Rays, CT scans: CT head, CT chest, CT cervical spine, MRI head, MRI spine, MRI Knee and other joints, Ultra-sound scan.

UNIT-V **08 Hours**

Introduction to AI and Machine Learning: Supervised and unsupervised learning, regression and classification task, Introduction to Deep Learning, SVM and Random Forest, Genetic algorithm.

Application of AI in Biology: Computer Assisted diagnosis of cancer from histopathology images, disease prediction from CT images and Chest X-Ray images, disease prediction from time series data, Disease detection from Gene data etc.

TEXT BOOKS

1. "Biology for Engineers: as per AICTE curriculum", Wiley Editorial (2018)
2. Lawrence E Hunter, "Artificial Intelligence and Molecular Biology", MIT Press.

REFERENCE BOOKS

1. David Baltimore and H. Lodish (2021) "Molecular Cell Biology", 9th edition, Macmillan Learning.

TEACHING METHODS

- Power Point presentation

ASSESSMENT METHODS

Continuous internal Evaluation (CIE) for 50 Marks

- Assignment/Project based on the practical application for 20 marks.
- Three mid semester examinations will be conducted each for 30 marks and the average of all the 3 will be taken.

Semester End Examination (SEE) for 50 Marks

Final examination, of 100 Marks will be conducted and will be evaluated for 50 marks.

COURSE OUTCOMES

Sl. No	COURSE OUTCOMES	BL
CO1	To introduce students to cellular level biology	L2
CO2	To introduce students to brief idea of Biochemistry and metabolism	L2
CO3	To introduce students to genetics	L2
CO4	To introduce students to microbiology and radiology	L3
CO5	To introduce some AI concepts, Deep Learning and other machine learning algorithms and using these algorithms to predict disease	L3

CO-PO MAPPING

	PROGRAM OUTCOMES												PSO		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1						2							2		
CO2	2					1							2		
CO3	1					2							2	2	
CO4	2				2	2							2	1	
CO5	3	3	2	1	3	2							2	3	

Department of Artificial Intelligence and Machine Learning

Department: *Artificial Intelligence and Machine Learning*	***Course Type: Programme Core***
Course Title: Database Management Systems	***Course Code: 21AI***
L-T-P: 3-0-0	***Credits: 03***
Total Contact Hours: 40 Hours	***Duration of SEE:*** *3 Hours*
SEE Marks*: 50*	***CIE Marks:*** *50*

COURSE DESCRIPTION

This course provides an understanding of Database management systems. The course also provides the knowledge of ER-diagram design, Relational Algebra and RDBMS, SQL for querying the database and Normalization for the good database design.

REREQUISITE

1. Students should know basics of Discrete Mathematics.
2. Students should know basic programming concepts.

COURSE OBJECTIVES

1. To understand the fundamentals of Relational database management systems.
2. To design database using ER-modeling, Normalization and querying the database using SQL.
3. To understand the fundamentals of transactions, locking mechanisms, database recovery.

COURSE CONTENTS

UNIT - I 08 Hour

Database and Database Users: Introduction, Example, Characteristics of Database Approach, Actors on the Scene, Workers Behind the Scene, Advantages of Using the DBMS Approach, A Brief History of Database Application. Database System Concepts and Architecture: Data Models, schemas, and Instances: Three-schema architecture and Data Independence, Database Languages and Interfaces, The Database System Environment, Centralized and Client/Server Architecture for DBMS, Classification of Database Management systems. Data Modeling Using the Entity-Relationship (ER) Model: Using High - Level Conceptual Data Models for Database Design, An Example Database Application, Entity Types, Entity Sets, Attributes, and Keys, Relationship Types, Relationship Sets, Roles, and Structural Constraints, Weak Entity Types, ER Diagrams, Naming Conventions, and Design Issues.

UNIT - II 08 Hour

The Relational Data Model and Relational Database Constraints: Relational Model Concepts, Relational Model Constraints and Relational Database Schemas, Update Operations, Transactions and Dealing with Constraint Violations. The Relational Algebra and Relational Calculus: Unary Relational Operations: SELECT and PROJECT, Relational Algebra Operations from Set Theory, Binary Relational Operations: JOIN and DIVISION, Additional Relational Operations; Examples of Queries in Relational Algebra.

SQL: Schema Definition, Constraints, Queries, and Views: SQL Data Definition and Data Types, Specifying Constraints in SQL, Schema Change Statements in SQL, Basic Queries in SQL, More Complex SQL Queries, Insert, Delete and Update Statements in SQL, Specifying Constraints as Assertion and Trigger, Views (Virtual Tables) in SQL.

UNIT - III — 08 Hour

Introduction to SQL Programming Techniques: Database Programming: Issues and Techniques, Embedded SQL, Dynamic SQL, Database Stored Procedures and SQL / PSM. **Database Design Theory and Methodology:** Informal Design Guidelines for Relation Schemas, Functional Dependencies, Normal Forms Based on Primary Keys, General Definitions of Second and Third Normal Forms, Boyce-Codd Normal Form.

UNIT - IV — 08 Hour

Transaction Processing Concepts: Introduction to Transaction Processing, Transaction and System Concepts, Desirable Properties of Transactions, Characterizing Schedules Based on Recoverability, Characterizing Schedules Based on Serializability, Transaction Support in SQL. **Concurrency Control Techniques:** Two-Phase Locking Techniques for Concurrency Control, Concurrency Control Based on Timestamp Ordering. **Database Recovery Techniques:** The ARIES Recovery Algorithm. Introduction to NO SQL.

UNIT - V — 08 Hour

Application Design and Development: User Interfaces and Tools, Web Interfaces to Databases, Web Fundamentals, Servlets and JSP, Building Large Web Applications, Triggers, Authorization in SQL, Application Security.

TEXT BOOKS

1. Elmasri and Navathe: Fundamentals of Database Systems, 7th Edition, Addison-Wesley, 2007
2.Silberschatz, Korth and Sudharshan: Data base System Concepts, 5th Edition, Mc-GrawHill, 2006.
3.Raghu Ramakrishnan and Johannes Gehrke: Database Management Systems, 3rd Edition, McGraw-Hill,2003.

REFERENCE BOOKS

1.C.J. Date, A. Kannan, S. Swamynatham: A Introduction to Database Systems, 8th Edition, Pearson education, 2006.

TEACHING METHODS

1. Blackboard teaching
2. PowerPoint presentations (if needed)
3. Programming Assignments using SQL

ASSESSMENT METHODS

Three Internals (Average of best of two) 30
Demonstration 10
Assignment 10

COURSE OUTCOMES

Sl. No.	COURSE OUTCOMES	BL
CO1	Have a broad understanding of database concepts, Understand the essentials o DBMS and its architectures, Design and Model a real time Scenario using EF Modeling.	L1
CO2	Convert entity relationship and convert entity relationship diagrams into RDBMS Design Relational Algebra and SQL queries to analyze on the respective data.	L3
CO3	Be able to design SQL commands to create tables and indexes, insert/ update/ delet data, and query data in a relational DBMS. Demonstrate an understanding of normalization theory and apply such knowledge to the normalization of a database.	L3
CO4	Illustrate the concepts of Transaction Management and Database Recovery Techniques.	L2
CO5	Design and Develop database application using Java Servlets an MYSQL(Web/Windows).	L4

CO-PO MAPPING

	PROGRAM OUTCOMES												PSO		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	3	2									3	2	
CO2		3	2	3	3								3	3	
CO3		3	3	3									3	2	
CO4	3	2	2										3	2	
CO5		2	3	2									2	2	

Department of Artificial Intelligence and Machine Learning

Department: *Artificial Intelligence and Machine Learning*	***Course Type:***
Course Title**: **Application Development using C++	***Course Code: 21AII473***
L-T-P :	***Credits: 2***
Total Contact Hours:	***Duration of SEE:***
SEE Marks:	***CIE Marks:***

COURSE DESCRIPTION

This course provides an understanding of OOP Programming paradigm. The course also provides the knowledge of application development for real-world problems using C++.

PREREQUISITES

Basic knowledge on Problem solving using programming in C.

COURSE OBJECTIVES

1. To understand the difference between Procedure Oriented and OO Programming.
2. To understand OOP features of C++.
3. To develop applications in C++.

COURSE CONTENTS

UNIT – I : An Overview of C++ 08 Hours

Object Oriented Programming Principles, The origins of C++, C++ Fundamentals- Introducing C++ Classes, Procedure Oriented Programming vs Object Oriented Programming, Class Diagram.

Classes and Objects : C++ Classes and Structures, Class and object declarations ,Friend Functions, Friend Classes, Inline Functions, Static Class Members, The Scope Resolution Operator, Functions and Objects.

Arrays, Pointers, References, and the Dynamic Allocation Operators: Arrays of Objects, this pointer, References, C++'s Dynamic Allocation operators. Best practices and coding standards.

UNIT – II: Applying Polymorphism 08 Hours

Function Overloading and Default Arguments: Function Overloading, Constructor types, Overloading Constructor Functions, Default Function Arguments, Function Overloading and Ambiguity

Operator Overloading: Creating a Member Operator Function, Operator Overloading Using a Friend Function, Namespaces.

UNIT – III: Inheritance in C++ 08 Hours

Inheritance: Base-Class Access Control, Inheritance and Protected Members, Inheriting Multiple Base Classes, Constructors, Destructors and Inheritance, Granting Access, Virtual Base Classes
Virtual Functions and Polymorphism: Virtual Functions, The Virtual Attribute Is Inherited, Virtual Functions Are Hierarchical, Pure Virtual Functions, Using Virtual Functions, Early vs Late Binding.

UNIT – IV: Templates, Exceptional Handling and STL 08 Hours

Templates: Generic Functions, Applying Generic Functions, Generic Classes
Exception Handling: Exception Handling Fundamentals, Applying Exception Handling.
Introduction to Standard Template Libraries: Introduction to STL Components, Containers, Algorithms, Iterators.

UNIT – V: C++ File I/O 08 Hours

C++ File I/O: <fstream> and File Classes, Opening and Closing a File, Reading and Writing Text Files, Unformatted and Binary I/O, Detecting EOF, Random Access.
Smart Pointers: auto pointer, RTTI.

TEXT BOOKS

1. The Complete Reference C++, Herbert Schildt, 4th Edition, TMH, 2005.

REFERENCE BOOKS

1. C++ Primer, Stanley B. Lippman, Josee Lajoie, Barbara E. Moo,4th Edition, AddisonWesley,2005.
2. Object-Oriented Programming with C++, Sourav Sahay, Oxford University Press, 2006.

TEACHING METHODS

- Lecture using Black board and chalk
- Presentations
- Programming Assignments
- Course Project

ASSESSMENT METHODS

Parameter	Marks
Three internals (Average of best of two)	30
Programming Assignments	10
Rubrics for the evaluation of Programming Assignments	10
	Total 50

Final Exam will be conducted for 100 marks (SEE)

COURSE OUTCOMES

Sl. No.	COURSE OUTCOMES	BL
CO1	Design classes for the given application scenarios and apply the concepts of classes and objects, friend functions, friend classes, static class members and this pointer in implementation of solutions to problems.	3
CO2	Analyze and apply the concepts of function overloading, default arguments, constructors and operator overloading in designing and implementing solutions to given problems.	4
CO3	Apply the principle of code reusability using Inheritance, use the concept of virtual base classes to prevent the possible ambiguity in multiple inheritance and analyze the benefit of dynamic binding using virtual functions and inheritance.	3
CO4	Design and use template classes that take generic parameters to support code reusability principle in problem solving, understand and apply the concept of exception handling to prevent run-time abnormal program termination error in applications	3
CO5	Create text and binary files and use them in the applications to handle voluminous data.	3

CO-PO MAPPING

	PROGRAM OUTCOMES												PSO		
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO1	2	3											3		
CO2	2	2												2	
CO3	3	3	3		3			1	2	2	2	1			3
CO4	2	2	2	2	2				3			2			3
CO5	2	2			3			2	2	2	2			2	

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Department of Artificial Intelligence and Machine Learning

Department: *Artificial Intelligence and Machine Learning*	***Course Type: PCC***
Course Title*: APPLICATION DEVELOPMENT USING JAVA*	***Course Code: 21AII471***
L-T-P: 2-0-0	***Credits: 2***
Total Contact Hours: 26	***Duration of SEE: 3Hrs***
SEE Marks*: 50*	***CIE Marks: 50***

COURSE DESCRIPTION

This course provides the knowledge of Object-Oriented Application Development using Java programming language. It discusses the application of programming concepts like Classes, Objects, Interfaces, Inheritance, Exception Handling and the Java's Collection framework to solve real-world computing problems.

PREREQUISITES

- Student should have the prior knowledge of C

COURSE OBJECTIVES

- To understand and apply the basic Object-Oriented features of Java.
- To understand and use the concept of Packages and Interfaces
- To understand and apply the Principle of Inheritance.
- To understand and use Exception Handling and Wrapper classes in application development
- To appraise the use of Java Collection Framework.

COURSE CONTENTS

UNIT - I **06Hour**

An Overview of Java --Object-Oriented Programming, Two Paradigms, Abstraction, The Three OOP Principles, A First Simple Program, Entering the Program, Compiling the Program, A Closer Look at the First Sample Program

Introducing Classes: Class Fundamentals, Declaring Objects, A Closer Look at new, Assigning Object Reference Variables, Introducing Methods, Constructors, Parameterized Constructors, The this Keyword, Instance Variable Hiding, Garbage Collection, The finalize( ) Method..

UNIT - II **05 Hour**

A Closer Look at Methods and Classes: Overloading Methods, Overloading Constructors, Using Objects as Parameters, A Closer Look at Argument Passing, Returning Objects, Introducing Access Control, Understanding static, Introducing final, Arrays, Exploring the String Class,

Packages and Interfaces: Packages, Access Protection, Importing Packages, Interfaces, Defining an Interfaces, Default Interface Methods.

UNIT - III **05Hour**

Inheritance: Inheritance Basics, Using super, Creating a Multilevel Hierarchy, When Constructors Are

Executed, Method Overriding, Dynamic Method Dispatch, Why Overridden Methods? Using Abstract Classes, Using final with Inheritance.

UNIT - IV **05 Hour**

Exception Handling: Exception-Handling Fundamentals, Exception Types, Uncaught Exceptions, Using try and catch, multiple catch Clauses, Nested try Statements, throw, throws and finally.

Type Wrappers: Character, Boolean, Numeric type wrappers. Autoboxing: Autoboxing and Methods, Autoboxing / Unboxing occurs in expressions, Autoboxing/Unboxing Boolean and Character values, Autoboxing / Unboxing helps prevents errors.

UNIT - V **05 Hour**

The Collections Framework: Collections Overview, The Collection Interfaces: the collection interface, the List interface, the Set interface. The Collection Classes: The ArrayList Class, The LinkedList Class, The HashSet Class. Accessing a Collection via an Iterator -Using an Iterator, The For-Each Alternative to Iterators.

TEXT BOOKS

1. Herbert Schildt, —Java – The Complete Reference –, 9th Edition, 2014, Oracle Press.

REFERENCE BOOKS

1. Y. Daniel Liang, —Introduction to JAVA Programming, 6thEdition, 2007, Pearson Education,
2. Stephanie Bodoff et al, —The J2EE Tutorial, 2nd Edition, 2004, Pearson Education.
3. Head First Java, O'Reilly Publication, 2005.

TEACHING METHODS

- Black Board/Power Point Presentations
- Demonstration of Applications through IDE

ASSESSMENT METHODS

Parameter	Marks
Three Internals (Average of best of two)	30
Programming Assignment based Test	10
Rubrics for the evaluation of Programming Assignments	10
Total	**50**
Final Examination will be conducted for 100 marks (SEE)	

COURSE OUTCOMES

Sl. No.	COURSE OUTCOMES	BL
CO1	Apply the object-oriented principles like Encapsulation, Abstraction inheritance and polymorphism to solve the real-world problems	L3
CO2	Illustrate with examples the use of Interfaces and packages	L2
CO3	Apply code reusability in application development using Inheritance	L3
CO4	Demonstrate exception handling in Java	L4
CO5	Solve computing real-world problems using the Java's Collection framework.	L4

CO-PO MAPPING

	PROGRAM OUTCOMES												PSO		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3		3						1	1			3	2	
CO2	2		3						1	1			3	2	
CO3	2		3						1	1			3	2	
CO4	2		3						1	1			3	2	
CO5	2		3						1	1			3	2	

Department of Artificial Intelligence and Machine Learning

Department: *Artificial Intelligence and Machine Learning*	***Course Type: Professional Elective Course***
Course Title: Image Processing for AI	***Course Code:*** *21AIE443*
L-T-P 3-0-0	***Credits: 3***
Total Contact Hours: 39	***Duration of SEE:*** 3 hrs
SEE Marks: 100	***CIE Marks:*** 50

COURSE DESCRIPTION

This course provides an overall concept of basic conventional image processing techniques like image filtering, image compression, image segmentation, etc. Thereafter, Some Deep Learning models or machine learning models will also be utilized to accomplish image processing tasks.

PREREQUISITES

Students should have knowledge of the basics of AI and Machine Learning algorithms.

COURSE OBJECTIVES

The main objective of this course is

1. To introduce students to basic low-level image processing concepts, revising some concepts of AI, ML and Deep learning.
2. To introduce students to high-level image processing concepts.
3. Thereafter, to make the students understand how Deep Learning or other machine learning algorithms can also be utilized to accomplish those image processing tasks.
4. Students should do one project for image detection or image segmentation task by using AI (specifically machine learning or advanced Deep learning algo)

COURSE CONTENTS

UNIT-I 08 Hours

Introduction to Image Processing: Digital image, Image statistics and basic relationship among pixels, Convolution operation, Image enhancement and transformations in spatial domain by mask operations, Histogram Equalization, CLAHE.

Introduction to AI and Machine Learning: Supervised and unsupervised learning, Introduction to Deep Learning, activation function, loss function, performance metrics for image processing.

UNIT-II **08Hours**

Conventional Low-level Image Processing: Image Filtering and noise reduction in frequency domain, DFT, DCT, Wavelet Transform, Image compression, JPEG, Singular Value Decomposition (SVD) and its application in image processing, Digital Image Watermarking, Image restoration.

UNIT-III **08 Hours**

High-Level Image Processing: Edge detection: Laplacian operator, Gaussian Filter, LoG, Multi-scale LoG, Canny edge detection, Image segmentation: Image thresholding, Otsu's Thresholding, Region growing and region merging operation, Watershed Transformation, Active Contour Model, Morphology: Dilation, erosion, opening, closing etc., feature extraction by boundary processing, PCA and SIFT.

UNIT-IV **08 Hours**

Image Processing task using Deep Learning or Machine Learning:
Image detection by Random Forest, Ensemble models and Support Vector Machines (SVM), Quality metric performance: Accuracy, Recall, Precision, F1Score, AUC, Transfer Learning, Image detection by Convolutional Neural Network (CNN), some pretrained CNN models: Alex-Net, VGG-16, ResNet etc., Image segmentation task by Seg-Net, U-Net model.

UNIT-V **08 Hours**

Project Work: Students should come up with a particular project of image processing, performance improvement of Deep learning or other machine learning algo by pre-processing, data-augmentation, modifying architecture and loss function etc.

TEXT BOOKS

1. Rafael C. Gonzalez and Richard E Woods (2018), "Digital Image Processing", Pearson Publication (4th edition).
2. Mohamed Elgendy (2020), "Deep learning for vision systems", Manning Publications (O'Reilly)

REFERENCE BOOKS

1. Ian Goodfellow, Y. Bengio, A. Courville, (2018) "Deep Learning", MIT Press Book.
2. Christopher M. Bishop (2006) "Pattern Recognition and Machine Learning", Springer Publication.
3. Lots of research publications.

TEACHING METHODS

- Black Board teaching
- Power Point presentation
- Assigning projects into groups

ASSESSMENT METHODS

Continuous internal Evaluation (CIE) for 50 Marks

- Assignment/ Project based on the practical application for 20 marks.
- Three mid semester examinations will be conducted each for 30marks and the average of all the 3 will be taken.

Semester End Examination (SEE) for 50 Marks

Final examination, of 100 Marks will be conducted and will be evaluated for 50 marks.

COURSE OUTCOMES

Sl. No	COURSE OUTCOMES	BL
CO1	To introduce students to basic low-level image processing concepts	L3
CO2	To revisit some of the machine learning and Deep learning models and the fundamentals	L3
CO3	To introduce students to high-level image processing concepts.	L3
CO4	Apply Machine Learning and Deep Learning for image processing tasks	L3
CO5	Come out of implementing some projects of object detection by SVM / Random orest / CNN model	L3

CO-PO MAPPING

	PROGRAM OUTCOMES												PSO		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	1											2	1	
CO2	2	1	1		3								2	2	
CO3	2	3			2								2	1	

CO4	2	3	3	2	3	3							2	3	
CO5	2	3	3	1	3	3			3		3		2	3	

Department of Artificial Intelligence and Machine Learning

Department: *Artificial Intelligence and Machine Learning*	***Course Type:*** *Programme Core*
Course Title*: Applications with Machine Learning Lab*	***Course Code:***
L-T-P : *0-0-2*	***Credits:*** *01*
Total Contact Hours: *36 Hours*	***Duration of SEE:*** *3 Hours*
SEE Marks*: 50*	***CIE Marks: 50***

COURSE DESCRIPTION

This course provides an in-depth knowledge of applying Python Programming Language to various machine learning problems like prediction or classification.

PREREQUISITES

- Students should have knowledge of Basics of programming.
- Students should have knowledge of Probability Theory.

COURSE OBJECTIVES

The objective of the course is to familiarize students with working of some machine learning models

- Understanding Linear Regression and do forecast modeling by using linear regression.
- Understanding Bayesian learning and its application.
- Understanding Artificial Neural Network and its application in image detection
- Understanding Decision tree, KNN and K-Means Clustering algorithm and their working principles

LABORATORY EXERCISES

1. Feed the data into a linear regression model for weather forecasting from the following table-1.

Days	8:00 AM	12:00 PM	6:00 PM	11:00 PM	4:00 AM
Monday	33°C	39°C	36°C	34°C	30°C
Tuesday	34°C	38°C	37°C	35°C	32°C
Wednesday	33°C	27°C	29°C	28°C	27°C
Thursday	31°C	33°C	32°C	30°C	?

   Write a program in TensorFlow (python) in order to predict what should be the temperature on Thursday at 4:00 AM? Use linear regression method for the prediction and analyze the result.

2. Employ weather forecasting data from Kaggle site (Weather Dataset | Kaggle) and apply a regression technique in TensorFlow in order to do the forecasting.

3. Write a program to demonstrate the working of the decision tree based ID3 algorithm. Use an

appropriate data set for building the decision tree and apply this knowledge to classify a new sample.

4. Build an Artificial Neural Network by implementing the Back-propagation algorithm in TensorFlow and test the same with MNIST dataset in order to do letter recognition task. Train the network from scratch.
5. Write a program to implement the naïve Bayesian classifier for a sample training data set stored as a .CSV file. Compute the accuracy of the classifier, considering few test data sets.
6. Write a program to implement k-Nearest Neighbour algorithm to classify the iris data set. Print both correct and wrong predictions. Python (TensorFlow) ML library classes can be used for this problem.
7. Apply K-Means clustering algorithm to a set of data stored in a .CSV file. Do the same experiments with considering different seeds and compare those two results. Analyze the limitations of K-Means clustering algorithm.
8. Do the same experiment of 4, for EM algorithm. Compare which of the algorithm is better for that particular dataset.

REFERENCES

1. Davy Cielen et al. "Introducing Data Science: Big Data, Machine Learning, and More, Using Python Tools", Dreamtech Press.
2. Sujit Bhattacharya, Subhrajit Bhattacharya," Practical Handbook of Machine Learning", GKP Publishers.
3. python-machine-learning-book/references.md at master · rasbt/python-machine-learning-book · GitHub

TEACHING METHODS

- Black Board/Power Point Presentations
- Programming Assignments
- NPTEL

ASSESSMENT METHODS

Parameter	Marks
Experiment write up, Execution, Viva & Record writing	30
Lab Internal Test	20
Total	**50**
Final Exam will be conducted for 100 marks (SEE)	

COURSE OUTCOMES

At the end of the course student will be able

COs	Description	Bloom's Level
CO 1	To understand the basic intelligent agents in artificial intelligence	**L4**
CO 2	Understanding and analyzing various search algorithms.	**L4**

CO 3	Understanding and analyzing game playing algorithms and agents that reason logically.	**L4**
CO 4	Understanding and analyzing the knowledge base system using knowledge-based system	**L4**
CO 5	Ability to design a reasoning system for a given requirement	**L4**

CO-PO MAPPING

Mapping of Course outcomes (COs) to Program outcomes (POs*)& PSO **															
Course Outcomes mapping to Program Outcomes													**PSOs**		
POs / COs	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**PSO 1**	**PSO 2**	**PSO 3**
CO1	3	3	3	2									3	3	
CO2	3	3	3										3	3	
CO3	3	3	3	2									3	3	
CO4	3	3	3										3	3	
CO5	3	3	3			3							3	3	

Department of Artificial Intelligence and Machine Learning

Department: *Mathematics*	***Course Type: Basic Science***
Course Title*: Probability and Discrete mathematics*	***Course Code: 21MAT41A***
L-T-P : 3-2-0	***Credits: 3***
Total Contact Hours: 50	***Duration of SEE: 3.00hrs***
SEE Marks*: 100*	***CIE Marks: 50***

COURSE DESCRIPTION

The course gives a broad view of Probability theory, Random Process, Discrete mathematical structures and Graph theory.

PREREQUISITES

Combination, permutation, set theory

COURSE OBJECTIVES

To Impart the knowledge and ability to apply basic concepts of Probability, random process, discrete mathematics and graph theory to engg. problems

COURSE CONTENTS

UNIT -I 8 Hours

Probability and Random Variables

Probability: Definition, Axioms of probability, Addition rule, Conditional Probability, Multiplication rule.

Random variable -: Probability distribution- discrete and continuous, probability density function, Cumulative density function, mean and variance, expectation.

Joint distribution - discrete joint probability distribution, marginal distribution, expectation, covariance, rank correlation.

Binomial, Poisson and Normal distributions

Self-Study: Baye's Theorem, continuous Joint distribution,

UNIT -II 8 Hours

Sampling Distribution

Sampling and Testing of hypothesis: Sampling with and without replacement, Sampling distribution of means. Estimation, confidence intervals for mean, statistical hypothesis, one tailed and two tailed test, Significance level, testing of hypothesis of large samples, t- test and chi- square test.

Markov Chain: Definition, transition probability matrix, regular stochastic matrix, stationary distribution

Self-Study: Exponential distribution and uniform distribution

UNIT -III 8 Hours

Discrete Mathematical structures

Relations: Definition, Properties, Equivalence, matrix representation, digraphs, partial order -Hasse diagram- Maximal and minimal elements, LUB and GLB.

Functions: Definition, surjective, injective and bijective functions, Inverse function and composition of functions.

Algebraic Structures: Groups, Semi Groups, Monoids (Definition and examples).

Self-Study: Mathematical Logic: Propositional Logic, logical operators, compound propositions - truth values, truth tables, Propositional Equivalences

UNIT -IV **8 Hours**

Graph Theory-I

Graphs- definitions and examples. Paths and cycles, degree of a vertex and hand shaking theorem. Graph isomorphism, Adjacency and Incidence matrices, Euler and Hamiltonian graphs, shortest path problems-Dijkstra's algorithm for undirected graphs.

Self-Study: Modeling of graphs and Travelling Salesman problem

UNIT -V **8 Hours**

Graph Theory-II

Trees- Properties, spanning trees, minimum spanning trees- Prim's and Kruskal's algorithm. Planar graphs, Problems on Euler's formula, Graph coloring – vertex coloring.

Self-Study: Graph coloring –Edge coloring.

TEXT BOOKS

1. Fundamentals of Statistics, S C Gupta, 6th edition, Himalaya Pub., 2007
2. Discrete Mathematics for New technology, Garnier, J Taylor, IOP, 2nd edition, 2002
3. Discrete Mathematics and its applications, Kenneth Rosen, 7th edition, Tata McGrawHill, 2011

REFERENCE BOOKS

1. Introduction to Graph theory, Gary Chartrand, Tata McGrawHill, 2006
2. Probability and Statistics, M R Spiegel, JJ Schiller, R A Srinivasan, 3rd edition, Mc GrawHill, 2019

TEACHING METHODS

- Black Board Teaching.
- Power point presentation
- Tutorial

CO-PO MAPPING

Continuous internal Evaluation (CIE) for 50 Marks

- Surprise test / Tutorials tests to be conducted for each topic for 10marks.
- Quiz/ assignment based on practical application for 10 marks.
- Three mid semester examinations will be conducted each for 30 marks and the average of all the 3 will be taken.

Semester End Examination (SEE) for 50 Marks

Final examination, of 100 Marks will be conducted and will be evaluated for 50 marks.

COURSE OUTCOMES

1. The concepts of Mathematical logic, functions and relations can be applied to Engg. Problems
2. The concepts of graph theory can be used to model and solve problems
3. The concepts of Graph theory can be applied to Engg. Problems
4. The basic concepts of Probability, random variables, distributions and Sampling can be used for problem solving
5. The testing of hypothesis and distributions can be applied to engg. Problems

CO	POs												PSO1	PSO2
	1	2	3	4	5	6	7	8	9	10	11	12		
1	3		2											
2	3		2		1									
3	3		2											
4	3		2		1									
5	3		2		1									

Department of Artificial Intelligence and Machine Learning

Department: *Artificial Intelligence and Machine Learning*	***Course Type:*** *Programme Core*
Course Title*:Parallel and Distributed Computing*	***Course Code:****21AIE445*
L-T-P: 4*-0-0*	***Credits:*** *04*
Total Contact Hours: *48 Hours*	***Duration of SEE:*** *3 Hours*
SEE Marks*: 50*	***CIE Marks:*** *50*

COURSE DESCRIPTION

This course deals with parallelism, limitation of memory system performance and Communication cost in parallel systems. This course also covers Programming systems, Distributed Computing and current methodologies

PREREQUISITES

Students should have knowledge of C, C++, Computer Network and Operating Systems

COURSE OBJECTIVES

- To understand parallel computing.
- To understand the principles of parallel Algorithms.
- To understand the basic communication operations.
- To understand distributed computing.

COURSE CONTENTS

UNIT-I — 10 Hours

Introduction: The Reality of High-Performance Computing – Modern Algorithms – Compilers – Scientific Algorithms – History – State-of-Art and Perspective – Things that are not Traditional Supercomputers. Parallel Computing – PDC models working mechanism – scalability of PDC architectures – applications, performance metrics and Amdahl's Law.

UNIT-II — 10 Hours

Models and Algorithms – PRAM algorithms, Process-level parallelism, data-level parallelism, Problem partitioning, divide-and-conquer, **Distributed algorithms** – Algorithm design techniques – filters, client / server, heartbeat, probe / echo, token passing, replicated servers Communication.

UNIT-III — 10 Hours

Interconnection network design- Topological and parametric models of interconnection networks; routing mechanisms; flow control mechanisms, communication protocols, Communication primitives – Point-to-point communication primitives; group communication patterns

UNIT-IV — 9 Hours

Broadcast in distributed systems-CSP, MPI; Synchronization – Locks, monitors, barriers; deadlock; hardware primitives and implementation issues; clock synchronization, distributed mutual exclusion; distribute deadlock detection

UNIT-V — 9 Hours

Computation: Threads – Creation, coordination, termination; futures. Shared Memory – Models of memory consistency; implementation of consistency protocols; transactions: serializability, concurrency

– control, commit protocols; Linda. Scheduling and Load Balancing: Load distribution algorithms; task migration; coscheduling; affinity scheduling; self-scheduling in loops.

TEXT BOOKS

1. Wilkinson B and Allen M, “Parallel Programming Techniques and Applications using Networked Workstations and Parallel Computer”, Second Edition, Prentice Hall, Upper Saddle River,2004

REFERENCE BOOKS

1. Tanenbaum A, “Distributed Operating Systems”, Prentice Hall, 1999
2. Nikhil R S and Arvind, “Implicit Parallel Programming in PH”, Morgan Kaufman, 2001.

TEACHING METHODS

- Black Board/Power Point
- Presentations Assignments

ASSESSMENT METHODS

- Three internals – 30 Marks each will be conducted
- Programming Assignments for 10 marks/NPTEL
- Rubrics for the evaluation of Course Project for 10 marks.
- Final examination will be conducted for 100 marks and evaluated for 50 Marks

COURSE OUTCOMES

At the end of the course student will be able to:

CO	Description
CO 1	To discuss the principles of parallel algorithm platforms, interconnection networks (ICN), and present a suite of techniques & cost estimation methods that can be applied across diverse range of applications.
CO 2	Apply and illustrate different decomposition techniques, mapping techniques, parallel algorithm models of hypercube, mesh and other topologies.
CO 3	Establish various mechanisms of communication in different ICN topologies used in parallel systems and analyse the cost.
CO 4	Provide analytical modeling of parallel programs, and assess performance through metrics for facilitating efficient data transfer in parallel algorithms.
CO 5	Analyze and evaluate the programming of message passing & shared address space parallel machines using paradigm such as POSIX threads, OpenMP and MPI.

	Course Outcomes mapping to program outcomes												Program Specific		
POs/	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**PSO1**	**PSO2**	**PSO3**
CO1		3	2										3	3	
CO2	3	3	2	2									3	3	
CO3	3	3	2										3	3	
CO4		3	2										3	3	
CO5					3		2	3							2
	3	3	2	2	3		2	3					3	3	2

Nitte Meenakshi Institute of Technology
Department of Electronics and Communication Engineering
B.E. 2021 Scheme – III Semester

III SEMESTER														
Sl. No.	**Course and Course Code**		**Course Title**	**Teaching Dept.**	**Teaching Hours /Week**				**Examination**				**Credits**
					L	**T**	**P**	**S**	**Duration in hours**	**CIE Marks**	**SEE Marks**	**Total Marks**	
1	BSC	21MAT31B	Integral Transforms And Numerical Methods	Maths	2	2	0	0	3	50	50	100	3
2	PCC	21EC32	Analog Electronic Circuits	EC	3	0	0	0	3	50	50	100	3
3	PCC	21EC33	ARM Microcontroller	EC	3	0	0	0	3	50	50	100	3
4	PCC	21EC34	Digital System Design	EC	3	0	0	0	3	50	50	100	3
5	PCC	21EC35	Networks and Systems	EC	3	0	2	0	4	50	50	100	4
6	PEC	21ECE36	Professional Elective - I	EC	3	0	0	0	3	50	50	100	3
7	PCC	21ECL37	Electronic Circuits and Logic Design Lab	EC	-	-	2	-	2	50	50	100	1
8	INT	21INT38	Internship - I							50	50	100	2
9	HSMC	21KSK39	Samskrutika Kannada / Balake Kannada							50	50	100	1
TOTAL										**450**	**450**	**900**	**23**

NOTE:

- BSC - **B**asic **S**cience **C**ourse
- PCC - **P**rofessional **C**ore **C**ourse
- PEC – **P**rofessional **E**lective **C**ourse
- HSMC - **H**umanity and **S**ocial Science & **M**anagement **C**ourses
- INT - **In**ternship

- L - **L**ecture/Theory
- T - **T**utorial
- P - **P**ractical/ Drawing
- S - **S**elf Study Component
- CIE - **C**ontinuous **I**nternal **E**valuation
- SEE - **S**emester **E**nd **E**xamination

Professional Elective Courses - I		
Sl. No.	**Subject Code**	**Subject Title**
1.	21ECE361	Embedded Systems with C
2.	21ECE362	DSD using Verilog
3.	21ECE363	Basics of Python Programming
4.	21ECE364	Computer Organization and Architecture
5.	21ECE365	Mathematical Essentials of Machine Learning

Nitte Meenakshi Institute of Technology
Department of Electronics and Communication Engineering
B.E. 2021 Scheme – IV Semester

IV SEMESTER

Sl. No.	Course and Course Code		Course Title	Teaching Dept.	Teaching Hours /Week				Examination				Credits
					L	T	P	S	Duration in hours	CIE Marks	SEE Marks	Total Marks	
1.	BSC	21MAT41	Probability, Random Process and Linear Algebra	Maths	2	2	0	0	3	50	50	100	3
2.	PCC	21EC42	Linear integrated Circuits	EC	3	0	0	0	3	50	50	100	3
3.	PCC	21EC43	Discrete Time Signal Processing	EC	3	0	0	0	3	50	50	100	3
4.	PCC	21EC44	Applications of Machine Learning using Python	EC	3	0	2	0	4	50	50	100	4
5.	PCC	21BE45	Electromagnetics	EC	3	0	0	0	3	50	50	100	3
6.	PEC	21ECE46	Professional Elective - II	EC	3	0	0	0	3	50	50	100	3
7.	PCC	21ECL47	Microcontroller Lab	EC	0	0	2	0	2	50	50	100	1
8.	AEC	21EC48x	Ability Enhancement Course			2	2			50	50	100	2
9.	HSMC	21CIP49	Constitution of India, Professional Ethics							50	50	100	1
TOTAL										**450**	**450**	**900**	**23**

Professional Elective Courses - II

Sl. No.	Subject Code	Subject Title
1.	21ECE461	Introduction to Nano Technology
2.	21ECE462	Biomedical Sensors
3.	21ECE463	OS/Linux Fundamentals
4.	21ECE464	IoT Fundamentals and Architecture

III SEMESTER

SEMESTER: III

INTEGRAL TRANSFORMS AND NUMERICAL METHODS

Course Code	**21MAT31B**		Credits	**03**
Hours/ Week (L-T-P)	**2-2-0**		CIE Marks	**50**
Total Hrs.	**39**		SEE Marks	**50**
Exam Hrs.	**03**		Course Type	**Professional Core Course**

COURSE OUTCOMES

1. Concepts of Fourier theory and integral transforms can be adopted to problem solving, analyzing physical situations relevant to periodic and aperiodic functions
2. Fourier theory and transforms can be applied to model and solve engineering problems.
3. Concept of Z transforms can be applied to problem solving and model discrete functions.
4. Numerical methods can be adopted for solving equations, ODE, interpolate and extrapolate data and integrate numerically, using finite differences and matrices
5. Numerical methods can be applied to model physical situations, find eigen values and interpret solutions.

COURSE CONTENTS

UNIT -1- (08 Hrs)

Z- transforms: Definition, Standard Z transforms, Linearity property, Damping Rule, Shifting rule, multiplication by n, Bivariate Z-transforms, region of convergence, Inverse by partial fractions method, convolution theorem. Solution of difference equations.
Self-Study: Initial and final value theorems, proof and problems

UNIT -2- (08 Hrs)

Fourier series: Euler's formulae, Dirichlet's conditions for Fourier series expansion, change of interval, Even and odd function, half range series, harmonic analysis.
Fourier Transforms: Definition, Complex Fourier transforms, Cosine and Sine transforms, Inverse Fourier transforms.
Self-Study: Parseval identity

UNIT -3- (08 Hrs)

Laplace Transforms: Definition, Transforms of standard functions, Transforms of $e^{at} f(t)$, $t^n f(t)$, $\frac{f(t)}{t}$, Laplace transforms of derivatives and integrals Laplace transforms of periodic functions, unit step function Dirac delta function . Inverse Laplace transforms, solutions of 1st and 2nd order ODE using Laplace transforms.
Self-Study: Convolution theorem: Proof and problems to find inverse.

UNIT -4- (08 Hrs)

Interpolation: Newton's divided difference formulae, Lagrange's formula, Cubic spline.
Numerical Differentiation: Newton's forward and backward formulae, Lagrange's formula.
Numerical Integration**:** Trapezoidal, Simpson's1/3rd and 3/8th, Gaussian Quadrature method.
Self-Study: Quadratic spline, Weddle's rule.

UNIT -5- (07 Hrs)

Numerical solution of ordinary differential equations: Taylor's series method, Runge-Kutta 4th order method - First order and second order initial value problems, Milne's predictor corrector method., shooting method for boundary value problems.
Explicit method for heat and wave equations. Discrete Fourier method, shooting for boundary value problems, Discrete Fourier transforms, Fast Fourier transforms.
Self-Study: Solution of Laplace equations

TEXTBOOKS

SI. No. Units	Textbook Title	Author(s)	Publisher(s)	Edition/Year of Publication

T1	Advanced Engg. Mathematics	Erwin Kreyszig		2014
T2	Numerical Methods for Scientific and Engg. Computation	M K Jain, S R K Iyengar, R K Jain	New Age,	6th edition, 2012
T3	Higher Engineering Mathematic	B S Grewal	Khanna publishers	44th Ed.2018

REFERENCE BOOKS

R1	Numerical Algorithms	Sen and Krishnamurthy		
R2	Advanced Engg. Mathematics	Erwin Kreyszig		
R3				

ONLINE RESOURCES (Links to MOOCS, NPTEL, MIT COURSEWARE etc.)

Topic/Title	Link

COURSE ASSESSMENT METHOD:

Continuous internal Evaluation (CIE) for 50 Marks

- Surprise test / Tutorials tests to be conducted for each topic for 10 marks.
- Quiz/ assignment based on practical application for 10 marks.
- Three mid semester examinations will be conducted each for 30 marks

Semester End Examination (SEE) for 50 Marks

- Final examination, of 100 Marks will be conducted and will be evaluated for 50 marks.

PEDAGOGY

1. Black Board Teaching.
2. Power point presentation
3. Tutorial Classes

CO-PO-PSO MAPPING

CO/ PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3	BT
CO1																
CO2																
CO3																
CO4																
CO5																

SEMESTER: III

ANALOG ELECTRONIC CIRCUITS

Course Code	**21EC32**		Credits	**03**
Hours/ Week (L-T-P)	**3-0-0**		CIE Marks	**50**
Total Hrs.	**39**		SEE Marks	**50**
Exam Hrs.	**03**		Course Type	**Professional Core Course**

COURSE OUTCOMES

Students will be able to

1. Analyze and explain the structure, V-I characteristics, working of diodes and Bipolar Junction Transistors (BJTs),
2. Analyze and explain the structure, V-I characteristics of MOSFETs.
3. Analyze and design MOSFET amplifiers.
4. Analyze types of voltage sources, current sources and feedback circuits.
5. Analyze power amplifier circuits.

COURSE CONTENTS

UNIT -1- (08 Hrs)

Diode and its Applications: Load line analysis, Rectifiers with Capacitor filters (with derivation), Nonlinear applications of diode (Shunt Clippers & Clampers), BJT DC Analysis: Operating point, Fixed bias circuits, Voltage divider biasing circuits. BJT AC Analysis: BJT r_e modelling (CE configuration), CE Fixed bias configuration, Voltage divider bias.

T1: **Chapter 2-** 2.2, 2.8 ,2.9 T1; **Chapter4 -**4.2 ,4.3 ,4.5 T1: **Chapter 5-**5.4, 5.5, 5.6

UNIT -2- (08 Hrs)

Metal-Oxide Field Effect Transistor (MOSFET): MOS Field –Effect Transistor, Two-Terminal MOS Structure, N-Channel and P Channel Enhancement –Mode MOSFET, Ideal MOSFET Current-Voltage Characteristics-NMOS Device and PMOS Device, MOSFET DC Circuit Analysis: Common-Source circuits, DC load line and region of operation, Common-MOSFETs configuration.

T2: **Chapter 3-** 3.1, 3.1.1, 3.1.2, 3.1.3, 3.1.4, 3.1.5, 3.1.6, 3.1.8, 3.2, 3.2.1

UNIT -3- (08 Hrs)

Basic Transistor Amplifier Configurations, The Common-Source Amplifier, The Common-Drain (Source-Follower) Amplifier, The Common-Gate Configuration, The Three Basic Amplifier Configurations and Comparison.

T2: **Chapter 4-** 4.2, 4.3, 4.3.1, 4.4, 4.4.1, 4.4.2, 4.5, 4.5.1, 4.5.2, 4.6

UNIT -4- (08 Hrs)

Current Sources, Voltage Sources and Feedback Concepts: Types of current sources and Voltage Sources (Voltage controlled and current controlled), Single Stage and Two Stage Current Mirror, Types of voltage sources (Voltage controlled and current controlled), Feedback Concepts, Feedback connection types.

T1: **Chapter 14-** 14.1, 14,2, 14.5, 14.6, 14.7, 14.8, 14.9

https://youtu.be/zF12z_R6xZA

UNIT -5- (07 Hrs)

Power Amplifiers: Introduction to Power Amplifiers, Definitions and amplifier types: Series fed class A amplifier, Class B amplifier operations, Class B amplifier circuits, Class C and Class D amplifier circuits.

T1: **Chapter 12-**12.1,12.2,12.4,12.5,12.8

TEXTBOOKS

SINO Units	Textbook Title	Author(s)	Publisher(s)	Edition/Year of Publication
T1	Electronic Devices and Circuit Theory	Robert L Boylestad Louis Nashelsky	Pearson	11th Edition, 2015

T2	"Electronic Circuit, Analysis and Design	Donald E. Neaman	Tata McGraw Hill Publishing	Third Edition, 2006
T3	"Digital Principles and Design	Donald D Givone	Tata McGraw Hill	Edition, 2003.

REFERENCE BOOKS

R1	Microelectronic Circuits	Adel S. Sedra, Kenneth C. Smith	Oxford University Press	Fifth Edition, 2005
R2	Thomas L. Floyd, David M. Buchla	Electronics Fundamentals: Circuits, Devices & Applications	Pearson education	8th Edition 2014
R3	"Digital Logic Applications and Design"	John M.Yarbrough,	Vikas Publishing House,	Third Reprint 2002

ONLINE RESOURCES (Links to MOOCS, NPTEL, MIT COURSEWARE etc)

Topic/Title	Link
Basic Analog Electronics Course	https://youtu.be/9g9dowLjmCA
Types of Current and Voltage Sources	https://youtu.be/zF12z_R6xZA
Current Mirror Circuits	https://youtu.be/vueo1EeSPYo

COURSE ASSESSMENT METHOD:

CIE:

1. Tool based Assessment - 10 Marks
2. Surprise tests based on Gate questions- 10Marks.
3. Three mid examinations, 30 Marks each will be conducted and the Average of best of two will be taken.

SEE:

1. Two Questions are to be set from each unit, carrying 20 Marks each.
2. Students have to answer 5 questions selecting one full question from each unit.

Learning Activity Components

1. Clipper and Clamper Circuits
2. BJT Amplifiers for given specifications
3. MOSFET Characteristics.
4. MOSFET Amplifiers (Common Source, Common Drain and Common Gate Amplifiers)
5. Current Mirrors
6. Solving a network for finding node voltages and currents
7. Feedback Amplifier Circuits
8. Power Amplifier Circuits

PEDAGOGY

1. Blackboard Teaching
2. PowerPoint Presentations (if needed)
3. Regular review of students by asking questions based on topics covered in the class.

CO-PO-PSO MAPPING

CO/ PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3	BT
CO1	3	2	1	3	3					1		1	3			3
CO2	3	2	2	1	3					1		1	3			3
CO3	3	2	2	1	3					1		1	3			3
CO4	3	2	2	3	1					1		**1**	**3**			3
CO5	3	3	2	3	1					1		**1**	3			3

SEMESTER: III ARM MICROCONTROLLER				
Course Code	**21EC33**		Credits	**03**
Hours/Week (L-T-P)	**3-0-0**		CIE Marks	**50**
Total Hrs.	**39**		SEE Marks	**50**
Exam Hrs.	**03**		Course Type	**Professional Core Course**

COURSE OUTCOMES

Students will be able

1. Students will get exposure to the loftier architecture of advanced microcontroller.
2. Students will get introduced to the diverse instructions of the advanced microcontroller.
3. Students will understand the role of tools and libraries in the software implementation of advanced microcontroller.
4. Students will get the exposure for handling interrupts in advanced microcontroller.
5. Student will understand the comprehensive debug support provided by advanced microcontroller.

COURSE CONTENTS

UNIT -1- (08 Hrs)

ARM Cortex M3: ARM Cortex M3 Processor and ARM Family, Cortex-M3 Processor Applications, Architecture of ARM Cortex M3, Operation Modes, The built-in nested Vectored Interrupt Controller, Memory Map, The Bus Interface, The MPU, Low Power and High Energy Efficiency, Debugging Support

Text: 1.1, 1.2, 1.5, 2.1, 2.3, 2.4, 2.5, 2.6, 2.7, 2.9.1, 2.10

ARM Cortex M3 Architecture: Registers, Special Registers, Vector Tables, Stack Memory Operation, Reset Sequence

Text 1: 3.1, 3.2, 3.5, 3.6, 3.7

UNIT -2- (08 Hrs)

ARM Cortex M3 Instruction Set: Assembly Basics, Instruction List, Instruction Descriptions, Several Useful Instructions in the Cortex M3

Text 1: 4.1, 4.2, 4.3.1 - 4.3.6, 4.4.1 - 4.4.9

ARM Cortex M3 Memory Systems: Memory System Features Overview, Memory Map, Memory Access Attributes, Memory Access Permissions, Bit-Band Operations, Unaligned Transfers, Exclusive Access, Endian Mode

Text 1: 5.1, 5.2, 5.3, 5.4, 5.5, 5.6,5.7,5.8

UNIT -3- (08 Hrs)

ARM Cortex M3 Exceptions: Exception Types, Definition of Priorities, Vector Tables, Interrupt Inputs and Pending Behaviour, Fault Exceptions, Supervisor Call and Pendable Service Call

Text 1: 7.1, 7.2, 7.3, 7.4, 7.5, 7.6

ARM Cortex M3 NVIC: Nested Vectored Interrupt Controller Overview, The Basic Interrupt Configuration, Example Procedures in Setting Up an Interrupt, Software Interrupts, The SYSTICK Timer

Text 1: 8.1, 8.2, 8.3, 8.4, 8.5

UNIT -4- (08 Hrs)

ARM Cortex M3 Programming: Overview, A Typical Development Flow, Using C, CMSIS, Using Assembly, Using Exclusive Access for Semaphores, Using Bit Band for Semaphores.

Text 1: 10.1, 10.2, 10.3, 10.4, 10.5, 10.6

UNIT -5- (08 Hrs)

ARM Cortex M3 MPU and Other Features: MPU Registers, Setting Up the MPU, Power Management, Multiprocessor Communication, Self-Reset Control

Text 1: 13.2,13.3, 14.2, 14.3, 14.4

ARM Cortex M3 Debug Architecture: Debugging Features Overview, Core Sight Overview, Debug Modes, Debugging Events, Breakpoint in the CORTEX-M3
Text 1: 15.1, 15.2, 15.3, 15.4,15.5

TEXTBOOKS

SINO Units	Textbook Title	Author(s)	Publisher(s)	Edition/Year of Publication
T1	"The Definitive Guide to the ARM Cortex-M3"	Joseph Yiu	Newnes, (Elsevier),	2nd Edition/2010

REFERENCE BOOKS

R1	"Computer Organization and Design	David Patterson and John L. Hennessey	Morgan Kaufmann	5th Edition (2014)

ONLINE RESOURCES (Links to MOOCS, NPTEL, MIT COURSEWARE etc)

Topic/Title	Link
Introduction to ARM Cortex M3 and M4 Processors	https://www.udemy.com/course/introduction-to-arm-cortex-m3-and-m4-processors

COURSE ASSESSMENT METHOD:

CIE:

1. One surprise test as a Learning activity 1 for 10 Marks
2. Assignment/course project-based Learning activity 2 is considered for 10 Marks.
3. Three internals for 30 Marks each with 40% of CIE -1, 40% of CIE- 2 and 20% of CIE- 3 is considered.

SEE:

Final examination, of 100 Marks will be conducted and will be evaluated for 50 Marks.

PEDAGOGY

1. Blackboard Teaching
2. Power Point Presentations(if needed)
3. Regular review of students by asking questions based on topics covered in the class.

CO-PO-PSO MAPPING

CO/ PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3	BT
CO1	2	2	3									3	3			2
CO2		2	3	2	3							3	3			3
CO3				2	3							3	3			3
CO4		2	3									3	3			3
CO5	2	2	3	2	3							3	3			3

SEMESTER: III

DIGITAL SYSTEM DESIGN

Course Code	**21EC34**		Credits	**03**
Hours/Week (L-T-P)	**3-0-0**		CIE Marks	**50**
Total Hrs.	**39**		SEE Marks	**50**
Exam Hrs.	**03**		Course Type	**Professional Core Course**

COURSE OUTCOMES

Students will be able to

1. Analyse the concepts of combinational and sequential logic circuits
2. Design the combinational and sequential logic circuits.
3. Apply the suitable design concepts to build Sequential Circuits
4. Design the sequential circuits using SR, JK, D, T flip-flops and Mealy & Moore machines
5. Design applications of Combinational & Sequential Circuits

COURSE CONTENTS

UNIT -1- (08 Hrs)

Analysis and design of combinational logic:

General approach to combinational logic design, Decoders, BCD decoders, Encoders, digital multiplexers, using multiplexers as Boolean function generators, Adders and subtractors, cascading full adders, Look ahead carry, Binary comparators, Arithmetic logic units,

Text 1 - Chapter 4.

UNIT -2- (08 Hrs)

Flip-Flops and its Applications:

Introduction, Flip flops, Triggering of Flip Flops, Analysis of clocked sequential circuits, State reduction and assignment, flip flop excitation table**,** Registers: Registers with parallel load, Sequential logic implementation

(Text 3: chapter 6: 6.1-6.6, chapter 7: 7.1 -7.3)

UNIT -3- (08 Hrs)

Sequential Circuit Design:

Simple counters: Asynchronous and synchronous counter, Johnson counter, Ring counter.

(Text 1: chapter 5).

Design of Binary counters, counters for other sequences, counter design using S-R and J-K Flip flops.

(Text2: chapter 12)

UNIT -4- (08 Hrs)

Introduction to sequential circuits:

Mealy and Moore models, sate machine notation, Synchronous sequential circuit analysis, construction of state diagram, Design of a Sequence Detector, Serial EX-3 to BCD Code converter, counter design

(Text1: chapter 6)

UNIT -5- (07 Hrs)

Applications of Digital Circuits:

Design Example – Code Converter, Design of Iterative Circuits (Comparator), Design of Sequential Circuits using ROMs and PLAs, CPLDs and FPGAs, Serial Adder with Accumulator, Design of Binary Multiplier, Design of Binary Divider.

(Text 2 –16.2, 16.3, 16.4, 18.1, 18.2, 18.3)

TEXTBOOKS

SINO Units	Textbook Title	Author(s)	Publisher(s)	Edition/Year of Publication
T1	Digital Logic Applications and Design	John M Yarbrough		2007

T2	Fundamentals of Logic Design, Cengage Learning	Charles H Roth Jr., Larry L. Kinney	Cengage Learning	7th Edition. 2015
T3	Digital Design and computer design	Morris Mano	PHI	4th Edition,2006

REFERENCE BOOKS

R1	Digital Principles and Design‖	Donald D. Givone	McGraw Hill	2002.

ONLINE RESOURCES (Links to MOOCS, NPTEL, MIT COURSEWARE etc)

Topic/Title	Link

COURSE ASSESSMENT METHOD:

CIE:50
SEE:50

PEDAGOGY

1. Blackboard Teaching
2. PowerPoint Presentations (if needed)
3. Regular review of students by asking questions based on topics covered in the class.

CO-PO-PSO MAPPING

CO/PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3	BT
CO1	1	3	3			1						1	2			3
CO2	1	3	3			1						1	2			2
CO3	1	3	3			1						1	2			3
CO4	1	3	3			1						**1**	**2**			3
CO5	1	3	3			1						**1**	2			3

SEMESTER: III

NETWORKS AND SYSTEMS

Course Code	**21EC35**		Credits	**04**
Hours/Week (L-T-P)	**3-0-2**		CIE Marks	**50**
Total Hrs.	**52**		SEE Marks	**50**
Exam Hrs.	**03**		Course Type	**Professional Core Course**

COURSE OUTCOMES

Students will be able to

1. Understand and interpret the response of electrical networks using various approaches and theorems
2. Analyse simple DC and AC electrical circuits by applying the concepts of transient behaviour and solving the same by using the concept of Laplace transformation and time domain methods.
3. Analyse the two-port network concepts Students are able to interpret and , and obtain the response of electrical networks using graphical method.
4. Analyse the different types of signals
5. Develop mathematical description and representation of continuous and discrete time signals and systems and to relate response of LTI system for given input.

COURSE CONTENTS

UNIT -1- (8 Hrs)

Basic circuit analysis concepts: Practical Sources, Source transformation, Mesh analysis and Node analysis with dependent and Independent sources for DC and AC networks. Concepts of super node and super mesh.

Text1: Ch 1, Ch 2

Network Theorems: Superposition theorem, , Thevenin's theorem, Norton's theorem, , Maximum power transfer theorem

Text1: Ch 7

UNIT -2- (8 Hrs)

Transient behaviour and initial conditions: Behaviour of circuit elements under switching condition and their representation of initial and final conditions in RL, RC and RLC circuits for DC excitations.

Laplace transform and its applications: Laplace transform of periodic functions, Solution of linear differential equation, Solution of network problems.

Text1: Ch 5, Ch 6

UNIT -3- (8 Hrs)

Graph Theory and Network equations: Graph of a network, Trees, Co-trees and Loops, Incidence Matrix, Cut-set Matrix, Tie-se Matrix and loop currents, Number of possible trees of a graph.

Text1: Ch 3

Two port Network: Characterization of linear time invariant two port network, open circuit impedance parameter, short circuit admittance parameter, transmission parameter

Text1: Ch 8, Ch 10

UNIT -4- (8 Hrs)

Introduction:

What is a signal and what is a system, classification of signals, Elementary Signals (Unit step, impulse function, Ramp function, Exponential function), Basic operations on signals, basic examples on signals operations

Text 1: ch1: 1.1,1.2, 1.4,1.5,1.6

UNIT -5- (8 Hrs)

Time domain representation for Linear Time Invariant Systems (LTI)

Properties of Systems, Problems based on system properties for Continuous LTI Systems, Convolution Integral (Problems on infinite step and exponential function)

Text 1: Ch 1: 1.8, Ch 2: 2.2

TEXTBOOKS

SINO Units	Textbook Title	Author(s)	Publisher(s)	Edition/Year of Publication
T1	Network Analysis	Van Valkenburg M. E.	Prentice Hall of India Pvt Ltd	3rd Edition, 2002
T1	Signals and Systems	Simon Haykin and Barry Van Veen	John Wiley and Sons, Inc.,	2002

REFERENCE BOOKS

R1	Networks and Systems	D. Roy Choudhury,	New Age International Pvt Ltd	January 30, 2010
R2	Network Analysis and Synthesis	Franklin F. Kuo,	John Wiley and Sons	2nd Edition, 2002
R1	Signals and Systems	Alan V Oppenheim, Alan S, Willsky and A Hamid Nawab	Pearson Education Asia / PHI	2nd edition, 2002
R2	Scham's outlines of Signals and Systems	H. P Hsu, R. Ranjan	TMH	2006

ONLINE RESOURCES (Links to MOOCS, NPTEL, MIT COURSEWARE etc)

Topic/Title	Link
Additional problems on Mesh analysis, Node analysis, KVL and KCL, Voltage and current sources	NPTEL :: Electrical Engineering - NOC:Network Analysis, https://archive.nptel.ac.in/courses/108/105/108105159
Graph theory applied to Network Analysis	https://archive.nptel.ac.in/courses/108/105/108105159
Network Theorems	https://archive.nptel.ac.in/courses/108/105/108105159
Two Port Networks	https://archive.nptel.ac.in/courses/108/105/108105159

COURSE ASSESSMENT METHOD:

CIE:

1. Tutorials/ Tool Based assignments - 10 Marks
2. Surprise tests - 10Marks.
3. Three mid examinations, 30 Marks each will be conducted and its scaled down to 12,12 and 06 in 1^{st},2^{nd} and in 3^{rd} CIE's

SEE:

1. Two Questions are to be set from each unit, carrying 20 Marks each.
2. Students have to answer 5 questions selecting one full question from each unit

PEDAGOGY

1. Blackboard Teaching
2. Power Point Presentations(if needed)
3. Regular review of students by asking questions based on topics covered in the class.

CO-PO-PSO MAPPING

CO/PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3	BT
CO1	3	2	2	1									2			3
CO2	3	2	2	1									2			3
CO3	3	2	2	1									2			2
CO4	3	2												**2**	**3**	3
CO5	3	2												2	3	3

PROFESSIONAL ELECTIVE COURSE - I

SEMESTER: III				
EMBEDDED SYSTEMS WITH C				
Course Code	**21ECE361**		Credits	**03**
Hours/Week (L-T-P)	**3-0-0**		CIE Marks	**50**
Total Hrs.	**39**		SEE Marks	**50**
Exam Hrs.	**03**		Course Type	**Professional Elective Course**

COURSE OUTCOMES

Students will be able to

1. Understand the Basics of Embedded systems
2. Understand the Architecture of Embedded systems
3. Understand the C-programming structure for Embedded systems
4. Understand the development of libraries for Embedded systems
5. Understand the Optimizing and testing of Embedded C

COURSE CONTENTS

UNIT -1- (07 Hrs)

Embedded Systems: Understanding the Basic Concepts: What is an Embedded System? Embedded Systems VS. General Computing Systems. History of Embedded Systems. Classification of Embedded Systems. Major Application Areas of Embedded Systems. Purpose of Embedded Systems. Wearable Devices—The Innovative Bonding of Lifestyle with Embedded Technologies.

Text -1: chapter 1

UNIT -2- (08 Hrs)

Microcontrollers Basics: The Central Processing Unit (CPU) . Instruction Sets . The Stack . Memory Addressing and Types . RAM and ROM . ROM and Programming. Von Neumann Versus Harvard Architectures . Timers . Watchdog Timer . Examples . Interrupt Circuitry . Vectored and Non- vectored Arbitration . Saving State during Interrupts . Executing Interrupt Handlers . Multiple Interrupts. RESET. I/O Ports . Analog-to-Digital Conversion . Serial Peripheral Buses . Development Tools for a Microcontroller**.**

Text-2 Chapter 3

UNIT -3- (08 Hrs)

C for Embedded Systems : In-line Assembly Language . Device Knowledge . #pragma has . #pragma port . Endianness . Mechanical Knowledge. Libraries . First Look at an Embedded C Program. **Data Types and Variables** : Identifier Declaration . Special Data Types and Data Access . Function Data Types . The Character Data Type . Integer Data Types . Byte Craft's Sized Integers . Bit Data Types . Real Numbers . Complex Data Types . Pointers . Arrays . Enumerated Types . Structures . Unions . typedef . Data Type Modifiers . Value Constancy Modifiers: const and volatile . Allowable Values Modifiers: signed and unsigned . Size Modifiers: short and long .Pointer Size Modifiers: near and far . Storage Class Modifiers . External Linkage . Internal Linkage . No Linkage . The extern Modifier . The static Modifier . The register Modifier . The auto Modifier.

Text-2 : Chapter-5. Chapter-6

UNIT -4- (08 Hrs)

C Statements: Structures, and Operations . Combining Statements in a Block . Functions 80 Function Parameters . Control Structures . The main() Function . Initialization Functions . Control Statements . Decision Structures . Looping Structures . Control Expression . break and continue . Operators and Expressions .Standard Math Operators . Bit Logical Operators . Bit Shift Operators.

Text-2: Chapter-7

UNIT -5- (08 Hrs)

Libraries : Creating Libraries . Writing the Library . Libraries and Linking. **Optimizing and Testing**

Embedded C Programs . Optimization . Instruction Set-Dependent Optimizations . Hand Optimization . Manual Variable Tweaking . Debugging Embedded C . Register Type Modifier . Local Memory . Pointers 105 Mixed C and Assembly . Calling Conventions . Access to C Variables from Assembly . Exercising Hardware 106 Debugging by Inspection . Working with Emulators and Simulators . Simulators . Emulators . The Packaging of Embedded Software.

Text-2 : Chapter-8. chapter-9

TEXTBOOKS

SINO Units	Textbook Title	Author(s)	Publisher(s)	Edition/Year of Publication
T1	Introduction To Embedded Systems (2016, Mc Graw Hill India) - libgen.lc	K. V Shibu	Mc Graw Hill India	Second Edition/2016
T2	C programming for embedded systems (2000, R&D Books)	Kirk Zurell	Team-Fly	First Edition/2000
REFERENCE BOOKS				
R1	Programming Embedded Systems in C and C ++	Michael Barr -	O'Reilly Media	1999
R2	Programming Embedded Systems With C and GNU Development Tools.	Michael Barr, Anthony Massa -	O'Reilly Media	2nd Edition /2006,

ONLINE RESOURCES (Links to MOOCS, NPTEL, MIT COURSEWARE etc)

Topic/Title	Link
Embedded System Programming for Beginner	https://www.udemy.com/course/embedded-systems-programming-for-beginners/

COURSE ASSESSMENT METHOD:

CIE: 50

SEE: 50

PEDAGOGY

1. Blackboard Teaching
2. PowerPoint Presentations (if needed)
3. Regular review of students by asking questions based on topics covered in the class.

CO-PO-PSO MAPPING

CO/PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3	BT
CO1	1	2	3													1
CO2		1	2	3												1
CO3	3	3	2	2	2	2										3
CO4	3	3	3	2	2	2										3
CO5	3	3	3	3	3											4

SEMESTER: III

DSD USING VERILOG

Course Code	**21ECE362**		Credits	**03**
Hours/Week (L-T-P)	**3-0-0**		CIE Marks	**50**
Total Hrs.	**39**		SEE Marks	**50**
Exam Hrs.	**03**		Course Type	**Professional Elective Course**

COURSE OUTCOMES

Students will be able to

1. Understand the basic concepts of Verilog HDL.
2. Familiarize with the different levels of abstraction in Verilog using different modelling styles.
3. Design different combinational and sequential circuits using Verilog HDL code
4. Compile and execute Verilog HDL programs using software tools.
5. Analyze Tasks, Functions and User -Define Primitives.

COURSE CONTENTS

UNIT -1- (8 Hrs)

Overview of Digital Design with Verilog HDL: Evolution of CAD, Emergence of HDLs, typical HDL-flow, why Verilog HDL? trends in HDL.

Hierarchical Modelling Concepts: Top-down and bottom-up design methodology, modules and module instances, Components of a simulation, design block, stimulus block.

Text 1:1.1-1.6, 2.1-2.7

UNIT -2- (8 Hrs)

Basic Concepts: Lexical conventions, data types, system tasks, compiler directives. **Modules and Ports:** Module definition, port declaration, connecting ports,

Text 1: 3.1- 3.3, 4.1-4.2

UNIT -3- (8 Hrs)

Gate-Level Modelling: Modelling using basic Verilog gate primitives, description of and/or and buf/not type gates, rise, fall and turn-off delays, min, max, and typical delays.

Dataflow Modelling: Continuous assignments, delay specification, expressions, operators, operands, operator types.

Lab programs:

1. Realization of logic gates and Boolean expressions.
2. Gate level Modeling of Half Adder, Full Adder and Parallel Binary Adder

Text 3: 5.1-5.3, 6.1-6.6

UNIT -4- (8 Hrs)

Behavioural Modelling: Structured Procedures, Procedural assignments, Timing controls, Conditional statements, multi-way branching, Loops, Sequential and Parallel Blocks, Examples.

Lab programs:

1. Realization of combinational designs using Verilog HDL code
   a. 2 to 4 decoders
   b. 8 to 3 (encoder without priority & with priority)
   c. 8 to 1 multiplexer
   d. 1 to 8 De Multiplexer
   e. 4 bit binary to gray converter and vice versa
2. Develop the HDL Code for the following flip-flops: SR, D, JK, and T

Text3: 7.1-7.7,7.9.

UNIT -5- (7 Hrs)
Tasks and Functions and User -Define Primitives: **Tasks and Functions:** Differences between tasks and functions, declaration, invocation, automatic, tasks and functions, Examples **User -Define Primitives:** UDP Basics, Combinational UDPs, Sequential UDPs, UDP Table shorthand symbols, Guidelines for UDP designs. **Text3**: 8.1-8.3 **Text1**: 12.1-12.3

TEXTBOOKS

SINO Units	Textbook Title	Author(s)	Publisher(s)	Edition/Year of Publication
T1	Verilog HDL-A Guide to digital design and synthesis	Samir Palnitkar	Pearson education	2^{nd} Edition, 2003

REFERENCE BOOKS

R1	HDL Programming (VHDL & Verilog)	NazeihM.Botros	John Weily - India & Thomson Learning	2006
R2	Fundamentals of digital logic with verilog Design	Stephen Brown, ZvonkoVransic	TMH	2nd Edition
R3	A verilog HDL Primer	J. Bhasker	BS Publications	3rd Edition,2008

ONLINE RESOURCES (Links to MOOCS, NPTEL, MIT COURSEWARE etc)

Topic/Title	Link
Hardware Modelling using Verilog by IIT KHARAGPUR	https://www.youtube.com/watch?v=FWE0-FOoE4s&list=PLUtfVcb-iqn-EkuBs3arreilxa2UKIChl
Verilog Modelling of Combinational Circuits	https://www.youtube.com/watch?v=397DDnkBm8A

COURSE ASSESSMENT METHOD:

CIE:

- Two Surprise Tests, 10 Marks each. Best of two tests will be taken.
- Three internals, 30 Marks each will be conducted and the Average of best of two will be taken.

SEE:

- Final examination, of 100 Marks will be conducted and will be evaluated for 50 Marks.

PEDAGOGY

1. Blackboard Teaching
2. PowerPoint Presentations (if needed)
3. Regular review of students by asking questions based on topics covered in the class.

CO-PO-PSO MAPPING

CO/PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3	BT
CO1	3		1										3			2
CO2	3		1		3				2			2	3			2
CO3	3	3	3		3				2	2		2	3			3
CO4	3	3	3	2	3				2	2		2	3			3
CO5	3	3	3						2	2		2	3			4

SEMESTER: III				
BASICS OF PYTHON PROGRAMMING				
Course Code	**21ECE363**		Credits	**03**
Hours/Week (L-T-P)	**3-0-0**		CIE Marks	**50**
Total Hrs.	**39**		SEE Marks	**50**
Exam Hrs.	**03**		Course Type	**Professional Elective Course**

COURSE OUTCOMES

1. Understand Python syntax and semantics and be fluent in the use of Python flow control and functions.
2. Demonstrate proficiency in handling Strings and File Systems.
3. Implement Python Programs using core data structures like Lists, Dictionaries and use Regular Expressions.
4. Interpret the concepts of Object-Oriented Programming as used in Python.
5. Implement exemplary applications related to Network Programming, Web Services and Databases inPython.

COURSE CONTENTS

UNIT -1- (8 Hrs)

Why should you learn to write programs?

Variables, Expressions and statements: Values and type, Variables, Variable names and keywords, Statements, Operators and operands, Expressions, Order of operations, Modulus operator, String operations, Asking the user for input, Comments, choosing mnemonic variable names, Debugging

Conditional execution: Boolean expressions, Logical operators, Conditional execution, Alternative execution, Chained conditionals, Nested conditionals, catching exceptions using try and except, short-circuit evaluation of logical expressions, Debugging

Functions: Function calls, Built-in functions, Type conversion functions, Math functions, Random numbers, adding new functions, Definitions and uses, Flow of execution, Parameters and arguments, Fruitful functions and void functions, why functions? Debugging

Text 1: Chapter 1, 2,3,4

UNIT -2- (8 Hrs)

Iteration: Updating variables, the while statement, Infinite loops, finishing iterations with continue, Definite loops using for, Loop patterns, Counting and summing loops, Maximum and minimum loops, Debugging

Strings: A string is a sequence, Getting the length of a string using Len, Traversal through a string with a loop, String slices, Strings are immutable, Looping and counting, the in operator, String comparison, String methods, Parsing strings, Format operator, Debugging

Files: Opening files, Text files and lines, reading files, searching through a file, Letting the userchoose the file name, Using try, except, and open, writing files, Debugging **Text 1 : Chapter 5, 6,7**

UNIT -3- (8 Hrs)

Lists: A list is a sequence, Lists are mutable, Traversing a list , List operations, List slices, List methods, Deleting elements , Lists and functions, Lists and strings, Parsing lines ,Objects and values , Aliasing , List arguments ,Debugging

Dictionaries: Dictionary as a set of counters, Dictionaries and files Looping and dictionaries, Advanced text parsing , Debugging

Tuples: Tuples are immutable, Comparing tuples, Tuple assignment, Dictionaries and tuples, Multiple assignment with dictionaries , The most common words, Using tuples as keys in dictionaries ,Sequences: strings, lists, and tuples - Oh My! , Debugging

Regular Expressions: Character matching in regular expressions , Extracting data using regular expressions , Combining searching and extracting ,Escape character ,,136 11.5 Summary ,Debugging ,

Text 1: Chapter 8,9, 10,11

UNIT -4- (8 Hrs)

Classes and objects: Programmer-defined types Attributes , Rectangles ,Instances as return values ,Objects are mutable, Debugging

Classes and functions : Time , Pure functions ,Modifiers ,Prototyping versus planning ,Debugging

Classes and methods: Object-oriented features, Printing objects ,A more complicated example, The init method ,The_str method , Operator overloading ,Type-based dispatch Polymorphism ,Debugging

Text 2 : Chapter 15,16,17

UNIT -5- (7 Hrs)

NumPy: Multidimensional array object, Linear algebra, Pseudo random generator,

Pandas: Pandas data structures, Data frame, Essential functionality, Handling missing data, Data transformation, Discretization and binning, Detecting and filling outliers, Computing indicator/Dummy variables, String manipulations.

Tex3: Chapter 4,5,7

TEXTBOOKS

SINO Units	Textbook Title	Author(s)	Publisher(s)	Edition/Year of Publication
T1	Python for Everybody: Exploring Data Using Python 3	Charles R. Severance	Create Space Independent Publishing Platform	2016
T2	"Think Python: How to Think Like a Computer Scientist",	Allen B. Downey	Green TeaPress	2nd Edition, 2015
T3	"Python for Data Analysis"	Wes McKinney	O'Reilly	2nd Edition

REFERENCE BOOKS

R1	"Computer Organization and Design	David Patterson and John L. Hennessey	Morgan Kaufmann	5th Edition (2014)

ONLINE RESOURCES (Links to MOOCS, NPTEL, MIT COURSEWARE etc)

Topic/Title	Link
Python Libraries	https://data-flair.training/blogs/python-libraries

COURSE ASSESSMENT METHOD:

CIE:

1. One surprise test as a Learning activity 1 for 10 Marks
2. Assignment/course project-based Learning activity 2 is considered for 10 Marks.
3. Three internals for 30 Marks each with 40% of CIE -1, 40% of CIE- 2 and 20% of CIE- 3 is considered.

SEE:

Final examination, of 100 Marks will be conducted and will be evaluated for 50 Marks.

PEDAGOGY

1. Blackboard Teaching
2. Power Point Presentations(if needed)
3. Regular review of students by asking questions based on topics covered in the class.

CO-PO-PSO MAPPING

CO/ PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3	BT
CO1	2	1	1		3				1			2		**1**		**2**
CO2	2	1	1		3				1			2		**1**		**3**
CO3	2	1	1		3				2			2		**1**		**2**
CO4	1	1	1		3				2			2		**1**		**3**

SEMESTER: III

COMPUTER ORGANIZATION AND ARCHITECTURE

Course Code	**21ECE364**		Credits	**03**
Hours/Week (L-T-P)	**3-0-0**		CIE Marks	**50**
Total Hrs.	**39**		SEE Marks	**50**
Exam Hrs.	**03**		Course Type	**Professional Core Course**

COURSE OUTCOMES

1. Students will be able to understand basic structure of a computer
2. Students will be able to understand the computer arithmetic Operations
3. Students will be able to understand the concept of I/O organization
4. Students will be able to understand the design of memory organization and the concept of cache mapping techniques
5. Student will be able to understand control unit operations

COURSE CONTENTS

UNIT -1- (8 Hrs)

Types of computers, functional units, basic operational concepts, performance: clock, performance equation, pipelining & superscalar operation, clockrate, CISC & RISC, compiler, evolution of computers.
[txt -1 : ch-1 : 1.1, 1.2, 1.3, 1.5, 1.6: 1.6.1 -1.6.7, 1.8]

Memory locations & address, memory operations, instructions & instruction sequencing: rtn, aln, basic instruction types: one, two, three address format (basic programs using them), instruction execution & st-line sequencing, addressing modes, assembly language, basic input/output operations, stacks and queues, subroutines, encoding of machine instruction.
[txt -1 : ch-2 : 2.2,2.3,2.4,2.5,2.6,2.7,2.8,2.9,2.12]

UNIT -2- (8 Hrs)

Data representation : representation of signed numbers (sign –mag form ,1's & 2's comp form) ,addition & subtraction of signed numbers, arithmetic overflow, **Floating point representation : IEEE standard** (single precision and double precision form)
[txt -1 : ch-2 : 2.1: 2.1.1,2.1.2, 2.1.3, 2.1.4 ch-6 : 6.7: 6.7.1]

Arithmetic: design of fast adders, multiplication of signed numbers: booth's algorithm, fast multiplication, integer division: restoring & non restoring division methods.
[txt -1 : ch-6 : 6.2,6.3,6.4,6.5,6.6]

UNIT -3- (8 Hrs)

Input/output organization: accessing i/o devices, interrupts: interrupt h/w, enabling & disabling interrupts, handling multiple devices, controlling device requests, exceptions, direct memory access, interface circuits :parallel ports, serial ports, standard i/o interfaces: PCI bus, SCSI bus, USB.
[txt -1 : ch-4 : 4.1, 4.2 : 4.2.1 -4.2.4 , 4.4 ,4.5, 4.6]

UNIT -4- (8 Hrs)

Memory system: basic concepts, ram-internal organization of memory chips, rom, cache memory, virtual memory, secondary storage.
[txt -1 : ch-5: 5.1 ,5.2 : 5.2.1,5.3 : 5.3.1, 5.4,5.5 :5.5.1 ,5.5.2 ,5.7, 5.9]

UNIT -5- (7 Hrs)

Basic processing unit: fundamental concepts : multiple bus organization, hardwired control, micro programed control: organization of micro control unit, basic control unit for handling conditional branching
[txt -1 : ch-7 : 7.1: 7.1.1-7.1.4 ,7.2,7.3,7.4,7.5:7.5.1-7.5.4]

Pipelining: basic concepts, data hazards, instruction hazards
[txt -1 : ch-8 :8.1,8.2,8.3]

TEXTBOOKS				
SINO Units	**Textbook Title**	**Author(s)**	**Publisher(s)**	**Edition/Year of Publication**
T1	Computer organization	Carl Hamecher, Z Vranesic & Zaky	MH	Fifth edition
REFERENCE BOOKS				
R1	Computer Architecture and Organisation	J.P. Hayes, Tata McGraw-Hill		Second edition (Chapter1: 1.2 for Unit1)
R2	Computer system architecture	Morris Mano	PHI	Second edition Unit III : Chapter 12

ONLINE RESOURCES (Links to MOOCS, NPTEL, MIT COURSEWARE etc.)	
Topic/Title	**Link**

COURSE ASSESSMENT METHOD:

CIE:50
SEE:50

PEDAGOGY

4. Blackboard Teaching
5. PowerPoint Presentations (if needed)
6. Regular review of students by asking questions based on topics covered in the class.

CO-PO-PSO MAPPING

CO/PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3	BT
CO1																
CO2																
CO3																
CO4																
CO5																

SEMESTER: III

MATHEMATICAL ESSENTIALS OF MACHINE LEARNING

Course Code	**21ECE365**		Credits	**03**
Hours/Week (L-T-P)	**3-0-0**		CIE Marks	**50**
Total Hrs.	**39**		SEE Marks	**50**
Exam Hrs.	**03**		Course Type	**Professional Elective Course**

COURSE OUTCOMES

1
2
3
4
5

COURSE CONTENTS

UNIT -1- (8 Hrs)

Linear Algebra: System of linear equations, matrices, solving system of linear equations, vector spaces, linear independence, Basis and Rank, Linear mapping, Affine spaces

UNIT -2- (8 Hrs)

Analytic Geometry: Norms, Inner products, Lengths and distances, angles and orthogonality, Orhonormal basis, orthogonal complement, Inner product of functions, Orthogonal projections, Rotations

UNIT -3- (8 Hrs)

Matrix decompositions: Determinant and Trace, Eigen values and Eigen functions, Cholesky decompositions, Eigen decompositions and diagonalizations, Singular Value Decompositions, Matrix approximation, Matrix phylogeny

UNIT -4- (8 Hrs)

Vector Calculus: Differentiation of Univariate functions, Partial differentiation and gradients, gradients of vector valued functions, Gradients of matrices, useful identities for computing gradients, Back propagation and automatic differentiation, Higher order derivatives, linearization and multivariate Taylor's series

UNIT -5- (7 Hrs)

Probability and Distributions: Construction of a probability space, discrete and continuous probabilities, Sum rule, product rule and Baye's Theorem, summary statistics and Independance, Gaussian distribution, Conjugacy and the exponential family, change of variables/Inverse transform,

Continuous Optimization: Optimization using gradient descent, constrained optimization and Lagrange multipliers, convex optimization

TEXTBOOKS

SINO Units	Textbook Title	Author(s)	Publisher(s)	Edition/Year of Publication
T1	Mathematics for Machine learning	Marc Peter Deisenroth A. Aldo Faisal Cheng Soon Ong	Cambridge University Press	2020

REFERENCE BOOKS

ONLINE RESOURCES (Links to MOOCS, NPTEL, MIT COURSEWARE etc)

Topic/Title	Link

COURSE ASSESSMENT METHOD:

CIE:50

SEE:50

PEDAGOGY

1. Blackboard Teaching
2. PowerPoint Presentations (if needed)
3. Regular review of students by asking questions based on topics covered in the class.

CO-PO-PSO MAPPING

CO/PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3	BT
CO1		3		2		2									1	2
CO2				2	1	2					1				1	2
CO3		2				2									1	2
CO4				2	1						1				**1**	2
CO5		1				1									1	2

IV SEMESTER

SEMESTER: IV PROBABILITY, RANDOM PROCESS AND LINEAR ALGEBRA				
Course Code	**21MAT41**		Credits	**03**
Hours/Week (L-T-P)	**2-2-0**		CIE Marks	**50**
Total Hrs.	**39**		SEE Marks	**50**
Exam Hrs.	**03**		Course Type	**Professional Core Course**

COURSE OUTCOMES

1. Concept of linear algebra can be applied to analyse and solve problems
2. Physical situations can be modelled using concepts and algorithms of Linear algebra
3. Concepts of random variables, probability distributions and sampling can be applied to problem solving.
4. Probability distributions can be used for testing of hypothesis of testing and model situations arising in analysis of data
5. Modelling situations using different random process like Poisson and Markov

COURSE CONTENTS

UNIT -1- (08 Hrs)

Linear Algebra-I

Vector spaces- definition, examples, Linear combinations, subspaces, linear dependence, basis and dimension, linear mapping, linear operator, matrix representation of linear operator, Rank and nullity of a transformations.

Self- Study: Applications to matrices row and column spaces, change of basis

UNIT -2- (11 Hrs)

Linear Algebra-II

Polynomial of matrices, Characteristic polynomial, Cayley-Hamilton theorem, diagonalization, Eigenvalues and eigen vectors, minimal polynomial, inner product space, Jordan canonical form, Orthogonal vectors and subspaces, Gram-Schmidt Orthogonalization process.

Self-Study: Bilinear and Quadratic forms

UNIT -3- (11 Hrs)

Probability and Random Variables

Probability: Definition, Axioms of probability, Addition rule, Conditional Probability, Multiplication rule.

Random variable -: Probability distribution- discrete and continuous, probability density function, cumulative density function, mean and variance, expectation.

Joint distribution - discrete joint probability distribution, marginal distribution, expectation, covariance, rank correlation.

Self-Study: Baye's Theorem, continuous Joint distribution.

UNIT -4- (8 Hrs)

Probability Distribution: Binomial, Poisson, Normal distribution,

Theory of Sampling: Population and sample, sampling with and without replacement, sampling distribution of means and variance, confidence intervals for mean. Testing Hypothesis, one tailed and two tailed test, testing of large samples, significance level and testing large samples.

t- test and Chi square test.

Self-Study: Weibull and Gamma distributions, exponential distribution, uniform distribution.

UNIT -5- (8 Hrs)

Random Process

Introduction, classification, probability density function, cumulative density function, mean, auto correlation, Stationary and Ergodic random process, Poisson process.
Markov process- Definition, examples, TPM, n – step transitional probabilities, regular, ergodic matrices, stationary distribution. States of Markov process
Correlation, Karl Pearson's coefficient, regression lines.
Self-study: Pure birth and Death process, Rank correlation

TEXTBOOKS

Units	Textbook Title	Author(s)	Publisher(s)	Edition/Year of Publication
T1	Probability and statistics	Murray R Spiegel, J Schiller, R Alu Srinivasan		Schaum's outline series, second edition
T2	Linear Algebra	Lipschitz, Schaum's	outline series	Second edition.
T3	Probability and random process	S Palaniammal		PHI, 2012.

REFERENCE BOOKS

R1	Probability and statistics for Science and Engg	G Shanker Rao	Univ Press	2011
R2	Probability and stochastic processes	Roy D Yates, David J Goodman	Wiley	Second edition, 2012,

ONLINE RESOURCES (Links to MOOCS, NPTEL, MIT COURSEWARE etc.)

Topic/Title	Link

COURSE ASSESSMENT METHOD:

Continuous internal Evaluation (CIE) for 50 Marks

- Surprise test / Tutorials tests to be conducted for each topic for 10 marks.
- Quiz/ assignment based on practical application for 10 marks.(Assignment for MATLAB)
- Three mid semester examinations will be conducted each for 30 marks and the average of best of two will be taken.

Semester End Examination (SEE) for 50 Marks

Final examination, of 100 Marks will be conducted and will be evaluated for 50 marks.

PEDAGOGY

1. Black Board Teaching.
2. Power point presentation (If needed).
3. Tutorial Classes

CO-PO-PSO MAPPING

CO/PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3	BT
CO1																
CO2																
CO3																
CO4																
CO5																

SEMESTER: IV

LINEAR INTEGRATED CIRCUITS

Course Code	**21EC42**		Credits	**03**
Hours/Week (L-T-P)	**3-0-0**		CIE Marks	**50**
Total Hrs.	**39**		SEE Marks	**50**
Exam Hrs.	**03**		Course Type	**Professional Core Course**

COURSE OUTCOMES

Students will be able to

1. Identify the different configurations of op-amp; understand the construction, characteristics and parameters.
2. Design and Demonstrate op -amp as DC and AC amplifier.
3. Observe the Op-Amp frequency response, stability and to design various linear circuits.
4. Design and analyse op amp for non-linear applications and Signal generator circuits.
5. Design and analyse the applications of op-amp as filters, 555 timers IC as Multivibrators

COURSE CONTENTS

UNIT -1- (8 Hrs)

Introduction to operational amplifiers: Operational amplifier description, Internal circuit of Basic operational amplifier circuit, OPAMP 741 IC (excluding IC amp circuit): Practical op amp circuitry, Internal circuit of: Voltage follower circuit, Non-inverting amplifier, Inverting amplifier.

Operational Amplifier parameters: Input and Output voltage, Common mode and supply rejection ratio, Offset voltages and currents, Input and output impedances, Slew rate and frequency limitations.

Text1: 1.1, 1.2, 1.3, 1.4, 1.5, 1.6, Text1: 2.1, 2.2, 2.3, 2.4, 2.5

UNIT -2- (8 Hrs)

OPAMP as DC Amplifier: Biasing operational amplifier, direct coupled voltage follower, direct coupled non inverting amplifier, direct coupled inverting amplifier

OPAMP as AC Amplifier: Capacitor coupled voltage follower, Capacitor coupled non inverting amplifier, Capacitor coupled inverting amplifier, setting the upper cut off frequency

Text 1: 3.1.3.2,3.3,3.4 Text 1: 4.1,4.3,4.5,4.6,4.7,4.8

UNIT -3- (8 Hrs)

OPAMP's frequency response and compensation: OPAMP circuit stability, Frequency and phase response, Frequency compensating methods

Miscellaneous OPAMP linear applications: Voltage sources, Current sources, Current amplifiers, Instrumentation amplifier

Text 1: 5.1, 5.2, 5.3 Text 1: 6.1, 6.2, 6.4, 6.8

UNIT -4- (8 Hrs)

Differentiating and Integrating Circuits: Differentiating circuit, Differentiator Design, Integrating circuit, Integrator Design,

OPAMP nonlinear circuits: OPAMP in switching circuits, crossing detectors inverting Schmitt trigger circuit, Non-inverting Schmitt circuits, Astable Multivibrator, and Mono stable Multivibrator.

Signal Generator: Triangular / Rectangular wave generator, Waveform Generator Design, Phase Shift Oscillator, Wein Bridge Oscillator

Text 2: 4.10,4.11, Text 2: 5.2,5.3,5.4,5.5, Text 1: 10.1, 10.2, 10.3, 10.5

UNIT -5- (7 Hrs)
Active Filters: All Pass shifting Circuits, First order Low Pass active filter, First order high pass filter, Band pass filter, Band Stop filter. **555 Timer**: Description of functional diagram, Monostable operation, Astable operation, Schmitt trigger. **PLL and ADC/DAC**: Basic Principles, Phase Detector/Comparator, Voltage controlled oscillator, Basic DAC Techniques, A-D converters. **Text 1:11.1, 11.2, 11.4, 11.8, 11.10, Text 2:8.1-8.4, Text 2:9.2,9.3,9.4, 10.2.,10.3** **Additional Topics beyond the syllabus in order to know other applications of op amp** **Signal Processing Circuits:** Precision half wave rectifiers, Precision full wave rectifiers, Clipping circuits, Clamping circuits, Peak detectors, Sample and hold circuits **Text 2:4.6, 4.7: 7.1, 7.2, 7.3, 7.4, 7.5, 7.6**

TEXTBOOKS

SINO Units	Textbook Title	Author(s)	Publisher(s)	Edition/Year of Publication
T1	“Operational Amplifiers and Linear IC's”	David A. Bell	PHI, 2nd edition,	2004
T2	" Linear Integrated Circuits"	D. Roy Choudhury and Shail B. Jain	New Age International, 2nd edition	2006

REFERENCE BOOKS

R1	Analog and Mixed mode VLSI	Allen Holberg		2006.
R2	Operational amplifiers and Linear Integrated Circuits	Robert. F. Coughlin and Fred.F.Driscoll	Pearson	
R3	Op - Amps and Linear Integrated Circuits	Ramakant A. Gayakwad	PHI, 4th edition	1999

ONLINE RESOURCES (Links to MOOCS, NPTEL, MIT COURSEWARE etc)

Topic/Title	Link
Integrated Circuits, MOSFETs, Op-Amps and their Applications	Integrated Circuits, MOSFETs, Op-Amps and their Applications - Course (nptel.ac.in)

COURSE ASSESSMENT METHOD:

CIE:
1. Hands-on Assignment for assessment of learning activities
2. Surprise test
3. Three Mid Examination, 30marks each will be conducted and average of all three will be considered

SEE:
1. Two questions are to be set from each unit, carrying 20 marks each

PEDAGOGY

1. Blackboard Teaching
2. PowerPoint Presentations(if needed)
3. Regular review of students by asking questions based on topics covered in the class.

CO-PO-PSO MAPPING

CO/PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3	BT
CO1	3	1	1		1							1	2			2
CO2	3	2	1		2							1	2	1		3
CO3	3	2	2	1	3							1	2	2	1	3
CO4	3	3	2	2	3							**2**	**3**	**2**	**2**	4

CO5	3	3	2	2	3							**2**	3	2	2	4

SEMESTER: IV **DISCRETE TIME SIGNAL PROCESSING**				
Course Code	**21EC43**		Credits	**03**
Hours/Week (L-T-P)	**3-0-0**		CIE Marks	**50**
Total Hrs.	**39**		SEE Marks	**50**
Exam Hrs.	**03**		Course Type	**Professional Core Course**

COURSE OUTCOMES

Students will be able to

1. Interpret the response of LTI systems using time domain and frequency domain techniques.
2. Analyze frequency domain representations of real and complex discrete time signals.
3. Design an analog and digital filter for the given specifications
4. Realization of Digital filters designed for the given specifications using digital computations.
5. Apply signal processing algorithms for the given input signal/specifications

COURSE CONTENTS

UNIT -1- (08 Hrs)

Time domain representations for LTI systems:
Introduction, convolution sum (Problems on infinite step and exponential sequence) properties of the Impulse response for LTI systems (Stability, causality, memoryless), Differential and Difference equation representation for LTI systems (Natural response and forced response)
Text1: Ch2: 2.1, 2.2 ,2.3, 2.4
Z transform: Definition of Z transform, Basic problems on z transform, Properties of ROC unilateral z-Transform (Natural and forced response of LTI system)
Ch -7 :7.1,7.2,7.3, 7.8

UNIT -2- (08 Hrs)

Fourier representation and Applications: Introduction to DTFS and DTFT, Frequency response of LTI system.
Text1: Ch- 4 : 4.1, 4.2
Discrete Fourier Transforms (DFT): Frequency domain sampling and reconstruction of discrete time signals. DFT as a linear transformation, its relationship with other transforms.
Ref: T2 multiplication of two DFTs- the circular convolution -7.1

UNIT -3- (08 Hrs)

Properties of DFT, Use of DFT in linear filtering, overlap-save and overlap-add method.
Ref: T2- 7.2, 7.3
Fast-Fourier-Transform (FFT) algorithms: Direct computation of DFT, need for efficient computation of the DFT (FFT algorithms), Radix-2 FFT algorithm for the computation of DFT and IDFT–decimation-in-time and decimation-in- frequency algorithms
Ref: T2-8.1.1,8.1.3,8.1.4

UNIT -4- (08 Hrs)

FIR filter design: Introduction to FIR filters, design of FIR filters using Window based method, Linear phase FIR filter design using frequency sampling and Equiripple filter design. Design of FIR Differentiators. Design of Hilbert Transformers
Structure for FIR Systems: Direct form, Linear Phase, Frequency Sampling Structure Lattice structure. Ref: Text book T2:4.6.1, T2:9.2

UNIT -5- (07 Hrs)
Analog filter design: Characteristics of commonly used analog filter – Butterworth and Chebyshev Ref: T2: Chapter 3 **IIR filter design:** Approximation of derivative and bilinear transformation method, Matched Z-Transforms, Verification for stability and linearity during mapping. Design of IIR Filters from analog filter (Butterworth and Chebyshev) Impulse invariance, Mapping of transfer functions. **Structure for IIR Systems:** Direct forms, Cascade form, Parallel form structures. Ref: T2:4.0-4.5, 5.1-5.3,T1:10.2.4-10.2.6

TEXTBOOKS

Units	Textbook Title	Author(s)	Publisher(s)	Edition/Year of Publication
T1	Signals and Systems	Simon Haykin and Barry Van Veen	John Wiley and Sons	Inc., 2002
T2	Digital signal processing – Principles Algorithms & Applications	Proakis & Monalakis	Pearson education	4th Edition, New Delhi, 2007
REFERENCE BOOKS				
R1	Discrete Time Signal Processing	Oppenheim & Schaffer		PHI, 2003
R2	Digital Signal Processing	S. K. Mitra, Tata Mc-Graw Hill		3rd Edition, 2010
R3	Digital Signal Processing and Applications with the C6713 and C6416 DSK	Rulph Chassaing Wiley Interscience		

ONLINE RESOURCES (Links to MOOCS, NPTEL, MIT COURSEWARE etc.)

Topic/Title	Link

COURSE ASSESSMENT METHOD:

CIE:

- Tutorials/Assignments - 10 Marks
- Surprise tests/Mini Project - 10Marks.
- Three mid examinations, 30 Marks each will be conducted and the Average of best of two will be taken.

SEE:

- Two questions are to be set from each unit, carrying 20 marks each

PEDAGOGY

1. Blackboard teaching
2. PowerPoint presentations (If needed)
3. Regular review of students by asking questions based on topics covered in the class

CO-PO-PSO MAPPING

CO/PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3	BT
CO1																
CO2																
CO3																
CO4																
CO5																

SEMESTER: IV

APPLICATIONS OF MACHINE LEARNING USING PYTHON

Course Code	**21EC44**		Credits	**04**
Hours/Week (L-T-P)	**3-0-2**		CIE Marks	**50**
Total Hrs.	**52**		SEE Marks	**50**
Exam Hrs.	**03**		Course Type	**Professional Core Course**

COURSE OUTCOMES

Students will be able to

1. Define machine learning and understand the basic theory underlying machine learning.
2. Analyse the basic concepts of supervised learning
3. Analyse the basic concepts of unsupervised learning and pre-processing
4. Understand the basics of Dimensionality
5. Understand data representation

COURSE CONTENTS

UNIT -1- (12 Hrs)

Introduction:

Why Machine Learning ? Why Python ? Essentials libraries and tools

Experiment : Basics of python libraries

Text Book 1 : Chapter 1

UNIT -2- (12 Hrs)

Supervised learning

Classification and Regression , Generalization , Overfiiting and Underfitting, Supervised Machine learning Algorithms

Experiment : Implementation of supervised learning algorithms

Text Book1, Chapter 2

UNIT -3- (12 Hrs)

Unsupervised learning and pre-processing

Types of Unsupervised learning , Challenges in Unsupervised learning , Pre-processing and scaling

Textbook 1, Chapter 3

UNIT -4- (08 Hrs)

Dimensionality & Clustering:

Dimensionality reduction , feature extraction and manifold learning , clustering

Text book 1, Chapter 3

UNIT -5- (08 Hrs)

Representing data and engineering features

Categorical Variables, Binning , Interactions and polynomials , automatic feature selection

Text book 1, Chapter 4

TEXTBOOKS

Unit	Textbook Title	Author(s)	Publisher (s)	Edition/Year of Publication
T1	Introduction to Machine Learning, with Python	Andreas C Muller & Sarah Guido	SPD	T1

REFERENCE BOOKS

R1	The Elements of Statistical Learning	Trevor Hastie, Robert Tibshirani, Jerome Friedman	Springer series in statistics.	2nd edition,
R2	Introduction to machine learning	Ethem Alpaydın	MIT press.	Second edition,

ONLINE RESOURCES (Links to MOOCS, NPTEL, MIT COURSEWARE etc.)	
Topic/Title	**Link**

COURSE ASSESSMENT METHOD

CIE: 50
SEE: 50

PEDAGOGY

1. Blackboard Teaching
2. PowerPoint Presentations (if needed)
3. Regular review of students by asking questions based on topics covered in the class.

CO	**POs**												**PSO 1**	**PSO 2**
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**		
1	2	1	1		3							2		1
2	2	1	1		3							2		1
3	2	1	1		3							2		1
4	1	1	1									2		1
5	1	1	1	1	1							2		1

SEMESTER: IV			
ELECTROMAGNETICS			
Course Code	**21EC45**	**Credits**	**03**
Hours/Week(L-T-P)	**3-0-0**	**CIE Marks**	**50**
Total Hours	**39(L)**	**SEE Marks**	**50**
Exam Hours	**03**	**Course Type**	**Professional Core Course**

COURSE OUTCOMES

After completion of the course students will be able to

1. Understand the basic concepts of electric fields, magnetic fields and electromagnetic waves
2. Apply the basic concepts to solve complex problems in electric fields, magnetic fields and electromagnetic waves.
3. Analyse different charge and current configurations to derive the electromagnetic field equations
4. Analyse static & time varying EM fields as governed by Maxwell's equations. Also study the propagation of EM wave in different media.
5. Design simple solutions for applications in electric and electronic circuits, electrical machines and communication systems

COURSE CONTENTS

UNIT-1 (8Hrs)

Electrostatics 1: Vector Analysis: Scalars & vectors, Basics of Coordinate systems. Coulomb's law, illustrative examples, Electric Field Intensity, Applications (Field due to Line charge distribution, Surface charge distribution), Illustrative examples. Flux, flux density, Gauss's Law, Application of Gauss's law, Divergence, Maxwell's First Equation (Electrostatics). Vector operator DEL and Divergence Theorem, Illustrative examples.

Text 1: Ch 1.1, 1.2,1.3,1.4,1.5,1.6,1.7,1.8,1.9, Ch 2.2.1 to 2.5, Ch 3.3.1, 3.2, 3.3, 3.4, 3.5, 3.6, 3.7

UNIT-2 (8 Hrs)

Electrostatics 2: Energy and Potential: Energy & potential in a moving point charge in an Electric Field, The Line Integral, |Definition of potential difference & potential, The potential field of a point charge, The potential Gradient, The Dipole, Energy density in the Electric Field.

Conductors, Dielectrics and Potential: Current & current density, continuity of current, conductor properties & boundary conditions. Boundary conditions for perfect dielectric materials.

Poisson's and Laplace Equations: Poisson's & Laplace Equations, Examples of the solutions of Laplace's equation & Poisson's equation.

Text 1: Ch 4. 4.1, 4.2, 4.3, 4.4, 4.6, 4.7, 4.8, Ch 5. 5.1, 5.2, 5.3, 5.4, 5.8 Ch 7- 7.1, 7.3, 7.4

UNIT-3 (8 Hrs)

Magnetostatics 1: The Steady Magnetic Field: Biot-Savart Law, Ampere's Circuital Law (Application: Magnetic Field Intensity due to Infinitely Long Straight Conductor, Magnetic Field Intensity due to Infinite Sheet of Current), Curl, Stokes' Theorem, Magnetic Flux & Magnetic Flux density, The Scalar & Vector magnetic potentials.

Text 1: Ch 8. 8.1, 8.2, 8.3, 8.4, 8.5, 8.6

UNIT-4 (8Hrs)

Magnetostatics 2: Magnetic Forces: Force on a moving charge, Force on a Differential current element, Force between differential Current elements, Force & Torque on a closed circuit.

Time- varying fields & Maxwell's Equations: Faraday's Law, Displacement current, Maxwell's equations in

point form, Maxwell's equations in Integral form.
Text-1: Ch 9. 9.1, 9.2, 9.3, 9.4 Ch 10. 10.1, 10.2, 10.3, 10.4

UNIT-5 (7Hrs)

Electromagnetic Waves: Wave propagation in Free space, Wave propagation in Dielectrics, The Poynting vector & power considerations, Propagation in good conductors: Skin Effect, Wave polarization.
Plane waves at Boundaries: Reflection of uniform plane waves at normal Incidence, Standing wave ratio, Wave reflection from multiple interfaces, Plane wave propagation in general Directions.
Text-1: Ch 11. 11.1, 11.2, 11.3, 11.4, 11.5, Ch 12. 12.1, 12.2, 12.3, 12.4

TEXT BOOKS

1. William H Hayt Jr. and John A Buck, "Engineering Electromagnetics", Tata McGraw-Hill, 6th Edition 2001.

REFERENCE BOOKS

1. Matthew N.O. Sadiku , "Elements of Electromagnetics", Oxford University 3rd Edition,2012
2. John Kraus, "Electromagnetics with Applications", Tata Mc-Graw Hill, 5th Edition 1999.
3. Edward C. Jordan, "Electromagnetic waves & Radiating systems", Prentice –Hall of India / Pearson education, 2nd edition, 1968

TEACHING METHODOLOGY

- Blackboard teaching
- PowerPoint presentations (if needed)
- Regular review of students by asking questions based on topics covered in the class

COURSE ASSESSEMENT METHOD

CIE:
1. Two Surprise Tests, 10 Marks each. Best of two tests will be taken.
2. Three internals, 30 Marks each will be conducted and the Average of best of two will be taken.
3. Final examination, of 100 Marks will be conducted and will be evaluated for 50 Marks.

SEE:
1. Final examination, of 100 Marks will be conducted; evaluated for 50 Marks.

CO-PO-PSO MAPPING

CO/PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3	BT
CO1	3	3										2		2		2
CO2	3	3	1	1								2	1	2		3
CO3	3	3		2								2	1	2		3
CO4	3	3		2								2		2		3
CO5	3	3		1								2		2		3

PROFESSIONAL CORE ELECTIVE - II

SEMESTER: IV

INTRODUCTION TO NANO TECHNOLOGY

Course Code	**21ECE461**		Credits	**03**
Hours/Week (L-T-P)	**3-0-0**		CIE Marks	**50**
Total Hrs.	**39**		SEE Marks	**50**
Exam Hrs.	**03**		Course Type	**Professional Elective Course**

COURSE OUTCOMES

Students will be able to

1. Analyse concept of nanotechnology, unique features of the materials and technologies that exist at the Nano scale level and categories of the Nano materials.
2. Analyse the tools Nano scientists utilize such as high powered micro-scopes that use unique methods to allow the visualization of surface features on the atomic scale.
3. Analyse the concept of quantum dots , examine their unique properties and synthesis methods and will be able to explore the imaging and sensing applications of quantum dots.
4. Analyse the concept of nanowire properties and fabrication methods and its sensing applications
5. Analyse the structure, properties and synthesis methods of carbon nanotubes (CNTs) and its sensing applications

COURSE CONTENTS

UNIT -1- (08 Hrs)

Introduction To Nanotechnology:

Definition, Surface to Volume Ratio, Nano Structures 0 D, 1D, 2D, 3D, Nano Composites

UNIT -2- (08 Hrs)

Fabrication And Characterization:

Nano Structure Fabrication: Top-down Fabrication , Bottom up Fabrication

Characterization Techniques: Atomic force Microscopy(AFM), Scanning Electron Microscopy(SEM), Transmission Electron Microscopy(TEM)

UNIT -3- (08 Hrs)

Quantum Dot Sensors:

Definition and main properties, quantum size effect, functionalization of quantum dots, synthesis, applications.

UNIT -4- (08 Hrs)

Nanowire Based Sensor:

Definition, properties, fabrication: top- down, bottom-up, fabrication by e-beam lithography, Nanowire in sensing applications.

UNIT -5- (07 Hrs)

Carbon Nanotube based Sensor:

Structure and properties of CNT, electrical properties, CNT strength and elasticity, CNT synthesis, CNT in sensor applications

TEXTBOOKS

SINO Units	Textbook Title	Author(s)	Publisher (s)	Edition/Year of Publication
T1	Nanotechnology and Nano sensors	Prof. Hossam Haick		2013

REFERENCE BOOKS

R1	Nanomaterials and Nano technologies and Design	Elsevier Publisher		2009

R2	Introduction to Nanomaterials and Nanotechnology	Vladimir Pokropivny Rynno Lohmus Irina Hussainova Alex Pokropivny Sergey Vlassov	Tartu University Press	2007

ONLINE RESOURCES (Links to MOOCS, NPTEL, MIT COURSEWARE etc.)

Topic/Title	Link
Introduction to Nanotechnology	NPTEL: https://youtu.be/ebO38bbq0_4

COURSE ASSESSMENT METHOD:

CIE:50
SEE:50

PEDAGOGY

1. Blackboard Teaching
2. PowerPoint Presentations (if needed)
3. Regular review of students by asking questions based on topics covered in the class.

CO-PO-PSO MAPPING

CO/PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3	BT
CO1	2	2											2		1	2
CO2	2	2											2		1	2
CO3	2	3	2	2		2						1	2	2	1	3
CO4	2	3	2	2		2						1	2	2	2	3
CO5	2	3	2	2		2						1	2	2	2	3

SEMESTER: IV BIOMEDICAL SENSORS				
Course Code	**21ECE462**		Credits	**03**
Hours/Week (L-T-P)	**3-0-0**		CIE Marks	**50**
Total Hrs.	**39**		SEE Marks	**50**
Exam Hrs.	**03**		Course Type	**Professional Elective Course**

COURSE OUTCOMES

Students will be able to

1. Identify the calibration procedure for the basic instruments involved in physiological parameter measurement.
2. Interpret the errors in measurement by analysing the performance characteristics of the sensors.
3. Demonstrate the appropriate sensor approach which is most likely to meet a specific biosensor application.
4. Apply the suitable design criteria for developing a medical sensor for a particular application.
5. Develop advanced medical sensors based on the basic transduction principles

COURSE CONTENTS

UNIT -1- (08 Hrs)

Science of Measurement:
Generalized Instrumentation System, General properties of input transducer. Static Characteristics: Accuracy, Precision, Resolution, Reproducibility, Sensitivity, Drift, Hysteresis, Linearity, Input Impedance and Output Impedance. Dynamic Characteristics: First Order and Second Order Characteristics, Time Delay, Transfer Function – First and Second Order Systems

UNIT -2- (08 Hrs)

Different transduction principles:
Temperature transducers- thermo resistive transducers, thermoelectric, Displacement transducers - potentiometric, resistive strain gauges, inductive displacement, and capacitive displacement transducer. Pressure transducer- indirect method - measurement of blood pressure using sphygmomanometer, piezoelectric type, catheter tip transducers, measurement of intracranial pressure, catheter tip- implantable type.

UNIT -3- (07 Hrs)

Biological sensors:
Optical Sensors, Electrolytic sensors, optical sensor, fiber optic sensors. Biosensors in clinical chemistry, medicine, and health care

UNIT -4- (08 Hrs)

Biochemical sensors:
Introduction, Advantages and limitations, various components of Biosensors, Biocatalysts based biosensors, bio-affinity based biosensors & microorganisms-based biosensors, Types of membranes used in biosensor constructions.

UNIT -5- (08 Hrs)

Bio potential electrodes:
Electrodes Electrolyte Interface, Half Cell Potential, Polarization, Polarizable and Non-Polarizable, Electrodes, Calomel Electrode, Electrode Circuit Model, Electrode Skin-Interface and Motion Artifact. Body Surface Electrodes. Ion exchange membrane electrodes, oxygen electrodes, CO_2 electrodes enzyme electrode.

TEXTBOOKS

SINO	Textbook Title	Author(s)	Publisher	Edition/Year of

Units			(s)	Publication
T1	Medical Instrumentation-Application and Design	John G. Webster		2013
T2	Transducers for Biomedical Measurements: Principles and Applications,	Richard S.C. Cobbold, John	Wiley & Sons	2004.
REFERENCE BOOKS				
R1	Electronics in Medicine and Biomedical Instrumentation by	Nandini K. Jog PHI	Second Edition	2013
R2	Instrument Transducer – An Introduction to their performance and design	Hermann K P. Neubert.		
R3	Biomedical sensors – Fundamentals and application	Harry N, Norton.		
R4	Biomedical Transducers and Instruments,	Tatsuo Togawa, Toshiyo Tamma and P. Akeoberg		

ONLINE RESOURCES (Links to MOOCS, NPTEL, MIT COURSEWARE etc)

Topic/Title	Link

COURSE ASSESSMENT METHOD:

CIE:50

SEE:50

PEDAGOGY

1. Blackboard Teaching
2. PowerPoint Presentations (if needed)
3. Regular review of students by asking questions based on topics covered in the class.

CO-PO-PSO MAPPING

CO/PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3	BT
CO1		3		2		2									1	2
CO2				2	1	2					1				1	2
CO3		2				2									1	2
CO4				2	1						1				**1**	2
CO5		1				1									1	

SEMESTER: IV OS/LINUX FUNDAMENTALS				
Course Code	**21ECE464**		Credits	**03**
Hours/Week (L-T-P)	**3-0-0**		CIE Marks	**50**
Total Hrs.	**39**		SEE Marks	**50**
Exam Hrs.	**03**		Course Type	**Professional Elective Course**

COURSE OUTCOMES

Students will be able to

1. Understand very high level picture of Operating system (OS)
2. Understand concepts related to processes and CPU scheduling
3. Understand concepts related to memory management and virtual memory
4. Understand concepts related to mass-storage and File-System interface
5. Understand Linux OS fundamentals

COURSE CONTENTS

UNIT -1- (8 Hrs)

What Operating Systems Do, Computer-System Organization , Computer-System Architecture , Operating-System Structure , Operating-System Operations , Process Management , Memory Management , Storage Management , Protection and Security

T1 1.1 to 1.9

UNIT -2- (8 Hrs)

Processes

Processes , Process Concept , Process Scheduling , Operations on Processes , Interprocess Communication , Examples of IPC Systems , Communication in Client– Server Systems

CPU Scheduling

Basic Concepts , Scheduling Criteria , Scheduling Algorithms

T1 3.1 to 3.6, 6.1 to 6.3

UNIT -3- (8 Hrs)

Main Memory

Background , Swapping , Contiguous Memory Allocation , Segmentation , Paging , Structure of the Page Table

Virtual Memory

Background ,Demand Paging

8.1 to 8.6, 9.1 – 9.2

UNIT -4- (8 Hrs)

Mass-Storage Structure

Overview of Mass-Storage Structure , Disk Structure

File-System Interface

File Concept , Access Methods , Directory and Disk Structure , File-System Mounting , File Sharing , Protection

10.1 to 10.2 , 11.1 to 11.6

UNIT -5- (7 Hrs)

Linux System

Linux History , Design Principles , Kernel Modules , Process Management , Scheduling , Memory Management , File Systems , Input and Output , Interprocess Communication , Network Structure, Security

18.1 – 18.11

TEXTBOOKS

SINO Units	Textbook Title	Author(s)	Publisher(s)	Edition/Year of Publication
T1	Operating System Principles, 9 th edition	Abraham Silberschatz, Peter Baer Galvin, Greg Gagne	Wiley-India	2006
REFERENCE BOOKS				
ONLINE RESOURCES (Links to MOOCS, NPTEL, MIT COURSEWARE etc)				
Topic/Title	**Link**			
COURSE ASSESSMENT METHOD:				

CIE:50
SEE:50

PEDAGOGY

1. Blackboard Teaching
2. PowerPoint Presentations (if needed)
3. Regular review of students by asking questions based on topics covered in the class.

CO-PO-PSO MAPPING

CO/PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3	BT
CO1		3		2		2									1	2
CO2				2	1	2					1				1	2
CO3		2				2									1	2
CO4				2	1						1				1	2
CO5		1				1									1	

SEMESTER: 5				
IoT FUNDAMENTALS AND ARCHITECTURE				
Course Code	**21ECE464**		Credits	**03**
Hours/Week (L-T-P)	**3-0-0**		CIE Marks	**50**
Total Hrs.	**39**		SEE Marks	**50**
Exam Hrs.	**03**		Course Type	**Professional Elective Course**

COURSE OUTCOMES

Students will be able

1. Interpret the impact and challenges posed by IoT networks leading to new architectural models.
2. Compare and contrast the deployment of smart objects and the technologies to connect them to network.
3. Appraise the role of IoT protocols for efficient network communication.
4. Elaborate the need for Data Analytics and Security in IoT.
5. Illustrate different sensor technologies for sensing real world entities and identify the applications of IoT in Industry.

COURSE CONTENTS

UNIT -1- (8 Hrs)

Introduction to IoT: Genesis of IoT, IoT and Digitization, IoT Impact, Convergence of IoT and IoT, IoT Challenges, IoT Network Architecture and Design, Drivers Behind New Network Architectures, Comparing IoT Architectures, A Simplified IoT Architecture, The Core IoT Functional Stack, IoT Data Management and Compute Stack.

UNIT -2- (8 Hrs)

Smart Objects: The “Things” in IoT, Sensors, Actuators, and Smart Objects, Sensor Networks, Connecting Smart Objects, Communications Criteria, IoT Access Technologies.

UNIT -3- (8 Hrs)

IP as the IoT Network Layer: The Business Case for IP, The need for Optimization, Optimizing IP for IoT, Profiles and Compliances, Application Protocols for IoT, The Transport Layer, IoT Application Transport Methods.

UNIT -4- (8 Hrs)

Data and Analytics for IoT: An Introduction to Data Analytics for IoT, Machine Learning, Big Data Analytics Tools and Technology, Edge Streaming Analytics, Network Analytics, Securing IoT, A Brief History of OT Security, Common Challenges in OT Security, How IT and OT Security Practices and Systems Vary, Formal Risk Analysis Structures: OCTAVE and FAIR, The Phased Application of Security in an Operational Environment.

UNIT -5- (7 Hrs)

IoT Physical Devices and Endpoints: Arduino UNO: Introduction to Arduino, Arduino UNO, Installing the Software, Fundamentals of Arduino Programming. IoT Physical Devices and Endpoints - RaspberryPi: Introduction to RaspberryPi, About the RaspberryPi Board: Hardware Layout, Operating Systems on RaspberryPi, Configuring RaspberryPi, Programming RaspberryPi with Python, Wireless Temperature Monitoring System Using Pi, DS18B20 Temperature Sensor, Connecting Raspberry Pi via SSH, Accessing Temperature from DS18B20 sensors, Remote access to RaspberryPi, Smart and Connected Cities, An IoT Strategy for Smarter Cities, Smart City IoT Architecture, Smart City Security Architecture, Smart City Use-Case Examples.

TEXTBOOKS

SINO Units	Textbook Title	Author(s)	Publisher(s)	Edition/Year of Publication
T1	“IoT Fundamentals: Networking Technologies, Protocols, and Use Cases for the Internet of Things”.	David Hanes, Gonzalo Salgueiro, Patrick Grossetete, Robert Barton, Jerome Henry.	Pearson Education	1^{st} Edition , (ISBN: 978-9386873743)
T2	Internet of Things	Srinivasa K G	CENGAGE	1st edition, 2017

			Leaning India	
REFERENCE BOOKS				
R1	"Internet of Things"	Vijay Madisetti and ArshdeepBahga.	VPT	1 st Edition, VPT, 2014. (ISBN: 978-8173719547)
R2	Internet of Things: Architecture and Design Principles	Raj Kamal.	McGraw Hill Education	1st Edition, 2017.

ONLINE RESOURCES (Links to MOOCS, NPTEL, MIT COURSEWARE etc)

Topic/Title	Link
Complete Guide to Build IOT Things from Scratch to Market	https://www.udemy.com/course/complete-guide-to-build-iot-things-from-scratch-to-market/

COURSE ASSESSMENT METHOD:

CIE:

1. One surprise test as a Learning activity 1 for 10 Marks
2. Assignment/course project-based Learning activity 2 is considered for 10 Marks.
3. Three internals for 30 Marks each with 40% of CIE -1, 40% of CIE- 2 and 20% of CIE- 3 is considered.

SEE:

1. Final examination, of 100 Marks will be conducted and will be evaluated for 50 Marks.

PEDAGOGY

1. Blackboard Teaching
2. Power Point Presentations(if needed)
3. Regular review of students by asking questions based on topics covered in the class.

CO-PO-PSO MAPPING

CO/PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3	BT
CO1	3	3	3									1	1			2
CO2		3	3	3	2							2	1			3
CO3				2	3							2	2			3
CO4		3	3									1	2			3
CO5	3	3	3	2	2							1	1			3

I/II SEMESTER

SEMESTER: I/II

BASIC ELECTRONICS ENGINEERING

Course Code	**18ELN14/24**	**Credits**	**04**
Hours/Week(L-T-P)	**3-2-0**	**CIE Marks**	**50**
Total Hours	**39(L)+26(T)**	**SEE Marks**	**50**
Exam Hours	**03**	**Course Type**	**Core**

COURSE OUTCOMES

After completion of the course students will be able to

1. Construct and implement basic digital electronic circuits for a given applications using the knowledge of Boolean algebra and logic gates.
2. Apply the knowledge of semiconductor physics to illustrate the operation of semiconductor devices.
3. Design electronic circuits such as rectifiers, amplifiers, oscillators, operational amplifier based applications using semiconductor devices.
4. Summarize the basic concepts of communication systems and cellular topology.
5. Apply the knowledge of electronic devices and circuits in interdisciplinary engineering domains.

COURSE CONTENTS

UNIT-1 (8Hrs)

Number system and Digital logic:
Introduction, Decimal, Binary, Octal & hexadecimal number system conversion, Compliments(only 2's,1's,10's & 9's compliment) Addition and Subtraction (Binary and Decimal numbers system), Binary Coded Decimal number, Boolean Algebra, Logic Gates .Introduction to Combinational Logic : Half Adder, Full adder ,Introduction to Sequential circuits : Flip Flops(RSFF , JK FF,D FF , T FF) (only truth table)
T1 Ch: 1.2,1.3,1.4,1.5,1.6,2.1,2.3,2.4,2.7,4.1,4.3,6.1,6.2

UNIT-2 (8Hrs)

Semiconductor Diode and Applications:
PN junction Diode, Characteristics and parameters, Diode approximations, Zener diode, Half wave Rectification, Full wave diode Rectification, Bridge rectifier, Half wave rectifier, Full wave rectifier DC power supply, Numerical Problems,
Optoelectronics devices: Light Emitting Diode, Photo diode.
T2 Ch: 2.1, 2.2, 2.3, 2.9, 3.1, 3.2, 3.3, 3.4, 20.2

UNIT-3 (8Hrs)

Transistor:
Bipolar Junction transistor, Transistor voltages and currents, Amplification, Common Base, Common Emitter and common Collector Characteristics (only input and output characteristics) numerical.
Amplifiers: Classification of Amplifiers, Single stage CE amplifier, Cascaded amplifier and capacitor coupled 2-stage CE amplifier.
Introduction to IC Technology: The IC era, Basic MOS transistor.
T2 CH: 4.1,4.2,4.3,4.5,4.6,4.7,9.5,12.1

UNIT-4 (8Hrs)

Oscillator: Introduction to Oscillator, RC phase shift Oscillator, Hartley Oscillator, Colpitts Oscillator, and Numerical.
Operational Amplifiers: Introduction to Operational Amplifiers Ideal Op-Amp, Voltage follower, Non-Inverting amplifier, Inverting amplifier, Summing amplifier, Difference amplifier (circuits, derivations of output voltage and numerical).
T2 Ch : 14.1, 14.3, 14.4, 14.5, 14.6, 14.7, 16.1, 16.2, 16.3

UNIT-5 (7Hrs)

Communication system: Introduction, Block diagram, Modulation, need for modulation, Types of modulation, Amplitude modulation, Frequency modulation: concept, waveform (no derivation & problems), Comparison between AM&FM, Super heterodyne receivers.

Optical Fiber Communication: Block diagram, Advantage & Disadvantage of OFC cable, OFC construction.

Cellular Telephone Concept: Cellular telephone, Frequency reuse (no problems), Cellular system topology, Roaming & Hands off

T3 Ch: 13.5, 13.3, 13.6.1, 19.4, 19.5, 19.8, 19.9

TEXT BOOKS

Unit 1	"Digital Logic and Computer Design", Morris Mano ,PHI 2002
Unit 2,3 4	"Electronics Devices and circuits", David A. Bell, PHI, 2004
Unit 5	"Electronic Communications Systems ", Wayne Tomasi , Fifth edition

REFERENCE BOOKS

1. "Principles of Electronics " , V K Mehta , S Chand publications , 2003
2. "Basic VLSI design" , Douglas A Pucknell& Kamran E, Third Edition (PHI)

TEACHING METHODOLOGY

- Blackboard teaching
- PowerPoint presentations (if needed)
- Regular review of students by asking questions based on topics covered in the class

COURSE ASSESEMENT METHOD

CIE:

1. Tutorials - 10 Marks
2. Surprise tests - 10Marks.
3. Three mid examinations, 30 Marks each will be conducted and the Average of best of two will be taken.

SEE:

1. Two Questions are to be set from each unit, carrying 20 Marks each.
2. Students have to answer 5 questions selecting one full question from each unit

CO-PO-PSO MAPPING

CO/PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3	BT
CO1	3	3										2	3	2		2
CO2	3	3										2	3	2		2
CO3	3	3		2								3	3	2		3
CO4	3	3		2								3	3	3	2	2
CO5	3	3	1	3								3	3	2		3

III SEMESTER

SEMESTER: III

ENGINEERING MATHEMATICS-III

Course Code	**18MAT31**	**Credits**	**04**
Hours/Week(L-T-P)	**3-2-0**	**CIE Marks**	**50**
Total Hours	**39(L)+26(T)**	**SEE Marks**	**50**
Exam Hours	**03**	**Course Type**	**Core**

COURSE OUTCOMES

1. Concepts of Fourier theory and integral transforms can be adopted to problem solving, analyzing physical situations relevant to periodic and aperiodic functions
2. Fourier theory and transforms can be applied to model and solve engineering problems
3. Concept of Z transforms can be applied to problem solving and model discrete functions.
4. Numerical methods can be adopted for solving equations, ODE, interpolate and extrapolate data and integrate numerically, using finite differences and matrices
5. Numerical methods can be applied to model physical situations, find eigen values and interpret solutions.

COURSE CONTENTS

UNIT-1 (8 Hrs)

Z- transforms : Definition, Standard Z transforms, Linearity property, Damping Rule, Shifting rule, multiplication by n, Initial and final value theorems(no proof), Bivariate Z-transforms, region of convergence, Inverse by partial fractions method, convolution theorem. Solution of difference equations (no derivations or proof).

UNIT-2 (8 Hrs)

Fourier series: Euler's formulae, Dirichlet's conditions for Fourier series expansion, change of interval, Even and odd function, half range series, Practical harmonic analysis. Fourier Transforms: Definition, Complex Fourier transforms, Cosine and Sine transforms, Inverse Fourier transforms.

UNIT-3 (8 Hrs)

Laplace Transforms: Definition, Transforms of standard functions (derivations and problems), Transforms of e f (t) at , t f (t) n , ( ) t f t , Laplace transforms of derivatives and integrals (no derivations), Laplace transforms of periodic functions, unit step function (no derivations), Dirac delta function . Inverse Laplace transforms, convolution theorem (without proof), solutions of 1st and 2nd order ODE using Laplace transforms.

UNIT-4 (8 Hrs)

Interpolation- Newton's forward and backward formula, Newton's divided difference formulae and Lagrange's formula for unequal intervals and inverse interpolation by Lagrange's formula, valuation of derivatives using Newton's forward and backward difference interpolation formulae. Numerical Integration - Trapezoidal, Simpson's 3 1 and 8 3 rules, Weddle's rule.

UNIT-5 (7 Hrs)

System of equations: Solution of system of equations by LU decomposition, Solution of Tridiagonal system by Thomas algorithm, eigen values of symmetric matrix by Jacobi method, Power method. Roots of transcendental equations by Newton Raphson Method Numerical solution of ODE: Taylor's series method, Runge-Kutta 4th order method.

TEXT BOOKS

1. Higher Engg. Mathematics by Dr. B S Grewal, 42nd Edition.
2. Advanced Engg. Mathematics by Erwin E Kreyszig, 10th edition, Wiley.
3. Introductory methods of numerical analysis, by S S Sastry, PHI India.

REFERENCE BOOKS

1. Advanced Engg. Mathematics by Erwin Kreyszig, 10th edition,Wiley,2011
2. Numerical Algorithms by Sen and Krishnamurthy

TEACHING METHODOLOGY

- Black Board Teaching.
- Power point presentation (If needed).
- Tutorial Classes.

COURSE ASSESSEMENT METHOD

CIE:

1. Tool based Assessment - 10 Marks
2. Surprise tests based on Gate questions- 10Marks.
3. Three mid examinations, 30 Marks each will be conducted and the Average of best of two willbe taken.

SEE:

1. Two Questions are to be set from each unit, carrying 20 Marks each.
2. Students have to answer 5 questions selecting one full question from each unit

CO-PO-PSO MAPPING

CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO1	2	2		1	1								1		
CO2	2	2		1	1								1		
CO3	2	2		1	1								1		
CO4	2	2		1	1								1		
CO5	2	2													

SEMESTER: III

ANALOG ELECTRONICS CIRCUITS

COURSE CODE	**18EC32**	**CREDITS**	**03**
HOURS/WEEK(L-T-P)	**3-0-0**	**CIE MARKS**	**50**
TOTAL HOURS	**39(L)**	**SEE MARKS**	**50**
EXAM HOURS	**03**	**COURSE TYPE**	**Core**

PRE-REQUISITES
Familiarity with elements of Electronics Engineering & basic circuit knowledge.

COURSE OUTCOMES

The student will be able to

1. Analyze and explain the structure, V-I characteristics, working of analog electronic devices - diodes, Bipolar Junction Transistors (BJTs), JFETs and MOSFETs.
2. Illustrate DC and AC analysis of BJT, JFET and MOSFET amplifier circuits.
3. Interpret the performance characteristics of transistor-based amplifiers and their frequency Response.
4. Design of analog electronic circuits such as diode clippers and clampers, amplifiers using BJTs, JFETs and MOSFETs, power amplifiers, feedback amplifiers, oscillators for given specifications.
5. Apply the knowledge of analog circuits for various applications in electronics & communication systems.

COURSE CONTENTS

UNIT-1 (8 Hrs)

Diode and its Applications: Load line analysis, Rectifiers with Capacitor filters (with derivation), Nonlinear applications of diode (Clippers & Clampers). (Only shunt clippers)

BJT DC Analysis: Operating point, Fixed bias circuits, Emitter stabilized biased circuits, Voltage divider biased.

BJT AC Analysis: BJT re modelling (CE configuration), CE Fixed bias configuration, Emitter Bias, Voltage divider bias, (Derivation of Zi,Z0,Av,Ai for the configuration)

T1:2.2,2.6,2.7,2.8,2.9, T1:4.2,4.3,4.4,4.5, T1:5.4,5.8,5.9,5.10

UNIT-2 (8 Hrs)

Junction Field Effect Transistor (JFET): Introduction, Construction and characteristics of JFET, Transfer Characteristics,

T1-Ch6 :6.1, 6.2, 6.3

JFET Frequency Response: logarithms, Decibels, low frequency response FET Amplifier,

T1-9.2,9.3,9.7

UNIT-3 (8 Hrs)

Metal-Oxide Field Effect Transistor (MOSFET): MOS Field –Effect Transistor, Two-Terminal MOS Structure, N-Channel Enhancement –Mode MOSFET, Ideal MOSFET Current-Voltage Characteristics-NMOS Device, p-Channel Enhancement –Mode MOSFET, Ideal MOSFET Current-Voltage Characteristics-PMOS Device, Additional MOSFET structures and Circuit Symbols, MOSFET DC Circuit **Analysis:** Common-Source circuits, DC load line and region of operation, Common-MOSFETs configuration

T2: 3.1, 3.2

UNIT-4 (8 Hrs)

Feedback and Oscillator Circuits: Feedback Concepts, Feedback connection types, Oscillator operation, Phase shift oscillator, Wein bridge oscillator, Tuned oscillator circuit, Crystal oscillator.

T1:14.1, 14,2, 14.5, 14.6, 14.7, 14.8, 14.9,

UNIT-5 (7 Hrs)

Power Amplifiers: Introduction, Definitions and amplifier types: series fed class A amplifier, Transformer coupled Class A amplifiers, Class B amplifier operations, Class B amplifier circuits, Class C and Class D amplifier circuits.

T1:12.1,12.2,12.3,12.4,12.5,12.8

TEXT BOOKS

1. Robert L. Boylestad and Louis Nashelsky, “Electronic Devices and Circuit Theory”, PHI/Pearson Education, 9th Edition.
2. Donald A. Neamen, “Electronic Circuit Analysis and Design”, TATA McGraw Hill, 3rd Edition 2.

REFERENCE BOOKS

1. David A. Bell, “Electronic Devices and Circuits”, PHI, 4th Edition, 2004
2. Malvino,Albert Paul “Electronic Principles”, 6th edition ,2000

   Jacob Millman& Christos C. Halkias, “Electronic Devices and Circuits”, Tata -McGraw Hill, 1991

TEACHING METHODOLOGY

- Blackboard teaching
- Regular review of students by asking questions based on topics covered in the class

COURSE ASSESSEMENT METHOD

CIE:

1. Tool based Assessment - 10 Marks
2. Surprise tests based on Gate questions- 10Marks.
3. Three mid examinations, 30 Marks each will be conducted and the Average of best of two will be taken.

SEE:

1. Two Questions are to be set from each unit, carrying 20 Marks each.
2. Students have to answer 5 questions selecting one full question from each unit

CO-PO-PSO MAPPING

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	BT
CO1	3	3										1	1			3
CO2	3	3										1	1			3
CO3	3	2										1	1			3
CO4	3	3	2	1	1							1	1	1		4
CO5	3	3	2	1	1					1		1	1	1		2

SEMESTER: III

DIGITAL ELECTRONICS

Course Code	**18EC33**	**Credits**	**03**
Hours/Week(L-T-P)	**3-0-0**	**CIE Marks**	**50**
Total Hours	**39(L)**	**SEE Marks**	**50**
Exam Hours	**03**	**Course Type**	**Core**

PRE-REQUISITES
A Fundamental course on Physics and Basic Electronics

COURSE OUTCOMES

Students will be able to

1. Apply the principles of Boolean algebra to manipulate/minimize logic expressions.
2. Optimize the logical circuits using various simplification techniques.
3. Analyze and design various combinational and sequential circuits.
4. Design finite state machines using various types of flip-flops and combinational circuits with prescribed functionality.
5. Design and implement a digital system for a given application to meet predefined functional requirements.

COURSE CONTENTS

UNIT-1 (8Hrs)

Boolean algebra and Combinational Networks:
Definition of Boolean algebra and theorems, Boolean formulas and functions, canonical formulas: minterm and maxterm, Equation complementation, Equation simplification and Reduction Theorems, Gates and combinational networks, Incomplete Boolean functions and Don't care conditions, Additional Boolean operations and gates, Gate Properties.
Text 1: Ch 3. 3.1 to 3.10

UNIT-2 (8 Hrs)

Simplification of Boolean expressions: Formulation of the simplification problem, Prime implicants and irredundant disjunctive expressions, Prime implicates and irredundant conjunctive expressions, Karnaugh Maps, Using K-Maps to obtain minimal expressions for complete Boolean functions, Minimal expressions of incomplete Boolean functions, Five-Variable and Six-variable K-Maps. Quine Mc-clusky method of generating prime implicants. Variable Entered K maps
Text 1: Ch 4.1- 4.8, 4.14

UNIT-3 (8 Hrs)

Logic Design with MSI components and programmable logic devices: Binary adders and Subtractors, Decimal adders. Comparators, Decoders, Encoders, Multiplexers, Programmable Logic Arrays (PLAs), Programmable Array Logic Devices (PLA)
Text 1: 5.1.1,5.2-5.6, 5.9-5.10

UNIT-4 (8Hrs)

Flip-Flops and Simple Flip-Flop Applications: The Basic Bistable Element, Latches, The SR Latch, Timing Considerations, Master-Slave Flips-Flops, Edge-Triggered Flip-Flops, Characteristic Equations, Registers
Text 1: chap 6.1-6.7

UNIT-5 (7Hrs)

Introduction to Sequential Circuit: Counters, Design of Synchronous Counters, Mealy and Moore Models, State Machine Notation, Construction of State Diagrams, Counter Design, Design of a Digital system for a given problem statement.

Text 1: chap 6.8-6.9 Text 2: chap 6

TEXT BOOKS

1. Donald D Givone, ”Digital Principles and Design “,Tata McGraw Hill Edition,2002.
2. John M.Yarbrough, “Digital Logic Applications and Design” Vikas Publishing House, Third Reprint 2002

REFERENCE BOOKS

1. Tocci,”Digital systems, Principles and Applications”, PHI/Pearson Education,6th Edition,1997

TEACHING METHODOLOGY

- Blackboard teaching
- PowerPoint presentations (if needed)
- Regular review of students by asking questions based on topics covered in the class

COURSE ASSESSEMENT METHOD

CIE:

1. Tutorials - 10 Marks
2. Surprise tests - 10Marks.
3. Three mid examinations, 30 Marks each will be conducted and the Average of best of two will be taken.

SEE:

1. Two Questions are to be set from each unit, carrying 20 Marks each.
2. Students have to answer 5 questions selecting one full question from each unit

CO-PO-PSO MAPPING

CO/ PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3	BL
CO1	3	2											1			3
CO2	3	2	1										1	1		3
CO3	3	3	1	1	1								3	1		4
CO4	3	3	2	3	1	1							3			4
CO5	3	3	3	3	1	2	1		2	1	1		3	2		6

SEMESTER: III

NETWORK ANALYSIS

Course Code	**18EC34**	**Credits**	**03**
Hours/Week(L-T-P)	**3-0-0**	**CIE Marks**	**50**
Total Hours	**39(L)**	**SEE Marks**	**50**
Exam Hours	**03**	**Course Type**	**Core**

PRE-REQUISITES

a) Mathematics-1
b) Basic Electrical Engineering

COURSE OUTCOMES

Students will be able to

1. Interpret the response of an electrical network using different approaches.
2. Apply network theorems to minimize circuit complexities and to arrive at optimized solution.
3. Interpret and analyze transient and steady state response of DC and AC electrical circuits using time domain and frequency domain approaches.
4. Solve and analyze the response of an electrical circuit by applying graph theory
5. Analyze and apply the knowledge of network concepts in various applications of Electronics & Communication Systems

COURSE CONTENTS

UNIT-1 (8Hrs)

Basic circuit analysis concepts: Practical Sources, Source transformation, Network reduction using star delta transformation, Mesh analysis and Node analysis with dependent and independent sources for DC and AC networks. Concepts of super node and super mesh. Matlab based exercises

Text1: Ch 1, Ch 2

UNIT-2 (8Hrs)

Network Theorems: Superposition theorem, Reciprocity theorem, Thevenin's theorem, Norton's theorem Millman's theorem, Maximum power transfer theorem and Matlab based exercises

Text1: Ch 7

UNIT-3 (8 Hrs)

Transient behaviour and initial conditions: Behavior of circuit elements under switching condition and their representation of initial and final conditions in RL,RC and RLC circuits for AC and DC excitations

Laplace transform and it's applications: Laplace transform of periodic functions, Solution of linear differential equation, Solution of network problems.

Text1: Ch 5, Ch 6

UNIT-4 (8Hrs)

Graph Theory and Network equations: Graph of a network, Trees, Co-trees and Loops, Incidence Matrix, Cut-set Matrix, Tie-se Matrix and loop currents, Number of possible trees of a graph, Analysis of networks, Duality.

Text1: Ch 3

UNIT-5 (7Hrs)

Two port Network: Characterization of linear time invariant two port network, open circuit impedance parameter, short circuit admittance parameter, transmission parameter, inverse transmission parameter, hybrid parameter, inverse hybrid parameter, relationship between parameters, input and output impedance in terms of two-port parameters and Matlab based exercises.

Text1: Ch 8, Ch 10

TEXT BOOKS

1. Van Valkenburg M. E. “Nework Analysis”, Prentice Hall of India Pvt Ltd. 3rd Edition, 2002

REFERENCE BOOKS

1. D. Roy Choudhury, “Networks and Systems”, New Age International Pvt Ltd Publishers (January 30, 2010)
2. Franklin F. Kuo, “Network Analysis and Synthesis”,. John Wiley and Sons 2nd Edition, 2002
3. Charles K.Alexander, Mathew N.O.Sadiku,”Fundamentals of Electric Circuits,McGraw Hill, 5th Edition

TEACHING METHODOLOGY

- Blackboard teaching
- PowerPoint presentations (if needed)
- Regular review of students by asking questions based on topics covered in the class

COURSE ASSESSEMENT METHOD

CIE:

1. Tutorials/ Matlab Based assignments - 10 Marks
2. Surprise tests - 10Marks.
3. Three mid examinations, 30 Marks each will be conducted and the Average of best of two will be taken.

SEE:

1. Two Questions are to be set from each unit, carrying 20 Marks each.
2. Students have to answer 5 questions selecting one full question from each unit

CO-PO-PSO MAPPING

CO/PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3	BT
CO1	3	3			1							1	1	1	1	2
CO2	3	3	2		1							1	1	1	2	3
CO3	3	3	2									3	3	2	2	3
CO4	3	2	1									1	1	3	1	2
CO5	3	3	1		1							2	1	3	2	3

SEMESTER: III			
SIGNALS AND SYSTEMS			
Course Code:	**18EC35**	**Credits:**	**04**
Hours/Week: (L:T:P)	**3-2-0**	**CIE Marks**	**50**
Total Hours:	**52Hrs**	**SEE Marks**	**50**
Exam Hours:	**03**	**Course Type**	**Core**

PRE-REQUISITES
Mathematics-I, Mathematics –II, Basic Electronics Engineering.

COURSE OUTCOMES
Upon Completion of the course students will be able to 1. Represent Continuous and discrete time signals using mathematical model and classify systems based on their properties. 2. Analyze the response of Linear Time Invariant system for given input 3. Apply the transform techniques for representing the signals in time and frequency domain. 4. Analyse the spectral characteristics of continuous and discrete time signals. 5. Relate signals from one domain to another domain and apply this to solve real time applications

COURSE CONTENTS
UNIT-1 (11Hrs)
Introduction: What is a signal and what is a system, overview of specific system, classification of signals, basic operations on signals, elementary signals, and systems viewed as interconnection of operations, properties of systems. [Operations on signals to be done using MAT LAB] **Text1: Ch - 1 1.1 to 1.8**
UNIT-2 (11 Hrs)
Time domain representations for LTI systems: Introduction, convolution: Impulse response representation for LTI systems, properties of the Impulse response representation for LTI systems, Differential and Difference equation representation for LTI systems. [Convolution examples to be done using MATLAB] **Text1: Ch- 2 2.1 to 2.5**
UNIT-3 (10 Hrs)
Fourier representations for signals: Introduction, discrete time periodic signals: DTFS, continuous time periodic signals: CTFS, discrete time non-periodic signals**,** continuous time non-periodic signals: CTFT **Text1: Ch-3 3.1 to 3.5**
UNIT-4 (10 Hrs)
Fourier representations and Applications: DTFT, properties of DTFT Frequency response of LTI system, Sampling, reconstruction of continuous time signals from samples, discrete time processing of continuous time signals, **Text1: Ch- 4 : 4.2,4.6,4.7,4.8**
UNIT-5 (10 Hrs)
Transform Analysis of LTI systems using Z transform : The Z transform, Properties of ROC, inverse z-Transform , Transform Analysis of LTI systems, Computational structures for implementing discrete time system, unilateral z-Transform **Text1: Ch -7 :7.1,7.2,7.3,7.5 ,7.6,7.7,7.8**
TEXT BOOKS
1. Simon Haykin and Barry Van Veen, “Signals and Systems” John Wiley and Sons, Inc., 2002 2. Michael J. Roberts, “Signals and Systems - Analysis using transform methods and MATLAB”, Tata McGraw-Hill , 1st Edition, 2003
REFERENCE BOOKS

1. Alan V Oppenheim, Alan S, Willsky and A Hamid Nawab, "Signals and Systems", Pearson Education Asia / PHI, 2nd edition, 2002.
2. H. P Hsu, R. Ranjan, "Scham's outlines of Signals and Systems", TMH, 2006.
3. B. P. Lathi, "Linear Systems and Signals", Oxford University Press, 2005

TEACHING METHODOLOGY

- Blackboard teaching
- PowerPoint presentations (If needed)
- Regular review of students by asking questions based on topics covered in the class

COURSE ASSESSEMENT METHOD

CIE:

1. Tutorials/Assignments - 10 Marks
2. Surprise tests/simulation experiments - 10Marks.
3. Three mid examinations, 30 Marks each will be conducted and the Average of best of two will be taken.

SEE:

1. Two Questions are to be set from each unit, carrying 20 Marks each.
2. Students have to answer 5 questions selecting one full question from each unit

CO-PO-PSO MAPPING

CO/ PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO1	PSO2	PSO3	BT
CO1	3	2			2				1	1		2	**1**	**1**	3	2
CO2	3	3	2		2					1		2	**1**	**2**	3	4
CO3	3	2			1					1		2	**1**	**2**	3	2
CO4	3	3	2		1					1		2	**1**	2	3	4
CO5	3	3	2	1	1	1				1		**3**	**2**	2	3	4

SEMESTER: III

MICROCONTROLLER

COURSE CODE	**18EC36**	**CREDITS**	**04**
HOURS/WEEK(L-T-P)	**3-0-2**	**CIE MARKS**	**50**
TOTAL HOURS	**39+26(L)**	**SEE MARKS**	**50**
EXAM HOURS	**03**	**COURSE TYPE**	**Core**

PRE-REQUISITES
• Knowledge of number Systems • Programming experience with C

COURSE OUTCOMES
Upon completion of the course, students will be able to
1. Interpret the architecture and addressing modes of 8051 microcontroller
2. Program 8051 microcontroller in assembly and C for various embedded system applications.
3. Using KEIL IDE, programming 8051 microcontroller in assembly and C.
4. Apply embedded C for programming 8051 microcontroller for serial communications and interrupts.
5. Interface 8051microcontroller with different peripheral devices.

COURSE CONTENTS
UNIT-1 (8 Hrs)
The 8051 Architecture:8051 Microcontroller Hardware, Input/Output Pins, Ports and circuits, External Memory. **Moving Data:** Addressing Modes, External data moves, Code Memory data moves PUSH and POP Instructions, Data Exchanges. Example Programs. **Text 1: Ch 3- 3.1 to 3.3,Ch 5- 5.l to 5.5**
UNIT-2 (7 Hrs)
Logical Operations: Byte level logical operations, Bit level logical operations, Rotate and swap operations. **Arithmetic Operations**: Incrementing and decrementing, addition, subtraction, multiplication and division, decimal arithmetic, **Jump and Call Instructions** Example Programs. **Text 1: Ch 6-6.1 to 6.3, Ch 7 – 7.1 to 7.6**
UNIT-3 (8 Hrs)
8051 Programming in C: Data types and time delays in 8051C, I/O programming, logic operations, data conversion programs and data serialization. **8051 Timer programming in C:** Programming 8051 timers, counter Programming, Examples in C. **Text 2: Ch 7-7.1 to 7.6, Ch 9-9.1 to 9.3**
UNIT-4 (8 Hrs)
8051 Serial Communication: Basics of serial Communication, 8051 connections to RS 232, Serial communication Programming, Programming examples in C. **Interrupts Programming:** 8051 Interrupts, Programming timer interrupts, programming external hardware interrupts, Programming the serial communication interrupts, Interrupt priority, Programming examples in C. **Text 2: Ch 10-10.1 to 10.2,10.4 to 10.5, Ch11-11.1 to 11.6**
UNIT-5 (8 Hrs)
8051 Interfacing and Applications: Interfacing 8051 to LCD, keyboard, parallel and serial ADC, DAC interfacing, stepper motor and DC motor interfacing. Programming in C. **Text 2: Ch 12- 12.1 to 12.2, Ch 13- 13.1 to 13.2, Ch 17-17.2 to 17.3**
TEXT BOOKS

1. Kenneth Ayala, “The 8051 Microcontroller”, Thomson Delmar Learning, 3rd Edition
2. Muhammad Ali Mazidi and Janice Gillespie Mazidi and Rollin D. McKinlay, “The 8051 Microcontroller and embedded systems – using assembly and C”, Prentice Hall India, Pearson, 2006

REFERENCE BOOKS

1. Predko,”Programming and customizing the 8051 micro controller”, Tata McGraw Hill
2. Frank Vahid& Tony Givargis, “Embedded System design”, John Wiley, 2002.
3. Michael J. Pont, “Embedded C”, Pearson Education, 2002.

TEACHING METHODOLOGY

- Blackboard teaching
- PowerPoint presentations (if needed) and demonstrations
- Regular topic-based discussions involving application examples of students by asking questions based on topics covered in the class

COURSE ASSESSEMENT METHOD

CIE:

1. Hands on assignments for assessment of learning activities (LA1 and LA2).
2. Three mid examinations, 30 Marks each will be conducted and the Average of best of two will be taken.

SEE:

1. Two Questions are to be set from each unit, carrying 20 Marks each.
2. Students have to answer 5 questions selecting one full question from each unit

CO-PO-PSO MAPPING

CO/ PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3	BT
CO1	3											2	1			2
CO2	3	2	1		3				1			2	2			3
CO3	3	2	2	1	3				1		1	2	2			3
CO4	3	2	2	1	3				1		1	2	2	2	2	3
CO5	3	2	2	1	3				1		1	2	2	2	1	3

MICROCONTROLLER INTEGRATED LAB

PART A: **Programming in Assembly language**

1. Programs on arithmetic operations
2. Block Transfer with and without overlapping programs.
3. Data exchange programs.
4. Programs on sorting data.
5. Programs on Logical operations.
6. Code conversion programs
7. Programs to generate delay using Timers and to transmit data using serial communication

PART B: INTERFACING (Programming in C)

1. Stepper and DC motor control interface to 8051
2. Interface Alpha Numeric LCD panel to 8051.
3. Interface Hex keypad to 8051.
4. Using DAC interface to 8051, generate different waveforms sine, square, triangular, ramp

SEMESTER: III

ANALOG ELECTRONICS LAB

Course Code	**18ECL37**	**Credits**	**01**
Hours/Week(L-T-P)	**0-0-2**	**CIE Marks**	**50**
Total Hours	**26(P)**	**SEE Marks**	**50**
Exam Hours	**03**	**Course Type**	**Core**

PRE-REQUISITES
Basic Electronics and Basic Electrical Engineering Concepts

COURSE OUTCOMES

Students will be able to

1. Analyze operation of electronic equipment's like CRO, Signal Generator, Power Supply.
2. Design and test rectifier, clipping circuits and clamping circuits.
3. Design and test amplifier and oscillator circuits.
4. Evaluate the device parameters from the characteristics of JFET and MOSFET.
5. Design and verify power amplifier characteristics

COURSE CONTENTS

LIST OF EXPERIMENTS

1. Demonstrate the working of Bridge Rectifier.
2. Design and conduct to demonstrate clipping and clamping circuits.
3. Design and set up the BJT common emitter amplifier using voltage divider bias with and without feedback and determine the gain-Bandwidth product from its frequency response.
4. Plot the transfer and drain characteristics of a JFET and calculate its drain resistance, mutual conductance and amplification factor.
5. Plot the transfer and drain characteristics of n-channel MOSFET and calculate its parameters, namely drain resistance, mutual conductance and amplification factor.
6. Design, setup and plot the frequency response of Common Source MOSFET amplifier and obtain the bandwidth.
7. Set-up and analyze the working of complementary symmetry Class B Push Pull Power Amplifier and calculate the efficiency.
8. Design and set-up a RC-Phase shift Oscillator for the specified frequency of oscillation.
9. Design and set-up a Hartley Oscillator for the specified frequency of oscillation.
10. Design and set-up a Colpitts Oscillator circuit for the specified frequency of oscillation.
11. Design a crystal oscillator circuit for the specified frequency of oscillation.
12. Realize BJT Darlington Emitter follower with and without Bootstrapping and determine the gain, input and output impedances. (Can be given as a Demo Experiment)

CO-PO-PSO MAPPING

CO/PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3	BL
CO1	3		1	2		1			2			1	3			2
CO2	3	3	1	1					2			1	3			3
CO3	3	3	1	1					2			2	3	1		3
CO4	3	3		1					2			2	3	1		2
CO5	3	3	1	2					2			2	3			3

DIGITAL ELECTRONICS LAB

Course Code	**18ECL38**	**Credits**	**01**
Hours/Week(L-T-P)	**0-0-2**	**CIE Marks**	**50**
Total Hours	**26(P)**	**SEE Marks**	**50**
Exam Hours	**03**	**Course Type**	**Core**

PREREQUISITES:
1. Basic Electronics

COURSE OUTCOMES

After successful completion of the course, students are able to

1. Realize the simplified expressions using Basic and universal gates.
2. Construct Combinational and Sequential circuits for an application.
3. Design Code Converter circuits for an application.
4. Design Counter and Shift register circuits for an application.
5. Implement the digital designs using CAD tools.

COURSE CONTENTS

LIST OF EXPERIMENTS

1. Realization of Basic Gates using Diodes and Transistors.
2. Simplification, Realization of Booleans Expressions using logic gates/universal gates and verify,
   (a) De-Morgan's Theorem for 2, 3, 4 variables.
   (b) The Sum-of-Product and Product-of- Sum expressions using universal gates.
3. Design and implement
   (a) Full Adder /Full Subtractor using basic logic gates.
   (b)Full Adder /Full Subtractor using Universal gates.
4. Design and implement 4-bit Parallel Adder/ Subtractor using IC 7483.
5. Design and Implement BCD to EXCESS-3 Conversion and Vice Versa using
   (a) Logic Gates
   (b)Parallel Adder/ Subtractor IC 7483
6. Design and Implement BCD to Gray Conversion and Vice Versa using logic gates.
7. Realize
   (a) 2:1/4:1 Multiplexer using gates.
   (b)Adders/Subtractors Using IC 74153
   (c) 1:4 Demux using Gates
   (d)Adders/Subtractors using IC 74139
8. Design and Implementation of magnitude comparators.
   (a) One and two bit Comparator using Logic gates
   (b) 4-bit and 8-bit comparator using IC 7485
9. Realize the following flip-flops using.
   (a) JK Flip-Flop using Nand gates
   (b) Clocked SR, JK, D, T Flip Flop using IC 7476
10. Realize the following operations using shift registers IC7495
    (a) SISO (b) SIPO (c) PISO (d) PIPO
11. Design and Implement Asynchronous Mod N up/Down Counter using IC 7476.
12. Design and Implement Synchronous Mod N up/down counter using IC 7476
13. Design and Implement Ring/Johnson counter Using IC 7495
14. Simulate Full- Adder using simulation tool.

15. Simulate Mod-8 Synchronous UP/DOWN Counter using simulation tool.

CO-PO-PSO MAPPING

CO/ PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3	BT
CO1	3								1				1			2
CO2	3	2	1						2				2			3
CO3	3	2	2	2					2			2	2			3
CO4	3	2	2	2	1				2			2	2			3
CO5	3	2	2	2	1				2			2	2			2

IV SEMESTER

SEMESTER: IV

ENGINEERING MATHEMATICS-IV

Course Code	**18MAT41**	**Credits**	**04**
Hours/Week(L-T-P)	**3-1-1**	**CIE Marks**	**50**
Total Hours	**39(L)+26(T)**	**SEE Marks**	**50**
Exam Hours	**03**	**Course Type**	**Core**

COURSE OUTCOMES

1. Concept of linear algebra can be applied to analyse and solve problems
2. Physical situations can be modeled using concepts and algorithms of Linear algebra
3. Concepts of random variables, probability distributions and sampling can be applied to problem solving.
4. Probability distributions can be used for testing of hypothesis of testing and model situations arising in analysis of data
5. Modelling situations using different random process like Poisson and Markov

COURSE CONTENTS

UNIT-1 (8 Hrs)

Random variable, discrete probability distribution, continuous random variables, continuous probability distribution, cumulative density function, Expectation, variance. Joint distribution- continuous and discrete, expectation, variance, standard deviation, covariance Binomial, Poisson, Exponential, Normal.

UNIT-2 (8 Hrs)

Population and sample, sampling with and without replacement, sampling distribution of means, sample variance. Unbiased estimate, confidence intervals for mean, statistical hypothesis, testing of hypothesis, Type I and II errors, one tailed, two tailed tests, t - distribution, χ 2 – test, test for goodness of fit.

UNIT-3 (8 Hrs)

Random process- definition, classification, pdf, cdf, mean, auto correlation, Stationary and Ergodic random process, Poisson process. Markov process- Definition, examples, TPM, n – step transitional probabilities, regular, ergodic matrices, stationary distribution, classification of states, Markov chain with absorbing states, periodic, transient and recurrent states.

UNIT-4 (8 Hrs)

Vector spaces- definition, examples, Linear combinations, subspaces, linear dependence, basis and dimension, linear mapping, linear operator, matrix representation of linear operator, change of basis.

UNIT-5 (7 Hrs)

Polynomial of matrices, Characteristic polynomial, Cayley-Hamilton theorem, diagonalization, Eigenvalues and eigen vectors, minimal polynomial, inner product space, Jordan canonical form, Orthogonal vectors and subspaces, Gram-Schmidt Orthogonalisation process, Quadratic forms.

TEXT BOOKS

1. Probability and statistics, by Murray R Spiegel, J Schiller, R Alu Srinivasan, Schaum's outline series, second edition.
2. Operations research by R. Bronson & G. Nadimuthu, Schaum's series, II edition.
3. Linear Algebra by Lipschitz, Schaum's outline series, second edition.
4. Probability and random process by S Palaniammal, PHI, 2012.

REFERENCE BOOKS

1. Probability and statistics for Science and Engg. By G Shanker Rao, Univ Press, 2011
2. Probability and stochastic processes , Roy D Yates, David J Goodman, second edition, 2012, Wiley

TEACHING METHODOLOGY

- Black Board Teaching.
- Power point presentation (If needed).
- Tutorial Classes.

COURSE ASSESSEMENT METHOD

CIE:

1. Surprise test / Tutorials tests to be conducted for each topic for 10 marks.
2. Quiz/ assignment based on practical application for 10 marks.(Assignment for MATLAB)
3. Three mid semester examinations will be conducted each for 30 marks and the average of best of two will be taken.

SEE:

1. Two Questions are to be set from each unit, carrying 20 Marks each.
2. Students have to answer 5 questions selecting one full question from each unit

CO-PO-PSO MAPPING

CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO1	2	2											1		
CO2	2	2		2	1								1		
CO3	2	2		1									1		
CO4	2	2		2	1								1		
CO5	2	2		2	1								1		

SEMESTER: IV			
LINEAR INTEGRATED CIRCUITS AND INTEGRATED LAB			
Course Code	18EC42	Credits	04
Hours/week(l-t-P)	3-0-2	CIE Marks	50
Total Hours	39(L)+26(P)	SEE Marks	50
Exam Hours	03	Course Type	Core

PRE-REQUISITES

- Basic electronics
- Analog electronic circuits

COURSE OUTCOMES

STUDENTS WILL BE ABLE TO

1. Identify the different configurations of op-amp, understand the construction, characteristics and parameters.
2. Design and Demonstrate op -amp as an AC amplifier and observe its frequency response and stability.
3. Design and analyze various linear applications and signal processing circuits of op-amp and verify the same using simulation Tool.
4. Design and analyze non-linear applications and Signal generator circuits using op-amp and verify the same using simulation Tool.
5. Design and analyze the applications of op-amp as filters, 555 timers IC as Multivibrators and D-A and A-D converter circuits, verify the same using simulation Tool.

COURSE CONTENTS

UNIT-1 (8Hrs)

Introduction to operational amplifiers: Operational amplifier description, Basic operational amplifier circuit, OPAMP 741 IC (excluding IC amp circuit), Voltage follower circuit, non-inverting amplifier, Inverting amplifier.

Operational Amplifier parameters: Input and Output voltage, Common mode and supply rejection ratio, Offset voltages and currents, Input and output impedances, Slew rate and frequency limitations.

Text1: 1.1, 1.2, 1.3, 1.4, 1.5, 1.6, Text1: 2.1, 2.2, 2.3, 2.4, 2.5

UNIT-2 (8Hrs)

OPAMP as AC Amplifier: Capacitor coupled voltage follower, Capacitor coupled non inverting amplifier, Capacitor coupled inverting amplifier, setting the upper cut off frequency

OPAMP's frequency response and compensation: OPAMP circuit stability, Frequency and phase response, Frequency compensating methods.

Text 1: 4.1,4.3,4.5,4.6,4.7,4.8 **Text 1: 5.1, 5.2, 5.3**

UNIT-3 (8Hrs)

Miscellaneous OPAMP linear applications: Voltage sources, Current sources, Current amplifiers, Instrumentation amplifier.

Signal Processing Circuits: Precision half wave rectifiers, Precision full wave rectifiers, Clipping circuits, Clamping circuits, Peak detectors, Sample and hold circuits

Text 1: 6.1, 6.2, 6.4, 6.8

Text 2:4.6, 4.7: 7.1, 7.2, 7.3, 7.4, 7.5, 7.6

UNIT-4 (8Hrs)

Differentiating and Integrating Circuits: Differentiating circuit, Differentiator Design, Integrating circuit, Integrator Design,

OPAMP nonlinear circuits: OPAMP in switching circuits, crossing detectors inverting Schmitt trigger circuit, Non-inverting Schmitt circuits, Astable multivibrator, and Mono stable multivibrator.

Signal Generator: Triangular / Rectangular wave generator, Waveform Generator Design, Phase Shift Oscillator, Wein Bridge Oscillator

Text 1: 8.1, 8.2, 8.4, 8.5, 9.1, 9.2, 9.3, 9.4, 9.5, 9.6

Text 1: 10.1, 10.2, 10.3, 10.5

UNIT-5 (7Hrs)

Active Filters: All Pass shifting Circuits, First order Low Pass active filter, First order high pass filter, Band pass filter, Band Stop filter.

555 Timer: Description of functional diagram, Monostable operation, Astable operation, Schmitt trigger

D-A and A-D Converters: Basic DAC techniques, weighted Resistor DAC, R-2R Ladder DAC, A-D Converters, Direct Type ADCs: Parallel Comparator (flash) A/D Converter, Successive Approximation Converter.

Text 1:11.1, 11.2, 11.4, 11.8, 11.10,

Text 2:8.1-8.4, 10.1, 10.2, 10.2.1, 10.2.2, 10.3,10.3.1, 10.3.4

TEXT BOOKS

1. David A. Bell, “Operational Amplifiers and Linear IC's", PHI, 2nd edition, 2004.
2. D. Roy Choudhury and Shail B. Jain "Linear Integrated Circuits", New Age International, 2nd edition, 2006.

REFERENCE BOOKS

1. Allen Holberg : Analog and Mixed mode VLSI”
2. Robert. F. Coughlin and Fred.F.Driscoll,” Operational amplifiers and Linear Integrated Circuits”, Pearson, 2006.
3. Ramakant A. Gayakwad, "Op - Amps and Linear Integrated Circuits", PHI, 4th edition, 1999.

TEACHING METHODOLOGY

- Blackboard teaching
- PowerPoint presentations (if needed)
- Regular review of students by asking questions based on topics covered in the class, Verification using simulation Tool.

COURSE ASSESSEMENT METHOD

CIE:

1. Hands on assignments for assessment of learning activities (LA1 and LA2, (2 hours per week as lab Experiments)
2. Surprise tests - 10Marks.
3. Three mid examinations, 30 Marks each will be conducted and the Average of best of two will be taken.

SEE:

1. Two Questions are to be set from each unit, carrying 20 Marks each.

CO-PO-PSO MAPPING

CO/PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3	BT
CO1	3	1	1		1							1	2			2
CO2	3	2	1		2							1	2	1		3
CO3	3	2	2	1	3							1	2	2	1	3
CO4	3	3	2	2	3							2	3	2	1	4
CO5	3	3	2	2	3							2	3	2	2	4

SEMESTER: IV			
DIGITAL SIGNAL PROCESSING			
Course Code	**18EC43**	**Credits**	**04**
Hours/Week(L-T-P)	**3-2-0**	**CIE Marks**	**50**
Total Hours	**52**	**SEE Marks**	**50**
Exam Hours	**03**	**Course Type**	**Core**

PRE-REQUISITES
Signals and systems, Engineering Mathematics

COURSE OUTCOMES
After studying this course, students will be able to: 1. Interpret the response of LTI systems using time domain and frequency domain techniques. 2. Analyze frequency domain representations of real and complex discrete time signals. 3. Design an analog and digital filter for the given specifications 4. Realization of Digital filters designed for the given specifications using digital computations. 5. Apply signal processing algorithms for the given input signal/specifications

COURSE CONTENTS
UNIT-1 (11 Hrs)
Review of Signals and Systems – LTI systems, Fourier representation **Discrete Fourier Transforms (DFT):** Frequency domain sampling and reconstruction of discrete time signals. DFT as a linear transformation, its relationship with other transforms. Properties of DFT, multiplication of two DFTs- the circular convolution, Additional DFT properties. Ref: T1-7.1,7.2
UNIT-2 (Hrs)
Use of DFT in linear filtering, overlap-save and overlap-add method. **Fast-Fourier-Transform (FFT) algorithms:** Direct computation of DFT, need for efficient computation of the DFT (FFT algorithms), Radix-2 FFT algorithm for the computation of DFT and IDFT–decimation-in-time and decimation-in- frequency algorithms Ref: T1-7.3,8.1.1,8.1.3,8.1.4
UNIT-3 (Hrs)
Applications of FFT Algorithms, Goertzel algorithm, and chirp-z transform. Ref: T1:8.2,8.3 **Analog filter design:** Characteristics of commonly used analog filter – Butterworth and Chebyshev (Type 1) filters, analog to analog frequency transformations. Ref: T2: Chapter 3 **Digital Signal processors:** Case study based on TMS320C6713 Digital Signal Processor, Programming examples. Ref: R3:1.2-1.6
UNIT-4 (Hrs)
IIR filter design: Approximation of derivative and bilinear transformation method, Matched Z-Transforms, Verification for stability and linearity during mapping. Design of IIR Filters from analog filter (Butterworth and Chebyshev) Impulse invariance, Mapping of transfer functions. **Structure for IIR Systems:** Direct forms, Cascade form, Parallel form structures. Ref: T2:4.0-4.5, 5.1-5.3,T1:10.2.4-10.2.6

UNIT-5 (Hrs)
FIR filter design: Introduction to FIR filters, design of FIR filters using Window based method, Linear phase FIR filter design using frequency sampling and Equiripple filter design. Design of FIR Differentiators. Design of Hilbert Transformers **Structure for FIR Systems:** Direct form, Linear Phase, Frequency Sampling Structure Lattice structure. Ref: Text book T2:4.6.1, T1:9.2

TEXT BOOKS

1. Digital signal processing – Principles Algorithms & Applications, Proakis &Monalakis, Pearson education, 4th Edition, New Delhi, 2007.
2. Fundamentals of Digital Signal Processing, Lonnie C. Ludeman,

REFERENCE BOOKS

1. Discrete Time Signal Processing, Oppenheim & Schaffer, PHI, 2003.
2. Digital Signal Processing, S. K. Mitra, Tata Mc-Graw Hill, 3rd Edition, 2010.
3. Digital Signal Processing and Applications with the C6713 and C6416 DSK, RulphChassaing, Wiley Interscience

TEACHING METHODOLOGY

- Blackboard teaching
- PowerPoint presentations (If needed)
- Regular review of students by asking questions based on topics covered in the class

COURSE ASSESSEMENT METHOD

CIE:

1. Tutorials/Assignments - 10 Marks
2. Surprise tests/Mini Project - 10Marks.
3. Three mid examinations, 30 Marks each will be conducted and the Average of best of two will be taken.

SEE:

1. Two Questions are to be set from each unit, carrying 20 Marks each.
2. Students have to answer 5 questions selecting one full question from each unit

CO-PO-PSO MAPPING

CO/PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3	BL
CO1	3				1				1	1		1		2	3	2
CO2	3	2	2	1	1				1	1		1		2	3	3
CO3	3	2	2	1	1				1	1		1		2	3	3
CO4	3				1				1	1		1		2	3	3
CO5	3	2	2	1	1				1	1		1		2	3	4

SEMESTER: IV

FIELDS AND WAVES

Course Code	**18EC44**	**Credits**	**03**
Hours/Week(L-T-P)	**3-0-0**	**CIE Marks**	**50**
Total Hours	**39(L)**	**SEE Marks**	**50**
Exam Hours	**03**	**Course Type**	**Core**

PRE-REQUISITES

1. Vector Analysis
2. Engineering Mathematics-I and II
3. Basic of Physics

COURSE OUTCOMES

After completion of the course students will be able to

1. Illustrate the basic mathematical concepts related to Electromagnetic vector field.
2. Apply the principles of Electro statistics to the solutions of problems relating to Electric field, Electric potential, boundary conditions & electric energy density.
3. Apply principles of Magneto statistics to solutions of problem relating to Magnetic field.
4. Analyze static & time varying EM fields as governed by Maxwell's equations.
5. Apply Maxwell's equations to analyze the propagation of EM wave in different media.

COURSE CONTENTS

UNIT-1 (8Hrs)

Vector Analysis: Scalars & vectors, Vector Algebra, the Cartesian coordinate system, vector components & unit vectors, vector field, Dot product & cross product, circular coordinate system, cylindrical coordinate system, spherical coordinate system.

Coulomb's Law and Electric Field Intensity: The Experimental law of Coulomb, Electric Field Intensity, and Field due to continuous Volume charge distribution, Field of a line charge, field of a sheet charge.

Electric Flux density, Gauss's Law & Divergence: Electric Flux density, Gauss Law, Applications of Gauss' Law: Differential Volume Element, Divergence, Maxwell's First Equation (Electrostatics), The vector operator DEL and Divergence Theorem.

Text 1: Ch 1.1, 1.2,1.3,1.4,1.5,1.6,1.71.8,1.9, Ch 2.2.1 to 2.5, Ch 3.3.1, 3.2, 3.3, 3.4, 3.5, 3.6, 3.7

UNIT-2 (8 Hrs)

Energy and Potential: Energy & potential in a moving point charge in an Electric Field, The Line Integral, |Definition of potential difference & potential, The potential field of a point charge, The potential field of a system of charges: conservative property, Potential Gradient, The Dipole, Energy density in the Electric Field.

Conductors, Dielectrics and Potential: Current & current density, continuity of current, metallic conductors, conductor properties & boundary conditions. The method of images, Semiconductors, Nature of Dielectric materials, Boundary conditions for perfect dielectric materials, Capacitance, several capacitance examples, capacitance of a two-wire line.

Poisson's and Laplace Equations: Poisson's & Laplace Equations, Uniqueness theorem, Examples of the solutions of Laplace's equation & Poisson's equation.

Text 1: Ch 4. 4.1, 4.2, 4.3, 4.4, 4.5, 4.6, 4.7, 4.8, Ch 5. 5.1, 5.2, 5.3, 5.4, 5.5, 5.6, Ch 7- 7.1, 7.2, 7.3, 7.4

UNIT-3 (8 Hrs)

The Steady Magnetic Field: Biot-Savart Law, Ampere's Circuital Law, Curl, Stokes' Theorem, Magnetic Flux & Magnetic Flux density, The Scalar & Vector magnetic potentials, Derivation of steady magnetic field Laws.

Magnetic Forces: Force on a moving charge, Force on a Differential current element, Force between differential Current elements, Force & Torque on a closed circuit.

Text 1: Ch 8. 8.1, 8.2, 8.3, 8.4, 8.5, 8.6, Ch 9. 9.1, 9.2, 9.3, 9.4

UNIT-4 (8Hrs)

Time- varying fields & Maxwell's Equations: Faraday's Law, Displacement current, Maxwell's equations in point form, Maxwell's equations in Integral form, The Retarded potentials.

Text-1: Ch 10. 10.1, 10.2, 10.3, 10.4, 10.5

UNIT-5 (5Hrs)

The Uniform Plane wave: Wave propagation in Free space, Wave propagation in Dielectrics, ThePoynting vector & power considerations, Propagation in good conductors: Skin Effect, Wave polarization.

Plane waves at Boundaries: Reflection of uniform plane waves at normal Incidence, Standing wave ratio, Wave reflection from multiple interfaces, Plane wave propagation in general Directions.

Text-1: Ch 12. 12.1, 12.2, 12.3, 12.4, 12.5, Ch 13. 13.1, 13.2, 13.3, 13.4

TEXT BOOKS

1. William H Hayt Jr. and John A Buck, "Engineering Electromagnetics", Tata McGraw-Hill, 6th Edition 2001.

REFERENCE BOOKS

1. John Kraus, "Electromagnetics with Applications", Tata Mc-Graw Hill, 5th Edition 1999.
2. Edward C. Jordan, "Electromagnetic waves & Radiating systems", Prentice –Hall of India / Pearson education, 2nd edition, 1968

TEACHING METHODOLOGY

- Blackboard teaching
- PowerPoint presentations (if needed)
- Regular review of students by asking questions based on topics covered in the class

COURSE ASSESEMENT METHOD

CIE:

1. Two Surprise Tests, 10 Marks each. Best of two tests will be taken.
2. Three internals, 30 Marks each will be conducted and the Average of best of two will be taken.
3. Final examination, of 100 Marks will be conducted and will be evaluated for 50 Marks.

SEE:

1. Final examination, of 100 Marks will be conducted; evaluated for 50 Marks.

CO-PO-PSO MAPPING

CO/ PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3	BT
CO1	3	3										2		2		2
CO2	3	3	1	1								2	1	2		3
CO3	3	3		2								2	1	2		3
CO4	3	3		2								2		2		3
CO5	3	3		1								2		2		3

SEMESTER: IV

ADVANCED MICROCONTROLLER

Course Code	**18EC45**	**Credits**	**04**
Hours/Week(L-T-P)	**4-0-0**	**CIE Marks**	**50**
Total Hours	**52(L)**	**SEE Marks**	**100**
Exam Hours	**03**	**Course Type**	**Core**

PRE-REQUISITES
Basic of Microcontroller (8051)

COURSE OUTCOMES

Students will be able to

1. Acquire the knowledge of an advanced microcontroller architectural features
2. Differentiate the instructions that an advanced microcontroller supports and to develop assembly level program applications.
3. Implement application programs using compatible EDA tools with associated libraries.
4. Synthesize HLL programs for interfacing the peripherals present in a microcontroller environment.
5. Analyze the interrupt events in advanced microcontroller programming.

COURSE CONTENTS

UNIT-1 (11Hrs)

ARM Cortex M3: ARM Cortex M3 Processor and ARM Family, Cortex-M3 Processor Applications, Architecture of ARM Cortex M3, Operation Modes, The built-in nested Vectored Interrupt Controller, Memory Map, The Bus Interface, The MPU, Low Power and High Energy Efficiency, Debugging Support

Text: 1.1, 1.2, 1.5, 2.1, 2.3, 2.4, 2.5, 2.6, 2.7, 2.9.1, 2.10

ARM Cortex M3 Architecture: Registers, Special Registers, Vector Tables, Stack Memory Operation, Reset Sequence

Text: 3.1, 3.2, 3.5, 3.6, 3.7

UNIT-2 (11Hrs)

ARM Cortex M3 Instruction Set: Assembly Basics, Instruction List, Instruction Descriptions, Several Useful Instructions in the Cortex M3

Text: 4.1, 4.2, 4.3, 4.4, 4.5, 4.6

ARM Cortex M3 Memory Systems: Memory System Features Overview, Memory Map, Memory Access Attributes, Memory Access Permissions, Bit-Band Operations, Unaligned Transfers, Exclusive Access, Endian Mode

Text: 5.1, 5.2, 5.3, 5.4, 5.5, 5.6

UNIT-3 (10Hrs)

ARM Cortex M3 Exceptions: Exception Types, Definition of Priorities, Vector Tables, Interrupt Inputs and Pending Behaviour, Fault Exceptions, Supervisor Call and Pendable Service Call

Text: S.1, 7.2, 7.3, 7.4, 7.5, 7.6

ARM Cortex M3 NVIC: Nested Vectored Interrupt Controller Overview, The Basic Interrupt Configuration, Example Procedures in Setting Up an Interrupt, Software Interrupts, The SYSTICK Timer

Text: 8.1, 8.2, 8.3, 8.4, 8.5, 8.6

UNIT-4 (10Hrs)

ARM Cortex M3 Programming: Overview, A Typical Development Flow, Using C, CMSIS, Using Assembly, Using Exclusive Access for Semaphores, Using Bit Band for Semaphores, Working with Bit Field Extract and Table Branch

Text: 10.1, 10.2, 10.3, 10.4, 10.5, 10.6

UNIT-5 (10Hrs)

ARM Cortex M3 MPU and Other Features: MPU Registers, Power Management, Multiprocessor Communication, Self-Reset Control

Text: 13.2, 14.2, 14.3, 14.4

ARM Cortex M3 Debug Architecture: Debugging Features Overview, Core Sight Overview, Debug Modes, Debugging Events, Text: 15.1, 15.2, 15.3, 15.4

TEXT BOOK

1. Joseph Yiu, "The Definitive Guide to the ARM Cortex-M3, Newnes, (Elsevier), 2008

REFERENCE BOOK

1. David Patterson and John L. Hennessey, "Computer Organization and Design", (ARM Edition), Morgan Kauffman.

TEACHING METHODOLOGY

- Blackboard teaching
- PowerPoint presentations (if needed)
- Regular review of students by asking questions based on topics covered in the class

COURSE ASSESSEMENT METHOD

CIE:

- Two Surprise Tests, 10 Marks each. Best of two tests will be taken.
- Assignment/course project-based test. 10 Marks each. Best of two tests will be taken.
- Three internals, 30 Marks each will be conducted and the Average of best of two will be taken.

SEE:

Final examination, of 100 Marks will be conducted and will be evaluated for 50 Marks.

CO-PO-PSO MAPPING

CO/ PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO 11	PO 12	PSO 1	PSO 2	PSO 3	BL
CO1	3			1		1	1					1	3	1		2
CO2	3	2	1	1								2	2	2	1	2
CO3	3	2	3	2	3				2	1	1	2	2	3	1	3
CO4	3	3	3	3	3				2	1	1	2	3	3		3
CO5	3	3		1	3							1	1	1		4

SEMESTER: IV

DSD USING VERILOG

Course Code	**18EC46**	**Credits**	**03**
Hours/Week(L-T-P)	**3-0-0**	**CIE Marks**	**50**
Total Hours	**39(L)**	**SEE Marks**	**50**
Exam Hours	**03**	**Course Type**	**Core**

PRE-REQUISITES
1. Digital Electronics

COURSE OUTCOMES
1. Students will be able to relate the basic concepts of Verilog HDL. 2. Students will be able to familiarize with the different levels of abstraction in Verilog using different modelling styles. 3. Students will be able to build and translate different combinational and sequential circuits into Verilog HDL code 4. Students will be able to construct, compile and execute Verilog HDL programs using provided software tools 5. Students will be able to design digital components and circuits that are testable, reusable and synthesizable.

COURSE CONTENTS
UNIT-1 (8Hrs)
Design Concepts: Digital Hardware, the design Process, Design of Digital Hardware, Introduction to CAD tools, standard chips, Programmable Logic Devices, Custom Chips and Gate arrays, Introduction to Verilog, What is Verilog HDL, History, Major capabilities. **Text 1**:1.1, 1.2, 1.3, 2.9, 3.5, 3.6, 3.7 **Text 2**:1.1, 1.2.1.3
UNIT-2 (7Hrs)
Language Elements & Modules and ports: Identifiers, comments, format, compiler directives, value set, data types, parameters modules and ports **Text2**: 3.1-3.8 **Text3**:4.1,4.2
UNIT-3 (8Hrs)
Gate Level Modelling and Data Flow Modelling: Gate types, Gate delays, Continuous assignments, Delays, Expressions, Operators and Operands, Operator types, Examples. **Text3**:5.1-5.3, 6.1-6.6
UNIT-4 (8 Hrs)
Behavioral Modelling and UDP: Structured Procedures, Procedural assignments, Timing controls, Conditional statements, multi-way branching, Loops, Sequential and Parallel Blocks, Examples, UDP Basics, Combinational UDPs, Sequential UDPs, UDP Table shorthand symbols, Guidelines for UDP designs **Text3**: 7.1-7.7,7.9, 12.1-12.5
UNIT-5 (7 Hrs)

Tasks and Functions, Useful Modelling Techniques and Examples: Difference between task-functions, Tasks, Functions, Procedural continues assignments, Overriding assignments, overriding parameters, conditional compilation and execution, timescales, Modelling simple elements, delays, Truth-table, conditional operations, synchronous logic,state machines and examples.

Text 3:8.1-8.3,9.1-9.4 , Text2:12.1-12.17

TEXT BOOKS

1. Stephen Brown, ZvonkoVransic," Fundamentals of digital logic with verilog Design", TMH 2nd Edition.
2. J. Bhasker," A verilog HDL Primer" BS Publications,2nd Edition.
3. Samir Palnitkar, "Verilog HDL-A Guide to digital design and synthesis", 2nd Edition, Pearson education. 2003

REFERENCE BOOKS

1. NazeihM.Botros, "HDL Programming (VHDL & Verilog)", John Weily - India & Thomson Learning, 2006

TEACHING METHODOLOGY

- Blackboard teaching
- PowerPoint presentations (if needed)
- Regular review of students by asking questions based on topics covered in the class

COURSE ASSESSEMENT METHOD

CIE:

- Two Surprise Tests, 10 Marks each. Best of two tests will be taken.
- Three internals, 30 Marks each will be conducted and the Average of best of two will be taken.

SEE:

- Final examination, of 100 Marks will be conducted and will be evaluated for 50 Marks.

CO-PO-PSO MAPPING

CO/ PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3	BT
CO1	3		1										3			2
CO2	3		1		2				2			2	3			2
CO3	3	2	2		3				2	2		2	3		1	3
CO4	3	3	3	2	3				2	2		2	3		1	3
CO5	3	3	3	3	3				2	2		2	3		1	4

SEMESTER: IV

DSD USING VERILOG LAB

Course Code	**18ECL47**	**Credits**	**01**
Hours/Week(L-T-P)	**0-0-2**	**CIE Marks**	**50**
Total Hours	**26(P)**	**SEE Marks**	**50**
Exam Hours	**03**	**Course Type**	**Core Lab**

PRE-REQUISITES

- Digital Electronics

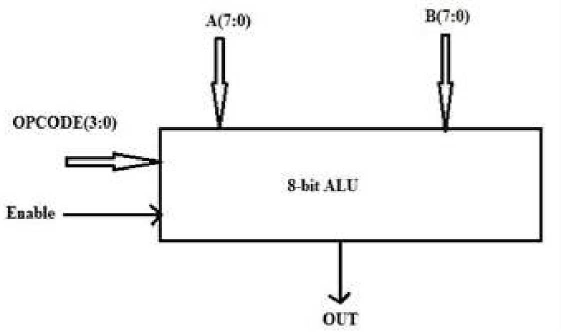
COURSE OUTCOMES

After the completion of the course, Students will be able to

1. Familiarize with EDA tools for simulation, verification and synthesis of digital design.
2. Simulate Combinational circuits in Dataflow, Behavioral and Gate level Abstraction using Verilog HDL code
3. Program sequential circuits like flip flops and counters in Behavioral description and obtain simulation waveforms.
4. Implement Combinational and Sequential circuits on FPGA and test the hardware.
5. Interface/Emulate the hardware to the FPGA and obtain the required output.

LIST OF EXPERIMENTS

1. Realization of logic gates using Verilog HDL code.
2. Realization of combinational designs using Verilog HDL code
   a. 2 to 4 decoders
   b. 8 to 3 (encoder without priority & with priority)
   c. 8 to 1 multiplexer
   d. 4 bit binary to gray converter and vice versa
   e. 4 bit binary to excess 3 and vice versa
   f. De-multiplexer, comparator.
3. Realize and verify the function of a Full Adder in three modelling styles using HDL code
4. Design of parallel adders using 1-bit full adder.
5. Write a model for 8/32-bit ALU using the schematic diagram shown below



5. Develop the HDL Code for the following flip-flops: SR, D, JK, and T

6. Design 4-bit binary, BCD counters (Synchronous reset and asynchronous reset) and “any sequence” counters.
7. Design and Realize an FSM for the given specification (specification in terms of State diagram, state table, problem statement)

Note: Test bench program should be written for all the above experiments

INTERFACING

1. Write HDL code to display messages on the given seven segment display and accepting Hex key pad input data.
2. Write HDL code to control speed, direction of DC and Stepper motor.
3. Write HDL code to generate different waveforms (Sine, Square, Triangle, Ramp etc.,) using DAC, change the frequency and amplitude.

CO-PO-PSO MAPPING															
CO/ PO	**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO 1**	**PSO 2**	**PSO 3**	**BT**
CO1	3		1		2				2	2		3	3			2
CO2	3	2	2		2				2	2		3	3		1	3
CO3	3	2	2		2				2	2		3	3		1	3
CO4	3	3	2	2	2				2	2		3	3	1	1	3
CO5	3	3	2	2	2				2	2		3	3	1	1	3

SEMESTER: IV

ADVANCED MICROCONTROLLER LAB

Course Code	**18ECL48**	**Credits**	**01**
Hours/Week(L-T-P)	**0-0-2**	**CIE Marks**	**50**
Total Hours	**02hrs/week**	**SEE Marks**	**50**
Exam Hours	**03**	**Course Type**	**Core Lab**

PRE-REQUISITES

- Knowledge of Digital electronics
- Knowledge of ARM cortex M3 instruction set and exposure to C programming

COURSE OUTCOMES

The students will be able to

1. Demonstrate the usage of standard tools for system development
2. Formulate programs using the assembly instructions of the processor and test using the IDE Environment
3. Analyze the working and execution of Special instructions of the processor
4. Develop Embedded C programs for Interfacing different input/output peripherals to microcontrollers.
5. Implement different communication protocols used in the design of portable device

LIST OF EXPERIMENTS

Two Parts: With Simulator and Board

A. Simulation – with ASM

1. Introduction / Overview of the IDE – Creation of Project, Editor, Compilation, Debugging / Execution (All with a sample code)

   Programming in Assembly for
2. Addition, Multiplication, calling subroutines, multiple source files, writing result(s) to RAM
3. The Execution of various special instructions of the processor (such as CMP / TST, LDRD / STRD, UBFX / SBFX, SDIV / UDIV, REV / REVH / REVSH, SXTB / SXTH / UXTB / UXTH, BFC etc.)
4. GPIOs interfacing LED and Switch
5. Timer Peripheral for demonstrating the use of interrupts
6. Mixed Programming

B. With the Board

Programming the device TM4C123GH6PM using Embedded C for

7. Controlling LED, Buzzer with SW and Timer (use of interrupt)
8. Display of text messages on LCD through UART Communication
9. Interfacing Motors- DC, Stepper
10. Generation of Sine wave through DAC using I2C interface
11. Generation of PWM signal whose duty cycle can be varied
12. The on-board Temperature Sensor
13. Special Communication Interface CAN

CO-PO-PSO MAPPING															
CO/PO	**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO 1**	**PSO 2**	**PSO 3**	**BT**
CO1	3	1	2	2	3				1	1		3	3	1		3
CO2	3	1	1	1	3				2	2		2	2	1		3
CO3	3	2	2	2	3				2	2		2	2	1		3
CO4	3	3	3	3	3				3	3		3	3	2		3
CO5	3	3	3	3	3				3	3		3	3	3		3

V SEMESTER

SEMESTER: V			
CONTROL SYSTEMS			
Course Code	**18EC51**	**Credits**	**4**
Hours/Week(L-T-P-S)	**3-2-0**	**CIE Marks**	**50**
Total Hours	**39(L)+26(T)**	**SEE Marks**	**50**
Exam Hours	**03**	**Course Type**	**Core**

COURSE OUTCOMES

At the end of the course, the students will be able to

1. Interpret the mathematical model of mechanical, electrical and electromechanical systems
2. Formulate transfer function for a given control system using block diagram reduction techniques and signal flow graph method.
3. Determine the time response specifications of first and second order systems by using standard test signals
4. Analyze the overall performance and stability of the control system using time domain and frequency domain approaches.
5. Anayze and interpret all the stability concepts using MATLAB tool

COURSE CONTENTS

UNIT-1 (08Hrs)

Introduction to Control Systems: Types of Control Systems, Effect of Feedback Systems, Differential equation of Physical Systems – Mechanical Systems, Electrical Systems, Analogous Systems. Block diagrams and signal flow graphs: Transfer functions, Block diagram algebra and Signal Flow graphs.

Introduction to MATLAB/Simulink for control system. Implementation of block diagram and signal flow diagram using MATLAB/Simulink.

Text Book T1: Chapter 1: 1.1,1.3,1.5,1.6 , Chapter 2: 2.1,2.2,2.4,2.5,2.6,2.7

Text Book T2: Chapter 3

UNIT-2 (07Hrs)

Time Response of feedback control systems: Standard test signals, Unit step response of First and Second order Systems. Time response specifications, Time response specifications of second order systems, steady state errors and error constants.

Analysis of second order system using MATLAB/ Simulink

Text Book T1: Chapter 5:5.1,5.2,5.3,5.4,5.5

Text Book T2: Chapter 3

UNIT-3 (08Hrs)

Stability analysis: Concept of stability, necessary conditions for Stability, Routh- stability criterion, Relative stability criterion

Root-Locus Techniques: Root locus concepts, Construction of root loci, Stability of System.

Time domain analysis of Root Locus plot exercises using MATLAB/Simulink

Text Book T1: Chapter 6:6.1,6.2,6.3,6.4,6.5 Chapter 7:7.1,7.2,7.3

Text Book T2: Chapter 3

UNIT-4 (08Hrs)

Frequency domain analysis and stability: Introduction to Polar Plots, Mathematical preliminaries, Nyquist Stability criterion, Nyquist plots.

Text Book T1: Chapter 8: 8.1,8.3, Chapter 9: 9.1,9.2,9.3
Text Book T2: Chapter 3

UNIT-5 (08Hrs)

Frequency domain analysis and stability using Bode plots: Correlation between time and frequency response, Bode Plots, Experimental determination of transfer function.

Analysis of Bode plots exercises using MATLAB/Simulink
Text Book T1: Chapter 8: 8.2,8.4,8.5,8.6,8.7
Text Book T2:Chapter 3

TEXT BOOKS

1. J.NagarathandMGopa1,"ControlSystemsEngineering",NewAgeInternational(p)LimitedPublishers, 5th Edition- 2005,ISBN:81-224-2008-7
2. Analysis and design of Control system using MATLAB by Rao V Dukkipati, New Age international (p) Limited Publishers,2006 Publication.

REFERENCE BOOKS

1. K.Ogata,"Modem Control Engineering" Pearson .Education Asia I PHI, 4th Edition, 2002.
2. K.ChannaVenkatesh and D. Ganesh Rao, "Control Systems", Sanguine Technical Publishers.
3. Chi-Tsong Chen, "Analog and Digital Control System Design Transfer-Function, State-Space, and Algebraic Methods", OUP, 2006

TEACHING METHODOLOGY

- Blackboard teaching
- PowerPoint presentations (If needed)
- Regular review of students by asking questions based on topics covered in the class

COURSE ASSESSEMENT METHOD

CIE:

1. Tutorial/MATLAB based assignments/Miniproject - 10Marks
2. Surprise Tests/Assignments -10Marks.
3. Three mid examinations, 30 Marks each will be conducted and the Average of best of two will be taken.

SEE:

1. Two Questions are to be set from each unit, carrying 20 Marks each.
2. Students have to answer 5 questions selecting one full question from each unit

CO-PO-PSO MAPPING

CO/ PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3	B T
CO1	3	2											2		1	2
CO2	3	2											2		1	2
CO3	3	3	2	2	2							1	2		1	3
CO4	3	3	2	2	2							1	2	2	2	3
CO5	3	3	2	2	2							1	2	2	2	3

SEMESTER: V

COMMUNICATION SYSTEM - I

Course Code:	**18EC52**	**Credits**	**03**
Hours/Week(L-T-P)	**3-0-0**	**CIE Marks**	**50**
Total Hours:	**39(L)**	**SEE Marks**	**50**
Exam Hours:	**03**	**Course Type**	**Core**

PRE-REQUISITES

1. Fundamentals of Signals and Systems.
2. Basics of probability, Fourier transform

COURSE OUTCOMES

Students will be able to :

1. Illustrate the fundamentals of basic communication system, random process and types of noise and its effect on communication system.
2. Apply concepts of Random process to the communication systems.
3. Analyze various methods of baseband analog transmission and detection in time domain and frequency domain.
4. Analyze the performance of communication system in the presence of noise.
5. Emphasize on fundamentals of digital transmission techniques.

COURSE CONTENTS

UNIT-1 (11Hrs)

Introduction: Elements of communication system, Limitations and resources of communication system
Random process: Mean, Correlation and Covariance function: Power Spectral Density, Principles of autocorrelation function, cross –correlation functions. Properties of Gaussian process.
Noise: Introduction, shot noise, thermal noise, white noise, Noise equivalent bandwidth **Noise in Continuous wave modulation systems:** Introduction, AM Receiver model
Text 1: Ch.1: 1.4,1.6Ch 8: 8.5,8.7,8.9,8.10,8.12 Ch9: 9.1,9.2
Text2: Ch1 : 1.9,1.10

UNIT-2 (11Hrs)

Amplitude Modulation: Introduction to AM: Time-Domain description, Frequency – Domain description. Generation of AM wave: Square Law Modulator, switching modulator. Detection of AM waves: envelope detector.
Double side band suppressed carrier modulation (DSBSC): Time-Domain description, Frequency-Domain representation, Generation of DSBSC waves: Balanced Modulator, ring modulator. Coherent detection of DSBSC modulated waves. Costas loop. Quadrature carrier multiplexing, Noise in DSB-SC receivers
Text 1: Ch 7: 7.1,7.2,7.3 Ch9:9.3

UNIT-3 (10Hrs)

Single Side-Band Modulation (SSB): Hilbert transform, properties of Hilbert transform, Pre-envelope, Canonical representation of band pass signals.Single side-band modulation, Frequency-Domain description of SSB wave, Time-

Domain description. Phase discrimination method for generating an SSB modulated wave. Demodulation of SSB waves. Noise in SSB receivers

Vestigial Side-Band Modulation (VSB): Frequency – Domain description, Time - Domain description, Comparison of amplitude modulation techniques, Frequency translation, Frequency division multiplexing. Application: AM radio.

Text 1: Ch. 7: 7.4, 7.5,7.6,7.7,7.8,7.9 Ch9: 9.3

UNIT-4 (10Hrs)

Angle Modulation (FM): Basic definitions, FM, narrow band FM, wide band FM, transmission bandwidth of FM waves, generation of FM waves: indirect FM and direct FM.

Demodulation of FM waves: Phase-locked loop, Nonlinear model of the phase – locked loop, Linear model of the phase – locked loop, Nonlinear effects in FM systems

Noise in FM receivers, FM threshold effect, Pre-emphasis and De-emphasis in FM

Text 1: Ch 7: 7.10,7.11,7.12. Ch9: 9.5,9.6, 9.7,9.8

UNIT-5 (10Hrs)

Pulse Modulation: Introduction, Sampling Process, Different forms of pulse modulation, Pulse Amplitude modulation, Bandwidth- noise trade-off, Quantization Process, Basic Elements Of PCM system.

Text 2: Ch 3- 3.1,3.2,3.3.,3.4,3.5,3.6,3.7

TEXT BOOKS

1.. Simon Haykins, An Introduction to Analog and Digital Communication, John Wiley, 2003

2. Simon Haykin, Communication Systems ,4th Edition, John Wiley

REFERENCE BOOKS

1. B.P.Lathi, Modern digital and analog Communication systems 3rd ed 2005 Oxford university press.
2. Harold P.E, Stern Samy and A Mahmond, Communication Systems, Pearson Edn, 2004
3. Singh and Sapre**:** Communication systems: Analog and digital TMH 2nd , Ed 2007

TEACHING METHODOLOGY

- Blackboard teaching
- PowerPoint presentations (If needed)
- Regular review of students by asking questions/conducting quiz based on topics covered in the class

COURSE ASSESEMENT METHOD

CIE:

1. Assignment- 10 Marks
2. Surprise tests - 10Marks.
3. Three mid examinations, 30 Marks each will be conducted and the Average of best of two will be taken.

SEE:

1. Two Questions are to be set from each unit, carrying 20 Marks each.
2. Students have to answer 5 questions selecting one full question from each unit

CO-PO-PSO MAPPING

CO/ PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3	BT
CO1	3	3	2	1		1						2		3	2	2
CO2	3	3	2	1								2		3	2	3
CO3	3	2	3	2		1						2	1	3	2	3
CO4	3	2	3	2		2	1					**2**	1	3	1	3
CO5	2	1	2	1								**2**	1	3	3	2

SEMESTER: V			
FUNDAMENTALS OF VLSI DESIGN			
Course Code:	**18EC53**	**Credits**	**03**
Hours/Week(L-T-P)	**3-0-0**	**CIE Marks**	**50**
Total Hours	**39(L)**	**SEE Marks**	**50**
Exam Hours	**03**	**Course Type**	**Core**

PRE-REQUISITES
Analog Electronic Circuits, Digital Electronics, Basics of Op-amp

COURSE OUTCOMES
Students will be able to
1. **Analyze** basic operation of MOSFETs.
2. **Characterize** and model MOSFETs using delay Models and parasitic parameters
3. **Design** combinational circuits at the MOSFET level for given specifications/functionality
4. **Design** sequential circuits at the MOSFET level for given specifications/functionality
5. **Analyze** basic physical design concepts employed in standard physical design techniques.

COURSE CONTENTS
UNIT-1 (11 Hrs)
Introduction: VLSI Design Flow, CMOS logic, CMOS Fabrication and Layout. **MOS Transistor Theory:** Introduction, Ideal I-V Characteristics**,** Simple MOS Capacitance Models, Non-ideal Effects, Velocity Saturation and Mobility Degradation, Channel Length Modulation, Body Effect, DC Transfer Characteristics, Complementary CMOS Inverter DC Characteristics, Beta Ratio Effects, Noise Margin. **Text 1: 1.4, 1.5, 1.6, 2.1, 2.2, 2.3.1, 2.4.1, 2.4.2, 2.4.3 , 2.5.1, 2.5.2, 2.5.3**
UNIT-2 (11 Hrs)
Circuit Characterization and Performance Estimation: Complementary: Introduction, Delay Estimation, Logical Effort and Transistor Sizing, Power Dissipation, Interconnect, Design Margin **Text 1: 4.1, 4.2, 4.3, 4.4, 4.5, 4.6**
UNIT-3 (10 Hrs)
Combinational Circuit Design: Introduction, Circuit families, Static Families, Ratioed Circuits, Cascode Voltage Switch Logic, Dynamic Circuits, Pass Transistor Circuits, BiCMOS Circuits, Other Circuit families, Comparison of Circuit Families **Text 1: 6.1, 6.2, 6.3.3, 6.3.4, 6.5**
UNIT-4 (10 Hrs)
Sequential Circuit Design: Introduction, Sequencing Static Circuits, Conventional CMOS Latches, Conventional CMOS Filp –flops, Datapath Subsystems, Single Bit Adder **Text 1: 7.1, 7.2, 7.3.1, 7.3.2, 8.1, 8.2.1**
UNIT-5 (10 Hrs)

Basics of Physical Design: Concepts of Full Custom Design and Semi-Custom Design Libraries, Standard Cells, Transistor sizing, Input-Output Pads, Library Characterization, Concepts of Floor planning, Power planning, Concepts of Placement and Routing. **Text 2: Chapter 1, 2.1, 3.1, 4.1**

TEXT BOOKS

1. Neil H. E. Weste, David Harris and Ayan Banerjee "CMOS VLSI Design", A Circuits and Systems Perspective," Pearson Education (Asia) Pvt. Ltd, 3rd Edition.
2. Khosrow Golshan, "Physical Design Essentials", An ASIC Design Implementation Perspective, Springer Publication

REFERENCE BOOKS

1. M. K. Achuthan and K. N. Bhat, "Fundamentals of Semiconductor Devices", Tata McGraw-Hill Publishing Company Limited, New Delhi, 2007.
2. Sung-Mo Kang & Yusuf Leblebici, "CMOS Digital Integrated Circuits: Analysis and Design", 3rd Edition, Tata McGraw-Hill Publishing Company Ltd., New Delhi, 2007.

TEACHING METHODOLOGY

- Blackboard teaching
- PowerPoint presentations (If needed)
- Regular review of students by asking questions based on topics covered in the class

COURSE ASSESSEMENT METHOD

CIE:

1. Tutorials - 10 Marks
2. Surprise tests - 10Marks.
3. Three mid examinations, 30 Marks each will be conducted and the Average of best of two will be taken.

SEE:

1. Two Questions are to be set from each unit, carrying 20 Marks each.
2. Students have to answer 5 questions selecting one full question from each unit

CO-PO-PSO MAPPING

CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3	BL
CO1	3	2	2									3	3			2
CO2	3	2	2	2	3							3	3			2
CO3	3	3	2	3								3	3			3
CO4	3	3	2	3	3							3	3			3
CO5	1	1	2									3	3			2

SEMESTER: V

DATA STRUCTURES USING C++

Course Code:	**18EC54**	**Credits**	**03**
Hours/Week(L-T-P)	**3-2-0**	**CIE Marks**	**50**
Total Hours	**39(L)**	**SEE Marks**	**50**
Exam Hours	**03**	**Course Type**	**Core**

PRE-REQUISITES

- Satisfactory completion and understanding of C programming

COURSE OUTCOMES

Students will be able to:

1. **Interpret** the various phases associated with the development of a system
2. **Analyze** the OOPs paradigm through different C++ language examples
3. **Analyze** the operations of Linear Data structures: Stack, Queue and Linked List and their applications
4. **Apply** the basics of data processing approaches like hashing and sorting for solving computing problems
5. **Apply** concepts of Data Structures using C++ for designing algorithms

COURSE CONTENTS

UNIT-1 (8 Hrs)

Overview: System Life Cycle
Chapter 1: 1.1,

Object-Oriented Design, Data Abstraction and Encapsulation, Basics of C++: Program Organization in C++, Scope in C++, C++ Statements and Operators, Data Declarations in C++, Comments in C++, Input / Output in C++, Functions in C++, Parameter Passing in C++, Function Name Overloading in C++. Classes and Objects, Inline Functions, Dynamic Memory Allocation in C++, Exceptions, STL, ADT and the C++ Class
Chapter 1: 1.2 (1.2.1 to 1.2.3), 1.3, 1.4 (1.4.1 to 1.4.12), 1.6

UNIT-2 (8 Hrs)

Array as an Abstract Data Type, Representation of Arrays, String Abstract Data Type, String Pattern Matching: A Simple Algorithm
Chapter 2: 2.1 (2.1.1 to 2.1.6), 2.2, 2.5, 2.6 (2.6 and 2.6.1)

Templates in C++, Template Functions, Using Templates to Represent Container Classes, The Stack and Abstract Data Type, The Queue Abstract Data Type, Subtyping and Inheritance in C++,
Evaluation of Expressions, Expressions, Postfix Notation, Infix Notation
Chapter 3: 3.1 to 3.4, 3.6

UNIT-3 (8 Hrs)

Singly Linked Lists and Chains, Representing Chains in C++, defining a Node in C++, Designing a Chain Class in C++, Pointer Manipulation in C++, Chain Manipulation Operations

The Template Chain Class, Implementing Chain with Templates, Chain Integrators, Chain Operations, Reusing a class, Circular Lists, Available Space Lists, Linked Stacks and Queues, Doubly Linked Lists

Chapter 4: 4.1, 4.2 (4.2.1 to 4.2.4), 4.3 (4.3.1 to 4.3.4), 4.4, 4.5, 4.6, 4.10

UNIT-4 (8 Hrs)

TREES: Introduction: Terminology, Representation of Trees, Binary Trees: ADT, Properties of Binary Tree, Binary Tree Representations,

Binary Tree Traversal and Tree Iterators: Introduction, In order, Preorder, Post order Traversal, Iterative In order Traversal, Level Order Traversal, Traversal without stack,

Heaps: Priority Queues, Definition of Max Heap, Insertion and Deletion from Max Heap, Binary Search Trees

Chapter 5: 5.1 (5.1.1 to 5.1.2), 5.2 (5.2.1 to 5.2.2), 5.3 (5.3.1 to 5.3.7, 5.6 (5.6.1 to 5.6.4), 5.7 (5.7.1 to 5.7.6)

UNIT-5 (7 Hrs)

SORTING AND HASHING:

Motivation, Insertion Sort, Quick Sort, How Fast Can We Sort? Merge Sort: Merging, Iterative Merge Sort, Recursive Merge Sort, Heap Sort

Introduction to Hashing, Static Hashing: Hash Tables, Hash Functions, Secure Hash Functions, Overflow Handling, Theoretical Evaluation of Overflow Techniques, Dynamic Hashing: Motivation, Dynamic Hashing using Directories, Directory less Dynamic Hashing

Chapter 7, 8: 7.1, 7.2, 7.3, 7.4, 7.5 (7.5.1 to 7.5.3), 7.6, 8.1, 8.2 (8.2.1 to 8.2.5), 8.3 (8.3.1 to 8.3.3)

TEXT BOOKS

Text Books:

- Horowitz, Sahni, Mehta: Fundamentals of Data Structures in C++, 2nd Edition, Pearson Education, 2013

REFERENCE BOOKS

1. Object Oriented Programming with C++, E.Balaguruswamy, TMH, 6th Edition, 2013.
2. Mark Allen Weiss: Data Structures and Algorithm Analysis in C++, 3rd Edition, Pearson Education
3. Yedidyah, Augenstein, Tannenbaum: Data Structures Using C and C++, 2nd Edition, Universities Press, 2003
4. Sahni: Data Structures, Algorithms and Applications in C++, 2nd Edition, McGraw Hill
5. W. Savitech: “Problem Solving with C++, The OOP, Fourth Edition, Pearson Education

TEACHING METHODOLOGY

- Blackboard teaching and PowerPoint presentations (If needed)
- Programming Examples using C++
- Regular review of students by asking questions based on topics covered in the class

COURSE ASSESEMENT METHOD

CIE:

1. Tutorials (hands on programming) - 20 Marks
2. Three mid examinations, 30 Marks each will be conducted and the Average of best of two will be taken.

SEE:

1. Two Questions are to be set from each unit, carrying 20 Marks each.
2. Students have to answer 5 questions selecting one full question from each unit

CO-PO-PSO MAPPING

CO/PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3	BT
CO1	2	1	2	1	1				2					1	1	2
CO2	2	3	1	1	3				2	2				1		3
CO3	3	3	3	3	3	1			2	2		3		2	2	3
CO4	3	3	3	3	3	1			2	2		3		2	2	3

CO5	3	3	3	3	3			1	2	3		3		2	2	3

SEMESTER: V

MICROWAVE AND RADIATING SYSTEMS

Course Code	**18EC55**	**Credits**	**03**
Hours/Week(L-T-P)	**3-0-0**	**CIE Marks**	**50**
Total Hours	**39(L)**	**SEE Marks**	**50**
Exam Hours	**03**	**Course Type**	**Core**

PRE-REQUISITES

- Basics of Signals and Systems
- Basics of Field Theory

COURSE OUTCOMES

1. Students will be able to model a transmission line and analyze the different performance parameters associated with them.
2. Students will be able to analyze the wave propagation inside a waveguide and develop a suitable equation for Electric and magnetic fields and design a suitable impedance matching scheme.
3. Analyze and study the s parameters associated with different types of microwave passive devices and their performance parameters.
4. Study and analyze the fundamental parameters associated with antennas and will be able to plot the radiation pattern for basic wire antennas of different lengths and evaluate their Electric and magnetic fields.
5. Design and analyze the construction and performance of different types of antennas and apply them for realtime applications.

COURSE CONTENTS

UNIT-1 (11 Hrs)

Microwave transmission lines: Introduction, transmission lines equations and solutions, reflection and transmission coefficients, standing waves and SWR, line impedance and line admittance, Microwave coaxial connectors.

Text 1**:** *Ch 3.3.1, 3.2, 3.3, 3.4, 3.7*

UNIT-2 (11 Hrs)

Microwave waveguides and Smith Chart: Rectangular waveguides: Solutions of wave equations in rectangular co-ordinates, TE modes in rectangular waveguides.

Smith chart: Introduction to Smith chart, A valuable Graphical aid, Derivation of Smith chart. Smith chart's Circular scales, Smith Chart's Radial scales. Applications of Smith chart: Input impedance determination using a known load, Input impedance determination using input Reflection Coefficient, Determination of Admittance from impedance, Determination of value and location of Zmax and Zmin from a known load, Single stub matching.

Text 1:Ch4: 4.0,4.1.1,4.1.2 ,4.1.3

Text 2: Ch. 9: 9.1, 9.2, 9.3,9.5,9.6 ;Ch10: 10.2.1, 10.2.2, 10.2.3, 10.2.4, 10.2.5 ;Ch. 11: 11.6.3

UNIT-3 (10 Hrs)

Circuit Representations of Two port RF/Microwave Networks Introduction, Low Frequencyparameters, High Frequency parameters, Properties of S parameters, Shifting Reference planes, Generalized scattering parameters. Passive devices: Attenuators, Waveguide Tees, Magic tees, Hybrid rings, waveguide corners, Bends and Twists.

Microwave components: Directional couplers: Two hole directional coupler, S matrix of a directional coupler, Circulators and Isolators.

Simulation of passive devices using HFSS, Matlab

Text 2: Ch. 3. 3.1, 3.2, 3.3, 3.4 ; Ch. 8 8.1,8.2,8.3,8.4,8.5,8.6

Text 1: Ch4. 4.4,4.5,4.6

UNIT-4 (10 Hrs)

Antenna Basics: Introduction, **antenna radiation mechanism**, basic Antenna parameters, patterns, beam area, radiation intensity, beam efficiency, directivity and gain, antenna apertures, effective height**, bandwidth, radiation efficiency,** antenna temperature and antenna field zones.

Wire Antennas: Electric dipoles: Introduction, short electric dipole (fields, **power density, power radiated, directivity,** and radiation resistance), Half wave dipoles (field: qualitative analysis **power density, power radiated, directivity**, radiation resistance).

Text 3: 2.1-2.10,2.13,2.19 6.1-6.6

UNIT-5 (10 Hrs)

Antenna Arrays: Introduction, ,Point sources ,Power theorem, Array of two isotropic point sources (Broad side and End fire with out of phase), N element linear array with uniform spacing and phase(Array factor), Broadside and end fire array, pattern multiplication.

Antenna Types: Folded dipole

Yagi-Uda array, parabolic reflectors(introduction, properties, field intensity ratio, feed system), log periodic antenna, Rectangular patch antenna(Introduction, features, limitations, advantages, feed methods) horn antenna (Qualitative analysis only: Construction, working). Simulation of few designs Using HFSS, Matlab

Text 3: 5.1-5.6, 5.9 (case1 and case2),5.10,5.13(case1 and case2) 6.24, 9.1,9.5,9.7,9.9,11.7, 7.19,7.20, 14.1-14.5

TEXT BOOKS

1. Liao, “Microwave Devices and circuits”,Pearson Education,2008
2. Matthew M. Radmanesh,”Radio Frequency and Microwave Electronics”, Pearson Education,2002
3. John D.Krauss, Ronald J Marhefka, Ahmad S Khan “Antennas and Wave Propagation”, McGraw- Hill International edition, IV edition, 2013**.**
4. Stutzman and Thiele, ”Antenna Theory and Design”, TMH, 3rd Ed, 2001

TEACHING METHODOLOGY

- Blackboard teaching
- PowerPoint presentations (if needed)
- Regular review of students by asking questions based on topics covered in the class

COURSE ASSESEMENT METHOD

CIE:

- Two Surprise Tests of 10 Marks each. Best of two tests will be taken.
- Tool based assignments covering the syllabus for 10 Marks
- Three internals of 30 Marks each will be conducted and the Average of best of two will be taken.

SEE:

- Final examination of 100 Marks will be conducted and will be evaluated for 50 Marks.
- Two Questions are to be set from each unit, carrying 20 Marks each.
- Students have to answer 5 questions selecting one full question from each unit

CO-PO-PSO MAPPING

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	BT
CO1	3	2	-	-	-						-	-	3	3	1	2
CO2	3	2	2	1	-	-	2	-	-	2	-	1	3	3	2	4
CO3	3	3	2	2	-	-	2	-	-	2	-	1	2	3	2	3
CO4	3	3	3	3	-	-	2	-	-	2	-	1	2	3	1	3
CO5	3	2	2	3	1	2	2	-	-	-	-		3	3	1	4

PROGRAM ELECTIVE – 1

SEMESTER: V

DIGITAL IMAGE PROCESSING

Course Code	**18ECE561**	**Credits**	**03**
Hours/Week(L-T-P)	**4-0-0**	**CIE Marks**	**50**
Total Hours	**39(L)**	**SEE Marks**	**50**
Exam Hours	**03**	**Course Type**	**Program Elective**

PRE-REQUISITES

- Digital Signal Processing
- Engineering Mathematics (Linear Algebra, Probability Theory)

COURSE OUTCOMES

At the end of the course students should be able to: ·

1. Interpret the basics of mathematical concepts to understand image processing algorithms
2. Interpret image formation and the role human visual system plays in perception of gray and color image data.·
3. Design image analysis techniques in the form of image segmentation, image enhancement techniques and morphological Image processing
4. Apply image processing techniques in both the spatial and frequency (Fourier)domains.
5. Analyze the output for the various image processing blocks for the given input image

COURSE CONTENTS

UNIT-1 (8 Hrs)

Digital Image Fundamentals

What is Digital Image Processing? Origins of Digital Image Processing, Examples of fields that use DIP, Fundamental Steps in Digital Image Processing, Components of an Image Processing System, Elements of Visual Perception, Image Sensing and Acquisition, Image Sampling and Quantization, Some Basic Relationships Between Pixels, Linear and Nonlinear Operations

Text 1: 1.1 – 1.5, 2.1, 2.3-2.5, 2.6.2

UNIT-2 (8 Hrs)

Image transforms

Introduction, Two dimensional Orthogonal and Unitary transforms, Properties of Unitary transforms, 2-Dimensional DFT, Discrete Cosine Transform (DCT), Discrete Sine transform (DST), Hadamard transform, Haar transform, Slant transform, KL Transform,

Text 2: 5.1-5.3, 5.5-5.11

UNIT-3 (8 Hrs)

Image enhancement

Spatial Domain: Some Basic Intensity Transformation Functions, Histogram Processing, Fundamentals of Spatial

Filtering, Smoothing Spatial Filters, Sharpening Spatial Filters

Frequency Domain: Basics of Filtering in the Frequency Domain, Image Smoothing using frequency domain filters, Image Sharpening Using Frequency Domain Filters, selective filters

Text 1: 3.2-3.6, 4.7-4.10

UNIT-4 (8 Hrs)

Image Restoration and Color Image Processing

Image Restoration: Noise models, Restoration in the Presence of Noise only - Spatial Filtering, Periodic noise reduction by Frequency Domain Filtering, Linear Position-Invariant Degradations, Estimating the Degradation Function, Inverse Filtering, Minimum Mean Square Error (Wiener) Filtering and Constrained Least Squares Filtering

Color Image Processing: Color Fundamentals, Color Models, Pseudo color Image Processing

Text 1: 5.2-5.9, 6.1-6.3

UNIT-5 (7 Hrs)

Morphological Image Processing and Image segmentation

Morphological Image Processing: Preliminaries, Erosion and Dilation, Opening and Closing, the Hit-or- Miss Transforms, Some Basic Morphological Algorithms

Image Segmentation: Fundamentals, point line and edge detection**,** Thresholding, Region-Based Segmentation

Text 1: 9.1-9.5, 10.1-10.4

TEXT BOOKS

Text Book:

1. Digital Image Processing- Rafael C Gonzalez and Richard E. Woods, PHI 3rd Edition, 2010. Fundamentals of Digital Image Processing-A. K. Jain, Pearson 2004.

REFERENCE BOOKS

Reference Books:

1. Digital Image Processing- S.Jayaraman, S.Esakkirajan, T.Veerakumar, Tata McGraw Hill 2014.

TEACHING METHODOLOGY

- Blackboard teaching
- PowerPoint presentations (If needed)
- Regular review of students by asking questions based on topics covered in the class

COURSE ASSESSEMENT METHOD

CIE:

1. Mini Project (Groupwise) - 10Marks
2. Surprise tests -10Marks.
3. Three mid examinations, 30 Marks each will be conducted and the Average of best of two will be taken.

SEE:

1. Two Questions are to be set from each unit, carrying 20 Marks each. Students have to answer 5 questions selecting one full question from each unit

CO-PO-PSO MAPPING

CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3	B T
CO1	3	2	1		2				2			1		1	3	**2**
CO2	3											1			3	**2**
CO3	3	2	1		2				2			1		1	3	**3**
CO4	3	2	1		2				2			1		1	3	**3**
CO5	3	2	1		2				2			**1**		1	3	**3**

SEMESTER: V

ARTIFICIAL NEURAL NETWORKS

Course Code	**18ECE562**	**Credits**	**03**
Hours/Week (L-T-P)	**4-0-0**	**CIE Marks**	**50**
Total Hours	**39 (L)**	**SEE Marks**	**50**
Exam Hours	**03**	**Course Type**	**Program Elective**

COURSE OUTCOMES

CO1: Explain the basic models of ANN

CO2: Demonstrate the basic learning schemes for supervised and unsupervised systems

CO3: Illustrate afew Algorithms in Single/Multi-layer Feed-forward ANN

CO4: Design Single/Multi-layer Feed-forward ANN

CO5: Work in teams to Implement/Simulate applications of CNN

COURSE CONTENTS

UNIT-1 (11 Hrs)

Introduction: What is a neural network? Human brain; models of a neuron; neural networks as directed graphs; feedback; network architectures; knowledge representation.

Learning Processes: Error-correction learning; memory-based learning; Hebbian learning; competitive learning; Boltzmann learning; credit-assignment problem; learning with and without a teacher.

Textbook #1: 1.1-1.7, 2.1-2.9

UNIT-2 (11 Hrs)

Single-Layer Perceptron: Adaptive filtering problem; unconstrained optimization techniques; linear least-squares filters; least-mean-square algorithm; learning curves; learning rate annealing techniques, Perceptron

Textbook #1: 3.1-3.8

UNIT-3 (10 Hrs)

Multi-Layer Perceptron: Preliminaries, Back-Propagation Algorithm, XOR problem, Heuristics to make Back-Propagation Algorithm perform better

Textbook #1: 4.1-4.6

UNIT-4 (10 Hrs.)

Support Vector Machines: Optimal Hyperplane for Linearly Separable Patterns, Optimal Hyperplane for Non-separable patterns, How to Build a SVM for Pattern recognition.

Textbook #1: 6.1-6.4

UNIT-5 (10 Hrs)

Convolutional Neural Networks: Concept and Applications in Image and video.

Textbook #1:4.19, other sources from the Internet

TEXT BOOKS

1.	“Neural Networks: A Comprehensive Foundation,”S.Haykin, 2nd Ed, Prentice Hall of India, 2003.

REFERENCE BOOKS

1. “Artificial Neural Systems”, JacekZurada

TEACHING METHODOLOGY

- Blackboard teaching
- PowerPoint presentations
- Regular review of students by asking questions based on topics covered in the class

COURSE ASSESSEMENT METHOD

CIE

1. Assignment - 10 Marks
2. Surprise tests - 10Marks.
3. 3 mid-sem exams (30 Marks each) will be conducted and the Average of best two will be taken.

SEE

1. Two Questions are to be set from each unit, carrying 20 Marks each.
2. Students have to answer 5 questions selecting one full question from each unit

CO-PO-PSO MAPPING

CO/PO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**	**BT**
CO1	**2**		**1**			1	1									2
CO2	**2**	2	**1**		**1**											2
CO3	**2**	2	1		**1**	1								1	1	2
CO4		**2**	**2**	1	**1**	1								1	1	2
CO5	**3**	**2**	**2**	2	**2**				**2**	1					3	3

SEMESTER: V

FPGA ARCHITECTURE AND APPLICATIONS

Course Code:	**18ECE563**	**Credits**	**04**
Hours/Week(L-T-P)	**4-0-0-0**	**CIE Marks**	**50**
Total Hours	**52(L)**	**SEE Marks**	**50**
Exam Hours	**03**	**Course Type**	**Program Elective**

COURSE OUTCOMES

Students will be able to

1. Have a basic knowledge of FPGA Architecture and FPGA design flow
2. Get hands on experience on FPGA EDA tool.
3. Design and implementation of digital logic circuits for various applications.
4. Design and Analyze data path circuits.
5. To implement digital system on FPGA

COURSE CONTENTS

UNIT-1 (8Hrs)

Introduction to Programmable logic Device:-Logic Implementation Options, FPGA, Advantages and Disadvantages of FPGA, Technology Trends, Designing for FPGAs.

FPGA Programming Technology: SRAM Programmable FPGAs, The Xilinx XC4000 Architecture, Programming the FPGA, Software, The future, Design Applications(Counter example)

Text 1 (Chapter1:1.1 to 1.6, Chapter 2: 2.1 to 2.6)

UNIT-2 (8Hrs)

Algorithmic State Machine, Digital System Design Using ASM Chart and PAL

Design of Combinational and Sequential Circuits: Introduction to Hardware Design Language, Design of Combinational Circuits, Verilog Modeling of Sequential Circuits, Coding Organization. Writing Test bench for the Design.

Text 2 (Chapter 2: 2.16 to 2.17, Chapter 3: 3.1 to 3.4, Chapter4: 4.1 to 4.3)

UNIT-3 (8Hrs)

RTL Coding Guidelines:-Synchronous Logic, Synchronous Flip-flop, Realization of Time Delays, Elimination of Glitches Using Synchronous Circuits, Hold Time Violation in Asynchronous Circuits, RTL Coding Style.

Arithmetic Circuit Designs, Digital Pipelining, Partitioning of a Design, Signed Adder Design, Multiplier Design. Data path designing.

Text 2 (Chapter 5: 5.1 to 5.7, Chapter 10: 10.1 to 10.4)

UNIT-4 (7Hrs)

FSMD Introduction and motivation, Fixed-Point Representation, Fixed-Point Representation in 3D Graphics, Unsigned saturating Arithmetic and Fixed-Point Numbers Fixed-Point Representation, Multiplication, The *Blend* Equation, Simple Datapaths and The Blend equation, Registering datapath inputs Versus Registering Datapath outputs, Pipelined computations Versus Execution Unit Pipelining, A Blend implementation With a Single Multiplier, Recursive Calculations, Initialization Versus Computation, A design methodology For higher Complexity Datapaths.

Text3 (Chapter 3:-3.1to 3.11,3.14,3.15)

UNIT-5 (8Hrs)

Embedded Memory Usage in Finite State Machine With Datapath (FSMD) Designs: -

Introduction to Embedded memories, Sample Application: Memory Sum, First-In, First-Out Buffer(FIFO), Dual-Port memory, Synchronization.

Text3 (Chapter 3:-4.1to 4.6)

TEXT BOOKS

1. Field Programmable Gate Array Technology - S. Trimberger, Edr, 1994, Kluwer Academic Publications.
2. Digital VLSI Systems Design, S. Ramachandran, Springer, 2007
3. Finite State Machine Datapath Design, Optimization, and Implementation (Synthesis Lectures on Digital Circuits and Systems) 1st Edition, Morgan and Claypool Publishers; 1 edition (February 27, 2008)

REFERENCE BOOKS

1. Digital Design Using Field Programmable Gate Array, P.K.Chan& S. Mourad, 1994,Prentice Hall.
2. Field programmable gate array, S. Brown, R.J.Francis, J.Rose,Z.G.Vranesic, 2007, BSP.
3. Digital Systems Design Using Verilog, First Edition Charles H. Roth, Jr. The University of Texas at Austin,LizyKurian John
4. The University of Texas at AustinByeong,Kil Lee The University of Texas at San Antonio.

TEACHING METHODOLOGY

- Blackboard teaching
- PowerPoint presentations (If needed)
- Regular review of students by asking questions based on topics covered in the class

COURSE ASSESEMENT METHOD

CIE:

1. Tool based assignments (to be submitted in the form report)- 10 Marks
2. Surprise tests - 10Marks.
3. Three mid examinations, 30 Marks each will be conducted and the Average of best of two will be taken.

SEE:

1. Two Questions are to be set from each unit, carrying 20 Marks each.
2. Students have to answer 5 questions selecting one full question from each unit

CO-PO-PSO MAPPING

CO	PO1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3	BT
CO1	3	1	2	1					1			1	2			2
CO2	3	2	1	2					2			2	2		1	3
CO3	3	3	2		2					1		1	2			3
CO4	3	2			2							2	2		2	3
CO5	3	3		3	3							2			1	3

SEMESTER: V

SOLID STATE DEVICES

Course Code	**18ECE564**	**Credits**	**04**
Hours/Week(L-T-P)	**4-0-0**	**CIE Marks**	**50**
Total Hours	**52(L)**	**SEE Marks**	**50**
Exam Hours	**03**	**Course Type**	**Program Elective**

PRE-REQUISITES
Familiarity with semiconductor physics

COURSE OUTCOMES
1. Apply the knowledge of semiconductor physics to devices
2. Analyse the importance of fabrication process parameters in device working
3. Realize the faults in semiconductor devices
4. Conceptualise the working of new semiconductor devices
5. Recognise the effects of scaling in device working

COURSE CONTENTS
UNIT-1 (10 Hrs)
Junctions Diode: pn junctions (Thermal Equilibrium and the build in potential, pn junction I-V Characteristics) Handson using silvacotool: pn junction diode characteristics Text 1: 2.1.1, 2.1.2
UNIT-2 (11 Hrs)
Metal Semiconductor Barriers (Blocking contacts): Thermal equilibrium, IV characteristics **Metal Semiconductor Barriers (Non-Blocking contacts):**Tunnel contacts and Schottky ohmic contacts Hands-on using silvaco tool: Metal semiconductor junctions' study Text 1:2.2.1, 2.2.2
UNIT-3 (10 Hrs)
Field Effect Transistor: MOS Capacitor system(Flat band voltage; Accumulation, Depletion, inversion, Model for Charges in the Silicon Substrate) Handson using silvaco tool: FET characteristics Text 1:4.1.1 to 4.1.5
UNIT-4 (10 Hrs)
MOSFETs: Long channel theory, Refinements and Extensions to Long-Channel Theory, Subthreshold Conduction Text 1:4.2.1to 4.2.3
UNIT-5 (11Hrs)

The Electronic Structure of Organic Semiconductors: Introduction, What Are "Organic Semiconductors"? Historical Context, Different Organic Semiconductor Materials, Molecular Crystals, Polymer Films, Further Related Compounds, A Comment on Synthetic Approaches, Electronic States of a Molecule, Atomic Orbitals in Carbon, From Atomic Orbitals to Molecular Orbitals, From Orbitals to States, Singlet and Triplet States

Text 2: 1.1 to 1.3.4

TEXT BOOKS

1. Christo Papadopoulos, Solid State Electronic devices an introduction, Springer, ISSN 2192-479
2. Anna Kohler and Heinz Bassler, Electronic Processes in organic Semiconductor, an introduction, Wiley – VCH, ISBN: 978-3-527-33292-2

REFERENCE BOOKS

1. Streetman, Banerjee, Solid State Devices, Pearson , 7th Edition
2. Jasprit Singh, Solid State Devices, McGraw Hill, 1994

TEACHING METHODOLOGY

- Blackboard teaching, PPT using ICT facility
- Regular review of students by asking questions based on topics covered in the class
- Integrated lab with Silvaco TCAD tool

COURSE ASSESSEMENT METHOD

CIE:

1. Integrated Lab.
2. Three mid examinations, 30 Marks each will be conducted and the Average of best of two will be taken.

SEE:

1. Two Questions are to be set from each unit, carrying 20 Marks each.
2. Students have to answer 5 questions selecting one full question from each unit

CO-PO-PSO MAPPING

CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3	BT
CO1	3	2	1	1	1							3	1			**2**
CO2	3	2	1	1	1							3	1			3
CO3	3	2	1	1	1							3	1			3
CO4	3	2	1	1	1							3	1			2
CO5	3	2	1	1	1							3	1			2

SEMESTER V

MICROELECTROMECHANICAL SYSTEMS

Course Code	**18ECE565**	**Credits**	**03**
Hours/Week(L-T-P)	**3-0-0**	**CIE Marks**	**50**
Total Hours	**39(L)**	**SEE Marks**	**50**
Exam Hours	**03**	**Course Type**	**Program Elective**

COURSE OUTCOMES

Students will be able to

1. Apply basic knowledge of engineering in MEMS Applications, modelling and Fabrication Process
2. Develop MEMS devices by designing, modelling and through use of MEMS CAD tool.
3. Apply the knowledge of MEMS devices with electronic circuitry for system development
4. Analyse working principle of MEMS Devices
5. Analyse the concept of scaling and its effects in device modelling and device applications

COURSE CONTENTS

UNIT-1 (11Hrs)

Introduction: Why Miniaturization?, Microsystems versus MEMS, Why microfabrication? Smart Materials, Structures and systems, Integrated Microsystems, Applications of smart Materials and Micro Systems

Micro Sensors, Actuators, Systems and Smart Materials: An Overview: Silicon Capacitive Accelerometer, Piezoresistive Pressure Sensor, Conductometric Gas Sensor, Fiber-Optic Sensors, Electrostatic Comb-Drive, Magnetic Microrelay, Microsystems at Radio Frequencies, Portable Blood Analyzer, Piezoelectric Inkjet Print Head, Micromirror Array for Video Projection, Micro-PCR Systems, Smart Materials and Systems

Text book 1: Ch.1: 1.1 to 1.6 Text book 1: Chapter 2 complete

UNIT-2 (11Hrs)

Micromachining Technologies: Thin Film Deposition: Evaporation, Sputtering, CVD, Epitaxial growth, Thermal oxidation for silicon di oxide, Lithography: photolithography, lift off, Etching: Isotropic etching, Anisotrppic etching, etch stops, Silicon Micromachining: Bulk micromachining, Surface micromachining, Specialized materials for microsystems: Polymers, Ceramic materials, Advanced Process for Microfabrication: Wafer Bonding Techniques, Dissolved Wafer process, Special microfabrication techniques. *Text Book1: Ch 3: 3.2, 3.3, 3.5, 3.7,3.8,3.9*

UNIT-3 (10Hrs)

Circuits for conditioning sensed signals: Differential charge measurement, switched capacitor circuits for capacitance measurement, circuits for measuring frequency shift,

Implementation of controllers: Design methodology, circuit implementation, digital controllers.

Scaling Effects in Microsystems: Scaling in the mechanical Domain, Scaling in the electrostatic Domain, Scaling in Magnetic Domain, Scaling in the thermal Domain, Scaling in Diffusion, Scaling in Fluids, scaling Effects in the Optical Domain, Scaling in Biochemical Phenomena. *Text book1: Ch. 7: 7.4,7.6*
Ch. 9: 9.1, to 9.8

UNIT-4 (10Hrs)

Mechanics of Slender Solids in Microsystems: The Simplest Deformable Element: A Bar, Transversely Deformable Element: A Beam, Energy Methods for Elastic Bodies
Text 1: Chapter 4: 4.1 to 4.4

UNIT-5 (10Hrs)

Integration of Micro and Smart Systems: Integration of Microsystems and Microelectronics: CMOS First, MEMS first, other approaches of integration , Microsystems Packaging: Objectives of packaging, Special issues in microsystem packaging, Types of Microsystem packages, Packaging technologies, Reliability and key failure mechanisms, Case studies of Integrated Microsystems: Pressure sensors, Micromachined Accelerometer, Case Study of a Smart Structure in Vibration Control: PZT transducers, Vibrations in beams. *Text Book 1: Ch 8 complete*

Simulations of the applications using MEMS tools

TEXT BOOKS

1. G.K. Ananthasuresh, K.J. Vinoy, S. Gopalakrishnan, K.N. Bhat, V.K. Aatre, " Micro and Smart Systems, Technology and Modeling", Wiley India, 2012

REFERENCE BOOKS

2. NadimMaluf, Kirt Williams "An Introduction to Microelectromechanical Systems Engineering" Second addition, Artech House, Boston London Inc.

TEACHING METHODOLOGY

- Blackboard teaching
- PowerPoint presentations (if needed)
- Regular review of students by asking questions based on topics covered in the class

COURSE ASSESSEMENT METHOD

CIE:

1. Two Surprise Tests, 10 Marks each. Best of two tests will be taken.
2. Assignment/course project-based test. 10 Marks each. Best of two tests will be taken.
3. Three internals, 30 Marks each will be conducted and the Average of best of two will be taken.

SEE:

1. Two Questions are to be set from each unit, carrying 20 Marks each.
2. Students have to answer 5 questions selecting one full question from each unit

CO-PO-PSO MAPPING

CO/ PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO8	PO9	PO1 0	PO 11	PO 12	PSO 1	PSO 2	PSO 3	BT
CO1	3	2	2	2	3	2	2					3	2	2		
CO2	3	2	3	3	3	1						3	1	1	1	
CO3	3			1	2							3	2	2		
CO4	3		1	3			1					3	2	2	1	
CO5	3	2	3	3	3	1	1	2				3	1	1		

SEMESTER: V

INTRODUCTION TO PYTHON PROGRAMMING

Course Code	**18ECE566**	**Credits**	**03**
Hours/Week(L-T-P)	**3-0-0**	**CIE Marks**	**50**
Total Hours	**39(L)**	**SEE Marks**	**50**
Exam Hours	**03**	**Course Type**	**Program Elective**

PRE-REQUISITES
Students should have the knowledge of programming in any of the programming languages as C.

COURSE OUTCOMES
1. Understand Python syntax and semantics and be fluent in the use of Python flow control and functions.
2. Demonstrate proficiency in handling Strings and File Systems.
3. Implement Python Programs using core data structures like Lists, Dictionaries and use Regular Expressions.
4. Interpret the concepts of Object-Oriented Programming as used in Python.
5. Implement exemplary applications related to Network Programming, Web Services and Databases in Python.

COURSE CONTENTS
UNIT-1 (8 Hrs)
Why should you learn to write programs? **Variables, Expressions and statements:** Values and type, Variables, Variable names and keywords, Statements, Operators and operands, Expressions, Order of operations, Modulus operator, String operations, Asking the user for input, Comments, choosing mnemonic variable names, Debugging **Conditional execution:** Boolean expressions, Logical operators, Conditional execution, Alternative execution, Chained conditionals, Nested conditionals, catching exceptions using try and except, short-circuit evaluation of logical expressions, Debugging **Functions:** Function calls, Built-in functions, Type conversion functions, Math functions, Random numbers, adding new functions, Definitions and uses, Flow of execution, Parameters and arguments, Fruitful functions and void functions, Why functions? Debugging **Text 1: Chapter 1, 2,3,4**
UNIT-2 (8 Hrs.)

Iteration: Updating variables, the while statement, Infinite loops, finishing iterations with continue, Definite loops using for, Loop patterns, Counting and summing loops, Maximum and minimum loops, Debugging

Strings: A string is a sequence, Getting the length of a string using Len, Traversal through a string with a loop, String slices, Strings are immutable, Looping and counting, the in operator, String comparison, String methods, Parsing strings, Format operator, Debugging

Files: Opening files, Text files and lines, reading files, searching through a file, Letting the user choose the file name, Using try, except, and open, writing files, Debugging

Text 1 : Chapter 5, 6,7

UNIT-3 (8 Hrs.)

Lists: A list is a sequence, Lists are mutable, Traversing a list , List operations, List slices, List methods, Deleting elements, Lists and functions, Lists and strings, Parsing lines, Objects and values, Aliasing, List arguments, Debugging

Dictionaries: Dictionary as a set of counters, Dictionaries and files Looping and dictionaries, Advanced text parsing, Debugging

Tuples: Tuples are immutable, Comparing tuples, Tuple assignment, Dictionaries and tuples, Multiple assignment with dictionaries, The most common words, Using tuples as keys in dictionaries, Sequences: strings, lists, and tuples - Oh My!, Debugging

Regular Expressions: Character matching in regular expressions, Extracting data using regular expressions, Combining searching and extracting, Escape character ,,136 11.5 Summary, Debugging ,

Text 1 : Chapter 8,9, 10,11

UNIT-4 (8 Hrs.)

Classes and objects: Programmer-defined types Attributes, Rectangles, Instances as return values, Objects are mutable, Debugging

Classes and functions: Time, Pure functions, Modifiers, prototyping versus planning, Debugging

Classes and methods: Object-oriented features, Printing objects, A more complicated example, the init method, the __str__ method, Operator overloading, Type-based dispatch Polymorphism, Debugging

Text 2 : Chapter 15,16,17

UNIT-5 (8 Hrs.)

Modules, Packages and Distribution: Modules and import statement, importing selected symbols, execution of main program, the module search path, module loading and compilation, reloading and unloading, packaging, distributing programs and libraries, installing third party Libraries, GUI Programming

Application: Networked programs using Web Services, Using databases and SQL

Text 1 : Chapter 12,13 ,15

TEXT BOOKS

Text Books:

1. Charles R. Severance, “Python for Everybody: Exploring Data Using Python 3”, 1st Edition, CreateSpace Independent Publishing Platform, 2016.
2. Allen B. Downey, "Think Python: How to Think Like a Computer Scientist”, 2ndEdition, Green Tea Press, 2015.
3. https://data-flair.training/blogs/python-libraries

REFERENCE BOOKS

1. Charles Dierbach, "Introduction to Computer Science Using Python", 1st Edition, Wiley India Pvt Ltd. ISBN-13: 978-8126556014
2. Mark Lutz, “Programming Python”, 4th Edition, O’Reilly Media, 2011.ISBN-13: 978-9350232873
3. Wesley J Chun, “Core Python Applications Programming”, 3rdEdition, Pearson Education India, 2015. ISBN-13: 978-9332555365

4. Roberto Tamassia, Michael H Goldwasser, Michael T Goodrich, "Data Structures and Algorithms in Python", 1st Edition, Wiley India Pvt Ltd, 2016. ISBN-13: 978- 8126562176
5. ReemaThareja, "Python Programming using problem solving approach", Oxford university press, 2017

TEACHING METHODOLOGY

- Blackboard teaching
- PowerPoint presentations (If needed)
- Regular review of students by asking questions based on topics covered in the class

COURSE ASSESSEMENT METHOD

CIE:

1. Tutorials - 10 Marks
2. Surprise tests - 10Marks.
3. Three mid examinations, 30 Marks each will be conducted and the Average of best of two will be taken.

SEE:

1. Two Questions are to be set from each unit, carrying 20 Marks each.
2. Students have to answer 5 questions selecting one full question from each unit

CO-PO-PSO MAPPING

CO/PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3	BT
CO1	2	1	1		3				1			2		**1**		**2**
CO2	2	1	1		3				1			2		**1**		**3**
CO3	2	1	1		3				2			2		**1**		**2**
CO4	1	1	1		3				2			2		**1**		**3**
CO5	1	1	2	1	3				3			**2**		**3**		**2**

PROGRAM LAB

SEMESTER: V

DIGITAL SIGNAL PROCESSING LAB

Course Code	**18ECL57**	**Credits**	**01**
Hours/Week(L-T-P-S)	**0-0-2**	**CIE Marks**	**50**
Total Hours	**26(P)**	**SEE Marks**	**50**
Exam Hours	**03**	**Course Type**	**Core Lab**

PRE-REQUISITES

1. Students should have knowledge of signals & Systems and Digital Signal Processing.
2. Knowledge of basic mathematical concepts.

COURSE OUTCOMES

STUDENTS WILL BE ABLE TO:

CO1: Analyze basic operations of Signal processing and DSP system modeling using MATLAB

CO2: Implement and Analyze discrete signal algorithm using MATLAB

CO3: Design and implement applications of the Fast Fourier transform.

CO4: Design IIR, and FIR filters for band pass, band stop, low pass and high pass filters.

CO5: Program a DSP chip with a variety of real-time signal processing algorithms, such as filtering for noise reduction or digital audio effects.

COURSE CONTENTS

Exp. No	EXPERIMENT
1	Introduction to MATLAB**,** MATLAB Functions, Plotting signals, examples Introduction to TMS320C67XX, Code composer studio, examples Introduction to simulink, FDA tool
	Part-A: Should be implemented Using MATALB/SCILAB/OCTAVE/ and CC Studio
2	LTI System: To find the impulse response of a given system, Solution of difference equation, Verification of Sampling Theorem
3	Circular convolution & Linear convolution, Cross correlation & Autocorrelation
4	DFT: To find the DFT and inverse DFT of a sequence FFT: To find the linear and circular convolution using FFT algorithm
5	To find the 2N point DFT using N point DFT To find the N point DFT of two sequences using single N point DFT (Use FFT algorithm to find DFT)
6	Sectioned convolution: Overlap save and overlap add method for long duration sequences

7	Design and simulation of analog IIR Filters (Butterworth and Chebyshev) Design and simulation of digital IIR Filters (Bilinear transformation, Impulse invariant Transformation)
8	Design and implementation of FIR Filters (LP, HP, BP, BS) by using window techniques
Hardware experiments (Using TMS320Cxxxx)	
9	Linear convolution and Circular convolution
10	LTI System: To find the impulse response of a given system
11	Computation of N point DFT/IDFT
12	Design and implementation of digital FIR Filters

TEXTBOOKS

1. J. G. Proakis and Ingle, “Digital signal processing using MATLAB”, 3rd Edition, Cengage Learning,2014.
2. Sanjit K. Mitra, “Digital Signal Processing”, 4th Edition, Tata McGraw Hill,2014.
3. RulphChassaing, “Digital Signal Processing and Applications with the C6713 and C6416 DSK”, Wiley.

Open ended experiments: (Using MATLAB/Hardware, Preferably Hardware)

1. Radix 4 DITFFT Algorithm
2. Radix 4 DIFFFT Algorithm
3. Implementation of Chirp Z-Transform
4. Implementation of Goertzen algorithm
5. Filtering of noisy signal using FIR filter
6. Design of FIR Filter using Window based method (Kaiser Window)
7. Generating signals of different frequencies and construction of AM wave
8. DTMF detection
9. Verification of Properties of cross correlation
10. Beat Detection Using Onboard LEDs
11. PID Controller
12. μ-Law for Speech Companding

CO-PO-PSO MAPPING

CO/ PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3	BT
CO1	3		1		2				2	2		3	3			2
CO2	3	2	2		2				2	2		3	3		1	3
CO3	3	2	2		2				2	2		3	3		1	3
CO4	3	3	2	2	2				2	2		3	3	1	1	3
CO5	3	3	2	2	2				2	2		3	3	1	1	3

SEMESTER: V

COMMUNICATION SYSTEM LAB - I

Course Code	**18ECL58**	**Credits**	**01**
Hours/Week(L-T-P-S)	**0-0-2**	**CIE Marks**	**50**
Total Hours	**2Hrs/Week**	**SEE Marks**	**50**
Exam Hours	**03**	**Course Type**	**Lab**

COURSE OUTCOMES

Upon successful completion of this course, the students will be able to

1. Design filters which are the basic building blocks in any communication system
2. Design and demonstrate the applications of op-amp as Multivibrators and Rectifiers
3. Test the R-2R DAC using Op amp
4. Design Analog modulation circuits such as amplitude and frequency modulation.
5. Design various pulse modulation techniques as PAM, PPM, PWM.

COURSE CONTENTS

1. Design a Second order active Low pass filter and High pass filter for a given cut off frequency
2. Design a Second order active BPF and BRF for a given cut off frequency
3. Design and test R-2R DAC using op-amp
4. Design and test the following circuits using IC 555
    a. Astable multivibrator for given frequency and duty cycle
    b. Monostable multivibrator for given pulse width W
    c. 555 timer as Schmitt trigger
5. Test Pre emphasis and De-emphasis
6. Design Amplitude modulation using circuit and demodulation using transistor (Generation and detection
7. To generate AM-Double Side Band Suppressed Carrier (DSB-SC) signal using Ring Modulator.
8. Design Pulse amplitude modulation circuit (PAM)
9. Design Pulse Width Modulation circuit (PWM)
10. Design Pulse Position Modulation circuit(PPM)
11. Generate Frequency modulation using IC 8038/2206

TEACHING METHODOLOGY

- Design of expts- Blackboard teaching
- Regular review of students by asking questions based on topics covered in the class

COURSE ASSESSEMENT METHOD

CIE:

1. Record and Observation - 30 Marks
2. Viva -5 marks
3. Lab internals-15marks

SEE:

1. One experiment will be given for conduction.

Write Up:8 marks

Viva Voce: 7 marks

Conduction and Execution: 35 marks

CO-PO-PSO MAPPING

CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3	BT
CO1	3		1			2			**2**			1	**3**	3	1	**3**
CO2	3								**2**			1	**3**	**3**	1	3
CO3	3		1						**2**			1	**3**	3	1	2
CO4	3	1	1						**2**			1	**1**	3	1	3
CO5	3	1	1						**2**			**1**	**1**	**3**	1	3

VI SEMESTER

SEMESTER: VI

COMPUTER NETWORKS AND APPLICATIONS

Course Code	**18EC61**	**Credits**	**04**
Hours/Week(L-T-P)	**3-2-0**	**CIE Marks**	**50**
Total Hours	**39(L)+26(T)**	**SEE Marks**	**50**
Exam Hours	**03**	**Course Type**	**Core**

PRE-REQUISITES
Basics of electronics, Analog and Digital circuits, Analog and Digital communication, Programming basics

COURSE OUTCOMES

1. Student will be able to understand of the fundamental concepts of basic networking, Protocols, Standards and Layered models
2. Student will be able to understand the basics of UDP,TCP, and socket programming
3. Student will be able to understand basics of a data application (WWW and HTTP)
4. Student will be able to understand basics of a real-time data application (VoIP and protocols)
5. Student will be able to understand basics of internet security

COURSE CONTENTS

UNIT-1 (8 Hrs)

Introduction – Data communications, networks, and network types
Network models – TCP/IPv4, OSI model
Wired LANs - Ethernet and standard ethernet
Wireless LANS – Introduction, 802.11
Connecting devices and VLAN
Network layer – IPv4 addresses, IP
1.1 to 1.3, 2.3 to 2.3, 13.1 and 13.2, 15.1, 15.2, 17.1,17.2, 18.4, 19.1

UNIT-2 (8 Hrs)

Introduction, UDP, and TCP, Client – Server Programming
Services , Port Numbers
User Datagram , UDP Services , UDP Applications
TCP Services , TCP Features , Segment ,A TCP Connection , State Transition Diagram ,Windows in TCP Flow Control , Error Control TCP Congestion Control ,TCP Timers ,Options
Application Programming Interface ,Using Services of the Transport Layer ,Iterative Communication Using UDP , Iterative Communication Using TCP , Concurrent Communication

24.1 to 24.3

UNIT-3 (8 Hrs)

WWW and HTTP
Architecture - Web client, server, URL, and web documents
Non-persistent vs persistent connections, message format, request message, response message, conditional request, cookies, caching and proxy server, HTTP security
26.1.1, 26.1.2

UNIT-4 (8 Hrs)

Multimedia data, Multimedia in the internet, Real-time interactive protocols
Text, Image , Video , Audio
Streaming Stored Audio/Video , Streaming Live Audio/Video , Real-Time Interactive Audio/Video
Rationale for New Protocols ,RTP ,RTCP , Session Initialization Protocol (SIP) , H.323
28.2 to 28.4

UNIT-5(8 Hrs)

Network layer security, Transport layer security, Application layer security, Firewalls
Two Modes , Two Security Protocols , Services Provided by IPSec , Security Association
Internet Key Exchange (IKE) , Virtual Private Network (VPN)
SSL Architecture , Four Protocols
E-mail Security , Pretty Good Privacy (PGP) , S/MIME
Packet-Filter Firewall 1152 32.4.2 Proxy Firewall
32.1 to 32.4

TEXT BOOKS

Text Book - Data Communications and Networking, 5/e By Behrouz A Forouzan, published by McGraw-Hill

TEACHING METHODOLOGY

- Blackboard teaching
- MS pptx slides
- Regular review of students' understanding by asking questions based on topics covered in the class

COURSE ASSESSEMENT METHOD

CIE:

4. Tool based Assessment - 10 Marks
5. Surprise tests based on GATE questions- 10Marks.
6. Three mid sem examinations, 30 Marks each will be conducted and the average of best of two will be taken.

SEE:

2. Two Questions are to be set from each unit, carrying 20 Marks each.
3. Students have to answer 5 questions selecting one full question from each unit

CO-PO-PSO MAPPING

CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3	BT
CO1	3	2			2				2				1	2	**2**	
CO2	3	2			2				2				1	2	2	
CO3	3		2		3				3				1	2	3	
CO4	3		2		3				3				1	2	3	
CO5	3	2			2				2						2	

SEMESTER: VI

COMMUNICATION SYSTEM II

Course Code:	**18EC62**	**Credits:**	**03**
Hours/Week(L-T-P):	**3-2-0**	**CIE Marks:**	**50**
Total Hours:	**39(L)+26(T)**	**SEE Marks:**	**50**
Exam Hours:	**03**	**Course Type:**	**Core**

PRE-REQUISITES
Basics of Communication System 1

COURSE OUTCOMES

The students will be able to:

1. Design and analyze a Digital communication system
2. Analyze the concept of line coding techniques and their Power spectral density, Inter symbol interference in Digital communication systems.
3. Apply the concepts of signal, Geometric representation of signal and performance of digital communication system in the presence of noise.
4. Compare the performance of digital modulation techniques and their probability of error performance.
5. Describe spread spectrum technology and its applications.

COURSE CONTENTS

UNIT-1 (8 Hrs)

Waveform Coding Techniques: PCM, Quantization noise and SNR, Robust quantization, DPCM, DM, Adaptive delta modulation, Coding speech at low bit rates: Adaptive pulse code modulation,

Applications: Digital Multiplexers,T1 System,M12 Multiplexer

Discrete PAM signals: Unipolar, Polar, Bipolar, Manchester,Polar quaternary formats .Power spectra of Unipolar, Polar, Bipolar, Manchester formats.

Text 1: Ch 5.5.1, 5.2, 5.3, 5.4, 5.5, 5.6, 5.7, 5.8, Ch 6. 6.1, 6.2

UNIT-2 (7 Hrs)

Base-Band Shaping for Data Transmission ISI, Nyquist’s criterion for distortion less base-band binary transmission, correlative coding, eye pattern, base-band M-ary PAM systems, adaptive equalization for data transmission.

TEXT 1:6.3,6.4,6.5,6.6,6.7,6.8

UNIT-3 (8 Hrs)

Detection & Estimation: Model of Digital communication system, Gram-Schmitt Orthogonalization procedure, geometric interpretation of signals, response of bank of correlators to noisy input.

Detection of known signals in noise, correlation receiver, matched filter receiver, detection of signals with unknown phase in noise.

Text 1: Ch. 3: 3.1, 3.2, 3.3, 3.4,3.5,3.7,3.8,3.9

UNIT-4 (8 Hrs)

Digital Modulation Techniques: Digital Modulation formats, Coherent Binary Modulation Techniques: Coherent binary PSK, Coherent binary FSK.

Coherent Quadrature Modulation Techniques: Quadrature phase shift keying, Minimum shift Keying, power spectra of PSK, Power spectra of FSK.

Non-coherent Binary Modulation Techniques: Non coherent Binary FSK, Differential phase shift keying, Comparison of Binary and Quatenary Modulation techniques.

TEXT1: Ch 7. 7.1, 7.2, 7.3,7.4,7.5,7.7

UNIT-5 (8 Hrs)

Spread Spectrum Modulation: Pseudo noise sequences, Notion of spread spectrum, Direct sequence spread Coherent binary Phase shift keying, Probability of Error: Anti jam characteristics.

Frequency hop spread spectrum: Slow frequency hopping, Fast frequency hopping, Applications: Code division Multiple Access, Multipath suppression.

Text 1: Ch 9. 9.1, 9.2, 9.3,9.5, 9.6,9.7

TEXT BOOKS

1. Simon Haykin, "Digital communications", JohnWiley, 2003.

REFERENCE BOOKS

1. K.SamShanmugam, "Digital and analog communication systems", John Wiley, 1996.
2. Simon Haykin," An introduction to Analog and Digital Communication", John Wiley, 2003
3. Bernard Sklar, "Digital communications" Pearson education, 2007

TEACHING METHODOLOGY

- Blackboard teaching
- PowerPoint presentations (if necessary)
- Regular review of students by asking questions based on topics covered in the class

COURSE ASSESSEMENT METHOD

CIE:

1. Test: 30 marks
2. Assignment: 10 marks
3. Surprise Test: 10 marks

SEE

1. Two Questions are to be set from each unit, carrying 20 Marks each.
2. Students have to answer 5 questions selecting one full question from each unit

CO-PO-PSO MAPPING

CO/PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO1	3	2	3	1	3	3			3	1	2	3	**3**	3	3
CO2	3	3	1	2						1		3		3	
CO3	3	3		3						1		2	**2**	3	2
CO4	3	3	3	3	3	1			3	1		3	**3**	3	3
CO5	3	3	2	2	3				2	1	2	2	**3**	3	3

SEMESTER:VI

INFORMATION THEORY AND CODING

Course Code	**18EC63**	**Credits**	**03**
Hours/Week(L-T-P)	**3-0-0**	**CIE Marks**	**50**
Total Hours	**39(L)**	**SEE Marks**	**50**
Exam Hours	**03**	**Course Type**	**Core**

PRE-REQUISITES

Engineering Mathematics, Digital Communication

COURSE OUTCOMES

STUDENTS WILL BE ABLE TO:

1. Apply basics of information theory to compute entropy, information rate and study advance algebraic Coding.
2. Illustrate different coding techniques and determine its efficiency.
3. Categorize various channels for information transmission and interpret Shannon's theorem in Continuous channels.
4. Design various Block Codes for error detection and convolutional codes for error correction.
5. Design different codes for Channel performance improvement against burst errors.

COURSE CONTENTS

UNIT-1 (11 Hrs)

Information Theory: Introduction, Measure of information, Information content of message, Average Information content of symbols in Long Independent sequences, Average Information content of symbols in Long dependent sequences, Markoff statistical model for information sources, Entropy and information rate for Markoff sources

Text Book 1: **Chapter 4.1-4.2**

Introduction to Algebra: Groups, fields, Binary Field Arithmetic, Construction of Galois field (2^m), Basic properties of Galois field (2^m), Computations using Galois field (2^m) Arithmetic.

Text Book 3: Chapter 2.1-2.6

UNIT-2 (11 Hrs)

Information theory and Source Coding: Definition of codes, Basic properties of codes, Construction of instantaneous codes, Kraft inequality, McMillan's Inequality, code efficiency and redundancy, Shannon's First theorem, construction of some basic codes, Shannon binary encoding procedure, Shannon-Fano binary encoding method, Huffman's Minimum redundancy code, Coding for sources with memory, Lempel-Ziv coding, Run-Length Encoding(RLE)

Text Book 2: **Chapter 5.1-5.6**

UNIT-3 (10 Hrs)

Information Channels: Joint and Conditional Entropies, Mutual information, Shannon Theorem, Capacity of channels, Symmetric channels, Binary symmetric channel (BSC).

Text Book 2: **Chapter 3.1-3.4.3**

Continuous Channels: Entropy of continuous signals, Maximization of entropy, Mutual information of a continuous noisy channel, Capacity of band limited channels with AWGN and Average power limitation of signals: The Shannon-Hartley law.

Text Book 2: Chapter 4.1-4.3

UNIT-4 (10 Hrs)

Error Control Coding: Linear block codes, matrix description of linear block codes, Error detection and error correction capabilities of linear block codes, Single error correcting Hamming codes, Table lookup decoding using standard array, Binary Cyclic Codes, Algebraic Structure of Cyclic Codes, Encoding using an (n-k) bit shift register, Syndrome Calculation, Error detection and correction.

Text Book 1: Chapter 9.1-9.3.3

BCH , CRC ,Maximum length , majority logical Decodable, Shortened cyclic,Golay and RS codes

Text Book 2:Chapter 7.7-7.13

UNIT-5 (10 Hrs)

Convolution Codes: Connection Pictorial representation , Convolution Encoding -Time domain approach, Transform domain Approach, Structural properties of convolutional codes, State diagrams, Tree and Trellis Diagram, Maximum likely-hood decoding of convolutional codes- The Viterbi Algorithm.

Text Book 2: **Chapter 8**

Coding for Burst Error Correction: Burst and Random Error Correcting Codes, Convolutional Codes for Burst error Correction.

Text Book 2: Chapter 9.1,9.3

TEXT BOOKS

1. K. Sam Shanmugham, “Digital and Analog Communication Systems”,JohnWiley Publications,1996.
2. Dr. P.S Satyanarayana, “Concepts of Information Theory and Coding”, Medtech Publications, 2nd Edition,2020
3. Shu Lin, Daniel J. Costello, “Error Control Coding”, Pearson/Prentice Hall, 2nd Edition,2004.

REFERENCE BOOKS

1. Khalid Sayood, “Introduction to Data Compression”, Elsevier, 4th Edition, 2012.

TEACHING METHODOLOGY

- Blackboardteaching
- PowerPoint presentations (Ifneeded)
- Regular review of students by asking questions based on topics covered in theclass

COURSE ASSESSEMENT METHOD

CIE:

1. Tutorials - 10Marks
2. Surprise tests - 10Marks.
3. Three mid examinations, 30 Marks each will be conducted and the Average of best of two will be taken.

SEE:

1. Two Questions are to be set from each unit, carrying 20 Marks each.
2. Students have to answer 5 questions selecting one full question from each unit

CO-PO-PSO MAPPING

CO/ PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3	BT
CO1	3	3	1	1								2		2	2	2
CO2	3	3	2	1								2		2	2	2
CO3	3	3	2	1								2		3	3	2

CO4	**3**	**3**	**3**	**3**							**3**		**3**	**3**	**3**	
CO5	**3**	**3**	**3**	**3**							**3**		**3**	**3**	**3**	

SEMESTER: VI

OPERATION RESEARCH

Course Code	**18ECH64**	**Credits**	**03**
Hours/Week(L-T-P-S)	**3-0-0**	**CIE Marks**	**50**
Total Hours	**52(L)**	**SEE Marks**	**50**
Exam Hours	**03**	**Course Type**	**Core**

COURSE OUTCOMES

Students will be able to:

1. Understand the concept, nature, models, benefits, scope and limitations of Operations Research in managerial problems to use the scarce resources (Capitals, staffing and machines).
2. Formulate as L.P.P and derive optimal solutions to linear programming problems by graphical method, Simplex method, Big-M method and Dual Simplex method.
3. Extend the skills in the use of operation research approaches in formulating and solving real time problems like transportation, assignment and game theory.
4. Competent with mathematical and computational modeling of real decision-making problems, including the use of modeling tools and computational tools.
5. Identify the resources required for a project, network techniques, queuing models and generate a plan and work schedule

COURSE CONTENTS

UNIT-1 (11 Hrs)

Introduction: Linear programming, Definition, scope of operations research (O.R) approach and limitations of OR models, characteristics and phases of OR mathematical formulation of L.P. Problems. Graphical solution methods. **Linear Programming Problems:** Introduction, Definitions, simplex method - computational procedure.

Textbook #1: 1.1-1.8,2.1 – 2.5.1, 3.1 – 3.3, 3.7

UNIT-2 (11 Hrs)

Artificial Variable Technique: Two phase method. Big-M-method (Charne's penalty method). Degeneracy-Methods to resolve degeneracy. Special cases- Alternative, unbounded & non-existing solution, Concept of duality, primal &dual correspondence, Dual simplex method.

Textbook #1: 3.10 – 3.11, 3.13, 3.14.3

UNIT-3 (10 Hrs)

Game Theory: Formulations of games, two person-zero sum game, games with and without saddle point, graphical solution (2 x n, m x 2 game), dominance property. **Transportation Problem:** Mathematical Formulation; Matrix form, Definitions, Initial basic feasible solution using different methods. Optimality methods. Minimization problem, unbalanced transportation problem, degeneracy in transportation problems.

Textbook #1: 10.1 – 10.8, 4.1 – 4.2, 4.4 – 4.6,4.8 -4.9

UNIT-4 (10 Hrs)

Assignment Problem: Mathematical Formulation, Hungarian method, Minimal, Maximal & unbalanced assignment problem, traveling salesman (Routing) problem. **Sequencing:** Terminology & notations, Johnson's algorithm, processing of: n-jobs to 2 machines, n jobs 3 machines, n jobs m machines without passing sequence. 2 jobs n machines with passing. Graphical solution.

Textbook #1: 5. – 5.4 (4th method) , 5.6 , 6.1 – 6.5

UNIT-5 (10 Hrs)

PERT-CPM Techniques: Definitions, difference between CPM & PERT. Applications. Network construction, labeling using Fulkerson's '1-J' Rule. Time Estimates and Critical path - Forward & Backward pass computation. Determination of Floats, Slack times & critical path. PERT-critical path, scheduling by project duration, variance under probabilistic models, prediction of date of completion, crashing of simple networks- Optimum duration & Minimum duration cost.
Queuing Theory: Queuing system and their characteristics. The M/M/1 queuing system, steady state performance and analysis of M/M/1 & MIMIC queuing model.

Textbook #1: 15.1 – 15.3, 9.1 – 9.2, 9.3.1- 9.3.2

Text book #2: 11.1 – 11. 5

TEXT BOOKS

1. Operation Research, S. D. Sharma - KedarnathRamnath and Co ,2002.
2. Problems in Operations Research - P.K.Gupta, Manmohan, Sultan Chand Publications,2005

REFERENCE BOOKS

1.Operations Research - An Introduction, Taha H.A. -Low price Edition, ih Edn,2006

2. Introduction to Operation Research, Hiller and Liberman, McGraw Hill. 5th edition 2001.
3. Operations Research: principles and practice: Ravindran, philiphs and Solberg, Wiley India its 2nd edition 2007.
4. Operation Research, Premkumar Gupta, 0 SHira, Schandpub, Newdelhi, 2007.
5. Operation Research, Premkumar Gupta, 0 S. Hira, Schandpub, Newdelhi, 2007.

TEACHING METHODOLOGY

- Blackboard teaching
- PowerPoint presentations (If needed)
- Regular review of students by asking questions based on topics covered in the class
- Case study

COURSE ASSESSEMENT METHOD

CIE:

- Assignment (Case Study) - 10 Marks
- Surprise tests - 10Marks.
- Three mid examinations, 30 Marks each will be conducted and the Average of best of two will be taken.

SEE:

- Two Questions are to be set from each unit, carrying 20 Marks each.

Students have to answer 5 questions selecting one full question from each unit

CO-PO-PSO MAPPING

CO/ PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3	BT
CO1	3	2							2							2
CO2	3	2		2	3				2	2	3					3
CO3	3	2	2	3		2			2	2	2					3
CO4	3	2	2	3	3				2	2	3					3
CO5	3			2		2				2	1					3

PROGRAM ELECTIVE 2

SEMESTER VI

SYSTEM VERILOG

Course Code:-	**18ECE651**	**Credits**	**03**
Hours/Week(L-T-P)	**3-0-0**	**CIE Marks**	**50**
Total Hours	**39**	**SEE Marks**	**50**
Exam Hours	**03**	**Course Type**	**Program Elective**

PRE-REQUISITES

- Satisfactory completion of understanding of basics of digital logic circuit design.
- Satisfactory knowledge of Digital Electronic design and its optimization.
- Knowledge of design of digital system using HDL.

COURSE OUTCOMES

Students will be able to:

CO1:- Understand the essentials of Verification language

CO2:- Familiarize with the basic components of System Verilog language.

CO3:- Learn the techniques to write the test benches and implement digital logic circuits for various applications

CO4:-Design and test the logic circuits at different abstraction level

CO5:- Analyze the various system verification techniques for FSM design

COURSE CONTENTS

UNIT-1 (09Hrs)

Introduction to System Verilog: System Verilog origins, Generations of the System Verilog standard, Donations to System Verilog, Key System Verilog enhancements for hardware design. Package definitions, Referencing package contents, Synthesis guidelines, $unit compilation-unit declarations, Coding guidelines, System Verilog identifier search rules ,Source code order, Coding guidelines for importing packages into $unit , Synthesis guidelines , Declarations in unnamed statement blocks , Local variables in unnamed blocks, Simulation time units and precision , Verilog's timescale directive, Time values with time units, Scope-level time unit and precision, Compilation-unit time units and precision

Text1(Chapter 1: 1.1,1.2, Chapter 2: 2.1,2.4)

UNIT-2 (08Hrs)

System Verilog Literal Values and Built-in Data Types: Enhanced literal value assignments, 'define enhancements , Macro argument substitution within strings, Constructing identifier names from macros, System Verilog variables, Object types and data types, System Verilog 4-state variables, System Verilog 2-state variables, Explicit and implicit variable and net data types ,Synthesis guidelines , Using 2-state types in RTL models, state type characteristics ,2-state types versus 2-state simulation ,Using 2-state types with case statements ,Relaxation of type rules, Signed and unsigned modifiers, Static and automatic variables, Static and automatic variable initialization , Synthesis guidelines for automatic variables, Guidelines for using static and automatic variables, Deterministic variable initialization,

Initialization determinism , Initializing sequential logic asynchronous inputs ,Type casting, Static (compile time) casting. Dynamic casting. Synthesis guidelines , Constants . **Text1(Chapter 3: 3.1,3.10)**
UNIT-3 (08Hrs)
System Verilog User-Defined and Enumerated Types: User-defined types, Local typed definitions, Shared typed definitions, Naming convention for user-defined types , Enumerated types ,Enumerated type label sequences., Enumerated type label scope, Enumerated type values, Base type of enumerated types, Typed and anonymous enumerations, Strong typing on enumerated type operations, Casting expressions to enumerated types, Special system tasks and methods for enumerated types., Printing enumerated types. Verilog general purpose always procedural block , System Verilog specialized procedural blocks, Combinational logic procedural blocks ,Latched logic procedural blocks , Sequential logic procedural blocks ,Synthesis guidelines Enhancements to tasks and functions, Implicit task and function statement grouping ,Returning function values , Returning before the end of tasks and functions., Void functions, Passing task/function arguments by name Enhanced function formal arguments ,Functions with no formal arguments ,Default formal argument direction and type ,Default formal argument values., Arrays, structures and unions as formal arguments, Passing argument values by reference instead of copy, Named task and function ends ,Empty tasks and functions . **Text1(Chapter 3: 4.1,4.2,Chapter 6: 6.1 to 6.3)**
UNIT-4 (07Hrs)
System Verilog Procedural Statements: New operators, Increment and decrement operators Assignment operators, Equality operators with don't care wildcards, Set membership operator inside Operand enhancements, Operations on 2-state and 4-state types.. Type casting ,Size casting, Sign casting , Enhanced for loops, Local variables within for loop declarations, Multiple for loop assignments, Hierarchically referencing variables declared in for loops , Synthesis guidelines , Bottom testing do...while loop , Synthesis guidelines, The for each array looping construct, New jump statements — break, continue, return 7.6.1 The continue statement 7.6.2 The break statement , The return statement, Synthesis guidelines , Enhanced block names, Statement labels, Enhanced case statements , Unique case decisions , Priority case statements, Unique and priority versus parallel_case and full_case ,Enhanced if...else decisions Unique if...else decisions ,Priority if decisions **Text1(Chapter 7:7.1 to 7.10)**
UNIT-5 (07Hrs)
Modeling state machines with enumerated types:- Representing state encoding with enumerated types Reversed case statements with enumerated types, Enumerated types and unique case statements, Specifying unused state values, Assigning state values to enumerated type variables, Performing operations on enumerated type variables, Using 2-state types in FSM models, Resetting FSMs with 2-state and enumerated types **Text1(8.1 to 8.3)**
TEXT BOOKS
Stuart Sutherland, SimonDavidmann, Peter Flake, " System verilog for Design: A Guide to Using System Verilog for Hardware Design and Modeling", Springer publications, 2nd Edition
REFERENCE BOOKS
Christian B Spear, "System Verilog for Verification: A guide to learning the Testbench language features", Springer publications, 3rd edition.
TEACHING METHODOLOGY
• Blackboard teaching • PowerPoint presentations (If needed) • Regular review of students by asking questions based on topics covered in the class
COURSE ASSESSEMENT METHOD
CIE: 1. Tutorials - 10 Marks 2. Surprise tests - 10Marks. 3. Three mid examinations, 30 Marks each will be conducted and the Average of best of two will be taken. **SEE:** 1. Two Questions are to be set from each unit, carrying 20 Marks each. 2. Students have to answer 5 questions selecting one full question from each unit

CO-PO-PSO MAPPING																
CO/ PO	**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO1 0**	**PO 11**	**PO 12**	**PSO 1**	**PSO 2**	**PSO 3**	**BT**
CO1	3	2	1	2									3			2
CO2	3	2	2	2					2				2	2	3	2
CO3	3	2	1		2								2	2		3
CO4	3	3			2								2	2	3	3
CO5	3	2														3

SEMESTER: VI

MACHINE LEARNING FOR PATTERN RECOGNITION

Course Code:	**18ECE652**	**Credits**	**03**
Hours/Week(L-T-P-S)	**3-0-0**	**CIE Marks**	**50**
Total Hours:	**39(L)**	**SEE Marks**	**50**
Exam Hours:	**03**	**Course Type**	**Program Elective**

COURSE OUTCOMES

1. Explain the Machine Learning Framework And Establish the Wide Ranging Applications of Machine Learning
2. Demonstrate the Working of Machine Learning Techniques.
3. Illustrate A Few Algorithms In Machine Learning.
4. Apply Appropriate Machine Learning Techniques For Real Time Applications As Per The Scope Of The Applications Learned.
5. Work in Teams To Implement/Simulate Machine Learning Algorithms.

COURSE CONTENTS

Unit-1 (08 Hrs)

Introduction to Pattern Recognition and **Machine Learning:** Introduction, Pattern Recognition Systems: Sensing, Segmentation and Grouping, Feature Extraction, Classification, Post Processing.
Machine Learning: Introduction, Machine Perception,
The Design Cycle: Data Collection, Feature Choice, Model Choice, Training, Evaluation And Computational Complexity.
Learning and Adaptation: Supervised Learning, Unsupervised Learning, Reinforcement Learning.
Learning Problems: Well-Posed Learning Problems, Perspectives and Issues in Machine Learning. (Text-1-Ch1: 1.1 To 1.5 Text-2-Ch1:1.1 and 1.3)

Unit-2 (08 Hrs)

Linear Models For Regression: Curve Fitting, Linear Basis Function Models: Maximum Likely Hood And Least Squares, Geometry of Least Squares, Sequential Learning, Regularized Least Squares, Multiple Outputs. Bias-Variance Decomposition, Bayesian Linear Regression: Parameter Distribution, Predictive Distribution, Equivalent Kernel. (Text-3-Ch 3: 3.1 To 3.3)

Unit-3 (08Hrs)

Concept Learning And Decision Trees: Concept Learning, Version Spaces And Candidate Elimination Algorithm, Decision Tree Learning: Introduction, representation and the basic decision tree learning algorithm.
(Text-2-Ch-2: 2.1, 2.2 and 2.4&Ch- 3:3.1, 3.2 and 3.4)

Unit-4 (08 Hrs)
Multilayer Neural Networks and Genetic Algorithm: Neural Network Representation, Perceptrons, Multilayer Networks: Feed forward operation and classification and Back Propagation Algorithms and problems. Genetic Algorithms: Introduction, Algorithms, Representation using Tree structure, Genetic Programming example. Models Of Evolution And Learning. (Text-1-Ch-6: 6.1,6.2 and 6.3&Text-2-Ch- 9: 9.2 ,9.5 And 9.6)
Unit-5 (07 Hrs)
Image And Speech Based Machine Learning: Review of Algorithms Related to Image Processing, Speech Recognition, Application of Digital Image Processing Approaches In Machine Learning Environment (Eg. Latest Approaches Like Enterprise Image Processing, Pattern Recognition Approaches Used in AI Etc. Will Be Used). (Case Study).

TEXT BOOKS

1. Richard O.Dude, Peter E. Hart and David G. Stork, " Pattern Recognition And Machine Learning", 2000 2nd Edition.
2. Tom M. Mitchell, "Machine Learning", Mcgraw-Hill Education (Indian Edition), 2013
3. Christopher M. Bishop, "Pattern Recognition And Machine Learning", 2006 Springer Science+ Business Media, Llc

REFERENCE BOOKS

1. Ethen Alpaydin, "Introduction To Machine Learning", 2nd Ed., Phi Learning Pvt. Ltd., 2013
2. EartGose, Richard Johnsonburg And Steve Joust, "Pattern Recognition And Image Analysis," Prentice-Hall Of India,2003.
3. 3. Damodar N. Gujarati ,"Basic Econometrics " Mc Grawhill ,Usa Software For Coding/Modelling : R , Python And Matlab

TEACHING METHODOLOGY

- Lectures, Problem Based Learning
- Discussion
- Demonstration
- Illustration

COURSE ASSESSEMENT METHOD

CIE:

1. Mid Sem Exams (Avg. Of 2 Exams) 30 Marks
2. Laboratory Based Exercises 20 Marks
3. Total 50 Marks

SEE:

1. Two Questions Are To Be Set From Each Unit, Carrying 20 Marks Each.
2. Students Have To Answer 5 Questions Selecting One Full Question From Each Unit

CO-PO-PSO MAPPING

CO/ PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3	BT
CO1	2	1										1			2	2
CO2	2	2										1			2	2
CO3	2	2	1									1			2	3
CO4	2	2	1							2		1			2	3
CO5	1	2	1	3	3	2			3	2		1			2	4

SEMESTER: VI

APPLIED DSP

Course Code	**18ECE653**	**Credits**	**03**
Hours/Week(L-T-P)	**3-0-0**	**CIE Marks**	**50**
Total Hours	**39(L)**	**SEE Marks**	**50**
Exam Hours	**03**	**Course Type**	**Program Elective**

PRE-REQUISITES

- Digital Signal Processing Course

COURSE OUTCOMES

Upon successful completion of this course the students will have developed following skills/abilities:

1. Integrate computer-based tools such as Code Composer Studio for DSP applications.
2. Determine and select data types for DSP algorithms in consideration with truncation and quantization errors.
3. Design & analysis of the system to perform multi-rate signal processing and evaluate the performance to meet expected system specifications using MATLAB.
4. Design of adaptive filters and filter banks for processing of discrete time signals and perform spectral analysis of the signals and analyze Time frequency Expansion.
5. Demonstrate an understanding of contemporary implementation issues such as computational complexity, hardware resource limitations as well as cost of DSP systems or DSP Processors by reviewing recent technical articles.

COURSE CONTENTS

UNIT-1 (10-Hrs)

Digital Signal Processing and Applications with the C6713

Introduction to DSP Development System, Programming Examples Using C Code, Architecture and Instruction Set of the C6x Processor, Compiler/Assembler/Linker Shell Programming Examples to Test the DSK Tools

Text3: Ch 1.1 to 1.8, 2.3, Ch 3

UNIT-2 (10-Hrs)

Data types and representation

Numbering System: Fixed Point, Floating Point, Truncation error Quantization of Filter Coefficients, Round-off Effects in Digital Filters Programming Examples Using C, Assembly, and Linear Assembly, DFT implementation example

Text2: Ch 9.4 to 9.6 Text3: 3.17 to 3.21

UNIT-3 (10-Hrs)

Multirate Digital Signal Processing
Multi Rate Digital Signal Processing Fundamentals, Down-sampling, Up-sampling and Sampling Rate Conversion, Multi Stage / Multi Rate Implementation of Digital Filters, · Efficient Implementation of Multi Rate Systems. Application of Multirate DSP: Digital to Analog Conversion **Text1: Ch 6, Text2: Ch 11**
UNIT-4 (11-Hrs)
Digital Filter banks, Trans-multiplexers and Adaptive Filters DFT Filter Banks for Signal Decomposition, Maximally decimated DFT Filter banks and trasmultiplexers, Introduction to adaptive filters Application of Transmultiplexers to Digital Communications modulation **Text1: Ch 7, Text2:Ch13, Text3: Ch7,**
UNIT-5 (11-Hrs)
Time frequency Expansion Short Time Fourier Transform (STFT), Gabor Transform, Wavelet Transform, Recursive Multi resolution Decomposition Image processing application as example. **Text1: Ch 9**
TEXT BOOKS
1. Modern Digital Signal Processing by Roberto Cristi, Brooks Cole, 2003 2. Digital Signal Processing, by Proakis and Manolakis, Prentice Hall 2007 (Fourth edition) 3. Digital Signal Processing and Applications with the C6713 and C6416 DSK, by RulphChassaing, A John Wiley & Sons, Inc., Publication, 2005
TEACHING METHODOLOGY
• Blackboard teaching and PowerPoint presentations • Tool based teaching using Matlab and Code Composer Studio & DSK (TMS320C6716)
COURSE ASSESSMENT METHOD
CIE: 1. Mini Project - 10 Marks 2. Surprise Test - 10Marks. 3. Three mid examinations, 30 Marks each will be conducted and Average of best of two will be taken. **SEE:** 1. Two Questions are to be set from each unit, carrying 20 Marks each. Students have to answer 5 questions selecting one full question from each unit
CO-PO-PSO MAPPING

CO/PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3	BT
CO1	**2**	3			3				1					2	**2**	**3**
CO2	3	3			2				1					2	3	**3**
CO3	3	3	3	2	2				1	1	1	1		2	3	**4**
CO4	3	3	3	2	2				1	1	1	1		2	3	**4**
CO5	3	3	3	2	2				1	1	2	2		2	3	**5**

SEMESTER: VI

ANTENNA THEORY AND DESIGN

Course Code	**18ECE654**	**Credits**	**03**
Hours/Week(L-T-P)	**3-0-0**	**CIE Marks**	**50**
Total Hours	**39(L)**	**SEE Marks**	**50**
Exam Hours	**03**	**Course Type**	**Program Elective**

COURSE OUTCOMES

Students will be able to

1. study the basics of different types of antennas and their performance parameters along with their radiation pattern.
2. Analyze the radiation characteristics of different types of antennas and improve the bandwidth.
3. Analyze the working of different types of Microstrip antenna, estimate the losses present and design for a particular application.
4. Analyze the working of different types of antennas used in personal communication and study the radiation effects on human body.
5. Analyze the working of smart antenna and ways to achieve different beam forming techniques and apply them for real-time applications.

COURSE CONTENTS

UNIT-1 (8 Hrs)

Reconfigurable Microstrip Antennas (*Jennifer T. Bernhard*) Introduction, Substrate Modification for Reconfigurability, Conductor Modification for Reconfigurability, Enabling Reconfigurability, Considerations for Reconfiguration Mechanisms, Future Trends in Reconfigurable Microstrip Antenna Research and Development.

UHF passive RFID tag Antennas: Introduction, Application requirement, Approaches, Fabrication.

Simulation using Matlab/HFSS

Text 4: Ch. 6: 6.1 to 6.5; Ch. 9: 9.1 to 9.4.1.

UNIT-2 (8 Hrs)

Defected Ground Structure for Microstrip Antennas Introduction, Fundamentals of DGS, DGS for controlling Microstrip Antenna Feeds and Front-End Characteristics, DGS to Control/Improve Radiation Properties of Microstrip Patch Antennas, DGS for Reduced Mutual Coupling between Microstrip Array Elements and Associated Improvements, Conclusion.

Text 4: 12.1 to 12.5

Regularly shaped Broadband Microstrip patch Antennas: RMSA's, parametric study of RMSA's, Effect of width. Effect of height, Effect of probe diameter, effect of Ground plane, effect of loss tangent, effect of cover, higher order modes, Orthogonal feeds for dual polarization

Simulation using Matlab/HFSS

Text 5: 2.1 to 2.2.3

UNIT-3 (8 Hrs)

Microstrip Antennas: Introduction, Basic characteristics, Feeding methods, methods of analysis, Rectangular patch, Transmission line model, Fringing effect, Effective length, Design, Conductance, input resistance. Circular patch, resonant frequencies and design, Quality factor, bandwidth and efficiency.

Simulation of passive devices using HFSS, Matlab

Text 1: Ch14: 14.1,14.1.1,14.1.2,14.1.3,14.2,14.2.1,14.3,14.3.2,14.3.3,14.4

UNIT-4 (8Hrs)

Printed UWB Antennas: Introduction, Antenna with reduced ground plane effect, slim UWB antenna, Diversity Antenna.

Low profile Antennas and personal communication Antennas: Introduction, Microstrip Arrays, Leaky wave Antennas, Fundamental Limits on Antenna size, Planar Inverted F Antennas, Radio Frequency Identification Antennas, Human Body Effect on Antenna performance, Radiation Hazards

Text 4:Ch 10: 10.1 to 10.3 (Guha)

Text 2: Ch 11: 11.1,11.3,11.5,11.6.4,11.6.5,11.9,11.10

UNIT-5 (7Hrs)

Smart Antennas: Introduction, need for smart antennas, overview, Smart Antenna configuration, Space division multiple Access, Architecture of a smart antenna system, Benefits and drawbacks, Basic principle, Mutual coupling effects.

Text 4: Ch 4: 4.1 to 4.9

TEXT BOOKS

1. C.A.Balanis,"Antenna Theory and Design",3rd edition, John Wiley and Sons,2005.
2. W.L Stutzman and G.A.Thiele,"Antenna Theory and Design", John Wiley and sons,2nd edition,1998
3. Constantine A. Balanis Panayiotis I. Ioannides "Introduction to Smart Antennas",1st edition,2007
4. DebatoshGuha,Yahia M MAntar,"Microstrip and Printed Antennas New Trends and Techniques", Wiley, 2011.
5. Girish Kumar,K.P.Ray, "Broadband Microstrip Antennas",Artech House Inc,2003

TEACHING METHODOLOGY

- Blackboard teaching
- PowerPoint presentations (if needed)
- Regular review of students by asking questions based on topics covered in the class

COURSE ASSESSEMENT METHOD

CIE:

- Two Surprise Tests of 10 Marks each. Best of two tests will be taken.
- Tool based assignments covering the syllabus for 10 Marks
- Three internals of 30 Marks each will be conducted and the Average of best of two will be taken.

SEE:

- Final examination of 100 Marks will be conducted and will be evaluated for 50 Marks.

CO-PO-PSO-BT MAPPING

CO/ PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2	PSO 1	PSO 2	PSO 3	B T
CO1	3	2	3	3	3			2	3	3	-	3	-	3	1	2

CO2	3	2	2	3	3	-	2	2	3	2	-	3	-	3	2	3
CO3	3	3	2	2	3	-	2	3	3	3	-	2	3	3	2	3
CO4	3	3	3	3	3	-	2	3	3	3	-	3	3	3	1	4
CO5	3	2	2	3	3	2	2	-	-	-	-	3	3	3	2	4

SEMESTER: VI

REAL-TIME OPERATING SYSTEM

Course Code	**18ECE655**	**Credits**	**03**
Hours/Week(L-T-P)	**3-0-0**	**CIE Marks**	**50**
Total Hours	**39(L)**	**SEE Marks**	**50**
Exam Hours	**03**	**Course Type**	**Program Elective**

PRE-REQUISITES

Computer Concepts and C Programming.

COURSE OUTCOMES

Students will be able to

1. Interpret the need of basics of Operating system, process and multi thread management.
2. Analyze the concept of deadlock situations, process scheduling and synchronization and different approaches of memory management.
3. Interpret the difference between OS and RTOS, concept of task and the role played by the scheduler of a real-time operating system.
4. Interpret inter process communication and other RTOS components.
5. Analyze the concepts of Exceptions and Interrupts with examples.

COURSE CONTENTS

UNIT-1 (8 Hrs)

Introduction to operating systems, System structures: What operating systems do; Computer System organization; Computer System architecture; Operating System structure; Operating System operations; Process management; Memory management; Storage management; Protection and Security; Distributed system; Special-purpose systems; Computing environments

Process Management: Process concept; Process scheduling; Operations on processes; Inter process communication

Multi-threaded Programming: Overview; Multithreading models; Thread Libraries; Threading issues.

Text book 1: Chapter 1 (1.1-1.12) , Chapter 3 (3.1-3.4), Chapter 4 (4.1-4.4)

UNIT-2 (8 Hrs)

Process Scheduling: Basic concepts; Scheduling Criteria; Scheduling Algorithms; Multiple-processor scheduling; Thread scheduling. **Deadlocks :** Deadlocks; System model; Deadlock characterization; Methods for handling deadlocks; Deadlock prevention; Deadlock avoidance; Deadlock detection and recovery from deadlock. **Memory Management:** Memory management strategies: Background; Swapping; Contiguous memory allocation; Paging; Structure of page table; Segmentation. **Text book 1: Chapter 5 (5.1- 5.5) , Chapter 7 (7.1- 7.7) , Chapter 8 (8.1 to 8.6)**
UNIT-3 (8 Hrs)
Introduction to Real-Time Operating Systems: Introduction, Defining an RTOS, The Scheduler, Schedulable Entities, Multitasking, The Context Switch, The Dispatcher, Scheduling Algorithms, Key Characteristics of an RTOS, Real-Time Service Timeline, Real-Time Standards **Tasks:** Introduction, Defining a Task, Task States (Ready / Running / Blocked States) and Scheduling, Task Operations, Task Structure, Task Synchronization, Communication and Concurrency **Text1: 4.2, 4.3, 4.4 (4.4.1 to 4.4.5), 4.5, 4.6, 4.7 , 5.1, 5.2, 5.3, 5.4, 5.5, 5.6**
UNIT-4 (8Hrs)
IPC 1: Semaphores – Definition, Binary, Counting and Mutex Semaphores, Semaphore Operations and Semaphore uses, Message Queues – Definition, Message Queue States, Message Queue Content, Message Queue Storage, Message Queue Operations, Message Queue Use **IPC 2**: Pipes – Definition, Pipe Control Blocks, Pipe States, Pipe Operations, Uses of Pipes, **Other RTOS Services**: TCP/IP Protocol Stack, File System Component, RPC Component, Command Shell, Target Debug Agent, Component Configuration. **Text1: 6.2 (6.2.1 to 6.2.3), 6.3(6.3.1 to 6.3.4), 6.4, 7.2, 7.3, 7.4, 7.5, 7.6 (7.6.1 to 7.6.3), 7.7, 8.1, 8.2, 9.1 9.2, 9.3**
UNIT-5 (7Hrs)
Exceptions and Interrupts: Introduction, What are Exceptions and Interrupts, Applications, A closer Look at Exceptions and Interrupts, Classification, Priorities and Processing of Exceptions, Installing Exception Handlers, Loading and Invoking Exception Handlers, Nested Exceptions and Stack Overflow, Exception Handling, The Nature of Spurious Interrupts. **Text1: 10.1, 10.2, 10.3, 10.4 , 10.5, 10.6**

TEXT BOOKS

1. Abraham Silberschatz, Peter Baer Galvin, Greg Gagne, Operating System Principles ,7th edition, Wiley-India, 2006
2. Qing Li, "Real-Time Concepts for Embedded Systems", Elsevier,2013

REFERENCE BOOKS

1. William Stallings Operating Systems: Internals and Design Principles, 6th Edition, Pearson.
2. "Programming for Embedded Systems", Dreamtech Software Team, Jhon Wiley, India Pvt. Ltd.,2008
3. Frank Vahid and Tony Givargis, " Embedded System Design – A Unified hardware/Software introduction " 3rd edition, Wiley

TEACHING METHODOLOGY

- Blackboard teaching
- PowerPoint presentations (If needed)
- Regular review of students by asking questions based on topics covered in theclass

COURSE ASSESSEMENT METHOD

CIE:

1. Surprise Tests - 10Marks
2. Tool Based Assignments -10Marks.
3. Three mid examinations, 30 Marks each will be conducted and the Average of best of two will be taken.

SEE:

1. Two Questions are to be set from each unit, carrying 20 Marks each.
2. Students have to answer 5 questions selecting one full question from each unit

CO-PO-PSO-BT MAPPING

CO/ PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3	BT
CO1	2											2				2
CO2	2	3	1									2				3
CO3	2	1										2				3
CO4	2											2		1		3
CO5	2	1	1									2				3

PROGRAM LAB

SEMESTER: VI			
	VLSI DESIGN LAB		
Course Code	**18ECL67**	**Credits**	**01**
Hours/Week(L-T-P)	**0-0-2**	**CIE Marks**	**50**
Total Hours	**26(P)**	**SEE Marks**	**50**

COURSE OUTCOMES
Students will be able to
1. Study the usage of VLSI CAD tool as an industry requirement.
2. Design inverter for extracting its parameters. .
3. Design MOSFET based amplifiers for extracting its parameters.
4. Design Current Mirror circuits as per the functionality specifications.

5. Design full custom layouts of inverters, common source and common drain amplifier circuits.

COURSE CONTENTS

Conduct the DC, AC and Transient Analysis for a given circuit

1. Draw the schematic of an Inverter and conduct the following experiments.
   i. DC Analysis
   ii. Transient Analysis
2. Draw the schematic of an Inverter and conduct the following experiments and evaluate Noise Margin, Overall Capacitance, Slew rate and Power.
3. Draw the schematic of an Inverter and conduct the experiment for evaluating Propagation delay, Rise time and fall time using Parametric Analysis.
4. Draw the schematic of an Inverter and conduct the experiment for evaluating Propagation delay, Rise time and fall time using Manual Method.
5. Draw the schematic of a Common Source Amplifier and perform the following:
   i. DC Analysis
   ii. Transient Analysis for a given gain.
   iii. AC analysis.
6. Draw the schematic of a Common Drain Amplifier and conduct the following:
   i. DC Analysis
   ii. Transient Analysis.
   iii. AC analysis
   iv. Input and output impedance
7. Draw the schematic of Single Stage Current mirror and match the currents in the circuit. Prove the working of Current Mirror using DC and Transient Analysis.
8. Draw the schematic of Two Stage Current mirror and match the currents in the circuit. Prove the working of Current Mirror using DC and Transient Analysis.
9. Draw the schematic of a Differential Amplifier and perform the following
   i. Analyze the operating conditions
   ii. Transient Analysis for a given gain.
   iii. AC analysis.
10. Draw the schematic of a Single Stage Op-amp and perform the following
    i. Analyze the operating conditions
    ii. Transient Analysis for a given gain.
    iii. AC analysis.
11. Draw the schematic of a Two Stage Op-amp and perform the following
    i. Analyze the operating conditions
    ii. Transient Analysis for a given gain.
    iii. AC analysis.
12. Layout of Inverter, Common Source Amplifier and Common Drain Amplifier.

CO-PO-PSO MAPPING

CO/ PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3	BT
CO1	1	1	1		3							3	3			3
CO2	3	3	3	1	3							3	3			3
CO3	3	3	3	1	3							3	3	3		3
CO4	3	3	3	1	3							3	3			3
CO5	3	3	3	1	3							3	3			4

SEMESTER: VI

COMMUNICATION SYSTEM LAB II

Course Code	**18ECL68**	**Credits**	**01**
Hours/Week(L-T-P)	**0-0-2**	**CIE Marks**	**50**
Total Hours	**3H/W**	**SEE Marks**	**50**
Exam Hours	**03**	**Course Type**	**Core**

PRE-REQUISITES

Fundamentals of Electromagnetics and Microwave Engineering.
Basic knowledge of Digital and Analog communication.

COURSE OUTCOMES

STUDENTS WILL BE ABLE TO:

CO1: Design and analyze the different digital modulation and demodulation systems

CO2: Analyze the propagation of waves in a waveguide and estimate the different performance parameters.

CO3: Analyze the different types of losses in a fiber optic link and estimate the different performance parameters.

CO4: Design and analyze the radiation characteristics of different types of antennas and estimate the gain and directivity.

CO5: Analyze the characteristics of different microwave devices (both waveguide and microstrip version) and estimate their performance parameters.

COURSE CONTENTS

1. Design and analysis of Time Division Multiplexing of two or more band limited signals.
2. Design of ASK generation & detection system.
3. Design of FSK generation & detection system.
4. Design of PSK generation & detection system.
5. Study of DPSK generation & detection system.
6. Study of QPSK generation & detection system.
7. Study of PCM generation & detection system using codec chip.
8. Analysis of different types of losses present in a Fiber optic communication system for both Analog and digital links and estimation of numerical aperture.
9. Estimation of power & electronic tuning range in a Reflex Klystron Oscillator operating in X band.
10. Determination of Guide wavelength and frequency using slotted line carriage in a microwave test bench operating in X band.
11. Determination of Gain and Directivity of a waveguide type rectangular Horn Antenna operating in the X band
12. Determination of Gain and Directivity of a Paraboloidal Reflector Antenna operating in the X band.
13. Design and analysis of standard dipole antenna (printed dipole antenna) and finding the gain & Directivity operating in the S band.
14. Determination of gain & directivity of micro strip patch antenna operating in the S band.
15. Design of a printed Yagi Antenna operating in the S band and estimating the gain & directivity.
16. Determination of coupling and isolation characteristics of strip line or micro strip line directional coupler.
17. Design of a micro strip ring resonator and estimation of Bandwidth and Quality factor operating in the S band.
18. Determination of power division & isolation characteristics of a Wilkinson 3dB power divider.
19. Determination of power division and Isolation characteristics of Waveguide Tees (E plane Tee,H plane Tee, Magic Tees) using a Microwave Test bench.

Note: Simulation of Experiments 1,2,3,4,5,11,12,13,14,15,16,17,18,19 need to be carried out using a suitable tool such as TINA/Multi Sim/HFSS/MATLAB by students and shown as Assignments.

TEXT BOOKS

Text Book:

1. David M Pozar, “Microwave Engineering”, John Wiley, 3rd Edition, 2004,ISBN-13: 978-0471644514

2. C A Balanis, “Antenna Theory and Design”, John Wiley & sons, Inc. publication, 3rd Edition,2005,ISBN-13: 978-0471667827

Reference Book:

1. R E Collin, “Foundations of Microwave Engineering”, IEEE Press on Electromagnetic and Wave Theory, 2 nd Edition, ISBN-13: 978-0-7803-6031-0/ 0-7803-6031-1

John D.Krauss, “Antennas”, McGraw-Hill International Edition, 3rd Edition,2006.ISBN-13: 978-0071232012

TEACHING METHODOLOGY

- Blackboard teaching

Regular review of students by asking questions based on topics covered in the class

COURSE ASSESSEMENT METHOD

CIE:

1. Record and Observation - 30 Marks
2. Viva -5 marks
3. Lab internals-15marks

SEE:

1. One experiment will be given for conduction.
2. Write Up:8 marks
3. Viva Voce: 7 marks
4. Conduction and Execution: 35 marks

CO-PO-PSO MAPPING

CO/PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3	BT
CO1	3	3	3	2	3	3				2	3	3	3	3		**5**
CO2	3	2	3	3	1	1				3	3	2	3	3		4
CO3	3	2	3	3						2	2	2	1	3		4
CO4	3	2	3	3	3	3				3	3	2	2	3		4
CO5	3	2	3	3	3	3				2	3	4	2	3		4

VII SEMESTER

SEMESTER: VII			
ARM PROGRAMMING AND OPTIMIZATION			
Course Code :	**18EC71**	**Credits:**	**03**
Hours/Week(L-T-P):	**3-0-0**	**CIE Marks:**	**50**
Total Hours:	**39**	**SEE Marks:**	**50**
Exam Hours:	**03**	**Course Type:**	**Core**

PRE-REQUISITES
Basics of microcontroller and microprocessors

COURSE CONTENTS
UNIT-1 (8 Hrs)
Programming in C for ARM: Introduction, Data Path Architecture, Registers, Modes, Exceptions Overview of C Compilers and optimization, basic C data types, C looping structures, register allocation, function calls, pointer aliasing, structure arrangement, bit fields, unaligned Data and Endianess, division, floating point, inline functions and inline assembly, portability issues Reference: Text 1 RBT Level: L1,L2
UNIT-2 (8 Hrs)
Digital Signal Processing on ARM: Representing a digital signal, Introduction to DSP on the ARM, FIR filters: Realization of filters on ARM7 and Cortex M3, IIR Filters: Realization of filters on ARM7 and Cortex M3, CMSIS DSP Library. Reference: Text 1 RBT Level: L2,L2
UNIT-3 (8 Hrs)
Memory Protection Unit: Over view of the MPU's, MPU registers, setting up the MPU, Memory barrier and memory configuration, Using sub-region disable, Consideration when using MPU, Other usages of MPU. **Reference: Text 1** **RBT Level:L2,L3**
UNIT-4 (8 Hrs)
Firmware: Firmware and Boot loader **Embedded Operating Systems:** Fundamental Components, Simple Operating System Reference: Text 1 RBT Level: L2,L3
UNIT-5 (7 Hrs)
Writing and Optimizing ARM Assembly Code: Writing assembly code, profiling and cycle counting, instruction scheduling, register allocation, conditional execution, looping constructs, Bit manipulation, efficient switches. Handling unaligned data. **Reference: Text 1** **RBT Level: L2,L3**
TEXT BOOKS
ARM System Developers Guide, Andrew N Sloss, Dominic Symes, Chris Wright, 2008, Elsevier, Morgan Kaufman publishers, ISBN-13:9788181476463
REFERENCE BOOKS
1. The definitive Guide to the ARM Cortex- M3 & M4 Processors, Joseph Yiu, 3rd Edition, 2014, Newnes (Elsevier), ISBN: 978-93-5107-175-4. 2. ARM System on Chip Architecture, Steve Furber, 2nd Edition, 2001, Pearson Education Limited, ISBN-13:9780201675191. 3. Technical reference manual for ARM processor cores, including Cortex M series, ARM 11, ARM 9 & ARM 7 processor families.
TEACHING METHODOLOGY

- Blackboard teaching
- MS PPTx slides
- Regular review of students’ understanding by asking questions based on topics covered in the class

COURSE ASSESSEMENT METHOD

CIE:

1. Tool based Assessment - 10 Marks
2. Surprise tests based on GATE questions- 10Marks.
3. Three mid sem examinations, 30 Marks each will be conducted and the average of best of two will be taken.

SEE:

1. Two Questions are to be set from each unit, carrying 20 Marks each.
2. Students have to answer 5 questions selecting one full question from each unit

CO-PO-PSO MAPPING

CO/ PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3	BT
CO1						3	2		2	1	3	2				2
CO2						3	2		1	2	3	1				2
CO3						3	1		3	2	2	2				2
CO4						3		3	3	2	2	3				2
CO5						3		3	3	2		3				3

SEMESTER: VII

WIRELESS COMMUNICATION

Course Code:	**18EC72**	**Credits**	**03**
Hours/Week(L-T-P-S):	**3-0-0**	**CIE Marks**	**50**
Total Hours:	**39**	**SEE Marks**	**50**
Exam Hours	**03**	**Course Type**	**Core**

PRE-REQUISITES

1. Knowledge of Antenna and Microwaves
2. Knowledge of computer network concepts
3. Understanding of basic electrical science

COURSE OUTCOMES
At the end of course , the students will be able to 1. Acquire the knowledge of frequency reuse concept by making use of allotted bandwidth. 2. Apply knowledge of mathematics, probability theory, and statistics to model analyze wireless communication 3. Understand of wireless communication systems at the physical layer level. 4.Acquire knowledge with the state of the art technologies like GSM, CDMA and personal Communication systems. 5.Familiar with the technology used in the successive generation of standards used in wireless Communication system

COURSE CONTENTS
UNIT-1 (08Hrs)
Introduction to Wireless Communication Systems: Examples of Wireless Communication Systems, Paging Systems, Cordless Telephone Systems, Cellular Telephone Systems, Comparison of Common Wireless Communication Systems, Trends in Cellular Radio and Personal Communication Systems. **The Cellular Concept- System Design Fundamental:** Introduction, Frequency Reuse, Channel Assignment Strategies, Handoff Strategies, Interference and System capacity, Trunking and Grade of Service, Improving Coverage& capacity in Cellular Systems. *Text1: Ch 1 ,1.4,1.5, Ch 3*
UNIT-2 (08Hrs)
Mobile Radio Propagation: Large Scale Path Loss: Introduction to Radio Wave Propagation, Free Space Propagation Model, Relating Power to Electric Field, The Three Basic propagation Mechanisms, Reflection, Ground Reflection (Two-Ray) Model, Diffraction, Scattering, Practical Link Budget Design Using Path Loss Models, Outdoor propagation Models, Indoor Propagation Models, Signals Penetration into Buildings, Ray Tracing and Site Specific Modeling. *Text: Ch 4*
UNIT-3 (08Hrs)
Mobile Radio Propagation: Small –Scale Fading and Multipath: Small-Scale Multipath Propagation, Impulse Response Model of a Multipath Channel, Small-Scale Multipath Measurements, Parameters of Mobile Multipath Channels, Types of Small-scale Fading. **Speech Coding** :Characteristics of Speech Signals, Quantization Techniques, Adaptive Differential Pulse Code Modulation, Frequency Domain Coding of Speech, Vocoders, Linear Predictive Coders, Choosing Speech Coders for Mobile Communications, The GSM Codec, The USDC Codec, Performance Evaluation of Speech Coders *Text: Ch 5. 5.1 to 5.5, Ch. 8*
UNIT-4 (08Hrs)
Multiple-Access (MA) Schemes: Introduction to FDMA,TDMA,SDMA, Packet radio, capacity of cellular system, Introduction to wireless Networks, Difference between Wireless and Fixed Telephone Networks, Public Switched telephone Networks, Limitations in Wireless networking, Merging Wireless networks and PST *Text: Ch 9, Ch 10, 10.1, 10.2*

UNIT-5(07Hrs)

Wireless Systems and Standards: Global System for Mobile(GSM), GSM services and Features ,GSM system Architecture, GSM Radio Subsystem, GSM channels type, Examples of GSM call, Frame structure for GSM, Signal Processing in GSM , CDMA Digital Cellular system, Frequency and channel specifications ,Forward CDMA channel, Reverse CDMA channel,IS-95 with 14.4 kbps speech coder

Text:Ch11.11.3,11,4

TEXT BOOKS

1. Theodore S.Rappaport, “Wireless Communications-Principles and practice”, Pearson Education, 2^{nd} Edition, 2002

REFERENCE BOOKS

1. Dr. Kamilo Fehel , “Wireless digital Communications”, PHI.5^{th} Print.1995.
2. William C.Y.Lee, “Mobile Communications Engineering, - Theory and applications”, McGraw-Hill, 2^{nd} Edition,1995.

3 .John W.Mark , “Wireless Communications and Networking “.2002.

TEACHING METHODOLOGY

- Blackboard teaching
- PowerPoint presentations (If needed)
- Regular review of students by asking questions based on topics covered in the class

COURSE ASSESSEMENT METHOD

CIE:

1. Two Surprise Tests, 10 Marks each. Best of two tests will be taken.
2. One Assignment test of 10 marks

Three mid examinations, 30 Marks each will be conducted and the Average of best of two will be taken.

SEE:

- Two Questions are to be set from each unit, carrying 20 Marks each.
- Students have to answer 5 questions selecting one full question from each unit

CO-PO-PSO MAPPING

CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3	BT
CO1	3	2	3						1	1		2	1	3	2	3
CO2	3	3	2	3	2					1	1	2	2	3	3	4
CO3	3	2	2		2				2	1		2	3	3	3	2
CO4	3	1	3	2	2				2	2	1	2	1	3	3	3
CO5	3	1			2	1			1	1	2	2		2		2

SEMESTER: VII

POWER ELECTRONICS

Course Code	**18EC73**	**Credits**	**03**
Hours/Week(L-T-P)	**3-0-0**	**CIE Marks**	**50**
Total Hours	**39(L)**	**SEE Marks**	**50**
Exam Hours	**03**	**Course Type**	**Core**

PRE-REQUISITES
Students should have the knowledge of analog electronics, signals and systems and embedded controllers

COURSE OUTCOMES

Students will be able to :

1. Interpret the basic operations of various power semiconductor devices and their applications
2. Analyze the working of a converter and determine the various performance parameters.
3. Analyze the different commutation techniques for the control of power.
4. Analyze the different modes of operation of Choppers and study their performance parameters.
5. Analyze the different configurations of inverters and interpret the different performance parameters.

COURSE CONTENTS

UNIT-1 (7 Hrs)

Introduction: Power semiconductor devices, applications of power electronics, control characteristics, types of power electronic circuits, peripheral effects.

Power BJTs: Switching characteristics, switching limits, base-drive control.

Text1: Ch1, 1.1, 1.3, 1.4, 1.5, 1.7 Ch8: 8.1,8.2

UNIT-2 (8 Hrs)

Thyristor: Introduction, Thyristor characteristics, Two-transistor model of Thyristor, di/dt and dv/dt protection circuit, Thyristor firing circuit and Uni-junction Transistor.

Controlled rectifiers: Introduction, principle of phase controlled converter operation, single- phase semi Converters, full converters and dual converters.

Text1: Ch4: 4-1,4-2,4-3,4-5,4-6,4-11,4-12 Ch 5, 5.1 to 5.5

UNIT-3 (8Hrs)

AC Voltage Controllers: Introduction, principle of ON-OFF and phase control, single-phase bidirectional controllers with resistive loads.

Commutation Techniques: Introduction, natural commutation, forced commutation: self-commutation, impulse commutation, resonant pulse commutation, complementary commutation

Text1: Ch 6, 6.1 to 6.4, Ch 7, 7.1 to 7.3

UNIT-4 (8 Hrs)

DC Choppers: Introduction, principle of step-down and step-up choppers step down chopper with RL loads, performance parameters. Chopper classification, analysis of impulse commutated thyristor chopper (only qualitative analysis). **Text1:** Ch9, 9.1 to 9.6 & 9.8

UNIT-5 (8 Hrs)

Inverters: Introduction, principle of operation, performance parameters, single phase bridge inverters, three phase inverters, voltage control of single phase inverters, current source inverter, variable DC link inverter.
Text 1: Ch10, 10.1 to 10.7 and 10.11

TEXT BOOKS

1. M.H.Rashid, “Power Electronics”, Prentice Hall of India Pvt. Ltd.,/Pearson(Singapore-Asia) New Delhi, 2nd Edition, 2002

REFERENCE BOOKS

1. M D Singh,K B Khanchandani,”Power Electronics”, ,Mc Graw-Hill,New Delhi, 2nd Edition,2009
2. L. Umanand, Power Electronics, Essentials and Applications, John Wiley India Pvt. Ltd, 2009.
3. Dr. P. S. Bimbhra, ―Power Electronics‖, Khanna Publishers, Delhi, 2012.
4. P.C. Sen, ―Modern Power Electronics‖, S Chand & Co New Delhi, 2005.

TEACHING METHODOLOGY

- Black board teaching
- PowerPoint presentations (if needed)
- Regular review of students by asking questions based on topics covered in the class

COURSE ASSESSEMENT METHOD

CIE:

1. Two Surprise tests/ Tool based assignment Tests of 10 Marks each.
2. Three internals of 30 Marks each will be conducted and the average of best of two will be taken.

SEE:

1. Final examination of 100 Marks will be conducted and will be evaluated for 50 Marks.

CO-PO-PSO MAPPING

CO/PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3	BT
CO1	3				3			2	3	3		1	2			2
CO2	3	1			3			2	3	3		1	3			3
CO3	3	3	2		3	2		3	3	3		3	3			3
CO4	3	3	2	2	3	3		3	3	3		3	3			3
CO5	3	3	2	2	3	3		3	3	3		3	3			3

SEMESTER: VII

ENTREPRENEURSHIP DEVELOPMENT, MANAGEMENT and IPR

Course Code :	**18ECH74**	**Credits:**	**3**
Hours/Week(L-T-P):	**3-0-0**	**CIE Marks:**	**50**
Total Hours:	**39**	**SEE Marks:**	**50**
Exam Hours:	**03**	**Course Type:**	**Core**

COURSE OUTCOMES

At the End of the course the students are able to

1. Recognize the importance of entrepreneurship and its role in economic development of the country.
2. Identify various schemes of Central and State Governments and their agencies available to promote MSME.
3. Ascertain the need of managerial skills for an entrepreneur and understand the different facts like planning, organizing, staffing etc.
4. Appreciate the essentiality of communication, coordination and control in managing the enterprise.
5. Appraise the IP rights like patents, industrial design, trademark, copyrights for effective protection and utilization of innovations.

COURSE CONTENTS

UNIT-1 (8 Hrs)

Entrepreneurship: Introduction, Importance of entrepreneurship, entrepreneur, characteristics, Types, entrepreneurial process, role of entrepreneurs in economic development, problems faced by entrepreneurs, scope in India

Make in India: Plans and policies, Sectors, Government Initiatives, Investment Opportunities, Ease of doing Business.

Text: 1, Chapter 5.1-5.10

UNIT-2 (8 Hrs)

Small scale industry: Definition of MSMEs as per MSME act, characteristics of small enterprises, need and advantages of small enterprises, Steps in setting up of small enterprises.

Text 1:Chapter 6.2,6.3,6.5,6.6,6.8

Supporting agencies and Institutional support-State schemes, TECSOK, KIADB, KSSIDC, KSFC, National Schemes- MSME-DI, NSIC, SIDBI

Text: 1 Chapter 7.2,7.3

UNIT-3 (8 Hrs)

Introduction to management - nature and characteristics of management, levels of management, roles of management, Functional areas and scope of management

Text: 1 Chapter 1.3,1.4,1.5,1.9,1.11,1.12

Planning- Nature, steps in planning, types of plans

Text: 1 Chapter 2.3,2.5,2.7

Organizing and Staffing- Purpose and Nature, types of Organization, Staffing, process of recruitment and selection

Text: 1 Chapter 3.3,3.4,3.5,3.17,3.19,3.20

UNIT-4 (8 Hrs)

Directing and controlling- Leadership and leadership styles, Qualities of good leader, Motivation, Importance of motivation,

Communication-Process of communication, Types of communication

Coordination- need, requirements, techniques

Controlling- Controlling process, types of control, control techniques

Text: 1 Chapter 4.3,4.5,4.6,4.10,4.11,4.12,4.13

UNIT-5 (7 Hrs)

Intellectual Property Rights-Introduction to IPR, Types of IPRs, Indian IPR scenario, Legal use of IP **Patents**-Introduction and history of patent, Criteria for patent, types of patents, Indian patent act, patents for computer software, business models, incremental innovation, patent infringement.

Trademarks-role of trademark, Trademark- a marketing tool, trademark rights, types, trademark act, trademark registration in India.

Copyrights- copyright protection in India, enforcement measures, copyright act.

Text: 2 Chapter 5,6,7,8

TEXT BOOKS

1. Entrepreneurship and Management by S Nagendra and V S Manjunath ,Sanguine Technical Publications
2. Managing Intellectual Property by Vinod V. Sople, PHI, 3rd Edition, 2012

REFERENCE BOOKS

1. Intellectual Property-Copyrights, trademarks and patents by Richard Stim, Cengage learning,2011
2. Management Fundamentals -Concepts, Application, Skill Development Robert Lusier –Thomson.

http://www.makeinindia.com

TEACHING METHODOLOGY

- Blackboard teaching
- PowerPoint presentations
- Regular review of students by asking questions based on topics covered in the class

COURSE ASSESSEMENT METHOD

CIE:

1. Test: 30 marks
2. Assignment: 10 marks
3. Case study/Surprise: 10 marks

SEE

1. Final Exam: 50 Marks
2. Two Questions are to be set from each unit, carrying 20 Marks each.
3. Students have to answer 5 questions selecting one full question from each unit

CO-PO-PSO MAPPING

CO/ PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3	BT
CO1						3	2		2	1	3	2				2
CO2						3	2		1	2	3	1				2
CO3						3	1		3	2	2	2				2
CO4						3		3	3	2	2	3				2
CO5						3		3	3	2		3				3

SEMESTER: VII

SATELLITE COMMUNICATION

Course Code	**18ECE751**	**Credits**	**03**
Hours/Week(L-T-P)	**3-0-0**	**CIE Marks**	**50**
Total Hours	**39(L)**	**SEE Marks**	**50**
Exam Hours	**03**	**Course Type**	**Program Elective**

PRE-REQUISITES
Fundamental Course on Engg Electromagnetics, Microwave and antennas

COURSE OUTCOMES

1. Students will be able to identify the fundamentals of orbital mechanics, and performance of communication system.
2. Students will be able to analyze the different types of subsystems present in a satellite.
3. Design a communication link for a satellite to meet the given performance parameters.
4. Analyze the different access technologies and error control techniques for satellites.
5. Design a satellite constellation for Navigation and GPS system considering different performance parameters.

COURSE CONTENTS

UNIT-1 (8Hrs)

Introduction: History, Overview

Orbital Mechanics and Launchers: Orbital mechanics, Look angle Determination, Orbital perturbations, Orbit determination, Launches and Launch Vehicles, Orbital effects in communications Systems performance

Text: Ch.1:1.1 to 1.4,Ch.2:2.1 to 2.6

UNIT-2 (8Hrs)

Satellite: Satellite subsystems, Attitude and orbit control systems(AOCS), Telemetry, Tracking, Tracking, Command and Monitoring, Power Systems, Communications subsystems, Satellite antennas, Equipment Reliability and space qualification tests.

VSAT System: Introduction, Overview of VSAT systems, Network Architecture VSAT systems, Network Architecture VSAT Earth Station Engineering

Text: Ch.3:3.1 to 3.7, Ch.9:9.1 to 9.3, 9.6

UNIT-3 (8Hrs)

Satellite Link Design: Introduction, Basic Transmission Theory, System Noise Temperature and G/T Radio, Design of Downlinks, satellite Systems using Small Earth Stations, Uplink Design, Design for Specified C/N: Combining C/N and C/I values in Satellite Links, System Design Examples *Text: Ch.4:4.1 to4.8*

UNIT-4 (8Hrs)

Multiple Access: Introduction, Frequency Division Multiple Access, Intermodulation, Intermodulation Example, Calculation of C/N with Intermodulation, Time Division multiple access, Demand Access Multiple Access (DAMA), Code Division Multiple Access (CDMA)

Error Control for Digital Satellite Links: Implementation of Error Detection on Satellite Links

Text Ch6:6.1, 6.2, 6.3, 6.5, and 6.8 Ch.7:7.6

UNIT-5 (7rs)

Low Earth Orbit and Non-Geo-stationary satellite Systems: Introduction, Orbit Considerations, Coverage and Frequency Considerations, Delay and Throughput Considerations, Operational NGSO Constellation Design-Iridium, Teledesic

Ch.10:10.1 to 10.4, 10.6

Satellite Navigation and the Global Positioning System: Radio and Satellite Navigation, GPS position Location Principles, GPS receivers and Codes

Text: *Ch.10:10.1 to 10.4, 10.6, Ch* 12:12.1, 12.2, 12.3

TEXT BOOKS

1. Charles Bostian, Jeremy Allnutt, Timothy Pratt, “Satellite Communications”, John Wiley & Sons-II Edition.

REFERENCE BOOKS

1. Dennis Roody “Satellite Communications”, Mc Graw Hill. II Edition

TEACHING METHODOLOGY

- Black board teaching
- PowerPoint presentations (if needed)
- Regular review of students by asking questions based on topics covered in the class

COURSE ASSESSEMENT METHOD

CIE:

1. Two Surprise Tests, 10 Marks each. Best of two tests will be taken.
2. Three internals, 30 Marks each will be conducted and the Average of best of two will be taken.

SEE:

1. Final examination, of 100 Marks will be conducted and will be evaluated for 50Marks.
2. Two Questions are to be set from each unit, carrying 20 Marks each.
3. Students have to answer 5 questions selecting one full question from each unit

CO-PO-PSO MAPPING

CO/ PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3	BT
CO1	3	2	1	3	1	1						2	2	3	1	2
CO2	3	2	1	2								2	2	3	1	3
CO3	3	3	3	1	3							3	2	3	1	5
CO4	3	3	3	3		2						2	1	3	1	4
CO5	3	2	1	2								2	1	3	2	5

SEMESTER: VII

IP NETWORKING

Course Code	**18ECE752**	**Credits**	**03**
Hours/Week(L-T-P)	**3-0-0**	**CIE Marks**	**50**
Total Hours	**39(L)**	**SEE Marks**	**50**
Exam Hours	**03**	**Course Type**	**Program Elective**

PRE-REQUISITES
Basics of electronics, Analog and Digital circuits, Analog and Digital communication, Programming basics

COURSE OUTCOMES
1. Students will be able to understand how to develop client and server programs 2. Students will be able to understand DNS basics 3. Students will be able to understand Network management / SNMP fundamentals 4. Students will be able to understand SDN fundamentals 5. Students will be able to understand IPv6 fundamentals

COURSE CONTENTS
UNIT-1 (8 Hrs)
The Client-Server Model, UDP Echo Server, Sequential and Concurrent Servers, Socket API The Socket Abstraction and Socket Operations, Socket options, TCP Connections, Obtaining and Setting the Host Name, Library Functions Related to Sockets. Examples (Client, Server) T1 Ch20 and Ch21
UNIT-2 (8 Hrs)
DNS Introduction, Names For Computers, Flat Namespace, Hierarchical Names, Delegation Of Authority For Names Subset Authority, Internet Domain Names, Top-Level Domains, Name Syntax And Type, Mapping Domain Names To Addresses, Domain Name Resolution , Efficient Translation ,Caching: The Key To Efficiency Domain Name System Message Format, Compressed Name Format, Abbreviation Of Domain Names , Inverse Mappings, Pointer Queries, Object Types And Resource Record Contents ,Obtaining Authority For A Subdomain Server Operation And Replication, Dynamic DNS Update And Notification , DNS Security Extensions (DNSSEC) T1 Ch 23
UNIT-3 (8 Hrs)
Network Management Introduction, The Level Of Management Protocols, Architectural Model, Protocol Framework , Examples of MIB Variables, The Structure Of Management Information, Formal Definitions Using ASN.1 , Structure And Representation Of MIB Object Names , Network Management Protocol SNMP Message Format, An Example Encoded SNMP Message , Security In SNMPv3 T1 Ch27
UNIT-4 (8 Hrs)
SDN Introduction ,Routes, Paths, And Connections, Traffic Engineering And Control Of Path Selection Connection-Oriented Networks And Routing Overlays ,SDN: A New Hybrid Approach Separation Of Data And Control, The SDN Architecture And External Controllers, SDN Across Multiple Devices Implementing SDN With Conventional Switches, Open Flow Technology, Open Flow Basics

Specific Fields In An Open Flow Pattern, Actions That Open Flow Can Take, Open Flow Extensions And Additions Open Flow Messages ,Uses Of Open Flow
T1 Ch 28.1- 28.16

UNIT-5 (7 Hrs)

Relationship Between Ipv4 And Ipv6,Ipv6 Migration, The Ipv6 Addressing Scheme Ipv6 Colon Hexadecimal Notation,Ipv6 Address Space Assignment, Embedding Ipv4 Addresses In Ipv6 For Transition
Ipv6 Unicast Addresses And /64,Ipv6 Interface Identifiers And MAC Addresses,Ipv6 Multicast And Anycast Addresses
Ipv6 Link-Local Addresses,Ipv6 Datagram Format,Ipv6 Base Header Format
T1 Ch 1.11,1.12,5.14,5.15,5.16,5.17,5.18,5.19,5.21.9,5.21.10,7.7.2,7.7.3

TEXT BOOKS

Text book 1 (T1) –Internetworking with TCP/IP VolumeOne,6/E Douglas E. Comer, PHI
Important Note – This course covers Ipv4 protocol only (Unit 1-4)

TEACHING METHODOLOGY

- Blackboard teaching
- MS pptx slides
- Regular review of students' understanding by asking questions based on topics covered in the class

COURSE ASSESSEMENT METHOD

CIE:

1. Tool based Assessment - 10 Marks
2. Surprise tests based on GATE questions- 10Marks.
3. Three mid semexaminations, 30 Marks each will be conducted and the average of best of two will be taken.

SEE:

1. Two Questions are to be set from each unit, carrying 20 Marks each.
2. Students have to answer 5 questions selecting one full question from each unit

CO-PO-PSO MAPPING

CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3	BT
CO1	3	2			2				2				1	2		3
CO2	3		2		2				2				1	2		3
CO3	3	2			2				2				1	2		2
CO4	3		2		2				2				1	2		2
CO5	3	2			2				2				1	2		2

SEMESTER: VII

OPTICAL FIBER COMMUNICATION

Course Code	**18ECE754**	**Credits**	**03**
Hours/Week(L-T-P)	**3-0-0**	**CIE Marks**	**50**
Total Hours	**39(L)**	**SEE Marks**	**50**
Exam Hours	**03**	**Course Type**	**Core Elective**

PRE-REQUISITES

1. Fundamentals of Electromagnetic theory
2. Principles of Communication Systems

COURSE OUTCOMES

Students will be able to

1. Study different components in an optical fiber communication system.
2. Analyze physics of optical sources and detectors
3. Design optical receivers and study power launching-coupling in optical fibers.
4. Design optical fiber transmission systems for given power and signal rise time.
5. Analyze applications of optical fiber communication systems in optical networks.

COURSE CONTENTS

UNIT-1 (08 Hrs)

Overview of optical fiber communication: Advantages of optical fiber communication, Basic principles, Fiber modes and configuration, step index and graded index structures, Fiber materials, Fiber fabrication, Mechanical properties of fibers, Fiber optic cables.

Signal Degradation in optical fibers: Attenuation, Signal distortion in optical Waveguides, Pulse broadening in graded index waveguides, Mode Coupling and Design optimization of single mode fibers.

Text 1: Ch 2.2 to 2.10 and 3.1 to 3.5

UNIT-2 (08 Hrs)

Optical sources: Basic characteristics of light sources for communication, LED sources and LASER diodes sources, Hetero junction structure.

Optical Detectors: Physical principles of photo diode, PIN photo diodes and AVALANCHE photo diodes, Detectors and their response time.

Text 1:Ch 4.1 to 4.3 and 6.1 to 6.3

UNIT-3 (08Hrs)

Power launching and coupling: Source of fiber power launching, Lensing schemes for Coupling improvement, fiber to fiber joints, LED coupling to single mode fibers, Fiber Splicing, optical fiber connectors.

Optical receiver operation: Fundamental receiver operation, Digital receiver Performance calculation, Pre amplifier types, Analog receiver.

Text 1: Ch 5.1 to 5.6 and 7.1 to 7.5

UNIT-4 08 Hrs)

Analog systems: Overview of analog links, Carrier to noise ratio, Multi-channel Transmission techniques.

Digital Transmission systems: Point to point links, System considerations, Link power Budget, Rise time budget, Line coding for optical fiber links multiplexing, and Error Correction.

Text 1:Ch 8.1 to 8.3 and 9.1 to 9.3

UNIT-5 (07 Hrs)
Advanced systems and techniques: Operational principles of Wavelength division multiplexing, passive components, Optical amplifiers, Local area networks, SONET/SDH Networks, Photonic switching, and non-linear optical effects. *Text 1: Ch 10.1 to 10.2 and 12.1 to 12.5 &Ch 11*
TEXT BOOKS
1. Gerd Keiser, "Optical fiber communication", MC Graw Hill, 3rd Edition, 2000.
REFERENCE BOOKS
1. John Gowar, "Optical communication systems", PHI,2001 2. D.C Agarwal, Wheeler "Fiber optic communication". Chand (S.) & Co Ltd ,India, 2005
TEACHING METHODOLOGY
• Black board teaching • PowerPoint presentations (if needed) • Regular review of students by asking questions based on topics covered in the class
COURSE ASSESSEMENT METHOD
CIE: 1. Two Surprise Tests, 10 Marks each. Best of two tests will be taken. 2. Three internals, 30 Marks each will be conducted and the Average of best of two will be taken. **SEE:** 1. Final examination, of 100 Marks will be conducted and will be evaluated for 50Marks. 2. Two Questions are to be set from each unit, carrying 20 Marks each. 3. Students have to answer 5 questions selecting one full question from each unit
CO-PO-PSO MAPPING

CO/ PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3	BT
CO1	3	2	3											3		2
CO2	3	3	3	1								1		3		3
CO3	3	3	2	1								1		3	2	3
CO4	3	2	3	2								1		3	2	3
CO5	3	1	3	1		2	3					2		3		3

SEMESTER: VIII

INTERNET OF THINGS

Course Code	**18ECE755**	**Credits**	**03**
Hours/Week (L-T-P)	**3-0-0**	**CIE Marks**	**50**
Total Hours	**39(L)**	**SEE Marks**	**50**
Exam Hours	**03**	**Course Type**	**Program Elective**

PRE-REQUISITES

1. Basic knowledge of Electronics and Logic design
2. Basic knowledge of Microprocessors, Microcontrollers and Interfacing
3. Programming in C language

COURSE OUTCOMES

1. Students will understand the fundamentals and applications of Internet of Things
2. Students will get exposure to the aspects of Communication and Protocols associated with IoT
3. Students will know the methodologies and tools involved in the design of IoT
4. Students will understand aspects of hardware and software associated with development of IoT
5. Students will get exposure to the basics of aggregation and analysis of shared data

COURSE CONTENTS

UNIT-1 (8 Hrs)

Introduction to IOT: Introduction to Internet of Things- Definition and Characteristics of IoT, Sensors, Actuators, Physical Design of IoT – IoT Protocols, IoT communication models, IoT Communication APIs, IoT enabled Technologies – Wireless Sensor Networks, Cloud Computing, Embedded Systems, IoT Levels and Templates, Domain Specific IoTs – Home, City, Environment, Energy, Agriculture and Industry.

Textbook #1: 1.1-1.5, 2.1-2.10.

UNIT-2 (8 Hrs)

IoT and M2M: Software defined networks, network function virtualization, difference between SDN and NFV for IoT, Basics of IoT System Management with NETCOZF, YANG- NETCONF, YANG and SNMP NETOPEER.
Textbook #1: 3.1-3.4, 4.1-4.6.

UNIT-3 (8 Hrs)

IoT Physical devices and End-points: Basic building blocks of an IoT device, Raspberry Pi, Linux on Raspberry Pi, Raspberry Pi Interfaces (Serial, SPI, I2C), Programming Raspberry Pi with Python (Controlling LED, Interfacing switch, Interfacing Light sensor).

Textbook #1: 7.1-7.6

UNIT-4 (8 Hrs.)

Controlling Hardware: Connecting LED, Buzzer, Switching High Power devices with transistors, Controlling AC Power devices with Relays, Controlling servo motor, speed control of DC Motor, unipolar and bipolar Stepper motors.
Textbook #2: 9.1-9.6, 10.1, 10.3, 10.5, 10.6

UNIT-5 (7 Hrs)

IoT Physical Servers and Cloud Offerings: Introduction to Cloud Storage models and communication APIs Webserver – Web server for IoT, Cloud for IoT, Python web application framework.

Textbook #1: 8.1-8.4

TEXT BOOKS

1. “Internet of Things: A Hands-on Approach”, Arshdeep Bahga, Vijay Madisetti, Universities Press, 2015.
2. “Raspberry Pi Cookbook, Software and Hardware Problems and Solutions”, Simon Monk, Oreilly, 2014.

REFERENCE BOOKS

1. “Designing the Internet of Things”, Adrian McEwen, Hakim Cassimally, Wiley Publication.

TEACHING METHODOLOGY

- Blackboard teaching
- PowerPoint presentations
- Regular review of students by asking questions based on topics covered in the class

COURSE ASSESSEMENT METHOD

CIE

1. Assignment - 10 Marks
2. Surprise tests - 10Marks.
3. 3 mid-sem exams (30 Marks each) will be conducted and the Average of best two will be taken.

SEE

1. Two Questions are to be set from each unit, carrying 20 Marks each.
2. Students have to answer 5 questions selecting one full question from each unit

CO-PO-PSO MAPPING

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	1		2			1	1		1					1	
CO2	1	1	2		3				1					1	
CO3	1	1	2		3	1			1				1		
CO4		1	2	3	3	1		1	1					1	
CO5	1	1	2	3	3				1					1	1

SEMESTER: VII

DATA COMPRESSION

Course Code	**18ECE756**	**Credits**	**03**
Hours/Week(L-T-P)	**3-0-0**	**CIE Marks**	**50**
Total Hours	**39(L)**	**SEE Marks**	**50**
Exam Hours	**03**	**Course Type**	**Program Elective**

PRE-REQUISITES
Information theory and Coding

COURSE OUTCOMES

1. To provide students with contemporary knowledge in Data Compression and Coding
2. To equip students with skills to analyze and evaluate different Data Compression and Coding methods
3. Analyze the operation of a range of commonly used Coding and Compression techniques
4. Identify the basic software and hardware tools used for data compression
5. Identify what new trends and what new possibilities of data compression are available.

COURSE CONTENTS

UNIT-1 (8 Hrs)

Introduction: Compression Techniques, Modeling and Coding

Mathematical Preliminaries for Lossless Compression: Overview , A Brief Introduction to Information, Models, Coding, Algorithmic Information Theory

Mathematical Preliminaries for Lossy Coding: Overview, Introduction, Distortion Criteria, Information Theory Revisited, Rate Distortion Theory, Models

UNIT-2 (8 Hrs)

Huffman Coding: Overview, The Huffman Coding Algorithm, Adaptive Huffman Coding, Golomb Codes, Rice Codes, Tunstall Codes, Applications of Huffman Coding

Arithmetic Coding: Overview, Introduction, Coding a Sequence, Generating a Binary Code, Comparison of Huffman and Arithmetic Coding, Applications

UNIT-3 (8 Hrs)

Dictionary Techniques: Introduction, Static Dictionary, Adaptive Dictionary, Applications

Lossless Image Compression : Overview, Introduction, CALIC, JPEG-LS, Multi-resolution Approaches, Facsimile Encoding

Scalar Quantization: Overview, Introduction, The Quantization Problem, Uniform Quantizer, Adaptive Quantization, Non-uniform Quantization

UNIT-4 (8 Hrs)

Vector Quantization: Overview, Introduction, Advantages of Vector Quantization over Scalar Quantization

Wavelet-Based Compression: Overview, Introduction, Wavelets, Multi-resolution Analysis and the Scaling Function, Implementation Using Filters, Compression, Embedded Zero-tree Coder, Set Partitioning in Hierarchical Trees, JPEG 2000

UNIT-5 (7 Hrs)

Audio Coding: Overview, Introduction, MPEG Audio Coding, MPEG Advanced Audio Coding

Video Compression: Overview, Introduction, Motion Compensation, Video Signal Representation, ITU-T Recommendation H.261

LITERATURE

Text Books:

Introduction to Data Compression, Khalid Sayood, Morgan Kaufman

Reference Books:

1. A concise introduction to data compression, David Salomon, Springer
2. Data compression: The Complete Reference ,David Salomon, G. Motta, D. Bryant, Springer

TEACHING METHODOLOGY

- Blackboard teaching
- PowerPoint presentations (If needed)
- Regular review of students by asking questions based on topics covered in the class

COURSE ASSESSEMENT METHOD

CIE:

4. Assignments /Tutorials - 10 Marks
5. Quiz/Mini Projects - 10Marks.
6. Three mid examinations, 30 Marks each will be conducted and the Average of best of two will be taken.

SEE:

- Two Questions are to be set from each unit, carrying 20 Marks each.
- Students have to answer 5 questions selecting one full question from each unit

CO-PO-PSO MAPPING

CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3	BT
CO1																
CO2																
CO3																
CO4																
CO5																

SEMESTER: VII

ADHOC WIRELESS NETWORKS

Course Code	**18ECO761**	**Credits**	**03**
Hours/Week(L-T-P-S)	**3-0-0**	**CIE Marks**	**50**
Total Hours	**39(L)**	**SEE Marks**	**50**
Exam Hours	**3**	**Course Type**	**Open Elective**

PRE-REQUISITES
1. Students are expected to have the basics of data communication.

COURSE OUTCOMES
Students will be able to
1. Compare ad-hoc wireless networks with cellular network and gain knowledge on their applications
2. Analyze the issues in designing different layers of ad-hoc wireless networks
3. Design protocols for different layers of adhoc wireless networks.
4. Analyze existing routing and transport protocols and modify them for adhoc wireless networks.
5. Evaluate the quality of service of a network and examine the network security.

COURSE CONTENTS
UNIT-1 (10Hrs)
AD HOC NETWORKS And MAC Protocols: Introduction, Issues in Ad hoc wireless networks, Ad hoc wireless internet. Issues in designing a MAC protocol for Ad hoc wireless Networks, Design goals of a MAC protocol for Ad hoc wireless Networks, Classification of MAC protocols *Text 1: Ch 5- 5.1,5.2,5.3 Ch 6-6.1,6.2.6.3,6.4*
UNIT-2 (11Hrs)
MAC PROTOCOLS: Contention - based MAC protocols with scheduling mechanism, MAC protocols that use directional antennas, Other MAC protocols. *Text1:Ch6 -6.5,6.6,6.7,6.8,6.9*
UNIT-3 (11Hrs)
Routing Protocols For Ad Hoc Wireless Networks: Introduction, Issues in designing a routing protocol for Ad hoc wireless Networks, Classification of routing protocols, Dynamic Source Routing Protocol, Adhoc On-Demand Distance Vector Routing Protocol, Associativity based Routing *Text 1: Ch7- 7.1,7.2,7.3,7.5.1,7.5.2,7.5.5*
UNIT-4 (10Hrs)
Transport Layer Protocols For Ad Hoc Wireless Networks: Introduction, Issues in designing a transport layer protocol for Ad hoc wireless Networks, Design goals of a transport layer protocol for Ad hoc wireless Networks, TCP over ADHOC wireless network *Text 1: Ch9-9.1,9.2,9.3,9.4,9.5,9.6*
UNIT-5 (10Hrs)
SECURITY: Security in wireless Ad hoc wireless Networks, Network security requirements, Issues & challenges in security provisioning, network security attacks and key management
QUALITY OF SERVICE IN AD HOC WIRELESS NETWORKS: Introduction, Issues and challenges in providing QoS in Ad hoc wireless Networks, Classification of QoS solutions. *Text1:Ch9- 9.7,9.8,9.9,9.10,9.11* *Ch10-10.1,10.2,10.3*
TEXT BOOKS

1. **“Ad hoc wireless Networks”**, C. Siva Ram Murthy & B. S. Manoj,Pearson Education, 2nd Edition, reprint 2005.

REFERENCE BOOKS

1. **“Ad hoc wireless Networks”**, Ozan K. Tonguz and Gianguigi Ferrari,Wiley
2. **“Ad hoc wireless Networking”**, Xiuzhen Cheng, Xiao Hung, Ding-Zhu Du, Kluwer Academic publishers.

TEACHING METHODOLOGY

- Black board teaching
- PowerPoint presentations (If needed)
- Regular review of students by asking questions based on topics covered in the class

COURSE ASSESSEMENT METHOD

CIE:

1. Assignment /Case Study - 10Marks
2. Surprise tests - 10Marks.
3. Three mid examinations, 30 Marks each will be conducted and the Average of best of two will be taken.

SEE:

Two Questions are to be set from each unit, carrying 20 Marks each.

Students have to answer 5 questions selecting one full question from each unit

CO-PO-PSOMAPPING

CO/ PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3	BT
CO1	2	2	2	1		1						1		2		2
CO2	3	3	3	1		1	1					1		2		3
CO3	3	3	3	2			1					1		2		3
CO4	3	3	3	2			1					1		2		3
CO5	2	3	3	1								1		2		3

SEMESTER: VII

AVIONICS

Course Code	**18ECO762**	**Credits**	**04**
Hours/Week(L-T-P)	**3-0-0**	**CIE Marks**	**50**
Total Hours:	**52(L)**	**SEE Marks**	**50**
Exam Hours :	**03**	**Course Type**	**Open ELECTIVE**

PRE-REQUISITES

Basics of electronics and aircraft science.

COURSE OUTCOMES

1. Students will understand the need of avionics for both military and civil aviation.
2. Students will be able to interpret the communication, surveillance concepts involved in avionics.
3. Students will be able to illustrate the navigation system involved in avionics.
4. Students will get a summary of avionics which integrates electronics and aviation in both manned and unmanned air vehicles.
5. Students will be able to analyze the various electronic systems/subsystems involved in an aircraft.

COURSE CONTENTS

UNIT-1 (10Hrs)

Introduction to Avionics: Importance and role of avionics, avionic environment, Choice of Units
Text 1: Ch 1.1 to 1.3

UNIT-2 (10 Hrs)

Surveillance Systems: Air traffic control, Primary radar, Secondary radar, Replies, Various system modes, error checking, Transponders of ATCCRB & Mode S, Collision avoidance, Lightning detection, Weather radar. *Text 2: Ch 5.1 to 5.18*

UNIT-3 (11 Hrs)

Airborne Communications Systems: VHF AM Communications, VHF Communications hardware, High frequency communications, ACARS, SELCAL, Digital Communications and Networking, VHF Digital communications, Data link Modes. *Text 2: Ch 6.1 to 6.10*

UNIT-4 (11 Hrs)

On-board Communications: Microphones, Digital communications, Transmission lines, Digital data bus systems ARINC 426, MIL STD 1553, ARINC 629, Commercial standard digital bus, Fiber optic communication. *Text 2: Ch 7.1 to 6.11*

UNIT-5 (10 Hrs)

Navigation System: Introduction and Basic Principles , Inertial Navigation , Aided IN system and Kalman Filters , Attitude Heading Reference System , GPS Global Positioning System , Terrain Reference System
Unmanned Air Vehicles: Importance of Unmanned air vehicles, UAV avionics. *Text 1: Ch 6.1 to 6.6and Text 2 : 10.1 to 10.3*

TEXT BOOKS

4. **Collinson RPG,** Introduction to Avionics, Third Edition, Kluwer Academic Publishers, Chapman & Hall.
5. **Albert Helfrick**, Principals of Avionics 2nd Edition, Avionics Communication Inc.

REFERENCE BOOKS

1. **Moir, I. and Sea bridge**, Civil avionics systems, AIAA Education series, 2nd Edition

2. **Moir, I. and Sea bridge** Military avionics systems (aerospace), Publisher: Wiley-Blackwell (24 February 2006), ISBN-10: 0470016329,ISBN-13: 978-0470016329

TEACHING METHODOLOGY

- Blackboard teaching
- PowerPoint presentations (If needed)
- Regular review of students by asking questions based on topics covered in the class

COURSE ASSESSEMENT METHOD

CIE:

1. Tutorials - 10 Marks
2. Surprise tests - 10Marks.
3. Three mid examinations, 30 Marks each will be conducted and the Average of best of two will be taken.

SEE:

1. Two Questions are to be set from each unit, carrying 20 Marks each.
2. Students have to answer 5 questions selecting one full question from each unit

CO-PO-PSO MAPPING

CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3	BT
CO1						2	2					2				L2
CO2	2	1				2	2			3		2		**3**		L3
CO3	2	1				2	2					2		**3**		L2
CO4						2	2					2				L3
CO5						2	2			3		**2**		**3**		L2

SEMESTER: VII

FORECASTING PERSPECTIVE USING R

COURSE CODE	**18ECO763**	**CREDITS**	**03**
HOURS/WEEK(L-T-P)	**3-0-0**	**CIE MARKS**	**50**
TOTAL HOURS	**39(L)**	**SEE MARKS**	**50**
EXAM HOURS	**03**	**COURSE TYPE**	**Open Elective**

PRE-REQUISITES
Familiarity with Statistics and C language

COURSE OUTCOMES
The student will be able to 1. Acquire the Forecasting Perspective 2. Analyze the different parameters of Forecasting using the Forecasting Toolbox 3. Apply different regression models for forecasting 4. Apply time series decomposition for seasonal forecasting 5. Realize various models using time series decomposition

COURSE CONTENTS
UNIT-1 (8 Hrs)
Getting Started: Introduction to Forecasting , Time Series Graphics and Concepts **T1: 1.1-1.9, 2.1-2.11**
UNIT-2 (8 Hrs)
Basic Forecasting Tools: Forecasting Toolbox: Simple Forecasting Methods, Time Series Adjustments & Transformations and Residual Diagnostics, Evaluating Forecast Accuracy and Prediction Intervals **T1:3.1-3.8**
UNIT-3(8 Hrs)
Linear Models: Simple and Multiple Regression Models , More on Regression and Forecasting with Regression Models **T1: 5.1-5.9**
UNIT-4 (8 Hrs)
Time Series Decomposition and Exponential Smoothing: Seasonal decomposition methods and examples, Simple Exponential Methods, Holts Trends Methods, Taxonomy of Exponential Smooth Models and ETS models. **T1:6.1, 6.3-6.5, 7.1-7.7**
UNIT-5 (7 Hrs)
Arima Models and Neural Network Models for Time Series: Introduction to Arima, Stationarity, and Differencing, Simple Neural Networks in Forecasting. **T1: 8.1-8.9, 11.3**
TEXT BOOKS
1. Forecasting: Principles and Practice, 2nd edition by Rob J Hyndman & George Athanasopoulos (2018)
REFERENCE BOOKS

3. Forecasting Methods and Applications by Spyros Makridakis, Steven C Wheelwright, Rob J Hyndman, Third Edition.
4. Practical Time Series Forecasting with R, A hands on Guide by Galit Shmueli, Kenneth C Lichtendahl Jr, Second Edition.

TEACHING METHODOLOGY

- PowerPoint Presentation
- R Tutorials on Certain Topics

COURSE ASSESSEMENT METHOD

CIE:

1. Tool based Assessment - 20 Marks
2. Three mid examinations, 30 Marks each will be conducted and the Average of best of two will be taken.

SEE:

1. Two Questions are to be set from each unit, carrying 20 Marks each.
2. Students have to answer 5 questions selecting one full question from each unit

CO-PO-PSO MAPPING

CO/PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3	BT
CO1	3	2	1	1	3			2	2	1		3			3	2
CO2	3	2	1	1	3			2	2	1		3			3	3
CO3	3	2	1	1	3			2	2	1		3			3	3
CO4	3	2	1	1	3			2	2	1		3			3	3
CO5	3	2	1	1	3			2	2	1		3			3	3

SEMESTER: VII			
INTRODUCTION TO DATA ANALYTICS			
Course Code	**18ECO764**	**Credits**	**03**
Hours/Week(L-T-P)	**3-0-0**	**CIE Marks**	**50**
Total Hours	**39 Hrs**	**SEE Marks**	**50**
Exam Hours	**3 Hrs**	**Course Type**	**Open Elective**

PRE-REQUISITES
Signal Analysis and Processing

COURSE OUTCOMES
At the end of the course, the student will be able to 1. Understand state- of-the art big data platforms and data analytic techniques and Analyse data using statistical techniques. 2. Identify real world applications that can be tackled with techniques from machine learning and Neural Networks. 3. Perform Time-series data analysis using recurrent model, autoregressive models. 4. Use different optimization techniques, predominantly used in data analytics. 5. Design and implement efficient data analytic solutions for real world applications.

COURSECONTENTS
UNIT-1 (06 Hrs)
Introduction: Wearables and big data- potential challenges, intelligent data analysis, analytic processes and tools, Analysis v/s Reporting; **Statistical concepts:** properties of an attribute: Mean, Median, Mode; Range, Variance, Standard Deviation; Expectation and Variance, probability distributions, sampling distributions, measures of similarity and dissimilarity, multi-dimensional vector spaces.
UNIT-2 (06 Hrs)
Data pre-processing and visualization: Data pre-processing: types of error and error handling, filtering, data transformation, data merging; Data Visualization: - plots and projection methods- 2D and 3D scatter diagram, principle component analysis, histogram, spectral analysis-amplitude, phase spectra, cosine and sine transform
UNIT-3 (06 Hrs)
Introduction to Machine Learning: Differentiating algorithmic and model based frameworks, Regression-least squares, Ridge regression, Lasso regression, K Nearest Neighbor regression and classification Linear Discriminant Analysis, logistic regression
UNIT-4 (06 Hrs.)
Supervised and Unsupervised Techniques: Classification-Naïve Bayesian classifier, Back propagation neural network, decision trees, support vector machine, fuzzy decision trees; Clustering- K Nearest Neighbor, K-Means, Fuzzy C Means, Deep learning concepts
UNIT-5 (06 Hrs)

Time-series data analysis: Auto-covariance and autocorrelation, finite state machines, recurrent model, autoregressive models

Optimization methods: Search by gradient descent, simulated annealing, Genetic algorithms

Contemporary issues: Implementation of the current Problem and Analysis of the Same. May be Carried out individually or Maximum of Group Size is Two.

TEXT BOOKS

1. Thomas A Runkler, Data Analytics: Models and Algorithms for Intelligent Data Analysis, Springer, 2012.

REFERENCE BOOKS

1. Montgomery, Douglas C., and George C. Runger. Applied Statistics and Probability for Engineers. John Wiley & Sons, 2010
2. Kevin P. Murphy & Francis Bach, Machine Learning: A probabilistic perspective , MITPress, 2012
3. Trevor Hastie, Robert Tibshirani & Jerome Friedman, The Elements of Statistical Learning: Data Mining, Inference, and Prediction, Springer, 2017
    1. Shai Shalev-Shwartz, Shai Ben-David, Understanding Machine Learning: From Theory to Algorithms, Cambridge University Press, 2014

TEACHING METHODOLOGY

COURSE ASSESSEMENT METHOD

CO-PO-PSO MAPPING

CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3	BT
CO1	3	2	1		1			2	2	1		3				**2**
CO2	3	2	1		3			2	2	1		3				**3**
CO3	3	2	1	2	3			2	2	1		3				**3**
CO4	3	2	1	1	3			2	2	1		3				**2**
CO5	3	2	1		3			2	2	1		3				**3**

LIST OF EXPERIMENTS (09Hrs)

- Programming with Data analytic tools: Waikato Environment for Knowledge Analysis(WEKA), R Tool, python and SPSS using R for Introductory Statistics
- Creating and customizing applications to analyse data.
- Exploring the data and pre-processing the data using WEKA tool Data Visualization
- Apply Regression and different classification techniques for classifying the given data:
  i) I Linear regression, ii) Logistic regression, iii) Neural networks,
  iv) SVM, v) Decision tree, vi) Naïve Bayes
- Apply various clustering techniques to cluster the data:
  i) K Nearest Neighbour, ii) K-Means
  iii) Fuzzy C Means, iv) Self-organizing map
- Apply Deep learning for extracting complex patterns from big data.
- Apply various associative rule mining algorithms

SEMESTER: VII

DATA COMMUNICATION NETWORK LAB

Course Code	**18ECL77**	**Credits**	**01**
Hours/Week(L-T-P)	**0-0-2**	**CIE Marks**	**50**
Total Hours	**26(P)**	**SEE Marks**	**50**

PRE-REQUISITES

- Knowledge of C Programming
- Basic Networking

COURSE OUTCOMES

Student will be able to:

1. Apply the principles of computer networks
2. Analyze the functionality of layered network architecture.
3. Apply different protocols to design and implement in wired/wireless networks.
4. Compare different routing algorithms
5. Analyze and implement error control coding techniques.

COURSE CONTENTS

1. Simulate a three nodes point-to-point network with duplex links between them. Set the queue size vary the bandwidth to find the number of packets dropped.
2. Simulate a four node point-to-point network, and connect the links as follows: n0-n2, n1-n2 and n2-n3. Apply TCP agent between n0-n3 and UDP n1-n3. Apply relevant applications over TCP and UDP agents to determine the number of packets sent by TCP/UDP
3. Simulate an Ethernet LAN using N nodes .Set multiple traffic nodes and determine collision across different nodes.
4. Simulate an Ethernet LAN using N-nodes(6-10), change bandwidth and compare the throughput
5. Simulate simple BSS and with transmitting nodes in wire-less LAN. Determine the performance with respect to transmission of packets.
6. Simulate transmission of ping messages over a network topology and capture the Round Trip Time.
7. Simulate a 6 node network to implement dynamic routing algorithm and verify its functionality.
8. Implement a method of cyclic data transmission using UDP protocol.
9. Implement using C, the error detecting code CRC for 16 bits.
10. Implement using C ,Hamming Code generation for error detection and correction
11. Simulate a wireless network to test Destination-Sequenced Distance-Vector Routing (DSDV) protocol.
12. Simulate a 7 node network to verify Link State routing protocol?

TEXT BOOK

1. Behrouzs Forouzan, “Data communication and networking”, TMH, 4th Edition, 2006.

REFERENCE BOOKS

1. Bhushsan Trivedi “Data Communication and Network ,” Oxford Higher Education, 1st edition , 2016

TEACHING METHODOLOGY

- Black board teaching
- PowerPoint presentations (If needed)
- Regular review of students by asking questions based on topics covered in the Lab

COURSE ASSESSEMENT METHOD

CIE:

1. Regular review of the students work in the lab and recording the work done on a day to day basis in Record and observation.
2. Conduction Exam for the students to assess the quality of the work done in the lab. We do modify the network setup, calculation to make sure students have understood the tool.
3. Viva voce examination to analyze the student's involvement in the experiment.
4. Record and Observation carries 30 marks
5. Execution carries 15 marks
6. Viva Voce carries 5 marks
7. Total CIE is foe 50 marks.

SEE:

1. One question is set to related to each experiment. We do modify the network setup, calculation to make sure students have understood the tool.
2. Write up is awarded 8 marks
3. Execution of the program is awarded 35marks.
4. Viva voce examination for the students is awarded with 7 marks
5. Total marks for SEE is 50 marks

CO-PO-PSO MAPPING

CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3	BT
CO1	3	3			3		2	1	1	1		3		3		3
CO2	3	3			3		2	1	1	1		3		3		3
CO3	3	3		1	3		2	1	1	1		3		3		3
CO4	3	3	2	1	3		2	1	1	1		3		3		2
CO5	3	3	2		3		2	1	1	1		**3**		3		3

SEMESTER: VII

POWER ELECTRONICS LAB

Course Code	**18ECL78**	**Credits:**	**1**
Hours/Week(L-T-P-S)	**0-0-2**	**CIE Marks**	**50**
Total Hours	**26Hr/week**	**SEE Marks**	**50**
Exam Hours	**3**	**Course Type:**	**Core**

PRE-REQUISITES

A Fundamental course on Basic Electronics, Analog Electronic circuits and Linear Integrated circuits is necessary to understand this subject.

COURSE OUTCOMES

Students will be able to:

1. Design and analyze the voltage versus current characteristics of power semiconductor devices viz. MOSFET, IGBT, SCR, DIAC and study their performance parameters.
2. Analyze the different types of power electronic circuits and their performance based on the variation in input voltage and firing angle.
3. Analyze the generation of firing pulses and use them in switching of different semiconductor devices.
4. Analyze the working of AC/DC Motors, their protection circuitry, driving mechanism and Evaluation of performance parameters associated with them.
5. Design and Analyze the working of DC power supply circuits and study their voltage and current behavior.

COURSE CONTENTS

LIST OF EXPERIMENTS

1. Design and analysis of static characteristics of SCR and determination of the breakdown voltage, latching and holding current.
2. Analysis of Static Characteristics of DIAC).
3. Design and analysis of static Characteristics of MOSFET and determination of trans-conductance and output resistance.
4. Design and analysis of static Characteristics of IGBT and determination of Trans- conductance and output resistance.
5. Design and analysis of Half and Full Wave rectifier using RC Triggering.
6. Design and analysis of AC voltage Controller and determination of rms voltage and current for different firing angles.
7. Determination of the speed of the Universal motor and study the voltage versus speed characteristics for different values of firing angles.
8. Determination of the speed of the Induction motor and study the voltage versus speed characteristics for different values of firing angles.
9. Determination of the speed of the DC Motor Using 1phase Half Controlled semi converter and estimate the speed for different values of firing angle.
10. Study the characteristics of stepper motor controller for a specified count and observe the angle of rotation in clockwise and anticlockwise direction.
11. Determination of output and rms voltage of SCR Based Voltage Commutated DC – Chopper Circuit for

specified value of the firing angle.

12. Analysis of a series inverter circuit for varying firing angle and frequency at the input.
13. Analysis of a Forced Commutation and observe the voltage across the capacitor and the output.
14. Analysis of an Auxiliary Commutation(CLASS-D) circuit and observe the output voltage and Turn off times.
15. Analysis of a Parallel inverter circuit for varying firing angle and frequency at the input.
16. Analysis of RC Half and Full Wave controlled rectifier using UJT Firing Circuits and observe the output voltage for different values of firing angle.
17. Analysis of Single phase PWM inverter for different value of firing angle and modulation index by considering different types of output waveform and observe the rms output voltage in each case.
18. Design Based Experiment
    i. Design of DC-Power Supply
    ii. Design Based Experiment-1-Phase AC Voltage Controller With R-Load
    iii. Design Based Experiment 1-Phase C Voltage Controller With RL-Load

SEMESTER: VII

INTERNSHIP/MINI-PROJECT/SELF-STUDY

Course Code	**18ECP79**	**Credits**	**02**
Hours/Week(L-T-P-S)	**0-0-0**	**CIE Marks**	**50**
Total Hours	**45(P)**	**SEE Marks**	**50**

PRE-REQUISITES

- Knowledge of Electronics and Communication subjects
- Knowledge of modern tools
- Knowledge of programming languages

COURSE OUTCOMES

CO 1: Students will be able to consolidate the literature search to identify and formulate the engineering problem.
CO 2: Students will be able to gain additional skills and education, networking opportunities, mentorship from an Internship.
CO 3: Students will be able to engage in independent study to arrive at an exhaustive list of available engineering tools that may be used for solving the identified engineering problem.
CO 4: Students will be able to perform the budget analysis of the project through resources utilization and identify the community that shall benefit through the solution to the identified engineering problem and also demonstrate concern for the environment.
CO 5: Students will be able to analyze and interpret results of experiments conducted on the designed solution to arrive at valid conclusions.
CO 6: Students will be able to abide by the norms of professional ethics

COURSE ASSESSEMENT METHOD

1. The student group details regarding Internship/mini-project are taken from students with the synopsis approved from their internal guide.
2. CIE and SEE is conducted for 50 marks.
3. CIE is conducted in 2 phases for a total of 50 marks and each phase carries 25 marks.
4. Demonstration of mini-project is must for both CIE and SEE.
5. Phase 1 evaluation is done by panel member along with internal guide for 25 marks.
6. Phase 2 evaluation is done by panel member along with internal guide for 25 marks and is conducted in slots.
7. CIE marks of the students is updated in SMS.
8. SEE timetable is prepared and is conducted for 50 marks.

CO-PO MAPPING

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3										
CO2									3	3		3
CO3			3		3							3
CO4						3	3				3	
CO5				3								
CO6								3				

VIII SEMESTER

SEMESTER: VIII

LTE AND BEYOND 5G

Course Code	**18EC81**	**Credits**	**03**
Hours/Week(L-T-P)	**3-0-0**	**CIE Marks**	**50**
Total Hours	**39**	**SEE Marks**	**50**
Exam Hours	**03**	**Course Type**	**Core**

COURSE OUTCOMES

Students will be able to

1. Study the basic technologies for deploying 4G
2. Study the different access and scheduling technologies for implementing 4G
3. Study the different spectrum standardization schemes and challenges for 5G
4. Study the basic architecture and beam forming techniques for supporting 5G
5. Study the different MIMO techniques with channel modelling

COURSE CONTENTS

UNIT-1 (8 Hrs)

Introduction to 4G

LTE – 4G Key Enablers for LTE 4G – OFDM, SC-FDE, SC-FDMA, Channel Dependent Multiuser Resource Scheduling, Multi-Antenna Techniques, Flat IP Architecture, LTE Network Architecture.

Text1: Ch1: 1.4.1 to 1.4.5

UNIT-2 (8 Hrs)

Introduction to 4G OFDMA and SC-FDMA

LTE – 4G OFDMA and SC-FDMA – Multiple Access for OFDM Systems, OFDMA, SCFDMA, Multiuser Diversity and Opportunistic Scheduling, OFDMA and SC-FDMA in LTE, OFDMA system Design Considerations

Text1: Ch4: 4.1 to 4.6

UNIT-3(8 Hrs)

Drivers for 5G

Evolution of LTE Technology to Beyond 4G – Pillars of 5G – Standardization Activities -Use cases and Requirements – System Concept – Spectrum and Regulations: Spectrum for 4G – Spectrum Challenges in 5G – Spectrum Landscape and Requirements – Spectrum Access Modes and Sharing Scenarios

Text2: Ch12: 12.1 to 12.3

Text3: Ch1: 1.3,1.5

UNIT-4 (8 Hrs)

5G **Architecture and Millimeter Wave Communication**

5G Architecture: Software Defined Networking – Network Function Virtualization – Basics about RAN Architecture – High-Level Requirements for 5G Architecture – Functional Architecture and 5G Flexibility – Physical Architecture and 5G Deployment Millimeter Wave Communication: Channel Propagation – Hardware Technologies for mmW Systems – Deployment Scenarios – Architecture and Mobility – Beam forming – Physical layer Techniques

Text2: Ch3: 3.1 to 3.3; Ch6: 6.2 to 6.5

UNIT-5 (7 Hrs)

Massive Multiple-Input Multiple –Output Systems

MIMO in LTE – Single-user MIMO – Multi-user MIMO – Capacity of Massive MIMO – Pilot Design of Massive MIMO – Resource Allocation and Transceiver Algorithms for Massive MIMO – Fundamentals of Baseband and RF Implementation in Massive MIMO – Channel Models

Text2: Ch8: 8.1 to 8.6

TEXT BOOKS

1. Arunabha Ghosh, Jan Zhang, Jefferey Andrews, Riaz Mohammed, Fundamentals of LTE, Pearson education (Formerly Prentice Hall, Communications Engg and Emerging Technologies), ISBN- 13: 978-0-13-703311-9.
2. Asif Oseiran, Jose F.Monserrat and Patrick Marsch, 5G Mobile and Wireless Communications Technology, Cambridge University Press, 2016, ISBN: 978-1107130098
3. Jonathan Rodriquez, Fundamentals of 5G Mobile Networks, Wiley, 2015 , ISBN: 978-1118867525

REFERENCE BOOKS

1. Patrick Marsch, Omer Bulakci, Olav Queseth and Mauro Boldi, 5G System Design – Architectural and Functional Considerations and Long Term Research, Wiley, 2018, ISBN: 978-1119425120

TEACHING METHODOLOGY

- Blackboard teaching
- PowerPoint presentations (If needed)
- Regular review of students by asking questions based on topics covered in the class

COURSE ASSESSEMENT METHOD

CIE:

- Two Surprise Tests, 10 Marks each. Best of two tests will be taken.
- Three internals, 30 Marks each will be conducted and the Average of best of two will be taken.

SEE:

- Final examination, of 100 Marks will be conducted and will be evaluated for 50 Marks.

CO-PO-PSO MAPPING

CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3	BT
CO1	3	2												3		
CO2	2	3	3											2		
CO3	2	1		3										2		
CO4	1	2	2	3										2		
CO5	2	1	2	2										3		

PROGRAM ELECTIVE - 4

SEMESTER: VIII

CRYPTOGRAPHY AND NETWORK SECURITY

Course Code	**18ECE821**	**Credits**	**03**
Hours/Week(L-T-P-S)	**3-0-0-0**	**CIE Marks**	**50**
Total Hours	**39**	**SEE Marks**	**50**
Exam Hours	**03**	**Course Type**	**Core Elective**

COURSE OUTCOMES

Students will be able to

1. Recognize the essential components and principles of cryptography;
2. Describe the fundamental principles and application of symmetric encryption and cryptographic hashing to provide an improved cyber security measure.
3. describe the fundamental principles and application of asymmetric and public-key encryption and a Public-Key Infrastructure (PKI) to provide an improved cyber security measure;
4. Implement the application of cryptographic techniques and protocols to protect the transmission and storage of information, provide confidentiality, integrity, protected message exchanges, data origin authentication, entity authentication and non-repudiation; Identify and explain key management, digital signatures and digital certificates
5. Describe network security applications, password management, Firewall, IDS, Web security, Email security, and malicious software etc.

COURSE CONTENTS

UNIT-1 (8 Hrs)

Overview: Services, Mechanisms and attacks, OSI security architecture, Model for network security.
Classical Encryption Techniques: Symmetric cipher model, Substitution techniques, Transposition techniques, Rotor machine, Steganography.

Block Ciphers and DES (Data Encryption Standards): Simplified DES, Block cipher principles, DES, Strength of DES, Block cipher design principles, Block cipher modes of operation.

UNIT-2 (8 Hrs)

Public Key Cryptography and RSA: Principles of public key cryptosystems, RSA algorithm, Key management, Diffie-Hellman key exchange, Elliptic curve arithmetic, Elliptic curve cryptography, PKI Infrastructure
Message Authentication and Hash Functions: Authentication requirements, Authentication functions, Message authentication codes, Hash functions, Security of hash functions and MAC's.

Digital Signature and Authentication Protocol: Digital signature, Authentication protocols, Digital signature standard. Kerberos, X.509 authentication service, Kerberos encryption technique.

UNIT-3(8 Hrs)

Electronic Mail Security: Pretty good privacy, S/MIME, Data compression using ZIP, Radix-64 conversion, PGP random number generator.
Transport Level Security: Web Security Considerations, Secure Socket layer, Handshake Protocol and Cryptographic Computations, Transport layer Security, HTTPS

UNIT-4 (8 Hrs)

Wireless Network Security: Wireless Network Threats, Wireless Security Measures, Mobile Device Security, IEEE 802.11 Wireless LAN Overview, IEEE.802.11i Wireless LAN Security

UNIT-5 (7 Hrs)

Intruders: Intruders, Intrusion detection, Password management
Firewalls: Firewall design principles, Trusted systems.

TEXT BOOKS

William Stallings, "**Cryptography and Network Security"**, 3rd edition, Pearson Education (Asia) Pvt. Ltd./ Prentice Hall of India, 2003.

REFERENCE BOOKS

1. C. Kaufman, R. Perlman, and M. Speciner, "**Network Security: Private Communication in a Public World**", 2nd edition, Pearson Education (Asia) Pvt. Ltd., 2002.
2. Atul Kahate, "**Cryptography and Network Security**", Tata McGraw-Hill, 2003.
3. Eric Maiwald, "**Fundamentals of Network Security**", McGraw-Hill, 2003.

- Blackboard teaching
- PowerPoint presentations (If needed)
- Regular review of students by asking questions based on topics covered in the class

COURSE ASSESSEMENT METHOD

CIE:

- Two Surprise Tests, 10 Marks each. Best of two tests will be taken.
- Three internals, 30 Marks each will be conducted and the Average of best of two will be taken.

SEE:

- Final examination, of 100 Marks will be conducted and will be evaluated for 50 Marks.

CO-PO-PSO MAPPING

CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3	BT
CO1	3				1			2				3		1		2
CO2	3	2			1	2		2				3		1		3
CO3	3	2			1	2		2				3		1		3
CO4	3	2				2		2				3		1		3
CO5	3	2				3		2				3		1		2

SEMESTER: VIII

ERROR CONTROL CODING

Course Code	**18ECE822**	**Credits**	**03**
Hours/Week	**3-0-0**	**CIE Marks**	**50**
Total Hours	**39 Hrs**	**SEE Marks**	**50**
Exam Hours	**03**	**Course Type**	**Core Elective**

PRE-REQUISITES
Mathematics III , Linear algebra, Information theory and coding

COURSE OUTCOMES

Upon Completion of the course students will be able to

1. Students will be able to apply the knowledge of linear algebra for various codes.
2. Students will be able to design linear block codes and cyclic codes.
3. Students will be able to analyze the basics of error control codes.
4. Students will be able to apply various algorithms to design the encoder and decoder circuit of error control codes.
5. Students will be able to illustrate the characteristic features and capability of different error control codes.

COURSE CONTENTS

UNIT-1 (8 Hrs)

Introduction to linear algebra: Groups, Fields ,Binary Field Arithmetic, Construction of Galois Field GF (2^m) and its basic Properties, Computation using Galois Field GF (2^m) Arithmetic, Vector spaces and Matrices.Text1 Ch-2 :2.1-2.6

Linear Block Codes: Reed – Muller codes, The (24, 12) Golay code,

Text1 ch4-4.3 and 4.6

UNIT-2 (8 Hrs)

BCH codes: Binary primitive BCH codes, Decoding procedures, Implementation of Galois field Arithmetic, Implementation of Error correction, , q – ary Linear Block Codes, Primitive BCH codes over GF (q),Decoding of BCH The Berlekamp – Massey algorithm, Zieler decoder method of decoding

Text1 Unit III- Ch 6- 6.1, 6.2. 6.8, ch 7-7.1-7.4

UNIT-3 (8 Hrs)

Majority logic decodable codes: One – Step Majority logic decoding, one – step Majority logic decodable Codes, Two – step Majority logic decoding, Multiple – step Majority logic decoding. Text1 ch-8.1-8.4

UNIT-4 (8 Hrs)

Turbo Codes, Encoder Structure, Interleaving and its types, Iterative decoding for turbo codes, MAP algorithm for turbo codes. Low Density Parity check codes, properties, Tanner graph representation, Galleger LFPC codes. Reference book 3 ch7-7.1, 7.2,7.7,7.8, ch8-8.1,8.2,8.3

UNIT-5 (7 Hrs)

Burst Error correcting Codes: Burst and Random error correcting codes, Concept of Inter – leaving, cyclic codes for Burst Error correction – Fire codes, Convolutional codes for Burst Error correction. Text1 ch 20 , 20.1-20.5

TEXT BOOKS

1. "Error Control Coding" Shu Lin & Daniel J. Costello, Jr. Pearson / Prentice Hall, Second Edition, 2004.

REFERENCE BOOKS

1. "The theory of error correcting codes" F.J. Mac Williams and N.J.A. Slone, North Holland, 1977
2. "Error control Coding" , Peter Sweeney,John Wiley and sons 2002
3. "Essentials of Error control coding", Jorge Castiñeira Moreira, Patrick Guy Farrell

TEACHING METHODOLOGY

- Blackboard teaching
- PowerPoint presentations (If needed)
- Regular review of students by asking questions based on topics covered in the class
-

COURSE ASSESSEMENT METHOD

CIE:

1. Assignments- 10 Marks
2. Surprise tests - 10Marks.
3. Three mid examinations, 30 Marks each will be conducted and the Average of best of two will be taken.

SEE:

1. Two Questions are to be set from each unit, carrying 20 Marks each.
2. Students have to answer 5 questions selecting one full question from each unit

CO-PO-PSO, BT MAPPING

CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3	BT
CO1	3	2	2										2		3	3
CO2	3	2	2	2										3	3	3
CO3	3	2	2										2		3	3
CO4	3	3	3	2										3		3
CO5	3	3	3	2											3	2

SEMESTER: VIII

AUTOMOTIVE ELECTRONICS

Course Code	**18ECE823**	**Credits**	**03**
Hours/Week(L-T-P)	**3-0-0**	**CIE Marks**	**50**
Total Hours	**39**	**SEE Marks**	**50**
Exam Hours	**03**	**Course Type**	**Core Elective**

COURSE OUTCOMES

CO 1: Students will get exposure to the key terminology and parameters of the Automotive industry

CO 2: Students will get exposure to the functioning of important mechanical sub-systems of the Automobiles

CO 3: Students will be able to interpret the role played by electronics in improving the performance and safety in different sub-systems of the Automobiles

CO 4: Students will analyse the steps involved in the implementation of electronic systems forth Automotive sub-systems

CO 5: Student will understand the standards and evolution of technologies in the use of electronics in the modern-day Automotives

COURSE CONTENTS

UNIT-1 (8 Hrs)

Automotive Systems, Design cycle and automotive industry overview:

a. Overview of Automotive industry. Role of technology in Automotive Electronics and interdisciplinary design. Tools and Processes.

b. Introduction to modern automotive systems and need for electronics in automobiles and application areas of electronic systems in modern automobiles

c. Spark and Compression Ignition Engines: Ignition

d. systems, Fuel delivery systems, Engine control functions, Fuel control, Electronic systems in Engines

e. Automotive transmissions: Transmission fundamentals.

f. Vehicle braking fundamentals: Vehicle dynamics during braking, hydraulic brake system components, Introduction to antilock braking systems

g. Steering Control: Steering system basics, Fundamentals of electronically controlled power steering: type, electronically controlled hydraulic systems and Electric powers steering systems. Passenger Safety and Convenience occupant protection systems.

g. Overview of Hybrid Vehicles,

ECU Design Cycle :V-Model development cycle , Components of ECU, Examples of ECU on Chassis, Infotainment, Body Electronics and cluster

UNIT-2 (8 Hrs)

Automotive Sensors and Actuators:

Systems approach to control and instrumentation: Concept of a system, Analog and Digital systems, Basic measurements systems, Analog and digital signal processing, Sensors, Sensor characteristics, Sensor response, Sensor error, Redundancy of sensors in ECUs, Smart Nodes , Examples of sensors : Accelerometers, wheel speed sensors, brake pressure sensors, Steering wheel angle, Vehicle speed sensor, Throttle position sensor, Temperature sensor, Mass air flow (MAF) rate sensor, Exhaust gas oxygen concentration sensor, Crankshaft

RPM sensor, Actuators: Solenoids, various types of electric motors, and piezoelectric force generators, Examplesforactuators:Relays,solenoidsandmotors.SensorsinAirbagsystem,ElectronicEngineControl System
UNIT-3 (8 Hrs)
Microcontrollers/Microprocessors in Automotive domain, Communication protocols, Infotainment systems: **A) Microcontrollers/Microprocessors in Automotive domain** a. Critical review of microprocessor, microcontroller and digital signal processor development (overview of development within the automotive context (Architecture of 8/16 bit microcontrollers with emphasis on Ports, Timer/Counters, Interrupts. Watchdog timers, PWM) b. Criteria to choose the right microcontroller/processor for various automotive applications c. Understanding various architectural attributes relevant to automotive applications d. Automotive grade processors ex: Renesas, Quorivva, Infineon e. Understanding and working on tool chains for different processors f. Development of control algorithm for different automotive subsystems Look-up tables and maps, Need of maps, Procedure to generate maps, Fuel maps/tables, Engine calibration, Torquetable. **B) Communication protocols** a. Overview of Automotive communication protocols: CAN, LIN , Flex Ray, MOST, Ethernet. b. Communication interface with ECUs Interfacing techniques and interfacing with infotainment gadgets c. Relevance of Protocols such as TCP/IP for automotive applications d. Wireless LANs standards such as Bluetooth, IEE802. 11x communication protocols for automotive e-applications. **Infotainment Systems**: Application of Telematics in Automotive domain, Global Positioning Systems (GPS)
UNIT-4 (8 Hrs)
Automotive Control Systems and Model Based Development: **A) Automotive Control System & Model Based development:** Control system approach in Automotive: Analog and Digital control methods, modelling of linear systems, System responses. Modeling of Automotive Systems simple examples. **B) Model based Development:** Introduction to MATLAB, Simulink and SIMSCAPE tool boxes. Model-Based Design for a small system - Motor Model, Generator Model, Controller Model Sim Drive line Intro Simulink Simulations, Explore the system response using different control methods .
UNIT-5 (7 Hrs)
Safety Systems in Automobiles and Diagnostic Systems: **A) Active Safety Systems:** ABS, TCS, ESP, Brake assist etc. **B) Passive Safety Systems:** Airbag systems, Advanced Driver Assistance Systems (ADAS): Combining computer vision techniques as pattern recognition, feature extraction, learning, tracking, 3D vision, etc. to develop real-time algorithms able to assist the driving activity. Examples of assistance applications: Lane Departure Warning, Collision Warning, Automatic Cruise Control, Headlights Control, Connected Cars technology and trends towards Autonomous vehicles.

C) **Functional Safety:** Need for safety systems, safety concept, safety process for product lifecycle

D) **Diagnostics:** Fundamentals of Diagnostics: Basic wiring system and Multiplex wiring system, Preliminary checks and adjustments, Self-diagnostic system. Fault finding and corrective measures, Diagnostic procedures and sequence, On board and off board diagnostics in Automobiles, OBDII, Concept of DTCs

TEXT BOOKS

1. William Ribbens, “Understanding Automotive Electronics”, 6th Edition,Elsevier
2. Tom Denton: "Advanced Automotive Diagnosis”, 2nd Edition, Elsevier,2006

REFERENCE BOOKS

1. Ronald K Jurgen: "Automotive Electronics Handbook, 2nd Edition, McGraw-Hill,1999
2. James D Halderman: -Automotive electricity and Electronics", PHIPublication
3. Terence Rybak. Mark Stefika: Automotive Electromagnetic Compatibility (EMC), Springer. 2004
4. Allan Bonnick.: “Automotive Computer Controlled Systems” Diagnostic Tools and Techniques". Elsevier Science,2001
5. Uwe Kieneke and Lars Nielsen: Automotive Control Systems Engine, Driveline and Vehicle, 2nd Edition Springer Verlag,2005
6. David Alciatore, Michael Histand: "Introduction to Mechatronics and Measurement Systems (SIE) TMH, 2007
7. Iqbal Husain: "Electric and Hybrid Vehicles: Design fundamentals” CRC Press,2003.
8. G. Meyer, J. Valldorf and W. Gessner: "Advanced Microsystems for Automotive Applications”, Springer. 2009
9. Tracy Martin: “How to Diagnose and Repair Automotive Electrical Systems" Motor Books/MBl Publishing Company. 2005.
10. MehrdadEbsani. Ali Emadi, YiminGao: - “Modern electronic. Hybrid Electric and Fuel Cell Vehicles: Fundamentals. Theory and Design". 2nd CRC Press.2009
11. Marc Herniter: “Introduction to Model Based System Design – Rose Hulman Institute of Technology.

TEACHING METHODOLOGY

- Blackboard teaching and
- PowerPoint presentations
- Field Visit to automotive Learning Centre
- Regular review of students by asking questions based on topics covered in the class

COURSE ASSESSEMENT METHOD

CIE:

1. Two Surprise Tests, 10 Marks each. Best of two tests will be taken.
2. Assignment/course project based test. 10 Marks each. Best of two tests will be taken.
3. Three internals, 30 Marks each will be conducted and the Average of best of two will be taken.

SEE:

Final examination, of 100 Marks will be conducted and will be evaluated for 50 Marks.

CO-PO-PSO MAPPING

CO/ PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3	BT
CO1	1		2			1	1			1	1					1
CO2	1	2	2	2	2	1	1				1			1	1	2
CO3	1		2	2	2	1	1				1			1	1	2
CO4	1	2		2	2	1	1				1			1	1	2
CO5	1		2			1	1			1	1					3

SEMESTER: VIII

MULTIMEDIA COMMUNICATION

Course Code	**18ECE824**	**Credits**	**03**
Hours/Week(L-T-P)	**3-0-0**	**CIE Marks**	**50**
Total Hours	**39 Hrs**	**SEE Marks**	**50**
Exam Hours	**3 Hrs**	**Course Type**	**Core Elective**

PRE-REQUISITES

1. DSP
2. Digital Communications
3. Basic Networking

COURSE OUTCOMES

Students will be able to

1. Learn the various categories of Multimedia and Networks
2. Analyze and select the network and signal form for various multimedia applications
3. Analyze and apply compression schemes for different Multimedia
4. Gain knowledge of various standards used for Compression, Multiplexing and Networks
5. Evaluate the Security aspects of Multimedia communications

COURSECONTENTS

UNIT-1 (8 Hrs)

Multimedia Communication: Introduction, Multimedia Information Representation, Multimedia Networks, Multimedia applications and Networking Terminology

Textbook #1: 1.1-1.5

UNIT-2 (8 Hrs)

Multimedia Information Representation: Introduction, Digitization principles, Text,Image ,Audio, Video

Text and Image compression: Introduction, Compression principles, Text compression, Image compression

Textbook #1: 2.1, 2.2,2.3,2.4,2.5,2.6, 3.1-3.4

UNIT-3 (8 Hrs)

Audio and Video compression: Introduction, Audio compression – DPCM, Adaptive DPCM, Linear Predictive Coding, Code -Excited LPC, Perceptual coding, MPEG Audio Coders.

Video compression – Principles, H.261, H.263,MPEG, MPEG1,MPEG2,MPEG4 (Coding Principles).

Textbook #1: 4.1-4.3

UNIT-4 (8 Hrs.)

Standards for Multimedia Communication: Introduction, Reference models, Standards related to Interpersonal communications, Standards related to Interactive applications over the Internet, Standards for Entertainment applications

Textbook #1: 5.1-5.5

UNIT-5 (7 Hrs)

Application Support Functions: Introduction, ASN.1 (Introduction) Security, Data Encryption, Non-repudiation, Authentication, Public Key certification authorities

Textbook #1:13.1,13.3-13.7

TEXT BOOKS

1. "Multimedia communication – applications, networks, protocols and standards" Fred Halsall, Pearson education, 2007.

REFERENCE BOOKS

"Fundamentals of Multimedia", Li and Drew, Pearson education, 2004.

TEACHING METHODOLOGY

- Black board teaching
- Power Point presentations
- Regular review of students by asking questions based on topics covered in the class

COURSE ASSESSEMENT METHOD

CIE

1. Assignment / Project - 10Marks
2. Surprise tests -10Marks.
3. 3 mid- sem exams (30 Marks each) will be conducted and the Average of best two will be taken.

SEE

1. Two Questions are to be set from each unit, carrying 20 Marks each.
2. Students have to answer 5 questions selecting one full question from each unit

CO-PO-PSO MAPPING

CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3	BT
CO1	3	3	1			1						2		2		2
CO2	3	3	2	2	1	1	1		1			2		2	2	3
CO3	3	3	2	2	1	1	1		1			2		2	2	3
CO4	3	2	1			1	1	1				2		2	2	2
CO5	3	3	2		1	1		1				2		2		3

SEMESTER: VIII

LOW POWER VLSI DESIGN

Course Code	**18ECE825**	**Credits**	**03**
Hours/Week(L-T-P)	**3-0-0**	**CIE Marks**	**50**
Total Hours	**39 Hrs**	**SEE Marks**	**50**
Exam Hours	**3 Hrs**	**Course Type**	**Core Elective**

COURSE OUTCOMES

Students will be able to

1. Interpret and describe the sources of power dissipation in digital IC systems and study the impact of power on system performance and reliability
2. Interpret power and performance management techniques in Digital VLSI Design
3. Analyse the effect of voltage scaling, power gating and other power reduction approaches for different design abstraction levels
4. Apply probabilistic analysis to characterize dynamic power estimation.

COURSECONTENTS

UNIT-1 (8 Hrs)

Introduction: Need for low power VLSI chips, Sources of power dissipation on Digital Integrated circuits. Emerging Low power approaches, Physics of power dissipation in CMOS devices. Degrees of Freedom, Device & Technology Impact on Low Power: Dynamic dissipation in CMOS, Transistor sizing & gate oxide thickness, Impact of technology Scaling, Technology & Device innovation.

UNIT-2 (8 Hrs)

Power Optimization at Logic level: Gate reorganization, signal gating, logic encoding, state machine encoding, pre-computation logic. Low power Clock Distribution: Power dissipation in clock distribution, single driver Vs distributed buffers, Zero skew Vs tolerable skew.

UNIT-3 (8 Hrs)

Low power Architecture & Systems: Power & performance management, switching activity reduction, parallel architecture with voltage reduction, flow graph transformation, low power arithmetic components.

UNIT-4 (8 Hrs.)

Leakage Power minimization Approaches: Variable-threshold-voltage CMOS (VTCMOS) approach, Multi-threshold-voltage CMOS (MTCMOS) approach, Power gating, Transistor stacking, Dual-Vt assignment approach (DTCMOS).

UNIT-5 (7 Hrs)

Power Estimation: SPICE circuit simulation, Gate level Simulation, Architectural level analysis, Data correlation analysis in DSP systems, Monte-Carlo simulation.

Power analysis: random signals, probabilistic techniques for signal activity estimation, propagation of static probability in logic circuits, gate level power analysis using transition density.

TEXT BOOKS

1. M. H. Rashid, “Power Electronics”, Prentice Hall of India Pvt. Ltd., /Pearson (Singapore -Asia), New Delhi, 2nd Edition, 2002

REFERENCE BOOKS

1. Gary K. Yeap, “Practical Low Power Digital VLSI Design”, KAP, 2002
2. Rabaey, Pedram, “Low Power Design Methodologies” Kluwer Academic, 1997

TEACHING METHODOLOGY

- Black board teaching
- Power Point presentations
- Regular review of students by asking questions based on topics covered in the class

COURSE ASSESSEMENT METHOD

CIE

1. Assignment / Project - 10Marks
2. Surprise tests -10Marks.
3. 3 mid- sem exams (30 Marks each) will be conducted and the Average of best two will be taken.

SEE

1. Two Questions are to be set from each unit, carrying 20 Marks each.
2. Students have to answer 5 questions selecting one full question from each unit

CO-PO-PSO MAPPING

CO/ PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3	B T
CO1	1	2	1	2	3	2					1	1	2			
CO2	1	2	1	2	3						1	1	2	1	1	
CO3	1	2	1		3						1	1	2			
CO4	1	2	1	2	3	2					1	1	2		1	

PROGRAM ELECTIVE - 5

SEMESTER: VIII

BIOMEDICAL DIGITAL SIGNAL PROCESSING

Course Code	**18ECE831**	**Credits**	**03**
Hours/Week (L-T-P)	**3-0-0**	**CIE Marks**	**50**
Total Hours:	**39(L)**	**SEE Marks**	**50**
Exam Hours	**03**	**Course Type**	**Program Elective**

PRE-REQUISITES

- Basics of digital signal processing
- Basics of signals and systems

COURSE OUTCOMES

The students are able to,

1. Analyze and interpret various bio signals using different signal processing techniques.
2. Design and development of different filters and different signal conversion techniques.
3. Design of signal averaging techniques for biomedical signal.
4. To apply and analyze data reduction and QRS detection techniques for biomedical signal.
5. Analyze different biomedical signal using latest technologies.

COURSE CONTENTS

UNIT-1 (8-Hrs)

Introduction to Biomedical Signals: The nature of Biomedical Signals, Examples of Biomedical Signals, Objectives and difficulties in Biomedical analysis.

Electrocardiography: Basic Electrocardiography, ECG lead systems, ECG signal Characteristics, Analog filters, ECG amplifiers and QRS detector.

(Text-1,1.1-1.5,2.1-2.4)

UNIT-2 (8-Hrs)

Signal Conversion: Simple signal conversion systems, Conversion requirements for biomedical signals, Signal conversion circuits *(Text-1)(3.1-3.4)*

Integer Filters: Basic design concept, low pass filters, High pass filters, Band pass and Band reject filters, effect of filter cascade. *(Text-1)(7.1-7.5)*

UNIT-3 (8 Hrs)

Adaptive Noise Cancelling: Principal noise canceller model, 60-Hz adaptive cancelling using a sine wave model, other applications of adaptive filtering. *(8.1-8.3)*

Signal Averaging: Basics of signal averaging, signal averaging as a digital filter, a typical average, software for signal averaging, limitations of signal averaging. *(Text-1) (9.1-9.5)*

UNIT-4 (8-Hrs)

Data Compression Techniques: Turning point algorithm, AZTEC algorithm, Fan algorithm, Huffman coding.

ECG QRS detection: Power spectrum of the ECG, Band pass filtering techniques. Differentiation technique, Template matching techniques, QRS detection algorithm.*(Text-1)(10.1-10.4)(12.1-12.5)*

UNIT-5 (7-Hrs)

ECG analysis Systems: ECG interpretation, ST segment analyzer, Portable arrhythmia monitor.

(Text-1)(13.1-13.3)

Case study:1) P. Tirumala Rao, S. Koteswarao Rao, G. Manikanta and S. Ravi Kumar**,"** Distinguishing Normal and Abnormal ECG Signal,Indian Journal of Science and Technology, Vol 9(10), DOI: 10.17485/Ijst/2016/v9i10/85449, March 2016, ISSN (Online) : 0974-5645

2) Jyoti Dhiman1, Shadab Ahmad, Kuldeep Gulia," Comparison between Adaptive filter Algorithms (LMS, NLMS and RLS)", International Journal of Science, Engineering and Technology Research (IJSETR) Volume 2, Issue 5, May 2013.
3) Pramod Kumar Meher and Sang Yoon Park," Low Adaptation-Delay LMS Adaptive Filter
Part-I: Introducing a Novel Multiplication Cell", Conference Paper in Midwest Symposium on Circuits and Systems · August 2011,DOI: 10.1109/MWSCAS.2011.6026642.
4) Umer Hassan and Muhammad Sabieh Anwar," Reducing noise by repetition: introduction to signal averaging, Eur. J. Phys. **31** (2010) 453–465 doi:10.1088/0143-0807/31/3/003,2010

TEXT BOOKS

1. Biomedical Digital Signal Processing, Willis J.Tompkins, PHI.

REFERENCE BOOKS

1. Biomedical Signal Processing, Akay M, Academic Press , 1994 2. Biomedical Signal Processing , Cohen.A, Vol. I , CRC Press, 1986.
2. Biomedical Signal Analysis, Rangaraj M. Rangayyan, IEEE Press, 2001.
3. Biomedical Signal and Image Processing Kayvan Najarian • Robert Splinter,2nd edition
4. Biomedical Signal Processing- principles and techniques, Tata McGraw-Hill, D.C.Reddy, 2005.

TEACHING METHODOLOGY

- Blackboard teaching
- PowerPoint presentations (If needed)
- Regular review of students by asking questions based on topics covered in the class

COURSE ASSESSEMENT METHOD

CIE:

1. Tutorials/Mini projects(MATLAB based) - 10 Marks
2. Surprise tests/Assignment based test (MATLAB based) - 10Marks.
3. Three mid examinations, 30 Marks each will be conducted and the Average of best of two will be taken.

SEE:

1. Two Questions are to be set from each unit, carrying 20 Marks each.
2. Students have to answer 5 questions selecting one full question from each unit

CO-PO-PSO MAPPING

CO/PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3	BT
CO1	2	1													**2**	**2**
CO2	2	1													3	2
CO3	3	2			1								**1**		3	3
CO4	3	2	2		2								**1**	**1**	3	3
CO5	2	2	2		2								**1**	**1**	3	3

SEMESTER: VIII

BIOMEDICAL SENSORS AND MEASUREMENTS

Course Code	**18ECE832**	**Credits**	**03**
Hours/Week(L-T-P-S)	**3-0-0**	**CIE Marks**	**50**
Total Hours:	**39(L)**	**SEE Marks**	**50**
Exam Hours	**03**	**Course Type**	**Core Elective**

PRE-REQUISITES

- Biomedical Instrumentation

COURSE OUTCOMES

The students are able to

1. Understand the purpose of measurement, the methods of measurements, errors associated with measurements.
2. To Know the principle of transduction, classifications and the characteristics of different transducers
3. To know the different bridges for measurement.
4. To know the different display and recording devices.

COURSE CONTENTS

UNIT-1 (08-Hrs)

SCIENCE OF MEASUREMENT: Measurement System – Instrumentation - Classification and Characteristics of Transducers - Static and Dynamic - Errors in Measurements and their statistical analysis – Calibration - Primary and secondary standards.

UNIT-2 (08-Hrs)

DISPLACEMENT, PRESSURE, TEMPERATURE SENSORS 6+6 Strain Gauge: Gauge factor, sensing elements, configuration, and unbounded strain gage. Capacitive transducer - various arrangements, Inductive transducer, LVDT, Passive types: RTD materials & range, relative resistance vs. temperature characteristics, thermistor characteristics, Active type: Thermocouple - characteristics.

UNIT-3 (08 Hrs)

PHOTOELECTRIC AND PIEZO ELECTRIC SENSORS 6+6 Phototube, scintillation counter, photo multiplier tube (PMT), photovoltaic, photo conductive cells, photo diodes, phototransistor, comparison of photoelectric transducers. Optical displacement sensors and optical encoders. Piezoelectric active transducer-Equivalent circuit and its characteristics.

UNIT-4 (07-Hrs)

SIGNAL CONDITIONING CIRCUITS 6+6 Functions of signal conditioning circuits, Preamplifiers, Concepts of passive filters, Impedance matching circuits, AC and DC Bridges - wheat stone bridge, Kelvin, Maxwell, Hay, Schering

UNIT-5 (08-Hrs)

DISPLAY AND RECORDING DEVICES 6+6 Digital voltmeter – Multi meter – CRO – block diagram, CRT – vertical & horizontal deflection system, DSO, LCD monitor, PMMC writing systems, servo recorders, photographic recorder, magnetic tape recorder, Inkjet recorder, thermal recorder.

TEXT BOOKS

1. A.K.Sawhney, “Electrical & Electronics Measurement and Instrumentation”, 10th edition, Dhanpat Rai& Co, New Delhi, 19th Revised edition 2011, Reprint 2014.

2. John G. Webster, “Medical Instrumentation Application and Design”, 4th edition, Wiley India Pvt. Ltd, New Delhi, 2015.
REFERENCE BOOKS
1. Ernest O Doebelin and Dhanesh N Manik, Measurement systems, Application and design, 6th edition, McGraw-Hill, 2012. 2. Khandpur R.S, “Handbook of Biomedical Instrumentation”, 3rdedition, Tata McGraw-Hill, New Delhi, 2014. 3. Leslie Cromwell, “Biomedical Instrumentation and measurement”, 2nd edition, Prentice hall of India, New Delhi, 2015. 4. Albert D.Helfrick and William D. Cooper. Modern Electronic Instrumentation and Measurement Techniques”, Prentice Hall of India, 1stedition, 2016
TEACHING METHODOLOGY
• Blackboard teaching • PowerPoint presentations (If needed) • Regular review of students by asking questions based on topics covered in the class
COURSE ASSESSEMENT METHOD
CIE: 1. Tutorials/Assignments - 10 Marks 2. Surprise tests - 10Marks. 3. Three mid examinations, 30 Marks each will be conducted and the Average of best of two will be taken. SEE: 1. Two Questions are to be set from each unit, carrying 20 Marks each. 2. Students have to answer 5 questions selecting one full question from each unit

CO-PO-PSO MAPPING

CO/PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO1															
CO2															
CO3															
CO4															
CO5															

https://karunya.edu/sites/default/files/uploads/content/syllabus/2019/biomedical-2019.pdf
https://cac.annauniv.edu/PhpProject1/aidetails/afug_2017_fu/04%20B.%20E.-BME%20final.pdf

SEMESTER: VIII

VLSI SYSTEM DESIGN

Course Code	**18ECE833**	**Credits**	**03**
Hours/Week(L-T-P)	**3-0-0**	**CIE Marks**	**50**
Total Hours	**39 Hrs**	**SEE Marks**	**50**
Exam Hours	**3 Hrs**	**Course Type**	**Core Elective**

PRE-REQUISITES
Digital Logic Design

COURSE OUTCOMES

At the end of the course, the student will be able to

1. Clear understanding of fundamental concepts of MOS transistors and able to design simple logic gates using CMOS logic style.
2. Able to calculate power and delay of simple CMOS circuits, understand fabrication processes and their impact on the circuit performance.
3. Able to design and validate combinational and sequential circuits using different logic styles.
4. Able to design VLSI circuits at sub-system abstraction level.
5. Able to use modern EDA tools to design VLSI circuits

COURSECONTENTS

UNIT-1 (10 Hrs)

MOS Transistor Theory:

I-V Characteristics, C-V Characteristics, Non ideal I-V effects of MOS Transistors.

CMOS Logic

Basic gates, Compound Gates, Transmission Gates based combinational and sequential logic design

UNIT-2 (8 Hrs)

CMOS Circuit characterization and Performance Estimation:

DC transfer Characteristics of CMOS inverter, Circuit characterization and performance estimation: Delay estimation, Logical effort and Transistor Sizing. Power Dissipation: Static & Dynamic Power Dissipation.

UNIT-3 (8 Hrs)

CMOS Fabrication and Layout:

CMOS Process Technology N-well, P-well process, Stick diagram for Boolean functions using Euler Theorem, Layout Design Rule

UNIT-4 (8 Hrs.)

CMOS Combinational Circuit Design

Static CMOS, Ratioed Logic, Cascode voltage Switch Logic, Dynamic circuits, Pass Transistor Circuits

UNIT-5 (7 Hrs)

CMOS Sequential Circuit Design

Conventional CMOS Latches and Flip Flops, Pulsed Latches, Resettable and Enabled Latches and Flip Flops

TEXT BOOKS

1. Neil CMOS VLSIA Circuits and System.

REFERENCE BOOKS

1. Jan M. Rabacy, Anantha Chandrakasan, BorivojeNikolic, : Digital Integrated Circuits: A Design Perspective:, 2014, Third Edition, Prentice Hall India, New Jersey, US.
2. Yogesh Chauhan, Darsen Duane Lu, Vanugopalan Sriramkumar, Sourabh Khandelwal, Juan Duarte, Navid

Payvadosi, Ai Niknejad, Chenming Hu, "FinFET Modelling for IC Simulation and Design", 2015, Academic Press, Elsevier.

TEACHING METHODOLOGY

- Blackboard teaching
- PowerPoint presentations (If needed)
- Regular review of students by asking questions based on topics covered in the class

COURSE ASSESSEMENT METHOD

CIE:

1. Tutorials/Assignments - 10 Marks
2. Surprise tests - 10Marks.
3. Three mid examinations, 30 Marks each will be conducted and the Average of best of two will be taken.

SEE:

i. Two Questions are to be set from each unit, carrying 20 Marks each.
ii. Students have to answer 5 questions selecting one full question from each unit

LIST OF CHALLENGING EXPERIMENTS

1.
i. Cadence EDA Tool Demo & Hands on - Schematic
ii. Basic Cell structure (NMOS & PMOS) using conventional MOS
iii. Verification with different corners
iv. Design and Analysis of CMOS circuits(Analysis: Power, Delay, NM, PDP, Design: Sizing)

2.
i. Cadence EDA Tool Demo & Hands on Layout & Post Layout Simulation
ii. Basic Cell layout (CMOS)
iii. Fingering and folding
iv. Standard cell design for different technology node

3.
i. Adder Design using conventional CMOS
ii. Multiplier using conventional CMOS
iii. Memory design (SRAM /DRAM /CAM).

4.
i. ALU Design using conventional CMOS
ii. Simple Processor Design using conventional CMOS

CO-PO-PSO MAPPING

CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3	BT
CO1																
CO2																
CO3																
CO4																
CO5																

SEMESTER: VIII

WIRELESS SENSORS NETWORKS

Course Code	**18ECE834**	**Credits**	**03**
Hours/Week(L-T-P)	**3-0-0**	**CIE Marks**	**50**
Total Hours	**39 Hrs**	**SEE Marks**	**50**
Exam Hours	**3 Hrs**	**Course Type**	**Core Elective**

COURSE OUTCOMES

- Understand the fundamentals of wireless sensor networks
- Understand the application of WSN to critical real time scenarios.
- Analyze various critical parameters in deploying a WSN
- Study the various protocols at various layers and its differences with traditional protocols.
- Interpret the issues pertaining to sensor networks and the challenges involved in managing a sensor network.

COURSECONTENTS

UNIT-1 (8 Hrs)

Introduction: Fundamentals of wireless communication technology, the electromagnetic spectrum radio propagation, characteristics of wireless channels, modulation techniques, multiple access techniques, wireless LANs, PANs, WANs, and MANs, Wireless Internet.

UNIT-2 (8 Hrs)

Introduction to adhoc/sensor networks: Key definitions of adhoc/ sensor networks, unique constraints and challenges, advantages of ad-hoc/sensor network, driving applications, issues in adhoc wireless networks, issues in design of sensor network, sensor network architecture, data dissemination and gathering.

UNIT-3 (8 Hrs)

MAC Protocols : Issues in designing MAC protocols for adhoc wireless networks, design goals, classification of MAC protocols, MAC protocols for sensor network, location discovery, quality, other issues, S-MAC, IEEE 802.15.4.

UNIT-4 (8 Hrs.)

Routing Protocols: Issues in designing a routing protocol, classification of routing protocols, table-driven, on-demand, hybrid, flooding, hierarchical, and power aware routing protocols.

UNIT-5 (7 Hrs)

QoS and Energy Management : Issues and Challenges in providing QoS, classifications, MAC, network layer solutions, QoS frameworks, need for energy management, classification, battery, transmission power, and system power management schemes.

TEXT BOOKS

1. C. Siva Ram Murthy, and B. S. Manoj, "AdHoc Wireless networks ", Pearson Education - 2008.

REFERENCE BOOKS

1. Feng Zhao and Leonides Guibas, "Wireless sensor networks ", Elsevier publication - 2004.
2. Jochen Schiller, "Mobile Communications", Pearson Education, 2nd Edition, 2003.
3. William Stallings, "Wireless Communications and Networks ", Pearson Education – 2004.

TEACHING METHODOLOGY

- Blackboard teaching
- PowerPoint presentations (If needed)
- Regular review of students by asking questions based on topics covered in the class

COURSE ASSESSEMENT METHOD

CIE:

1. Tutorials/Assignments - 10 Marks
2. Surprise tests - 10Marks.
3. Three mid examinations, 30 Marks each will be conducted and the Average of best of two will be taken.

SEE:

1. Two Questions are to be set from each unit, carrying 20 Marks each.
2. Students have to answer 5 questions selecting one full question from each unit

CO-PO-PSO MAPPING

CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3	BT
CO1	*	*	*		*											**2**
CO2	*	*	*		*											**2**
CO3	*	*	*	*												**3**
CO4		*	*	*												**2**
CO5	*	*		*												**2**

SEMESTER: VIII

VLSI TESTING

Course Code	**18ECE835**	**Credits**	**03**
Hours/Week(L-T-P)	**3-0-0**	**CIE Marks**	**50**
Total Hours	**39**	**SEE Marks**	**50**
Exam Hours	**03**	**Course Type**	**Program Elective**

PRE-REQUISITES

- Basic knowledge on Digital electronics
- Basic knowledge of Fundamentals of VLSI

COURSE OUTCOMES

Students will be able to:

CO1: Apply the Techniques to improve the Testability of VLSI Circuits

CO2: Apply functional timing and verification methods at various design abstractions of VLSI circuits

CO3: Able To Identify The Design For Testability Methods for Combinational And Sequential CMOS Circuits

CO4: Utilize Logic Simulation Methods, Bist and Boundary Scan Techniques In Testing VLSI Circuits

CO5: Able to solve the verification problems to serve the VLSI industries.

COURSE CONTENTS

UNIT-1 (8 Hrs)

Faults in digital circuits: Failures and Faults, Modelling of faults, Temporary Faults. (Text 1)

Logic Simulation: Applications, Problems in simulation based design verification, types of simulation, The unknown logic values, compiled simulation, event-driven simulation, Delay models, Element evaluation, Hazard detection, Gate-level event-driven Simulation. (Text 2)

UNIT-2 (8 Hrs)

Test generation for Combinational Logic circuits: Fault Diagnosis of digital circuits, Test generation techniques for combinational circuits, Detection of multiple faults in Combinational logic circuits. (Text 1)

Testable Combinational logic circuit design: The Read-Muller expansion technique, Three level OR-AND-OR design, Automatic synthesis of testable logic. (Text 1)

UNIT-3 (8 Hrs)

Testable Combinational logic circuit design: Testable design of multilevel combinational circuits, Synthesis of random pattern testable combinational circuits, Path delay fault testable combinational logic design, Testable PLA design. (Text 1)

Test generation for Sequential circuits: Testing of sequential circuits as Iterative combinational circuits, state table verification, Test generation based on Circuit Structure, Functional Fault models, test Generation based on Functional Fault models. (Text 1)

UNIT-4 (8 Hrs)

Design of testable sequential circuits: Controllability and observability, Ad-Hoc design rules for improving testability, design of diagnosable sequential circuits, the scan-path technique for testable sequential circuit design, Level Sensitive Scan Design (LSSD), Random Access Scan Technique, Partial scan, testable sequential circuit design using Nonscan Techniques, Cross check, Boundary Scan. (Text 1)

UNIT-5 (7 Hrs)

Built-In Self Test: Test pattern generation for BIST, Output response analysis, Circular BIST, BIST Architectures. (Text 1)

Testable Memory Design: RAM Fault Models, Test algorithms for RAMs, Detection of pattern- sensitive faults, BIST techniques for RAM chips, Test generation and BIST for embedded RAMs. (Text1)

TEXT BOOKS

Text Book:

1. 'Digital Circuit Testing and Testability', Lala Parag K, New York, Academic Press, 1997
2. 'Digital Systems Testing and Testable Design', Abramovici M, Breuer M A and Friedman A D, Wiley, 1994

Reference Book:

1. 'Essential of Electronic Testing for Digital, Memory and Mixed Signal Circuits', Vishwani D Agarwal, Springer, 2002
2. 'VLSI Test Principles and Architectures', Wang, Wu and Wen, Morgan Kaufmann, 2006

TEACHING METHODOLOGY

- Blackboard teaching
- Power point presentation
- Regular review of students by asking questions based on topics covered in the class

COURSE ASSESSEMENT METHOD

CIE:

1. Assessment through Assignments/test - 10 Marks
2. Surprise tests - 10Marks.
3. Three mid examinations, 30 Marks each will be conducted and the Average of best of two will be taken.

SEE:

1. Two Questions are to be set from each unit, carrying 20 Marks each.
2. Students have to answer 5 questions selecting one full question from each unit

CO-PO-PSO MAPPING

CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3	BT
CO1	2	2	2										2			3
CO2	1	2	3										2			3
CO3	2	3	2										2			3
CO4	1	2	2										2			3
CO5	2	1	1										2			3

SEMESTER: VIII

CELLULAR MOBILE COMMUNICATION

Course Code	**18ECE836**	**Credits**	**03**
Hours/Week(L-T-P)	**3-0-0**	**CIE Marks**	**50**
Total Hours	**39 Hrs**	**SEE Marks**	**50**
Exam Hours	**3 Hrs**	**Course Type**	**Core Elective**

COURSE OUTCOMES

At the end of the course, the students will be able to:

1. Apply the understanding of statistical characterization of urban mobile channels to compute the performance for simple modulation schemes.
2. Demonstrate the limitations of GSM, GPRS and CDMA to meet high data rate requirements and limited improvements that are needed.
3. Analyze the call process procedure between a calling number and called number for all scenarios in GSM or CDMA based systems.
4. Test and validate voice and data call handling for various scenarios in GSM and CDMA systems for national and international interworking situations.

COURSECONTENTS

UNIT-1 (8 Hrs)

Cellular Concept: Frequency Reuse, Channel Assignment Strategies, Interference and System Capacity, Power Control for Reducing Interference, Trunking and Grade of Service, Improving Capacity in Cellular Systems. **Mobile Radio Propagation**: Large Scale path Loss- Free Space Model, Three basic propagation mechanisms.
Text-1: 3.1, 3.2, 3.3, 3.5, 3.5.1, 3.5.3, 3.5.4, 3.6, 3.7, 4.1, 4.2, 4.4

UNIT-2 (8 Hrs)

Mobile Radio Propagation: Small-Scale Fading and Multipath: Small scale Multipath Propagation, Impulse Response Model of a Multipath Channel, Small-Scale Multipath Measurements, Parameters of Mobile Multipath Channels, Types of Small-Scale Fading, Statistical Model for Multipath Fading Channels (Clarke's Model for Flat Fading only).
Text Book - 1: 5.1.1, 5.2, 5.3.1, 5.3.2, 5.4, 5.5, 5.7.1

UNIT-3 (8 Hrs)

System Architecture and Addressing: System architecture, The SIM concept, Addressing, Registers and subscriber data, Location registers (HLR and VLR) Security-related registers (AUC and EIR), Subscriber data.
Text Book - 2: 3.1, 3.2, 3.3, 3.4, 3.4.1, 3.4.2, 3.4.3,

Air Interface – GSM Physical Layer: Logical channels, Physical channels, Synchronization- Frequency and clock synchronization, Adaptive frame synchronization.
Text Book - 2: 4.1, 4.2, 4.3, 4.3.2

UNIT-4 (8 Hrs)

GSM Roaming Scenarios and Handover: Mobile application part interfaces, Location registration and location update, Connection establishment and termination, Handover.
Text Book – 2: 6.1, 6.2, 6.3, 6.4 (Up to 6.4.1).

Services: Classical GSM services, Popular GSM services: SMS and MMS.
Text Book – 2: 7.1, 7.2

UNIT-5 (7 Hrs)

CDMA Technology – Introduction to CDMA,CDMA frequency bands, CDMA Network and System Architecture, Mobile-Services Switching Center and Visitor Location Register, CDMA Channel concept, Forward Logical Channels, Reverse logical Channels, CDMA frame format, CDMA System Operations(Initialization/Registration), Call Establishment, CDMA Call handoff.

Text Book – 3: 6.1, 6.2, 6.3, 6.4

TEXT BOOKS

1. Theodore Rapport, ―Wireless Communications – Principles and Practice‖, Prentice Hall of India, 2nd Edition, 2007, ISBN 978-8-120-32381-0.
2. Jorg Eberspacher, Hans-Jorg Vogel, Christian Bettstetter, Christian Hartmann, "GSM– Architecture, Protocols and Services‖, Wiley, 3rd Edition, 2009, ISBN-978- 0-470-03070-7.
3. Gary J Mullet, ―Introduction To Wireless Telecommunications Systems and Networks", Cengage Learning.

TEACHING METHODOLOGY

- Blackboard teaching
- PowerPoint presentations (If needed)
- Regular review of students by asking questions based on topics covered in the class

COURSE ASSESSEMENT METHOD

CIE:

1. Tutorials/Assignments - 10 Marks
2. Surprise tests - 10Marks.
3. Three mid examinations, 30 Marks each will be conducted and the Average of best of two will be taken.

SEE:

1. Two Questions are to be set from each unit, carrying 20 Marks each.
2. Students have to answer 5 questions selecting one full question from each unit

CO-PO-PSO MAPPING

CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3	BT
CO1																
CO2																
CO3																
CO4																
CO5																

NITTE MEENAKSHI INSTITUTE OF TECHNOLOGY

(An Autonomous Institution, affiliated to VTU, Belgaum and accredited by NBA, New Delhi)
Yelahanka, Bangalore – 560 064

DEPARTMENT OF AERONAUTICAL ENGINEERING

KNOWLEDGE • CHARACTER • UNITY

SYLLABUS, SCHEME OF TEACHING AND EXAMINATION FOR SEMESTER III & IV AS PER NEP

2021 SCHEME

Vision and Mission of the Department

Vision

- To develop technically competent Aeronautical Engineers of the highest academic standards to meet the national and global requirements of industry and society.

Mission

- To impart quality education in Aeronautical Engineering through top-class teaching – learning process, well-designed curricular& co-curricular activities and state-of-the-art infrastructure
- To inculcate ethical values and develop innovative ideas to meet ever changing global requirements through industry-institute interaction and interdisciplinary research.

Program Outcomes

Engineering Graduates will be able to:

1. **Engineering knowledge**: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
2. **Problem analysis**: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
3. **Design/development of solutions**: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
4. **Conduct investigations of complex problems**: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
5. **Modern tool usage**: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modelling to complex engineering activities with an understanding of the limitations.
6. **The engineer and society**: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.

7. **Environment and sustainability**: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
8. **Ethics**: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
9. **Individual and team work**: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
10. **Communication**: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
11. **Project management and finance**: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
12. **Life-long learning**: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

Program Specific outcomes (PSOs)

In addition to the above outcomes, the undergraduates of NMIT Aeronautical Engineering programme shall demonstrate the following capability defined by the two PSOs.

1. **PSO1**: Graduates will be able to design and analyze various aircraft materials and structures.
2. **PSO2**: Graduates will be able to develop solutions for various aerodynamic, propulsion and control systems used in aircrafts.

Program Educational Objectives (PEOs)

1. **PEO-1** Graduates will be successful professionals in the field of Aeronautical Engineering and allied areas.
2. **PEO-2** Graduates will exhibit skills to work individually and as part of the team with ethics.
3. **PEO-3** Graduates will pursue higher studies, research and adapt to a world of constantly changing technologies

CREDIT SYSTEM

In credit system, students are assessed in two parts

1. Continuous Internal Evaluation (CIE).

2. Semester End Examination (SEE).

CIE will be conducted by the subject teacher all through the semester; which includes mid-term tests, weekly/ fortnightly class tests, assignments, quiz, seminar, projects etc. The breakup of CIE and SEE is as follows:

THEORY	**Marks Allotment**
Continuous internal evaluation (CIE)	
Mid-Sem Exam (MSE-1)	30 Marks
Mid-Sem exam (MSE-2)	30 Marks
Mid- Sem exam (MSE-3)	30 Marks
Assignment, Mini Projects, Quiz, Case study, Seminar, Tutorials, Experimental work Learning component-1 and Learning component-2 Any two assessments for 10 marks each	10+10 Marks
Semester End Exam (SEE)	50 Marks
Grand total	100 Marks
PRACTICALS	
Continuous internal evaluation (CIE)	15 Marks
Records and continuous assessments	30 Marks
Viva-voce on each experiments	5 Marks
Semester end Exam (SEE)	50 Marks
Grand total	100 Marks

SEE will be conducted at the end of the semester, on dates to be fixed at the college level A grade is basically a qualitative measure (alphabet) giving the performance of a student in a Subject such as Outstanding(S), Excellent (A), Very good (B), Good(C), Average (D), Poor (E), and Fail/Unsatisfactory (F), based on the raw marks obtained by the student (includes both CIE & SEE)

GRADE POINT SCALE

Grade	S	A	B	C	D	E	F
Grade Point	10	9	8	7	05	04	00
Marks Obtained out of 100	≥ 90	75-89	60-74	50-59	45-49	40-44	<40

There will be no re-examination for any course in the credit system, to take care of student who has failed. Student would require re-register for the course when it is offered again (either in a main or supplementary SEM) and fulfill the Passing Standards laid down to earn the specified credits.

PASSING STANDARDS

CIE	50 Marks	≥40%(i.e.20 Marks)
SEE	50 Marks	≥40%(i.e.20 Marks)

A Student will not be allowed to take up SEE, if the CIE will be less than 40%.

A Student will be put in Not Eligible (NE) status which will amount to F grade in the course in the following cases,

- Not allowed to take SEE for not fulfilling minimum attendance requirement.
- Not allowed to take SEE for not fulfilling the minimum CIE requirement
- Absent for SEE.
- There shall be no re-examination for any course in the credit system to take care of such students:
  - Who have absented themselves from attending CIE or SIE without valid reasons or
  - Who have failed (secured 'F' grade) to meet the minimum passing standards prescribed for CIE and / or SEE or
  - Who have been detained for attendance or
  - Who have withdrawn ('w' grade)

Such students shall be required to re-register for the course(s) for study and go through CIE and SEE again and obtain a grade equal to or better than 'E'.

Grade point average is a credit index used for calculating Semester Grade Points Average (CGPA), both of which are important performance indices. SGPA& CGPA are calculated as below:

SGPA= ∑ (Subject Credit X Grade Point) for all the subjects registered in the current semester /∑ (subject credit) for all the subjects registered in the current semester (Excluding Transitional Grades I, X).

CGPA= ∑ (Subject Credit X Grade Point) for all the subjects registered up to the end of the current semester /∑ (Subject Credit) for all the subjects registered but excluding subjects with 'F' grade up to the end of the current semester (Excluding Transitional Grades I, X).

Vertical Progression

It would also be necessary to lay down uniform minimum standards for the vertical progression of students from current academic year to the next academic year. This would be helpful in facilitating the mobility of students from one college to another and also in avoiding any confusion among the students. The prescribed standards foe vertical progressions are,

- A student can carry a maximum of 4(four) 'F' grades/ four subject of the current year of study to become eligible for admission to the next year of studying.
- Should have passed all the first and second semester courses to become eligible for the admission for fifth semester and carry a maximum of four subjects of second year.
- Should have passed all courses of first to fourth semesters to become eligible for the admission for seventh semester and can carry a maximum of four subjects of third year.
- **Minimum standard for CGPA=5.0 at each academic year**.

III - Semester											
Sl. No.	Subject Code	Subject Name	Course Type	Teaching Dept.	Teaching Hours/week			Examination			Credits
					L	T	P	CIE	SEE	Total	
1	21MAT31	Engineering Mathematics –III	BS	MAT	2	2	-	50	50	100	3
3	21AE32	Introduction to Aircraft Engineering	PC	AE	3	-	-	50	50	100	3
4	21AE33	Aerothermodynamics	PC	AE	3	-	-	50	50	100	3
5	21AE34	Fluid Mechanics	PC	AE	3	-		50	50	100	3
2	21AE35	Basics of Aerostructure & Aerostructure lab)	PC	AE	3	-	2	50	50	100	4
6	21AEE36X	**Program Elective-A**	PE	AE	3	-	-	50	50	100	3
7	21AEL37	Computer Aided Aircraft Drawing	PL	AE	-	-	2	50	50	100	1
8	21KAN38A/21KAN38B	Samskrutika Kannada/ Balake Kannada	HU	HU	1	-	-	50	50	100	1
	21CIP38	Constitution of India & Professional Ethics									
9	21INT39	Internship-I	PL	AE	-	-	-	50	50	100	2
Total								450	450	900	23

IV - Semester											
Sl. No.	Subject Code	Subject Name	Course Type	Teaching Dept.	Teaching Hours/week			Examination			Credits
					L	T	P	CIE	SEE	Total	
1	21MAT41	Engineering Mathematics –IV	BS	MAT	2	2	-	50	50	100	3
2	21AE42	Fundamentals of Aero-propulsion	PC	AE	3	-	-	50	50	100	3
3	21AE43	Aircraft materials and manufacturing	PC	AE	3	-	-	50	50	100	3
4	21AE44	Advanced Aerostructure	PC	AE	3	-	-	50	50	100	3
5	21AE45	Aerodynamics-I & Aerodynamics lab	PC	AE	3	-	2	50	50	100	4
6	21AEE46X	**Program Elective-B**	PE	AE	3	-	-	50	50	100	3
7	21AEL47	Advance Aerostructure lab	PL	AE	-	-	2	50	50	100	1
8	21KAN48A/21KAN48B	Samskrutika Kannada/ Balake Kannada	HU		1	-		50	50	100	1
	21CIP48	Constitution of India & Professional Ethics									
9	21AEC49X	Ability Enhancement course-II	AEC	AE	2	-		50	50	100	2
Total								450	450	900	23

V - Semester											
Sl. No.	**Subject Code**	**Subject Name**	**Course Type**	**Teaching Dept.**	**Teaching Hours/week**			**Examination**			**Credits**
					L	**T**	**P**	**CIE**	**SEE**	**Total**	
1	21AE51	Aerodynamics-II	PC	AE	3	-	-	50	50	100	3
2	21AE52	Advanced propulsion	PC	AE	3	-	-	50	50	100	3
3	21AE53	Airplane Performance and Design - (Flight simulation lab)	PC	AE	3	-	2	50	50	100	4
4	21AEE54X	**Program Elective- C**	PE	AE	3	-	-	50	50	100	3
5	21AEO55X	**Open Elective-I**	PE	AE	3	-	-	50	50	100	3
6	21AEL56	Propulsion lab	PL	AE	-	-	2	50	50	100	1
7	21AE57	Ability Enhancement course-III	PC	AE	2	-	-	50	50	100	2
8	21AEH58	Universal Human Values	NCMC	HU	-	-	2	50	50	100	2
9	21EVS59	Environmental Science	HSMC	CV	2	-	-	50	50	100	1
Total								450	450	900	22

VI - Semester											
Sl. No.	**Subject Code**	**Subject Name**	**Course Type**	**Teaching Dept.**	**Teaching Hours/week**			**Examination**			**Credits**
					L	**T**	**P**	**CIE**	**SEE**	**Total**	
1	21AE61	Aircraft Stability and control	PC	AE	3	-	-	50	50	100	3
2	21AE62	Composite Materials & Structures	PC	AE	3	-	-	50	50	100	3
3	21AE63	Computational methods in aerospace engineering - (Design ,Modelling & Analysis lab)	PC	AE	3	-	2	50	50	100	4
4	21AEH64	Aviation safety management and accident investigations	PC	AE	3	-	-	50	50	100	3
5	21AEE65X	Program Elective-D	PE	AE	3	-	-	50	50	100	3
6	21AEL66	Composite material lab	PL	AE	-	-	2	50	50	100	1
7	21INT67	Internship-II	-	AE	-	-	10	50	50	100	3
Total								350	350	700	20

VII - Semester											
Sl. No.	Subject Code	Subject Name	Course Type	Teaching Dept.	Teaching Hours/week			Examination			Credits
					L	T	P	CIE	SEE	Total	
1	21AE71	Aircraft Design & Analysis	PC	AE	3	-	-	50	50	100	3
2	21AE72	Aircraft systems and Avionics	PC	AE	3	-	-	50	50	100	3
3	21AE73	Research Methodology	PC	AE	1	-	-	50	50	100	1
3	21AEO74X	Open Elective-MOOC	OE	AE	2	-	-	50	50	100	2
4	21AEP75	Major Project Phase-I	PL	AE	-	-	2	50	50	100	4
5	21AEL76	Aircraft systems lab	PL	AE	-	-	2	50	50	100	1
6	21AEC77X	Ability Enhancement course-IV	PL	AE	2	-	-	50	50	100	2
Total								350	350	700	16

VIII - Semester											
Sl. No.	Subject Code	Subject Name	Course Type	Teaching Dept.	Teaching Hours/week			Examination			Credits
					L	T	P	CIE	SEE	Total	
1	21AEP81	Internship-III	PC	AE	-	-	-	50	50	100	10
2	21AEI82	Major Project Phase-II	PC	AE	-	-	3	50	50	100	6
Total								100	100	200	16
Total credit											120

Semester-3 - Program Elective- A			Semester-4 - Program Elective- B		
Sl. No.	**Subject Code**	**Subject Name**	**Sl. No.**	**Subject Code**	**Subject Name**
1	21AEE361	UAV Design	1	21AEE461	Airworthiness & Certification
2	21AEE362	Introduction to Space Science and Technology	2	21AEE462	Mechanism and machine theory
3	21AEE363	Airport Planning & Management	3	21AEE463	Flight Scheduling and Operations
4	21AEE364	Introduction to aerospace engines	4	21AEE464	Astronomy and astrophysics
5	21AEE365	Experimental Techniques and Data Analysis	5	21AEE465	Aircraft maintenance and repair
Semester-4 -Ability Enhancement course-II			**Semester-5 - Program Elective- C**		
Sl. No.	**Subject Code**	**Subject Name**	**Sl. No.**	**Subject Code**	**Subject Name**
1	21AEC491	Introduction to Python Programming	1	21AEE541	Artificial Intelligence and Machine Learning in Aerospace Engineering
2	21AEC492	Ethics, technology and engineering	2	21AEE542	Control Engineering
3	21AEC493	Business communication	3	21AEE543	Industrial Aerodynamics
4	21AEC494	UAV Flying Skills	4	21AEE544	Managerial Economics and Financial Analysis
			5	21AEE545	Rockets and Missiles
			6	21AEE546	Vibration and Aero elasticity

Semester-5 -Open Elective-I			Semester-5 - Ability Enhancement course-III		
Sl. No.	**Subject Code**	**Subject Name**	**Sl. No.**	**Subject Code**	**Subject Name**
1	21AEO551	Elements of Aerospace Propulsion	1	21AEC571	Introduction to MATLAB Programming
2	21AEO552	UAV and its applications	2	21AEC572	Probability and statistics for aerospace engineering
3	21AEO553	Introduction To Astrophysics and Space Environment	3	21AEC573	Technical Authoring in Aircraft Manuals
4	21AEO554	Introduction to Rockets & Missiles			
5	21AEO555	Aerospace Materials			
6	21AEO556	Mechanics of Flight			

Semester-6 - Program Elective- D			Semester-7 –Ability enhancement course-IV		
Sl. No.	**Subject Code**	**Subject Name**	**Sl. No.**	**Subject Code**	**Subject Name**
1	21AEE651	Helicopter Engineering	1	21AEC761	Business Communications
2	21AEE652	Fatigue, Fracture and creep	2	21AEC762	Introduction to Data Science & Data Analytics
3	21AEE653	Smart Materials and Nano Technology	4	21AEC763	Numerical analysis using commercial software tools
4	21AEE654	Heat and Mass Transfer			
5	21AEE655	Rapid Prototyping			
6	21AEE656	Finite Element methods			

SEMESTER-III

ENGINEERING MATHAMEATICS - III				
Course Code	21MAT31		**Credits**	3
Hours/Week (L-T-P)	2-2-0		**CIE Marks**	50
Total Hrs	39		**SEE Marks**	50
Exam Hrs	3		**Course Type**	Core

COURSE OUTCOMES

Course outcomes: After completion of the course, students will be able to-

1. Model and use the appropriate numerical, analytical method to solve ordinary and partial differential equations
2. Adopt and apply the methods of solving differential equations learnt, to different engineering problems
3. Analyse , fit appropriate function to the data given by interpolation of least square process
4. Interpolate extrapolate and predict the data obtained by survey or experiments and from real life situations
5. Use variation methods to model the situation and apply methods to solve integral equations

TEACHING METHODOLOGY

- Blackboard teaching/PowerPoint presentation (if needed) /Flipped Classes for specified topics
- Tutorial classes on topics covered
- Unit tests on covered topics

COURSE CONTENTS

UNIT-1 (08 HOURS)

Numerical methods to solve ordinary differential equations

Taylor's series method for 1st and 2nd order IVP, 4th order Runge-Kutta method for 1st order IVP, simultaneous equations, 2nd order IVP, Milne's predictor and correctormethod1st and 2nd order IVP. Finite difference for BVP of 2nd order.

UNIT-2 - (08 HOURS)

Analytical methods to solve ordinary differential equation

Laplace Transforms: Introduction, transforms of standard functions, Inverse Laplace transforms, Solution to initial value problems related to first and second order Ordinary differential equations

Fourier Transforms: Complex Fourier transforms, Cosine and Sine transforms, Inverse Fourier transforms, Solution of differential equations using Fourier Transforms. Power series method, Frobeniuos method. Self-Study: Convolution Theorem for Fourier and Laplace transforms.

UNIT-3 - (08 HOURS)

Methods to solve partial differential equations

Finite Difference method: Schmidt method for heat, wave equation, cranks Nicholson for heat equations, Laplace equations- SOR, ADI method. Fourier series of periodic functions with period $2l$, Fourier series solution of heat and wave equations. Self-Study: Application problems.

UNIT-4 - (08 HOURS)

Interpolation, curve fitting and Numerical integration

Interpolation: Newton's divided difference formulae, Lagrange's formula, Cubic spline. Numerical Differentiation: Newton's forward and backward formulae, Lagrange's Interpolation. Numerical Integration**:** Trapezoidal, Simpson's1/3rd and 3/8th, Weddle's rule, Gaussian Quadrature method. Fitting Fourier series: Harmonic analysis. Self-Study: Quadratic spline, Fitting non-linear curves by least square method.

UNIT-5 - (07 HOURS)

Calculus of Variation and Numerical methods to solve integral equations

Functional, Euler's equation, Solution to Euler's equation, geodesics, isoperimetric problems, Rayleigh Ritz method, Galerkin's method, Point collocation method. Solutions of integral equations: Fredholm equations, quadrature method and Cubic spline method to solve integral equations. Self-Study: Simpson's 1/3rd rule for solving integral equations.

TEXT BOOKS

Sl. No	Title of the Book	Name of the Author	Name of the Publishers	Edition and Year
1	Advanced Engg. Mathematics	Erwin E Kreyszig	Wiley	10th edition,
2	Numerical Methods for Scientific and Engg. Computation	M K Jain, S R K Iyengar, R K Jain	New Age,	6th edition, 2012

REFERENCE BOOKS

Sl. No.	Title of the Book	Name of the Author	Name of the Publishers	Edition and Year
1	Fourier Series, Transforms and	J R Hanna, J H Rowland	Dover,	2nd edition, 2008

	Boundary Value Problems			
2	Numerical Algorithms	E V Krishnamurthy, S K Sen	East West press,	2007

ONLINE RESOURCES	Link
NPTEL	https://nptel.ac.in/courses/111104125/
NPTEL	https://nptel.ac.in/courses/111106100/
NPTEL	https://nptel.ac.in/courses/111105090/
MIT OCW	https://nptel.ac.in/courses/111106139/
TU Delft	https://ocw.mit.edu/courses/mathematics/18-175-theory-of-probability-spring-2014

COURSE ASSESSMENT METHOD

Continuous Internal Evaluation (CIE)

Three internal assessments for 30 Marks each.

Two Learning Activities for10 Marks each.

Semester End Examination (SEE)

Semester end examination for 100 Marks

Program Outcomes – Articulation matrix

PO	1	2	3	4	5	6	7	8	9	10	11	12	PSO1	PSO2
CO1	2	2		1	1									
CO2	2	2		1	1									
CO3	2	2		1	1									
CO4	2	2		1	1									
CO5	2	2		1	1									

INTRODUCTION TO AIRCRAFT ENGINEERING				
Course Code	21AE32		**Credits**	3
Hours/Week (L-T-P)	3-0-0		**CIE Marks**	50
Total Hrs	36		**SEE Marks**	50
Exam Hrs	3		**Course Type**	Core

COURSE OUTCOMES

Course outcomes: After completion of the course, students will be able to-

1. Describe the history and configurations of aircraft
2. Explain the various types of airfoils and wings
3. Analyse the performance of aircrafts
4. Analyse structural components of aircraft
5. Understand various design parameters of aircrafts

TEACHING METHODOLOGY

- Blackboard teaching/PowerPoint presentation (if needed) /Flipped Classes for specified topics
- Regular review of students by asking questions based on topics covered in the class

COURSE CONTENTS

UNIT-1 - (10 HOURS)

History and Aircraft Configurations
Early development of Airplanes, biplanes and monoplanes, Developments in materials, structures and propulsion over the years, types of flight vehicles, Classifications-Components of an airplane and their functions.
Environments: Design Motivation, Atmosphere and its character, pressure measurement, standard atmosphere, use of standard atmosphere.

UNIT-2 - (10 HOURS)

Aerodynamics, Airfoils and Wings: Design Motivation, Basic aerodynamics, Aerodynamics
Application, Viscous flow, airfoil characteristics , wings, High lift device, Aircraft lift, Aircraft Drag and Drag polar, Mach number effect, Aircraft analysis example.

UNIT-3 - (10 HOURS)

Performance: Design Motivation, equation of motion, propulsion, drag curve, lift to drag ratio, power curves, curve shifts, glides, cline range and endurance, take off and landing, turns, V-notation energy height and specific excess Power.

UNIT-4 - (10 HOURS)

Structures and Sizing: Design Motivation, Types of stress, loads, structural layout, materials, component sizing, structural sizing examples, weight estimates, FEA, Internal layout, structural weight, geometry constraints, mission analysis, sizing equations, weight fraction method, weight and balance mission analysis and sizing examples, aerodynamics cost.

UNIT-5 - (08 HOURS)

Design: Introduction, design method, example, Brief history of aircraft design, conceptual design introduction, 12 activities, custom faces, design synthesis, geometry modeling and engineering drawing, Aerodynamic analysis, Constraint analysis, Mission analysis, weight analysis sizing, cost analysis, optimization, performance case study(F-16).

TEXT BOOKS

Sl. No.	Title of the Book	Name of the author/s	Name of the publisher	Edition and year
1	Aircraft Design - A Conceptual Approach,	Raymer, D. P.,	AIAA Educational Series,	4th Ed., 2006
2	Fundamentals of Aircraft and Airship Design Volume I – Aircraft Design,	Leland M. Nicolai and Grant E. Carichner,	AIAA Education Series,	2010

REFERENCE BOOKS

Sl. No.	Title of the Book	Name of the author/s	Name of the publisher	Edition and year
1	Introduction to Aeronautics: A Design Perspective,	Brandt, S. A., Stiles, R. J., Bertin, J. J., Whitford, R.,	AIAA Educational Series,	2nd ed., 2004
2	Civil Jet Aircraft Design	Jenkinson, L. R., Simpkin, P. and Rhodes, D.,	Arnold Publishers, London,	1999.
3	Introduction to Aircraft Design,	Fielding, J.,	Cambridge Aerospace Series, Cambridge University Press,	1999

ONLINE RESOURCES	Link
NPTEL	https://onlinecourses.nptel.ac.in/noc20_ae14/preview
NPTEL	https://www.digimat.in/nptel/courses/video/101101083/L77.html
NPTEL	https://www.digimat.in/nptel/courses/video/101101083/L01.html

COURSE ASSESSMENT METHOD

Continuous Internal Evaluation (CIE)

Three internal assessments for 30 Marks each.

Two Learning Activities for10 Marks each.

Semester End Examination (SEE)														
Semester end examination for 100 Marks														
Program Outcomes – Articulation matrix														
PO	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**PSO1**	**PSO2**
CO1	3													3
CO2	3	3	3											3
CO3	3	2	3											2
CO4	3	3	3											3
CO5	3	3	3											3

AERO THERMODYNAMICS				
Course Code	21AE33		**Credits**	3
Hours/Week (L-T-P)	3		**CIE Marks**	50
Total Hrs	39		**SEE Marks**	50
Exam Hrs	3		**Course Type**	Core

COURSE OUTCOMES

Course outcomes: After completion of the course, students will be able to-

1. Apply the basic concepts of thermodynamics and heat -work interaction
2. Illustrate the laws and principles of thermodynamics and its applications
3. Analyze and examine the properties of entropy.
4. Analyze the performance of gas turbines

TEACHING METHODOLOGY

- Blackboard teaching/PowerPoint presentation (if needed)
- Videos and animation
- Tutorial classes on problems

COURSE CONTENTS

UNIT-1 - (10 HOURS)

Fundamental Concepts:
Systems; Thermodynamic state, path, process; Zeroth Law and temperature measurement; definition of work and its limitations. Thermodynamic definition of work - examples, signs convention. Heat and work transfer in flow, expressions for displacement work in various processes through p-v diagrams; Heat- definition, units and sign convention

UNIT-2 (08 HOURS)

First law of thermodynamics:
Introduction, First law of thermodynamics- for a closed system undergoing a cycle, for a change in state of a closed system; Joules experiment, Enthalpy, Specific Heat, PMMK-1, Limitations of first law; Problems. First law of thermodynamics for open system-Principle of conservation of mass, Steady flow energy equation, unsteady flow process.

UNIT-3 (10 HOURS)

Second Law of Thermodynamics:
Introduction, Thermal energy reservoir, Heat Engine, Heat Pump, Kelvin plank Statement, Clausius statement- Equivalence; Carnot Cycle, reversed Carnot Cycle, Carnot's first theorem, Carnot Second theorem, Carnot third theorem, Efficiency and C.O.P in terms of temp., Problems.
Entropy: Clausius inequality; Statement, proof, application to a reversible cycle. Entropy; definition, a property, change of entropy, principle of increase in entropy, entropy as a quantitative test for irreversibility, calculation of entropy using Tds relations, entropy as a coordinate. Available and unavailable energy.

UNIT-4 - (10 HOURS)

Gas Turbine
Introduction, Types of gas turbines-Constant volume and constant pressure; Gas turbine cycles-Closed cycle and Open cycle; Analysis of Brayton cycle: Optimum pressure ratio concept, Effect of blade friction: Methods of improving turbine efficiency, Problems.

UNIT-5 - (10 HOURS)

Jet propulsion:
Introduction: Airbreathing Engines-Turbojet- Thrust equation, Turboprop, turbofan and turbo shaft construction and working principle, Problems on Thrust and SFC. Performance comparison of each with P-V, T-S diagram; Ram Jet, Scram jet and pulsejet construction and Working: Comparison between Subsonic, supersonic and Hypersonic engines.

TEXT BOOKS

Sl. No.	Title of the Book	Name of the Author	Name of the Publishers	Edition and Year
1.	Fundamentals of Engineering Thermodynamics;	Rathakrishnan E	PhI Learning Pvt. Ltd- New Delhi	2nd revised edition, 2005.
2.	Engineering Thermodynamics	P K Nag	Tata McGraw Hill Education Private Limited	4th Edition, (2008).

REFERENCE BOOKS

Sl. No.	Title of the Book	Name of the Author	Name of the Publishers	Edition and Year
1.	Thermodynamics: An Engineering Approach	Yunus A. Cengel and Michael A. Boles	McGraw-Hill College	4thedition, 2001
2.	Basics of Aerothermodynamics (Progress in Astronautics and Aeronautics)	Ernst Heinrich Hirschel	Springer	2005
3.	Engineering Thermodynamics: Work and Heat Transfer	Rogers GFC and Mayhew Y	Longman	4thEdition, 1992

ONLINE RESOURCES	Link
NPTEL	https://nptel.ac.in/courses/101104063/
NPTEL	https://nptel.ac.in/noc/courses/noc20/SEM2/noc20-me51
NPTEL	https://nptel.ac.in/courses/112103275/

MIT OCW	https://nptel.ac.in/courses/101104067/
TU Delft	https://ocw.mit.edu/courses/materials-science-and-engineering/3-205-thermodynamics-and-kinetics-of-materials-fall-2006/lecture-notes/

COURSE ASSESSMENT METHOD

Continuous Internal Evaluation (CIE)

Three internals tests (each 30 marks) are conducted, average of best two performances will be considered.

1. Minimum two Assignments/Model making - evaluated through rubrics for 10 marks. Average of two will be considered.
2. Tutorial classes and assessment are carried out/Surprise quiz tests are conducted and evaluated for 10 marks. Average of these two will be considered.

Semester End Examination (SEE)

1. Two Questions are to be set from each unit, carrying 20 Marks each.
2. Students have to answer 5 questions selecting one full question from each unit

Program Outcomes – Articulation matrix

PO	1	2	3	4	5	6	7	8	9	10	11	12	PSO1	PSO2
CO1	3	3							3	3				**3**
CO2	3	3							3	3				3
CO3	3	3							3	3				3
CO4	3	3							3	3				**3**
CO5	3	3							3	3				3

FLUID MECHANICS				
Course Code	21AE34		**Credits**	3
Hours/Week (L-T-P)	3-0-0		**CIE Marks**	50
Total Hrs	39		**SEE Marks**	50
Exam Hrs	3		**Course Type**	Core

COURSE OUTCOMES

Course outcomes: After completion of the course, students will be able to-

1. Identify fluid properties and distinguish between different types of manometers understanding.
2. Apply principles of dimensional analysis and similitude to simple engineering problems and describe buoyancy force.
3. Discuss the continuity equation and flow visualization techniques
4. Analyze the forces and energy for the fluid flow in a conduit and compare the different flow measuring devices.
5. Evaluate the losses and viscous effects in the flow through pipes.

TEACHING METHODOLOGY

- Blackboard teaching/PowerPoint presentation (if needed)
- Tutorial classes

COURSE CONTENTS

UNIT-1 - (09 HOURS)

Fluids: Introduction, Types of fluid, Properties of fluids.
Fluid Statistics: Fluid pressure at a point, Pascal's law, pressure variation in a static fluid, absolute, gauge, atmospheric and vacuum pressures, simple manometers and differential manometers. Total pressure and center of pressure on submerged plane surfaces; horizontal, vertical and inclined plane surfaces, curved surface submerged in liquid.

UNIT-2 - (09 HOURS)

Buoyancy: Buoyancy, center of buoyancy, meta-centre and meta-centric height, conditions of equilibrium of floating and submerged bodies, determination of Meta-centric height experimentally and theoretically.
Dimensional Analysis: Introduction, derived quantities, dimensions of physical quantities, dimensional homogeneity, Rayleigh's method, Buckingham's π theorem, dimensionless numbers, similitude, types of similitude.

UNIT-3 - (10 HOURS)

Fluid Kinematics: Types of fluid flow, continuity equation in 2D and 3D (Cartesian Co-ordinates only), velocity and acceleration, Flow net: its characteristics and utility. Fundamentals of flow visualization stream tube, timelines, flow visualization techniques, Plots of fluid flow data: profile plot, vector plot, and contour plot.

UNIT-4 - (10 HOURS)

Fluid Dynamics: Introduction equation of motion, Bernoulli's equation from first principles and also from Euler's equation, limitations of Bernoulli's equation.
Fluid Flow Measurements: Venturimeter, orifice meter, pitot-tube, vertical orifice, V-Notch and rectangular notches.

UNIT-5 - (10 HOURS)

Flow through pipes: Minor losses through pipes. Darcy's and Chezy's equation for loss of head due to friction in pipes. HGL and TEL.
Laminar flow and viscous effects : Reynolds's number, critical Reynold's number, laminar flow through circular pipe-Hagen Poiseille's equation, laminar flow between parallel and stationary plates. Boundary layer concept, displacement, momentum and energy thickness

TEXT BOOKS

Sl. No.	Title of the Book	Name of the Author	Name of the Publishers	Edition and Year
1	Fluid Mechanics	Dr. R K Bansal,	Lakshmi Publications	2004
2	Engineering Fluid Mechanics	Prof. K L Kumar	S Chand publications	Eighth revised edition, 2009.
3	Fluid Mechanics (SI Units)	Yunus A. Cengel John M. Simbala	Tata McGraw Hill,	2nd Edition, 2006.

REFERENCE BOOKS

Sl. No.	Title of the Book	Name of the Author	Name of the Publishers	Edition and Year
1	Fluid Mechanics and hydraulics	Dr. Jagadishlal	Metropolitan Book Co-Ltd.	1997
2	Fluid Mechanics and Fluid Power Engineering	Kumar D.S	Kataria and Sons	2004
3	Fluid mechanics	Frank M White	McGraw- Hill	7th Edition
	Introduction to fluid mechanics	Fox and McDonald's, Philip J. Pritchard, John C. Leylegian	John Wiley & Sons	8th Edition, Inc.2011.

ONLINE RESOURCES	Link
NPTEL	https://youtu.be/TKk3Sqbsdbg
NPTEL	https://nptel.ac.in/courses/112105269/
NPTEL	https://nptel.ac.in/courses/112105206/
MIT OCW	https://ocw.mit.edu/courses/find-by-topic/#cat=engineering&subcat=mechanicalengineering&spec=fluidmechanics

COURSE ASSESSMENT METHOD

Continuous Internal Evaluation (CIE)

Three internals tests (each 30 marks) are conducted, average of best two performances will be considered.														
1. Minimum two Assignments/Model making - evaluated through rubrics for 10 marks. Average of two will be considered.														
2. Tutorial classes and assessment are carried out/Surprise quiz tests are conducted and evaluated for 10 marks. Average of these two will be considered.														
Semester End Examination (SEE)														
1. Two Questions are to be set from each unit, carrying 20 Marks each.														
2. Students have to answer 5 questions selecting one full question from each unit														
Program Outcomes – Articulation matrix														
PO	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**PSO1**	**PSO2**
CO1	2	2							2	2				3
CO2	3	3							3	3				3
CO3	3	3							3	3				3
CO4	3	2							3	2				3
CO5	3	3							3	3				3

BASICS OF AEROSTRUCTURE				
Course Code	21AE35		**Credits**	3
Hours/Week (L-T-P)	3-2-0		**CIE Marks**	50
Total Hrs	50		**SEE Marks**	50
Exam Hrs	3		**Course Type**	Core

COURSE OUTCOMES

Course outcomes: After completion of the course, students will be able to-

1. Summarize and interpret the concepts of simple and compound stresses and related strain in structural members
2. Solve and predict the effects of force and moments (shear Force and Bending Moment) on beams
3. Analyse the Bending Stresses and shear stress in Beams due to bending
4. Analyse the statically determinate and indeterminate structures.
5. Solve and analyze the problems on deflection of beam and torsion effect on shaft

TEACHING METHODOLOGY

- Blackboard teaching/PowerPoint presentation (if needed) /Flipped Classes for specified topics
- Regular review of students by asking questions based on topics covered in the class

COURSE CONTENTS

UNIT-1 - (08 HOURS)

Stresses and Strains:
Introduction to Stress and strain, Types of stress and Strain, Stress Strain Diagram of Ductile, Brittle, Visco- Elastic, Linear & Non-linear Elastic materials. Bars with varying sections, Bars of composite sections, Simple problems. Thermal stresses, Elastic constants and its relation, volumetric stains, Simple problems. Compound Stresses: Methods of Determining stresses in oblique sections, Principal planes and stresses, Simple problems, Construction of Mohr's circle, simple problems.
Derivation of Equilibrium equations, strain- displacement relation, compatibility conditions and boundary conditions. Plane stress and Plane strain problems in 2D elasticity.

UNIT-2 - (08 HOURS)

Shear Force and Bending Moment Diagram:
Introduction to shear force, Bending moment, Types of Beams and loads, Sign convention for shear force and bending moment, Shear force and bending moment diagram for various beams. Relation between shear force and bending moment. Bending Stresses and shear stress in Beams: Introduction, Pure Bending and Simple Bending, Expression of Bending stress, Neutral axis and Moment of resistance, bending stress in symmetrical sections- simple problems. Introduction to shear stress, shear stress distribution for different section simple problems.

UNIT-3 - (10 HOURS)

Analysis of beams and truss:
Introduction to Deflection and slope, Finding Deflection and slope of a beam subjected to various loads, Relation between slope, Deflection and radius of curvature, Simple problems. Fixed & Continuous beam analysis - Clapeyron's Three Moment Equation. Analysis of plane truss – Method of joints – Method of sections, Plane frames. Torsion of Shafts: Introduction to torsion, Derivation of shear stress produced in a circular shaft subjected to Torsion, Expression of Torque in terms of polar moment of Inertia, Power transmitted by shaft, simple problem

UNIT-4 - (08 HOURS)

Column and struts:
Introduction to columns and struts, Failure of a column, Expression of crippling load when (a) both ends are hinged (b) One end of the column is fixed and the other end is free (c) both ends are fixed (d) One end is fixed and the other end is hinged. Simple problems to be solved used Euler's formula and Rankine formula. Column with initial curvature - Eccentric loading – South well plot – Beam column. Thick and Thin cylinders: Thin cylinders subjected to internal pressure. Stresses in a thin cylinder subjected to internal pressure, Expression of circumferential stress and hoop stress, Simple problems Thick Cylinder: Lame's theorem, Stresses in a thick cylinder, Simple problems to be solved.

UNIT-5 - (08 HOURS)

Energy Methods: Strain Energy due to axial, bending, shear and torsional loading - Castigliano's theorem - Maxwell's Reciprocal theorem, Unit load method - application to beams, trusses, frames, rings, etc.
Theory of Failures: Maximum principal stress theory, Maximum principal strain theory, Maximum shear stress theory, Maximum strain energy theory, Maximum shear strain Energy theory. Graphical representation of theories for two-dimensional stress system, Application to aircraft structural problems.

TEXT BOOKS

Sl. No	Title of the Book	Name of the Author	Name of the Publishers	Edition and Year
1	Strength of Materials	R K Bansal	Laxmi Publication Pvt Ltd., New Delhi	2004
2	Strength of Materials	Ramamrutham	Vikas Publication, New Delhi	8th edition, 2014
3	Mechanics of materials	Gere and Timoshenko	CBS Publishers & Distributors	2nd edition, 2006
4	Aircraft Structures for Engineering Students	Megson T. H. G	Elsevier, New York	5th edition 2012
5	Aircraft Structures	Peery D. J, and Azar J. J	McGraw – Hill	2nd edition 1999

REFERENCE BOOKS

Sl. No	Title of the Book	Name of the Author	Name of the Publishers	Edition and Year
1	Engineering Mechanics of Solids	Egor P. Popov	PHI publications	2nd edition

2	Mechanics of materials	RC Hbbeler	Pearson publications	9th edition,
3	Mechanics of Materials	B.C. Punmia, Ashok Kumar Jain &Arun Kumar Jain	Laxmi publications, New Delhi	2006
4	Theory of Structures	Dr. B. C. Punmia	Laxmi Publications (P) Ltd,	13th Edition 2011
5	Analysis of Aircraft Structures – An Introduction	Donaldson, B.K	McGraw-Hill	1993

ONLINE RESOURCES	Link
NPTEL	https://youtu.be/N68fNrRa8-M
NPTEL	https://nptel.ac.in/noc/courses/noc20/SEM2/noc20-me84
NPTEL	https://ocw.mit.edu/courses/civil-and-environmental-engineering/1-050-solid-mechanics-fall-2004
MIT OCW	https://youtu.be/N68fNrRa8-M
NPTEL	https://youtu.be/N68fNrRa8-M

COURSE ASSESSMENT METHOD

Continuous Internal Evaluation (CIE)

1. Three internal assessments for 30 Marks each.
2. Two Learning Activities for10 Marks each.

Semester End Examination (SEE)

3. Semester end examination for 100 Marks

AEROSTRUCTURES LAB

List of experiments

1. Tensile and compression test of metallic specimens using Universal Testing Machine
2. Bending and torsion Test of metallic specimens
3. Impact tests on metallic Specimen.
4. Hardness test of metallic specimen
5. Deflection of beams with various conditions.
6. Shear test of riveted joint and bolted joints
7. Column test – south well plot
8. Symmetrical and unsymmetrical bending of beams
9. Combined loading of beams
10. Measurement of stresses in thin walled vessel
11. Fatigue test

Course Assessment Method:

Record: 30 marks
Test: 15 marks
Viva-voce: 05 marks
SEE - Final Exam: 50 Marks
Scheme of Examination: Student will be asked to conduct two experiment

Program Outcomes – Articulation matrix

PO	1	2	3	4	5	6	7	8	9	10	11	12	PSO1	PSO2
CO1	2	2							2	2				3
CO2	3	3							3	3				3
CO3	3	3							3	3				3
CO4	3	2							3	2				3
CO5	3	3							3	3				3

COMPUTER AIDED AIRCRAFT DRAWING LAB				
Course Code	21AEL37		**Credits**	1
Hours/Week (L-T-P)	0-0-2		**CIE Marks**	50
Total Hrs	24		**SEE Marks**	50
Exam Hrs	03		**Course Type**	Core

COURSE OUTCOMES

Course outcomes: After completion of the course, students will be able to-

1 Plot the orthographic views of engineering components
2. Use suitable thread forms, Fasteners and riveted joints for engineering applications.
3. Design propeller and hub assembly using advanced modelling tools.
4. Design wing assembly, fuselage and engine mounts using advanced modelling tools.
5. Design of landing gear assembly using advanced modelling tools

TEACHING METHODOLOGY

●Blackboard teaching/PowerPoint presentation (if needed) /Flipped Classes for specified topics

COURSE CONTENTS

PART -A

1. Orthographic Views: Conversion of pictorial views into orthographic projections of simple machine parts with or without section. (Bureau of Indian Standards conventions are to be followed for the drawings) Hidden line conventions. Precedence of lines.
2. Thread Forms: Thread terminology, sectional views of threads. ISO Metri(Internal & External) BSW (Internal & External) square and Acme. Sellers thread, American Standard thread.
3. Fasteners: Hexagonal headed bolt and nut with washer (assembly), square headed bolt and nut with washer (assembly) simple assembly using stud bolts with nut and lock nut.
4. Riveted Joints: Single and double riveted lap joints, butt joints with single/doublcover straps (Chain and Zigzag, using snap head rivets).

PART -B

1. Design of propeller and hub assembly
2. Design of wing assembly
3. Design of Engine Mounts
4. Design of fuselage assembly
5. Design of landing gear

Course Assessment Method:
Record: 30 marks
Test: 15 marks
Viva-voce: 05 marks
SEE - Final Exam: 50 Marks
Scheme of Examination: Student will be asked to conduct any one experiment from Part A & B

Program Outcomes – Articulation matrix:

PO	1	2	3	4	5	6	7	8	9	10	11	12	PSO1	PSO2
CO1	3	3	2		3				2	2			2	1
CO2	3	3	2		3				2	2			2	1
CO3	3	2	2		3				2	2			2	1
CO4	3	2	2		3				2	2			2	1
CO5	3	2	2		3				2	2			2	1

PROGRAM ELECTIVE-A

UAV DESIGN				
Course Code	21AEE361		**Credits**	3
Hours/Week (L-T-P)	3-0-0		**CIE Marks**	50
Total Hrs	39		**SEE Marks**	50
Exam Hrs	03		**Course Type**	Program Elective

COURSE OUTCOMES

Course outcomes: After completion of the course, students will be able to-
1. Identify types of UAVs and its applications
2. Describe the aerodynamics and stability of UAV
3. Identify suitable Propulsion system, and materials for UAVs
4. Explain Mission Planning and Control of UAV

TEACHING METHODOLOGY

- Blackboard teaching/PowerPoint presentation (if needed) /Flipped Classes for specified topics
- Regular review of students by asking questions based on topics covered in the class
- Video and animation

COURSE CONTENTS

UNIT-1 - (08 HOURS)

Introduction: Aviation History and Overview of UAV systems, Classes and Missions of UAVs, Definitions and Terminology, UAV fundamentals, Examples of UAV systems-very small, small, Medium and Large UAV

UNIT-2 - (08 HOURS)

The Air Vehicle Basic Aerodynamics: Basic Aerodynamics equations, Aircraft polar, the real wing and Airplane, Induced drag, the boundary layer, Flapping wings, Total Air-Vehicle Drag
Performance: Overview, climbing flight, Range and Endurance – for propeller driven aircraft, range- a jet-driven aircraft, Guiding Flight

UNIT-3 - (08 HOURS)

Stability and Control: Overview, Stability, longitudinal, lateral, dynamic stability, Aerodynamics control, pitch control, lateral control, Autopilots, sensor, controller, actuator, airframe control, inner and outer loops, Flight-Control Classification, Overall Modes of Operation, Sensors Supporting the Autopilot.

UNIT-4 - (08 HOURS)

Propulsion: Overview, Thrust Generation, Powered Lift, Sources of Power, The Two-Cycle Engine, The Rotary Engine, The Gas Turbine, Electric Motors, Sources of Electrical Power
Loads and Structures Loads, Dynamic Loads, Materials, Sandwich Construction, Skin or Reinforcing Materials, Resin Materials, Core Materials, Construction Techniques

UNIT-5 - (07 HOURS)

Mission Planning and Control: Air Vehicle and Payload Control, Reconnaissance/Surveillance Payloads, Weapon Payloads, Other Payloads, Data-Link Functions and Attributes, Data-Link Margin, Data-Rate Reduction, Launch Systems, Recovery Systems, Launch and Recovery Tradeoffs

TEXT BOOKS

Sl. No	Title of the Book	Name of the author/s	Name of the publisher	Edition and year
1	Introduction to UAV Systems	Paul Gerin Fahlstrom, Thomas James Gleason	Wiley PublicationJohn Wiley & Sons, Ltd	4th Edition 2012
2	Unmanned Aerial Vehicle	Landen Rosen `	Alpha Editions, ISBN13: 9789385505034	2012

REFERENCE BOOKS

Sl. No.	Title of the Book	Name of the author/s	Name of the publisher	Edition and year
1	Unmanned Aerial Vehicles	Valavanis, Kimon P `	Springer	2011
2	Unmanned Aerial Vehicles	Valavanis, K., Vachtsevanos, George J	Springer	2015

ONLINE RESOURCES	Link
NPTEL	https://nptel.ac.in/course.html
NPTEL	https://nptel.ac.in/courses/101/104/101104073/
MIT OCW	https://ocw.mit.edu/search/ocwsearch.htm?q=AERIAL%20VEHICLE
TU Delft	https://online-learning.tudelft.nl/courses/

Program Outcomes – Articulation matrix:

PO	1	2	3	4	5	6	7	8	9	10	11	12	PSO1	PSO2
CO1	3	1							3	1			2	2
CO2	3	1							3	1			2	2

CO3	3	1							3	1			2	2
CO4	3	1							3	1			2	2
CO5	3	1							3	1			2	2

INTRODUCTION TO SPACE SCIENCE AND SPACE TECHNOLOGY				
Course Code	21AEE362		**Credits**	3
Hours/Week (L-T-P)	3-0-0		**CIE Marks**	50
Total Hrs	39		**SEE Marks**	50
Exam Hrs	3		**Course Type**	Program Elective

COURSE OUTCOMES

Course outcomes: After completion of the course, students will be able to-

1. Explain the fundamentals of rocket propulsion and trajectories
2. Describe the solar system.
3. Describe the trajectory, motion of rockets, satellite launch and satellite orbits.
4. Outline the Satellite Applications and interplanetary mission

TEACHING METHODOLOGY

- Blackboard teaching/PowerPoint presentation (if needed) /Flipped Classes for specified topics
- Regular review of students by asking questions based on topics covered in the class

COURSE CONTENTS

UNIT-1 - (08 HOURS)

Earth and Atmosphere: The Planet Earth; Earth's Gravitational Field; Earth as an Ellipsoid; Peer- shaped Earth; Ellipticity of the Earth; The Geoid and Its Importance; Thermal Structure of the Atmosphere; Atmospheric Density Variation; Van-Allen Radiation Belt; The Ionosphere.

UNIT-2 - (07 HOURS)

Solar System: Motion and Rotation of the Planets; Geocentric and Heliocentric Systems; Sidereal and Synodic Periods; Ecliptic Plane and the Zodiac; Direct and Retrograde Motions; Configuration and Phases of Interior Planets; Configurations of Exterior Planets; Asteroids; Comets; Meteors, Meteorites and Tektites; Micrometeorites; The Milky Way, the Galaxies and the Universe.

UNIT-3 - (08 HOURS)

Trajectory and rocket: Mass ratio and propellant mass fraction, equation of motion of an ideal rocket. Motion of rocket in a gravitational field, simplified vertical trajectory, burnout velocity and burn out height, step rockets, ideal mission velocity and losses effect of launch angle, factors causing dispersion of rockets in flight, dispersion of finned rockets, stability of flight.

UNIT-4 - (08 HOURS)

Satellite Launch and Satellite Orbits: Orbits and Trajectories; Conic Sections; Kepler's Laws of Satellite Motion; Orbital Velocity of Satellites; Orbital Periods; Eccentric Elliptical Orbits; Effect of Injection Conditions; Perturbation of Orbits; Effect of Earth's Rotation; Low Earth Orbits; Geostationary Satellites; Sun- synchronous Satellites. Parking Orbit; Transfer Trajectory; Impulsive Shot; Launching of Interplanetary Spacecraft.

UNIT-5 - (08 HOURS)

Satellite Applications and interplanetary mission: Satellite for metrological, communication, navigational and geodetic applications, atmospheric sounding rocket, satellitefor geophysical and interplanetary studies, parking orbit, transfer trajectory, impulsive shot, launching of interplanetary space craft.

TEXT BOOKS

Sl. No.	Title of the Book	Name of the Author	Name of the Publishers	Edition and Year
1.	Spaceflight dynamics	W.E. Wiesel	McGraw Hill	1997
2.	Rocket propulsion elements	George P. Sutton, Oscar Biblarz	Wiley	9th Edition

REFERENCE BOOKS

Sl. No.	Title of the Book	Name of the Author	Name of the Publishers	Edition and Year
1.	Rocket Propulsion and Space flight dynamics	Cornelisse, Schoyer HFR and Wakker KF	Pitman	1984
2.	Fundamentals of Space Systems	Vincet L. Pisacane	Oxford University Press	2005
3.	Understanding Space: An Introduction to Astronautics	J. Sellers	McGraw Hill,	2000
4.	Introduction to Space Flight	Francis J Hale	Prentice-Hall	1994
5.	Spacecraft Mission Design	Charies D. Brown	AIAA education Series	1998
6.	Elements of Space Technology for aerospace Engineers	Meyer Rudolph X	Academic Press	1999

ONLINE RESOURCES	Link
NPTEL	https://nptel.ac.in/courses/101105077/
NPTEL	https://nptel.ac.in/courses/101106082/
NPTEL	https://nptel.ac.in/courses/101105083/
MIT OCW	https://ocw.mit.edu/courses/aeronautics-and-astronautics/16-83x-space-systems-engineering-spring-2002-spring-2003
TU Delft	https://ocw.mit.edu/courses/aeronautics-and-astronautics/16-512-rocket-propulsion-fall-2005

COURSE ASSESSMENT METHOD

Continuous Internal Evaluation (CIE)
Three internals tests (each 30 marks) are conducted, average of best two performances will be considered.
1. Minimum two Assignments/Model making - evaluated through rubrics for 10 marks. Average of two will be considered.
2. Tutorial classes and assessment are carried out/Surprise quiz tests are conducted and evaluated for 10 marks. Average of these two will be considered.
Semester End Examination (SEE)
1. Two Questions are to be set from each unit, carrying 20 Marks each.
2. Students have to answer 5 questions selecting one full question from each unit
Program Outcomes – Articulation matrix

PO	1	2	3	4	5	6	7	8	9	10	11	12	PSO1	PSO2
CO1	3								2	2		2		
CO2	3	2							2	2		2		
CO3	3	2							2	2		2		
CO4	3	2							2	2		2		
CO5	2	2							2	2		2		

AIRPORT PLANNING & MANAGEMENT				
Course Code	21AEE363		**Credits**	3
Hours/Week (L-T-P)	3-0-0		**CIE Marks**	50
Total Hrs	39		**SEE Marks**	50
Exam Hrs	3		**Course Type**	Program Elective

COURSE OUTCOMES

Course outcomes: After completion of the course, students will be able to-

1. Explain the typical operations of airports from a management perspective
2. Identify the economic, political and social role of airports
3. Discuss the airport financial management
4. Explain and defining capacity, factors affecting capacity and delay

TEACHING METHODOLOGY

- Blackboard teaching/PowerPoint presentation (if needed)

COURSE CONTENTS

UNIT-1 - (08 HOURS)

Airports and Airport Systems: Introduction: Airport management on an international level; The national plan of integrated airport systems; The nation's airport system plan; The rules that govern airport management; Organizations that influence airport regulatory policies; A historical and legislative perspective: Introduction the formative period of aviation and airports, Airport growth: World War-II and the postwar period airport modernization: The early jet age.

UNIT-2 - (08 HOURS)

Components of the airport

The components of an airport, the airfield. Navigational aids (NAVAIDS) located on airfields; Air traffic control and surveillance facilities located on the airfield; Weather reporting facilities located on airfields; Security infrastructure on airfields; Airspace and air traffic control: Brief history of air traffic control; The basics of air traffic control; Current and future enhancements to air traffic control; Airport terminals and ground access: The historical development of airport terminals; Components of the airport terminal; Airport ground access

UNIT-3 - (08 HOURS)

Airport operations and financial management

Airport operations management: Introduction, pavement management, aircraft rescue and firefighting (ARFF); Snow and ice control, safety inspection programs. Bird and wildlife hazard management; Airport security: Security at commercial service airports, security at general aviation airports; the future of airport security

UNIT-4 - (08 HOURS)

Airport financial management

Airport financial accounting, revenue strategies at commercial airports, pricing of airport facilities and services, variation in the sources of operating revenues, rise in airport financial burdens, airport funding, grant programs, airport financing, private investment sale of the airport.

UNIT-5 - (07 HOURS)

Airport capacity and delay

Defining capacity, factors affecting capacity and delay, estimating capacity, analytical estimates of delay: The queuing diagram; The future of airport management: Introduction, restructuring of commercial air carriers, new large aircraft and small aircraft transportation systems.

TEXT BOOKS

Sl. No.	Title of the Book	Name of the Author	Name of the Publishers	Edition and Year
1	Airport planning and Management	Alexander T Wells, Ed. D Seth Young	McGraw-Hill Education	6nd Edition, 2011

REFERENCE BOOKS

Sl. No.	Title of the Book	Name of the Author	Name of the Publishers	Edition and Year
1	Airport Operations	Norman J. Ashford, H. P. Martin Stanton, Clifton A. Moore, Pierre Coutu	McGraw Hill	3rd Edition, 2013

ONLINE RESOURCES	Link
NPTEL	https://nptel.ac.in/courses/101101083/
NPTEL	https://nptel.ac.in/noc/courses/noc18/SEM1/noc18-ae03
NPTEL	https://nptel.ac.in/noc/courses/noc20/SEM1/noc20-ae03
MIT OCW	https://ocw.mit.edu/courses/civil-and-environmental-engineering/1-206j-airline-schedule-planning-spring-2003
TU Delft	https://ocw.mit.edu/courses/aeronautics-and-astronautics/16-75j-airline-management-spring-2006

COURSE ASSESSMENT METHOD

Continuous Internal Evaluation (CIE)

Three internals tests (each 30 marks) are conducted, average of best two performances will be considered.

1. Minimum two Assignments/Model making - evaluated through rubrics for 10 marks. Average of two will be considered.

2. Tutorial classes and assessment are carried out/Surprise quiz tests are conducted and evaluated for 10 marks. Average of these two will be considered.

Semester End Examination (SEE)

1. Two Questions are to be set from each unit, carrying 20 Marks each.

2. Students have to answer 5 questions selecting one full question from each unit

Program Outcomes – Articulation matrix:

PO	1	2	3	4	5	6	7	8	9	10	11	12	PSO1	PSO2
CO1	3								3	3				
CO2	3								3	3			2	
CO3	3								3	3			3	
CO4	3								3	3			2	

INTRODUCTION TO AEROSPACE ENGINES				
Course Code	21AEE364		**Credits**	3
Hours/Week (L-T-P)	3		**CIE Marks**	50
Total Hrs	39		**SEE Marks**	50
Exam Hrs	3		**Course Type**	Program Elective

COURSE OUTCOMES

Course outcomes: After completion of the course, students will be able to-

1. Understand the basics of jet propulsion
2. Explain the need of inlet duct and nozzle in jet engines
3. Explain the need of turbine jet in aircraft engines
4. Describe the working principle of rocket engines

TEACHING METHODOLOGY

- Blackboard teaching/PowerPoint presentation (if needed)
- Video and animation

COURSE CONTENTS

UNIT-1 - (08 HOURS)

Basic theory of jet propulsion:
Introduction, Principle of operation of propulsive engine, Equation of thrust, Comparison between gas turbine engine and reciprocating engine, Relation between pressure, velocity and thrust in a jet engine, Classification of propulsive engine and Types of air breathing engine, ideal and real gas turbine cycle, Turbo prop, turbo fan, turbo shaft, turbojet, ramjet, scramjet , pulse jet, Advantages, Disadvantages & Application of different types of Air breathing engines.

UNIT-2 - (08 HOURS)

Inlet ducts, compressors:
Inlet Ducts: Inlet duct-purpose, Function of inlet-duct, Types of inlet –duct, Ram effect and efficiency, Effects on pressure, velocity and temperature of airflow, Compressors
Compressor-purpose, Constructional features,Materials of Construction, principles of operation of axial flow compressor and centrifugal flow compressor, Functions of impellers, diffuser, and rotor blades. Stator blade, inlet guide vane, Advantages and disadvantages of centrifugal and axial flow compressor, Compressor choking, stalling and surging..

UNIT-3 - (08 HOURS)

Turbine, jet nozzle :
Turbines:: Turbine and its action, constructional details of turbine. Materials of construction, general arrangement of turbo-prop and turbo-shaft engines, Type of turbines and their functions, Turbine disc, nozzle, guide vane, Principle and operation of- impulse, reaction turbines, Brief description of turbine blade to disc attachment, Blade creep, **Jet Nozzle:** Jet exhaust- purpose, 1-D flow basics, Simple flows; Nozzle flow, nozzle design, nozzle operating characteristics for isentropic flow, nozzle flow and shock waves. Nozzle characteristics of some operational Engines. Rayleigh flow and Fanno flow.

UNIT-4 - (08 HOURS)

Chemical Rockets: Conservation of momentum, generation of thrust, Rocket performance parameters,The rocket equationApplication and Classification of Solid Propellant Rocket Motors; Propellants and Characteristics;Propellant Burning Rate;Combustion fundamentals,Propellant Grains and Grain Configurations, Grain Design.

UNIT-5 - (07 HOURS)

Liquid Propellant and their Properties; Liquid Propellant Feed Systems; Injectors; Thrust Chamber Shapes and Characteristic Length, Design of liquid rocket; Hybrid Propellant Rocket Motors; Gaseous Propellant Rocket Motors and Reaction Control Systems, Design of Hybrid Rocket.

TEXT BOOKS

Sl. No.	Title of the Book	Name of the Author	Name of the Publishers	Edition and Year
1	Rocket Propulsion Elements,	Sutton, G.P., Biblarz, O.,	7thEd. John Wiley & Sons, Inc., New York,	1st Edition, 2001.
2	Rocket Propulsion, Barrere, M., Jaumotte	A., Fraeijs de Veubeke, B.,Vandenkerckhove J.,	Elsevier Publishing Company,	1st Edition, 1960.

REFERENCE BOOKS

Sl. No.	Title of the Book	Name of the Author	Name of the Publishers	Edition and Year
1	Rocket and Spacecraft Propulsion: Principle, Practice and New Developments,	Turner, M. J. L.,	Springer Verlag.	2nd Edition, 2000.

ONLINE RESOURCES	Link
NPTEL	https://nptel.ac.in/courses/121106014/
NPTEL	https://nptel.ac.in/noc/courses/noc19/SEM2/noc19-ge22
NPTEL	https://swayam.gov.in/nd1_noc20_ge16/preview
MIT OCW	https://ocw.mit.edu/courses/earth-atmospheric-and-planetary-sciences/12-085-seminar-in-environmental-science-spring-2008

COURSE ASSESSMENT METHOD

Continuous Internal Evaluation (CIE)

1. Three internal assessments for 30 Marks each.
2. Two Learning Activities for10 Marks each.

Semester End Examination (SEE)														
3. Semester end examination for 100 Marks														
Program Outcomes – Articulation matrix:														
PO	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**PSO1**	**PSO2**
CO1	2	2	1						1	1				**3**
CO2	2	2	1						1	1				**3**
CO3	2	2	1						1	1				**3**
CO4	2	2	1						1	1				**3**

EXPERIMENTAL TECHNIQUES AND DATA ANALYSIS				
Course Code	21AEE365		**Credits**	3
Hours/Week (L-T-P)	3-0-0		**CIE Marks**	50
Total Hrs	39		**SEE Marks**	50
Exam Hrs	03		**Course Type**	Program Elective

COURSE OUTCOMES

Course outcomes: After completion of the course, students will be able to-

1. Apply temperature measurement concepts
2. Use metallurgical techniques for research
3. Use statistical techniques for research and thesis work

●Blackboard teaching/PowerPoint presentation (if needed) /Flipped Classes for specified topics
●Regular review of students by asking questions based on topics covered in the class

COURSE CONTENTS

UNIT-1 - (08 HOURS)

Measurement of Cutting Forces: Strain gauge and piezoelectric transducers and their characteristics. Dynamometer construction, Bridge circuits. Instrumentation and calibration. Displacement and strain measurements by photo elasticity. Holography, interferometer, Moir techniques, strain gauge rosettes

UNIT-2 - (08 HOURS)

Temperature Measurement: Circuits and instrumentation for different transducers viz, bimetallic, expanding fluid, electrical resistance, thermister, thermocouples, pyrometers. Flow Measurement: Transducers for flow measurements of Non-compressible and compressible fluids. Obstruction and drag methods. Vortex shredding flow meters. Ultrasonic, Laser Dopler and Hotwire anemometer. Flow visualization techniques, Shadow graphs, Schlieren photography. Interferometer.

UNIT-3 - (08 HOURS)

Metallurgical Studies: Optical and electron microscopy, X-Ray diffraction, Bragg's Law and its application for studying crystal structure and residual stresses. Electron spectroscopy, electron microprobe. Surface Measurements: Micro hardness, roughness, accuracy of dimensions and forms. 3-D co-ordinate measuring machines

UNIT-4 - (08 HOURS)

Experiment design & data analysis: Statistical methods, Randomized block design, Latin and orthogonal squares, factorial design. Replication and randomization. Data Analysis: Deterministic and random data, uncertainty analysis, tests for significance: Chi-square, student's't' test. Regression modeling, direct and interaction effects. ANOVA, F-test. Time Series analysis, Autocorrelation and autoregressive modeling

UNIT-5 - (07 HOURS)

Taguchi Methods: Experiment design and planning with Orthogonal arrays and linear graphs. Additive cause effect model. Optimization of response level. Identification of Design and noise factors. Performance evaluation and Optimization by signal to noise ratios. Concept of loss function and its application

TEXT BOOKS

Sl. No.	Title of the Book	Name of the Author	Name of the Publishers	Edition and Year
1	Experimental Methods for Engineers	Holman, J.P	McGraw Hill Int., New York.	1st
2	Experimental Methods in Metal Cutting	Venkatesh, V.C., and Chandrasekharan,	Prentice Hall of India, Delhi.	1st
3	The Design and Analysis of Industrial Experiments	Davis, O.V.		1st

REFERENCE BOOKS

Sl. No.	Title of the Book	Name of the Author	Name of the Publishers	Edition and Year
1	Time Series analysis, Forecasting and control,	Box and Jenkins;	Holden Day, Sanfrancisco.	1st
2	Experimental stress analysis and motion measurement,	Dove and Adams,	Prentice Hall of India, Delhi.	1st
3	Taguchi Methods Explained,	Tapan P. Bagchi,	Prentice Hall of India, Delhi.	1st

ONLINE RESOURCES	Link
NPTEL	https://onlinecourses.nptel.ac.in/noc21_mg48/preview

COURSE ASSESSMENT METHOD

Continuous Internal Evaluation (CIE)

1. Three internal assessments for 30 Marks each.
2. Two Learning Activities for10 Marks each.

Semester End Examination (SEE)

3. Semester end examination for 100 Marks

Program Outcomes – Articulation matrix:

PO	1	2	3	4	5	6	7	8	9	10	11	12	PSO1	PSO2
CO1	3	3			3				3	3			1	1
CO2	3	3			3				3	3			1	1
CO3	3	3			3				3	3			1	1
CO4	3	3			3				3	3			1	1

SEMESTER- IV

ENGINEERING MATHEMATICS -IV				
Course Code	21MAT41		**Credits**	4
Hours/Week (L-T-P)	2-2-0		**CIE Marks**	50
Total Hrs	50		**SEE Marks**	50
Exam Hrs	3		**Course Type**	Core

COURSE OUTCOMES

Course outcomes: After completion of the course, students will be able to-

1. Concepts of random variables, probability distributions and sampling can be applied to problem solving.
2. Probability distributions can be used for testing of hypothesis of testing and model situations arising in analysis of data
3. Different techniques of testing hypothesis and random variables can be applied to model engineering problems
4. Concepts of correlation and regression can be applied to analyse and predict data.
5. Concepts of linear algebra can be applied to different physical situations.

TEACHING METHODOLOGY

●Blackboard teaching/PowerPoint presentation (if needed) /Flipped Classes for specified topics
●Regular review of students by asking questions based on topics covered in the class

COURSE CONTENTS

UNIT-1 - (10 HOURS)

Probability and Random Variables
Probability: Definition, sum and product Rule, Conditional Probability. Random variable -: Probability distribution- discrete and continuous, probability density function, cumulative density function, mean and variance, expectation. Joint distribution - discrete and continuous, marginal distribution, expectation, covariance.
Self-Study: Baye's Theorem- proof and problems

UNIT-2 - (10 HOURS)

Probability Distributions and Sampling
Probability Distribution: Binomial, Poisson, Normal distribution, exponential distribution, uniform distribution. Theory of Sampling: Population and sample, sampling with and without replacement, sampling distribution of means and variance, confidence intervals for mean.
Self-Study: Weibull and Gamma distribution

UNIT-3 - (10 HOURS)

Testing Hypothesis
One tailed and two tailed test, testing of large samples, significance level, testing small samples using t – test, χ^2 test for goodness of fit, F-test and Analysis of variance for one factor experiments.
Self-Study: Test of significance for difference of means

UNIT-4 - (10 HOURS)

Correlation and Regression
Correlation, Karl Pearson's coefficient of correlation, Rank correlation, Spearman's rank correlation coefficient, Regression lines, multiple regressions. Mathematical models for time series: Graphical curve fitting, least square curve fitting,
Self-Study: Angle between regression lines, relation between correlation coefficient and lines of regression.

UNIT-5 - (10 HOURS)

Linear Algebra
Vector spaces- Introduction, subspaces, Linear combinations, linear dependence, basis and dimension, linear Transformation, matrix representation of linear transformation, Eigen values and Eigen space, Eigen values by Rutishauser method, inner products, orthogonal vectors, Gram Schmidt Orthogonalization process
Self- Study: Characteristic and minimal polynomial, Block matrices

TEXT BOOKS

Sl. No.	Title of the Book	Name of the author/s	Name of the publisher	Edition and year
1	Fundamentals of Statistics	S C Gupta	Himalaya Pub.,	6th edition 2007
2	Probability and Statistics,	M R Spiegel, JJ Schiller, R A Srinivasan,	McGrawHill,	3th edition, 2019
3	Linear Algebra,	SeymoreLipschutz and Marc Lipson,	Tata McGrawhill,	3rd Edition,2005
4	Advanced Engg. Mathematics,	ErwynKreyzig,	Wiley	9th edition, 2011

REFERENCE BOOKS

Sl. No.	Title of the Book	Name of the author/s	Name of the publisher	Edition and year
1	Probability and statistics for Science and Engg.	G Shanker Rao,	Univ Press,	2011

ONLINE RESOURCES	Link
NPTEL	https://nptel.ac.in/courses/111/104/111104030/
NPTEL	https://nptel.ac.in/courses/111/104/111104025/
NPTEL	https://nptel.ac.in/courses/111/104/111104073/
MIT OCW	https://ocw.mit.edu/educator/
TU Delft	https://online-learning.tudelft.nl/courses/pre-university-calculus/

- Surprise test / Tutorials tests to be conducted for each topic for 10marks.
- Quiz/ assignment based on practical application for10 marks.
- Three mid semester examinations will be conducted each for 30 marks

COURSE ASSESSMENT METHOD

Continuous Internal Evaluation (CIE)

Three internal assessments for 30 Marks each.

Two Learning Activities for10 Marks each.

Semester End Examination (SEE)

Semester end examination for 100 Marks

Program Outcomes – Articulation matrix:

PO	1	2	3	4	5	6	7	8	9	10	11	12	PSO1	PSO2
CO1	2	2		1										
CO2	2	2		1										
CO3	2	2		2	1									
CO4	2	2		2	1									
CO5	2	2		1	1									

FUNDAMENTALS OF AERO-PROPULSION

Course Code	21AE42		**Credits**	3
Hours/Week (L-T-P)	3-0-0		**CIE Marks**	50
Total Hrs	39		**SEE Marks**	50
Exam Hrs	3		**Course Type**	Core

COURSE OUTCOMES

Course outcomes: After completion of the course, students will be able to-
1. Review the basic thermodynamic principles and illustrate the working principles of gas turbine engines
2. Outline the importance of subsonic, supersonic inlets, combustion chamber and nozzles for jet engines
3. Evaluate the operating characteristics of compressors and turbines in terms of blade shapes, angles, and direction of rotation
4. Describe the fundamentals of ramjet and rocket propulsion.

TEACHING METHODOLOGY

●Blackboard teaching/PowerPoint presentation (if needed) /Flipped Classes for specified topics
●Regular review of students by asking questions based on topics covered in the class

COURSE CONTENTS

UNIT-1 - (08 HOURS)

Introduction: Review of thermodynamic principles, Review of thermodynamics of ideal gases, enthalpy, isentropic flow, atmospheric models,Introduction to gasdynamics- I stagnation enthalpy, stagnation temperature, stagnation pressure Introduction to gasdynamics-II shock waves.
Fundamentals of Gas Turbine Engines: Illustration of working of gas turbine engine – The thrust equation – Factors affecting thrust – Effect of pressure, velocity and temperature changes of air entering compressor – After burner arrangements for thrust augmentation.– Performance parameters of aircraft engines,Ramjets, scramjets, Turbojets, turbofans,Turboprops, modern trends in aircraft design.

UNIT-2 - (08 HOURS)

Parametric Cycle Analysis of Ideal Engines : Engine cycle analysis and basic assumptions. Applications to (i) Ramjet, (ii) Turbojet with and without after burner, (iii) Turbo fan Engine, optimum by pass ratio (iv) Turbo-Prop Engine Cycle analysis of real engines.
Inlets, Nozzles and Combustion Chambers for Jet Engine: Internal flow and Stall in subsonic inlets – relation between minimum area ratio and eternal deceleration ratio – diffuser performance – supersonic inlets – starting problem on supersonic inlets – shock swallowing by area variation – . real flow in nozzles and nozzle efficiency – losses in nozzles – equilibrium flow and frozen flow in nozzles- two phase flow in nozzles – ejector and variable area nozzles - interaction of nozzle flow with adjacent surfaces – thrust reversal- classification of combustion chambers – combustion chamber performance – effect of operating variables on performance – flame stabilization

UNIT-3 - (08 HOURS)

Compressors: Principle of operation of centrifugal compressor – Work done and pressure rise – Velocity diagrams – Diffuser vane design considerations – Concept of pre-whirl– Rotation stall – Elementary theory of axial flow compressor – Velocity triangles– degree of reaction – Three dimensional – Air angle distributions for free vortex and constant reaction designs – Compressor blade design – Centrifugal and Axial compressor performance characteristics.

UNIT-4 - (08 HOURS)

Introduction to Turbines: Types of turbines-Principle of operation of axial flow turbines– limitations of radial flow turbines- Work done and pressure rise – Velocity diagrams – degree of reaction – constant nozzle angle designs – performance parameters of axial flow turbine– turbine blade cooling methods – stage efficiency calculations – basic blade profile design considerations – matching of compressor and turbine.

UNIT-5 - (07 HOURS)

Ramjet Propulsion: Operating principle – Sub critical, critical and supercritical operation –Combustion in ramjet engine – Ramjet performance – Sample ramjet design calculations – Introduction to scramjet – Preliminary concepts in supersonic combustion – Integral ram- rocket
Fundamentals of Rocket Propulsion: Thrust equation and specific impulse, vehicle acceleration, drag, gravity losses, multi-staging of rockets. Classification of chemical rockets, performance of solid and liquid propellant rockets.

TEXT BOOKS

Sl. No.	Title of the Book	Name of the Author	Name of the Publisher	Edition and Year
1	Gas Turbine	V. Ganesan	", Tata McGraw Hill Pub. Co. Ltd.	1996
2	Mechanics & Thermodynamics of Propulsion	Hill, P.G. & Peterson, C.R	Addison – Wesley Longman INC	1999

REFERENCE BOOKS

Sl. No.	Title of the Book	Name of the Author	Name of the Publisher	Edition and Year
1	Gas Turbine Theory	Cohen, H. Rogers, G.F.C. and Saravanamuttoo, H.I.H	Longman	1989
2	Aero thermodynamics of Aircraft Engine Components	Oates, G.C	AIAA Education Series, NewYork	1985
3	Jet Engine	Rolls Royce	Wiley	3rd Edition – 1983.
4	Gas Turbine, Jet and Rocket Propulsion	Mathur, M.L. and Sharma, R.P.,	Standard Publishers & Distributors, Delhi	1999
5	Rocket Propulsion Elements	Sutton, G.P	John Wiley & Sons Inc., New York	5th Edition. 1993

ONLINE RESOURCES	Link

NPTEL	https://nptel.ac.in/courses/101/101/101101002/
NPTEL	https://nptel.ac.in/courses/112/103/112103281/
MIT OCW	https://ocw.mit.edu/courses/aeronautics-and-astronautics/16-50-introduction-to-propulsion-systems-spring-2012/
TU Delft	https://www.tudelft.nl/en/ae/organisation/departments/aerodynamics-wind-energy-flight-performance-and-propulsion/flight-performance-and-propulsion/

COURSE ASSESSMENT METHOD

Continuous Internal Evaluation (CIE)

Three internals tests (each 30 marks) are conducted, average of best two performances will be considered.

1. Minimum two Assignments/Model making - evaluated through rubrics for 10 marks. Average of two will be considered.
2. Tutorial classes and assessment are carried out/Surprise quiz tests are conducted and evaluated for 10 marks. Average of these two will be considered.

Semester End Examination (SEE)

1. Two Questions are to be set from each unit, carrying 20 Marks each.
2. Students have to answer 5 questions selecting one full question from each unit

Program Outcomes – Articulation matrix

PO	1	2	3	4	5	6	7	8	9	10	11	12	PSO-1	PSO-2
CO1	3	2												3
CO2	3	2												3
CO3	3	2												3
CO4	3	2												3

AIRCRAFT MATERIALS & MANUFACTURING				
Course Code	21AE43		**Credits**	3
Hours/Week (L-T-P)	3-0-0		**CIE Marks**	50
Total Hrs	39		**SEE Marks**	50
Exam Hrs	03		**Course Type**	Core

COURSE OUTCOMES

Course outcomes: After completion of the course, students will be able to-

1. Describe the basics of manufacturing processes, patterns, properties of moulding sands, gating and risers.
2. Explain the process of moulding, cores, special moulding processes and melting furnaces.
3. Explain the importance of various materials for aircraft structures and engines.
4. Describe the importance of Metal Alloys, Super alloys and heat treatment process, Polymers, Polymeric Materials, Plastics, Ceramics, Glass and composite materials in aerospace applications.
5. Identify the applications of High Energy Materials for rockets and missiles

TEACHING METHODOLOGY

●Blackboard teaching/PowerPoint presentation (if needed) /Flipped Classes for specified topics

COURSE CONTENTS

UNIT-1 (08 HOURS)

Aircraft Engineering Materials

Engineering materials Steels, Solid solutions, Binary phase diagrams, study of iron, iron carbon phase diagram, heat treatment, annealing, normalizing, hardening and tempering of Aluminum and steel, Non-Ferrous metals and Alloys: Structure and properties of copper and its alloys, Aluminum and its alloys, Titanium and its alloys.

UNIT-2 (08 HOURS)

Casting, Welding and Inspection Techniques

General principles of various casting processes Sand casting, die-casting, centrifugal casting, investment casting, Shell molding types; Principles and equipment used in arc welding, gas welding, resistance welding, solid, laser welding, and electron beam welding, soldering and brazing techniques. Need for NDT, ultrasonic testing, Radiographic testing, Flight-testing.

UNIT-3 - (08 HOURS)

Sheet Metal Processes in Aircraft Industry

Sheet metal operations: shearing, punching, super plastic forming; operations in bending like stretch forming spinning drawing. Riveting, types and techniques, equipment, fasteners, integral tanks, Jigs and Fixtures,

UNIT-4 - (07 HOURS)

Conventional and Modern Manufacturing Processes

General working principles, applications and operations of lathe, shaper, milling machines, grinding, drilling machine, computer numeric control machining. Working principles and applications of abrasive jet machining, ultrasonic machining, Electric discharge machining and electro chemical machining, laser beam, electron beam, plasma arc machining. Rapid prototyping, Additive manufacturing process.

UNIT-5 (08 HOURS)

Aircraft Composites

Introduction, Physical metallurgy, Wrought aluminum alloys, Cast aluminum alloys, Production of semi-fabricated forms, Aerospace applications, Plastics and rubber, Introduction to fiber reinforced plastics, glass and carbon composites; Fibers and resins; Characteristics and applications, Classification of aircraft materials; Materials used for aircraft components, Application of composite materials, Super alloys, emerging trends in aerospace materials.

TEXT BOOKS

Sl. No.	Title of the Book	Name of the author/s	Name of the publisher	Edition and year
1	Manufacturing Engineering and Technology	S. Kalpakjian, Steven R. Schmid	Addison Wesley	5th Edition, 1991.
2	Aircraft production technology and management	` S. C. Keshu, K. K Ganapathy	Interline Publishing House, Bangalore	3rd Edition, 1993
3	Aircraft production technology	Douglas F. Horne	Cambridge University Press	1st Edition,1986.

REFERENCE BOOKS

Sl. No.	Title of the Book	Name of the author/s	Name of the publisher	Edition and year
1	Production technology	R. K. Jain	Mc Graw Hill	1st Edition, 2002.
2	Production technology	O. P. Khanna, M. Lal `	Dhanpat Rai Publications	5th Edition, 1997

ONLINE RESOURCES	Link
NPTEL	https://nptel.ac.in/courses/101/104/101104069/
NPTEL	https://nptel.ac.in/courses/112/106/112106293/
NPTEL	https://nptel.ac.in/courses/108/102/108102175/
MIT OCW	https://ocw.mit.edu/courses/new-courses/#anthropology

Program Outcomes – Articulation matrix:

PO	1	2	3	4	5	6	7	8	9	10	11	12	PSO1	PSO2
CO1	3								2	2			2	

CO2	3								2	2			2	
CO3	2								2	2			2	
CO4	3								2	2			2	
CO5	3								2	2			2	

ADVANCED AEROSTRUCTURE				
Course Code	21AE44		**Credits**	4
Hours/Week (L-T-P)	3-0-0		**CIE Marks**	50
Total Hrs	48		**SEE Marks**	50
Exam Hrs	3		**Course Type**	Core

COURSE OUTCOMES

Course outcomes: After completion of the course, students will be able to-

1. Analyze aircraft structural design and bending in unsymmetrical sections
2. Analyze the shear flow in open and closed sections
3. Compute the buckling of plates, joints and fittings.
4. Formulate stress in wings fuselage and structure of aircraft.

TEACHING METHODOLOGY

- Blackboard teaching/PowerPoint presentation (if needed) /Flipped Classes for specified topics
- Regular review of students by asking questions based on topics covered in the class

COURSE CONTENTS

UNIT-1 - (10 HOURS)

Introduction to Aircraft Structural Design: conceptual design – Detailed design – Airworthiness- certification. Design criteria – Safety Factor – Design life criteria – Analysis method – Life Assessment procedures – Design Principle.
Unsymmetrical Bending: Bending stresses in beams of unsymmetrical sections – Bending of symmetric sections with skew loads

UNIT-2 (10 HOURS)

Shear Flow in Open Sections: Thin walled beams, Concept of shear flow, shear centre, Elastic axis. With one axis of symmetry, with wall effective and ineffective in bending, unsymmetrical beam sections.

UNIT-3 (10 HOURS)

Shear Flow in Closed Sections: Bredt – Batho formula, Single and multi – cell structures, approximate methods and Shear flow in single &multicell structures under torsion. Shear flow in single and multi-cell under bending with walls effective and ineffective.

UNIT-4 - (10 HOURS)

Buckling of Plates: Rectangular sheets under compression, Local buckling stress of thin walled sections, Crippling stresses by Needham's and Gerard's methods, Thin walled column strength. Sheet – stiffener panels. Effective width, inter rivet and sheet wrinkling failures.
Introduction to Post Buckling, Joints and Fittings: Introduction to Post Buckling: post buckling of structures, concepts of effective width - General theory for the design of fittings, Estimation of fitting design loads, design of riveted, bolted and welding joints, post buckling of structures, and concept of effective width.

UNIT-5 - (08 HOURS)

Stress Analysis in Wing and Fuselage: Procedure – Shear and bending moment distribution for semi cantilever and other types of wings and fuselage, thin webbed beam. With parallel and non-parallel flanges, Shear resistant web beams, Tension field web beams (Wagner's).

TEXT BOOKS

Sl. No.	Title of the Book	Name of the Author	Name of the Publisher	Edition and Year
1	Aircraft Structures for Engineering Students	Megson, T.M.G	Edward Arnold	1995
2	Aircraft Structures	Peery, D.J., and Azar, J.J	McGraw– Hill, N.Y.	2nd edition, 1993

REFERENCE BOOKS

Sl. No.	Title of the Book	Name of the Author	Name of the Publisher	Edition and Year
1	Analysis and Design of Flight vehicles Structures	Bruhn. E.H	ate off set company, USA,	1985
2	Theory and Analysis of Flight Structures	Rivello, R.M	McGraw- Hill	1993
3	An Introduction to the Theory of Aircraft Structures	D Williams &Edward Arnold	Edward Arnold	1st Edition, 1960

ONLINE RESOURCES	Link
NPTEL	https://nptel.ac.in/courses/101/105/101105022/
NPTEL	https://swayam.gov.in/nd1_noc20_ae08/preview
TU Delft	https://ocw.tudelft.nl/course-readings/3-1-1-introduction-to-aircraft-structures/

COURSE ASSESSMENT METHOD

Continuous Internal Evaluation (CIE)

Three internals tests (each 30 marks) are conducted, average of best two performances will be considered.

1. Minimum two Assignments/Model making - evaluated through rubrics for 10 marks. Average of two will be considered.
2. Tutorial classes and assessment are carried out/Surprise quiz tests are conducted and evaluated for 10 marks. Average of these two will be considered.

Semester End Examination (SEE)

1. Two Questions are to be set from each unit, carrying 20 Marks each.
2. Students have to answer 5 questions selecting one full question from each unit

Program Outcomes – Articulation matrix														
PO	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**PSO-1**	**PSO-2**
CO1	**3**	**3**							**3**	**3**			**3**	
CO2	**3**	**3**							**3**	**3**			**3**	
CO3	**3**	**3**							**3**	**3**			**3**	
CO4	**3**	**3**							**3**	**3**			**3**	

AERODYNAMICS -I				
Course Code	21AE45		**Credits**	4
Hours/Week (L-T-P)	3-0-2		**CIE Marks**	50
Total Hrs	50		**SEE Marks**	50
Exam Hrs	3		**Course Type**	Core

COURSE OUTCOMES

Course outcomes: After completion of the course, students will be able to-

1. Review basic fluid mechanics and description of fluid motion
2. Discuss airfoil characteristics
3. Analyze the pressure distribution for incompressible inviscid flow over the airfoil\
4. Discuss the flow over circular cylinders, airfoils
5. Discuss to carry out the Aerodynamic Testing

TEACHING METHODOLOGY

●Blackboard teaching/PowerPoint presentation (if needed) /Flipped Classes for specified topics
●Regular review of students by asking questions based on topics covered in the class

COURSE CONTENTS

UNIT-1 - (10 HOURS)

Review of Basic Fluid Mechanics: Continuity, momentum and energy equation, units and dimensions, Types of flow, compressibility, and Mach number regimes.
Description of Fluid Motion: Euler and Lagrangian descriptions, Control volume approach to continuity and momentum equations, Path lines, Streamlines and Streak lines, Angular velocity, Vorticity, Circulation, Stream function, Velocity potential and Relationship between them.

UNIT-2 - (10 HOURS)

Airfoil Characteristics: Airfoil section geometry and wing plan form geometry, Fundamental aerodynamic variables, Aerodynamic forces and moments and pressure coefficient. Centre of pressure, calculation of airfoil lift and drag from measured surface pressure distributions, typical airfoil aerodynamic characteristics at low speeds

UNIT-3 - (10 HOURS)

Two-Dimensional Inviscid Incompressible Flows: Bernoulli's equation, Pitot-tube measurement of airspeed, condition on velocity for incompressible flow. Governing equations for Irrotational, incompressible flow: Laplace equation and boundary conditions. Two-dimensional source, sink and doublet flows and vortex flow and combinations of elementary flows.

UNIT-4 - (10 HOURS)

Flow Over Circular Cylinders: Non-lifting flow over a two-dimensional circular cylinder, Lifting flow over a two-dimensional circular cylinder, Kutta-Joukowski theorem and generation of lift, D'Alembert's paradox. Incompressible Flow Over Airfoils: Kelvin's circulation theorem and the starting vortex, vortex sheet, Kutta condition, Classical thin airfoil theory for symmetric and cambered airfoils

UNIT-5 - (08 HOURS)

Introduction to Aerodynamic Testing: Principles of wind tunnel flow simulation, open and closed circuit wind tunnels, and Major features of low speed, transonic and supersonic wind tunnels, smoke and tuft flow visualization techniques, Pressure and Aerodynamic load measurements on a model, total drag determination of two-dimensional bodies using wake survey at low speeds

TEXT BOOKS

Sl. No.	Title of the Book	Name of the author/s	Name of the publisher	Edition and year
1	Fundamentals of Aerodynamics	Anderson, Jr. J.D. Tata McGraw	Hill Publishing Co. Ltd., New Delhi	2007. (Special Indian Edition).
2	Aerodynamics for Engineering Students	` Houghton E.L and Carpenter P.W	CBS Publications and Distributors	1993. (4th Edition)

REFERENCE BOOKS

Sl. No.	Title of the Book	Name of the author/s	Name of the publisher	Edition and year
1	Introduction to Flight	Anderson, Jr. J.D	Tata McGraw-Hill Publishing Co. Ltd., New Delhi	2007. (Special Indian Edition)
2	Boundary Layer Theory	`Schlichting,,	Mc Graw Hill NewYork	2004
3	Low Speed Wind Tunnel testing	Pope A. and Harper, J J	John Wiley & Sons Inc	3rd Edition, 1966
4	High Speed Wind Tunnel Testing	Pope A. and Goin, KL	John Wiley & Sons Inc	99th edition 1965

AERODYNAMICS LABORATORY

List of Experiments

1. Calibration of a subsonic wind tunnel
2. Smoke flow visualization studies
   i. On a two-dimensional circular cylinder at low speeds.
   ii. On a two dimensional airfoil at different angles of incidence at low speeds.

3. Tuft flow visualization on a wing model at different angles of incidence at low speeds.
4. Surface pressure distributions and calculation of aerodynamic coefficients.
    i. On a two-dimensional circular cylinder at low speeds
    ii. On a two-dimensional symmetric airfoil at different angles of incidence.
    iii. On a two-dimensional cambered airfoil at different angles of incidence.
5. Measurement of a typical boundary layer velocity profile on the tunnel wall
6. Measurement of Aerodynamic Loads and Moment using three-component balance.
    i. Over a rectangular wing with symmetrical airfoil
    ii. Over a rectangular wing with cambered airfoil
7. Calculation of total drag using Pitot-static probe wake survey
    i. Of a two-dimensional circular cylinder at low speeds.
    ii. Of total drag of a two-dimensional airfoil at low speeds.

ONLINE RESOURCES	Link
NPTEL	https://nptel.ac.in/courses/101/105/101105059/
NPTEL	https://nptel.ac.in/courses/101/103/101103003/
NPTEL	https://nptel.ac.in/courses/101/101/101101058/
MIT OCW	https://ocw.mit.edu/courses/aeronautics-and-astronautics/16-100-aerodynamics-fall-2005/lecture-notes/
TU Delft	https://online-learning.tudelft.nl/courses/introduction-aeronautical-engineering/

COURSE ASSESSMENT METHOD

Continuous Internal Evaluation (CIE)

Three internals tests (each 30 marks) are conducted, average of best two performances will be considered.

1. Minimum two Assignments/Model making - evaluated through rubrics for 10 marks. Average of two will be considered.

2. Tutorial classes and assessment are carried out/Surprise quiz tests are conducted and evaluated for 10 marks. Average of these two will be considered.

Semester End Examination (SEE)

1. Two Questions are to be set from each unit, carrying 20 Marks each.
2. Students have to answer 5 questions selecting one full question from each unit

Program Outcomes – Articulation matrix:

PO	1	2	3	4	5	6	7	8	9	10	11	12	PSO1	PSO2
CO1	3								3	3				3
CO2	3	3	3						3	3				3
CO3	3	2	3						3	2				2
CO4	3	3	3						3	3				3
CO5	3	3	3						3	3				3

AERO STRUCTURAL DESIGN LAB				
Course Code	21AEL47		**Credits**	1
Hours/Week (L-T-P)	0-0-2		**CIE Marks**	50
Total Hrs	13		**SEE Marks**	50
Exam Hrs	03		**Course Type**	Core

COURSE OUTCOMES

List of experiments

1.Study of structural components of Aircraft
2. Deflection of beams with various end conditions.
3.Verification of Maxwell's Reciprocal theorem & principle of superposition
4.Column – Testing
5.South – well's plot
6.Calibration of Photo Elastic Materials
7.Determination of stresses using photo elastic materials
8.Creep testing of Materials
9. Measurement of stresses in thin walled vessels.
10. Fatigue Testing of materials.
11.Vibration of beams

Course Assessment Method:
Record: 30 marks
Test: 15 marks
Viva-voce: 05 marks
SEE - Final Exam: 50 Marks
Scheme of Examination: Student will be asked to conduct two experiment

PROGRAM ELECTIVE-B

AIRWORTHINESS AND CERTIFICATION				
Course Code	21AEE461		**Credits**	3
Hours/Week (L-T-P)	3-0-0		**CIE Marks**	50
Total Hrs	39		**SEE Marks**	50
Exam Hrs	03		**Course Type**	Program Elective

COURSE OUTCOMES

Course outcomes: After completion of the course, students will be able to-

1.Explain the Airworthiness requirements for different categories of aircrafts
2.Discuss the various certifications, technical log book
3.Explain the procedure for development, test flight and certification
4. Explain the procedure for training and their licenses, inspection, and approved materials.
5.Discuss the accident investigation procedures

TEACHING METHODOLOGY

●Blackboard teaching/PowerPoint presentation (if needed) /Flipped Classes for specified topics

COURSE CONTENTS

UNIT-1 (08 HOURS)

Introduction to aircraft rules as far as they relate to airworthiness and safety of aircraft. Airworthiness requirements for civil and military aircraft CAR, FAR, EASA and ICAO, regulations, Defense standards. Military standards and specifications

UNIT-2 (08 HOURS)

Privileges and responsibilities of various categories of AME license and approved persons. Knowledge of mandatory documents like certificate of Registration, certificate of Airworthiness - conditions of issue and validity. Export certificate of Airworthiness. Knowledge of Log Book, Journey Log Book, Technical Log Book, etc.

UNIT-3 (08 HOURS)

Procedure for development and test flights and certification. Certificate of Flight release, Certificate of Maintenance, Approved Certificates
Technical Publications, Aircraft Manual, Flight Manual, Aircraft Schedules. Registration, Procedure, Certification, Identification and Marking of Aircraft.

UNIT-4 (07 HOURS)

Modifications, concessions, airworthiness directives, service bulletins. Crew training and their licenses, approved inspection, and approved materials, identification of approved materials. Bonded and quarantine stores. Storage of various aeronautical products like rubber goods, various fluids.

UNIT-5 - (08 HOURS)

Accident investigation procedures. Circumstances under which C of A is suspended. ICAO and IATA regulations, Chicago and Warsaw conventions. Familiarization of recent issues of Advisory Circulars. Civil Aviation Requirements Section 2 - Airworthiness.

TEXT BOOKS

1. The Indian Aircraft Act and the Rules
2. Manual of Civil Aviation
3. DEF STANDARD 970
4. Gran E L, Statistical Quality Control, McGraw Hill
5. Civil Airworthiness Requirements

REFERENCE BOOKS

1. Aeronautical Information Circulars (relating to Airworthiness)
2. Advisory Circulars - DGCA
3. Civil Aircraft Airworthiness Information and Procedures (CAP 562)
4. Civil Aviation Requirements Section 2 - Airworthiness.

ONLINE RESOURCES	LINK
NPTEL	https://www.sciencedirect.com/topics/engineering/airworthiness-certification
NPTEL	https://www.iata.org/en/training/courses/aircraft-airworthiness/tcvt19/en/
NPTEL	https://ntrl.ntis.gov/NTRL/dashboard/searchResults/titleDetail/PB2000103115.xhtml
MIT OCW	https://ocw.mit.edu/courses/aeronautics-and-astronautics/16-400-human-factors-engineering-fall-2011
TU Delft	https://online-learning.tudelft.nl/courses/air-safety-investigation/

Program Outcomes – Articulation matrix:

PO	1	2	3	4	5	6	7	8	9	10	11	12	PSO1	PSO2
CO1	3								2	2				
CO2	3								2	2				
CO3	3								2	2				
CO4	3								2	2				
CO5	3								2	2				

MECHANISM AND MACHINE THEORY				
Course Code	21AEE462		**Credits**	3
Hours/Week (L-T-P)	3-0-0		**CIE Marks**	50
Total Hrs	39		**SEE Marks**	50
Exam Hrs	03		**Course Type**	Program Elective

COURSE OUTCOMES

Course outcomes: After completion of the course, students will be able to-

1. Identify various mechanisms and its degrees of freedom
2. Analyze gears, gear train to produce desired motion
3. Determine the suitability of flywheel, governor and gyroscope for industrial applications.
4. Design of cams and followers
5. Distinguish between static & dynamic balancing of rotating masses

TEACHING METHODOLOGY

●Blackboard teaching/PowerPoint presentation (if needed) /Flipped Classes for specified topics

COURSE CONTENTS

UNIT-1 (08 HOURS)

SIMPLE MECHANISMS

Introduction: Kinematic, link, pair, constraint motion- Definition and its classification, types of joints, kinematic chain, Grubbler's criteria, Mechanisms, machines and structures, degrees of freedom, simple problems.

Fundamentals of mechanisms: Inversions: Inversions of 4 bar chain, single slider and double slider crank chain. Pantograph, Geneva, Ratchet and Pawl mechanisms.

Straight line motion mechanisms: Peaucellier Mechanisms, Scotch Russell, Hart mechanism, watt mechanism Steering Gear mechanism: Davis and Ackermann steering gear mechanism

UNIT-2 (08 HOURS)

THEORY OF GEAR AND GEAR TRAINS

Gear: Introduction, types of gears, terminology of gears, Fundamental law of gearing, Gear tooth forms, Interference, determination of minimum number of teeth to avoid interference, simple problems.

Gear trains: Introduction, types of Gear trains, sun and planet gear trains, Epicyclic gear train, Torques in Gear train, simple problems.

UNIT-3 (08 HOURS)

GOVERNORS AND GYROSCOPE

Types of governors; force analysis of Watt, Proell, Porter and Hartnell governors. Controlling force, stability, sensitiveness, isochronism, effort and power. (Only definitions).

GYROSCOPE: Vectorial representation of angular motion, basic definitions, gyroscopic couple. Effect of gyroscopic couple on a plane disc, an aero plane and a naval ship.

UNIT-4 (07 HOURS)

CAMS: Introduction, types of cams and followers, Procedure for drawing cam profile. Follower motion: uniform velocity, uniform acceleration and deceleration, SHM and cycloid motions, problems to be solved using the above said types of motions.

UNIT-5 - (08 HOURS)

BALANCING OF ROTATING MASSES:

Static and dynamic balancing, Balancing of single rotating mass by balancing masses in same plane and in different planes. Balancing of several rotating masses by balancing masses in same plane and in different planes.

TEXT BOOKS

1. Theory of Machines, by J Rattan, McGraw Hill Publication.
2. Theory of Machines, by J K Gupta,, S Chand Pvt Ltd.
3. Theory of Machines, by Sadhu Singh, Pearson Education.

REFERENCE BOOKS

1. Theory of Machines by Thomas Bevan, CBS Publication 1984.
2. Mechanisms and Dynamics of Machinery by J. Srinivas, Scitech Publications, Chennai, 2002

ONLINE RESOURCES	LINK
NPTEL	https://archive.nptel.ac.in/courses/112/106/112106270/
NPTEL	https://nptel.ac.in/courses/112105268

Program Outcomes – Articulation matrix:

PO	1	2	3	4	5	6	7	8	9	10	11	12	PSO1	PSO2
CO1	3								2	2				
CO2	3								2	2				
CO3	3								2	2				
CO4	3								2	2				
CO5	3								2	2				

FLIGHT SCHEDULING AND OPERATIONS				
Course Code	21AEE463		**Credits**	3
Hours/Week (L-T-P)	3-0-0		**CIE Marks**	50
Total Hrs	39		**SEE Marks**	50

Exam Hrs	3		**Course Type**	Program Elective

COURSE OUTCOMES

Course outcomes: After completion of the course, students will be able to-

1. Discuss the Network Flows and Integer Programming Models
2. Understand the Aircraft Routing and Management of Irregular Operations
3. Explain the Significance of flight scheduling
4. Discuss the Fleet Assignment, Crew and Manpower Scheduling
5. Discuss the Gate Assignment and Aircraft Boarding Strategy

TEACHING METHODOLOGY

- Blackboard teaching/PowerPoint presentation (if needed)

COURSE CONTENTS

UNIT-1 - (08 HOURS)

Network Flows and Integer Programming Models: Complexity of airline planning, operations and dispatch- need for optimization-role of operations research and simulation. Networks- definitions, network flow models- shortest path problem, minimum cost flow problem, maximum flow problem, multi-commodity problem. mathematical formulation- decision variables, objective function, constraints, and methods of solution.

UNIT-2 - (08 HOURS)

Fleet Assignment, Crew and Manpower Scheduling: Purpose of fleet assignment. Fleet types, fleet diversity, and fleet availability-performance measures, Formulation of the fleet assignment problem- decision variables, objective function, constraints, and solution. Scenario analysis, fleet assignment models. Crew scheduling process-significance. Development of crew pairing- pairing generators-mathematical formulation of crew pairing problem methods of solution. Crew rostering- rostering practices. The crew rostering problem-formulation solutions.

UNIT-3 - (08 HOURS)

Manpower scheduling- modeling, formulation of the problem, solutions
Flight Scheduling: Significance of flight scheduling: The route system of the airlines- point-to-point flights, hub and spoke flights. Schedule construction-operational feasibility, economic viability. Route development and flight scheduling process- load factor and frequency- case study

UNIT-4 - (08 HOURS)

Aircraft Routing and Management of Irregular Operations: Goal of aircraft routing- maintenance requirements, other constraints. Routing cycles, route generators. Mathematical models of routing- decision variables, objective functions, alternatives, constraints-flight coverage and aircraft available. Example problems and solutions. The problem statement, the time band approximation model-formulation of the problem-the scenarios- solution

UNIT-5 - (07 HOURS)

Gate Assignment and Aircraft Boarding Strategy: Gate assignment-significance- the problem-levels of handling-passenger flow, distance matrix mathematical formulation, solution. Common strategies for aircraft boarding process, mathematical model, interferences, model description, aisle interferences

TEXT BOOKS

Sl. No.	Title of the Book	Name of the Author	Name of the Publishers	Edition and Year
1	Airline Operations and Scheduling	Bazargan M,	Ash gate Publishing Ltd	2nd edition,2010

REFERENCE BOOKS

Sl. No.	Title of the Book	Name of the Author	Name of the Publishers	Edition and Year
1	The Global Airline Industry	Belobaba P, Odoni, A., Barnhart, C	Wiley	2009
2	Wensveen, J.G	Air Transportation: A Management Perspective	Ashgate Publishing Ltd.	6th Edition, 2007.
3	Network Flows-Theory, Algorithms and Applications	Ahuja, R. et al	Prentice-Hall	1993

ONLINE RESOURCES	Link
MIT OCW	https://ocw.mit.edu/courses/civil-and-environmental-engineering/1-206j-airline-schedule-planning-spring-2003/download-course-materials/
MIT OCW	https://ocw.mit.edu/courses/civil-and-environmental-engineering/1-206j-airline-schedule-planning-spring-2003/lecture-notes/

COURSE ASSESSMENT METHOD

Continuous Internal Evaluation (CIE)

Three internal assessments for 30 Marks each.

Two Learning Activities for10 Marks each.

Semester End Examination (SEE)

Semester end examination for 100 Marks

Program Outcomes – Articulation matrix

PO	1	2	3	4	5	6	7	8	9	10	11	12	PSO1	PSO2

CO1	3	3											1	2
CO2	3	3											1	2
CO3	3	3	3		3								1	2
CO4	3	2	3		3								1	2
CO5	2	3	3		3								1	2

ASTRONOMY AND ASTROPHYSICS				
Course Code	21AEE464		**Credits**	3
Hours/Week (L-T-P)	3-0-0		**CIE Marks**	50
Total Hrs	39		**SEE Marks**	50
Exam Hrs	03		**Course Type**	Program Elective

COURSE OUTCOMES

Course outcomes: After completion of the course, students will be able to-

1. Understand the history of astronomy and luminosity of stars
2. Explain the life cycle of stars through HR diagram
3. Understand the origin of sun and planets
4. Describe Origin and Nature of Asteroids, Meteors, Comets and Galaxies
5. Outline the characteristics of milky way galaxy and Big Bang concepts

TEACHING METHODOLOGY

- Blackboard teaching/PowerPoint presentation (if needed) /Flipped Classes for specified topics
- Regular review of students by asking questions based on topics covered in the class

COURSE CONTENTS

UNIT-1 - (08 HOURS)

History of Astronomy and Apparent Luminosity of Stars: Ptolemy's astronomical work, Copernican heliocentrism and Tychonian system, Luminosity (Apparent and Absolute) of stars, Magnitude scale, and Luminosity measurement: 1) Visual Method 2) Photographic method and 3) Photoelectric method.

UNIT-2 - (08 HOURS)

Stellar Evolution (HR diagram): Life cycle; Stellar Processes (Nuclear) and spectral classification of Stars O, B, A, F, G, K, M.

UNIT-3 - (08 HOURS)

Sun and Planets Origin of the solar system: Internal structure and surface features of sun, Sun spots and Magnetic field on the sun and Solar activity. Surface features of planets, Atmospheres and Magnetic fields of Planets and their moons.

UNIT-4 - (08 HOURS)

Asteroids, Meteors, Comets and Galaxies: Asteroids: Discovery and designation, Origin, Nature and Orbits of Asteroids. Meteors: Meteor showers and sporadic meteors. Comets : Periodic comets, Brightness variation in Comets. Gas production rates, dust and ion tails.

UNIT-5 - (07 HOURS)

Galaxies: Milky Way Galaxy & Galaxies beyond Structure of the Milky Way Galaxy What are galaxies? Different types of galaxies. Hubble's classification. Structure, size & mass of the Milky Way galaxy. Position of our Sun and its motion around the galactic centre. Cosmology The expanding universe. Cosmological models: Big Bang and Steady State models. Dark matter

TEXT BOOKS

Sl. No.	Title of the Book	Name of the Author	Name of the Publishers	Edition and Year
1	Astronomy structure of the Universe	A.E. Roy and D. Clarke	Adam Hilger, Subsequent edition	1989
2	Source Book of Space Sciences	Samuel Galsstone	Van Nostrand Reinhold Inc.,U.S.	1965
3	Textbook of Astronomy and Astrophysics with elements of cosmology,	V.B. Bhatia,	Alpha Science International Ltd	2001
4	Introduction to Astrophysics	BaidyanathBasu	Prentice Hall India Learning Private Limited;	2nd edition, 2010
5	Astrophysics: Stars and Galaxies	K.D.Abhyankar	Universities Press	2001

REFERENCE BOOKS

Sl. No.	Title of the Book	Name of the Author	Name of the Publishers	Edition and Year
1	Fundamental Astronomy	H. Karttunen, P Kroger, H Oja, M Poutanen& K. J. Donner	Springer	5th Edition 2007
2	Foundations of Astronomy	W.M.Smart	Prentice Hall Press	1942
3	The Physical Universe: An Introduction to Astronomy	Frank Shu	University Science Books	1981

ONLINE RESOURCES	Link
NPTEL	https://nptel.ac.in/courses/115/105/115105046/
MIT OCW	https://ocw.mit.edu/courses/physics/8-282j-introduction-to-astronomy-spring-2006/

COURSE ASSESSMENT METHOD

Continuous Internal Evaluation (CIE)

Three internal assessments for 30 Marks each.														
Two Learning Activities for10 Marks each.														
Semester End Examination (SEE														
Semester end examination for 100 Marks														
Program Outcomes – Articulation matrix:														
PO	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**PSO1**	**PSO2**
CO1	3	3	2										1	1
CO2	3	3	2										1	1
CO3	3	3	2										1	1
CO4	3	3	2										1	1

AIRCRAFT MAINTENANCE AND REPAIR				
Course Code	21AEE465		**Credits**	3
Hours/Week (L-T-P)	3-0-0		**CIE Marks**	50
Total Hrs	39		**SEE Marks**	50
Exam Hrs	03		**Course Type**	Program Elective

COURSE OUTCOMES

Course outcomes: After completion of the course, students will be able to-

1. Identify and apply the principles of function and safe operation to aircraft as per FAA. Understand general airframe structural repairs, the structural repair manual and structural
2. Understand the nature of airframe structural component inspection, corrosion repair and control programme. non-destructive inspection
3. Understand aircraft component disassembly, reassembly and troubleshooting
4. Know about aircraft adhesives, sealants, bonding techniques, repair procedures and the types and detection of defects in aircraft composite materials
5. Identify, install, inspect, fabricate and repair aircraft sheet metal and synthetic, material structures.

TEACHING METHODOLOGY

- Blackboard teaching/PowerPoint presentation (if needed) /Flipped Classes for specified topics
- Regular review of students by asking questions based on topics covered in the class

COURSE CONTENTS

UNIT-1 - (08 HOURS)

MAINTENANCE OF AIRCRAFT STRUCTURAL COMPONENTS Equipments used in welding shop and their maintenance - Ensuring quality welds - Welding jigs and fixtures - Soldering and brazing – laser welding. Sheet metal repair and maintenance: Selection of materials; Repair schemes; Fabrication of replacement patches; Tools - power/hand; Repair techniques; Peening - Close tolerance fasteners; Sealing compounds; forming/shaping; Calculation of weight of completed repair; Effect of weight - change on surrounding structure. Sheet metal inspection - N.D.T. Testing. Riveted repair design - Damage investigation - Reverse engineering.

UNIT-2 - (08 HOURS)

PLASTICS AND COMPOSITES IN AIRCRAFT Review of types of plastics used in airplanes - Maintenance and repair of plastic components - Repair of cracks and holes - various repairs schemes - Scopes. Cleaning of fibre reinforced plastic (FRP) materials prior to repair; Break test - Repair Schemes; FRP/honeycomb sandwich materials; laminated FRP structural members and skin panels; Tools/equipment; Vacuum-bag process. Special precautions – Autoclaves

UNIT-3 - (08 HOURS)

AIRCRAFT JACKING, ASSEMBLY AND RIGGING Airplane jacking and weighing and C.G. Location. Balancing of control surfaces - Inspection maintenance. Helicopter flight controls. Tracking and balancing of main rotor.

UNIT-4 - (08 HOURS)

REVIEW OF HYDRAULIC AND PNEUMATIC SYSTEM Trouble shooting and maintenance practices - Service and inspection - Inspection and maintenance of landing gear systems. - Inspection and maintenance of air-conditioning and pressurization system, water and waste system. Installation and maintenance of Instruments - handling - Testing - Inspection. Inspection and maintenance of auxiliary systems - Rain removal system - Position and warning system - Auxiliary Power Units (APUs).

UNIT-5 - (07 HOURS)

SAFETY PRACTICES Hazardous materials storage and handling, Aircraft furnishing practices - Equipments. Trouble shooting. Theory and practices.

TEXT BOOKS

Sl. No.	Title of the Book	Name of the Author	Name of the Publishers	Edition and Year
1.	"Aircraft Maintenance and Repair"	Kroes, Watkins, Delp,	McGraw Hill, New York	1992

REFERENCE BOOKS

Sl. No.	Title of the Book	Name of the Author	Name of the Publishers	Edition and Year
1.	"Aircraft Maintenance",	Brimm D.J. Bogges H.E.,	Pitman Publishing corp., New York,	1940.
2.	"Aircraft Maintenance Repair",	Delp. Bent and Mckinely	McGraw Hill, New York,	1987.
3.	"Aircraft Repair Manual",	Larry Reithmeir,	Palamar Books, Marquette,	1992.

ONLINE RESOURCES	Link
NPTEL	https://onlinecourses.nptel.ac.in/noc20_ae07/preview
NPTEL	https://onlinecourses.nptel.ac.in/noc20_ae03/preview

COURSE ASSESSMENT METHOD

Continuous Internal Evaluation (CIE)

Three internal assessments for 30 Marks each.

Two Learning Activities for10 Marks each.

Semester End Examination (SEE)

Semester end examination for 100 Marks

Program Outcomes – Articulation matrix:

PO	1	2	3	4	5	6	7	8	9	10	11	12	PSO1	PSO2
CO1	3	3											1	1
CO2	3	3											1	1
CO3	3	3											1	1
CO4	3	3											1	1

ABILITY ENHANCEMENT COURSE-II

INTRODUCTION TO PYTHON PROGRAMMING				
Course Code	21AEC491		**Credits**	2
Hours/Week (L-T-P)	1-0-1		**CIE Marks**	50
Total Hrs	24		**SEE Marks**	50
Exam Hrs	03		**Course Type**	AEC

COURSE OUTCOMES

Course outcomes: After completion of the course, students will be able to-

1. Develop and illustrate algorithms to solve simple mathematical problems
2. Write programs using various data types, operators, functions, and modules in Python
3. Distinguish conditional and loop statements in Python and identify data handling functions to solve a given problem
4. Use appropriate data structures in python to represent compound data
5. Apply basic operations on data from/to files, modules and packages in Python. Choose appropriate error and exception handling methods for debugging.

TEACHING METHODOLOGY

- Blackboard teaching/PowerPoint presentation (if needed) /Flipped Classes for specified topics
- Regular review of students by asking questions based on topics covered in the class

COURSE CONTENTS

UNIT-1 - (05 HOURS)

Algorithmic Problem Solving Algorithms, building blocks of algorithms, notation, algorithmic problem solving, simple strategies for developing algorithms.
Illustrative problems: find minimum in a list, insert a card in a list of sorted cards, guess an integer number in a range, Towers of Hanoi.

UNIT-2 - (05 HOURS)

Data And Expressions Python interpreter and interactive mode; values and types: int, float, Boolean, string, and list; variables, expressions, statements, tuple assignment, precedence of operators, comments; modules and functions, function definition and use, flow of execution, parameters and arguments.
Illustrative programs: exchange the values of two variables, circulate the values of n variables, distance between two points.

UNIT-3 - (05 HOURS)

Control Flow And Functions
Conditionals: Boolean values and operators, conditional, alternative, chained conditional; Iteration: state, while, for, break, continue, pass; Fruitful functions: return values, parameters, local and global scope, function composition, recursion; Strings: string slices, immutability, string functions and methods, string module; Lists as arrays.
Illustrative programs: square root, gcd, exponentiation, sum an array of numbers, binary search, different patterns.

UNIT-4 - (05 HOURS)

Data Structures: Lists, Tuples, Dictionaries
Lists: list operations, list slices, list methods, list loop, mutability, aliasing, cloning lists, list parameters; Tuples: tuple assignment, tuple as return value; Dictionaries: operations and methods; advanced list processing - list comprehension;
Illustrative programs: selection sort, insertion sort, merge sort, histogram

UNIT-5 - (04 HOURS)

Files, Modules, Packages Files and exception: text files, reading and writing files, format operator; command line arguments, errors and exceptions, handling exceptions, modules, packages.
Illustrative programs: word count, copy file.

TEXT BOOKS

Sl. No.	Title of the Book	Name of the author/s	Name of the publisher	Edition and year
1	Think Python: How to Think Like a Computer Scientist	Allen B. Downey	Shroff/O'Reilly Publishers	2nd edition,2016
2	Learning Python	Mark Lutz & David Ascher	Oreilly	5th edition, 2013

REFERENCE BOOKS

Sl. No.	Title of the Book	Name of the author/s	Name of the publisher	Edition and year
1	An Introduction to Python	Guido van Rossum and Fred L. Drake Jr	Network Theory Ltd	2011.
2	Introduction to Computation and Programming Using Python'', Revised and expanded Edition	John V Guttag	MIT Press	2013

ONLINE RESOURCES	Link
NPTEL	https://onlinecourses.nptel.ac.in/noc22_cs32/preview
PYTHON	https://www.python.org/about/gettingstarted/
NPTEL	https://www.udemy.com/course/pythonforbeginners/

TU Delft	https://docs.python.org/												
Program Outcomes – Articulation matrix:													
PO	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**PSO1**	**PSO2**
CO1	3	2			3				3	2				
CO2	3	2			3				3	2				
CO3	3	2			3				3	2				
CO4	2	2			2				2	2				
CO5	3	2			3				3	2				

ETHICS,TECHNOLOGY AND ENGINEERING

Course Code	21AEC492		**Credits**	2
Hours/Week (L-T-P)	2-0-0		**CIE Marks**	50
Total Hrs	24		**SEE Marks**	50
Exam Hrs	03		**Course Type**	AEC

COURSE OUTCOMES

Course outcomes: After completion of the course, students will be able to-

1. Understand the morals, value s and ethics in work
2. Describe engineering ethics and various moral values
3. Explain and follow safety, risk and risks at work place
4. Describe and solve global Issues at work place

TEACHING METHODOLOGY

- Blackboard teaching/PowerPoint presentation (if needed) /Flipped Classes for specified topics
- Regular review of students by asking questions based on topics covered in the class

COURSE CONTENTS

UNIT-1 - (06 HOURS)

Human Values Morals, values and Ethics – Integrity – Work ethic – Service learning – Civic virtue – Respect for others – Living peacefully – Caring – Sharing – Honesty – Courage – Valuing time – Cooperation – Commitment – Empathy – Self-confidence – Character – Spirituality – Introduction to Yoga and meditation for professional excellence and stress management.

UNIT-2 - (06 HOURS)

Engineering Ethics Senses of 'Engineering Ethics' – Variety of moral issues – Types of inquiry – Moral dilemmas – Moral Autonomy – Kohlberg's theory – Gilligan's theory – Consensus and Controversy – Models of professional roles - Theories about right action – Self-interest – Customs and Religion – Uses of Ethical Theories

UNIT-3 - (06 HOURS)

Engineering As Social Experimentation Engineering as Experimentation – Engineers as responsible Experimenters – Codes of Ethics – A Balanced Outlook on Law. Safety and Risk – Assessment of Safety and Risk – Risk Benefit Analysis and Reducing Risk - Respect for Authority – Collective Bargaining – Confidentiality – Conflicts of Interest – Occupational Crime – Professional Rights – Employee Rights – Intellectual Property Rights (IPR) – Discrimination.

UNIT-4 - (04 HOURS)

Global Issues Multinational Corporations – Environmental Ethics – Computer Ethics – Weapons Development – Engineers as Managers – Consulting Engineers – Engineers as Expert Witnesses and Advisors – Moral Leadership –Code of Conduct – Corporate Social Responsibility.

UNIT-5 - (04 HOURS)

Safety, Responsibilities And Rights

Safety and Risk – Assessment of Safety and Risk – Risk Benefit Analysis and Reducing Risk - Respect for Authority – Collective Bargaining – Confidentiality – Conflicts of Interest – Occupational Crime – Professional Rights – Employee Rights – Intellectual Property Rights (IPR) – Discrimination.

TEXT BOOKS

Sl. No.	Title of the Book	Name of the author/s	Name of the publisher	Edition and year
1	Ethics in Engineering	Mike W. Martin and Roland Schinzinger	Tata McGraw Hill, New Delhi	2004

REFERENCE BOOKS

Sl. No.	Title of the Book	Name of the author/s	Name of the publisher	Edition and year
1	Engineering Ethics	Charles B. Fleddermann	Pearson Prentice Hall	2004
2	Engineering Ethics – Concepts and Cases	Charles E. Harris, Michael S. Pritchard and Michael J. Rabins	Cengage Learning	2009
3	Ethics and the Conduct of Business	John R Boatright	Pearson Education	2003
4	Fundametals of Ethics for Scientists and Engineers	Edmund G Seebauer and Robert L Barry	Oxford University Press	2001

ONLINE RESOURCES	Link
NPTEL	https://onlinecourses.nptel.ac.in/noc21_mg46/preview
Coursera	https://www.coursera.org/learn/ethics-technology-engineering

Program Outcomes – Articulation matrix:

PO	1	2	3	4	5	6	7	8	9	10	11	12	PSO1	PSO2
CO1	3					3		3	2	3		3		
CO2	3					3		3	2	3		3		
CO3	3					3		3	2	3		3		

CO4	3					3		2	2	3		3		
CO5	3					3		3	2	3		3		

BUSINESS COMMUNICATION				
Course Code	21AEC493		**Credits**	2
Hours/Week (L-T-P)	2-0-0		**CIE Marks**	50
Total Hrs	24		**SEE Marks**	50
Exam Hrs	03		**Course Type**	AEC

COURSE OUTCOMES

Course outcomes: After completion of the course, students will be able to-

1. Comprehend the role of business communication in organization
2. Describe the techniques of writing letters and reports
3. Understand the importance of presentation skills in organization
4. Present well during meetings and conferences

TEACHING METHODOLOGY

●Blackboard teaching/PowerPoint presentation (if needed) /Flipped Classes for specified topics
●Regular review of students by asking questions based on topics covered in the class

COURSE CONTENTS

UNIT-1 - (05 HOURS)

Introduction
Role of communication – defining and classifying communication – purpose of communication –process of communication – characteristics of successful communication – importance of communication in management – communication structure in organization – communication in crisis.
Oral communication
What is oral Communication – principles of successful oral communication – barriers to communication –two sides of effective oral communication – effective listening – non – verbal communication

UNIT-2 - (05 HOURS)

Written communication
Purpose of writing – clarity in writing – principles of effective writing – approaching the writing process systematically: The 3X3 writing process for business communication: Pre writing – **Writing** – Revising – Specific writing features – coherence – electronic writing process
Business letters and reports
Introduction to business letters – writing routine and persuasive letters – positive and negative messages- writing memos – what is a report purpose, kinds and objectives of reports- writing reports.

UNIT-3 - (05 HOURS)

Presentation skills
Presentation skills: What is a presentation – elements of presentation – designing a presentation. Advanced visual support for business presentation- types of visual aid Negotiations skills: What is negotiations – nature and need for negotiation – factors affecting negotiation –stages of negotiation process – negotiation strategies

UNIT-4 - (05 HOURS)

Employment communication
Introduction – writing CVs – Group discussions – interview skills Impact of Technological Advancement on Business Communication, Communication networks – Intranet – Internet – e mails – SMS – teleconferencing – videoconferencing

UNIT-5 - (04 HOURS)

Group communication
Meetings – Planning meetings – objectives – participants – timing – venue of meetings– leading meetings. Media management – the press release- press conference – media interviews Seminars – workshop – conferences. Business etiquettes.

TEXT BOOKS

Sl. No.	Title of the Book	Name of the author/s	Name of the publisher	Edition and year
1	Business communication essentials	Bovee, C.L. & Thill	Boston Pearson	2014

REFERENCE BOOKS

Sl. No.	Title of the Book	Name of the author/s	Name of the publisher	Edition and year
2	The goof-proofer: How to avoid the 41 most embarrassing errors in your speaking and writing	Manhard, S. J.	New York, NY: Simon & Schuster. ISBN: 0-684-83826-5.	1998

ONLINE RESOURCES	Link
Coursera	https://www.coursera.org/specializations/effective-business-communication
NPTEL	https://onlinecourses.swayam2.ac.in/imb19_mg14/preview

Program Outcomes – Articulation matrix:

PO	1	2	3	4	5	6	7	8	9	10	11	12	PSO1	PSO2
CO1	2				3	3		3	3	3		3		
CO2	2				3	3		3	3	3		3		

CO3	**2**				**3**	**3**		**3**	**3**	**3**		**3**		
CO4	**2**				**3**	**3**		**3**	**3**	**3**		**3**		

UAV FLYING SKILLS				
Course Code	21AEC494		**Credits**	3
Hours/Week (L-T-P)	1-0-1		**CIE Marks**	50
Total Hrs	26		**SEE Marks**	50
Exam Hrs	03		**Course Type**	Program Elective

COURSE OUTCOMES

Course outcomes: After completion of the course, students will be able to-
1. Apply the concept of Flight dynamics for building UAV
2. Assemble and Program the UAV
3. Perform Testing and Control operations on the flight simulator
4.Implement UAV for real world applications

TEACHING METHODOLOGY

- Blackboard teaching/PowerPoint presentation (if needed) /Flipped Classes for specified topics
- Regular review of students by asking questions based on topics covered in the class

COURSE CONTENTS

UNIT-1 - (05 HOURS)

Introduction to Aerial Vehicles
Definitions of Drone, UAV, RPA, Quad copters -Basic Components and Categories – Principles of Flight - Flight Maneuvers – Airframes - Creating a Frame: Materials, Different Frame Shapes – Building Airframes - Flight dynamics - Applications - Future potential - Comparison with other aerial vehicles

UNIT-2 - (05 HOURS)

Hardware Anatomy of UAV
Power Train – Propellers, Motors- Total Lift - Electronic Speed Controllers – Flight Battery – Radio transmitter and receiver – Flight Controller – GPS, Compass, Camera Assembling for Quad copter, payload, Connectors, Mounting of Propellers and Powering up.

UNIT-3 - (05 HOURS)

Real World Applications and Case Studies
Beneficial Drones, Aerial Photography, Mapping and Surveying, Precision Agriculture, Search and Rescue, Infrastructure Inspection, Conservation. Case Studies: Agriculture Weed Classification, Micro drone surveillances.

UNIT-4 - (06 HOURS)

Drone flight simulator and fly a Drone in simulator training & live training for various applications.

UNIT-5 - (05 HOURS)

Assembly of UAVs and Flight Test

TEXT BOOKS

Sl. No.	Title of the Book	Name of the author/s	Name of the publisher	Edition and year
1	Kilby, Make: Getting Started with Drones	Terry Kilby and Belinda	Maker Media, Inc,	2016
2	Building a Quadcopter with Arduino	VasilisTzivaras,	Packt Publishing,	2016

REFERENCE BOOKS

Sl. No.	Title of the Book	Name of the author/s	Name of the publisher	Edition and year
1	Building Your Own Drones: A Beginners' Guide to Drones, UAVs, and ROVs,	Baichtal,	Que Publishing,	2016.

ONLINE RESOURCES	Link
NPTEL	https://onlinecourses.nptel.ac.in/noc21_ae14/preview
NPTEL	https://onlinecourses.nptel.ac.in/noc19_ae06/preview
NPTEL	https://archive.nptel.ac.in/courses/101/104/101104083/

Program Outcomes – Articulation matrix:

PO	1	2	3	4	5	6	7	8	9	10	11	12	PSO1	PSO2
CO1	3	3	3		3				3	3			2	2
CO2	3	3	3		3				3	3			2	2
CO3	3	3	3		3				3	3			2	2
CO4	3	3	3		3				3	3			2	2

NITTE MEENAKSHI INSTITUTE OF TECHNOLOGY

(An autonomous institution, Accredited by NBA (AICTE) New Delhi)

Course content, scheme of teaching and examination, 2018 scheme

Department of Aeronautical Engineering

Semester: III

Sl No	Subject Code	Subject Name	Course Type	Teaching Dept.	Teaching Hours/week			Examination			Credits
					L#	T#	P#	CIE*	SEE**	Total	
1	18MAT31	Engineering Mathematics –III	BS	MAT	4	-	-	50	50	100	4
2	18AE32	Introduction to Aircraft Engineering & Design	PC	AE	4	-	-	50	50	100	3
3	18AE33	Aero Engineering Thermodynamics	PC	AE	3	2	-	50	50	100	3
4	18AE34	Solid Mechanics	PC	AE	3	2	-	50	50	100	3
5	18AE35	Fluid Mechanics	PC	AE	3	-	-	50	50	100	3
6	18AEE36X	Program Elective-A	PE	AE	3	-	-	50	50	100	3
7	18KAN03A/ 18KAN03B	Vyavaharika Kannada (Kannada for communication)/ Aadalitha Kannada (Kannada for Administration)		Kannada	3	-	-				1
8	18AEL37	Solid Mechanics Lab	PL	AE	-	-	3	50	50	100	1
9	18AEL38	Fluid Mechanics Lab	PL	AE	-	-	3	50	50	100	1
10	18AEL39A	Aerothermal Engineering Lab	PL	AE	-	-	3	50	50	100	1
							Total	450	450	900	23

Semester: IV

Sl No	Subject Code	Subject Name	Course Type	Teaching Dept.	Teaching Hours/week			Examination			Credits
					L#	T#	P#	CIE*	SEE**	Total	
1	18MAT41	Engineering Mathematics –IV	BS	MAT	3	2	-	50	50	100	4
2	18AE42	Aerodynamics-I	PC	AE	3	-	-	50	50	100	4
3	18AE43	Aircraft Structures-I	PC	AE	3	2	-	50	50	100	4
4	18AE44	Aircraft Systems & Instruments	PC	AE	3	-	-	50	50	100	3
5	18AE45	Aircraft Materials & Manufacturing	PC	AE	3	-	-	50	50	100	3
6	18AEE46X	Program Elective-B	PE	AE	3	-	-	50	50	100	3
7	18AEL47	Computer Aided Aircraft Drawing Lab	PL	AE	-	-	3	50	50	100	1
7	18AEL48	Manufacturing Process Lab	PL	AE	-	-	3	50	50	100	1
8	18AEL49	Aerospace structural design lab	PL	AE	-	-	3	50	50	100	1
							Total	450	450	900	24

Semester: V

Sl No	Subject Code	Subject Name	Course Type	Teaching Dept.	Teaching Hours/week			Examination			Credits
					L#	T#	P#	CIE*	SEE**	Total	
1	18AE51	Aircraft Performance	PC	AE	3	-	-	50	50	100	3
2	18AE52	Aerodynamics-II	PC	AE	4	-	-	50	50	100	4
3	18AE53	Aircraft Structures-II	PC	AE	3	2	-	50	50	100	4
4	18AE54	Aircraft Propulsion	PC	AE	3	-	-	50	50	100	3
5	18AEH55	Aviation safety management and accident investigations	HU	AE	3	-	-	50	50	100	3
6	18AEE56X	Program Elective- C	PE	AE	3	-	-	50	50	100	3
7	18AEL57	Propulsion Lab	PL	AE	-	-	3	50	50	100	1
8	18AEL58	Aerodynamics Lab	PL	AE	-	-	3	50	50	100	1
9	18AEL59	Composite Material lab	PL	AE	-	-	3	50	50	100	1
10	18AEM510	Swayam/NPTEL/MOOC	MO	-	-	-	-	-	-	-	3
							Total	450	450	900	26

Semester: VI

Sl No	Subject Code	Subject Name	Course Type	Teaching Dept.	Teaching Hours/week			Examination			Credits
					L#	T#	P#	CIE*	SEE**	Total	
1	18AE61	Aircraft Stability & Control	PC	AE	4	-	-	50	50	100	3
2	18AE62	Advanced Propulsion	PC	AE	3	2	-	50	50	100	4
3	18AE63	Aircraft Maintenance & Practice	PC	AE	3	-	-	50	50	100	3
4	18AE64	Space Flight & Space Dynamics	PC	AE	3	-	-	50	50	100	3
5	18AEE65X	Program Elective-D	PE	AE	3	-	-	50	50	100	3
6	18AEO66X	Open Elective – I (Swayam/NPTEL/MOOC)	MO	AE	3	-	-	-	-	-	3
7	18AEL67	Computer Aided Design, Modeling & Analysis lab	PL	AE	-	-	3	50	50	100	1
8	18AEL68	Structures Lab	PL	AE	-		3	50	50	100	1
9	18AEL69	Flight Physics lab	PL	AE	-	-	3	50	50	100	1
10	18AEP610	Project Phase -I	PP	AE			4	-	-	-	1
							Total	450	450	900	23

Semester: VII

Sl No	Subject Code	Subject Name	Course Type	Teaching Dept.	Teaching Hours/week				Examination			Credits
					L#	T#	P#	S#	CIE*	SEE**	Total	
1	18AE71	Vibration & Aeroelasticity	PC	AE	3	2	-		50	50	100	3
2	18AE72	CFD in Aerospace Engineering	PC	AE	3	2	-		50	50	100	3
3	18AE73	Composite Materials & Structures	PC	AE	3	-	-		50	50	100	3
4	18AEH74	Entrepreneurship Development & IPR	HU	AE	3	-	-		50	50	100	3
5	18AEE75X	Program Elective- E	PE	AE	3	-	-		50	50	100	3
6	18AEO76X	Open Elective- II	OE	AE	3	-	-		50	50	100	3
8	18AEL77	Simulation Laboratory	PL	AE	-	-	3		50	50	100	1
9	18AEL78	Aircraft Systems Lab	PL	AE	-	-	3		50	50	100	1
10	18AEI/S/P79	Internship/Self-Study/Minor Project	IN/SS//MP	AE	-	-	-	8	50	50	100	2
11	18AEP710	Project Phase-II	PP	AE			2		50^	-	-	1
								Total	500	500	1000	23

Semester: VIII

Sl No	Subject Code	Subject Name	Course Type	Teaching Dept.	Teaching Hours/week			Examination			Credits
					L#	T#	P#	CIE*	SEE**	Total	
1	18AE81	Aircraft Design & Analysis	PC	AE	4	-	-	50	50	100	3
2	18AEE82X	Program Elective-F	PE	AE	3	-	-	50	50	100	3
3	18AEP83	Project Work	PR	AE	-	-	26	50+50^	100	200	10
							Total	200	200	400	16

*Continuous Internal Evaluation ** Semester End Examination # L- Lecture, T- Tutorial, P- Practical, S-Self Study
PC-Program Core PE-program Elective OE-Open Elective

Semester-3
Program Elective- A

Sl. No.	Subject Code	Subject Name
1.	18AEE361	Flight Scheduling and Operations
2.	18AEE362	Introduction to Space Science and Technology
3.	18AEE363	Mechanical Measurements & Metrology
4.	18AEE364	Airport Planning & Management
5.	18AEE365	Environmental Science and Technology
6.	18AEE366	Non-Conventional Energy Resources
7	18AEE367	Introduction to Python programming
8	18AEE368	Introduction to Robotics
9	18AEE369	Rapid Prototyping

Semester-4
Program Elective- B

Sl. No.	Subject Code	Subject Name
1.	18AEE461	Airworthiness & Certification
2.	18AEE462	Turbomachinery
3.	18AEE463	Computer Integrated Manufacturing
4.	18AEE464	Unmanned Aerial Vehicle and its Applications
5.	18AEE465	Wind Tunnel Techniques
6.	18AEE466	Design of Machine Elements
7	18AEE467	Fundamentals of Astronomy and Astrophysics
8	18AEE468	Introduction to Aero acoustics
9	18AEE469	Introduction to Artificial intelligence and machine learning

Semester-5
Program Elective –C

Sl. No.	Subject Code	Subject Name
1.	18AEE551	Fuels and Combustion
2.	18AEE552	Control Engineering
3.	18AEE553	Non Destructive Testing
4.	18AEE554	Industrial Aerodynamics
5.	18AEE555	Industrial Engineering & Management
6.	18AEE556	Total Quality Management
7.	18AEE557	Experimental techniques and data analysis
8.	18AEE558	Robust Technology

Semester-6
Program Elective-D

Sl. No.	Subject Code	Subject Name
1.	18AEE651	Optimization Techniques
2.	18AEE652	Rockets & Missiles
3.	18AEE653	Finite Element Methods
4.	18AEE654	Hypersonic Vehicle Design
5.	18AEE655	Guidance, Navigation and Control
6.	18AEE656	Aero Engine Design
7.	18AEE657	Aviation Management
8.	18AEE658	System Engineering and Analysis

Semester 7
Program Elective -E

Sl. No.	Subject Code	Subject Name
1.	18AEE761	Heat and Mass transfer
2.	18AEE762	Fatigue and Fracture
3.	18AEE763	Plates and shells
4.	18AEE764	Launch Vehicle dynamics
5.	18AEE765	Advanced Aerodynamics
6.	18AEE766	Reliability Engineering
7.	18AEE767	Satellite Design
8.	18AEE768	Experimental stress analysis

Semester 8
Program Elective- F

Sl. No.	Subject Code	Subject Name
1.	18AEE821	Design of Gas Turbine
2.	18AEE822	Missile Technology
3.	18AEE823	High Temperature Materials
4.	18AEE824	Avionics & Instrumentations
5.	18AEE825	Smart Materials & Nano Technology
6.	18AEE826	Helicopter Engineering
7.	18AEE827	Wind Engineering
8	18AEE828	Flight Testing

Semester 7
Open elective-II

Sl. No.	Subject Code	Subject Name
1.	18AEO761	Mechanics of Flight
2.	18AEO762	Maintenance, Overhaul & Repair of Aircraft Systems
3.	18AEO763	Introduction To Astrophysics And Space Environment
4.	18AEO764	Introduction to Rockets & Missiles
5.	18AEO765	Aerospace Materials
6.	18AEO766	Introduction to Aerospace Engineering
7.	18AEO767	Introduction to Aerial Robotics
8.	18AEO768	Elements of Aerospace Propulsion
9.	18AEO769	Introduction to Jet Engines

SEMESTER-III

ENGINEERING MATHAMEATICS - III				
Course Code	18MAT31		**Credits**	4
Hours/Week (L-T-P)	3		**CIE Marks**	50
Total Hrs	48		**SEE Marks**	50
Exam Hrs	3		**Course Type**	Core

COURSE OUTCOMES

Course outcomes: After completion of the course, students will be able to-

1. Concepts of Fourier theory and transforms can be adopted to problem solving, analyzing physical situations relevant to periodic and aperiodic functions
2. Fourier theory and transforms can be applied to model engg. Problem
3. Numerical methods can be adopted for solving equations, interpolate and extrapolate data using, finite differences and matrices
4. Numerical methods can be adopted to differentiate, integrate function
5. Numerical methods can be applied to model physical situations and interpret solutions

TEACHING METHODOLOGY

- Blackboard teaching/PowerPoint presentation (if needed) /Flipped Classes for specified topics
- Tutorial classes on topics covered
- Unit tests on covered topics

COURSE CONTENTS

UNIT -1 (08 HOURS)

Errors and approximations – Floating and fixed point numbers, Inherent, Percentage, Truncation, Round-off errors, Absolute and Relative errors, Approximation of series.
Solution of algebraic and transcendental equations- Iteration method, Aitken's Δ^2 method for acceleration of convergence. Secant method, Newton Raphson method for simple root

UNIT -2- (10 HOURS)

Finite differences and interpolation – forward, backward and central difference operators, construction of difference table, Newton's forward and backward difference interpolation, Sterling and Bessel central difference formulae, Newton's divided difference and Lagrange's interpolation formula, Numerical differentiation with Newton's forward and backward difference interpolation.

UNIT -3- (10 HOURS)

Numerical differentiation using Newton's forward, backward and Lagrangian interpolation
Numerical integration- Newton Cotes formula, Trapezoidal, Simpson's 1/3rd and 3/8th rule, Weddle's rule, Gauss-Legendre Quadrature method.

UNIT -4- (10 HOURS)

Fourier series: Euler's formulae, Dirichlet's conditions for Fourier series expansion, change of interval, Even and odd function, half range series, Practical harmonic analysis.**Fourier Transforms**: Definition, Complex Fourier transforms, Cosine and Sine transforms, Inverse Fourier transforms.

UNIT -5- (10 HOURS)

Laplace Transforms: Definition, Transforms of standard functions (derivation and problems), Transforms of $e^{at} f(t)$, $t^n f(t)$, $\frac{f(t)}{t}$, Laplace transforms of derivatives and integrals, Laplace transforms of periodic functions, unit step function (no derivations), Dirac delta function . Inverse Laplace transforms, convolution theorem (no proof), solution of 1st and 2nd order ODE using Laplace transforms.

TEXT BOOKS

Sl.no	Title of the Book	Name of the Author	Name of the Publishers	Edition and Year
1	Higher Engg. Mathematics	Dr. B S Grewal	Khanna publications	42nd edition,2012
2	Advanced Engg. Mathematics	Erwin E Kreyszig	Wiley	10th edition

REFERENCE BOOKS'

Sl.no	Title of the Book	Name of the Author	Name of the Publishers	Edition and Year
1	Differential equations and the calculus of variations	G Yankovsky		1977
2	Probability and statistics for Engg	Miller and Freund	Pearson	6th edition, 2001

ONLINE RESOURCES	Link
NPTEL	https://nptel.ac.in/courses/111104125/
NPTEL	https://nptel.ac.in/courses/111106100/
NPTEL	https://nptel.ac.in/courses/111105090/
MIT OCW	https://nptel.ac.in/courses/111106139/
TU Delft	https://ocw.mit.edu/courses/mathematics/18-175-theory-of-probability-spring-2014

COURSE ASSESSMENT METHOD

Continuous Internal Evaluation (CIE)

Three internals tests (each 30 marks) are conducted, average of best two performances will be considered.

1.Minimum two Assignments/Model making - evaluated through rubrics for 10 marks. Average of two will be considered.

2.Tutorial classes and assessment are carried out/Surprise quiz tests are conducted and evaluated for 10 marks. Average of these two will be considered.

Semester End Examination (SEE)

1. Two Questions are to be set from each unit, carrying 20 Marks each.
2. Students have to answer 5 questions selecting one full question from each unit

Program Outcomes – Articulation matrix

PO	1	2	3	4	5	6	7	8	9	10	11	12	PSO1	PSO2
CO1	2	2		1	1									
CO2	2	2		1	1									
CO3	2	2		1	1									
CO4	2	2		1	1									
CO5	2	2		1	1									

INTRODUCTION TO AIRCRAFT ENGINEERING & DESIGN				
Course Code	18AE32		**Credits**	3
Hours/Week (L-T-P)	3		**CIE Marks**	50
Total Hrs	39		**SEE Marks**	50
Exam Hrs	3		**Course Type**	Core

COURSE OUTCOMES

Course outcomes: After completion of the course, students will be able to-

1.Describe the history and configurations of aircraft
2. Explain the various types of aircraft configurations, structures and materials
3.Describe the basics of aircraft propulsion and stability
4..Explain various aircraft systems

TEACHING METHODOLOGY

- Blackboard teaching/PowerPoint presentation (if needed) /Flipped Classes for specified topics
- Regular review of students by asking questions based on topics covered in the class

COURSE CONTENTS

UNIT -1- (08 HOURS)

HISTORY AND AIRCRAFT CONFIGURATIONS

Early development of Airplanes, biplanes and monoplanes, Developments in materials, structures and propulsion over the years, types of flight vehicles, classifications-Components of an airplane and their functions.

UNIT -2 (08 HOURS)

BASICS OF FLIGHT

Structures of the Atmosphere - Temperature, pressure and altitude relationships, Evolution of Aerodynamics forces and moments-center of pressure - aerodynamic center – pressure coefficients, Aerofoils and its nomenclature, speed of sound, Mach number, concepts of aircraft stability and control.

UNIT -3 (07 HOURS)

BASICS OF AIRCRAFT STRUCTURES AND DESIGN

General types of construction, Monocoque, semi-monocoque and geodesic constructions, typical wing and fuselage structure. Metallic and non-metallic materials. Use of Aluminium alloy, titanium, stainless steel and composite materials- V-n diagram and load factor. Phases of conceptual design of an aircraft.

UNIT -4 (08 HOURS)

BASICS OF PROPULSION

Introduction to aircraft power plants – classification – principle of operation , Characteristics of piston, turboprop, turbofan and turbo shaft engines, use of propeller and jets for thrust production- Comparative merits and demerits , Principle of operation of rocket, types of rocket and typical applications.

UNIT -5 (08 HOURS)

AIRCRAFT CONTROL, COMMUNICATION & NAVIGATION SYSTEMS

Conventional control, powered control- Basic instruments for flying-Typical systems for control actuation & Modern control systems.

Need for communication system on aircraft, working principle of communication system. Basics of navigation system, Principle of operation of radar

TEXT BOOKS

Sl.no	Title of the Book	Name of the Author	Name of the Publishers	Edition and Year
1	Introduction to Flight	Anderson, J.D	McGraw-Hill	8th edition, 2015
2	Introduction to aeronautics: A design perspective	Stephen. A. Brandt	AIAA Education Series	2^{nd} edition, 2004

REFERENCE BOOKS'

Sl.no	Title of the Book	Name of the Author	Name of the Publishers	Edition and Year
1	Flight without Formulae	Kermode, A.C	Pearson Education	11^{th} edition, 2011
2	Introduction to Radar Systems	Skolnik	Tata McGraw-Hill Education	2003
3	Aircraft Communications and Navigation Systems: Principles, Operation and Maintenance	Mike Tooley and David Wyatt	Publisher- Elsevier	First Edition 2007
4	Intractive aerospace engineering and design	Deva Newman	McGraw-Hill	2002

ONLINE RESOURCES	Link
NPTEL	https://nptel.ac.in/courses/101/101/101101053//
NPTEL	https://nptel.ac.in/courses/101/101/101101083/
NPTEL	https://nptel.ac.in/courses/101/104/101104069/
MIT OCW	https://ocw.mit.edu/courses/aeronautics-and-astronautics/16-00-introduction-to-aerospace-engineering-and-design-spring-2003/
TU Delft	https://online-learning.tudelft.nl/courses/

COURSE ASSESSMENT METHOD

Continuous Internal Evaluation (CIE)

Three internals tests (each 30 marks) are conducted, average of best two performances will be considered.

1. Minimum two Assignments/Model making - evaluated through rubrics for 10 marks. Average of two will be considered.
2. Tutorial classes and assessment are carried out/Surprise quiz tests are conducted and evaluated for 10 marks. Average of these two will be considered.

Semester End Examination (SEE)

1. Two Questions are to be set from each unit, carrying 20 Marks each.
2. Students have to answer 5 questions selecting one full question from each unit

Program Outcomes – Articulation matrix

PO	1	2	3	4	5	6	7	8	9	10	11	12	PSO1	PSO2
CO1	2								**2**	**2**			2	
CO2	3								2	2			2	
CO3	3								2	2				2
CO4	3								2	2				2

AERO ENGINEERING THERMODYNAMICS				
Course Code	18AE33		**Credits**	3
Hours/Week (L-T-P)	3		**CIE Marks**	50
Total Hrs	48		**SEE Marks**	50
Exam Hrs	3		**Course Type**	Core

COURSE OUTCOMES

Course outcomes: After completion of the course, students will be able to-

1. Apply the basic concepts of thermodynamics and heat -work interaction
2. Illustrate the laws and principles of thermodynamics and its applications
3. Analyze and examine the properties of entropy, Ideal gases and real gases.
4. Describe the concepts of pure substances
5. Analyze the performance of gas power cycles and IC Engines

TEACHING METHODOLOGY

- Blackboard teaching/PowerPoint presentation (if needed)
- Videos and animation
- Tutorial classes on problems

COURSE CONTENTS

UNIT -1- (10 HOURS)

Fundamental Concepts:
Systems; Thermodynamic state, path, process; Zeroth Law and temperature measurement; definition of work and its limitations. Thermodynamic definition of work - examples, sign convention. Heat and work transfer in flow, expressions for displacement work in various processes through p-v diagrams; Heat- definition, units and sign convention

UNIT -2 (08 HOURS)

First Law of Thermodynamics:
Joules experiments, equivalence of heat and work. Statement of the First law of thermodynamics, extension of the First law to non - cyclic processes, energy, energy as a property, modes of energy, pure substance; definition, two-property rule, Specific heat at constant volume, enthalpy, specific heat at constant pressure.
Extension of the First law to control volume; steady state-steady flow energy equation, important applications, analysis of unsteady processes such as film and evacuation of vessels with and without heat transfer.

UNIT -3 (10 HOURS)

Second Law of Thermodynamics:
Devices converting heat to work; (a) in a thermodynamic cycle, (b) in a mechanical cycle. Thermal reservoir. Direct heat engine; schematic representation and efficiency. Devices converting work to heat in a thermodynamic cycle; reversed heat engine, schematic representation, coefficients of performance. Kelvin - Planck statement of the Second law of Thermodynamics; PMM I and PMM II, Clausius statement of Second law of Thermodynamics, Equivalence of the two statements; Reversible and Irreversible processes; factors that make a process irreversible, reversible heat engines, Carnot cycle, Carnot principles.
Entropy: Clasius inequality; Statement, proof, application to a reversible cycle. Entropy; definition, a property, change of entropy, principle of increase in entropy, entropy as a quantitative test for irreversibility, calculation of entropy using Tds relations, entropy as a coordinate. Available and unavailable energy.

UNIT -4- (10 HOURS)

Pure Substances & Ideal Gases: Mixture of ideal gases and real gases, ideal gas equation, compressibility factor use of charts. P-T and P-V diagrams, triple point and critical points. Sub-cooled liquid, Saturated liquid, mixture of saturated liquid and vapour, saturated vapour and superheated vapour states of pure substance with water as example. Enthalpy of change of phase (Latent heat). Dryness fraction (quality), T-S and H-S diagrams, representation of various processes on these diagrams.

Thermodynamic relations

Maxwell's equations, Tds relations, ratio of heat capacities, evaluation of thermodynamic properties from an equation of state.

UNIT -5- (10 HOURS)

Gas Power Cycles: Efficiency of air standard cycles, Carnot, Otto, Diesel cycles, P-V & T-S diagram, calculation of efficiency.

IC Engines:

Actual and theoretical PV diagrams of two stroke and four stroke IC engines. Performance of IC engines, Heat Balance sheet calculations. Introduction to dynamometer

TEXT BOOKS

Sl.no	Title of the Book	Name of the Author	Name of the Publishers	Edition and Year
1	Fundamentals of Engineering Thermodynamics;	Rathakrishnan E	PhI Learning Pvt. Ltd-New Delhi	2nd revisededition, (2005).
2	Engineering Thermodynamics	P K Nag	Tata McGraw Hill Education Private Limited	4th Edition, (2008).

REFERENCE BOOKS'

	Title of the Book	Name of the Author	Name of the Publishers	Edition and Year
1	Thermodynamics: An Engineering Approach	Yunus A. Cengel and Michael A. Boles	McGraw-Hill College	;4thedition; ISBN-10: 0072383321; (2001)
2	Basics of Aerothermodynamics (Progress in Astronautics and Aeronautics)	Ernst Heinrich Hirschel	Springer	2005
3	Engineering Thermodynamics: Work and Heat Transfer	Rogers GFC and Mayhew Y	Longman	4thEdition; ISBN-10: 0582045665; (1992).
4	Basic Engineering Thermodynamics	Rayner Joel	Pearson India	1stEdition; ISBN-10: 8131718883; (2008)

ONLINE RESOURCES	Link
NPTEL	https://nptel.ac.in/courses/101104063/
NPTEL	https://nptel.ac.in/noc/courses/noc20/SEM2/noc20-me51
NPTEL	https://nptel.ac.in/courses/112103275/
MIT OCW	https://nptel.ac.in/courses/101104067/
TU Delft	https://ocw.mit.edu/courses/materials-science-and-engineering/3-205-thermodynamics-and-kinetics-of-materials-fall-2006/lecture-notes/

COURSE ASSESSMENT METHOD

Continuous Internal Evaluation (CIE)

Three internals tests (each 30 marks) are conducted, average of best two performances will be considered.

1. Minimum two Assignments/Model making - evaluated through rubrics for 10 marks. Average of two will be considered.
2. Tutorial classes and assessment are carried out/Surprise quiz tests are conducted and evaluated for 10 marks. Average of these two will be considered.

Semester End Examination (SEE)

1. Two Questions are to be set from each unit, carrying 20 Marks each.
2. Students have to answer 5 questions selecting one full question from each unit

Program Outcomes – Articulation matrix

PO	1	2	3	4	5	6	7	8	9	10	11	12	PSO1	PSO2
CO1	3	3							3	3				**3**
CO2	3	3							3	3				3
CO3	3	3							3	3				3
CO4	3	3							3	3				**3**
CO-5	3	3							3	3				3

SOLID MECHANICS				
Course Code	18AE34		**Credits**	3
Hours/Week (L-T-P)	3		**CIE Marks**	50
Total Hrs	48		**SEE Marks**	50
Exam Hrs	3		**Course Type**	Core

COURSE OUTCOMES

Course outcomes: After completion of the course, students will be able to-

1. Summarize and interpret the concepts of simple and compound stresses and related strain in structural members
2. Solve and predict the effects of force and moments (shear Force and Bending Moment) on beams
3. Analyse the Bending Stresses and shear stress in Beams due to bending
   Solve and analyze the problems on deflection of beam and torsion effect on shaft
4. Outline the failure theories for structural members of materials of all the composition

TEACHING METHODOLOGY

- Blackboard teaching/PowerPoint presentation (if needed)
- Tutorial classes on problems

COURSE CONTENTS

UNIT -1- (10 HOURS)

Stresses and Strains: Introduction to Stress, Types of stress, Strain, Types of Strain, Modulus of Elasticity, True Stress, True Strain, Simple problems, Stress Strain Diagram of Ductile, Brittle, Visco- Elastic, Linear & Non-linear Elastic materials, Bars with varying sections, Bars of composite sections, Simple problems, Thermal stresses, Simple problems, Elastic constants and its relation, volumetric stains, Simple problems.

Compound Stresses: Methods of Determining stresses in oblique sections, Principal planes and stresses, Simple problems, Construction of Mohr's circle, simple problems

UNIT -2- (10 HOURS)

Shear Force and Bending Moment Diagram: Introduction to shear force, Bending moment, Types of Beams and loads, Sign convention for shear force and bending moment, Shear force and bending moment diagram for various beams. Relation between shear force and bending moment.

UNIT -3- (08 HOURS)

Bending Stresses and shear stress in Beams: Introduction, Pure Bending and Simple Bending, Expression of Bending stress, Neutral axis and Moment of resistance, bending stress in symmetrical sections, Section modulus, Section modulus for various shapes of the beam section. Introduction to shear stress, shear stress distribution for different section

UNIT -4- (10 HOURS)

Deflection of Beams: Introduction to Deflection and slope, Finding Deflection and slope of a beam subjected to various loads, Relation between slope, Deflection and radius of curvature, Simple problems to be solved for the beams experiencing various loads.

Torsion of Shafts: Introduction to torsion, Derivation of shear stress produced in a circular shaft subjected to Torsion, Expression of Torque in terms of polar moment of Inertia, Power transmitted by shaft, simple problem.

UNIT -5- (10 HOURS)

Column and struts: Introduction to columns and struts, Failure of a column, Expression of crippling load when (a) both ends are hinged (b) One end of the column is fixed and the other end is free (c) both ends are fixed (d) One end is fixed and the other end is hinged. Simple problems to be solved used Euler's formula and Rankine formula.

Theory of Failures: Maximum principal stress theory, Maximum principal strain theory, Maximum shear stress theory, Maximum strain energy theory, Maximum shear strain Energy theory. Graphical representation of theories for two-dimensional stress system (No problems).

Thick and Thin cylinders: Thin cylinders subjected to internal pressure. Stresses in a thin cylinder subjected to internal pressure, Expression of circumferential stress and hoop stress, Simple problems Thick Cylinder: Lame's theorem, Stresses in a thick cylinder, Simple problems to be solved.

TEXT BOOKS

Sl.no	Title of the Book	Name of the Author	Name of the Publishers	Edition and Year
1	Strength of Materials	R K Bansal	Laxmi Publication Pvt Ltd., New Delhi	2004
2	Strength of Materials	Ramamrutham	Vikas Publication, New Delhi	Eighth edition (2014)
3	Mechanics of materials	Gere and Timoshenko	CBS Publishers & Distributors	2^{nd} edition, 2006

REFERENCE BOOKS'

Sl.no	Title of the Book	Name of the Author	Name of the Publishers	Edition and Year
1	Engineering Mechanics of Solids	Egor P. Popov	PHI publications	2^{nd} edition
2	Mechanics of materials	RC Hbbeler	Pearson publications	9^{th} edition,
3	Mechanics of Materials	B.C. Punmia, Ashok Kumar Jain & Arun Kumar Jain	Laxmi publications, New Delhi	2006

ONLINE RESOURCES	Link
NPTEL	https://youtu.be/N68fNrRa8-M
NPTEL	https://nptel.ac.in/noc/courses/noc20/SEM2/noc20-me84
NPTEL	https://ocw.mit.edu/courses/civil-and-environmental-engineering/1-050-solid-mechanics-fall-2004
MIT OCW	https://youtu.be/N68fNrRa8-M

COURSE ASSESSMENT METHOD

Continuous Internal Evaluation (CIE)

Three internals tests (each 30 marks) are conducted, average of best two performances will be considered.

1. Minimum two Assignments/Model making - evaluated through rubrics for 10 marks. Average of two will be considered.

2. Tutorial classes and assessment are carried out/Surprise quiz tests are conducted and evaluated for 10 marks. Average of these two will be considered.
Semester End Examination (SEE)
1. Two Questions are to be set from each unit, carrying 20 Marks each.
2. Students have to answer 5 questions selecting one full question from each unit

Program Outcomes – Articulation matrix

PO	1	2	3	4	5	6	7	8	9	10	11	12	PSO1	PSO2
CO1	3	3							**2**	**2**			3	
CO2	3	3							2	2			2	
CO3	3	2							2	2			3	
CO4	3	3							2	2			3	
CO-5	3	3							2	2			3	

FLUID MECHANICS				
Course Code	18AE35		**Credits**	3
Hours/Week (L-T-P)	3		**CIE Marks**	50
Total Hrs	48		**SEE Marks**	50
Exam Hrs	3		**Course Type**	Core

COURSE OUTCOMES

Course outcomes: After completion of the course, students will be able to-

1. Identify fluid properties and distinguish between different types of manometers understanding.
2. Apply principles of dimensional analysis and similitude to simple engineering problems and describe buoyancy force.
3. Discuss the continuity equation and flow visualization techniques
4. Analyze the forces and energy for the fluid flow in a conduit and compare the different flow measuring devices.
5. Evaluate the losses and viscous effects in the flow through pipes.

TEACHING METHODOLOGY

- Blackboard teaching/PowerPoint presentation (if needed)
- Tutorial classes

COURSE CONTENTS

UNIT -1- (09 HOURS)

Fluids: Introduction, Types of fluid, Properties of fluids.
Fluid Statistics: Fluid pressure at a point, Pascal's law, pressure variation in a static fluid, absolute, gauge, atmospheric and vacuum pressures, simple manometers and differential manometers. Total pressure and center of pressure on submerged plane surfaces; horizontal, vertical and inclined plane surfaces, curved surface submerged in liquid.

UNIT -2- (09 HOURS)

Buoyancy: Buoyancy, center of buoyancy, meta-centre and meta-centric height, conditions of equilibrium of floating and submerged bodies, determination of Meta-centric height experimentally and theoretically.
Dimensional Analysis: Introduction, derived quantities, dimensions of physical quantities, dimensional homogeneity, Rayleigh's method, Buckingham's π theorem, dimensionless numbers, similitude, types of similitude.

UNIT -3- (10 HOURS)

Fluid Kinematics: Types of fluid flow, continuity equation in 2D and 3D (Cartesian Co-ordinates only), velocity and acceleration, Flow net: its characteristics and utility. Fundamentals of flow visualization stream tube, timelines, flow visualization techniques, Plots of fluid flow data: profile plot, vector plot, and contour plot.

UNIT -4- (10 HOURS)

Fluid Dynamics: Introduction equation of motion, Bernoulli's equation from first principles and also from Euler's equation, limitations of Bernoulli's equation.
Fluid Flow Measurements: Venturimeter, orifice meter, pitot-tube, vertical orifice, V-Notch and rectangular notches.

UNIT -5- (10 HOURS)
Flow through pipes: Minor losses through pipes. Darcy's and Chezy's equation for loss of head due to friction in pipes. HGL and TEL. **Laminar flow and viscous effects** : Reynolds's number, critical Reynold's number, laminar flow through circular pipe-Hagen Poiseille's equation, laminar flow between parallel and stationary plates. Boundary layer concept, displacement, momentum and energy thickness

TEXT BOOKS

Sl.no	Title of the Book	Name of the Author	Name of the Publishers	Edition and Year
1	Fluid Mechanics	Dr. R K Bansal,	Lakshmi Publications	2004
2	Engineering Fluid Mechanics	Prof. K L Kumar	S Chand publications	Eighth revised multi-color edition 2009.
3	Fluid Mechanics (SI Units)	Yunus A. Cengel John M. Simbala	Tata McGraw Hill,	2nd Edition., 2006.

REFERENCE BOOKS'

Sl.no	Title of the Book	Name of the Author	Name of the Publishers	Edition and Year
1	Fluid Mechanics and hydraulics	Dr. Jagadish lal	Metropolitan Book Co-Ltd.	1997
2	Fluid Mechanics and Fluid Power Engineering	Kumar D.S	Kataria and Sons	2004
3	Fluid mechanics	Frank M White	McGraw- Hill	7th Edition
4	Introduction to fluid mechanics	Fox and McDonald's, Philip J. Pritchard, John C. Leylegian	John Wiley & Sons	8th Edition, Inc.2011.

ONLINE RESOURCES	Link
NPTEL	https://youtu.be/TKk3Sqbsdbg
NPTEL	https://nptel.ac.in/courses/112105269/
NPTEL	https://nptel.ac.in/courses/112105206/
MIT OCW	https://ocw.mit.edu/courses/find-by-topic/#cat=engineering&subcat=mechanicalengineering&spec=fluidmechanics

COURSE ASSESSMENT METHOD

Continuous Internal Evaluation (CIE)

Three internals tests (each 30 marks) are conducted, average of best two performances will be considered.

1. Minimum two Assignments/Model making - evaluated through rubrics for 10 marks. Average of two will be considered.
2. Tutorial classes and assessment are carried out/Surprise quiz tests are conducted and evaluated for 10 marks. Average of these two will be considered.

Semester End Examination (SEE)

1. Two Questions are to be set from each unit, carrying 20 Marks each.
2. Students have to answer 5 questions selecting one full question from each unit

Program Outcomes – Articulation matrix

PO	1	2	3	4	5	6	7	8	9	10	11	12	PSO1	PSO2
CO1	2	2												3
CO2	3	3												3
CO3	3	3												2
CO4	3	2												2
CO-5	3	3												2

PROGRAM ELECTIVE –A

FLIGHT SCHEDULING AND OPERATIONS				
Course Code	18AEE361		**Credits**	3
Hours/Week (L-T-P)	3		**CIE Marks**	50
Total Hrs	39		**SEE Marks**	50
Exam Hrs	3		**Course Type**	Program Elective

COURSE OUTCOMES

Course outcomes: After completion of the course, students will be able to-

1. Discuss the Network Flows and Integer Programming Models
2. Understand the Aircraft Routing and Management of Irregular Operations
3. Explain the Significance of flight scheduling
4. Discuss the Fleet Assignment, Crew and Manpower Scheduling
5. Discuss the Gate Assignment and Aircraft Boarding Strategy

TEACHING METHODOLOGY

- Blackboard teaching/PowerPoint presentation (if needed)

COURSE CONTENTS

UNIT -1- (08 HOURS)

Network Flows and Integer Programming Models: Complexity of airline planning, operations and dispatch- need for optimization- role of operations research and simulation. Networks- definitions, network flow models- shortest path problem, minimum cost flow problem, maximum flow problem, multi-commodity problem. mathematical formulation-decision variables, objective function, constraints, and methods of solution.

UNIT -2- (08 HOURS)

Fleet Assignment, Crew and Manpower Scheduling: Purpose of fleet assignment. Fleet types, fleet diversity, and fleet availability-performance measures, Formulation of the fleet assignment problem- decision variables, objective function, constraints, and solution. Scenario analysis, fleet assignment models. Crew scheduling process-significance. Development of crew pairing- pairing generators- mathematical formulation of crew pairing problem methods of solution. Crew rostering- rostering practices. The crew rostering problem-formulation solutions.

UNIT -3- (08 HOURS)

Manpower scheduling- modeling, formulation of the problem, solutions
Flight Scheduling: Significance of flight scheduling: The route system of the airlines-point-to-point flights, hub and spoke flights. Schedule construction-operational feasibility, economic viability. Route development and flight scheduling process- load factor and frequency- case study

UNIT -4- (08 HOURS)

Aircraft Routing and Management of Irregular Operations: Goal of aircraft routing-maintenance requirements, other constraints. Routing cycles, route generators. Mathematical models of routing- decision variables, objective functions, alternatives, constraints- flight coverage and aircraft available. Example problems and solutions. The problem statement, the time band approximation model-formulation of the problem-the scenarios- solution

UNIT -5- (08 HOURS)

Gate Assignment and Aircraft Boarding Strategy: Gate assignment-significance- the problem-levels of handling-passenger flow, distance matrix mathematical formulation, solution. Common strategies for aircraft boarding process, mathematical model, interferences, model description, aisle interferences

TEXT BOOKS

Sl.no	Title of the Book	Name of the Author	Name of the Publishers	Edition and Year
1	Airline Operations and Scheduling	Bazargan M,	Ash gate Publishing Ltd	2nd edition,2010

REFERENCE BOOKS'

Sl.no	Title of the Book	Name of the Author	Name of the Publishers	Edition and Year
1	The Global Airline Industry	Belobaba P, Odoni, A., Barnhart, C	Wiley	2009
2	Wensveen, J.G	Air Transportation: A Management Perspective	1. Ashgate Publishing Ltd.	6th Edition, 2007.
3	Network Flows-Theory, Algorithms and Applications	Ahuja, R. et al	Prentice-Hall	1993

3.

ONLINE RESOURCES	Link
MIT OCW	https://ocw.mit.edu/courses/civil-and-environmental-engineering/1-206j-airline-schedule-planning-spring-2003/download-course-materials/
MIT OCW	https://ocw.mit.edu/courses/civil-and-environmental-engineering/1-206j-airline-schedule-planning-spring-2003/lecture-notes/

COURSE ASSESSMENT METHOD

Continuous Internal Evaluation (CIE)

Three internals tests (each 30 marks) are conducted, average of best two performances will be considered.

1.Minimum two Assignments/Model making - evaluated through rubrics for 10 marks. Average of two will be considered.

2.Tutorial classes and assessment are carried out/Surprise quiz tests are conducted and evaluated for 10 marks. Average of these two will be considered.

Semester End Examination (SEE)

1. Two Questions are to be set from each unit, carrying 20 Marks each.
2. Students have to answer 5 questions selecting one full question from each unit

Program Outcomes – Articulation matrix

PO	1	2	3	4	5	6	7	8	9	10	11	12	PSO1	PSO2
CO1														
CO2	3	3											1	2
CO3	3	3	3		3								1	2
CO4	3	2	3		3								1	2
CO-5	2	3	3		3								1	2

INTRODUCTION TO SPACE SCIENCE AND SPACE TECHNOLOGY				
Course Code	18AEE362		**Credits**	3
Hours/Week (L-T-P)	3		**CIE Marks**	50
Total Hrs	39		**SEE Marks**	50
Exam Hrs	3		**Course Type**	Program Elective

COURSE OUTCOMES

Course outcomes: After completion of the course, students will be able to-

1. Explain the fundamentals of rocket propulsion and trajectories
2. Describe the solar system.
3. Describe the trajectory, motion of rockets, satellite launch and satellite orbits.
4. Outline the Satellite Applications and interplanetary mission

TEACHING METHODOLOGY

- Blackboard teaching/PowerPoint presentation (if needed) /Flipped Classes for specified topics
- Regular review of students by asking questions based on topics covered in the class

COURSE CONTENTS

UNIT -1- (08 HOURS)

Earth and Atmosphere: The Planet Earth; Earth's Gravitational Field; Earth as an Ellipsoid; Peer- shaped Earth; Ellipticity of the Earth; The Geoid and Its Importance; Thermal Structure of the Atmosphere; Atmospheric Density Variation; Van-Allen Radiation Belt; The Ionosphere.

UNIT -2- (07 HOURS)

Solar System: Motion and Rotation of the Planets; Geocentric and Heliocentric Systems; Sidereal and Synodic Periods; Ecliptic Plane and the Zodiac; Direct and Retrograde Motions; Configuration and Phases of Interior Planets; Configurations of Exterior Planets; Asteroids; Comets; Meteors, Meteorites and Tektites; Micrometeorites; The Milky Way, the Galaxies and the Universe.

UNIT -3- (08 HOURS)

Trajectory and rocket: Mass ratio and propellant mass fraction, equation of motion of an ideal rocket. Motion of rocket in a gravitational field, simplified vertical trajectory, burnout velocity and burn out height, step rockets, ideal mission velocity and losses effect of launch angle, factors causing dispersion of rockets in flight, dispersion of finned rockets, stability of flight.

UNIT -4- (08 HOURS)

Satellite Launch and Satellite Orbits: Orbits and Trajectories; Conic Sections; Kepler's Laws of Satellite Motion; Orbital Velocity of Satellites; Orbital Periods; Eccentric Elliptical Orbits; Effect of Injection Conditions; Perturbation of Orbits; Effect of Earth's Rotation; Low Earth Orbits; Geostationary Satellites; Sun- synchronous Satellites. Parking Orbit; Transfer Trajectory; Impulsive Shot; Launching of Interplanetary Spacecraft.

UNIT -5- (08 HOURS)

Satellite Applications and interplanetary mission: Satellite for metrological, communication, navigational and geodetic applications, atmospheric sounding rocket, satellite for geophysical and interplanetary studies, parkin**g** orbit, transfer trajectory, impulsive shot, launching of interplanetary space craft.

TEXT BOOKS

Sl.no	Title of the Book	Name of the Author	Name of the Publishers	Edition and Year
1	Spaceflight dynamics	W.E. Wiesel	McGraw Hill	1997
2	Rocket propulsion elements	George P. Sutton, Oscar Biblarz	Wiley	9th Edition

REFERENCE BOOKS'

Sl.no	Title of the Book	Name of the Author	Name of the Publishers	Edition and Year
1	Rocket Propulsion and Space flight dynamics	Cornelisse, Schoyer HFR and Wakker KF	Pitman	1984
2	Fundamentals of Space Systems	Vincet L. Pisacane	Oxford University Press	2005
3	Understanding Space: An Introduction to Astronautics	J. Sellers	McGraw Hill,	2000
4	Introduction to Space Flight	Francis J Hale	Prentice-Hall	1994
5	Spacecraft Mission Design	Charies D. Brown	AIAA education Series	1998
6	Elements of Space Technology for aerospace Engineers	Meyer Rudolph X	Academic Press	1999

ONLINE RESOURCES	Link
NPTEL	https://nptel.ac.in/courses/101105077/
NPTEL	https://nptel.ac.in/courses/101106082/
NPTEL	https://nptel.ac.in/courses/101105083/
MIT OCW	https://ocw.mit.edu/courses/aeronautics-and-astronautics/16-83x-space-systems-engineering-spring-2002-spring-2003
TU Delft	https://ocw.mit.edu/courses/aeronautics-and-astronautics/16-512-rocket-propulsion-fall-2005

COURSE ASSESSMENT METHOD

Continuous Internal Evaluation (CIE)

Three internals tests (each 30 marks) are conducted, average of best two performances will be considered.

1. Minimum two Assignments/Model making - evaluated through rubrics for 10 marks. Average of two will be considered.
2. Tutorial classes and assessment are carried out/Surprise quiz tests are conducted and evaluated for 10 marks. Average of these two will be considered.

Semester End Examination (SEE)

1. Two Questions are to be set from each unit, carrying 20 Marks each.
2. Students have to answer 5 questions selecting one full question from each unit

Program Outcomes – Articulation matrix

PO	1	2	3	4	5	6	7	8	9	10	11	12	PSO1	PSO2
CO1	3								2	2		2		
CO2	3	2							2	2		2		
CO3	3	2							2	2		2		
CO4	3	2							2	2		2		
CO-5	2	2							2	2		2		

MECHANICAL MEASURMENTS & METROLOGY				
Course Code	18AEE363		**Credits**	3
Hours/Week (L-T-P)	3		**CIE Marks**	50
Total Hrs	39		**SEE Marks**	50
Exam Hrs	3		**Course Type**	Program Elective

COURSE OUTCOMES

Course outcomes: After completion of the course, students will be able to-

1. Illustrate concept of standards, system, methods of measurements, error, quality etc.,
2. Interpret measurement of variables like force, torque and pressure
3. Outline the fundamentals of thermocouple, pyrometers and strain measurement
4. Describe Metrology Standards and Systems of Limits, Fits and Tolerances
5. Identify the basic standards of measurement, limits, fits, tolerances, comparators and screw threads

TEACHING METHODOLOGY

- Blackboard teaching/PowerPoint presentation (if needed)

COURSE CONTENTS

UNIT -1- (09 HOURS)

Introduction to Measurement System:
Definition, Requirements and Significance of measurement system, Methods of measurements, Generalized measurement systems, Definition and basic concepts of Accuracy, Precision, Calibration, threshold, sensitivity, hysteresis, repeatability, linearity, System response, delay, Errors in measuring instruments.
Transducers: Definition, Classifications of transducers, Mechanical transducers, Electrical transducers, piezoelectric transducers, Electronic transducers, Radio-frequency identification (RFID).

UNIT -2 (07 HOURS)

Measurement of Force, Torque and Pressure:
Introduction, Analytical Balance, Platform Balance, Proving Ring, Types of Dynamometers, Use of Elastic Members in Pressure Measurement, Mc- Leod Gauge, the Bridgman Gauge, Thermal Conductivity Gages - Pirani Thermal Conductivity Gage, Thermocouple Vacuum Gage.

UNIT -3- (08 HOURS)

Temperature Measurements and Strain Gage:
Introduction, Electrical Resistance thermometer, Thermoelectric Effects, Thermocouple, Laws of Thermocouples, Thermocouple materials and construction.
Optical Pyrometers and Radiation Pyrometers, Mechanical Strain Gages, Optical Strain Gages, and Electrical Resistance Strain Gages – Unbonded type,
Bonded Type and Piezo resistive strain gages Preparation and Mounting of strain Gages, Gage Factor, Strain Measurement using wheatstone bridge, Calibration of Strain Gages

UNIT -4- (07 HOURS)

Metrology Standards and Systems of Limits, Fits and Tolerances:
Introduction, objectives of metrology, Standards of Length – International Prototype meter, Imperial Standard Yard, Wavelength standard, Subdivision of standards – Line Standard and End Standard, Calibration of End bars (Numerical), Slip Gauges, Wringing Phenomena,

Indian Standards (M-81, M-112), Numerical Problems on Building of Slip Gages.
Introduction, Limit System, Definition of Limits, Concept of Limits of Size and Tolerance, Definition of Fit, Types of Fit and their designation, Special Types of Fit.
Definition of Tolerance, Unilateral and Bilateral Tolerance, Concept of Interchangeability and Selective Assembly.

UNIT -5- (07 HOURS)

Metrology Standards and Systems of Limits, Fits and Tolerances:
Introduction, objectives of metrology, Standards of Length – International Prototype meter, Imperial Standard Yard, Wavelength standard, Subdivision of standards – Line Standard and End Standard, Calibration of End bars (Numerical), Slip Gauges, Wringing Phenomena, Indian Standards (M-81, M-112), Numerical Problems on Building of Slip Gages.
Introduction, Limit System, Definition of Limits, Concept of Limits of Size and Tolerance, Definition of Fit, Types of Fit and their designation, Special Types of Fit.
Definition of Tolerance, Unilateral and Bilateral Tolerance, Concept of Interchangeability and Selective Assembly.

TEXT BOOKS

Sl.no	Title of the Book	Name of the Author	Name of the Publishers	Edition and Year
1	Mechanical measurements	Beckwith Marangoni and Lienhard	Pearson Education	6th Ed., 2006
2	Engineering Metrology	R.K.Jain	Khanna Publishers	1994

REFERENCE BOOKS'

Sl.no	Title of the Book	Name of the Author	Name of the Publishers	Edition and Year
1	Engineering Metrology	I.C.Gupta	Dhanpat Rai Publications, Delhi	
2	Mechanical measurements	R.K.Jain	Pearson Education India	6th edition (2013)
3	Industrial Instrumentation	Alsutko, Jerry. D.Faulk	Thompson Asia Pvt. Ltd	2002
4	Measurement Systems Applications and Design	Ernest O, Doblin	McGraw Hill Book Co.	6 edition (1 July 2017)

ONLINE RESOURCES	Link
NPTEL	https://nptel.ac.in/courses/112107242/
NPTEL	https://nptel.ac.in/courses/112103261/
NPTEL	https://nptel.ac.in/courses/112106237/
MIT OCW	https://ocw.mit.edu/courses/biological-engineering/20-309-biological-engineering-ii-instrumentation-and-measurement-fall-2006

COURSE ASSESSMENT METHOD

Continuous Internal Evaluation (CIE)

Three internals tests (each 30 marks) are conducted, average of best two performances will

be considered.
1 Minimum two Assignments/Model making - evaluated through rubrics for 10 marks. Average of two will be considered.
2.Tutorial classes and assessment are carried out/Surprise quiz tests are conducted and evaluated for 10 marks. Average of these two will be considered.

Semester End Examination (SEE)

1. Two Questions are to be set from each unit, carrying 20 Marks each.
2. Students have to answer 5 questions selecting one full question from each unit

Program Outcomes – Articulation matrix:

PO	1	2	3	4	5	6	7	8	9	10	11	12	PSO1	PSO2
CO1														
CO2	3	3		1								1		2
CO3	3	2		1		1								3
CO4	3	3				1								2
CO-5	3	3										2		2

AIRPORT PLANNING & MANAGEMENT				
Course Code	18AEE364		**Credits**	3
Hours/Week (L-T-P)	3		**CIE Marks**	50
Total Hrs	39		**SEE Marks**	50
Exam Hrs	3		**Course Type**	Program Elective

COURSE OUTCOMES

Course outcomes: After completion of the course, students will be able to-

1. Explain the typical operations of airports from a management perspective
2. Identify the economic, political and social role of airports
3. Discuss the airport financial management
4. Explain and defining capacity, factors affecting capacity and delay

TEACHING METHODOLOGY

- Blackboard teaching/PowerPoint presentation (if needed)

COURSE CONTENTS

UNIT -1- (08 HOURS)

Airports and Airport Systems: Introduction: Airport management on an international level; The national plan of integrated airport systems; The nation's airport system plan; The rules that govern airport management; Organizations that influence airport regulatory policies; A historical and legislative perspective: Introduction the formative period of aviation and airports, Airport growth: World War-II and the postwar period airport modernization: The early jet age.

UNIT -2- (08 HOURS)

Components of the airport

The components of an airport, the airfield. Navigational aids (NAVAIDS) located on airfields; Air traffic control and surveillance facilities located on the airfield; Weather reporting facilities located on airfields; Security infrastructure on airfields; Airspace and air traffic control: Brief history of air traffic control; The basics of air traffic control; Current and future enhancements to air traffic control; Airport terminals and ground access: The historical development of airport terminals; Components of the airport terminal; Airport ground access

UNIT -3- (08 HOURS)

Airport operations and financial management

Airport operations management: Introduction, pavement management, aircraft rescue and firefighting (ARFF); Snow and ice control, safety inspection programs. Bird and wildlife hazard management; Airport security: Security at commercial service airports, security at general aviation airports; the future of airport security

UNIT -4- (08 HOURS)

Airport financial management

Airport financial accounting, revenue strategies at commercial airports, pricing of airport facilities and services, variation in the sources of operating revenues, rise in airport financial burdens, airport funding, grant programs, airport financing, private investment sale of the airport.

UNIT -5- (07 HOURS)

Airport capacity and delay

Defining capacity, factors affecting capacity and delay, estimating capacity, analytical estimates of delay: The queuing diagram; The future of airport management: Introduction, restructuring of commercial air carriers, new large aircraft and small aircraft transportation systems.

TEXT BOOKS

Sl.no	Title of the Book	Name of the Author	Name of the Publishers	Edition and Year
1	Airport planning and Management	Alexander T Wells, Ed. D Seth Young	McGraw-Hill Education	6nd Edition, 2011

REFERENCE BOOKS'

Sl.no	Title of the Book	Name of the Author	Name of the Publishers	Edition and Year
1	Airport Operations	Norman J. Ashford, H. P. Martin Stanton, Clifton A. Moore, Pierre Coutu	McGraw Hill	3rd Edition, 2013

ONLINE RESOURCES	Link
NPTEL	https://nptel.ac.in/courses/101101083/
NPTEL	https://nptel.ac.in/noc/courses/noc18/SEM1/noc18-ae03
NPTEL	https://nptel.ac.in/noc/courses/noc20/SEM1/noc20-ae03
MIT OCW	https://ocw.mit.edu/courses/civil-and-environmental-engineering/1-206j-airline-schedule-planning-spring-2003
TU Delft	https://ocw.mit.edu/courses/aeronautics-and-astronautics/16-75j-airline-management-spring-2006

COURSE ASSESSMENT METHOD

Continuous Internal Evaluation (CIE)

Three internals tests (each 30 marks) are conducted, average of best two performances will be considered.

1. Minimum two Assignments/Model making - evaluated through rubrics for 10 marks. Average of two will be considered.

2.Tutorial classes and assessment are carried out/Surprise quiz tests are conducted and evaluated for 10 marks. Average of these two will be considered.

Semester End Examination (SEE)

1. Two Questions are to be set from each unit, carrying 20 Marks each.
2. Students have to answer 5 questions selecting one full question from each unit

Program Outcomes – Articulation matrix:

PO	1	2	3	4	5	6	7	8	9	10	11	12	PSO1	PSO2
CO1	3								3	3				
CO2	3								3	3			2	
CO3	3								3	3			3	
CO4	3								3	3			2	

ENVIRONMENTAL SCIENCE AND TECHNOLOGY				
Course Code	18AEE365		**Credits**	3
Hours/Week (L-T-P)	3		**CIE Marks**	50
Total Hrs	39		**SEE Marks**	50
Exam Hrs	3		**Course Type**	Program Elective

COURSE OUTCOMES

Course outcomes: After completion of the course, students will be able to-

1. Understand the scope and importance of ecosystem
2. Classify the natural and mineral resources.
3. Explain the biodiversity and biotic resources of India.
4. Describe the Environmental pollution, control technologies and environmental policy, legislation & EIA
5. Describe environmental policy, legislation & EIA

TEACHING METHODOLOGY

- Blackboard teaching/PowerPoint presentation (if needed)
- Videos and animation

COURSE CONTENTS

UNIT -1- (08 HOURS)

Ecosystems: Definition, Scope and Importance of ecosystem. Classification, structure, and function of an ecosystem, Food chains, food webs, and ecological pyramids. Flow of energy, Biogeochemical cycles, Bioaccumulation, Bio magnification, ecosystem value, services and carrying capacity, Field visits.

UNIT -2- (08 HOURS)

Natural Resources: Classification of Resources: Living and Non-Living resources, **water resources:** use and over utilization of surface and ground water, floods and droughts, Dams: benefits and problems. **Mineral resources:** use and exploitation, environmental effects of extracting and using mineral resources, **Land resources:** Forest resources

UNIT -3- (08 HOURS)

Biodiversity and Biotic Resources: Introduction, Definition, genetic, species and ecosystem diversity. Value of biodiversity; consumptive use, productive use, social, ethical, aesthetic and optional values. India as a mega diversity nation, Hot spots of biodiversity. Field visit. Threats to biodiversity: habitat loss, poaching of wildlife, man-wildlife conflicts; conservation of biodiversity: In-Situ and Ex-situ conservation. National Biodiversity act.

UNIT -4- (08 HOURS)

Environmental Pollution and Control Technologies: Environmental Pollution: Classification of pollution, Air Pollution: Primary and secondary pollutants, Automobile and Industrial pollution, Ambient air quality standards. Water pollution: Sources and types of pollution, drinking water quality standards. Soil Pollution: Sources and types, Impacts of modern agriculture, degradation of soil. Noise

Pollution: Sources and Health hazards, standards, Solid waste: Municipal Solid Waste management, composition and characteristics of e-Waste and its management. Pollution control technologies: Wastewater Treatment methods: Primary, secondary and Tertiary. Overview of air pollution control technologies, Concepts of bioremediation.

Global Environmental Problems and Global Efforts: Climate change and impacts on human environment. Ozone depletion and Ozone depleting substances (ODS). Deforestation and desertification. International conventions / Protocols: Earth summit, Kyoto protocol, and Montréal Protocol.

UNIT -5- (07 HOURS

Environmental Policy, Legislation & EIA: Environmental Protection act, Legal aspects Air Act- 1981, Water Act, Forest Act, Wild life Act, Municipal solid waste management and handling rules, biomedical waste management and handling rules, hazardous waste management and handling rules. EIA: EIA structure, methods of baseline data acquisition. Overview on Impacts of air, water, biological and Socio-economical aspects. Strategies for risk assessment, Concepts of Environmental Management Plan (EMP).

Towards Sustainable Future: Concept of Sustainable Development, Population and its explosion, Crazy Consumerism, Environmental Education, Urban Sprawl, Human health, Environmental Ethics, Concept of Green Building, Ecological Foot Print, Life Cycle assessment (LCA), Low carbon life s

TEXT BOOKS

Sl.no	Title of the Book	Name of the Author	Name of the Publishers	Edition and Year
1	Textbook of Environmental Studies for Undergraduate Courses	Erach Bharucha	University Grants Commission	2nd Edition, 2013
2	Environmental Studies	R. Rajagopalan	Oxford University Press	2015

REFERENCE BOOKS'

Sl.no	Title of the Book	Name of the Author	Name of the Publishers	Edition and Year
1	Environmental Science: towards a sustainable future	Richard T. Wright	2008 PHL Learning Private Ltd. New Delhi	2008
2	Environmental Engineering and science	Gilbert M. Masters and Wendell P. Ela	PHI Learning Pvt. Ltd.	2008
3	Environmental Science	Daniel B. Botkin & Edward A. Keller	Wiley INDIA edition	
4	Environmental Studies	Anubha Kaushik	New age international publishers	4th Edition

ONLINE RESOURCES	Link
NPTEL	https://nptel.ac.in/courses/127105018/
NPTEL	https://nptel.ac.in/courses/121106014/

NPTEL	https://swayam.gov.in/nd1_noc20_ge16/preview
MIT OCW	https://ocw.mit.edu/courses/earth-atmospheric-and-planetary-sciences/12-102-environmental-earth-science-fall-2005
TU Delft	https://nptel.ac.in/courses/127105018/

COURSE ASSESSMENT METHOD

Continuous Internal Evaluation (CIE)

Three internals tests (each 30 marks) are conducted, average of best two performances will be considered.

1. Minimum two Assignments/Model making - evaluated through rubrics for 10 marks. Average of two will be considered.
2. Tutorial classes and assessment are carried out/Surprise quiz tests are conducted and evaluated for 10 marks. Average of these two will be considered.

Semester End Examination (SEE)

3.Two Questions are to be set from each unit, carrying 20 Marks each.

4.Students have to answer 5 questions selecting one full question from each unit

Program Outcomes – Articulation matrix:

PO	1	2	3	4	5	6	7	8	9	10	11	12	PSO1	PSO2
CO1	2					2	3		2	1		2		
CO2	2					2	3		2	1		2		
CO3	2					2	3		2	1		2		
CO4	2					2	3		2	1		2		
CO-5	2					2	3		2	1		2		

NON-CONVENTIONAL ENERGY RESOURCES				
Course Code	18AEE366		**Credits**	3
Hours/Week (L-T-P)	3		**CIE Marks**	50
Total Hrs	39		**SEE Marks**	50
Exam Hrs	3		**Course Type**	Program Elective

COURSE OUTCOMES

Course outcomes: After completion of the course, students will be able to-

1. Identify various non-conventional energy resources.
2. Explain the significance of solar thermal energy
3. Outline the applications of energy from geothermal and biomass
4. Describe the principle of working, performance thermo-electrical and thermionic conversions
5. Describe Bio-mass as part of non-conventional energy

TEACHING METHODOLOGY

- Blackboard teaching/PowerPoint presentation (if needed)
- Video and animation

COURSE CONTENTS

UNIT -1- (08 HOURS)

Introduction: Various non-conventional energy resources- Introduction, availability, classification, relative merits and demerits. Solar Cells: Theory of solar cells. solar cell materials, solar cell array, solar cell power plant, limitations.

UNIT -2- (08 HOURS)

Solar Thermal Energy: Solar radiation, flat plate collectors and their materials, applications and performance, focusing of collectors and their materials, applications and performance; solar thermal power plants, thermal energy storage for solar heating and cooling, limitations

UNIT -3- (08 HOURS)

Geothermal Energy: Resources of geothermal energy, thermodynamics of geo-thermal energy conversion-electrical conversion, non-electrical conversion, environmental considerations. Magneto-hydrodynamics (MHD): Principle of working of MHD Power plant, performance and limitations. Fuel Cells: Principle of working of various types of fuel cells and their working, performance and limitations

UNIT -4- (08 HOURS)

Thermo-electrical and thermionic Conversions: Principle of working, performance and limitations. Wind Energy: Wind power and its sources, site selection, criterion, momentum theory, classification of rotors, concentrations and augments, wind characteristics. performance and limitations of energy conversion systems

UNIT -5- (07 HOURS)

Bio-mass: Availability of bio-mass and its conversion theory. Ocean Thermal Energy Conversion (OTEC): Availability, theory and working principle, performance and limitations. Wave and Tidal Wave: Principle of working, performance and limitations. Waste Recycling Plants

TEXT BOOKS

Sl.no	Title of the Book	Name of the Author	Name of the Publishers	Edition and Year
1	Introduction to Non-Conventional Energy Resources	Raja et al	Scitech Publications	2015
2	Renewal Energy Resources	John Twideu and Tony Weir	BSP Publications	2006
3	Energy Resources: Conventional & Non-Conventional	M.V.R. Koteswara Rao	BSP Publications,	2006

REFERENCE BOOKS'

Sl.no	Title of the Book	Name of the Author	Name of the Publishers	Edition and Year
1	Non-conventional Energy Resources	D.S. Chauhan	New Age International	2012
2	Renewal Energy Technologies: A Practical Guide for Beginners	C.S. Solanki	PHI Learning.	2008
3	Advances in Energy System and Technology	Peter Auer	Academic Press	Vol. 1 & II Edited

ONLINE RESOURCES	Link
NPTEL	https://nptel.ac.in/courses/121106014/
NPTEL	https://nptel.ac.in/noc/courses/noc19/SEM2/noc19-ge22
NPTEL	https://swayam.gov.in/nd1_noc20_ge16/preview
MIT OCW	https://ocw.mit.edu/courses/earth-atmospheric-and-planetary-sciences/12-085-seminar-in-environmental-science-spring-2008

COURSE ASSESSMENT METHOD

Continuous Internal Evaluation (CIE)

Three internals tests (each 30 marks) are conducted, average of best two performances will be considered.

1. Minimum two Assignments/Model making - evaluated through rubrics for 10 marks. Average of two will be considered.
2. Tutorial classes and assessment are carried out/Surprise quiz tests are conducted and evaluated for 10 marks. Average of these two will be considered.

Semester End Examination (SEE)

1. Two Questions are to be set from each unit, carrying 20 Marks each.
2. Students have to answer 5 questions selecting one full question from each unit

Program Outcomes – Articulation matrix:

PO	1	2	3	4	5	6	7	8	9	10	11	12	PSO1	PSO2
CO1	2		1			2	3		1	1		2		
CO2	2		1			2	3		1	1		2		
CO3	2		1			2	3		1	1		2		
CO4	2		1			2	3		1	1		2		
CO-5	2		1			2	3		1	1		2		

INTRODUCTION TO PYTHON PROGRAMMING				
Course Code	18AEE367		**Credits**	3
Hours/Week (L-T-P)	3		**CIE Marks**	50
Total Hrs	39		**SEE Marks**	50
Exam Hrs	3		**Course Type**	Program Elective

COURSE OUTCOMES

Course outcomes: After completion of the course, students will be able to-

1. Develop algorithmic solutions to simple computational problems
2. Execute by hand simple Python programs.
3. Structure simple Python programs for solving problems.
4. Decompose a Python program into functions.
5. Represent compound data using Python lists, tuples, dictionaries.

TEACHING METHODOLOGY

- Blackboard teaching/PowerPoint presentation (if needed)
- Hands on sessions

COURSE CONTENTS

UNIT -1- (08 HOURS)

Introduction to Python: Python variables, Python basic Operators, Understanding python blocks. Python Data Types, Declaring and using Numeric data types: int, float etc.

UNIT -2- (08 HOURS)

Python Program Flow Control Conditional blocks: if, else and else if, Simple for loops in python, For loop using ranges, string, list and dictionaries. Use of while loops in python, Loop manipulation using pass, continue, break and else. Programming using Python conditional and loop blocks.

UNIT -3- (08 HOURS)

Python Complex data types: Using string data type and string operations, Defining list and list slicing, Use of Tuple data type. String, List and Dictionary, Manipulations Building blocks of python programs, string manipulation methods, List manipulation. Dictionary manipulation, Programming using string, list and dictionary in-built functions. Python Functions, Organizing python codes using functions.

UNIT -4- (08 HOURS)

Python File Operations: Reading files, Writing files in python, Understanding read functions, read(), readline(), readlines(). Understanding write functions, write() and writelines() Manipulating file pointer using seek Programming, using file operations. Database Programming: Connecting to a database, Creating Tables,INSERT, UPDATE, DELETE and READ operations, Transaction Control,Disconnecting from a database, Exception Handling in Databases.

UNIT -5- (07 HOURS)

Python packages: Simple programs using the built-in functions of packages matplotlib, numpy, pandas etc. GUI Programming: Tkinter introduction, Tkinter and PythonProgramming, Tk Widgets, Tkinter examples. Python programming with IDE.

TEXT BOOKS

Sl.no	Title of the Book	Name of the Author	Name of the Publishers	Edition and Year
1	Core Python Applications Programming	Wesley J. Chun	Pearson Education	3rd Edition 2016
2	Introduction to Computer Science using Python	Charles Dierbach	Wiley	2015
3	Introduction to Computing and Problem Solving with PYTHON,	Jeeva Jose & P.SojanLal,	Khanna Publishers, New Delhi	2016

REFERENCE BOOKS'

Sl.no	Title of the Book	Name of the Author	Name of the Publishers	Edition and Year
1	How to think like a Computer Scientist: Learning with Python	Downey, A. et al.,	John Wiley	2015
2	Learning Python	Mark Lutz,	Orelly Publication,	2013, 5th edition,
3	Python Cookbook	David Beazley, Brian Jones	Orelly Publication,	3rd Edition, 2013

ONLINE RESOURCES	Link
NPTEL	https://onlinecourses.nptel.ac.in/noc19_cs41/preview
NPTEL	https://onlinecourses.nptel.ac.in/noc21_cs21/preview
MIT OCW	https://ocw.mit.edu/courses/electrical-engineering-and-computer-science/6-01sc-introduction-to-electrical-engineering-and-computer-science-i-spring-2011/index.htm

COURSE ASSESSMENT METHOD

Continuous Internal Evaluation (CIE)

Three internals tests (each 30 marks) are conducted, average of best two performances will be considered.

1. Minimum two Assignments/Model making - evaluated through rubrics for 10 marks. Average of two will be considered.
2. Tutorial classes and assessment are carried out/Surprise quiz tests are conducted and evaluated for 10 marks. Average of these two will be considered.

Semester End Examination (SEE)

1. Two Questions are to be set from each unit, carrying 20 Marks each.
2. Students have to answer 5 questions selecting one full question from each unit

Program Outcomes – Articulation matrix:

PO	1	2	3	4	5	6	7	8	9	10	11	12	PSO1	PSO2
CO1	3	3	2						2	1	1	2		
CO2	3	3	2						2	1	1	2		
CO3	3	3	2						2	1	1	2		
CO4	3	3	2						2	1	1	2		
CO-5	3	3	2						2	1	1	2		

INTRODUCTION TO ROBOTICS				
Course Code	18AEE368		**Credits**	3
Hours/Week (L-T-P)	3+0+0		**CIE Marks**	50
Total Hrs	39		**SEE Marks**	50
Exam Hrs	03		**Course Type**	Program Elective

COURSE OUTCOMES

Course outcomes: After completion of the course, students will be able to-

1. Describe the principles mobility and DoF of robots
2. Identify open and closed loop systems
3. Select suitable laser range finders, communication and Bayesian Networks
4. Describe autonomy of robots in terms of multi robot coordination

TEACHING METHODOLOGY

- Blackboard teaching/PowerPoint presentation (if needed) /Flipped Classes for specified topics
- Regular review of students by asking questions based on topics covered in the class

COURSE CONTENTS

UNIT -1 (08 HOURS)

Mechanics

Introduction, motivation, mobility and degrees-of-freedom, manipulator kinematics, vehicle kinematics

UNIT -2 (08 HOURS)

Control

Open vs. closed loop control, analog and discreet linear models, optimal and adaptive control methods

UNIT -3 (08 HOURS)

Perception

Laser-range Finders and Odometry, Computer Vision, Localization

UNIT -4 (08 HOURS)

Artificial Intelligence

Communication, logic, Bayesian Networks,

UNIT -5 (07 HOURS)

Autonomy

Simultaneous localization and mapping, Robot architectures, multi robot coordination

TEXT BOOKS

Sl.no	Title of the Book	Name of the Author	Name of the Publishers	Edition and Year
1	Introduction to Robotics Mechanics and Control,	J J. Craig	Pearson Education, Inc,.	2005
2	Mechanisms and Robots Analysis with MATLAB,	Dan B. Marghitu	Springer-Verlag London Limited	2009

REFERENCE BOOKS'

Sl.no	Title of the Book	Name of the Author	Name of the Publishers	Edition and Year
1	Robot Modeling and Control,	Mark W. Spong, Seth Hutchinson, and M. Vidyasagar,	John Wiley & Sons, Inc.,	2006,
3	Introduction to Robotics Analysis, Control, Applications,	S B Niku,	John Wiley & Sons, Inc,	2011

ONLINE RESOURCES	Link
NPTEL	https://nptel.ac.in/courses/112/105/112105249/
MIT OCW	https://ocw.mit.edu/courses/mechanical-engineering/2-12-introduction-to-robotics-fall-2005/

COURSE ASSESSMENT METHOD

Continuous Internal Evaluation (CIE)

Three internals tests (each 30 marks) are conducted, average of best two performances will be considered.

1. Minimum two Assignments/Model making - evaluated through rubrics for 10 marks. Average of two will be considered.
2. Tutorial classes and assessment are carried out/Surprise quiz tests are conducted and evaluated for 10 marks. Average of these two will be considered.

Semester End Examination (SEE)

1. Two Questions are to be set from each unit, carrying 20 Marks each.
2. Students have to answer 5 questions selecting one full question from each unit

Program Outcomes – Articulation matrix:

PO	1	2	3	4	5	6	7	8	9	10	11	12	PSO1	PSO2
CO1	3	3												1
CO2	3	3												1
CO3	3	3												1
CO4	3	3												1

RAPID PROTOTYPING				
Course Code	18AEE369		**Credits**	3
Hours/Week (L-T-P)	3+0+0		**CIE Marks**	50
Total Hrs	39		**SEE Marks**	50
Exam Hrs	03		**Course Type**	Program Elective

COURSE OUTCOMES

Course outcomes: After completion of the course, students will be able to-

1. Describe the principles of rapid prototyping
2. Classify liquid based and solid based rapid prototyping systems
3. Identify powder based rapid prototyping systems
4. Select materials for rapid prototyping systems
5. Describe the concepts of reverse engineering and new technologies

TEACHING METHODOLOGY

- Blackboard teaching/PowerPoint presentation (if needed) /Flipped Classes for specified topics
- Regular review of students by asking questions based on topics covered in the class

COURSE CONTENTS

UNIT -1 (06 HOURS)

INTRODUCTION- History – Development of RP systems – Applications in Product Development, Reverse Engineering, Rapid Tooling, Rapid Manufacturing- Principle – Fundamental – File format – Other translators – medical applications of RP - On demand manufacturing – Direct material deposition - Shape Deposition Manufacturing..

UNIT -2 (08 HOURS)

LIQUID BASED AND SOLID BASED RAPID PROTOTYPING SYSTEMS- Classification – Liquid based system - Stereolithography Apparatus (SLA), details of SL process, products, Advantages, Limitations, Applications and Uses. Solid based system - Fused Deposition Modeling, principle, process, products, advantages, applications and uses - Laminated Object Manufacturing

UNIT -3 (08 HOURS)

POWDER BASED RAPID PROTOTYPING SYSTEMS -Selective Laser Sintering – principles of SLS process, principle of sinter bonding process, Laser sintering materials, products, advantages, limitations, applications and uses. Three Dimensional Printing – process, major applications, research and development. Direct shell production casting – key strengths, process, applications and uses, case studies, research and development. Laser Sintering System, e-manufacturing using Laser sintering, customized plastic parts, customized metal parts, e-manufacturing - Laser Engineered Net Shaping (LENS).

UNIT -4 (07 HOURS)

MATERIALS FOR RAPID PROTOTYPING SYSTEMS - Nature of material – type of material – polymers, metals, ceramics and composites- liquid based materials, photo polymer development – solid based materials, powder based materials - case study.

UNIT -5 (07 HOURS)

REVERSE ENGINEERING and NEW TECHNOLOGIES- Introduction, measuring device- contact type and non-contact type, CAD model creation from point clouds-preprocessing, point clouds to surface model creation, medical data processing - types of medical imaging, software for making medical models, medical materials, other applications - Case study.

TEXT BOOKS

Sl.no	Title of the Book	Name of the Author	Name of the Publishers	Edition and Year
1	Rapid Prototyping, "Principles and Applications",	Rafiq I. Noorani	Wiley & Sons,	2006.
2	"Rapid Prototyping: Principles and Applications",	Chua C.K, Leong K.F and Lim C.S	Second Edition, World Scientific,	2003

REFERENCE BOOKS'

Sl.no	Title of the Book	Name of the Author	Name of the Publishers	Edition and Year
1	"Rapid Manufacturing – An Industrial revolution for the digital age",	N.Hopkinson, R.J.M, Hauge, P M, Dickens,	Wiley,	2006,
2	"Advanced Manufacturing Technology for Medical applications: Reverse Engineering, Software conversion and Rapid Prototying",	Ian Gibson,	Wiley,	2006
3	, "Rapid Prototyping and Manufacturing : Fundamentals of Stereolithography",	Paul F.Jacobs	McGraw Hill,	1993

ONLINE RESOURCES	Link
NPTEL	https://nptel.ac.in/courses/112/104/112104265/
MIT OCW	https://ocw.mit.edu/courses/aeronautics-and-astronautics/16-810-engineering-design-and-rapid-prototyping-january-iap-2007/

COURSE ASSESSMENT METHOD

Continuous Internal Evaluation (CIE)

Three internals tests (each 30 marks) are conducted, average of best two performances will be considered.

1. Minimum two Assignments/Model making - evaluated through rubrics for 10 marks. Average of two will be considered.
2. Tutorial classes and assessment are carried out/Surprise quiz tests are conducted and evaluated for 10 marks. Average of these two will be considered.

Semester End Examination (SEE)

1. Two Questions are to be set from each unit, carrying 20 Marks each.
2. Students have to answer 5 questions selecting one full question from each unit

Program Outcomes – Articulation matrix:

PO	1	2	3	4	5	6	7	8	9	10	11	12	PSO1	PSO2
CO1	3	3											3	
CO2	3	3											3	
CO3	3	3											3	
CO4	3	3											3	
CO5	3	3											3	

SOLID MECHANICS LAB				
Course Code	18AEL37		**Credits**	1
Hours/Week (L-T-P)	3		**CIE Marks**	50
Total Hrs	39		**SEE Marks**	50
Exam Hrs	3		**Course Type**	Core

COURSE OUTCOMES

Course outcomes: After completion of the course, students will be able to-

1. Analyze the tensile, shear and compression characteristics of metallic specimens using Universal Testing Machine
2. Examine the torsion and bending strengths of metallic specimens.
3. Determine the impact strength of metallic specimen using Izod and Charpy testing machines
4. Analyze the hardness and fatigue properties of metallic specimen Carry out the Fatigue test of metallic specimen

TEACHING METHODOLOGY

- Blackboard teaching/PowerPoint presentation (if needed) /Flipped Classes for specified topics

List of experiments

1. Tensile test of metallic specimens using Universal Testing Machine
2. Shear test of metallic specimens using Universal Testing Machine Compression tests of metallic specimens using Universal Testing Machine
3. Torsion Test of metallic specimens
4. Bending Test on metallic specimens.
5. Izod impact test on metallic Specimen.
6. Charpy impact test on metallic Specimen.
7. Hardness test of metallic specimen using Brinell hardness testing machine
8. Hardness test of metallic specimen using Rockwell hardness testing machine
9. Hardness test of metallic specimen using Vickers testing machine
10. Fatigue test of metallic specimen

COURSE ASSESSMENT METHOD

Record: 30 marks

Test: 15 marks

Viva-voce: 05 marks

SEE - Final Exam: 50 Marks

Scheme of Examination: Student will be asked to conduct two experiment

Program Outcomes – Articulation matrix:

PO	1	2	3	4	5	6	7	8	9	10	11	12	PSO1	PSO2
CO1	3	3							3	2			3	
CO2	3	3		2					3	2			3	
CO3	3	2		2					2	2		1	3	
CO4	3	3		2					3	2		1	2	

FLUID MECHANICS LAB				
Course Code	18AEL38		**Credits**	1
Hours/Week (L-T-P)	3		**CIE Marks**	50
Total Hrs	39		**SEE Marks**	50
Exam Hrs	3		**Course Type**	Core

COURSE OUTCOMES

Course outcomes: After completion of the course, students will be able to-

1. Obtain the necessary practical skills & real time knowledge that helps them in long run to gain the abilities necessary to tackle the fluid mechanics problems
2. Apply scientific method for analyzing the qualitatively & quantitatively to solve the problem situations
3. Apply scientific method for analyzing the qualitatively & quantitatively to solve the problem situations
4. Compute the performance single stage and Multi stage centrifugal pup
5. Compute the performance of reciprocating pumps

List of experiments

1. Determination of Coefficient of Friction of flow in a pipe.
2. Determination of Minor Losses in Flow through pipes.
3. Determination of Force developed by impact on jets on Vanes.
4. Calibration of Orifice Plate
5. Calibration of Venturimeter
6. Calibration of Rotameter
7. Calibration of Nozzle
8. Performance testing of pumps Single stage centrifugal pump
9. Performance testing of multi stage centrifugal pump
10. Performance testing of Double acting Reciprocating pump.
11. Performance test on a two stage Reciprocating Air compressor.

Course Assessment Method:
Record: 30 marks
Test: 15 marks
Viva-voce: 05 marks
SEE - Final Exam: 50 Marks
Scheme of Examination: Student will be asked to conduct two experiment

Program Outcomes – Articulation matrix:

PO	1	2	3	4	5	6	7	8	9	10	11	12	PSO1	PSO2
CO1	3	3							3	3				**2**
CO2	3	3							3	3				2
CO3	3	3							3	3				2
CO4	3	2							3	2				3
CO-5	3	3							3	3				2

AEROTHERMAL ENGINEERING LAB				
Course Code	18AEL39A		**Credits**	1
Hours/Week (L-T-P)	3		**CIE Marks**	50
Total Hrs	39		**SEE Marks**	50
Exam Hrs	3		**Course Type**	Core

COURSE OUTCOMES

Course outcomes: After completion of the course, students will be able to-

1. Analyze the performance of diesel and petrol engines
2. Analyze the characteristics of fuels/Lubricates used in IC Engines
3. Determine the heat transfer phenomena predict the relevant coefficient using implementation
4. Determine the emissivity of grey surface
5. Analyse the performance of heat exchangers

List of experiments

Part-A

1. Determination of Flash Point and Fire Point of various fuels / lubricants.
2. Determination of viscosity of various fuels / lubricants
3. Valve Timing diagram of four stroke engine.
4. Performance and heat Balance Test on 4 – stroke Diesel Engine.
5. Morse Test on Multi-cylinder Petrol Engine

Part-B

1. Determination of Thermal conductivity of metal rod
2. Determination of Thermal conductivity of composite wall.
3. Determination of effectiveness on a metallic fin (natural & Forced)
4. Determination of emissivity of a grey surface.

COURSE ASSESSMENT METHOD

Record: 30 marks

Test: 15 marks

Viva-voce: 05 marks

SEE - Final Exam: 50 Marks

Scheme of Examination: Student will be asked to conduct one experiment from each part.

Program Outcomes – Articulation matrix:

PO	1	2	3	4	5	6	7	8	9	10	11	12	PSO1	PSO2
CO1	3	3							3	3				**3**
CO2	3	3							3	3				**3**
CO3	3	3							3	3				**3**
CO4	3	2							2	2				**3**
CO-5	3	3							3	3				**3**

SEMESTER- IV

ENGINEERING MATHEMATICS -IV				
Course Code	18MAT41		**Credits**	4
Hours/Week (L-T-P)	3		**CIE Marks**	50
Total Hrs	48		**SEE Marks**	50
Exam Hrs	3		**Course Type**	Core

COURSE OUTCOMES

Course outcomes: After completion of the course, students will be able to-

1. Concepts of Numerical methods can be applied to problem solving, finding Eigen values, solving ODE and PDE
2. Physical situations can be modeled and solutions can be obtained by Numerical methods
3. Concepts of random variables, probability distributions and sampling can be applied to problem solving
4. Probability distributions can be used for testing of hypothesis of testing and model situations arising in analysis of data
5. Concept of functional and variational techniques can be applied to Engg. Problems

TEACHING METHODOLOGY

- Blackboard teaching/PowerPoint presentation (if needed) /Flipped Classes for specified topics
- Regular review of students by asking questions based on topics covered in the class

COURSE CONTENTS

UNIT -1- (10 HOURS)

Solution of ODE- Taylor's series method, 4th order Runge - Kutta method, Milne's predictor and corrector method.

Solution of PDE – Schmidt method to solve heat equation, explicit method for wave equation, Numerical solution of Laplace equation.

UNIT -2- (10 HOURS)

Eigen values and Eigen vectors- Largest Eigen value by Power method, Rutishauser's method Jacobi method for symmetric matrices, Given's and House Holder's method to reduce symmetric matrix to tridiagonal matrix

UNIT -3- (10 HOURS)

Random variable - discrete and continuous, probability distribution- discrete and continuous, probability density function, cumulative density function, mean and variance, expectation.

Joint distribution - discrete and continuous, marginal distribution, expectation, covariance, rank correlation. Binomial, Poisson, Normal distribution

UNIT -4- (10 HOURS)

Sampling theory - Population and sample, sampling with and without replacement, sampling distribution of means, sample variance. Unbiased estimate, reliability, confidence intervals for mean statistical hypothesis, testing of hypothesis, Type I and II errors, one tailed, two tailed tests, test for significance level of large and small samples, t - test, χ^2 – test for goodness of fit

UNIT -5- (08 HOURS)

Calculus of Variation: Introduction, Functional, Euler's equation, Solution to Euler's equation, geodesics, isoperimetric problems, Rayleigh Ritz method, Galerkin's method, Hamilton's principle.

TEXT BOOKS

SL.NO	Title of the Book	Name of the author/s	Name of the publisher	Edition and year
1	Numerical methods for scientific and Engg Computation	M K Jain, S R K Iyengar, R K Jain	New age	6th edition 2012.
2	Introductory methods of numerical analysis	S S Sastry	PHI India	5th edition, 2012
3	Probability and statistics,	Murray R Spiegel, J Schiller, Alu Srinivasan	Schaum's outline series	3rd Edition,2010
4	Higher Engg. Mathematics	Dr. B S Grewal	Khanna publications	42nd edition 2012

REFERENCE BOOKS'

SL.NO	Title of the Book	Name of the author/s	Name of the publisher	Edition and year
1	Numerical algorithm	Krishnamurthy and Sen	EWP,	2007
2	Probability and statistics for Science and Engg	G Shanker Rao	Univ Press	2011

ONLINE RESOURCES	Link
NPTEL	https://nptel.ac.in/courses/111/104/111104030/
NPTEL	https://nptel.ac.in/courses/111/104/111104025/
NPTEL	https://nptel.ac.in/courses/111/104/111104073/
MIT OCW	https://ocw.mit.edu/educator/
TU Delft	https://online-learning.tudelft.nl/courses/pre-university-calculus/

MATLAB Programming for evaluation of LA2 component

1. Largest Eigen value by power method
2. Solution of differential equations with constant coefficients of second order
3. Solution of simultaneous differential equations
4. Linear regression coefficients by least square method drawing straight lines

Coefficient of correlation between two samples

COURSE ASSESSMENT METHOD

Continuous Internal Evaluation (CIE)

Three internals tests (each 30 marks) are conducted, average of best two performances will be considered.

1. Minimum two Assignments/Model making - evaluated through rubrics for 10 marks. Average of two will be considered.

2. Tutorial classes and assessment are carried out/Surprise quiz tests are conducted and evaluated for 10 marks. Average of these two will be considered.

Semester End Examination (SEE)
1. Two Questions are to be set from each unit, carrying 20 Marks each.
2. Students have to answer 5 questions selecting one full question from each unit

Program Outcomes – Articulation matrix:

PO	1	2	3	4	5	6	7	8	9	10	11	12	PSO1	PSO2
CO1	2	2		1	1									
CO2	2	2		1	1									
CO3	2	2		1	1									
CO4	2	2		1	1									
CO5	2	2		1	1									

AERODYNAMICS -I				
Course Code	18AE42		**Credits**	4
Hours/Week (L-T-P)	4		**CIE Marks**	50
Total Hrs	48		**SEE Marks**	50
Exam Hrs	3		**Course Type**	Core

COURSE OUTCOMES

Course outcomes: After completion of the course, students will be able to-

1. Review basic fluid mechanics and description of fluid motion
2. Discuss airfoil characteristics
3. Analyze the pressure distribution for incompressible inviscid flow over the airfoil\
4. Discuss the flow over circular cylinders, airfoils
5. Discuss to carry out the Aerodynamic Testing

TEACHING METHODOLOGY

- Blackboard teaching/PowerPoint presentation (if needed) /Flipped Classes for specified topics
- Regular review of students by asking questions based on topics covered in the class

COURSE CONTENTS

UNIT -1- (10 HOURS)

Review of Basic Fluid Mechanics: Continuity, momentum and energy equation, units and dimensions, Types of flow, compressibility, Mach number regimes.
Description of Fluid Motion: Euler and Lagrangian descriptions, Control volume approach to continuity and momentum equations, Pathlines, Streamlines and Streaklines, Angular velocity, Vorticity, Circulation, Stream function, Velocity potential and Relationship between them.

UNIT -2- (10 HOURS)

Airfoil Characteristics: Airfoil section geometry and wing planform geometry, Fundamental aerodynamic variables, Aerodynamic forces and moments and pressure coefficient. Centre of pressure, calculation of airfoil lift and drag from measured surface pressure distributions, typical airfoil aerodynamic characteristics at low speeds

UNIT -3- (10 HOURS)

Two-Dimensional Inviscid Incompressible Flows: Bernoulli's equation, Pitot-tube measurement of airspeed, condition on velocity for incompressible flow. Governing equations for irrotational, incompressible flow: Laplace equation and boundary conditions. Two-dimensional source, sink and doublet flows and vortex flow and combinations of elementary flows.

UNIT -4- (10 HOURS)

Flow Over Circular Cylinders: Non-lifting flow over a two-dimensional circular cylinder, Lifting flow over a two-dimensional circular cylinder, Kutta-Joukowski theorem and generation of lift, D'Alembert's paradox.**Incompressible Flow Over Airfoils**: Kelvin's circulation theorem and the starting vortex, vortex sheet, Kutta condition, Classical thin airfoil theory for symmetric and cambered airfoils

UNIT -5- (08 HOURS)

Introduction to Aerodynamic Testing: Principles of wind tunnel flow simulation, open and closed circuit wind tunnels, and Major features of low speed, transonic and supersonic wind tunnels, smoke and tuft flow visualization techniques, Pressure and Aerodynamic load measurements on a model, total drag determination of two-dimensional bodies using wake survey at low speeds

TEXT BOOKS

SL.NO	Title of the Book	Name of the author/s	Name of the publisher	Edition and year
1	Fundamentals of Aerodynamics	Anderson, Jr. J.D. Tata McGraw	Hill Publishing Co. Ltd., New Delhi	2007. (Special Indian Edition).
2	Aerodynamics for Engineering Students	` Houghton E.L and Carpenter P.W	CBS Publications and Distributors	1993. (4th Edition)

REFERENCE BOOKS'

SL.NO	Title of the Book	Name of the author/s	Name of the publisher	Edition and year
1	Introduction to Flight	Anderson, Jr. J.D	Tata McGraw-Hill Publishing Co. Ltd., New Delhi	2007. (Special Indian Edition)
2	Boundary Layer Theory	` Schlichting,,	Mc Graw Hill NewYork	2004
3	Low Speed Wind Tunnel testing	Pope A. and Harper, J J	John Wiley & Sons Inc	3rd Edition, 1966
4	High Speed Wind Tunnel Testing	Pope A. and Goin, KL	John Wiley & Sons Inc	99th edition 1965

ONLINE RESOURCES	Link
NPTEL	https://nptel.ac.in/courses/101/105/101105059/
NPTEL	https://nptel.ac.in/courses/101/103/101103003/
NPTEL	https://nptel.ac.in/courses/101/101/101101058/
MIT OCW	https://ocw.mit.edu/courses/aeronautics-and-astronautics/16-100-aerodynamics-fall-2005/lecture-notes/
TU Delft	https://online-learning.tudelft.nl/courses/introduction-aeronautical-engineering/

COURSE ASSESSMENT METHOD

Continuous Internal Evaluation (CIE)

Three internals tests (each 30 marks) are conducted, average of best two performances will be considered.

1. Minimum two Assignments/Model making - evaluated through rubrics for 10 marks. Average of two will be considered.

2. Tutorial classes and assessment are carried out/Surprise quiz tests are conducted and evaluated for 10 marks. Average of these two will be considered.

Semester End Examination (SEE)

1. Two Questions are to be set from each unit, carrying 20 Marks each.
2. Students have to answer 5 questions selecting one full question from each unit

Program Outcomes – Articulation matrix:

PO	1	2	3	4	5	6	7	8	9	10	11	12	PSO1	PSO2
CO1	3								3	3				3
CO2	3	3	3						3	3				3
CO3	3	2	3						3	2				2
CO4	3	3	3						3	3				3
CO5	3	3	3						3	3				3

AIRCRAFT STRUCTURE - I				
Course Code	**18AE43**		**Credits**	4
Hours/Week (L-T-P)	3+2+0		**CIE Marks**	50
Total Hrs	48		**SEE Marks**	50
Exam Hrs	03		**Course Type**	Core

COURSE OUTCOMES

Course outcomes: After completion of the course, students will be able to-

1. Outline the types of loads experienced by aircraft structure and materials used for aircraft structures.
2. Apply different methodologies to analyze statically determinate and indeterminate structures under various loading conditions
3. Develop different methodologies available to analyze the aircraft structures in the form of beams & columns under different loading conditions
4. Solve aircraft structural problems by applying the concepts of theory of elasticity and failure theory.
5. Discuss about the theory of failure of aircraft structure

TEACHING METHODOLOGY

- Blackboard teaching/PowerPoint presentation (if needed) /Flipped Classes for specified topics
- Regular review of students by asking questions based on topics covered in the class

COURSE CONTENTS

UNIT -1- (10 HOURS)

Loads on Aircraft: Structural nomenclature – Types of loads – load factor – Aerodynamics loads – Symmetric maneuver loads – Velocity diagram – Function of structural components.
Materials for Aircraft Structures: Metallic and non-metallic materials, Use of Aluminum alloy, titanium, stainless steel and composite materials. Desirable properties for aircraft application **Mechanical Properties of Material:** Stress-Strain - Tensile properties – Compression properties – Shear properties– Bending properties – Creep and relaxation properties –Fatigue properties - Fracture properties

UNIT -2- (10 HOURS)

Statically Determinate and Indeterminate Structures: Analysis of plane truss – Method of joints – Method of sections, Plane frames, Fixed & Continuous beam analysis - Clapeyron’s Three Moment Equation. Introduction to 3D Truss, Introduction to Composite beam

UNIT -3- (10 HOURS)

Energy Methods: Strain Energy due to axial, bending, shear and torsional loading - Castigliano’s theorem - Maxwell’s Reciprocal theorem, Unit load method - application to beams, trusses, frames, rings, etc.**Columns**: Columns with various end conditions – Euler’s Column curve – Rankine’s formula - Column with initial curvature - Eccentric loading – South well plot – Beam column

UNIT IV (10 HOURS)

Theory of Elasticity: Concept of stress and strain**,** derivation of Equilibrium equations, strain-displacement relation, compatibility conditions and boundary conditions. Plane stress and Plane strain problems in 2D elasticity and Airy’s Stress function

UNIT -V(08 HOURS)
Failure Theory: Maximum stress theory – Maximum strain theory – Maximum shear stress theory – Distortion theory – Maximum strain energy theory – Application to aircraft structural problems

TEXT BOOKS

SL.NO	Title of the Book	Name of the author/s	Name of the publisher	Edition and year
1	Aircraft Structures for Engineering Students	Megson T. H. G	Elsevier, New York	5th edition 2012
2	Aircraft Structures	Peery D. J, and Azar J. J	McGraw – Hill	2nd edition 1999
3	Analysis and design of flight vehicle structures	Bruhn.E.F.,	Tri-state offset company	1973

REFERENCE BOOKS'

SL.NO	Title of the Book	Name of the author/s	Name of the publisher	Edition and year
1	Analysis of Aircraft Structures – An Introduction	Donaldson, B.K	McGraw-Hill	1993
2	A text book of strength of materials	Dr. R. K. Bansal `	Laxmi Publications (P) Ltd	6th Edition 2015
3	Strength of materials	Er. R. K. Rajput	Chand & Company Pvt. Ltd	5th Edition 2010
4	Theory of Structures	Dr. B. C. Punmia	, “”, , Laxmi Publications (P) Ltd,	13th Edition 2011
5	Mechanics of Materials	Dr. B C Punmia Ashok Kumar Jain & Arun Kumar Jain	Lakshmi Publication	2001
6	Strength of Materials	Timoshenko, S Princeton D	Von Nostrand Co	Vol. I and II 1990

ONLINE RESOURCES	Link
NPTEL	https://nptel.ac.in/courses/101/105/101105084/

NPTEL	https://nptel.ac.in/course.html
NPTEL	https://nptel.ac.in/course.html
MIT OCW	https://ocw.mit.edu/courses/aeronautics-and-astronautics/16-21-techniques-for-structural-analysis-and-design-spring-2005/
TU Delft	https://online-learning.tudelft.nl/courses/introduction-aeronautical-engineering/

Program Outcomes – Articulation matrix:

PO	1	2	3	4	5	6	7	8	9	10	11	12	PSO1	PSO2
CO1	3	3							3	3			3	
CO2	3	3							3	3			3	
CO3	3	3							3	2			2	
CO4	3	2							3	3			3	
CO5	3	3							3	3			3	

AIRCRAFT SYSTEM AND INSTRUMENTS				
Course Code	18AE44		**Credits**	3
Hours/Week (L-T-P)	3+0+0		**CIE Marks**	50
Total Hrs	39		**SEE Marks**	50
Exam Hrs	03		**Course Type**	Core

COURSE OUTCOMES

Course outcomes: After completion of the course, students will be able to-

1. Explain the principles of flight control
2. Describe Aircraft Fuel and Hydraulic Systems
3. Classify aircraft communication and radar systems
4. Explain application of instrument system used in aircraft
5. Describe the Principles of data acquisitions systems

TEACHING METHODOLOGY

- Blackboard teaching/PowerPoint presentation (if needed) /Flipped Classes for specified topics
- Regular review of students by asking questions based on topics covered in the class

COURSE CONTENTS

UNIT -1 (08 HOURS)

Flight Control Systems: Primary and secondary flight controls. Flight control linkage system. Conventional Systems, Power assisted and fully powered flight controls. Power control unit – Mechanical, Electro-hydraulic. Advanced actuation concepts. Fly-by-wire system: - basic concept and features. Pitch and Roll rate: - command and response. Control Laws Cooper Harper scale. Redundancy and failure survival. Common mode of failures and effects analysis.

UNIT -2 (08 HOURS)

Aircraft Fuel and Hydraulic Systems: Characteristics of aircraft fuel system. Gravity feed and pressure. A generalized fuel system. Fuel pumps-classification. Fuel control unit. Engine starting sequence. Starting and Ignition systems. Engine oils and a typical lubricating system. Hydraulic fluid. Hydraulic system and components. Study of typical workable system. Power packs. Hydraulic actuators. Pneumatic system and components. Use of bleed air. Emergency lowering of landing gear and braking. Shock absorbers - Retraction mechanism

UNIT -3 (08 HOURS)

Aircraft Communication and Radar systems: Useful definitions, communication principles, communication system, role of communication in management, barriers in communication, how to overcome the barriers, rule of effective communication**.** Operation principle of an airborne radar. Radar altimeter and multimode radar.

UNIT -4 (08 HOURS)

Introduction to instrumentation: Functional elements of a measuring instrument, International Standards, Typical application of instrument system on aircraft, Classification of instruments, Calibration. Functional elements of a measuring instrument, International Standards, Typical applications of instrument system on aircraft. Classification of instruments. Calibration.

Aircraft Instruments: Instruments displays, panels & layouts. Instrumentation grouping. Navigation instruments, Radio instruments. Hydraulic and Engine instruments

UNIT -5 (07 HOURS)
Air Data Instruments: Principles of data acquisitions, Data multiplexing, Data recording devices, Basic air data system and probes. Mach meter, Air speed indicator, Vertical speed indicator. Barometric pressure sensing. Altimeter. Air data alerting system, angle of attack sensing, stall warning, Mach warning, altitude alerting system. **Gyroscopic Flight Instruments:** The gyroscope and its properties. Limitations of a free gyroscope. Drift. Gyroscopic flight. Instruments -Pneumatic, and Electric. Direction indicator, Turn and Bank Indicator. **Engine& other system Instruments:** Study of various types of engine instruments- RPM, Measurement of Force, Torque, Temperature, Fuel flow, Fuel quantity, Vibrations

TEXT BOOKS

SL.NO	Title of the Book	Name of the author/s	Name of the publisher	Edition and year
1	Aircraft Systems: Mechanical, Electrical and Avionics-Subsystem Integration	Ian Moir and Allan Sea bridge	AIAA Educational Series	2001
2	Aircraft Instruments and Integrated Systems	Pallet, E.H.J.,	Longman Scientific and Technical, Indian reprint	1996

REFERENCE BOOKS'

SL.NO	Title of the Book	Name of the author/s	Name of the publisher	Edition and year
1	Aircraft Hydraulic Systems	William A Neese	Himalayan Books	2007
2	The aircraft Engineers Handbook	`	Sterling Book House	6th Edition, 2005
3	Gas Turbine Technology	Treager, S.,	McGraw-Hill	1997
4	Pneumatic Systems	S R Maunder	Tata McGraw Hill Publishing Co	1995
5	The aircraft Engineers Handbook	R. W. Sloley and W. H. Coulthard	Sterling Book House	6th Edition, 2005.
6	Aircraft Instrumentation and Systems	Nagabhushana S	I. K. International	2013

ONLINE RESOURCES	Link
NPTEL	https://ocw.mit.edu/courses/aeronautics-and-astronautics/16-687-private-pilot-ground-school-january-iap-2019/class-videos/lecture-4-aircraft-systems/
NPTEL	https://nptel.ac.in/course.html

NPTEL	https://nptel.ac.in/courses/101/105/101105083/
MIT OCW	https://ocw.mit.edu/courses/find-by-topic/
TU Delft	https://online-learning.tudelft.nl/tips-successful-online-learning/

Program Outcomes – Articulation matrix:

PO	1	2	3	4	5	6	7	8	9	10	11	12	PSO1	PSO2
CO1	2	1							2	2				2
CO2	2	1							2	2				2
CO3	2	1							2	2				2
CO4	2	1							2	2				2
CO5	2	1							2	2				2

AIRCRAFT MATERIALS & MANUFACTURING				
Course Code	18AE45		**Credits**	3
Hours/Week (L-T-P)	3+0+0		**CIE Marks**	50
Total Hrs	39		**SEE Marks**	50
Exam Hrs	03		**Course Type**	Core

COURSE OUTCOMES

Course outcomes: After completion of the course, students will be able to-

1. Describe the basics of manufacturing processes, patterns, properties of moulding sands, gating and risers
2. Explain the process of moulding, cores, special moulding processes and melting furnaces.
3. Explain the importance of various materials for aircraft structures and engines.
4. Describe the importance of Metal Alloys, Super alloys and heat treatment process, Polymers, Polymeric Materials, Plastics, Ceramics, Glass and composite materials in aerospace applications.
5. Identify the applications of High Energy Materials for rockets and missiles

TEACHING METHODOLOGY

- Blackboard teaching/PowerPoint presentation (if needed) /Flipped Classes for specified topics

COURSE CONTENTS

UNIT -1 (08 HOURS)

Aircraft Engineering Materials

Engineering materials Steels, Solid solutions,Binary phase diagrams, study of iron, iron carbon phase diagram, heat treatment, annealing, normalizing, hardening and tempering of Aluminum and steel, Non-Ferrous metals and Alloys: Structure and properties of copper and its alloys, Aluminum and its alloys, Titanium and its alloys.

UNIT -2 (08 HOURS)

Casting, Welding and Inspection Techniques

General principles of various casting processes Sand casting, die-casting, centrifugal casting, investment casting, Shell molding types; Principles and equipment used in arc welding, gas welding, resistance welding, solid, laser welding, and electron beam welding, soldering and brazing techniques. Need for NDT, ultrasonic testing, Radiographic testing, Flight-testing.

UNIT -3 (08 HOURS)

Sheet Metal Processes in Aircraft Industry

Sheet metal operations: shearing, punching, super plastic forming; operations in bending like stretch forming spinning drawing. Riveting, types and techniques, equipment, fasteners, integral tanks, Jigs and Fixtures,

UNIT -4 (07 HOURS)

Conventional and Modern Manufacturing Processes

General working principles, applications and operations of lathe, shaper, milling machines, grinding, drilling machine, computer numeric control machining. Working principles and applications of abrasive jet machining, ultrasonic machining, Electric discharge machining and electro chemical machining, laser beam, electron beam, plasma arc machining. Rapid prototyping, Additive manufacturing process.

UNIT -5 (08 HOURS)

Aircraft Composites

Introduction, Physical metallurgy, Wrought aluminum alloys, Cast aluminum alloys, Production of semi-fabricated forms, Aerospace applications, Plastics and rubber, Introduction to fiber reinforced plastics, glass and carbon composites; Fibers and resins; Characteristics and applications, Classification of aircraft materials; Materials used for aircraft components, Application of composite materials, Super alloys, emerging trends in aerospace materials.

TEXT BOOKS

SL.NO	Title of the Book	Name of the author/s	Name of the publisher	Edition and year
1	Manufacturing Engineering and Technology	S. Kalpakjian, Steven R. Schmid	Addison Wesley	5th Edition, 1991.
2	Aircraft production technology and management	` S. C. Keshu, K. K Ganapathy	Interline Publishing House, Bangalore	3rd Edition, 1993
3	Aircraft production technology	Douglas F. Horne	Cambridge University Press	1st Edition,1986.

REFERENCE BOOKS'

SL.NO	Title of the Book	Name of the author/s	Name of the publisher	Edition and year
1	Production technology	R. K. Jain	Mc Graw Hill	1st Edition, 2002.
2	Production technology	O. P. Khanna, M. Lal `	Dhanpat Rai Publications	5th Edition, 1997

ONLINE RESOURCES	Link
NPTEL	https://nptel.ac.in/courses/101/104/101104069/
NPTEL	https://nptel.ac.in/courses/112/106/112106293/
NPTEL	https://nptel.ac.in/courses/108/102/108102175/
MIT OCW	https://ocw.mit.edu/courses/new-courses/#anthropology

Program Outcomes – Articulation matrix:

PO	1	2	3	4	5	6	7	8	9	10	11	12	PSO1	PSO2
CO1	3								2	2			2	
CO2	3								2	2			2	
CO3	2								2	2			2	
CO4	3								2	2			2	
CO5	3								2	2			2	

PROGRAM ELECTIVE-B

AIRWORTHINESS AND CERTIFICATION				
Course Code	18AEE461		**Credits**	3
Hours/Week (L-T-P)	3+0+0		**CIE Marks**	50
Total Hrs	39		**SEE Marks**	50
Exam Hrs	03		**Course Type**	Program Elective

COURSE OUTCOMES

Course outcomes: After completion of the course, students will be able to-

1.Explain the Airworthiness requirements for different categories of aircrafts
2.Discuss the various certifications, technical log book
3.Explain the procedure for development, test flight and certification
4.Explain the procedure for training and their licenses, inspection, and approved materials.
5.Discuss the accident investigation procedures

TEACHING METHODOLOGY

- Blackboard teaching/PowerPoint presentation (if needed) /Flipped Classes for specified topics

COURSE CONTENTS

UNIT -1 (08 HOURS)

Introduction to aircraft rules as far as they relate to airworthiness and safety of aircraft. Airworthiness requirements for civil and military aircraft CAR, FAR, EASA and ICAO, regulations, Defense standards. Military standards and specifications

UNIT -2 (08 HOURS)

Privileges and responsibilities of various categories of AME license and approved persons. Knowledge of mandatory documents like certificate of Registration, certificate of Airworthiness - conditions of issue and validity. Export certificate of Airworthiness. Knowledge of Log Book, Journey Log Book, Technical Log Book, etc.

UNIT -3 (08 HOURS)

Procedure for development and test flights and certification. Certificate of Flight release, Certificate of Maintenance, Approved Certificates
Technical Publications, Aircraft Manual, Flight Manual, Aircraft Schedules. Registration, Procedure, Certification, Identification and Marking of Aircraft.

UNIT -4 (07 HOURS)

Modifications, concessions, airworthiness directives, service bulletins. Crew training and their licenses, approved inspection, and approved materials, identification of approved materials. Bonded and quarantine stores. Storage of various aeronautical products like rubber goods, various fluids.

UNIT -5- (08 HOURS)

Accident investigation procedures. Circumstances under which C of A is suspended. ICAO and IATA regulations, Chicago and Warsaw conventions. Familiarization of recent issues of Advisory Circulars. Civil Aviation Requirements Section 2 - Airworthiness.

TEXT BOOKS
1. The Indian Aircraft Act and the Rules 2. Manual of Civil Aviation 3. DEF STANDARD 970 4. Gran E L, Statistical Quality Control, McGraw Hill 5. Civil Airworthiness Requirements
REFERENCE BOOKS'
1. Aeronautical Information Circulars (relating to Airworthiness) 2. Advisory Circulars - DGCA 3. Civil Aircraft Airworthiness Information and Procedures (CAP 562) 4. Civil Aviation Requirements Section 2 - Airworthiness.

	ONLINE RESOURCES LINK
NPTEL	https://www.sciencedirect.com/topics/engineering/airworthiness-certification
NPTEL	https://www.iata.org/en/training/courses/aircraft-airworthiness/tcvt19/en/
NPTEL	https://ntrl.ntis.gov/NTRL/dashboard/searchResults/titleDetail/PB2000103115.xhtml
MIT OCW	https://ocw.mit.edu/courses/aeronautics-and-astronautics/16-400-human-factors-engineering-fall-2011
TU Delft	https://online-learning.tudelft.nl/courses/air-safety-investigation/

Program Outcomes – Articulation matrix:

PO	1	2	3	4	5	6	7	8	9	10	11	12	PSO1	PSO2
CO1	3								2	2				
CO2	2								2	2				
CO3	3								2	2				
CO4	3								2	2				
CO5	3								2	2				

TURBOMACHINERY				
Course Code	18AEE462		**Credits**	3
Hours/Week (L-T-P)	3+1+0		**CIE Marks**	50
Total Hrs	39		**SEE Marks**	50
Exam Hrs	03		**Course Type**	Program Elective

COURSE OUTCOMES

Course outcomes: After completion of the course, students will be able to-

1. Describe the working principle of various turbo machines and energy transfer between fluid and rotor using governing equations.
2. Interpret the performance curves of various turbines and compressors
3. Discuss about air flow compressor
4. Analyze problems related to axial flow and centrifugal compressors.
5. Solve problems related to centrifugal pumps.

TEACHING METHODOLOGY

- Blackboard teaching/PowerPoint presentation (if needed) /Flipped Classes for specified topics
- Regular review of students by asking questions based on topics covered in the class

COURSE CONTENTS

UNIT -1 (08 HOURS)

Introduction: Definition of turbomachines, parts of turbomachines, Comparison with positive displacement machines, Classification, Dimensionless parameters and their significance, Effect of Reynolds number, Unit and specific quantities, model studies on Turbomachines. Efficiencies of turbo machines. Problems.

Thermodynamics of fluid flow: Static and Stagnation states-Incompressible fluids and perfect gases, overall isentropic efficiency, stage efficiency (their comparison) and polytrophic efficiency for both compression and expansion processes. Reheat factor for expansion process

UNIT -2 (08 HOURS)

Energy exchange in Turbomachines: Euler's turbine equation, Alternate form of Euler's turbine equation, Velocity triangles for different values of degree of reaction, Components of energy transfer, Degree of Reaction, utilization factor, Relation between degree of reaction and Utilization factor, Problems.

General Analysis of Turbomachines: Radial flow compressors and pumps-general analysis, Expression for degree of reaction, velocity triangles, Effect of blade discharge angle on energy transfer and degree of reaction, Effect of blade discharge angle on performance, Theoretical head – capacity relationship, General analysis of axial flow pumps and compressors, degree of reaction, velocity triangles, Problems**.**

UNIT -3 (08 HOURS)

Axial flow Compressors: Expression for pressure ratio developed in a stage, work done factor, efficiencies and stalling. Problems.

UNIT -4 (08 HOURS)

Centrifugal Compressors: Stage velocity triangles, slip factor, power input factor, Stage work, Pressure developed, stage efficiency, surging and problems.

UNIT -5 (07 HOURS)
Centrifugal Pumps: Classification and parts of centrifugal pump, different heads and efficiencies of centrifugal pump, Minimum speed for starting the flow, Maximum suction lift, Net positive suction head, Cavitation, Need for priming, positive displacement pumps- gear pumps and multi piston pumps. Problems **(Note:** Since dimensional analysis is covered in Fluid Mechanics subject, questions on dimensional analysis may not be given. However, dimensional parameters and model studies may be given more weightage.**)**

TEXT BOOKS

SL.NO	Title of the Book	Name of the author/s	Name of the publisher	Edition and year
1	Turbomachines	M. S. Govindgouda and A. M. Nagaraj	M. M. Publications	4th Edition, 2008
2	Turbomachine	` B.K.Venkanna	PHI New Delhi	2009

REFERENCE BOOKS'

SL.NO	Title of the Book	Name of the author/s	Name of the publisher	Edition and year
1	An Introduction to Energy Conversion, Volume III Turbo machinery	V. Kadambi and Manohar Prasad	New Age International Publishers	Reprint 2008.
2	Principals of Turbomachines	D. G. Shepherd	The Macmillan Company	1964
3	Fluid Mechanics & Thermodynamics of Turbomachines	S. L. Dixon	Elsevier	2005
4	Gas Turbine Theory	H.I.H. Saravanamuttoo, G.F.C. Rogers , H. Cohen, Paul Straznicky , Andrew Nix	Pearson.	6th Edition, 2017

ONLINE RESOURCES	Link
NPTEL	https://nptel.ac.in/courses/101/101/101101058/
NPTEL	https://ocw.mit.edu/courses/mechanical-engineering/2-27-turbulent-flow-and-transport-spring-2002
NPTEL	https://ocw.mit.edu/courses/aeronautics-and-astronautics/16-540-internal-flows-in-turbomachines-spring-2006
MIT OCW	https://online-learning.tudelft.nl/courses/introduction-to-wind-turbines-physics-and-technology/

TU Delft	https://nptel.ac.in/courses/101/101/101101058/

Program Outcomes – Articulation matrix:

PO	1	2	3	4	5	6	7	8	9	10	11	12	PSO1	PSO2
CO1	3	3												2
CO2	3	2	3											2
CO3	3	3	3											3
CO4	3	3	3											3
CO5	3	3	3											3

COMPUTER INTEGRATED MANUFACTURING				
Course Code	18AEE463		**Credits**	3
Hours/Week (L-T-P)	3+0+0		**CIE Marks**	50
Total Hrs	39		**SEE Marks**	50
Exam Hrs	03		**Course Type**	Program Elective

COURSE OUTCOMES

Course outcomes: After completion of the course, students will be able to-

1. Describe the basic concepts of CIM systems
2. Discuss high volume production systems, automated flow line and line balancing in manufacturing
3. Identify the suitable automation techniques in shop floor control and develop effective automation systems for various industrial applications.
4. Illustrate the Computerized Manufacturing Planning System AND THE use of CNC machine. Illustrate the robots for industrial manufacturing units.

TEACHING METHODOLOGY

- Blackboard teaching/PowerPoint presentation (if needed) /Flipped Classes for specified topics
- Regular review of students by asking questions based on topics covered in the class

COURSE CONTENTS

UNIT -1 (08 HOURS)

Computer Integrated Manufacturing Systems: Introduction, Automation definition, Types of automation, CIM, processing in manufacturing, Production concepts, Mathematical Models-Manufacturing lead time, production rate, components of operation time, capacity, Utilization and availability, Work-in-process, WIP ratio, TIP ratio, Problems using mathematical model equations.

UNIT -2 (08 HOURS)

High Volume Production System: Introduction Automated flow line symbols, objectives, Work part transport continuous, Intermittent, synchronous, Pallet fixtures, Transfer Mechanism-Linear-Walking beam, roller chain drive, Rotary-rack and pinion, Rachet & Pawl, Geneva wheel, Buffer storage, control functions-sequence, safety, Quality, Automation for machining operation.

Analysis of Automated Flow Line & Line Balancing: General terminology and analysis, Analysis of transfer Line without storage upper bound approach, lower bound approach and problems, Analysis of Transfer lines with storage buffer, Effect of storage, buffer capacity with simple problem, Partial automation-with numerical problems, flow lines with more than two stages, Manual Assembly lines, line balancing problem.

UNIT – 3 (08 HOURS)

Minimum Rational Work Element: Work station process time, Cycle time, precedence constraints. Precedence diagram, Balance delay methods of line balancing-largest Candidate rule, Kenbridge and Wasters method, Ranked positional weight method, Numerical problems covering all above methods and computerized line balancing.

Automated Assembly Systems: Design for automated assembly systems, types of automated assembly system, Parts feeding devices-elements of parts delivery system-hopper, part feeder, Selectors, feedback, escapement and placement analysis of Multi-station Assembly Machine analysis of single station assembly.

Automated Guided Vehicle System: Introduction, Vehicle guidance and routing, System management, Quantitative analysis of AGV's with numerical problems and application.

UNIT -4 (08 HOURS)

Computerized Manufacturing Planning System: Introduction, Computer Aided Process Planning, Retrieval types of process planning, Generative type of process planning, Material requirement planning, Fundamental concepts of MRP inputs to MRP, Capacity planning.
CNC Machining Centers: Introduction to CNC, elements of CNC, CNC machining centers, part programming, fundamental steps involved in development of part programming for milling and turning.

UNIT -5 (07 HOURS)

Robotics: Introduction to Robot configuration, Robot motion, and programming of Robots end effectors, Robot sensors and Robot applications.

TEXT BOOKS

SL.NO	Title of the Book	Name of the author/s	Name of the publisher	Edition and year
1	Automation, Production system & Computer Integrated manufacturing	M. P. Grover	Person India	2nd edition. 2007
2	Principles of Computer Integrated Manufacturing	S. Kant Vajpayee `	Prentice Hall India	2007

REFERENCE BOOKS'

SL.NO	Title of the Book	Name of the author/s	Name of the publisher	Edition and year
1	Computer Integrated Manufacturing	A. Rah & Henry Kroeber	Pearson	3rd edition 2004
2	CAD-CAM	Zeid	Tata McGraw Hil	1991

ONLINE RESOURCES	Link
NPTEL	https://nptel.ac.in/courses/112104289/
NPTEL	https://nptel.ac.in/courses/112/104/112104289/
MIT OCW	https://ocw.mit.edu/courses/mechanical-engineering/2-737-mechatronics-fall-2014/

Program Outcomes – Articulation matrix:

PO	1	2	3	4	5	6	7	8	9	10	11	12	PSO1	PSO2
CO1	3								3	3			1	
CO2	3								3	3			1	
CO3	3								3	3			1	
CO4	3								3	3			1	

UNMANNED AERIAL VEHICLE AND IT'S APPLICATIONS				
Course Code	18AEE464		**Credits**	3
Hours/Week (L-T-P)	3+0+0		**CIE Marks**	50
Total Hrs	39		**SEE Marks**	50
Exam Hrs	03		**Course Type**	Program Elective

COURSE OUTCOMES

Course outcomes: After completion of the course, students will be able to-

1. Identify types of UAVs and its applications
2. Describe the aerodynamics and stability of UAV
3. Identify suitable Propulsion system, and materials for UAVs
4. Explain Mission Planning and Control of UAV

TEACHING METHODOLOGY

- Blackboard teaching/PowerPoint presentation (if needed) /Flipped Classes for specified topics
- Regular review of students by asking questions based on topics covered in the class
- Video and animation

COURSE CONTENTS

UNIT -1 (08 HOURS)

Introduction: Aviation History and Overview of UAV systems, Classes and Missions of UAVs, Definitions and Terminology, UAV fundamentals, Examples of UAV systems-very small, small, Medium and Large UAV

UNIT -2 (08 HOURS)

The Air Vehicle Basic Aerodynamics: Basic Aerodynamics equations, Aircraft polar, the real wing and Airplane, Induced drag, the boundary layer, Flapping wings, Total Air-Vehicle Drag
Performance: Overview, climbing flight, Range and Endurance – for propeller driven aircraft, range- a jet-driven aircraft, Guiding Flight

UNIT -3 (08 HOURS)

Stability and Control:Overview, Stability, longitudinal, lateral, dynamic stability, Aerodynamics control, pitch control, lateral control, Autopilots, sensor, controller, actuator, airframe control, inner and outer loops, Flight-Control Classification, Overall Modes of Operation, Sensors Supporting the Autopilot.

UNIT -4 (08 HOURS)

Propulsion: Overview, Thrust Generation, Powered Lift, Sources of Power, The Two-Cycle Engine, The Rotary Engine, The Gas Turbine, Electric Motors, Sources of Electrical Power
Loads and Structures Loads, Dynamic Loads, Materials, Sandwich Construction, Skin or Reinforcing Materials, Resin Materials, Core Materials, Construction Techniques

UNIT -5 (07 HOURS)

Mission Planning and Control: Air Vehicle and Payload Control, Reconnaissance/Surveillance Payloads, Weapon Payloads, Other Payloads, Data-Link Functions and Attributes, Data-Link Margin, Data-Rate Reduction, Launch Systems, Recovery Systems, Launch and Recovery Tradeoffs

TEXT BOOKS

SL.NO	Title of the Book	Name of the author/s	Name of the publisher	Edition and year
1	Introduction to UAV Systems	Paul Gerin Fahlstrom, Thomas James Gleason	Wiley Publication John Wiley & Sons, Ltd	4th Edition 2012
2	Unmanned Aerial Vehicle	Landen Rosen `	Alpha Editions, ISBN13: 9789385505034	2012

REFERENCE BOOKS'

SL.NO	Title of the Book	Name of the author/s	Name of the publisher	Edition and year
1	Unmanned Aerial Vehicles	Valavanis, Kimon P `	Springer	2011
2	Unmanned Aerial Vehicles	Valavanis, K., Vachtsevanos, George J	Springer	2015

ONLINE RESOURCES	Link
NPTEL	https://nptel.ac.in/course.html
NPTEL	https://nptel.ac.in/courses/101/104/101104073/
MIT OCW	https://ocw.mit.edu/search/ocwsearch.htm?q=AERIAL%20VEHICLE
TU Delft	https://online-learning.tudelft.nl/courses/

Program Outcomes – Articulation matrix:

PO	1	2	3	4	5	6	7	8	9	10	11	12	PSO1	PSO2
CO1	3	1							3	1			2	2
CO2	3	1							3	1			2	2
CO3	3	1							3	1			2	2
CO4	3	1							3	1			2	2
CO5	3	1							3	1			2	2

WIND TUNEL TECHNIQES				
Course Code	18AEE465		**Credits**	3
Hours/Week (L-T-P)	3+0+0		**CIE Marks**	50
Total Hrs	39		**SEE Marks**	50
Exam Hrs	03		**Course Type**	Program Elective

COURSE OUTCOMES

Course outcomes: After completion of the course, students will be able to-

1 Describe Buckingham Theorem and similarity parameters and apply for non-dimensional numbers and scaling effects respectively
2. Classify the wind tunnels and discuss about layouts and design parameters
3. Perform various Calibration methods to calibrate wind tunnel
4. Outline the various wind tunnel measurements
5. Discuss the various method of flow visualization techniques

TEACHING METHODOLOGY

- Blackboard teaching/PowerPoint presentation (if needed) /Flipped Classes for specified topics
- Regular review of students by asking questions based on topics covered in the class

COURSE CONTENTS

UNIT -1 (08 HOURS)

Introduction to Aerodynamics: Types of flows, Basic principles of wind tunnel.
Principles of Model Testing: Buckingham Theorem – Non-dimensional numbers. Scale effect – Geometric Kinematic and Dynamic similarities.

UNIT -2 (08 HOURS)

Wind Tunnels:
Classification – special problems of testing in subsonic, transonic, supersonic and hypersonic speed regions – Layouts – sizing and design parameters.

UNIT -3 (08 HOURS)

Calibration of Wind Tunnels:
Test section speed – Horizontal buoyancy – Flow angularities – Turbulence measurements – Associated instrumentation – Calibration of supersonic tunnels.

UNIT -4 (08 HOURS)

Wind Tunnel Measurements:
Steady and Unsteady Pressure and velocity measurements – Force measurements – Three component and six component balances – Internal balances – Principles of Hotwire Anemometer.

UNIT -5 (07 HOURS)

Flow Visualization
Smoke and Tuft grid techniques – Dye injection special techniques – Optical methods of flow visualization.

TEXT BOOKS				
SL.NO	**Title of the Book**	**Name of the author/s**	**Name of the publisher**	**Edition and year**
	Low Speed Wind Tunnel Testing	Rae, W.H. and Pope, A.	John Wiley Publication	1984.

REFERENCE BOOKS'				
SL.NO	**Title of the Book**	**Name of the author/s**	**Name of the publisher**	**Edition and year**
1	High Speed Wind Tunnel Testing,	Pope, A., and Goin, L	John Wiley Bradsaw Experimental Fluid Mechanics.	1985.

ONLINE RESOURCES	Link
NPTEL	https://nptel.ac.in/courses/101/103/101103003/
NPTEL	https://ocw.mit.edu/courses/aeronautics-and-astronautics/16-100-aerodynamics-fall-2005
NPTEL	https://online-learning.tudelft.nl/courses/introduction-to-wind-turbines-physics-and-technology/
MIT OCW	https://nptel.ac.in/courses/101/103/101103003/
TU Delft	https://ocw.mit.edu/courses/aeronautics-and-astronautics/16-100-aerodynamics-fall-2005

Program Outcomes – Articulation matrix:

PO	1	2	3	4	5	6	7	8	9	10	11	12	PSO1	PSO2
CO1	3	2												3
CO2	3	2												3
CO3	3	2												3
CO4	2	2												2
CO5	3	2												3

DESIGN OF MACHINE ELEMENTS				
Course Code	18AEE466		**Credits**	3
Hours/Week (L-T-P)	3+0+0		**CIE Marks**	50
Total Hrs	39		**SEE Marks**	50
Exam Hrs	03		**Course Type**	Program Elective

COURSE OUTCOMES

Course outcomes: After completion of the course, students will be able to-

1 Describe Buckingham Theorem and similarity parameters and apply for non-dimensional numbers and scaling effects respectively
2. Classify the wind tunnels and discuss about layouts and design parameters
3. Perform various Calibration methods to calibrate wind tunnel
4. Outline the various wind tunnel measurements
5. Discuss the various method of flow visualization techniques

TEACHING METHODOLOGY

- Blackboard teaching/PowerPoint presentation (if needed) /Flipped Classes for specified topics
- Regular review of students by asking questions based on topics covered in the class

COURSE CONTENTS

UNIT -1 (08 HOURS)

Stress Concentration: Definition, Reason for occurrence, Methods to reduce, Stress concentration factor. Design of stress concentrated members subjected to various loads. Design for Variable Loading: Types of variable/Cyclic loads Mean & amplitude Stresses, Fatigue Failure, Endurance Limit & Strength, SN Diagram. Goodman and Soderberg criterion, **Modifying factors:** Size effect, surface effect, Reliability, stress concentration effects etc. Problems on design of members for finite & infinite life in members subjected to individual & combined loading.

UNIT -2 (08 HOURS)

Shafts: Types, Design of solid & hollow shaft on strength and rigidity basis with steady loading subjected to pure torsion. Design of shafts carrying pulleys & gears (Combined loading). ASME Code for shaft design.

Springs: Types of Springs, terminology – Stresses in Helical coil springs of circular and non-circular cross sections. Concentric springs, springs under fluctuating loads, - Energy stored in springs, torsion.

UNIT – 3 (08 HOURS)

Riveted Joints: Types, Design of longitudinal & circumferential joint for various types, Simple Riveted Brackets.

Welded joints: Types, Strength of Butt, parallel, transverse welds, eccentrically loaded welded joint subjected to torsion & Bending moment.

UNIT-4 (08 HOURS)

Helical Gears: Terminology, Forces analysis, formative/virtual number of teeth, Beam strength of helical gear tooth. Lewis Equation and form factor, Design for strength, Dynamic Load and wear load.

Worm Gears: Terminology, Forces analysis, efficiency of worm and worm gear, worm gear strength, Thermal capacity of worm gear SETS

UNIT -5 (07 HOURS)
Sliding Contact bearings: Journal bearing-Terminology, Bearing Modulus, Minimum oil film thickness. Coefficient of Friction, Summerfield number, Heat generated & Dissipated. Design of journal bearing using Petroff's, McKee's equation and Raymond & Boyd charts, tables. Footstep & collar Bearing. **Rolling contact bearings:** Types & classification, Terminology- Life, Static & dynamic load capacity, equivalent load, Load-life relationship, Design – finding Life, selection from manufacturer's catalogue.

TEXT BOOKS

SL.NO	Title of the Book	Name of the author/s	Name of the publisher	Edition and year
1	Design of Machine Elements	V.B.Bhandari	TataMcgrawhill	2^{nd} edition 2007
2	Mechanical Engineering Design	Joseph.E.Shigley and Charles R. Mischke `	2Tata McGraw-Hill Design	6th Edition 2003

REFERENCE BOOKS'

SL.NO	Title of the Book	Name of the author/s	Name of the publisher	Edition and year
1	Machine Design	L.Norton Robert,	Pearson Education	2001
2	Design of Machine Elements	M.F.SPotts, T.E.Shoup `	Pearson Edition	2006.
3	Fundamentals of Machine Component Design	Robert C.Juvinal	Wiley India Pvt. Ltd	3rd Edition, 2007.

ONLINE RESOURCES	Link
NPTEL	https://nptel.ac.in/courses/108/101/108101167/
NPTEL	https://nptel.ac.in/courses/112/105/112105124/
NPTEL	https://nptel.ac.in/courses/108/101/108101167/
MIT OCW	https://ocw.mit.edu/courses/
TU Delft	https://online-learning.tudelft.nl/courses/

Program Outcomes – Articulation matrix:

PO	1	2	3	4	5	6	7	8	9	10	11	12	PSO1	PSO2
CO1	3	3	2						2	2			3	
CO2	3	3	2						2	2			3	
CO3	3	2	2						2	2			2	
CO4	3	2	1						2	2			3	
CO5	3	2	2						2	2			3	

FUNDAMENTALS OF ASTRONOMY AND ASTROPHYSICS

Course Code	18AEE467		**Credits**	3
Hours/Week (L-T-P)	3+0+0		**CIE Marks**	50
Total Hrs	39		**SEE Marks**	50
Exam Hrs	03		**Course Type**	Program Elective

COURSE OUTCOMES

Course outcomes: After completion of the course, students will be able to-

1. Understand the history of astronomy and luminosity of stars
2. Explain the life cycle of stars through HR diagram
3. Understand the origin of sun and planets
4. Describe Origin and Nature of Asteroids, Meteors, Comets and Galaxies
5. Outline the characteristics of milky way galaxy and Big Bang concepts

TEACHING METHODOLOGY

- Blackboard teaching/PowerPoint presentation (if needed) /Flipped Classes for specified topics
- Regular review of students by asking questions based on topics covered in the class

COURSE CONTENTS

UNIT -1 (08 HOURS)

History of Astronomy and Apparent Luminosity of Stars: Ptolemy's astronomical work, Copernican heliocentrism and Tychonian system, Luminosity (Apparent and Absolute) of stars, Magnitude scale, Luminosity measurement: 1)Visual Method 2) Photographic method and 3) Photoelectric method.

UNIT -2 (08 HOURS)

Stellar Evolution (HR diagram): Life cycle; Stellar Processes (Nuclear) and spectral classification of Stars O, B, A, F, G, K, M.

UNIT -3 (08 HOURS)

Sun and Planets Origin of the solar system: Internal structure and surface features of sun, Sun spots and Magnetic field on the sun and Solar activity. Surface features of planets, Atmospheres and Magnetic fields of Planets and their moons.

UNIT -4 (08 HOURS)

Asteroids, Meteors, Comets and Galaxies: Asteroids: Discovery and designation, Origin, Nature and Orbits of Asteroids. Meteors : Meteor showers and sporadic meteors. Comets : Periodic comets, Brightness variation in Comets. Gas production rates, dust and ion tails.

UNIT -5 (07 HOURS)

Galaxies: Milky Way Galaxy & Galaxies beyond Structure of the Milky Way Galaxy What are galaxies? Different types of galaxies. Hubble's classification. Structure, size & mass of the Milky Way galaxy. Position of our Sun and its motion around the galactic centre.

Cosmology The expanding universe. Cosmological models: Big Bang and Steady State models. Dark matter

TEXT BOOKS

Sl.no	Title of the Book	Name of the Author	Name of the Publishers	Edition and Year
1	Astronomy structure of the Universe	A.E. Roy and D. Clarke	Adam Hilger, Subsequent edition	1989
2	Source Book of Space Sciences	Samuel Galsstone	Van Nostrand Reinhold Inc.,U.S.	1965
3	Textbook of Astronomy and Astrophysics with elements of cosmology,	V.B. Bhatia,.	Alpha Science International Ltd	2001
4	Introduction to Astrophysics	Baidyanath Basu	Prentice Hall India Learning Private Limited;	2nd edition, 2010
5	Astrophysics: Stars and Galaxies	K.D.Abhyankar	Universities Press	2001

REFERENCE BOOKS'

Sl.no	Title of the Book	Name of the Author	Name of the Publishers	Edition and Year
1	Fundamental Astronomy	H. Karttunen, P Kroger, H Oja, M Poutanen & K. J. Donner	Springer	5th Edition 2007
2	Foundations of Astronomy	W.M.Smart	Prentice Hall Press	1942
3	The Physical Universe: An Introduction to Astronomy	Frank Shu	University Science Books	1981

ONLINE RESOURCES	Link
NPTEL	https://nptel.ac.in/courses/115/105/115105046/
MIT OCW	https://ocw.mit.edu/courses/physics/8-282j-introduction-to-astronomy-spring-2006/

COURSE ASSESSMENT METHOD

Continuous Internal Evaluation (CIE)

Three internals tests (each 30 marks) are conducted, average of best two performances will be considered.

1. Minimum two Assignments/Model making - evaluated through rubrics for 10 marks. Average of two will be considered.
2. Tutorial classes and assessment are carried out/Surprise quiz tests are conducted and evaluated for 10 marks. Average of these two will be considered.

Semester End Examination (SEE)
1. Two Questions are to be set from each unit, carrying 20 Marks each.
2. Students have to answer 5 questions selecting one full question from each unit

Program Outcomes – Articulation matrix:

PO	1	2	3	4	5	6	7	8	9	10	11	12	PSO1	PSO2
CO1	3	3	2										1	1
CO2	3	3	2										1	1
CO3	3	3	2										1	1
CO4	3	3	2										1	1
CO5	3	3	2										1	1

INTRODUCTION TO AEROACOUSTICS				
Course Code	18AEE468		**Credits**	3
Hours/Week (L-T-P)	3+0+0		**CIE Marks**	50
Total Hrs	39		**SEE Marks**	50
Exam Hrs	03		**Course Type**	Program Elective

COURSE OUTCOMES

Course outcomes: After completion of the course, students will be able to-

1. Describe the principles of aero acoustics
2. Explain transmission of sound through various media
3. Describe noise measuring techniques
4. Understand acoustic insulation and methods of controlling noise.

TEACHING METHODOLOGY

- Blackboard teaching/PowerPoint presentation (if needed) /Flipped Classes for specified topics
- Regular review of students by asking questions based on topics covered in the class

COURSE CONTENTS

UNIT -1 (08 HOURS)

Introduction – Basic acoustic principles – acoustic terminology and definitions –plane waves – harmonic solution – velocity of sound in inviscid fluids – relationship between wave length, particle velocities, acceleration – energy density – acoustic intensity – reference standards and measurement.

UNIT -2 (08 HOURS)

Transmission-Transmission of sound through one, two, and three media. Transmission through pipes – branched and un-branched resonators – Transmission loss reflection at plane surface-standing waves and standing wave apparatus, spherical waves – radiation – simple source – hemispherical source – radiating piston – pressure intensity distribution – beam width and directivity index – sound absorbing materials.

UNIT -3 (08 HOURS)

Noise Measurement Techniques-Noise measurement: Decibel scale – relationship between pressure, intensity and power – sound level meter, noise analyser and graphic level recorder – measurement in anechoic and reverberation chambers, machinery noise control. Environmental noise control: Human reaction to sound – definitions of speech interference level, perceived noise level, phon and sone etc, hearing loss – principles of noise control –control at source, during transmission and at receiver – protection of receiver.

UNIT -4 (08 HOURS)

Acoustic Insulation Acoustic insulation – acoustic materials – acoustic filter and mufflers – plenum chamber – noise criteria and standards –noise and number index guide lines for designing quieter equipments – machinery noise such as pumps, rotating machines, reciprocating machines etc.

UNIT -5 (07 HOURS)

Methods of Control of Noise- Methods of control of noise using baffles, coverings, perforations etc. Transmission through structures –control vibration by damping and other methods. Principles of noise control in an auditorium – requirements of a good auditorium.

TEXT BOOKS

Sl.no	Title of the Book	Name of the Author	Name of the Publishers	Edition and Year
1	Noise and Vibration Control for Industrialists,	Pertrusowicz and Longmore	Elsevier	1974.
2	Secrets of Noise Contro	Thumann A and R. K. Miller	Fairmont Press,	1976
3	Industrial Noise and Vibration Control,	J. D. Irvin and e. R. Graf,	Prantice-Hall, Englewood Cliffs, New Jersey,	1979
4	Introduction to Acoustics,	Ford R. D.,	Elsevier, New York,	1970.
5	Astrophysics: Stars and Galaxies	K.D.Abhyankar	Universities Press	2001

REFERENCE BOOKS'

Sl.no	Title of the Book	Name of the Author	Name of the Publishers	Edition and Year
1	Engineering principles of Acoustics,	Reynolds D. D.,	Alyn and Bacon Inc., Boston,	1981.
2	Noise and vibration control engineering: principles and applications,	Berenekm L. L. and Istvan L. Ver	Wiley-Inter Science,	1992.
3	Handbook of Noise Control,	Harris C. M.,	McGraw Hill,	1979.

ONLINE RESOURCES	Link
NPTEL	https://nptel.ac.in/courses/101/106/101106031/
MIT OCW	https://www.youtube.com/watch?v=fzmhXb_DkNw

COURSE ASSESSMENT METHOD

Continuous Internal Evaluation (CIE)

Three internals tests (each 30 marks) are conducted, average of best two performances will be considered.

1. Minimum two Assignments/Model making - evaluated through rubrics for 10 marks. Average of two will be considered.
2. Tutorial classes and assessment are carried out/Surprise quiz tests are conducted and evaluated for 10 marks. Average of these two will be considered.

Semester End Examination (SEE)

1. Two Questions are to be set from each unit, carrying 20 Marks each.
2. Students have to answer 5 questions selecting one full question from each unit

Program Outcomes – Articulation matrix:

PO	1	2	3	4	5	6	7	8	9	10	11	12	PSO1	PSO2
CO1	3	3											1	1
CO2	3	3											1	1
CO3	3	3											1	1
CO4	3	3											1	1

INTRODUCTION TO ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING				
Course Code	18AEE469		**Credits**	3
Hours/Week (L-T-P)	3-0-0		**CIE Marks**	50
Total Hrs	39		**SEE Marks**	50
Exam Hrs	3		**Course Type**	Program Elective

COURSE OUTCOMES

Course outcomes: After completion of the course, students will be able to-

1. Understand the concepts of data science,AI and ML
2. Apply the concepts of Artificial Intelligence and Machine Learning
3. Develop the knowledge to understand, represent and visualise the data that form the foundation to AI and ML
4. Apply different ML algorithms to different situations in Aerospace Industry

TEACHING METHODOLOGY

- Blackboard teaching/PowerPoint presentation (if needed) /Flipped Classes for specified topics
- Regular review of students by asking questions based on topics covered in the class

COURSE CONTENTS

UNIT -1 (08 HOURS)

Introduction to Data Science and AI & ML, Data Science, AI & ML, Essential Concepts in AI and ML Data Understanding, Representation and Visualisation

UNIT -2- (08HOURS)

Machine Learning: Linear Methods, Linear Regression, Multiple Linear Regression, Non-Linear Regression, Clustering, Forecasting models, Perceptron and Neural Network, Decision Trees, Support Vector Machines.

UNIT -3- (08 HOURS)

Probabilistic Models, Dynamic programming and Reinforcement Programming, Evolutionary Algorithms, Time Series Models, Deep Learning, Emerging Trends in ML, Unsupervised Learning

UNIT -4- (08 HOURS)

Foundations for AI, AI Basics , AI Classification, Supervised Learning, Feature Engineering Regression, Model Selection, Model Performance , Ranking

UNIT -5- (07 HOURS)

Introduction to ML with R and using Python, Python and R for Artificial Intelligence, Machine Learning, and Data Science, AI/ML in aerospace industry

TEXT BOOKS

SL.NO	Title of the Book	Name of the author/s	Name of the publisher	Edition and year
1	Machine Learning and Artificial Intelligence	Ameet V Joshi	Springer	2019
2	Artificial Intelligence and Machine Learning	Vinod Chandra SS	PHI Learning	2014.

REFERENCE BOOKS'

SL.NO	Title of the Book	Name of the author/s	Name of the publisher	Edition and year
1	Basics of Artificial Intelligence and Machine Learning	Dheeraj Mehrotra	Notion Press	2019

COURSE ASSESSMENT METHOD

Continuous Internal Evaluation (CIE)

Three internals tests (each 30 marks) are conducted, average of best two performances will be considered.

1.Minimum two Assignments/Model making - evaluated through rubrics for 10 marks. Average of two will be considered.

2.Tutorial classes and assessment are carried out/Surprise quiz tests are conducted and evaluated for 10 marks. Average of these two will be considered.

Semester End Examination (SEE)

1. Two Questions are to be set from each unit, carrying 20 Marks each.
2. Students have to answer 5 questions selecting one full question from each unit

Program Outcomes – Articulation matrix:

PO	1	2	3	4	5	6	7	8	9	10	11	12	PSO1	PSO2
CO1	2	2							2	2				
CO2	3	3							2	2				
CO3	3	3							2	2				
CO4	3	3							2	2				

COMPUTER AIDED AIRCRAFT DRAWING LAB				
Course Code	18AEL47		**Credits**	1
Hours/Week (L-T-P)	0+0+3		**CIE Marks**	50
Total Hrs	39		**SEE Marks**	50
Exam Hrs	03		**Course Type**	Core

COURSE OUTCOMES

Course outcomes: After completion of the course, students will be able to-

1 Plot the orthographic views of engineering components

2. Use suitable thread forms,Fasteners and riveted joints for engineering applications.
3. Design propeller and hub assembly using advanced modelling tools.
4. Design wing assembly,fuselage and engine mounts using advanced modelling tools.
5. Design of landing gear assembly using advanced modelling tools

TEACHING METHODOLOGY

- Blackboard teaching/PowerPoint presentation (if needed) /Flipped Classes for specified topics

COURSE CONTENTS

PART -A

1. Orthographic Views: Conversion of pictorial views into orthographic projections of simple machine parts with or without section. (Bureau of Indian Standards conventions are to be followed for the drawings) Hidden line conventions. Precedence of lines.
2. Thread Forms: Thread terminology, sectional views of threads. ISO Metri(Internal & External) BSW (Internal & External) square and Acme. Sellers thread, American Standard thread.
3. Fasteners: Hexagonal headed bolt and nut with washer (assembly), square headed bolt and nut with washer (assembly) simple assembly using stud bolts with nut and lock nut.
4. Riveted Joints: Single and double riveted lap joints, butt joints with single/doublcover straps (Chain and Zigzag, using snap head rivets).

PART -B

1. Design of propeller and hub assembly
2. Design of wing assembly
3. Design of Engine Mounts
4. Design of fuselage assembly
5. Design of landing gear

Course Assessment Method:

Record: 30 marks

Test: 15 marks

Viva-voce: 05 marks

SEE - Final Exam: 50 Marks

Scheme of Examination: Student will be asked to conduct any one experiment from Part A & B

Program Outcomes – Articulation matrix:

PO	1	2	3	4	5	6	7	8	9	10	11	12	PSO1	PSO2
CO1	3	3	2		3				2	2			2	1
CO2	3	3	2		3				2	2			2	1
CO3	3	2	2		3				2	2			2	1
CO4	3	2	2		3				2	2			2	1
CO5	3	2	2		3				2	2			2	1

MANUFACTURING PROCESS LAB				
Course Code	18AEL48		**Credits**	1
Hours/Week (L-T-P)	0+0+3		**CIE Marks**	50
Total Hrs	39		**SEE Marks**	50
Exam Hrs	03		**Course Type**	Core

COURSE OUTCOMES

Course outcomes: After completion of the course, students will be able to-

1. Make use of mould boxes to prepare mould cavities with or without patterns
2. Develop models using taper turning, step turning and thread cutting using lathe machine
3. Develop models using facing, drilling and boring using lathe machine
4. Prepare models using shaping and milling machine tools in producing V, rectangular and dovetail grooves

List of experiments

1. Preparation of moulds using patterns or without patterns.
   a. Split pattern,
   b. Match plate pattern
2. Preparation of models using lathe involving Plain turning,
   a. Taper turning,
   b. Step turning,
   c. Thread cutting,
   d. Facing,
   e. Knurling,
   f. Drilling,
   g. Boring,
3. Shaping operation
   a. Cutting of V Groove
   b. dovetail
   c. Rectangular groove
4. Milling operation and Gear cutting

Course Assessment Method:

Record: 30 marks

Test: 15 marks

Viva-voce: 05 marks

SEE - Final Exam: 50 Marks

Scheme of Examination: Student will be asked to conduct two experiments

Program Outcomes – Articulation matrix:

PO	1	2	3	4	5	6	7	8	9	10	11	12	PSO1	PSO2
CO1	3	3			3				3	2			2	
CO2	3	3			3				3	3			2	
CO3	3	3			3				3	3			2	
CO4	3	2			3				3	3			2	

AEROSPACE STRUCTURAL DESIGN LAB				
Course Code	18AEL49		**Credits**	1
Hours/Week (L-T-P)	0+0+3		**CIE Marks**	50
Total Hrs	39		**SEE Marks**	50
Exam Hrs	03		**Course Type**	Core

COURSE OUTCOMES

Course outcomes: After completion of the course, students will be able to-

1. Apply simple design calculations and produce gear teeth using milling machine

2. Analyse the structural components of Aircraft
3. Examine the Photo Elastic Materials
4. Determination of stresses using photo elastic materials
5. Examine the Fatigue Testing of materials and Vibration of beams

List of experiments

1. Study of structural components of Aircraft
2. Deflection of beams with various end conditions.
3. Verification of Maxwell's Reciprocal theorem & principle of superposition
4. Column – Testing
5. South – well's plot
6. Calibration of Photo Elastic Materials
7. Determination of stresses using photo elastic materials
8. Creep testing of Materials
9. Measurement of stresses in thin walled vessels.
10. Fatigue Testing of materials
11. Vibration of beams

Course Assessment Method:

Record: 30 marks
Test: 15 marks
Viva-voce: 05 marks
SEE - Final Exam: 50 Marks
Scheme of Examination: Student will be asked to conduct two experiment

Program Outcomes – Articulation matrix:

PO	1	2	3	4	5	6	7	8	9	10	11	12	PSO1	PSO2
CO1	3	3			3				3	2		3	2	
CO2	3	3			3				3	3		3	3	
CO3	3	3			3				3	3		2	3	
CO4	3	2			2				3	3		2	3	
CO5	3	3			3				3	3		2	3	

SEMESTER-V

AIRCRAFT PERFORMANCE				
Course Code	18AE51		**Credits**	3
Hours/Week (L-T-P)	3		**CIE Marks**	50
Total Hrs	39		**SEE Marks**	50
Exam Hrs	3		**Course Type**	Core

COURSE OUTCOMES

Course outcomes: After completion of the course, students will be able to-

1. Describe aerodynamic characteristics, engine performance and effects of flight altitude on aircraft performance.
2. Predict and analyze the performance of an airplane for accelerating and Non-accelerating cases
3. Determine the range and endurance of propeller and jet driven airplane
4. Describe the different aircraft maneuvers

TEACHING METHODOLOGY

- Blackboard teaching/PowerPoint presentation (if needed) /Flipped Classes for specified topics
- Regular review of students by asking questions based on topics covered in the class

COURSE CONTENTS

UNIT -1 (08 HOURS)

Introduction: The evolution of the airplane and the performance, a short history. The standard atmosphere, The Drag polar, source of aerodynamic force-lift, drag and moments, aerodynamic coefficients, Variation of lift, drag and moment coefficient with angle of attack and Mach number, Components of drag, Aerodynamic center, Equilibrium conditions, Variation of thrust, power and SFC with velocity and altitudes for air breathing engines

The Equations of Motion Steady Unaccelerated Flight: Introduction, Four forces of flight, General equation of motion, Power available and power required curves. Thrust available and thrust required curves. Conditions for power required and thrust required minimum. Thrust available and maximum velocity, Power available and maximum velocity, Altitude effects on power available and power required; thrust available and thrust required

UNIT -2- (08 HOURS)

Steady Performance – Level Flight, Climb &Glide: Equation of motion for steady level flight, Performance of airplane in level flight. Maximum speed in level flight, Climb Performance: Equation of motion for Rate of climb- graphical and analytical approach - Absolute ceiling, Service ceiling, Time to climb – graphical and analytical approach , climb performance graph (hodograph diagram); maximum climb angle and rate of climb Gliding flight, Range during glide, minimum rate of sink and shallowest angle of glide.

Fundamental Airplane Performance Parameters: Thrust – to – weight ratio, Wing loading, Drag polar, and lift-to – drag ratio. Minimum velocity: Stall and High lift devices, Nature of stall – flow separation, High lift deices, Aerodynamic relations associated with lift-to-drag ratio.

UNIT -3- (08 HOURS)

Range and Endurance: Propeller driven Airplane: Physical consideration, Quantitative formulation, Breguet equation for Range and Endurance, Conditions for maximum range and endurance.

Jet Airplane: Physical consideration, Quantitative formulation, Equation for Range and Endurance, Conditions for maximum range and endurance, Effect of head wind tail wind.

UNIT -4- (08 HOURS)

Aircraft Performance in Accelerated Flight: Take-off Performance: Calculation of Ground roll, Calculation of distance while airborne to clear obstacle, Balanced field length
Landing Performance and Accelerated Climb: Calculation of approach distance, Calculation of flare distance, Calculation of ground roll, ground effects. Acceleration in climb.

UNIT -5- (07 HOURS)

Maneuver Performance: Turning performance: Level turn, load factor, Constraints on load factor, Minimum turn radius, Maximum turn rate. Pull-up and Pull-down maneuvers: (Turning rate, turn radius). Limiting case for large load factor. The V-n diagram. Limitations of pull up and push over.

TEXT BOOKS

Sl.no	Title of the Book	Name of the Author	Name of the Publisher	Edition and Year
1	Aircraft Performance and Design	John D. Anderson, Jr.	McGraw-Hill International Editions, Aerospace Science/ Technology	1999
2	Introduction to flight	John D. Anderson, Jr.	McGraw-Hill International Editions, Aerospace Science/ Technology	2000

REFERENCE BOOKS'

Sl.no	Title of the Book	Name of the Author	Name of the Publisher	Edition and Year
1	Airplane Performance stability and Control	Perkins, C.D., and Hage, R.E	John Wiley Son Inc, New York,	1988
2	Aerodynamics, Aeronautics, and Flight Mechanics	Barnes W. McCormick	John Wiley & Sons	2nd Edition, 1994

ONLINE RESOURCES	Link
NPTEL	https://nptel.ac.in/courses/101/104/101104007/
NPTEL	https://nptel.ac.in/courses/101/106/101106041/
NPTEL	https://nptel.ac.in/courses/101/104/101104061/

COURSE ASSESSMENT METHOD

Continuous Internal Evaluation (CIE)

Three internals tests (each 30 marks) are conducted, average of best two performances will be considered.

1. Minimum two Assignments/Model making - evaluated through rubrics for 10 marks. Average of two will be considered.
2. Tutorial classes and assessment are carried out/Surprise quiz tests are conducted and evaluated for 10 marks. Average of these two will be considered.

Semester End Examination (SEE)

1. Two Questions are to be set from each unit, carrying 20 Marks each.
2. Students have to answer 5 questions selecting one full question from each unit

Program Outcomes – Articulation matrix

PO	1	2	3	4	5	6	7	8	9	10	11	12	PSO1	PSO2
CO1	3	3												3
CO2	3	3												3
CO3	3	3												3
CO4	3	3												3

AERODYNAMICS – II				
Course Code	18AE52		**Credits**	04
Hours/Week (L-T-P)	4		**CIE Marks**	50
Total Hrs	48		**SEE Marks**	50
Exam Hrs	3		**Course Type**	Core

COURSE OUTCOMES

Course outcomes: After completion of the course, students will be able to-

1. Explain two-dimensional panel methods and incompressible flow over finite wings
2. Analyze subsonic linearized flow and outline the effects of compressibility and viscous flow over the airfoils
3. Identify and describe the applications of finite wing theory and flow over bodies of revolution.
4. Illustrate the effects of swept wings and high-lift systems

TEACHING METHODOLOGY

- Blackboard teaching/PowerPoint presentation (if needed) /Flipped Classes for specified topics
- Regular review of students by asking questions based on topics covered in the class

COURSE CONTENTS

UNIT -1- (10 HOURS)

Introduction to Two-Dimensional Panel Methods: Non-lifting flows over arbitrary bodies, source panel method, lifting flows over arbitrary bodies, vortex panel method, some examples

Incompressible Flows over Finite Wings: Downwash, Induced drag, vortex filament, the Biot-Savart Law, Prandtl's lifting line theory and its limitations, Elliptic lift distribution.

UNIT -2- (10 HOURS)

Subsonic linearized flow over airfoils: Full velocity potential equation, linearized velocity potential equation and boundary condition, Prandtl-Glauert compressibility correction.

Effects of Compressibility: Basics of speed of sound, Mach waves, Normal shock waves, Oblique shock waves, Expansion fan, Prandtl – Meyer expansion, Critical Mach number; Drag- divergence Mach number, Sound Barrier, Transonic area rule.

UNIT -3- (10 HOURS)

Applications of Finite Wing Theory: Simplified horseshoe vortex model, Formation flight, Influence of downwash on tail plane, ground effects.

Bodies of Revolution: Introduction to slender body theory, Cylindrical coordinates, boundary conditions, Pressure coefficient, Subsonic flow past an axially symmetric body at zero incidence and solution for a slender cone.

UNIT -4 (10 HOURS)

Swept Wings and High-Lift Systems: Introduction to sweep effects, swept wings, pressure coefficient, typical aerodynamic characteristics, Subsonic and Supersonic leading edges. Introduction to high-lift systems, flaps, leading-edge slats and typical high - lift characteristics.

UNIT -5 (08 HOURS)

Viscous Flows: Derivation of Navier-Stokes equation for two-dimensional flows, boundary approximations, laminar boundary equations and boundary conditions, Blasius solution, qualitative features of boundary layer flow under pressure gradients, aspects of transition to turbulence, turbulent boundary layer properties over a flat plate at low speeds.

TEXT BOOKS

Sl.no	Title of the Book	Name of the Author	Name of the Publisher	Edition and Year
1	Fundamentals of Aerodynamics	Anderson, Jr. J.D	Tata McGraw-Hill Publishing Co. Ltd., New Delhi	2007 (Special Indian Edition).
2	Boundary layer theory	Schlichting, H	McGraw Hill, New York	2004
3	Elements of Gas Dynamics	H.W .Liepmann And A.Roshko	Dover Publications (January 11, 2002)	(January 11, 2002)

REFERENCE BOOKS'

Sl.no	Title of the Book	Name of the Author	Name of the Publisher	Edition and Year
1	Aerodynamics for Engineers	Bertin, John J	Pearson Education Inc	2002
2	Fluid Mechanics	White, F.M	Mc Graw Hill Inc. New York	1986
3	Aerodynamics for Engineering Students	Houghton E.L and Carpenter P.W	CBS Publications and Distributors	1993 (4th Edition).
4	Introduction to Flight	Anderson, Jr. J.D	Tata McGraw-Hill Publishing Co. Ltd., New Delhi,	2007(Special Indian Edition).

ONLINE RESOURCES	Link
NPTEL	https://nptel.ac.in/courses/101/105/101105059/
NASA	https://www.nasa.gov/audience/forstudents/k-4/stories/nasa-knows/what-is-aerodynamics-k4.html

COURSE ASSESSMENT METHOD

Continuous Internal Evaluation (CIE)

Three internals tests (each 30 marks) are conducted, average of best two performances will be considered.

1. Minimum two Assignments/Model making - evaluated through rubrics for 10 marks. Average of two will be considered.
2. Tutorial classes and assessment are carried out/Surprise quiz tests are conducted and evaluated for 10 marks. Average of these two will be considered.

Semester End Examination (SEE)

1. Two Questions are to be set from each unit, carrying 20 Marks each.
2. Students have to answer 5 questions selecting one full question from each unit

Program Outcomes – Articulation matrix

PO	1	2	3	4	5	6	7	8	9	10	11	12	PSO-1	PSO-2
CO-1	3	2							3	2				3
CO-2	3	2							3	2				3
CO-3	3	2							3	2				3
CO-4	3	2							3	2				3

AIRCRAFT STRUCTURES-II				
Course Code	18AE53		**Credits**	4
Hours/Week (L-T-P)	4		**CIE Marks**	50
Total Hrs	48		**SEE Marks**	50
Exam Hrs	3		**Course Type**	Core

COURSE OUTCOMES

Course outcomes: After completion of the course, students will be able to-

1. Analyze aircraft structural design and bending in unsymmetrical sections
2. Analyze the shear flow in open and closed sections
3. Compute the buckling of plates, joints and fittings.
4. Formulate stress in wings fuselage and structure of aircraft.

TEACHING METHODOLOGY

- Blackboard teaching/PowerPoint presentation (if needed) /Flipped Classes for specified topics
- Regular review of students by asking questions based on topics covered in the class

COURSE CONTENTS

UNIT -1- (10 HOURS)

Introduction to Aircraft Structural Design: conceptual design – Detailed design – Airworthiness- certification. Design criteria – Safety Factor – Design life criteria – Analysis method – Life Assessment procedures – Design Principle.

Unsymmetrical Bending: Bending stresses in beams of unsymmetrical sections – Bending of symmetric sections with skew loads

UNIT -2 (10 HOURS)

Shear Flow in Open Sections: Thin walled beams, Concept of shear flow, shear centre, Elastic axis. With one axis of symmetry, with wall effective and ineffective in bending, unsymmetrical beam sections.

UNIT -3 (10 HOURS)

Shear Flow in Closed Sections: Bredt – Batho formula, Single and multi – cell structures, approximate methods and Shear flow in single & multicell structures under torsion. Shear flow in single and multi-cell under bending with walls effective and ineffective.

UNIT -4- (10 HOURS)

Buckling of Plates: Rectangular sheets under compression, Local buckling stress of thin walled sections, Crippling stresses by Needham's and Gerard's methods, Thin walled column strength. Sheet – stiffener panels. Effective width, inter rivet and sheet wrinkling failures.

Introduction to Post Buckling, Joints and Fittings: Introduction to Post Buckling: post buckling of structures, concepts of effective width - General theory for the design of fittings, Estimation of fitting design loads, design of riveted, bolted and welding joints, post buckling of structures, and concept of effective width.

UNIT -5- (08 HOURS)

Stress Analysis in Wing and Fuselage: Procedure – Shear and bending moment distribution for semi cantilever and other types of wings and fuselage, thin webbed beam. With parallel and non-parallel flanges, Shear resistant web beams, Tension field web beams (Wagner's).

TEXT BOOKS				
Sl.no	Title of the Book	Name of the Author	Name of the Publisher	Edition and Year
1	Aircraft Structures for Engineering Students	Megson, T.M.G	Edward Arnold	1995
2	Aircraft Structures	Peery, D.J., and Azar, J.J	McGraw– Hill, N.Y.	2nd edition, 1993

REFERENCE BOOKS'				
Sl.no	Title of the Book	Name of the Author	Name of the Publisher	Edition and Year
1	Analysis and Design of Flight vehicles Structures	Bruhn. E.H	Tristate off set company, USA,	1985
2	Theory and Analysis of Flight Structures	Rivello, R.M	McGraw- Hill	1993
3	An Introduction to the Theory of Aircraft Structures	D Williams &Edward Arnold	Edward Arnold	1st Edition, 1960

ONLINE RESOURCES	Link
NPTEL	https://nptel.ac.in/courses/101/105/101105022/
NPTEL	https://swayam.gov.in/nd1_noc20_ae08/preview
TU Delft	https://ocw.tudelft.nl/course-readings/3-1-1-introduction-to-aircraft-structures/

COURSE ASSESSMENT METHOD

Continuous Internal Evaluation (CIE)

Three internals tests (each 30 marks) are conducted, average of best two performances will be considered.

1. Minimum two Assignments/Model making - evaluated through rubrics for 10 marks. Average of two will be considered.
2. Tutorial classes and assessment are carried out/Surprise quiz tests are conducted and evaluated for 10 marks. Average of these two will be considered.

Semester End Examination (SEE)

1. Two Questions are to be set from each unit, carrying 20 Marks each.
2. Students have to answer 5 questions selecting one full question from each unit

Program Outcomes – Articulation matrix

PO	1	2	3	4	5	6	7	8	9	10	11	12	PSO-1	PSO-2
CO-1	3	3							3	3			3	
CO-2	3	3							3	3			3	
CO-3	3	3							3	3			3	
CO-4	3	3							3	3			3	

AIRCRAFT PROPULSION				
Course Code	18AE54		**Credits**	3
Hours/Week (L-T-P)	3		**CIE Marks**	50
Total Hrs	39		**SEE Marks**	50
Exam Hrs	3		**Course Type**	Core

COURSE OUTCOMES

Course outcomes: After completion of the course, students will be able to-

1. Review the basic thermodynamic principles and illustrate the working principles of gas turbine engines
2. Outline the importance of subsonic, supersonic inlets, combustion chamber and nozzles for jet engines
3. Evaluate the operating characteristics of compressors and turbines in terms of blade shapes, angles, and direction of rotation
4. Describe the fundamentals of ramjet and rocket propulsion.

TEACHING METHODOLOGY

- Blackboard teaching/PowerPoint presentation (if needed) /Flipped Classes for specified topics
- Regular review of students by asking questions based on topics covered in the class

COURSE CONTENTS

UNIT -1- (08 HOURS)

Introduction: Review of thermodynamic principles, Principles of aircraft propulsion, Types of power plants, Basics of heat transfer; conduction, convection, radiation, diffusion mass transfer basic concepts and governing equations.

Fundamentals of Gas Turbine Engines: Illustration of working of gas turbine engine – The thrust equation – Factors affecting thrust – Effect of pressure, velocity and temperature changes of air entering compressor – Methods of thrust augmentation – Characteristics of turboprop, turbofan and turbojet – Performance characteristics.

UNIT -2- (08 HOURS)

Subsonic and Supersonic Inlets for Jet Engines: Internal flow and Stall in subsonic inlets – Boundary layer separation – Major features of external flow near a subsonic inlet – Relation between minimum area ratio and eternal deceleration ratio – Diffuser performance – Supersonic inlets – Starting problem on supersonic inlets – Shock swallowing by area variation – External declaration – Models of inlet operation.

Combustion Chambers and Nozzles: Classification of combustion chambers. Important factors affecting combustion chamber design. Combustion process. Combustion chamber performance. Effect of operating variables on performance. Flame tube cooling. Flame stabilization. Use of flame holders. Theory of flow in isentropic nozzles. Convergent nozzles and nozzle choking. Nozzle throat conditions. Nozzle efficiency. Losses in nozzles. Over expanded and under. expanded nozzles. Ejector and variable area nozzles. Interaction of nozzle flow with adjacent surfaces. Thrust reversal.

UNIT -3- (08 HOURS)

Compressors: Principle of operation of centrifugal compressor – Work done and pressure rise – Velocity diagrams – Diffuser vane design considerations – Concept of pre-whirl– Rotation stall – Elementary theory of axial flow compressor – Velocity triangles– degree of reaction – Three dimensional – Air angle distributions for free vortex and constant reaction designs – Compressor blade design – Centrifugal and Axial compressor performance characteristics.

UNIT -4- (08 HOURS)

Introduction to Turbines: Types of turbines-Operating Principle-Design consideration – Velocity triangles– degree of reaction - performance parameters – Basics of blade design principles.

UNIT -5- (07 HOURS)

Ramjet Propulsion: Operating principle – Sub critical, critical and supercritical operation – Combustion in ramjet engine – Ramjet performance – Sample ramjet design calculations – Introduction to scramjet – Preliminary concepts in supersonic combustion – Integral ram-rocket

Fundamentals of Rocket Propulsion: Types and Classification of rockets Operating principle – Specific impulse of a rocket – Rocket nozzle classification – Rocket performance considerations.

TEXT BOOKS

Sl.no	Title of the Book	Name of the Author	Name of the Publisher	Edition and Year
1	Gas Turbine	V. Ganesan	", Tata McGraw Hill Pub. Co. Ltd.	1996
2	Mechanics & Thermodynamics of Propulsion	Hill, P.G. & Peterson, C.R	Addison – Wesley Longman INC	1999

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REFERENCE BOOKS'

Sl.no	Title of the Book	Name of the Author	Name of the Publisher	Edition and Year
1	Gas Turbine Theory	Cohen, H. Rogers, G.F.C. and Saravanamuttoo, H.I.H	Longman	1989
2	Aero thermodynamics of Aircraft Engine Components	Oates, G.C	1. AIAA Education Series, NewYork	1985
3	Jet Engine	Rolls Royce	Wiley	3rd Edition – 1983.
4	Gas Turbine, Jet and Rocket Propulsion	Mathur, M.L. and Sharma, R.P.,	2. Standard Publishers & Distributors, Delhi	1999
5	Rocket Propulsion Elements	Sutton, G.P	John Wiley & Sons Inc., New York	5th Edition. 1993

ONLINE RESOURCES	Link
NPTEL	https://nptel.ac.in/courses/101/101/101101002/
NPTEL	https://nptel.ac.in/courses/112/103/112103281/
MIT OCW	https://ocw.mit.edu/courses/aeronautics-and-astronautics/16-50-introduction-to-propulsion-systems-spring-2012/
TU Delft	https://www.tudelft.nl/en/ae/organisation/departments/aerodynamics-wind-energy-flight-performance-and-propulsion/flight-performance-and-propulsion/

COURSE ASSESSMENT METHOD
Continuous Internal Evaluation (CIE) Three internals tests (each 30 marks) are conducted, average of best two performances will be considered. 1. Minimum two Assignments/Model making - evaluated through rubrics for 10 marks. Average of two will be considered. 2. Tutorial classes and assessment are carried out/Surprise quiz tests are conducted and evaluated for 10 marks. Average of these two will be considered. Semester End Examination (SEE) 1. Two Questions are to be set from each unit, carrying 20 Marks each. 2. Students have to answer 5 questions selecting one full question from each unit

Program Outcomes – Articulation matrix

PO	1	2	3	4	5	6	7	8	9	10	11	12	PSO-1	PSO-2
CO-1	3	2												3
CO-2	3	2												3
CO-3	3	2												3
CO-4	3	2												3

AVIATION SAFETY MANAGEMENT AND ACCIDENT INVESTIGATIONS				
Course Code	18AEH55		**Credits**	3
Hours/Week (L-T-P)	3		**CIE Marks**	50
Total Hrs	39		**SEE Marks**	50
Exam Hrs	3		**Course Type**	Core

COURSE OUTCOMES

Course outcomes: After completion of the course, students will be able to-

1. Build and implement aviation safety management programs in aviation related organizations.
2. Explain the importance of human factor and thereby build human factor training for their organization to reduce accidents and incidents occurring because of human factor.
3. Formulate and implement aviation safety management programs and to prepare accident and incedent reports.
4. Plan and schedule maintenance activities for the aircrafts.
5. Understand and maintain the airport certification manual and to conduct airport and helipad inspection program.

TEACHING METHODOLOGY

- Blackboard teaching/PowerPoint presentation (if needed)
- Videos and animation

COURSE CONTENTS

UNIT -1- (08 HOURS)

INTRODUCTION-Aviation safety -Meaning -Need -Economic of Aviation Safety -Safety Vs Mission -Randomness of Damage and Injury -Zero Accident Rate -Accident causes -Multiple Vs Single Cause -Aircraft Accident -Aircraft Mischap -Aircraft Incident -Building Aviation Safety Program -Prevention Methodology -Risk Management

UNIT -2- (08 HOURS)

HUMAN FACTORS IN AVIATION SAFETY-Theory of Risk -Changing the Behaviour of the risk takers -Attitudes -Discipline -Punishment -Protection of Safety -Motivating Safe Behaviour -Human factors difficulties -Training invlovling human factors -Human Performance Concerns -Human Performance Factors.

UNIT -3- (08 HOURS)

AVIATION SAFETY PROGRAM ELEMENTS-Internal Reporting Systems -Information Distribution systems -Aviation Safety Committees -Aviation Safety Inspection Programs -Aviation safety program Evaluation -Flight Operation Safety Inspection -Safety Inspection report Format -Aviation Safety Education and Training -Aviation Safety Awards Programs -Accident Preparation and Investigation.

UNIT -4- (08 HOURS)

AIRCRAFT MAINTENANCE SAFETY-Aircraft Discrepancies -Delayed and Deferred Descrepancies -Training -Configuration Control -Maintenance Engine Runs and Taxiing -Maintenance Test Flights -maintenance Analysis -Tool Control -Hazarodous Waste Disposal -Bogus parts -Technical Data -maintenance Inspections -Flight Line Practices -Maintenance Safety Programs -Maintenance Safety Inspections.

UNIT -5- (07 HOURS)

AIRPORTS AND HELIPORTS-Airport Certification Manual -Airport Emergency Plan -Airports/Heliports criteria -Airfield Criteria -Airspace Criteria -Foreign Object Control -Bird Hazards -Snow and Ice Removal -Fuel Handling -Vehicle Control -Airport and Heliport Safety Inspections.

TEXT BOOKS				
Sl.no	Title of the Book	Name of the Author	Name of the Publisher	Edition and Year
1	Aviation Safety Programs -A Management Handbook	Richard H. Wood		
2	Safety Management Systems in Aviation	Alan J. Stolzer, John J. Goglia,	Routledge	2nd edition,2015

REFERENCE BOOKS'				
Sl.no	Title of the Book	Name of the Author	Name of the Publisher	Edition and Year
1	Aircraft Safety: Accident Investigations, Analyses, & Applications	Shari Stamford Krause,	McGraw-Hill Education	Second Edition, 2003

ONLINE RESOURCES	Link
TU Delft	https://ocw.tudelft.nl/course-readings/introduction-case-aircraft-landing-accident/
TU Delft	https://online-learning.tudelft.nl/courses/air-safety-investigation/

COURSE ASSESSMENT METHOD

Continuous Internal Evaluation (CIE)

Three internals tests (each 30 marks) are conducted, average of best two performances will be considered.

1. Minimum two Assignments/Model making - evaluated through rubrics for 10 marks. Average of two will be considered.
2. Tutorial classes and assessment are carried out/Surprise quiz tests are conducted and evaluated for 10 marks. Average of these two will be considered.

Semester End Examination (SEE)

1. Two Questions are to be set from each unit, carrying 20 Marks each.
2. Students have to answer 5 questions selecting one full question from each unit

Program Outcomes – Articulation matrix

PO	1	2	3	4	5	6	7	8	9	10	11	12	PSO-1	PSO-2
CO-1	2					3	3	2	3	2	1	2		
CO-2	2					3	3	2	2	2	1	2		
CO-3	2					3	3	2	2	2	1	2		
CO-4	2					3	3	2	2	2	1	2		
CO-5	2					3	3	2	2	2	1	2		

PROPULSION LAB				
Course Code	18AEL57		**Credits**	01
Hours/Week (L-T-P)	0-0-3		**CIE Marks**	50
Total Hrs	39		**SEE Marks**	50
Exam Hrs	3		**Course Type**	Core

COURSE OUTCOMES

Course outcomes: After completion of the course, students will be able to-

1. Describe the construction and working principle of aircraft piston engine and jet engines.
2. Analyze forced convective heat transfer over flat plate.
3. Examine the nozzle flow and fuel injection characteristics
4. Predict the performance of a propeller and determine heat release by combustion of fuel
5. Sketch the velocity profile of free jet at variable positions of pitot tube

List of experiments

1. Study of an aircraft piston engine. (Includes study of assembly of sub systems, various components, their functions and operating principles)
2. Study of an aircraft jet engine (Includes study of assembly of sub systems, various components, their functions and operating principles)
3. Study of forced convective heat transfer over a flat plate.
4. Cascade testing of a model of axial compressor blade row.
5. Study of performance of a propeller.
6. Determination of heat of combustion of aviation fuel.
7. Study of free jet
8. Measurement of burning velocity of a premixed flame.
9. Fuel-injection characteristics
10. Measurement of nozzle flow.

COURSE ASSESSMENT METHOD

Record: 30 marks
Test: 15 marks
Viva-voce: 05 marks
SEE - Final Exam: 50 Marks
Scheme of Examination: Student will be asked to conduct two experiment

Program Outcomes – Articulation matrix

PO	1	2	3	4	5	6	7	8	9	10	11	12	PSO-1	PSO-2
CO-1	3				3				3	3				3
CO-2	3	3	2		3				3	3				3
CO-3	3	3	2		3				3	3				3
CO-4	3	3	3		3				3	3				3
CO-5	3	2	2		3				3	3				3

AERODYNAMICS LAB				
Course Code	18AEL58		**Credits**	1
Hours/Week (L-T-P)	0-0-3		**CIE Marks**	50
Total Hrs	39		**SEE Marks**	50
Exam Hrs	3		**Course Type**	Core

COURSE OUTCOMES

Course outcomes: After completion of the course, students will be able to-

1. Identify the different types of wind tunnels and aerodynamic loads.
2. Analyze the pressure distribution of symmetrical and unsymmetrical airfoil and 2D cylinder.
3. Examine flow visualization of airfoil and bluff bodies at different angle of attacks
4. Analyze the boundary layer and velocity profile on the wind tunnel wall.

List of experiments

1. Calibration of a subsonic wind tunnel
2. Smoke flow visualization studies on a two-dimensional circular cylinder at low speeds.
3. Smoke flow visualization studies on a two dimensional airfoil at different angles of incidence at low speeds
4. Tuft flow visualization on a wing model at different angles of incidence at low speeds: identify zones of attached and separated flows.
5. Surface pressure distributions on a two-dimensional circular cylinder at low speeds and calculation of pressure drag.
6. Surface pressure distributions on a two-dimensional symmetric airfoil at zero incidences at low speeds.
7. Surface pressure distributions on a two-dimensional cambered airfoil at different angles of incidence and calculation of lift and pressure drag.
8. Calculation of total drag of a two-dimensional circular cylinder at low speeds using Pitot-static probe wake survey.
9. Calculation of total drag of a two-dimensional cambered airfoil at low speeds at incidence using Pitot static probe wake survey.
10. Measurement of a typical boundary layer velocity profile on the tunnel wall (at low speeds) using a Pitot probe and calculation of boundary layer displacement and momentum thickness.

COURSE ASSESSMENT METHOD

Record: 30 marks
Test: 15 marks
Viva-voce: 05 marks
SEE - Final Exam: 50 Marks
Scheme of Examination: Student will be asked to conduct two experiment

Program Outcomes – Articulation matrix

PO	1	2	3	4	5	6	7	8	9	10	11	12	PSO-1	PSO-2
CO-1	3	3	2						3	3				3
CO-2	3	3	2						3	3				3
CO-3	3	3	2						3	3				3
CO-4	3	3	2						3	3				3

COMPOSITE MATERIAL LAB				
Course Code	18AEL59		**Credits**	1
Hours/Week (L-T-P)	3		**CIE Marks**	50
Total Hrs	39		**SEE Marks**	50
Exam Hrs	3		**Course Type**	Core

COURSE OUTCOMES

Course outcomes: After completion of the course, students will be able to-

1. Perform hand layup and filament winding of composite material
2. Use hand injection moulding for manufacture of composite materials
3. Explain various materials,resins and catalyst used for manufacture of composite materials.
4. Perform vacuum bagging method of composite materials and NDT tests.

List of Experiments

1. Composite Hand Layup procedure
2. Filament Winding of composite material
3. Hand Injection Moulding of composite material
4. Composite Beam deflection analysis
5. NDT tests for composite materials
6. Vacuum Bagging Method of composite material
7. Different Types of Materials, Resin & Catalyst
8. Demonstration on use of autoclave and hydraulic press for manufacturing of composite materials.

COURSE ASSESSMENT METHOD

Record: 30 marks
Test: 15 marks
Viva-voce: 05 marks
SEE - Final Exam: 50 Marks
Scheme of Examination: Student will be asked to conduct two experiment

Program Outcomes – Articulation matrix

PO	1	2	3	4	5	6	7	8	9	10	11	12	PSO-1	PSO-2
CO-1	3	2			3				3	3			3	
CO-2	3	2			3				3	3			3	
CO-3	3	2			3				3	3			3	
CO-4	3	2			3				3	3			3	

PROGRAM ELECTIVE – C

FUELS AND COMBUSTION				
Course Code	18AEE551		**Credits**	3
Hours/Week (L-T-P)	3		**CIE Marks**	50
Total Hrs	36		**SEE Marks**	50
Exam Hrs	3		**Course Type**	Program Elective

COURSE OUTCOMES

Course outcomes: After completion of the course, students will be able to-

1. Determine and analyze the fuel properties
2. Describe the fuel treatment process.
3. Understand the use of alternative fuels in aerospace applications
4. Analyze the combustion performance of fuel systems

TEACHING METHODOLOGY

- Blackboard teaching/PowerPoint presentation (if needed) /Flipped Classes for specified topics
- Regular review of students by asking questions based on topics covered in the class

COURSE CONTENTS

UNIT -1- (08 HOURS)

Fuel Properties: Fuel Properties, Relative Density, API Gravity, Molecular Mass, Distillation Range, Vapor Pressure, Flash Point, Volatility Point, Viscosity, Surface Tension, Freezing Point, Specific Heat, Latent Heat, Thermal Conductivity, Combustion Properties of Fuels, Calorific Value, Enthalpy, Spontaneous-Ignition temperature, Limits of Flammability, Smoke Point, Luminometer Number, Smoke Volatility Index, Pressure and Temperature Effects, Sub atmospheric Pressure, Low Temperature, High Temperature.

UNIT -2- (07 HOURS)

Fuel Treatment: Introduction, Types of Hydrocarbons, Paraffins, Olefins, Naphthenes, Aromatics, Production of Liquid Fuels, Removal of Sulfur Compounds, Contaminants, Asphaltenes, Gum, Sediment, Ash, Water, Sodium, Vanadium, Additives, Gum Prevention, Corrosion Inhibition/Lubricity Improvers, Anti-Icing, Antistatic–Static Dissipators, Metal Deactivators, Antismoke.

UNIT -3- (07 HOURS)

Alternative Fuels aerospace applications: Hydrogen, Methane, Propane, Ammonia, Alcohols, Slurry fuels, Synthetic fuels, Fuels Produced by Fischer–Tropsch Synthesis of Coal/Biomass, Biofuels, Alternative fuel Properties, Combustion and Emissions Performance, Fischer–Tropsch Fuels, Biodiesel Fuels, Highly Aromatic (Broad Specification) Basic Considerations: Introduction to Gas turbine Combustor, Basic Design Features, Combustor Requirements, Combustor Types and parts, Fuel Preparation, Atomizers, liner wall-cooling Techniques, combustor stability limits, combustor exit temperature traverse quality (pattern factors), Combustors for Low Emissions

UNIT -4- (07 HOURS)

Combustion Fundamentals: Deflagration, Detonation, Classification of Flames, Physics of combustion Chemistry, Flammability Limits, Global Reaction-Rate Theory, Weak Mixtures, Rich Mixtures, Laminar Premixed Flames, laminar and turbulent flame burning velocity, measurement techniques for flame velocity, Factors Influencing Laminar Flame Speed, Equivalence Ratio, Initial Temperature, Pressure, Laminar Diffusion Flames, Turbulent Premixed Flames, Flame Propagation in Heterogeneous Mixtures of Fuel Drops, **Fuel Vapor and Air Combustion flame characterization:** Droplet and Spray Evaporation, Heat-Up Period, Evaporation Constant, Convective Effects, Effective Evaporation Constant, Spray Evaporation, Ignition

UNIT -5- (07 HOURS)

Combustion Performance: Combustion Efficiency, the Combustion Process, Reaction-Controlled Systems, Burning Velocity Model, Stirred Reactor Model, Mixing-Controlled Systems, Evaporation Controlled Systems, Reaction- and Evaporation-Controlled Systems. Flame Stabilization & Fuel Classification: Definition of Stability Performance, Measurement of Stability Performance, Bluff-Body Flame holders, Stabilization, Mechanisms of Flame Stabilization, Flame Stabilization in Combustion Chambers, Classification of Liquid Fuels, Aircraft Gas Turbine Fuels, Engine Fuel System, Aircraft Fuel Specifications and Classification of Gaseous Fuels.

TEXT BOOKS

Sl.no	Title of the Book	Name of the Author	Name of the Publisher	Edition and Year
1	Gas Turbine Combustion	Arthur H.Lefebvre & Dilip R. Ballal	CRC Press	3rd Edition, 2010
2	Chemistry of Combustion Reaction	Minkoff, G.J., and C.F.H. Tipper	London Butterworths	1962
3	Fuels & Combustion	Samir Sarkar	Orient Long man	1996

REFERENCE BOOKS'

Sl.no	Title of the Book	Name of the Author	Name of the Publisher	Edition and Year
1	Coal, Coke and Coal Chemicals	Wilson, P.J. and J.H. Wells	New York, McGraw-Hill,	1960
2	Liquid Fuels	Williams, D.A. and G. James	London Pergamon	1963
3	Gas Engineers Handbook		New York, Industrial Press	1966

ONLINE RESOURCES	Link
NPTEL	https://nptel.ac.in/courses/108/106/108106098/
NPTEL	https://nptel.ac.in/courses/108/101/108101037/

COURSE ASSESSMENT METHOD

Continuous Internal Evaluation (CIE)

Three internals tests (each 30 marks) are conducted, average of best two performances will be considered.

1.Minimum two Assignments/Model making - evaluated through rubrics for 10 marks. Average of two will be considered.

2.Tutorial classes and assessment are carried out/Surprise quiz tests are conducted and evaluated for 10 marks. Average of these two will be considered.

Semester End Examination (SEE)

1. Two Questions are to be set from each unit, carrying 20 Marks each.
2. Students have to answer 5 questions selecting one full question from each unit

Program Outcomes – Articulation matrix

PO	1	2	3	4	5	6	7	8	9	10	11	12	PSO-1	PSO-2
CO-1	2	2							2	2				2
CO-2	2	2							2	2				2
CO-3	2	2							2	2				2
CO-4	2	2							2	2				2

CONTROL ENGINEERING				
Course Code	18AEE552		**Credits**	3
Hours/Week (L-T-P)	3		**CIE Marks**	50
Total Hrs	36		**SEE Marks**	50
Exam Hrs	3		**Course Type**	Program Elective

COURSE OUTCOMES

Course outcomes: After completion of the course, students will be able to-

1. Classify the open and closed loop systems and various types of controllers and their applications
2. Apply mathematical models for mechanical, electrical, hydraulic and thermal control systems to obtain transfer functions
3. Sketch block diagrams and signal flow graphs, to obtain transfer functions
4. Predict the stability of a control system employing nyquist, polar, bode and root locus plots as stability criteria.

TEACHING METHODOLOGY

- Blackboard teaching/PowerPoint presentation (if needed) /Flipped Classes for specified topics
- Regular review of students by asking questions based on topics covered in the class

COURSE CONTENTS

UNIT -1- (08 HOURS)

Introduction: Concept of automatic controls, open and closed loop systems, concepts of feedback, requirement of an ideal control system. Types of controllers – Proportional, Integral, Proportional Integral, Proportional Integral Differential controllers.

UNIT -2- (07 HOURS)

Mathematical Models: Transfer function models, models of mechanical systems, models of electrical circuits, DC and AC motors in control systems, models of thermal systems, models of hydraulic systems. Analogous Systems: Force-voltage analogy and force-current analogy.

Transient and Steady State Response Analysis: Introduction, first order and second order system response to step, ramp and impulse inputs, concepts of time constant and its importance in speed of response.

UNIT -3- (08 HOURS)

Block Diagrams and Signal Flow Graphs: Transfer Functions definition, function, block representation of system elements, reduction of block diagrams, Signal flow graphs: Manson’s gain formula.

UNIT -4- (08 HOURS)

Frequency Response Analysis: Polar plots, NyQuest Stability Criterion, Stability Analysis, Relative stability concepts, phase and gain margin, M & N circles. System stability: Roth’s-Hurwitz Criterion.

Frequency Response Analysis using Bode Plots: Bode attenuation diagrams, Stability Analysis using Bode plots, Simplified Bode Diagrams.

UNIT -5- (08 HOURS)

Root Locus Plots: Definition of root loci, general rules for constructing root loci, Analysis using root locus plots.

Control Action and System Compensation: Series and feedback compensation, Physical devices for system compensation.

TEXT BOOKS

Sl.no	Title of the Book	Name of the Author	Name of the Publisher	Edition and Year
1	Modern Control Engineering	Katsuhiko Ogata	Pearson Education	2003
2	Control Systems Principles and Design	M. Goal	TMH	2000

REFERENCE BOOKS'

Sl.no	Title of the Book	Name of the Author	Name of the Publisher	Edition and Year
1	Control systems	J. W. Somerville, N. F. Macia	Schism's series	2001
2	Feedback Control Systems	I.J. Nazareth & M. Goal	New age International publishers	2002
3	Automatic Control Systems	B.C. Koop, F. Golnaraghi	John Wiley & Sons	2003

ONLINE RESOURCES	Link
NPTEL	https://nptel.ac.in/courses/101105077/
NPTEL	https://nptel.ac.in/courses/101106082/
NPTEL	https://nptel.ac.in/courses/101105083/
MIT OCW	https://ocw.mit.edu/courses/aeronautics-and-astronautics/16-83x-space-systems-engineering-spring-2002-spring-2003
TU Delft	https://ocw.mit.edu/courses/aeronautics-and-astronautics/16-512-rocket-propulsion-fall-2005

COURSE ASSESSMENT METHOD

Continuous Internal Evaluation (CIE)

Three internals tests (each 30 marks) are conducted, average of best two performances will be considered.

1. Minimum two Assignments/Model making - evaluated through rubrics for 10 marks. Average of two will be considered.
2. Tutorial classes and assessment are carried out/Surprise quiz tests are conducted and evaluated for 10 marks. Average of these two will be considered.

Semester End Examination (SEE)

1. Two Questions are to be set from each unit, carrying 20 Marks each.
2. Students have to answer 5 questions selecting one full question from each unit

Program Outcomes – Articulation matrix

PO	1	2	3	4	5	6	7	8	9	10	11	12	PSO-1	PSO-2
CO-1	3	3	2											3
CO-2	3	2	2											2
CO-3	3	2	2											3
CO-4	3	2	2											3

NON DESTRUCTIVE TESTING				
Course Code	18AEE553		**Credits**	~~3~~
Hours/Week (L-T-P)	3		**CIE Marks**	50
Total Hrs	36		**SEE Marks**	50
Exam Hrs	3		**Course Type**	Program Elective

COURSE OUTCOMES

Course outcomes: After completion of the course, students will be able to-

1. Describe the basic concepts and principles of NDT methods.
2. Explain magnetic particle inspection and liquid penetrant inspection techniques.
3. Discuss the principle and applications of electrical and ultrasonic testing techniques
4. Identify the applications of radiography and other techniques in NDT

TEACHING METHODOLOGY

- Blackboard teaching/PowerPoint presentation (if needed) /Flipped Classes for specified topics
- Regular review of students by asking questions based on topics covered in the class

COURSE CONTENTS

UNIT -1- (08 HOURS)

Introduction: Basic Principle, NDT techniques, importance, Advantages & Disadvantages and applications of NDT.

Liquid penetrant Inspection: Introduction, principles of penetrant inspection, Characteristics of a penetrant, Water washable system, Post emulsification system, solvent removable system, surface preparation and cleaning, penetrant application, development, advantages and disadvantages, range of applications.

UNIT -2 (07 HOURS)

Magnetic Particle Inspection: Introduction, magnetization, methods, continuous and residual methods, sensitivities, demagnetization, Magnetic particles, applications, advantages and disadvantages.

UNIT -3- (07 HOURS)

Electrical Test Methods (Eddy Current Testing): Introduction, principle, conductivity of a material, Magnetic properties, coil impedance, lift off factor and edge effects, skin effect, inspection frequency, coil arrangements, inspection probes, types of circuit, display methods, application of eddy current techniques.

UNIT -4- (07 HOURS)

Ultrasonic Testing: Introduction, Nature of sound, wave velocity and length. Generation of ultrasound, characteristics of an ultrasonic beam, sound waves at interfaces, sound attenuation, Inspection techniques identification of defects, immersion testing, surface conditioning, application of ultrasonic testing.

UNIT -5- (07 HOURS)

Radiography: Introduction, uses, limitation. Principle, radiation sources, production od X rays, ray spectra, radiation sources, shadow formation Exposure factor, Viewing and interpretation of radiographs, radiation hazard, protection against radiation, measurement of radiation received by personnel.

Advanced NDT techniques: Optical inspection, Neutron radiography, laser induced ultrasonic, acoustic emission, Thermography, laser Doppler vibrometer and holography, digital image correlation.

TEXT BOOKS

Sl.no	Title of the Book	Name of the Author	Name of the Publisher	Edition and Year
1	Non Destructive Testing	Barry Hull & Vernon John	Published by Macmillan Education, Great Bri	1988
2	Metals Handbook Vol. II, Nondestructive inspection and quality control Nondestructive inspection and quality control		American Society for Metals	8th Edition,1976

REFERENCE BOOKS'

Sl.no	Title of the Book	Name of the Author	Name of the Publisher	Edition and Year
1	Practical non-destructive testing.	Baldev Raj, Jayakumar, Thavasimuthu	Wood Head Publishing Ltd	2nd edition
2	Non-destructive Testing	Halmshaw.R	Butterworth-Heinemann	2nd edition (January 3, 1991

ONLINE RESOURCES	Link
NPTEL	https://nptel.ac.in/courses/113/106/113106070/
NPTEL	https://nptel.ac.in/noc/courses/noc19/SEM1/noc19-mm07/

COURSE ASSESSMENT METHOD

Continuous Internal Evaluation (CIE)

Three internals tests (each 30 marks) are conducted, average of best two performances will be considered.

1 Minimum two Assignments/Model making - evaluated through rubrics for 10 marks. Average of two will be considered.

2.Tutorial classes and assessment are carried out/Surprise quiz tests are conducted and evaluated for 10 marks. Average of these two will be considered.

Semester End Examination (SEE)

1. Two Questions are to be set from each unit, carrying 20 Marks each.
2. Students have to answer 5 questions selecting one full question from each unit

Program Outcomes – Articulation matrix

PO	1	2	3	4	5	6	7	8	9	10	11	12	PSO-1	PSO-2
CO-1	3				2	2			2	2			1	3
CO-2	2				2	2			2	2			1	2
CO-3	3				2	2			2	2			1	3
CO-4	3				2	2			2	2			1	3

INDUSTRIAL AERODYNAMICS				
Course Code	18AEE554		**Credits**	3
Hours/Week (L-T-P)	3		**CIE Marks**	50
Total Hrs	36		**SEE Marks**	50
Exam Hrs	3		**Course Type**	Core

COURSE OUTCOMES

Course outcomes: After completion of the course, students will be able to-

1. Classify winds and discussing properties of atmosphere
2. Identify various wind energy collectors
3. Discuss vehicle aerodynamics, power requirements
4. Describe building aerodynamics and predict flow induced vibrations

TEACHING METHODOLOGY

- Blackboard teaching/PowerPoint presentation (if needed) /Flipped Classes for specified topics
- Regular review of students by asking questions based on topics covered in the class

COURSE CONTENTS

UNIT -1- (08 HOURS)

Atmosphere: Types of winds, Causes of variation of winds, Atmospheric boundary layer, Effect of terrain on gradient height, Structure of turbulent flows.

UNIT -2- (07 HOURS)

Wind Energy Collectors: Horizontal axis and vertical axis machines, Power coefficient, Betz coefficient by momentum theory.

UNIT -3- (07 HOURS)

Vehicle Aerodynamics: Power requirements and drag coefficients of automobiles, Effects of cut back angle, Aerodynamics of trains and Hovercraft.

UNIT -4- (07 HOURS)

Building Aerodynamics: Pressure distribution on low-rise buildings, wind forces on buildings. Environmental winds in city blocks, Special problems of tall buildings, Building codes, Building ventilation and architectural aerodynamics.

UNIT -5- (07 HOURS)

Flow Induced Vibrations: Effects of Reynolds number on wake formation of bluff shapes, Vortex induced vibrations, Galloping and stall flutter.

TEXT BOOKS

Sl.no	Title of the Book	Name of the Author	Name of the Publisher	Edition and Year
1	Aerodynamics and drag mechanisms of bluff bodies and road vehicles	M.Sovran (Ed)	Plenum press, New York	1978

2	Winds forces in engineering	P. Sachs	Pergamon Press	1978

REFERENCE BOOKS'

Sl.no	Title of the Book	Name of the Author	Name of the Publisher	Edition and Year
1	Wind Power Principles	R.D. Blevins	Van Nostrand	1990.
2	Wind Power Principles	N.G. Calvent	Charles Griffin & Co., London	1979.

ONLINE RESOURCES	Link
NPTEL	https://nptel.ac.in/courses/101/105/101105059/
NPTEL	https://nptel.ac.in/courses/107/106/107106080/

COURSE ASSESSMENT METHOD

Continuous Internal Evaluation (CIE)

Three internals tests (each 30 marks) are conducted, average of best two performances will be considered.

1. Minimum two Assignments/Model making - evaluated through rubrics for 10 marks. Average of two will be considered.

2.Tutorial classes and assessment are carried out/Surprise quiz tests are conducted and evaluated for 10 marks. Average of these two will be considered.

Semester End Examination (SEE)

1. Two Questions are to be set from each unit, carrying 20 Marks each.
2. Students have to answer 5 questions selecting one full question from each unit

Program Outcomes – Articulation matrix

PO	1	2	3	4	5	6	7	8	9	10	11	12	PSO-1	PSO-2
CO-1	3	2												3
CO-2	3	2												3
CO-3	3	2												3
CO-4	3	2												3

INDUSTRIAL ENGINEERING AND MANAGEMENT				
Course Code	18AEE555		**Credits**	3
Hours/Week (L-T-P)	3		**CIE Marks**	50
Total Hrs	36		**SEE Marks**	50
Exam Hrs	3		**Course Type**	Core

COURSE OUTCOMES

Course outcomes: After completion of the course, students will be able to-

1. Recall the history and describe the various management functions
2. Identify the role of staffing, work-study, incentives, health and safety in management.
3. Apply techniques of decision-making, customer involvement, work-study, incentive schemes and process improvement.
4. Describe the various management behavioral technique.

TEACHING METHODOLOGY

- Blackboard teaching/PowerPoint presentation (if needed) /Flipped Classes for specified topics
- Regular review of students by asking questions based on topics covered in the class

COURSE CONTENTS

UNIT -1- (08 HOURS)

Introduction: Historical perspective, contribution of Taylor, Henry Fayol, Gilbert, Charles Babbage, HL Gantt and others to the evolution of management science in the Indian context. Ownership of Industries Proprietorship, partnership, joint stock companies, public and private undertakings, co-operative organizations.

Management Functions: Planning, corporate objectives, policies, strategies need for planning, responsibilities and types of plans, modern type of planning, selection of alternatives and process of decision-making, case studies. Organization: Basic requirement, types, structures and merits, Departmentation, vertical and horizontal, formal and growth, span of control, authority and responsibility, centralization and decentralization informal organizations, case studies.

UNIT -2- (07 HOURS)

Staffing: Appraisal of needs, executive development schemes, performance appraisal and managerial mobility. Directing. Types of instructions and characteristics of good order, communication flow of instructions motivation and leadership. Controlling: process of control, requirements of effective controlling, controlling techniques.

Work study, Incentives, Health and Safety: Method study and time study, Foundations of work-study, Job evaluation systems, Multi skilling, Incentive schemes, Training and Development, Safety Regulations and safe practices.

UNIT -3- (07 HOURS)

Management and Behavioral Approach: Contribution of Elton Mayo and skinner and others to behavior sciences. Skills of a manager at various levels in an organization and inter-related systems, understanding past behavior, predicting future behavior, directing, changing And controlling behavior.

Motivation and Behavior: Maslow's hierarchy of needs, pretense of needs and satisfaction of needs, goal oriented behavior, integration of organizational goals and needs of employee. Hawthorn's studies and its findings theory X and theory Y, immaturity theory, motivation hygiene theory.

UNIT -4- (08 HOURS)

Process Management: Definition of process management. Major process decisions-process choice, vertical integration, resource flexibility, customer involvement, capital intensity, relationships between decisions, service operation relationships between decisions, service operation relationships, economics of scale and gaining focus. Designing process-process rearranging and process improvement.

UNIT -5- (08 HOURS

Management of Technology: Meaning and role of technology-primary areas of technology management, management of technology and its role in improving business performance. Creating and applying technology-R and D stages and technology fusion. Technology strategy. Implementation guidelines.

TEXT BOOKS

Sl.no	Title of the Book	Name of the Author	Name of the Publisher	Edition and Year
1	Principles of Management	Koontz Odonnel	Mc.Graw Hill Intl. Book Co	4Rev Ed edition (1968)
2	Production and Operations Management	S.N Chary	TATA McGraw Hill.	6th Edition, April 9, 2019

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REFERENCE BOOKS'

Sl.no	Title of the Book	Name of the Author	Name of the Publisher	Edition and Year
1	Essentials of Management	Koontz Weirich	TATA McGraw Hill Intl. Book Co.,	10 Edition,2017
2	Management of Organizational Behaviour	Hersey Paul and Kenneth H	PHI	2nd Revised edition Edition(1 August 1972)
3	Operations Management- Strategy and Analysis	Lee J. Krajewski and Larry P. Ritzman,	Addison-Wesley	Fifth Edition ,1999

ONLINE RESOURCES	Link
NPTEL	https://nptel.ac.in/courses/127105018/
NPTEL	https://nptel.ac.in/courses/121106014/
NPTEL	https://swayam.gov.in/nd1_noc20_ge16/preview
MIT OCW	https://ocw.mit.edu/courses/earth-atmospheric-and-planetary-sciences/12-102-environmental-earth-science-fall-2005
TU Delft	https://nptel.ac.in/courses/127105018/

COURSE ASSESSMENT METHOD

Continuous Internal Evaluation (CIE)

Three internals tests (each 30 marks) are conducted, average of best two performances will be considered.

1. Minimum two Assignments/Model making - evaluated through rubrics for 10 marks. Average of two will be considered.

2Tutorial classes and assessment are carried out/Surprise quiz tests are conducted and evaluated for 10 marks. Average of these two will be considered.

Semester End Examination (SEE)
3.Two Questions are to be set from each unit, carrying 20 Marks each.
4.Students have to answer 5 questions selecting one full question from each unit

Program Outcomes – Articulation matrix

PO	1	2	3	4	5	6	7	8	9	10	11	12	PSO-1	PSO-2
CO-1	2					2	2	2	2	2				
CO-2	2					2	2	2	2	2				
CO-3	2					2	2	2	2	2				
CO-4	2					2	2	2	2	2				

TOTAL QUALITY MANAGEMENT				
Course Code	18AEE556		**Credits**	3
Hours/Week (L-T-P)	3		**CIE Marks**	50
Total Hrs	36		**SEE Marks**	50
Exam Hrs	3		**Course Type**	Core

COURSE OUTCOMES

Course outcomes: After completion of the course, students will be able to-

1. Understand the basic concepts of TQM and its benefits
2. Identify the tools and technique of TQM
3. Choose the framework to evaluate the performance excellence of organization and human resource practices.
4. Recognize the areas for building quality improvement through QFD and FMEA

TEACHING METHODOLOGY

- Blackboard teaching/PowerPoint presentation (if needed) /Flipped Classes for specified topics
- Regular review of students by asking questions based on topics covered in the class

COURSE CONTENTS

UNIT -1- (08 HOURS)

Overview of TQM: Introduction-Definition, Basic Approach, Contribution of Gurus – TQM framework, Historical Review, Benefits of TQM, TQM organization.

Leadership, Customer Satisfaction and Employee Involvement: Characteristics of quality leaders, Customers satisfaction, Customer perception of quality, Feedback, Using customers' complaints, Employee involvement -Introduction, Teams, Cross functional teams, Quality circles, Suggestion system, Benefits of employee involvement.

UNIT -2- (07 HOURS)

Human Resource Practices: Scope of Human Resources Management, leading practices, designing high performance work systems-work and job design, Recruitment and career development, Training and education, Compensation and recognition, Health, safety and employee well-being, performance appraisal.

UNIT -3- (07 HOURS)

Tools and Techniques in TQM: 7 basic tools of quality control, Kaizen, Re-engineering, 6 sigma, Benchmarking, Definition and Process of benchmarking, 5S.

Quality Management Systems: Quality management systems, ISO-9000 series of standards.

UNIT -4- (08 HOURS)

Building and Sustaining Total Quality Organizations: Making the commitment to TQ, Organizational culture and Total Quality, Change management, sustaining the quality organization.

Product Acceptance Control: Product acceptance control through IS 2500 part 1 and part 2.

UNIT -5- (08 HOURS)

Quality Function Deployment and Failure Modes Effects Analysis: Introduction to QFD and QFD process, Quality by design, Rationale for implementation of quality by design, FMEA, Design FMEA and process FMEA.

TEXT BOOKS				
Sl.no	Title of the Book	Name of the Author	Name of the Publisher	Edition and Year
1	Total Quality Management	Dale H. Besterfield	Pearson Education India	Edition 03/e Paperback (Special Indian Edition).

REFERENCE BOOKS'				
Sl.no	Title of the Book	Name of the Author	Name of the Publisher	Edition and Year
1	Total Quality Management for Engineers	M. Zairi, ISBN: 1855730243	Woodhead Publishing	1th edition (November 13, 1991)
2	100 Methods for Total Quality Management	Gopal K. Kanji and Mike Asher , ISBN: 0803977476	Sage Publications	Edition – 1

ONLINE RESOURCES	Link
NPTEL	https://nptel.ac.in/courses/110/104/110104080/
NPTEL	https://nptel.ac.in/courses/110/104/110104085/

COURSE ASSESSMENT METHOD

Continuous Internal Evaluation (CIE)

Three internals tests (each 30 marks) are conducted, average of best two performances will be considered.

1. Minimum two Assignments/Model making - evaluated through rubrics for 10 marks. Average of two will be considered.
2. Tutorial classes and assessment are carried out/Surprise quiz tests are conducted and evaluated for 10 marks. Average of these two will be considered.

Semester End Examination (SEE)

1. Two Questions are to be set from each unit, carrying 20 Marks each.
2. Students have to answer 5 questions selecting one full question from each unit

Program Outcomes – Articulation matrix

PO	1	2	3	4	5	6	7	8	9	10	11	12	PSO-1	PSO-2
CO-1	3					3	3	2	2	2	3	2		
CO-2	3					2	2	2	2	2	2	2		
CO-3	3					3	3	2	2	2	3	3		
CO-4	3					2	3	2	2	2	2	2		

EXPERIMENTAL TECHNIQUES AND DATA ANALYSIS				
Course Code	18AEE557		**Credits**	3
Hours/Week (L-T-P)	3		**CIE Marks**	50
Total Hrs	39		**SEE Marks**	50
Exam Hrs	3		**Course Type**	Program Elective

COURSE OUTCOMES

Course outcomes: After completion of the course, students will be able to-

1. Understand force measurement and temperature measurement systems
2. Carryout metallurgical studies using advanced tools for various applications
3. Apply suitable experimental techniques and analyze the data
4. Apply taguchi methods for various research.

TEACHING METHODOLOGY

- Blackboard teaching/PowerPoint presentation (if needed)
- Laboratory experiments will be conducted to understand the concepts

COURSE CONTENTS

UNIT -1- (08 HOURS)

Measurement of Forces: Strain gauge and piezoelectric transducers and their characteristics. Dynamometer construction, Bridge circuits. Instrumentation and calibration. Displacement and strain measurements by photoelasticity. Holography, interferometer, Moir techniques, strain gauge rosettes

UNIT -2- (08 HOURS)

Temperature Measurement: Circuits and instrumentation for different transducers viz, bimetallic, expanding fluid, electrical resistance, thermister, thermocouples, pyrometers. Flow Measurement: Transducers for flow measurements of Non-compressible and compressible fluids. Obstruction and drag methods. Vortex shredding flow meters. Ultrasonic, Laser Dopler and Hotwire anemometer. Flow visualization techniques, Shadow graphs, Schlieren photography. Interferometer

UNIT -3- (08 HOURS)

Metallurgical Studies: Optical and electron microscopy, X-Ray diffraction, Bragg's Law and its application for studying crystal structure and residual stresses. Electron spectroscopy, electron microprobe. Surface Measurements: Micro hardness, roughness, accuracy of dimensions and forms. 3-D co-ordinate measuring machines.

UNIT -4- (08 HOURS)

Experiment design & data analysis: Statistical methods, Randomized block design, Latin and orthogonal squares, factorial design. Replication and randomization. Data Analysis: Deterministic and random data, uncertainty analysis, tests for significance: Chi-square, student's't' test. Regression modeling, direct and interaction effects. ANOVA, F-test. Time Series analysis, Autocorrelation and autoregressive modeling

UNIT -5- (07 HOURS)

Taguchi Methods: Experiment design and planning with Orthogonal arrays and linear graphs. Additive cause effect model. Optimization of response level. Identification of Design and noise factors. Performance evaluation and Optimization by signal to noise ratios. Concept of loss function and its application

TEXT BOOKS

SL.NO	Title of the Book	Name of the author/s	Name of the publisher	Edition and year
1	Experimental Methods for Engineers,	Holman, J.P.	McGraw Hill Int., New York.	**1992**
2	The Design and Analysis of Industrial Experiments,	Davis, O.V.,	Longman, London	1955
3	Taguchi Methods Explained,	Tapan P. Bagchi	Prentice Hall of India, Delhi.	1993

REFERENCE BOOKS'

SL.NO	Title of the Book	Name of the author/s	Name of the publisher	Edition and year
1	Time Series analysis, Forecasting and control,	Box and Jenkins	Holden Day, Sanfrancisco	5^{th} Edition
2	Experimental stress analysis and motion measurement,	Dove and Adams	Prentice Hall of India, Delhi.	1964

COURSE ASSESSMENT METHOD

Continuous Internal Evaluation (CIE)

Three internals tests (each 30 marks) are conducted, average of best two performances will be considered.

1. Minimum two Assignments/Model making - evaluated through rubrics for 10 marks. Average of two will be considered.
2. Tutorial classes and assessment are carried out/Surprise quiz tests are conducted and evaluated for 10 marks. Average of these two will be considered.

Semester End Examination (SEE)

1. Two Questions are to be set from each unit, carrying 20 Marks each.
2. Students have to answer 5 questions selecting one full question from each unit

Program Outcomes – Articulation matrix:

PO	1	2	3	4	5	6	7	8	9	10	11	12	PSO1	PSO2
CO1	3	2	2	1								2	2	2
CO2	3	2	2	1								2	2	2
CO3	3	2	2	1								2	2	2
CO4	3	2	2	1								2	2	2

ROBUST TECHNOLOGY				
Course Code	18AEE558		**Credits**	3
Hours/Week (L-T-P)	3		**CIE Marks**	50
Total Hrs	39		**SEE Marks**	50
Exam Hrs	3		**Course Type**	Program Elective

COURSE OUTCOMES

Course outcomes: After completion of the course, students will be able to-

1. Describe matrix theory
2. Apply linear system theory
3. Apply Fixed-Structure Filter and Controller Synthesis
4. Describe frequency domain concepts and robust stability performance

TEACHING METHODOLOGY

- Blackboard teaching/PowerPoint presentation (if needed)
- Laboratory experiments will be conducted to understand the concepts

COURSE CONTENTS

UNIT -1- (08 HOURS)

An Introduction to Matrix Theory

Matrix Operations, Matrix Decompositions (Jordan, Schur, Singular Value), Nonnegative, Positive Definite Matrices, Matrix Norms, Generalized Inverses • Kronecker Calculus, The Matrix Exponential

UNIT -2- (08 HOURS)

Linear System Theory

Controllability, Observability, Stabilizability, Detectability , Lyapunov Functions, Lyapunov Equations, H_2Norm: Deterministic Formulation, H_2 Norm: Stochastic Formulation ,Matrix Differentials and Optimization Theory

UNIT -3- (08 HOURS)

Fixed-Structure Filter and Controller Synthesis

The Standard Problem , The Linear-Quadratic Regulator Problem (LQR) , Analysis of the Algebraic Riccati Equation , Static Output Feedback Controllers , Least Squares Estimation Theory , The Kalman Filter and The Observer Riccati Equation , The Linear-Quadratic-Gaussian Problem (LQG) , Full-Order Dynamic Compensation and the Separation Principle , PI Control, Model Following

UNIT -4- (08 HOURS)

Frequency Domain Concepts

Frequency Domain Properties of the LQR and LQG Problems , Guarantees of Phase and Gain Margins , The Return Difference Equali

UNIT -5- (07 HOURS)

Robust Stability and Performance

The H Norm ,H Performance Measure , Internal Stability , The Multivariable Nyquist Criterion Sensitivity/Complementary Sensitivity, MIMO Performance Specifications, Nominal Performance , Robust Performance, The Small Gain Theorem, The Complex Structured Singular Value, Necessary and Sufficient Conditions for Robust Stability, μ-Analys.

TEXT BOOKS

SL.NO	Title of the Book	Name of the author/s	Name of the publisher	Edition and year
1	Multivariable Control-System Synthesis: The Fixed-Structure Approach,	D. S. Bernstein and W.M. Haddad	IEEE	
2	Optimal Control-Linear Quadraic Methods,	B.D.O. Anderson and J. B. Moore,	Prentice Hall, Englewood Cliffs,	1990
3	Linear Optimal Control Systems,	H. Kwakernaak and R. Íivan,	Wiley, New York,.	1972

REFERENCE BOOKS'

SL.NO	Title of the Book	Name of the author/s	Name of the publisher	Edition and year
1	Robust and Optimal Control,	K. Zhou, J.C. Doyle, and K. Glover	Prentice Hall, New Jersey,	1996
2	Multivariable Feedback Design,	J.M. Maciejowski,	Addison-Wesley, Reading, MA,	1988

ONLINE RESOURCES	Link
MIT OCW	https://ocw.mit.edu/courses/aeronautics-and-astronautics/16-881-robust-system-design-summer-1998/

COURSE ASSESSMENT METHOD

Continuous Internal Evaluation (CIE)

Three internals tests (each 30 marks) are conducted, average of best two performances will be considered.

1. Minimum two Assignments/Model making - evaluated through rubrics for 10 marks. Average of two will be considered.

2.Tutorial classes and assessment are carried out/Surprise quiz tests are conducted and evaluated for 10 marks. Average of these two will be considered.

Semester End Examination (SEE)

1. Two Questions are to be set from each unit, carrying 20 Marks each.
2. Students have to answer 5 questions selecting one full question from each unit

Program Outcomes – Articulation matrix:

PO	1	2	3	4	5	6	7	8	9	10	11	12	PSO1	PSO2
CO1	3	2											2	2
CO2	3	2											2	2
CO3	3	2											2	2
CO4	3	2											2	2

SEMESTER-VI

AIRCRAFT STABILITY & CONTROL				
Course Code	18AE61		**Credits**	4
Hours/Week (L-T-P)	4		**CIE Marks**	50
Total Hrs	48		**SEE Marks**	50
Exam Hrs	3		**Course Type**	Core

COURSE OUTCOMES

Course outcomes: After completion of the course, students will be able to-

1. Explain static longitudinal stability and its effect on airframe components.
2. Analyze the static directional stability and its effect on CG location
3. Identify static lateral stability and dynamic longitudinal stability in aircrafts
4. Formulate the dynamic derivatives involved in the aircraft stability and control
5. Predict the dynamic lateral and directional stability of aircraft

TEACHING METHODOLOGY

- Blackboard teaching/PowerPoint presentation (if needed) /Flipped Classes for specified topics

COURSE CONTENTS

UNIT -1 (10 HOURS)

Static Longitudinal Stability: Historical perspective, Aerodynamic Nomenclature, Equilibrium conditions, Definition of static stability, Definition of longitudinal static stability, stability criteria, Contribution of airframe components: Wing contribution, Tail contribution, and Fuselage contribution.

Static Longitudinal Stability and Control-Stick Fixed: Introduction, Trim condition. Static neutral points. , Elevator power, Elevator angle versus equilibrium lift coefficient, Restriction on forward C.G. range

UNIT -2- (10 HOURS)

Static Longitudinal Stability and Control-Stick Free: Introduction, Hinge moment parameters, Control surface floating characteristics and aerodynamic balance, Estimation of hinge moment parameters, The trim tabs, Stick-free Neutral point, Restriction on aft C.G. Static

Directional Stability and Control: Introduction, Definition of directional stability, Static directional stability rudder fixed, Contribution of air frame components, Directional control. Rudder power, Stick-free directional stability, Requirements for directional control, Rudder lock, Dorsal fin. One engine inoperative condition.

UNIT -3- (10 HOURS)

Static Lateral Stability and Control Introduction, definition of Roll stability. Estimation of dihedral effect, Effect of wing sweep, flaps, and power, Lateral control, Estimation of lateral control power, Aileron control forces, Balancing the aileron. Coupling between rolling and yawing moments. Adverse yaw effects. Aileron reversal.

UNIT -4- (09 HOURS)

Estimation of Dynamic Derivatives: Aerodynamic force and moment representation, Derivatives due to change in forward speed, Derivatives due to the pitching velocity, Derivatives due to the time rate of change of angle of attack, Derivatives due to rolling rate, Derivatives due to yawing rate.

UNIT -5- (09 HOURS)
Dynamic Lateral and Directional Stability: Definition of Dynamic longitudinal stability: types of modes of motion: long or phugoid motion, short period motion. Factors affecting period and damping of oscillations. Effect of wind shear. Cooper-Harper Scale, Dutch roll and Spiral instability. Auto- rotation and spin. Roll-Pitch- Yaw Inertial coupling.

TEXT BOOKS

SL.NO	Title of the Book	Name of the author/s	Name of the publisher	Edition and year
1	Flight Stability and Automatic Control	Nelson, R.C	McGraw-Hill Book Co	2007

REFERENCE BOOKS

SL.NO	Title of the Book	Name of the author/s	Name of the publisher	Edition and year
1	Airplane Performance stability and Control	Perkins	John Wiley Son Inc, New York	1988

ONLINE RESOURCES	Link
NPTEL	https://nptel.ac.in/courses/101/104/101104062/
MIT OCW	https://ocw.mit.edu/courses/aeronautics-and-astronautics/16-333-aircraft-stability-and-control-fall-2004/
Flight Mechanic	https://www.flight-mechanic.com/stability-and-control/

COURSE ASSESSMENT METHOD

Continuous Internal Evaluation (CIE)

Three internals tests (each 30 marks) are conducted, average of best two performances will be considered.

1. Minimum two Assignments/Model making - evaluated through rubrics for 10 marks. Average of two will be considered.

2.Tutorial classes and assessment are carried out/Surprise quiz tests are conducted and evaluated for 10 marks. Average of these two will be considered.

Semester End Examination (SEE)

1. Two Questions are to be set from each unit, carrying 20 Marks each.
2. Students have to answer 5 questions selecting one full question from each unit

Program Outcomes – Articulation matrix:

PO	1	2	3	4	5	6	7	8	9	10	11	12	PSO1	PSO2
CO1	3													3
CO2	3	2	2											3
CO3	3	2	2											3
CO4	3	2	2											3
CO5	3	2	2											3

ADVANCED PROPULSION				
Course Code	18AE62		**Credits**	3
Hours/Week (L-T-P)	3-2-0		**CIE Marks**	50
Total Hrs.	39		**SEE Marks**	50
Exam Hrs	3		**Course Type**	Core

COURSE OUTCOMES

Course outcomes: After completion of the course, students will be able to-

1. Analyze the thermodynamic cycles of air breathing propulsion systems.
2. Design and evaluate diffusers, combustors and nozzle performance parameters
3. Apply fundamental concepts of scramjet propulsion system to estimate the performance parameters of combustors
4. Design and estimate the performance parameters of Nuclear rocket engine
5. Explain electric and ion propulsion concepts.

TEACHING METHODOLOGY

- Blackboard teaching/PowerPoint presentation (if needed) /Flipped Classes for specified topics

COURSE CONTENTS

UNIT -1 (08 HOURS)

Thermodynamic Cycle Analysis Of Air-Breathing Propulsion Systems: Air breathing propulsion systems like Turbojet, turboprop, ducted fan, Ramjet and Air augmented rockets – Thermodynamic cycles – Pulse propulsion – Combustion process in pulse jet engines – inlet-charging process – Subcritical, Critical and Supercritical charging.

UNIT -2- (08 HOURS)

Ramjets And Air Augmented Rockets: Preliminary performance calculations – Diffuser design with and without spike, Supersonic inlets – combustor and nozzle design – integral Ram rocket.

UNIT -3- (08 HOURS)

Scramjet Propulsion System: Fundamental considerations of hypersonic air breathing vehicles – Preliminary concepts in engine airframe integration – calculation of propulsion flow path – flow path integration – Various types of supersonic combustors – fundamental requirements of supersonic combustors – Mixing of fuel jets in supersonic cross flow – performance estimation of supersonic combustors.

UNIT -4- (08 HOURS)

Nuclear Propulsion: Nuclear rocket engine design and performance – nuclear rocket reactors – nuclear rocket nozzles – nuclear rocket engine control – radioisotope propulsion – basic thruster configurations – thruster technology – heat source development – nozzle development – nozzle performance of radioisotope propulsion systems.

UNIT -5- (07 HOURS)

Electric And Ion Propulsion: Basic concepts in electric propulsion – power requirements and rocket efficiency – classification of thrusters – electrostatic thrusters – plasma thruster– Fundamentals of ion propulsion – performance analysis – ion rocket engine.

TEXT BOOKS

SL.NO	Title of the Book	Name of the author/s	Name of the publisher	Edition and year
1	Rocket Propulsion Elements	G.P. Sutton	John Wiley & Sons Inc	1998
	Hypersonic Airbreathing propulsion	William H, Heiser and David T,	AIAA Education Series,	2001

REFERENCE BOOKS'

SL.NO	Title of the Book	Name of the author/s	Name of the publisher	Edition and year
1,	Spacecraft Systems Engineering	Fortescue and Stark	Cambridge University Press	2003
2,	Jet propulsion	Cumpsty	Cambridge University Press	2003

ONLINE RESOURCES	Link
NPTEL	https://nptel.ac.in/courses/101/104/101104018/
MIT OCW	https://ocw.mit.edu/courses/aeronautics-and-astronautics/16-50-introduction-to-propulsion-systems-spring-2012/

COURSE ASSESSMENT METHOD

Continuous Internal Evaluation (CIE)

Three internals tests (each 30 marks) are conducted, average of best two performances will be considered.

1.Minimum two Assignments/Model making - evaluated through rubrics for 10 marks. Average of two will be considered.

2.Tutorial classes and assessment are carried out/Surprise quiz tests are conducted and evaluated for 10 marks. Average of these two will be considered.

Semester End Examination (SEE)

1. Two Questions are to be set from each unit, carrying 20 Marks each.
2. Students have to answer 5 questions selecting one full question from each unit

Program Outcomes – Articulation matrix:

PO	1	2	3	4	5	6	7	8	9	10	11	12	PSO1	PSO2
CO1	3													3
CO2	3	2	2											3
CO3	3	2	2											3
CO4	3	2	2											3
CO5	3	2	2											3

AIRCRAFT MAINTENANCE & PRACTICE				
Course Code	18AE63		**Credits**	3
Hours/Week (L-T-P)	3-2-0		**CIE Marks**	50
Total Hrs	39		**SEE Marks**	50
Exam Hrs	3		**Course Type**	Core

COURSE OUTCOMES

Course outcomes: After completion of the course, students will be able to-

1. Understand the various Aircraft maintenance practices
2. Identify various tools used in aircraft maintenance
3. Identify various materials used in aircrafts
4. Describe NDT and welding process used in aircraft maintenance
5. Illustrate the methods of harnessing Electrical cables and connectors in aircraft.

TEACHING METHODOLOGY

- Blackboard teaching/PowerPoint presentation (if needed) /Flipped Classes for specified topics
- Regular review of students by asking questions based on topics covered in the class

COURSE CONTENTS

UNIT -1 (08 HOURS)

Aircraft maintenance practices: Standard maintenance practices-aircraft maintenance practices-general purpose tools-measuring tools-torque wrenches and torque loading practice.

UNIT -2- (08 HOURS)

Tools: Aircraft fastening devices-bolts and screws, nuts and washers, locking devices and springs, engineering drawings and diagrams, bearings and gears.

UNIT -3- (08 HOURS)

Aircraft materials: Aircraft materials-ferrous, nonferrous and composite/non-metallic. Corrosion and corrosion control and protection.

UNIT -4- (08 HOURS)

Nuclear Propulsion: Nuclear rocket engine design and performance – nuclear rocket reactors – nuclear rocket nozzles – nuclear rocket engine control – radioisotope propulsion – basic thruster configurations – thruster technology – heat source development – nozzle development – nozzle performance of radioisotope propulsion systems**.**

UNIT -5- (07 HOURS)

Aircraft miscellaneous: Electrical cables and connectors, usage of electrical instruments and equipment, testing and calibration methods, pipes, hoses and control cables, aircraft weight and balance control, quality system and procedures.

TEXT BOOKS

SL.NO	Title of the Book	Name of the author/s	Name of the publisher	Edition and year
1	Aviation Maintenance Management, Second Edition	Kinnison, H.A.,	McGraw-Hill	2013

2	Maintenance and Repair of Aerospace Vehicles	McKinley, J. L., Bent, R.D	Northrop Institute of Technology McGraw-Hill	1967

REFERENCE BOOKS'

SL.NO	Title of the Book	Name of the author/s	Name of the publisher	Edition and year
1	Aircraft Maintenance Management	Friend, C.H	Longman	1992
2	Aircraft Maintenance and Repair	Kroes, M., Watkins, W., and Delp, F	Tata McGraw-Hill	2010
3	Risk Management and Error Reduction in Aviation Maintenance	Patankar, M.S. And Taylor, J.C	Ashgate, ISBN 0-7546-1941-9	2004

ONLINE RESOURCES	Link
NPTEL	https://nptel.ac.in/courses/101/104/101104071/

COURSE ASSESSMENT METHOD

Continuous Internal Evaluation (CIE)

Three internals tests (each 30 marks) are conducted, average of best two performances will be considered.

1.Minimum two Assignments/Model making - evaluated through rubrics for 10 marks. Average of two will be considered.

2.Tutorial classes and assessment are carried out/Surprise quiz tests are conducted and evaluated for 10 marks. Average of these two will be considered.

Semester End Examination (SEE)

1. Two Questions are to be set from each unit, carrying 20 Marks each.
2. Students have to answer 5 questions selecting one full question from each unit

Program Outcomes – Articulation matrix:

PO	1	2	3	4	5	6	7	8	9	10	11	12	PSO1	PSO2
CO1	2								2	3			1	1
CO2	3								3	3			1	1
CO3	2								2	3			1	1
CO4	2								2	3			1	1
CO5	2								2	3			1	1

SPACE FLIGHT & SPACE DYNAMICS				
Course Code	18AE64		**Credits**	3
Hours/Week (L-T-P)	3-0-0		**CIE Marks**	50
Total Hrs	39		**SEE Marks**	50
Exam Hrs	3		**Course Type**	Core

COURSE OUTCOMES

Course outcomes: After completion of the course, students will be able to-

1. Understand Peculiarities of space environment and its description
2. Describe Basic Concepts and the General N-Body systems
3. Explain the concepts of Satellite Injection and Satellite Perturbations
4. Illustrate the Interplanetary Trajectories
5. Explain the concepts of Ballistic Missile Trajectories

TEACHING METHODOLOGY

- Blackboard teaching/PowerPoint presentation (if needed) /Flipped Classes for specified topics
- Regular review of students by asking questions based on topics covered in the class

COURSE CONTENTS

UNIT -1 (08 HOURS)

Space Environment: Peculiarities of space environment and its description, effect of space environment on materials of spacecraft structure and astronauts, manned space missions, effect on satellite lifetime.

UNIT -2- (08HOURS)

Basic Concepts and the General N-Body: The solar system, reference frames and coordinate systems, terminology related to the celestial sphere and its associated concepts, Kepler's laws of planetary motion and proof of the laws, Newton's universal law of gravitation, the many body problem, Lagrange-Jacobi identity, the circular restricted three body problem, libration points, the general N-body problem, two body problem, relations between position and time

UNIT -3- (08 HOURS)

Satellite Injection and Satellite Perturbations: General aspects of satellite injection, satellite orbit transfer, various cases, orbit deviations due to injection errors, special and general perturbations, Cowell's method and Encke's method, method of variations of orbital elements, general perturbations approach.

UNIT -4- (08 HOURS)

Interplanetary Trajectories: Two-dimensional interplanetary trajectories, fast interplanetary trajectories, three dimensional interplanetary trajectories, launch of interplanetary spacecraft, trajectory estimation about the target planet, concept of sphere of influence, Lambert's theorem

UNIT -5- (07 HOURS)

Ballistic Missile Trajectories: Introduction to ballistic missile trajectories, boost phase, the ballistic phase, trajectory geometry, optimal flights, time of flight, re-entry phase, the position of impact point, influence coefficients.

TEXT BOOKS

SL.NO	Title of the Book	Name of the author/s	Name of the publisher	Edition and year
1	Rocket Propulsion and Space Dynamics	Cornelisse, J.W	W.H. Freeman & co	1984
2	Introduction to Space Dynamics	Thomson	Dover Publications	Revised edition 2012

REFERENCE BOOKS'

SL.NO	Title of the Book	Name of the author/s	Name of the publisher	Edition and year
1	Elements of Astromechanics	Van de Kamp, P	Pitman	1979
2	Space Flight Dynamics, Create Space Independent Publishing Platform	Willian E. Wiesel	Pitman	3rd Edition, 2010, ISBN-13: 978-1452879598
3	Rocket Propulsion Elements	George P. Sutton and Oscar Biblarz	Wiley India Pvt Ltd	7th edition, 2010,

ONLINE RESOURCES	Link
NPTEL	https://nptel.ac.in/courses/101/105/101105030/
MIT OCW	https://ocw.mit.edu/courses/aeronautics-and-astronautics/16-61-aerospace-dynamics-spring-2003/

COURSE ASSESSMENT METHOD

Continuous Internal Evaluation (CIE)

Three internals tests (each 30 marks) are conducted, average of best two performances will be considered.

1.Minimum two Assignments/Model making - evaluated through rubrics for 10 marks. Average of two will be considered.

2.Tutorial classes and assessment are carried out/Surprise quiz tests are conducted and evaluated for 10 marks. Average of these two will be considered.

Semester End Examination (SEE)

1. Two Questions are to be set from each unit, carrying 20 Marks each.
2. Students have to answer 5 questions selecting one full question from each unit

Program Outcomes – Articulation matrix:

PO	1	2	3	4	5	6	7	8	9	10	11	12	PSO1	PSO2
CO1	3	3											2	3
CO2	3	3											2	3
CO3	3	3											2	3
CO4	3	3											2	3
CO5	3	2											2	3

COMPUTER AIDED DESIGN, MODELING & ANALYSIS LAB				
Course Code	18AEL67		**Credits**	01
Hours/Week (L-T-P)	0-0-3		**CIE Marks**	50
Total Hrs	39		**SEE Marks**	50
Exam Hrs	3		**Course Type**	Core

COURSE OUTCOMES

Course outcomes: After completion of the course, students will be able to-

1. Model and analyse symmetric and unsymmetric Aerofoil Geometry
2. Model and Analyse 2D Convergent- Divergent Nozzle and 3Dserpentine inlet duct.
3. Analyse Sandwich Beam, 3D Wing and bulk head
4. Perform Structural Modeling and Stress Analysis of a Simply Supported Rectangular Plate Uniformly Compressed in one Direction with a Cut- Out in Center

List of experiments

PART A

1. Geometric Modeling and Mesh Generation of symmetric Aerofoil Geometry.
2. Geometric Modeling and Mesh Generation of unsymmetric Aerofoil Geometry
3. Computations and Analysis of 2-D Incompressible and Inviscid Flow over symemtric and unsymmetric Aerofoil.
4. Geometric Modeling, Mesh Generation and flow analysis of 2-D Convergent-Divergent Nozzle.
5. Generation of body fitting hexagonal mesh and flow analysis of serpentine inlet duct

PART B

1. Structural Modeling of Sandwich Beam of Rectangular Cross-Section and Analyses for Stresses.
2. Structural Modeling of a Three Dimensional Wing.
3. Structural Modeling and Stress Analysis of a Fuselage Bulk Head.
4. Structural Modeling and Stress Analysis of a Simply Supported Rectangular Plate Uniformly Compressed in one Direction.
5. Structural Modeling and Stress Analysis of a Simply Supported Rectangular Plate Uniformly Compressed In one Direction with a Cut- Out in Center.

COURSE ASSESSMENT METHOD

Record: 30 marks

Test: 15 marks

Viva-voce: 05 marks

SEE - Final Exam: 50 Marks

Scheme of Examination: Student will be asked to conduct two experiment

Program Outcomes – Articulation matrix:

PO	1	2	3	4	5	6	7	8	9	10	11	12	PSO-1	PSO-2
CO-1	3	3	3		3				3	2			3	3
CO-2	3	3	3		3				3	2			3	3
CO-3	3	3	3		3				3	2			3	3
CO-4	3	3	3		3				3	2			3	3

STRUCTURES LAB				
Course Code	18AEL68		**Credits**	01
Hours/Week (L-T-P)	0-0-3		**CIE Marks**	50
Total Hrs	39		**SEE Marks**	50
Exam Hrs	3		**Course Type**	Core

COURSE OUTCOMES

Course outcomes: After completion of the course, students will be able to-

1. Calculate the deflections of simply supported beams and cantilever beams
2. Apply maxwell reciprocal theorem and superposition theorem for simply supported beam and cantilever beam respectively
3. Find the buckling load of the column for fixed and hinged conditions by applying South Well's theorem
4. Analyze shear failure of bolts and riveted joints
5. Examine frequency spectrum analysis of cantilever beam.

List of experiments

1. Deflection of a Simply Supported Beam.
2. Verification of Maxwell's Reciprocal Theorem.
3. Determination of Young's Modulus using strain gauges.
4. Poisson Ratio Determination
5. Buckling load of slender Eccentric Columns and Construction of South well Plot
6. Shear Failure of Bolted and Riveted Joints
7. Bending Modulus of sandwich Beam
8. Verification of Superposition Theorem
9. Determination of fundamental frequency of a cantilever beam and harmonics and Frequency spectrum analysis for a cantilever beam.
10. Shear centre for open section

COURSE ASSESSMENT METHOD

Record: 30 marks

Test: 15 marks

Viva-voce: 05 marks

SEE - Final Exam: 50 Marks

Scheme of Examination: Student will be asked to conduct two experiment

Program Outcomes – Articulation matrix:

PO	1	2	3	4	5	6	7	8	9	10	11	12	PSO-1	PSO-2
CO-1	3	3	3						3	2			3	
CO-2	3	3	3	2					3	2			3	
CO-3	3	3	3	2					3	2			3	
CO-4	3	3	3	2					3	2			3	
CO-5	3	3	3	2					3	2			3	

FLIGHT PHYSICS LAB				
Course Code	18AEL69		**Credits**	01
Hours/Week (L-T-P)	0-0-3		**CIE Marks**	50
Total Hrs	39		**SEE Marks**	50
Exam Hrs	3		**Course Type**	Core

COURSE OUTCOMES

Course outcomes: After completion of the course, students will be able to-

1. Analyse the performance of an aircraft propeller and fluid structure interaction over a wing
2. Design the control surface and study theperformance of uavblades using weight base design concept.
3. Simulate the marphing technologyof wing and analyse aero acoustic over an aircraft
4. Understand biomimetics on natural flight

List of experiments

1. Study of performance of propeller on engine power development
2. Study the various types of propeller on performance of aircraft
3. Study the function of control surface
4. Design the control surface for aircraft using modelling tools
5. Study the performance of UAV blades and use the weightbase design concept.
6. Analyze the fluid structure interaction over wing
7. Study the aero acoustics over the aircraft
8. Simulate the morphing technology of wing and analyze aircraft performance.
9. Study about biomimetics on natural flight

COURSE ASSESSMENT METHOD

Record: 30 marks
Test: 15 marks
Viva-voce: 05 marks
SEE - Final Exam: 50 Marks

Program Outcomes – Articulation matrix

PO	1	2	3	4	5	6	7	8	9	10	11	12	PSO-1	PSO-2
CO-1	3	3	3		3				3	2			3	2
CO-2	3	3	3		3				3	2			3	2
CO-3	3	3	3		3				3	2			3	2
CO-4	3	3	3		3				3	2			3	2
CO-5	3	3	3		3				3	2			3	2

PROGRAM ELECTIVE-D				
OPTIMIZATION TECHNIQUES				
Course Code	18AEE651		**Credits**	3
Hours/Week (L-T-P)	3-0-0		**CIE Marks**	50
Total Hrs	39		**SEE Marks**	50
Exam Hrs	3		**Course Type**	Program Elective

COURSE OUTCOMES

Course outcomes: After completion of the course, students will be able to-

1. Define and use optimization terminology, concepts, and understand how to classify an optimization problem.
2. Understand how to classify an optimization problem
3. Apply the mathematical concepts formulate the problem of the systems
4. Analyze the problems for optimal solution using the algorithms.
5. Interpret the optimum solution

TEACHING METHODOLOGY

- Blackboard teaching/PowerPoint presentation (if needed) /Flipped Classes for specified topics
- Regular review of students by asking questions based on topics covered in the class

COURSE CONTENTS

UNIT -1 (08 HOURS)

Introduction: Statement of optimisation problem, Design vector, Design constraints, Objective function, Classification of optimisation problems based on :constraints, nature of design variables, nature of the equations involved Single variable optimisaton: Necessary and sufficient conditions, Multivariable optimization with no constraints: Necessary and sufficient conditions, Semidefinite case, Saddle point, Multivariable optimization with equality constraints, Solution by direct substitution, Lagrange Multipliers, Interpretation of Lagrange multipliers, Multivariable optimization with inequality constraints: Khun Tucker conditions (concept only)

UNIT -2- (08HOURS)

Nonlinear Programming: One-Dimensional Minimization Methods Introduction, Unimodal Function, Elimination methods: unrestricted search, fixed step size, accelerated step size, Exhaustive search: dichotomous search, interval halving method, Fibonacci method, golden section method, Interpolation methods: Quadratic and cubic interpolation method, direct root method, Newton method, Quasi-Newton method, secant method.

UNIT -3- (08 HOURS)

Nonlinear Programming: Direct search methods: Classification of unconstrained minimization methods, rate of convergence, scaling of design variables, random search methods, univariate method, pattern directions, Powell's method, Simplex method.

UNIT -4- (08 HOURS)

Nonlinear Programming: Indirect Search (Descent) Methods: Gradient of a function, Steepest decent method, Fletcher Reeves method, Newtons method, Davidon-Fletcher-Powell method.

UNIT -5- (07 HOURS)

Integer Programming: Introduction, Graphical representation, Gomory's cutting plane method: concept of a cutting plane, Gomory's method for all-integer programming problems, Balas' algorithm for zero–one programming, Branch-and Bound Method.

TEXT BOOKS				
SL.NO	**Title of the Book**	**Name of the author/s**	**Name of the publisher**	**Edition and year**
1	Engineering Optimization Theory and Practice	S. S. Rao	John Wiley & Sons	Fourth Edition 2009

REFERENCE BOOKS'				
SL.NO	**Title of the Book**	**Name of the author/s**	**Name of the publisher**	**Edition and year**
1	Optimisation Concepts and Applications in Engineering	D. Belegundu, T.R. Chanrupatla	Cambrige University Press	2011
2	Engineering Optimization: Methods and Applications	Ravindran, K. M. Ragsdell, and G. V. Reklaitis	Wiley, New York	2nd ed, 2006.

ONLINE RESOURCES	**Link**
NPTEL	https://nptel.ac.in/courses/111/105/111105039/

COURSE ASSESSMENT METHOD

Continuous Internal Evaluation (CIE)

Three internals tests (each 30 marks) are conducted, average of best two performances will be considered.

1.Minimum two Assignments/Model making - evaluated through rubrics for 10 marks. Average of two will be considered.

2.Tutorial classes and assessment are carried out/Surprise quiz tests are conducted and evaluated for 10 marks. Average of these two will be considered.

Semester End Examination (SEE)

1. Two Questions are to be set from each unit, carrying 20 Marks each.
2. Students have to answer 5 questions selecting one full question from each unit

Program Outcomes – Articulation matrix:

PO	1	2	3	4	5	6	7	8	9	10	11	12	PSO1	PSO2
CO1	3	3			3						2	2	1	1
CO2	3	3			3						2	2	1	1
CO3	3	3			3						2	2	1	1
CO4	3	3			3						2	2	1	1
CO5	3	3			3						2	2	1	1

ROCKETS & MISSILES				
Course Code	18AEE652		**Credits**	3
Hours/Week (L-T-P)	3-0-0		**CIE Marks**	50
Total Hrs	39		**SEE Marks**	50
Exam Hrs	3		**Course Type**	Program Elective

COURSE OUTCOMES

Course outcomes: After completion of the course, students will be able to-

1. Identify various ignition systems and types of igniters used in rockets
2. Understand Aerodynamics of Rockets and Missiles
3. Apply the phenomenon of Motion of rockets and missiles in Space and Gravitational field.
4. Analyse the staging and control phenomenon of rockets
5. Classify various types of materials used in manufacture of rockets and missiles.

TEACHING METHODOLOGY

- Blackboard teaching/PowerPoint presentation (if needed) /Flipped Classes for specified topics
- Regular review of students by asking questions based on topics covered in the class

COURSE CONTENTS

UNIT -1 (08 HOURS)

Rockets System: Types of Ignition System in rockets and types of Igniters – Igniter Design. Consideration of liquid Rocket Combustion Chamber, Injector Propellant Feed Lines. Propellant Tanks Outlet and Helium Pressurized and Turbine feed Systems– Propellant Slash and Propellant Hammer–Elimination of Geysering Effect in Missiles– Combustion System of Solid Rockets.

UNIT -2- (08HOURS)

Aerodynamics Of Rockets And Missiles : Airframe Components of Rockets and Missiles – Forces Acting on a Missile While Passing Through Atmosphere– methods of Describing Aerodynamic Forces and Moments – Lateral Aerodynamic Moment – Lateral Damping Moment and Longitudinal Moment of a Rocket – lift and Drag Forces – Drag Estimation – Body Upwash and Downwash in Missiles.

UNIT -3- (08 HOURS)

Motion in Space and Gravitational Field: One Dimensional and Two Dimensional rocket Motions in Free Space and Homogeneous Gravitational Fields–description of Vertical, Inclined and Gravity Turn Trajectories– Determination of range and Altitude Simple Approximations to Burnout Velocity.

UNIT -4- (08 HOURS)

Staging And Control: Rocket Vector Control – Methods – Thrust termination – SITVC – Multistaging of rockets – Vehicle Optimization – Stage Separation Dynamics – Separation Techniques

UNIT -5- (07 HOURS)

Materials Used For Rockets and Missiles: Selection of Materials –Special Requirements of Materials to Perform under Adverse Conditions.

TEXT BOOKS

SL.NO	Title of the Book	Name of the author/s	Name of the publisher	Edition and year
1	Rocket Propulsion Elements	Sutton G. P	John Wiley & Sons Inc., New York	1993.
2	Rocket Propulsion and Space Dynamics	Cornelisse, J.W	J.W., Freeman & Co. Ltd London	1982.

REFERENCE BOOKS'

SL.NO	Title of the Book	Name of the author/s	Name of the publisher	Edition and year
1	Gas Turbines and Jet and Rocket Propulsion	Mathur, M., and Sharma, R.P	Standard Publishers New Delhi	1998.
2	Materials for Missiles and Spacecraft	Parker, E. R	McGraw-Hill Book Co. Inc	1982.
3	Missile Propulsion	M. J. Zucrow	John Wiley & sons	1982
4	Understanding Aerospace Chemical Propulsion	H. S. Mukunda	Interline Publishing Company Bangalore	

ONLINE RESOURCES	Link
NPTEL	https://nptel.ac.in/courses/101/108/101108054/
MIT OCW	https://ocw.mit.edu/courses/aeronautics-and-astronautics/16-512-rocket-propulsion-fall-2005/

COURSE ASSESSMENT METHOD

Continuous Internal Evaluation (CIE)

Three internals tests (each 30 marks) are conducted, average of best two performances will be considered.

1.Minimum two Assignments/Model making - evaluated through rubrics for 10 marks. Average of two will be considered.

2.Tutorial classes and assessment are carried out/Surprise quiz tests are conducted and evaluated for 10 marks. Average of these two will be considered.

Semester End Examination (SEE)

1. Two Questions are to be set from each unit, carrying 20 Marks each.
2. Students have to answer 5 questions selecting one full question from each unit

Program Outcomes – Articulation matrix:

PO	1	2	3	4	5	6	7	8	9	10	11	12	PSO1	PSO2
CO1	3	3											2	2
CO2	3	3											2	2
CO3	3	3											2	2
CO4	3	3											2	2
CO5	3	2											2	2

FINITE ELEMENT METHODS				
Course Code	18AEE653		**Credits**	3
Hours/Week (L-T-P)	3-0-0		**CIE Marks**	50
Total Hrs	39		**SEE Marks**	50
Exam Hrs	3		**Course Type**	Program Elective

COURSE OUTCOMES

Course outcomes: After completion of the course, students will be able to-

1. Apply the concepts of FEM, theory of elasticity and solving techniques for various engineering problems
2. Solve Two and Three dimensional Element problems
3. Analyze higher order elemental problems
4. Solve Heat transfer problems

TEACHING METHODOLOGY

- Blackboard teaching/PowerPoint presentation (if needed) /Flipped Classes for specified topics

COURSE CONTENTS

UNIT -1 (08 HOURS)

Introduction: Basic Concepts, Background Review: Stresses and Equilibrium, Plane stress, Plane strain, Potential energy and Equilibrium. Rayleigh - Ritz Method, Galerkin's Method, Simple applications in structural Analysis. Construction or discrete models - sub domains and nodes - simple elements for the FEM - Simplex, complex and multiples elements Polynomial selection -illustrative examples Elements and shape functions and natural coordinates, Use of local and natural coordinates, compatibility and convergence requirements of shape functions

UNIT -2- (08HOURS)

Fundamentals of Finite Element Method: Construction of shape functions for bar element and beam element, Bar elements, uniform bar elements, uniform section, mechanical and thermal loading, varying section, truss analysis, Frame element, Beam element, problems for various loadings and boundary conditions

UNIT -3- (08 HOURS)

Analysis of Two and Three dimensional Elements: Shape functions of Triangular, Rectangular and Quadrilateral elements, different types of higher order elements, constant and linear strain triangular elements, stiffness matrix Four-Noded Tetrahedral Element (TET 4), Eight-Noded Hexahedral Element (HEXA 8), Tetrahedral elements, Hexahedral elements: Serendipity family, Hexahedral elements: Lagrange family.

UNIT -4- (08 HOURS)

Theory of Isoparametric Elements and Axisymmetric: Isoparametric, sub parametric and super-parametric elements, characteristics of Isoparametric quadrilateral elements, structure of computer program for FEM analysis, description of different modules, pre and post processing, Axisymmetric formulation finite element modeling of triangular and quadrilateral element.

UNIT -5- (07 HOURS)

Field Problems: Heat transfer problems, Steady state fin problems, 1D heat conduction governing equation, Derivation of element matrices for two dimensional problems, Dynamic consideration- Formulation Hamilton's principle, Element mass matrices

TEXT BOOKS				
SL.NO	**Title of the Book**	**Name of the author/s**	**Name of the publisher**	**Edition and year**
1	Finite Elements in engineering	Chandrupatla T. R	ISBN-13: 978-8120321069	PHI, 3rd edition 2002
2	Finite element Analysis	Bhavikatti	ISBN-13: 978-8122436716.	New Age International, 3rd edition, 2015

REFERENCE BOOKS'				
SL.NO	**Title of the Book**	**Name of the author/s**	**Name of the publisher**	**Edition and year**
1	Finite element analysis in engineering design	Rajasekharan.S	Wheeler Publishers	2012
2	Finite Element Procedures	Bathe. KJ	PHI Pvt. Ltd., New Delhi,	2002
3	The Finite Element Method	Zienkiewicz. O.C	ISBN-13: 978-9351071587	Elsevier,7th edition, 2013
4	Finite Element analysis - Theory and Programming	C.S. Krishnamurthy	Tata McGraw Hill Co. Ltd, New Delhi, ISBN-13: 978-0074622100	2nd edition, 2011

ONLINE RESOURCES	**Link**
NPTEL	https://nptel.ac.in/courses/112/104/112104116/
MIT OCW	https://ocw.mit.edu/resources/res-2-002-finite-element-procedures-for-solids-and-structures-spring-2010/

COURSE ASSESSMENT METHOD

Continuous Internal Evaluation (CIE)

Three internals tests (each 30 marks) are conducted, average of best two performances will be considered.

1.Minimum two Assignments/Model making - evaluated through rubrics for 10 marks. Average of two will be considered.

2.Tutorial classes and assessment are carried out/Surprise quiz tests are conducted and evaluated for 10 marks. Average of these two will be considered.

Semester End Examination (SEE)

1. Two Questions are to be set from each unit, carrying 20 Marks each.
2. Students have to answer 5 questions selecting one full question from each unit

Program Outcomes – Articulation matrix:

PO	1	2	3	4	5	6	7	8	9	10	11	12	PSO1	PSO2
CO1	3	3	2		2								3	
CO2	3	3	2		2								3	
CO3	3	3	2		2								3	
CO4	3	3	2		2								3	

HYPERSONIC VEHICLE DESIGN				
Course Code	18AEE654		**Credits**	3
Hours/Week (L-T-P)	3-0-0		**CIE Marks**	50
Total Hrs	39		**SEE Marks**	50
Exam Hrs	3		**Course Type**	Program Elective

COURSE OUTCOMES

Course outcomes: After completion of the course, students will be able to-

1. Understand Mission objectives, needs, requirements and constraints.
2. Solve problems related to thermal design and balance.
3. Analyze and understand the basic launch vehicle consideration, selection process, Navigation & Telecommunication, systems.
4. Understand the fundamentals of spacecraft design management

TEACHING METHODOLOGY

- Blackboard teaching/PowerPoint presentation (if needed) /Flipped Classes for specified topics
- Regular review of students by asking questions based on topics covered in the class

COURSE CONTENTS

UNIT -1 (08 HOURS)

Space Mission Analysis and Design Process: Space mission life cycle, Mission objectives, Mission needs, Mission requirements and constraints, Space environment and survivability, Space logistics and reliability, Orbital debris.

UNIT -2- (08HOURS)

Spacecraft Configuration And Structural Design: Design requirements, Design process, Material solution, Analysis, Design verification, Impact protection, Configuration, The future of space structure.

UNIT -3- (08 HOURS)

Thermal Control Of Spacecraft: Thermal environment, Thermal balance, Thermal analysis, Thermal design, Thermal technology, Thermal design verification, Satellite thermal design.

UNIT -4- (08 HOURS)

Spacecraft Attitude, Control and Instrumentation: Basic launch vehicle consideration, Launch system selection process, determining the spacecraft design envelope, Attitude requirements, kinematics, measurements, estimation and dynamics, Space control system, Telecommunication, Onboard systems, Science instruments, Navigation

UNIT -5- (07 HOURS)

Spacecraft Design Management: Vehicle design and mission concept, System engineering, Product assurance, Spacecraft integration and test, Spacecraft reliability and quality assurance, Small satellite engineering and application, Cost.

TEXT BOOKS				
SL.NO	**Title of the Book**	**Name of the author/s**	**Name of the publisher**	**Edition and year**
1	Fundamentals of Space Systems	V.L. Pisacane and R.C. Moore	PHI Pvt. Ltd., New Delhi	AIAA Series, 2003

REFERENCE BOOKS'				
SL.NO	**Title of the Book**	**Name of the author/s**	**Name of the publisher**	**Edition and year**
1	Spacecraft Systems Engineering	P. Fortescue, J. stark, and G. Swinerd	Wheeler Publishers	AIAA Series, 2005
2	Space Mission Analysis and design	W.J. Larson and J. R. Wertz	PHI Pvt. Ltd., New Delhi,	1998 M.J.L. Turner,
3	Rocket and Spacecraft Propulsion	W.J. Larson and J. R. Wertz (Principles, Practice and New Developments).		

ONLINE RESOURCES	Link
AERO WEB	http://www.aerospaceweb.org/design/waverider/design.shtml

COURSE ASSESSMENT METHOD

Continuous Internal Evaluation (CIE)

Three internals tests (each 30 marks) are conducted, average of best two performances will be considered.

1.Minimum two Assignments/Model making – evaluated through rubrics for 10 marks. Average of two will be considered.

2.Tutorial classes and assessment are carried out/Surprise quiz tests are conducted and evaluated for 10 marks. Average of these two will be considered.

Semester End Examination (SEE)

1. Two Questions are to be set from each unit, carrying 20 Marks each.
2. Students have to answer 5 questions selecting one full question from each unit

Program Outcomes – Articulation matrix:

PO	1	2	3	4	5	6	7	8	9	10	11	12	PSO1	PSO2
CO1	3	2											3	2
CO2	3	3											3	2
CO3	3	3											3	2
CO4	3	3											3	2

GUIDANCE, NAVIGATION AND CONTROL				
Course Code	18AEE655		**Credits**	3
Hours/Week (L-T-P)	3-0-0		**CIE Marks**	50
Total Hrs	39		**SEE Marks**	50
Exam Hrs	3		**Course Type**	Program Elective

COURSE OUTCOMES

Course outcomes: After completion of the course, students will be able to-

1. Understand basics of control systems
2. Analyse the control systems and guidance/control of launch vehicles
3. Design and analyse Auto-pilot for Aerospace vehicles
4. Describe the concepts of navigation and guidance
5. Analyze the aerospace vehicle systems

TEACHING METHODOLOGY

- Blackboard teaching/PowerPoint presentation (if needed) /Flipped Classes for specified topics
- Regular review of students by asking questions based on topics covered in the class

COURSE CONTENTS

UNIT -1 (08 HOURS)

Introduction to Control System: open loop and closed loop control system-Transfer function poles and zeroes-block diagram-representation-block diagram reduction-signal flow graph Mason's gain formula-Characteristics equation-concept of stability-stability of feedback systems-Routh's stability Criteria.

UNIT -2- (08HOURS)

Time Domain Analysis: Transient and Steady State Response-Time domain Specifications Second Order system- Impulse and Step Response-Steady State error analysis.

UNIT -3- (08 HOURS)

Frequency Domain Analysis: Closed Loop Frequency Response-Bode Plot-Polar Plot-Gain Margin-Phase Margin-Nyquist Stability Criteria-Stability Analysis from Bode Plot Fuzzy Logic Neural Control-Robust Control.

UNIT -4- (08 HOURS)

Introduction to the concepts of navigation guidance and control: General principles of early conventional navigation systems. Geometric concepts of navigation. Reference frames. Direction cosine matrix, Euler angles, Transformation of angular velocities, Quaternion representation in co-ordinate transformation. Comparison of transformation methods

UNIT -5- (07 HOURS)

Modeling of Aerospace vehicles, Linear system analysis, Stabilization and Control of space crafts, Missile control systems and Autopilots, Launch vehicle flight control systems. Longitudinal and lateral autopilots for aircraft. Radar systems command and housing guidance systems.

TEXT BOOKS				
SL.NO	**Title of the Book**	**Name of the author/s**	**Name of the publisher**	**Edition and year**
1	Control System	Gopal.M	Tata Mc-Grah Hill.	2008 Edition
2	Guidance and Control Processing	Modern Navigation	Ching-Fang Lin, Prentice Hall Inc., Englewood Cliffs	New Jersey, 1991

REFERENCE BOOKS'				
SL.NO	**Title of the Book**	**Name of the author/s**	**Name of the publisher**	**Edition and year**
1	Aerospace Avionics System A Modern Synthesis’	George M Siouris	Academic Press Inc	1993
2	Modern Space Craft Dynamics and Control	Kaplan M	Wiley	1976

ONLINE RESOURCES	**Link**
NPTEL	https://nptel.ac.in/courses/101/108/101108056/

COURSE ASSESSMENT METHOD

Continuous Internal Evaluation (CIE)

Three internals tests (each 30 marks) are conducted, average of best two performances will be considered.

1.Minimum two Assignments/Model making - evaluated through rubrics for 10 marks. Average of two will be considered.

2.Tutorial classes and assessment are carried out/Surprise quiz tests are conducted and evaluated for 10 marks. Average of these two will be considered.

Semester End Examination (SEE)

1. Two Questions are to be set from each unit, carrying 20 Marks each.
2. Students have to answer 5 questions selecting one full question from each unit

Program Outcomes – Articulation matrix:

PO	1	2	3	4	5	6	7	8	9	10	11	12	PSO1	PSO2
CO1	3	1	1											2
CO2	3	1	1											2
CO3	3	1	1											2
CO4	3	1	1											2
CO5	3	1	1											2

AERO ENGINE DESIGN				
Course Code	18AEE656		**Credits**	3
Hours/Week (L-T-P)	3-0-0		**CIE Marks**	50
Total Hrs	39		**SEE Marks**	50
Exam Hrs	3		**Course Type**	Program Elective

COURSE OUTCOMES

Course outcomes: After completion of the course, students will be able to-

1. Utilize the fundamental principles of fluid mechanics and thermodynamics to analyze aircraft engines.
2. Understand the common gas turbine aircraft propulsion systems and be able to determine the applicability of each
3. Identify aircraft engine systems for specified cruise conditions at the preliminary design level
4. Analyze and perform preliminary aero thermal design of turbo machinery components.
5. Analyze and perform preliminary design of terrestrial gas turbine systems, including alternative cycles.

TEACHING METHODOLOGY

- Blackboard teaching/PowerPoint presentation (if needed) /Flipped Classes for specified topics
- Regular review of students by asking questions based on topics covered in the class

COURSE CONTENTS

UNIT -1 (08 HOURS)

Introduction: Introduction to Aircraft Engine System, Design Concept, Fundamentals of thermodynamics, fluid mechanics and aerodynamics for a turbine engine from an analytical and theoretical perspective Conservation, Equilibrium Combustion, Equilibrium Combustion with STANZAN 7, Review of Gas Dynamics Examples, Thermodynamics of jet engines

UNIT -2- (08 HOURS)

Jet Engine: Aero thermodynamics of jet engines, Ramjets, Gas turbine engines, Engine/aircraft performance.

UNIT -3- (08 HOURS)

Static Sections: Inlets, combustors & nozzles, Inlets, Combustors, Nozzles.

UNIT -4- (08 HOURS)

Dynamic Section: axial compressors, single and multi-staging, instabilities, efficiency, centrifugal compressors, axial turbines, cooling and performance, matching compressor & turbine, examples, design considerations.

UNIT -5- (06 HOURS)

Advavce Concepts: Intro to terrestrial gas turbines, Terrestrial systems, Combined cycles, Advanced cycles, TBCC Engine, Pulse Detonation Engine.

TEXT BOOKS				
SL.NO	**Title of the Book**	**Name of the author/s**	**Name of the publisher**	**Edition and year**
1	Mechanics and Thermodynamics of Propulsion	Hill & Peterson	Addison Wesle	1992 , 2nd Edition
REFERENCE BOOKS'				
1	Aircraft Engine Design	Jack D. Mattingly William H. Heiser and David T. Pratt	AIAA education series	2nd edition, 2002
2	Aerothermodynamics of Gas Turbine and Rocket Propulsion	Gordon C Oates	AIAA education series	1984

COURSE ASSESSMENT METHOD

Continuous Internal Evaluation (CIE)

Three internals tests (each 30 marks) are conducted, average of best two performances will be considered.

1.Minimum two Assignments/Model making - evaluated through rubrics for 10 marks. Average of two will be considered.

2.Tutorial classes and assessment are carried out/Surprise quiz tests are conducted and evaluated for 10 marks. Average of these two will be considered.

Semester End Examination (SEE)

1. Two Questions are to be set from each unit, carrying 20 Marks each.
2. Students have to answer 5 questions selecting one full question from each unit

Program Outcomes – Articulation matrix:

PO	1	2	3	4	5	6	7	8	9	10	11	12	PSO1	PSO2
CO1	2	3	3											3
CO2	3	3	3											3
CO3	3	3	3											3
CO4	3	3	3											3
CO5	3	3	3											2

AVIATION MANAGEMENT				
Course Code	18AEE657		**Credits**	3
Hours/Week (L-T-P)	3-0-0		**CIE Marks**	50
Total Hrs	39		**SEE Marks**	50
Exam Hrs	3		**Course Type**	Program Elective

COURSE OUTCOMES

Course outcomes: After completion of the course, students will be able to-
1. Describe history of aviation
2. Understand airport infrastructure and various air transport services
3. Identify the institutional framework of DGCA
4. Understand the role of controlling air traffic

TEACHING METHODOLOGY

- Blackboard teaching/PowerPoint presentation (if needed) /Flipped Classes for specified topics
- Regular review of students by asking questions based on topics covered in the class

COURSE CONTENTS

UNIT -1 (08 HOURS)

Introduction- history of aviation – organisation, global, social & ethical environment – history of aviation in india – major players in the airline industry - swot analysis of the different airline companies in india – market potential of airline industry in india – new airport development plans – current challenges in the airline industry - competition in the airline industry – domestic and international from an indian perspective.

UNIT -2- (08 HOURS)

Airport infrastructure and management - airport planning – terminal planning design and operation – airport operations – airport functions – organisation structure in an airline - airport authority of india - comparison of global and indian airport management – role of aai -airline privatisation - full privatisation - gradual privatisation – partial privatisation

UNIT -3- (08 HOURS)

Air transport services various airport services - international air transport services – indian scenario – an overview of airports in delhi, mumbai, hyderabad and bangalore – the role of private operators – airport development fees, rates, tariffs

UNIT -4- (08 HOURS)

Institutional framework 8 role of DGCA - slot allocation – methodology followed by ATC and DGCA -management of bilaterals – economic regulations

UNIT -5- (06 HOURS)

Controlling role of air traffic control - airspace and navigational aids – control process – case studies in airline industry – mumbai delhi airport privatisation – navi mumbai airport tendering process – 6 cases in the airline industry
.

TEXT BOOKS

SL.NO	Title of the Book	Name of the author/s	Name of the publisher	Edition and year
1	Managing Airports: An International Perspective Butterworth Heinemann,	Graham.A.	Oxford	2011
2	Airport Planning and management	Wells A	McGrah Hill, London	2000, 4th Edition

REFERENCE BOOKS'

1	Airport Business Routeledge, London	Doganis R	Butterworth's London	1992
2	Principal Of Airport Management	Alexander T Wells, 5th Young	MC Grah Hill	2003
3	Airport System: Planning,Design and Management	Richard De Nuefille	MC Grah Hill, London	2007

COURSE ASSESSMENT METHOD

Continuous Internal Evaluation (CIE)

Three internals tests (each 30 marks) are conducted, average of best two performances will be considered.

1.Minimum two Assignments/Model making - evaluated through rubrics for 10 marks. Average of two will be considered.

2.Tutorial classes and assessment are carried out/Surprise quiz tests are conducted and evaluated for 10 marks. Average of these two will be considered.

Semester End Examination (SEE)

1. Two Questions are to be set from each unit, carrying 20 Marks each.
2. Students have to answer 5 questions selecting one full question from each unit

Program Outcomes – Articulation matrix:

PO	1	2	3	4	5	6	7	8	9	10	11	12	PSO1	PSO2
CO1	2					2	2	2	2	2	2			
CO2	2					2	2	2	2	2	2			
CO3	2					2	2	2	2	2	2			
CO4	2					2	2	2	2	2	2			

SYSTEM ENGINEERING AND ANALYSIS				
Course Code	18AEE658		**Credits**	3
Hours/Week (L-T-P)	3-0-0		**CIE Marks**	50
Total Hrs	39		**SEE Marks**	50
Exam Hrs	3		**Course Type**	Program Elective

COURSE OUTCOMES

Course outcomes: After completion of the course, students will be able to-

1. Understand the system design requirements, architecture, functional requirements
2. Describe the system requirements documents as per the requirement analysis.
3. Understand the system reliability, maintainability, usability issues.
4. Carry out the system reliability analysis

TEACHING METHODOLOGY

- Blackboard teaching/PowerPoint presentation (if needed) /Flipped Classes for specified topics
- Regular review of students by asking questions based on topics covered in the class

COURSE CONTENTS

UNIT -1 (08 HOURS)

Fundamentals of systems engineering and system architecting of aeronautical system, system engg. Standards, requirements analysis, functional analysis and allocation, preliminary system architecture

UNIT -2- (08HOURS)

Systems analysis, system design, and the basics of test and evaluation, Introduction to combat systems

UNIT -3- (08 HOURS)

System development phases (Conceiving, Designing, Implementing and Operating).

UNIT -4- (08 HOURS)

Techniques of system design and assessment for operational feasibility, including Reliability, mai (including human factors and human performance), Supportability, and Producibility. System Effectiveness estimation.

UNIT -5- (07 HOURS)

Reliability analysis and management (basic tools and methods of reliability for developing complex systems including electronic components, mechanical components, and software), redundancy, graceful degradation, fault tolerance, MTBF.

TEXT BOOKS				
SL.NO	**Title of the Book**	**Name of the author/s**	**Name of the publisher**	**Edition and year**
1	The Engineering Design of Systems: Models and Methods	Buede D.M.	Publisher: John Wiley & Sons Inc	Second edition 1995
2	System Analysis Design and Development	Charles S. Wasson	Wiley Series in System Engineering and Management.	
REFERENCE BOOKS'				
1	Principles of Planned Maintenance	Clifton R H.	McGraw Hill, New York	
2	Reliability Engineering	Srinath L S.	Affiliated East-West Press Limited, New Delhi,	2002.

COURSE ASSESSMENT METHOD

Continuous Internal Evaluation (CIE)

Three internals tests (each 30 marks) are conducted, average of best two performances will be considered.

1.Minimum two Assignments/Model making - evaluated through rubrics for 10 marks. Average of two will be considered.

2.Tutorial classes and assessment are carried out/Surprise quiz tests are conducted and evaluated for 10 marks. Average of these two will be considered.

Semester End Examination (SEE)

1. Two Questions are to be set from each unit, carrying 20 Marks each.
2. Students have to answer 5 questions selecting one full question from each unit

Program Outcomes – Articulation matrix:

PO	1	2	3	4	5	6	7	8	9	10	11	12	PSO1	PSO2
CO1	2	2												1
CO2	3	3												1
CO3	3	3												1
CO4	3	3												1

MAJOR PROJECT PHASE-I				
Course Code	18AEP610		**Credits**	1
Hours/Week (L-T-P)	3		**CIE Marks**	50
Total Hrs	36		**SEE Marks**	50
Exam Hrs	3		**Course Type**	Core

COURSE OUTCOMES

Course outcomes: After completion of the course, students will be able to-

1. Identify and define the problem for the project work
2. Apply the knowledge acquired to analyze and estimate the cost and time
3. Examine and use appropriate tools to solve the defined problem in a team
4. Develop an end product and prepare a technical report/paper

COURSE ASSESSMENT METHOD

Project work: Based on the ability/abilities of the student/s and recommendations of the mentor, a single discipline or a multi disciplinary project can be assigned to an individual student or to a group having not more than 4 students. In extraordinary cases, like the funded projects requiring students from different disciplines, the project student strength can be 5 or 6.

CIE procedure for Project Work Phase - 1:

The CIE marks shall be awarded by a committee consisting of the Head of the concerned Department and senior faculty members of the Department, one of whom shall be the Guide. The CIE marks awarded for the project work phase-1, shall be based on the evaluation of the project in terms of Report (covering Literature Survey, Problem identification, Objectives and Methodology), project presentation skill and question and answer session in the ratio 50:25:25..

SEE Procedure for project Work Phase-1

The SEE marks shall be awarded by senior examiners (internal & External). The students have to present/demonstrate the project work carried out. SEE marks awarded for the project work phase -1. The marks will be awarded for the students based on Report (covering Literature Survey, Problem identification, Objectives and Methodology), project presentation skill and question and answer session in the ratio 50:25:25.

Program Outcomes – Articulation matrix:

PO	1	2	3	4	5	6	7	8	9	10	11	12	PSO1	PSO2
CO1	3	3	3	3	3	2	2	3	3	3	3	3	3	3
CO2	3	3	3	3	3	2	2	3	3	3	3	3	3	3
CO3	3	3	3	3	3	2	2	3	3	3	3	3	3	3
CO4	3	3	3	3	3	2	2	3	3	3	3	3	3	3

SEMESTER-VII

VIBRATION & AEROELASTICITY				
Course Code	18AE71		**Credits**	**4**
Hours/Week (L-T-P)	4-2-0		**CIE Marks**	50
Total Hrs	48		**SEE Marks**	50
Exam Hrs	3		**Course Type**	Core

COURSE OUTCOMES

Course outcomes: After completion of the course, students will be able to-

1. Formulate the mathematical models for undamped and damped mechanical vibrations Systems.
2. Determine and interpret the characteristics of linear vibration mechanical systems
3. Predict the frequency response for mechanical vibration systems under loading conditions
4. Evaluate the natural frequencies of different DOF Systems using various numerical techniques.

TEACHING METHODOLOGY

- Blackboard teaching/PowerPoint presentation (if needed) /Flipped Classes for specified topics

COURSE CONTENTS

UNIT -1 (10 HOURS)

Single degree of freedom systems -Introduction to simple harmonic motion, D'Alembert's principle, free vibrations – damped vibrations –forced vibrations, with and without damping – support excitation – transmissibility – vibration measuring instruments.

UNIT -2- (10 HOURS)

Multi degrees of freedom systems-Two degrees of freedom systems - static and dynamic couplings - vibration absorber- principal coordinates- principal modes and orthogonal conditions - Eigen value problems - Hamilton's principle - Lagrangean equations and application.

UNIT -3- (10 HOURS)

Continuous systems-Vibration of elastic bodies - vibration of strings – longitudinal, lateral and torsional vibrations

UNIT -4- (08 HOURS)

Approximate methods-Approximate methods - Rayleigh's method - Dunkerlay's method – Rayleigh-Ritz method, matrix iteration method.

UNIT -5- (10 HOURS)

Elements of aeroelasticity-Vibration due to coupling of bending and torsion - aeroelastic problems - collars triangle – wing divergence - aileron control reversal – flutter – buffeting. – Elements of servo elasticity.

TEXT BOOKS

L.NO	Title of the Book	Name of the author/s	Name of the publisher	Edition and year
1	Elements of Vibration Analysis	Leonard Meirovitch	McGraw Hill International Edition	McGraw Hill International Edition 2007
2	Mechanical Vibrations	Grover. G.K `	Nem Chand Brothers,	7th Edition 2003
3	Theory of Vibration with Application	Thomson W T	CBS Publishers	1990
4	eroelasticity	Bisplinghoff R.L, Ashely H and Hogman R.L	Addision Wesley Publication, New Tork	1983

REFERENCE BOOKS

SL.NO	Title of the Book	Name of the author/s	Name of the publisher	Edition and year
1	Vibration	William Weaver, Stephen P. Timoshenko, Donovan H.		
2	Problems in Engineering’	Yound, Donovan H. Young.`	John Wiley and Sons, New York	2001
3	Mechanical Vibrations	William W Seto	McGraw Hill	Schaum Series.
4	Mechanical Vibrations	TSE. F.S., Morse, I.F., Hinkle, R.T	Prentice Hall New York	1984
5	Mechanical Vibrations	Den Hartog	Crastre Press	2008

ONLINE RESOURCES	Link
NPTEL	https://nptel.ac.in/courses/112/103/112103111/
NPTEL	https://nptel.ac.in/courses/101/104/101104005/

COURSE ASSESSMENT METHOD

Continuous Internal Evaluation (CIE)

Three internals tests (each 30 marks) are conducted, average of best two performances will be considered.

1.Minimum two Assignments/Model making - evaluated through rubrics for 10 marks. Average of two will be considered.

2.Tutorial classes and assessment are carried out/Surprise quiz tests are conducted and evaluated for 10 marks. Average of these two will be considered.

Semester End Examination (SEE)

1. Two Questions are to be set from each unit, carrying 20 Marks each.
2. Students have to answer 5 questions selecting one full question from each unit

Program Outcomes – Articulation matrix:

PO	1	2	3	4	5	6	7	8	9	10	11	12	PSO1	PSO2
CO1	3	2	2										3	
CO2	3	2	2										3	
CO3	3	2	2										3	
CO4	3	2	2										3	
CO5	3	2	2										3	

CFD IN AEROSPACE ENGINEERING				
Course Code	18AE72		**Credits**	4
Hours/Week (L-T-P)	3-0-2		**CIE Marks**	50
Total Hrs	36		**SEE Marks**	50
Exam Hrs	3		**Course Type**	Core

COURSE OUTCOMES

Course outcomes: After completion of the course, students will be able to-

1. Describe the basic concepts and principles of CFD
2. Apply Governing Equations for CFD
3. Apply Discretization of Conservation Equations & Simulation of Turbulence
4. Use the Solution of Linear Equation System and Application Examples of CFD

TEACHING METHODOLOGY

- Blackboard teaching/PowerPoint presentation (if needed) /Videos and animation
- CFD problems will be solved using analysis tools like ANSYS for better understandings of the topics.

COURSE CONTENTS

UNIT -1- (10 HOURS)

Basic Thoughts and Equations: Basic philosophy of CFD, The Governing equations of fluid dynamics and its significance, Flux vector representation of the governing equations, Classification of PDEs and its nature, Discussion about Elliptic, Parabolic and Hyperbolic PDEs..

UNIT -2 (10 HOURS)

Basics of Numerical Computation & Grid Generation Techniques: Basics of Numerics: Different discretization techniques, Finite difference approximation, Explicit and implicit approaches, Discussion about consistency, stability and convergence, Errors and stability of numerical schemes. Grid Generation: Need for grid, Various grid generation techniques, Transformation of equations. Modern aspects of grid generation

UNIT -3 (10 HOURS)

Some Simple CFD Techniques and Their Applications: The Lax-Wendroff technique, The MacCormack's technique, The relaxation technique, Aspects of numerical dissipation an dispersion; Artificial viscosity, The Alternating-Direction-Implicit (ADI) technique, The pressure correction technique, Incompressible Couette flow numerical solution by means of an Implicit method and by the Pressure Correction Method.

UNIT -4 (10 HOURS)

Some Advanced CFD Techniques: The Beam and Warming method, Approximate factorization technique for multidimensional problems, Upwind schemes, Flux vector splitting. Wave based flux methods: The Riemann approach, Total Variation Diminishing (TVD) schemes. Flux limiters, Multigrid methods, Artificial compressibility method, Entropy condition.

UNIT -5 (08 HOURS)

Introduction to Finite Volume Techniques and Some Aspects of Modern CFD: Introduction to finite volume techniques, Methodology, Solution to simple problems, Modern aspects of CFD, Parallel processing, Introduction to turbulence modelling, Ideas about RANS, DNS and LES for turbulence simulations

TEXT BOOKS

SL.NO	Title of the Book	Name of the author/s	Name of the publisher	Edition and year
1	Computational Fluid Dynamics– The basics and applications	Anderson J.D. Jr	Mcgraw-Hill, New York	1995
2	An introduction to CFD	H. Versteeg and W. Malalasekra, `	Pearson , Education	2nd Edition, 2008.
3	Introduction to Computational Fluid Dynamics	A. A. Hirsch	McGraw-Hill	1989

REFERENCE BOOKS'

SL.NO	Title of the Book	Name of the author/s	Name of the publisher	Edition and year
1	Computational Fluid Dynamic – a practical approach	Jiyuan Tu, Guan Heng Yeoh and Chaoqun Liu	Butterworth-Heinemann	(ELSEVIER), 2008.
2	Introduction to Computational Fluid Dynamics	Pradip Niyogi, S.K. Chakrabarthy and M.K. Laha	Pearson Education	2006
3	Numerical Methods in Fluid Dynamics	H.J. Wirz and J.J. Smeldern	McGraw-Hill & Co	**1978**
4	Computational Fluid Dynamics	T.J. Chung	Cambridge University Press	2002

ONLINE RESOURCES	Link
NPTEL	https://nptel.ac.in/courses/101/106/101106045/
MIT OPEN Course	https://ocw.mit.edu/courses/mechanical-engineering/2-29-numerical-fluid-mechanics-spring-2015/lecture-notes-and-references/

COURSE ASSESSMENT METHOD

Continuous Internal Evaluation (CIE)

Three internals tests (each 30 marks) are conducted, average of best two performances will be considered.

1. Minimum two Assignments/Model making - evaluated through rubrics for 10 marks. Average of two will be considered.
2. Tutorial classes and assessment are carried out/Surprise quiz tests are conducted and evaluated for 10 marks. Average of these two will be considered.

Semester End Examination (SEE)

1. Two Questions are to be set from each unit, carrying 20 Marks each.
2. Students have to answer 5 questions selecting one full question from each unit

Program Outcomes – Articulation matrix:

PO	1	2	3	4	5	6	7	8	9	10	11	12	PSO1	PSO2
CO1	3	3			2				2	2				3
CO2	3	3			2				2	2				3
CO3	3	3			2				2	2				3
CO4	3	3			2				2	2				3

COMPOSITE MATERIALS & STRUCTURES				
Course Code	18AE73		**Credits**	3
Hours/Week (L-T-P)	3		**CIE Marks**	50
Total Hrs	39		**SEE Marks**	50
Exam Hrs	3		**Course Type**	Core

COURSE OUTCOMES

Course outcomes: After completion of the course, students will be able to-

1.Understand the manufacturing process of various aircraft materials and theories of failures.
2.Apply the characterization methods for various engineering materials
3. Analyze and apply theories of structures for engineering problems
4.Solve problems related to thin walled structures
5.Apply classical plate theory and circular cylindrical theories for plates & shells

TEACHING METHODOLOGY

- Blackboard teaching/PowerPoint presentation
- Laboratory visits and hands on sessions on manufacturing of composite materials.

COURSE CONTENTS

UNIT -1- (8 HOURS)

Introduction to Composite Materials
Definition, classification of composite materials, classification of reinforcement - particulate, short fiber,
whiskers, long fibers composites. matrix materials – metals, ceramics, polymers (including thermoplastics and thermosets), Carbon-Carbon Composites.

Metal Matrix Composites:
MMC with particulate and short fiber reinforcement, liquid and solid-state processing of MMC – stir casting, squeeze casting. Properties of MMCs, Applications of Al, Mg, Ti based MMC.

UNIT -2 (08 HOURS)

Processing of Polymer Matrix Composites: Thermoset Polymers, Hand layup Process, Vacuum Bagging Process, Post Curing Process, Filament winding, Pultrusion, Pulforming, Autoclave Process.
Processing of Polymer Matrix Composites: Thermoplastic Polymers, Extrusion process, Injection Moulding Process, Thermo-forming process.
Post Processing of Composites – Adhesive bonding, drilling, cutting processes

UNIT -3 (08 HOURS)

Micromechanics: Introduction – advantages and application of composite materials – types of reinforcements and matrices – micro mechanics – mechanics of materials approach, elasticity approach- bounding techniques – fiber volume ratio – mass fraction – density of composites. Effect of voids in composites, discussion of Failure theories

UNIT -4- (08 HOURS)

Macromechanics: Generalized Hooke's Law – elastic constants for anisotropic, orthotropic and isotropic materials – macro mechanics – stress-strain relations with respect to natural axis, arbitrary axis – determination of in plane strengths of a lamina – experimental characterization of lamina.

UNIT -5- (7 HOURS)

Introduction to Design of Composite Structures: Elements of design, objectives of design, design drivers, material selection factors w.r.t fibers, matrix, advantages of composite material in stiffened structures, types of stiffeners, different types of joints.

Applications of Composites Materials:

Automobile, Aircrafts, missiles, Space hardware, Electrical and electronics, marine, recreational and Sports equipment, future potential of composites.

TEXT BOOKS

SL.NO	Title of the Book	Name of the author/s	Name of the publisher	Edition and year
1	Mechanics of Composite Materials	Dam Ishai	Oxford University Press	2nd Edition 2005
2	Mechanics of Composite Materials’	Autar K Kaw	CRC Press	1997
3	Mechanics of Composite Materials and Structures	Madhuji Mukhapadhyay	University Press	2004

REFERENCE BOOKS'

SL.NO	Title of the Book	Name of the author/s	Name of the publisher	Edition and year
1	Analysis and Performance of Fibre Composites	Agarwal, B.D., and Broutman, L.J	John Wiley and sons. Inc., New York	1995
2	Handbook on Advanced Plastics and Fibre Glass	Lubin, G `	Von Nostrand Reinhold Co., New York	1989.
3	The Analysis of laminated Composite Structures	Calcote, L R	Von – Nostrand Reinhold Company New York	1998.
4	Composite Materials for Aircraft Structures	Allen Baker	AIAA Series	II Edition, 1999.

ONLINE RESOURCES	Link
NPTEL	https://nptel.ac.in/courses/101/104/101104010/#
NPTEL	https://nptel.ac.in/courses/101/106/101106038/
NPTEL	https://nptel.ac.in/courses/112/104/112104229/
MIT OCW	https://ocw.mit.edu/courses/materials-science-and-engineering/3-11-mechanics-of-materials-fall-1999/modules/

COURSE ASSESSMENT METHOD

Continuous Internal Evaluation (CIE)

Three internals tests (each 30 marks) are conducted, average of best two performances will be considered.

1. Minimum two Assignments/Model making - evaluated through rubrics for 10 marks. Average of two will be considered.
2. Tutorial classes and assessment are carried out/Surprise quiz tests are conducted and evaluated for 10 marks. Average of these two will be considered.

Semester End Examination (SEE)
1. Two Questions are to be set from each unit, carrying 20 Marks each.
2. Students have to answer 5 questions selecting one full question from each unit

Program Outcomes – Articulation matrix:

PO	1	2	3	4	5	6	7	8	9	10	11	12	PSO1	PSO2
CO1	3	2							2	3			3	
CO2	3	2							2	3			3	
CO3	3	2							2	3			3	
CO4	3	2							2	3			3	
CO5	3	2							2	3			3	

ENTERPRENEURSHIP DEVELOPMENT & IPR				
Course Code	18AEH74		**Credits**	3
Hours/Week (L-T-P)	3-0-0		**CIE Marks**	50
Total Hrs	39		**SEE Marks**	50
Exam Hrs	3		**Course Type**	Core

COURSE OUTCOMES

Course outcomes: After completion of the course, students will be able to-

1. Recognize the importance of entrepreneurship and its role in economic development of the Country.
2. Identify various schemes of Central and State Governments and their agencies available to promote MSME and process of setting up the same.
3. Identify & select various projects to become entrepreneur by conducting feasibility studies in respect of market, finance, technical & social
4. Prepare project report for starting an enterprise in line with guidelines proposed by planning commission for appraising to various statutory authorities and financial institutions.
5. Appraise of IP rights like patents, industrial design, trademark, copyrights for effective protection and utilization of their innovations.

TEACHING METHODOLOGY

- Blackboard teaching/PowerPoint presentation (if needed)
- Case studies on entrepreneurship and IPR

COURSE CONTENTS

UNIT -1- (8 HOURS)

Introduction-meaning and importance of entrepreneurship, entrepreneur, types, characteristics entrepreneur process, role of entrepreneurs in economic development, problems faced by entrepreneurs, scope in India.

UNIT -2- (8 HOURS)

Micro, Small and medium enterprises-Definition of MSMEs as per MSME act, characteristics of small enterprises, need and advantages of small enterprises, Steps in setting up of small enterprises, Institutional support to MSMEs-State supporting agencies-TECSOK, KIADB, KSSIDC, KSFC, National Schemes-MSME-DI, NSIC, SIDBI

UNIT -3- (8 HOURS)

Preparation of Project reports- control variables in project, project lifecycle, project report, need, project identification, project selection, components of project report, formulation of report, planning commission guidelines, project appraisal, feasibility study-market, financial, technical and economic, PERT and CPM, errors in report

UNIT -4- (7 HOURS)

Introduction to IP- What is Intellectual Property (IP)?, Historical background of IP, Economic value of IP, Motivation to IP development, IP system strategy, Emerging issues, IPR governance, Institutions for administering the IP system, IP rights and marketing regulations, IPR protection, protecting consumers and protecting competition,
IP management framework, Drivers of IP management, IP value chain, IP management framework, IP strategies, Strategic considerations, managing trademarks.

UNIT -5- (8 HOURS)

Intellectual Property Rights-What are IPRs?, Types of IPRs, Indian IPR scenario, Legal use of IP, Global vs Indian IPR landscape, TRIPS and its implications
Patents-What is a patent, history of patent, Criteria for patent, types of patents, Indian patent act, patents for computer software, business models, incremental innovation, patent infringement
Trademarks-role, as a marketing tool, trademark rights, types, use of trademarks, trademark act, trademark registration in India Copyrights-meaning, copyright protection in India, enforcement measures, copyright act.

TEXT BOOKS

SL.NO	Title of the Book	Name of the author/s	Name of the publisher	Edition and year
1	Dynamics of Entrepreneurial Development and Management	Vasanth Desai	Himalaya Publishing House	Sixth edition 2011
2	Entrepreneurship and Management	` S Nagendra and Manjunath VS	Pearson Publications	2010
3	Managing Intellectual Property	Vinod V. Sople,	PHI	3rd Edition, 2012
4	Intellectual Property-Copyrights, trademarks and patents	Richard Stim	Cengage learning,	2011

REFERENCE BOOKS'

SL.NO	Title of the Book	Name of the author/s	Name of the publisher	Edition and year
1	Management Fundamentals – Concepts Application	Robers Lusier, Thomson	South-Western, Div of *Thomson* Learning;	International Edition, 2005
2	Entrepreneurship Development	S. S. Khanka, S `	Chand & Co. New Delhi	Reprint edition,2005
3	Management	Stephen Robbins	Pearson Education/PHI	17thEdition, 2003.

ONLINE RESOURCES	Link
NPTEL	https://nptel.ac.in/courses/127/105/127105007/
NPTEL	https://nptel.ac.in/courses/110/106/110106141/
NPTEL	https://nptel.ac.in/courses/110/105/110105139/

COURSE ASSESSMENT METHOD

Continuous Internal Evaluation (CIE)
Three internals tests (each 30 marks) are conducted, average of best two performances will be considered.

1. Minimum two Assignments/Model making - evaluated through rubrics for 10 marks. Average of two will be considered.
2. Tutorial classes and assessment are carried out/Surprise quiz tests are conducted and evaluated for 10 marks. Average of these two will be considered.

Semester End Examination (SEE)
1. Two Questions are to be set from each unit, carrying 20 Marks each.
2. Students have to answer 5 questions selecting one full question from each unit

Program Outcomes – Articulation matrix:

PO	1	2	3	4	5	6	7	8	9	10	11	12	PSO1	PSO2
CO1	2					2	3	2	2	3	2	2		
CO2	2					2	3	2	2	3	2	2		
CO3	2					2	3	2	2	3	2	2		
CO4	2					2	3	2	2	3	2	2		
CO5	2					2	3	2	2	3	2	2		

PROGRAM ELECTIVE-E				
HEAT AND MASS TRANSFER				
Course Code	18AEE751		**Credits**	3
Hours/Week (L-T-P)	3-1-0		**CIE Marks**	50
Total Hrs	36		**SEE Marks**	50
Exam Hrs	3		**Course Type**	Program Elective

COURSE OUTCOMES

Course outcomes: After completion of the course, students will be able to-

1. Understand the fundamentals of heat transfer
2. Solve problems related to variable thermal conductivity in extended surfaces
3. Analyze the Basic Relations in Boundary Layers and free convection heat transfer
4. Solve problems related to forced convection and mass transfer
5. Apply the concepts of radiation heat transfer and heat exchangers in real time engineering problems

TEACHING METHODOLOGY

- Blackboard teaching/PowerPoint presentation (if needed) /Flipped Classes for specified topics

COURSE CONTENTS

UNIT -1- (08 HOURS)

Introductory Concepts and Definitions: Modes of heat transfer: Basic laws governing conduction, convection, and radiation heat transfer; Thermal conductivity; convective heat transfer coefficient; radiation heat transfer, combined heat transfer mechanism. Boundary conditions of 1st, 2nd and 3rd kind

Conduction: Derivation of general three dimensional conduction equation in Cartesian coordinate, special cases, Derivation on 3-D conduction in Cartesian coordinate system and application of Cartesian, cylindrical and spherical coordinate systems to problems.

UNIT -2- (07 HOURS)

Variable Thermal Conductivity: Derivation for heat flow and temperature distribution in plane wall. Heat transfer in extended surfaces of uniform cross-section without heat generation, Long fin, short fin with insulated tip and without insulated tip and fin connected between two heat sources. Fin efficiency and effectiveness. Numerical problems. **One-Dimensional Transient Conduction:** Conduction in solids with negligible internal temperature gradient (Lumped system analysis) Numerical Problems.

UNIT -3- (07 HOURS)

Concepts And Basic Relations In Boundary Layers: Flow over a body velocity boundary layer; critical Reynolds number; general expressions for drag coefficient and drag force; thermal boundary layer; general expression for local heat transfer coefficient; Average heat transfer coefficient; Nusselt number. Flow inside a duct- velocity boundary layer, hydrodynamic entrance length and hydro dynamically developed flow; flow through tubes (internal flow discussion only). Numericals based on empirical relation given in data handbook.

UNIT -4- (07 HOURS)

Forced Convections: Applications of dimensional analysis for forced convection. Physical

significance of Reynolds, Prandtl, Nusselt and Stanton numbers. Use of various correlations for hydro dynamically and thermally developed flows inside a duct, use of correlations for flow over a flat plate, over a cylinder and sphere. Numerical problems.
Free Or Natural Convection: Application of dimensional analysis for free convection- physical significance of Grashoff number; use of correlations of free convection in vertical, horizontal and inclined flat plates, vertical and horizontal cylinders and spheres, Numerical problems.

UNIT -5- (07 HOURS)

Radiation Heat Transfer: Definitions, concept of a black body, Kirchoff's law, Lambert's Cosine Law, Stefan-Boltzman's law, Plank's distribution law, Wein's displacement law, configuration factor. Radiation heat exchange between two parallel plates, radiation shielding, radiation heat exchange in an enclosure.
Mass transfer: Introduction to mass transfer, definition and terms used in mass transfer ,Ficks law of diffusion ,mass transfer coefficient.

TEXT BOOKS

SL.NO	Title of the Book	Name of the author/s	Name of the publisher	Edition and year
1	Heat & Mass Transfer	Tirumaleshwar	Pearson	2006
2	Heat Transfer	P.K. Nag `	Tata Mc Graw Hill	2002
3	Heat and mass transfer	Er.R K Rajput.S	Chand & Comp	2012.

REFERENCE BOOKS

SL.NO	Title of the Book	Name of the author/s	Name of the publisher	Edition and year
1	Heat Transfer, a Practical Approach	Yunus A	Cengel Tata Mc Graw Hill	
2	Principles of Heat Transfer	by Kreith Thomas `	Learning 2001	Learning 2001
3	Fundamentals of Heat and Mass Transfer	Frenk P. Incropera and David P. Dewitt	John Wiley and son's.	

ONLINE RESOURCES	Link
NPTEL	https://nptel.ac.in/courses/112/101/112101097/
NPTEL	https://nptel.ac.in/courses/103/103/103103145/
NPTEL	https://nptel.ac.in/courses/112105206/
MIT OCW	https://ocw.mit.edu/courses/mechanical-engineering/2-051-introduction-to-heat-transfer-fall-2015/

COURSE ASSESSMENT METHOD

Continuous Internal Evaluation (CIE)

Three internals tests (each 30 marks) are conducted, average of best two performances will be considered.

1. Minimum two Assignments/Model making - evaluated through rubrics for 10 marks. Average of two will be considered.
2. Tutorial classes and assessment are carried out/Surprise quiz tests are conducted and evaluated for 10 marks. Average of these two will be considered.

Semester End Examination (SEE)

1. Two Questions are to be set from each unit, carrying 20 Marks each.
2. Students have to answer 5 questions selecting one full question from each unit

Program Outcomes – Articulation matrix:

PO	1	2	3	4	5	6	7	8	9	10	11	12	PSO1	PSO2
CO1	3	3	3											3
CO2	3	3	3											3
CO3	3	3	3											3
CO4	3	3	3											3

FATIGUE AND FRACTURE				
Course Code	18AEE752		**Credits**	3
Hours/Week (L-T-P)	3		**CIE Marks**	50
Total Hrs	39		**SEE Marks**	50
Exam Hrs	3		**Course Type**	Program Elective

COURSE OUTCOMES

Course outcomes: After completion of the course, students will be able to-

1. Apply mathematical knowledge to define fatigue behaviors
2. Analyze the load histories and cumulative damage due to fatigue.
3. Distinguish the safe life and fail safe design philosophies
4. Apply the principles of failures

TEACHING METHODOLOGY

- Blackboard teaching/PowerPoint presentation
- Videos and animations related to fatigue and fracture of aircraft components

COURSE CONTENTS

UNIT -1- (08 HOURS)

FATIGUE OF STRUCTURES

S.N. curves - Endurance limits - Effect of mean stress, Goodman, Gerber and Soderberg relations and diagrams - Notches and stress concentrations - Neuber's stress concentration factors - Plastic stress concentration factors - Notched S.N. curves.

UNIT -2- (07 HOURS)

STATISTICAL ASPECTS OF FATIGUE BEHAVIOUR

Low cycle and high cycle fatigue - Coffin - Manson's relation - Transition life - cyclic strain hardening and softening - Analysis of load histories - Cycle counting techniques - Cumulative damage - Miner's theory - Other theories.

UNIT -3- (08 HOURS)
PHYSICAL ASPECTS OF FATIGUE AND FRACTURE Phase in fatigue life - Crack initiation - Crack growth - Final Fracture - Dislocations - fatigue fracture surfaces - Strength and stress analysis of cracked bodies - Potential energy and surface energy - Griffith's theory - Irwin - Orwin extension of Griffith's theory to ductile materials - Effect of thickness on fracture toughness - stress intensity factors for typical geometries
UNIT -4- (08 HOURS)
FATIGUE DESIGN AND TESTINIG Safe life and Fail-safe design philosophies - Importance of Fracture Mechanics in aerospace structures - Application to composite materials and structures.
UNIT -5- (08 HOURS)
FUNDAMENTALS OF FAILURE ANALYSIS Common causes of failure. Principles of failure analysis. Fracture mechanics approach to failure problems. Techniques of failure analysis. Service failure mechanisms - ductile and brittle fracture, fatigue fracture, wear failures, fretting failures, environment induced failures, high temp. failure. Faulty heat treatment and design failures, processing failures (forging, casting, machining etc.),
TEXT BOOKS

SL.NO	Title of the Book	Name of the author/s	Name of the publisher	Edition and year
1	Fundamentals of Metal Fatigue Analysis	Julie A Bannantine, Jess J Comer & James	Prentice-Hall, Inc, New Jersey	1990
2	Metal fatigue in Engineering	Ralph I Stephens, Ali Fatemi, Robert	A Wiely-Interscience Publication	2nd Edition, 2001

REFERENCE BOOKS

SL.NO	Title of the Book	Name of the author/s	Name of the publisher	Edition and year
1	Elementary Engineering Fracture Mechanics	D. Broek	Noordhoff International Publishing Co., London	1994
2	Fundamentals of Fracture Mechanics	` J. F. Knott	Butterworth & Co., (Publishers) Ltd., London	1983
3	Deformation and Fracture Mechanics of Engineering Materials	Richard W. Hertzberg	John Wiely & Sons	1996 4th Edition
4	Fatigue of structures & materials	Jaap Schijive	Kluwer Academic Publishers,	2004

5	Fracture Mechanics – Fundamentals & Applications	T. L. Anderson	Taylor & Francis Group	3rd Edition 2005
6	Damage & Failure of Composite Materials	Ramesh Talreja & Chandra V Singh	Cambridge University Press	2012
7	Mechanics of Composite Materials	Autar K. Kaw	Taylor & Francis Group,	2nd Edition 2006.

ONLINE RESOURCES	Link
NPTEL	https://nptel.ac.in/courses/112/106/112106065/
NPTEL	http://www.nptelvideos.in/2012/12/engineering-fracture-mechanics.html
MIT OCW	https://ocw.mit.edu/courses/materials-science-and-engineering/3-35-fracture-and-fatigue-fall-2003/

COURSE ASSESSMENT METHOD

Continuous Internal Evaluation (CIE)

Three internals tests (each 30 marks) are conducted, average of best two performances will be considered.

1.Minimum two Assignments/Model making - evaluated through rubrics for 10 marks. Average of two will be considered.

2.Tutorial classes and assessment are carried out/Surprise quiz tests are conducted and evaluated for 10 marks. Average of these two will be considered.

Semester End Examination (SEE)

1. Two Questions are to be set from each unit, carrying 20 Marks each.
2. Students have to answer 5 questions selecting one full question from each unit

Program Outcomes – Articulation matrix:

PO	1	2	3	4	5	6	7	8	9	10	11	12	PSO1	PSO2
CO1	3	3											3	
CO2	3	3											3	
CO3	3	3											3	

PLATES AND SHELLS				
Course Code	18AEE753		**Credits**	3
Hours/Week (L-T-P)	3		**CIE Marks**	50
Total Hrs	36		**SEE Marks**	50
Exam Hrs	3		**Course Type**	Program Elective

COURSE OUTCOMES

Course outcomes: After completion of the course, students will be able to-

1. Explain classical plate theory and boundary conditions
2. Explain the various method of solution for different geometry of plates
3. Discuss the various approximate methods to vibration analysis in plate.
4. Describe the basic concepts of shell type of structures

TEACHING METHODOLOGY

- Blackboard teaching/PowerPoint presentation (if needed) /Flipped Classes for specified topics

COURSE CONTENTS

UNIT -1- (07 HOURS)

Classical Plate Theory: Classical Plate Theory – Assumptions – Differential Equation – Boundary Conditions

UNIT -2- (07 HOURS)

Plates of Various Shades: Navier's Method of Solution for Simply Supported Rectangular Plates – Leavy's Method of Solution for Rectangular Plates under Different Boundary Conditions. Governing Equation – Solution for Axisymmetric loading – Annular Plates – Plates of other shapes.

UNIT -3- (07 HOURS)

Eigen Value Analysis: Stability and free Vibration Analysis of Rectangular Plates.

UNIT -4- (08 HOURS)

Approximate Methods: Rayleigh – Ritz, Galerkin Methods– Finite Difference Method – Application to Rectangular Plates for Static, Free Vibration and Stability Analysis

UNIT -5- (07 HOURS)

Shells: Basic Concepts of Shell Type of Structures – Membrane and Bending Theories for Circular Cylindrical Shells.

TEXT BOOKS

SL.NO	Title of the Book	Name of the author/s	Name of the publisher	Edition and year
1	Theory of Plates and Shells	Timoshenko, S.P. Winowsky. S., and Kreger	McGraw-Hill Book Co	1990.
2	Theory of Plates and Shells	Varadan. T. K. and Bhaskar. K `	Narosa.	1999,

REFERENCE BOOKS'

SL.NO	Title of the Book	Name of the author/s	Name of the publisher	Edition and year
1	Stresses in Shells	Flugge, W	Springer – Verlag	**1985**
2	Theory of Elastic Stability	Timoshenko, S.P. and Gere, J.M `	McGraw-Hill Book Co	**1986**

ONLINE RESOURCES	Link
NPTEL	https://nptel.ac.in/courses/112/103/112103251/
NPTEL	https://nptel.ac.in/noc/courses/noc18/SEM2/noc18-me65/
MIT OCW	https://ocw.mit.edu/courses/mechanical-engineering/2-081j-plates-and-shells-spring-2007/readings/lecturenote.pdf

COURSE ASSESSMENT METHOD

Continuous Internal Evaluation (CIE)

Three internals tests (each 30 marks) are conducted, average of best two performances will be considered.

1. Minimum two Assignments/Model making - evaluated through rubrics for 10 marks. Average of two will be considered.
2. Tutorial classes and assessment are carried out/Surprise quiz tests are conducted and evaluated for 10 marks. Average of these two will be considered.

Semester End Examination (SEE)

1. Two Questions are to be set from each unit, carrying 20 Marks each.
2. Students have to answer 5 questions selecting one full question from each unit

Program Outcomes – Articulation matrix:

PO	1	2	3	4	5	6	7	8	9	10	11	12	PSO1	PSO2
CO1	3	2										2	3	
CO2	3	2										2	3	
CO3	3	2										2	3	
CO4	3	2										2	3	

LAUNCH VEHICLE DYNAMICS				
Course Code	18AEE754		**Credits**	3
Hours/Week (L-T-P)	3		**CIE Marks**	50
Total Hrs	39		**SEE Marks**	50
Exam Hrs	3		**Course Type**	Program Elective

COURSE OUTCOMES

Course outcomes: After completion of the course, students will be able to-

1. Describe the Environment and Mission Design Interpret measurement of variables like force, torque and pressure
2. Explain the Trajectory of a Rocket
3. Explain the Astrodynamics, Atmospheric Entry, Attitude Determination and Control
4. Describe the Configuration, Structural Design and Communications

TEACHING METHODOLOGY

- Blackboard teaching/PowerPoint presentation.
- Animation and videos

COURSE CONTENTS

UNIT -1- (09 HOURS)

Environment and Mission Design

Earth environment, launch environment, atmosphere, space and upper atmosphere; earth-bound orbits, lunar and deep space missions, advanced missions, launch vehicle selection, launching and deployment

UNIT -2 (07 HOURS)

Trajectory of a Rocket

Mass ratio and propellant mass fraction; equation of motion of an ideal rocket; motion of a rocket in a gravitational field; simplified vertical trajectory; burn-out velocity and burn-out height; step-rockets; ideal mission velocity and losses; effect of launch angle; factors causing dispersion of rockets in flight; dispersion of finned rockets; stability of flight.

UNIT -3- (08 HOURS)

Astrodynamics

Orbits and trajectories, Kepler's laws, orbital velocity and periods, eccentric elliptical orbits; effect of injection conditions, effect of earth's rotation, perturbation analysis; parking orbit, transfer trajectory, impulsive shot; rendezvous; recent interplanetary missions

UNIT -4- (08 HOURS)

Atmospheric Entry, Attitude Determination and Control

Entry flight mechanics, entry heating, entry vehicle design, aero-assisted orbit transfer; concepts and terminology of attitude determination, rotational dynamics, rigid body dynamics, disturbance torques, passive attitude control, active control, attitude determination, system design considerations.

UNIT -5- (06 HOURS)

Configuration, Structural Design and Communications

Design drivers and concepts, mass properties, structural loads; power sources, design drivers and practice, command subsystems, redundancy and autonomy, radio communications, tracking

TEXT BOOKS				
SL.NO	**Title of the Book**	**Name of the author/s**	**Name of the publisher**	**Edition and year**
1	Space Vehicle Design	M.D. Griffin and J.R. French	AIAA Education Series	2nd Edition 2004

REFERENCE BOOKS'				
SL.NO	**Title of the Book**	**Name of the author/s**	**Name of the publisher**	**Edition and year**
1	Rocket Propulsion and Spacecraft Dynamics	J.W. Cornelisse, H.F.R. Schöyer, and K.F. Wakkar	Pitman	1st Edition 1979)
2	Space Science and Engineering	E. Stuhlinger and G. Mesmer.`	McGraw-Hill, New York	1st Edition 1965
3	Space Science	W.N. Hess	, Blackie and Son	1st Edition 1965

ONLINE RESOURCES	Link
NPTEL	https://nptel.ac.in/courses/101/105/101105030/
NPTEL	https://nptel.ac.in/courses/101/105/101105029/

COURSE ASSESSMENT METHOD

Continuous Internal Evaluation (CIE)

Three internals tests (each 30 marks) are conducted, average of best two performances will be considered.

1 Minimum two Assignments/Model making - evaluated through rubrics for 10 marks. Average of two will be considered.

2.Tutorial classes and assessment are carried out/Surprise quiz tests are conducted and evaluated for 10 marks. Average of these two will be considered.

Semester End Examination (SEE)

1. Two Questions are to be set from each unit, carrying 20 Marks each.
2. Students have to answer 5 questions selecting one full question from each unit

Program Outcomes – Articulation matrix:

PO	1	2	3	4	5	6	7	8	9	10	11	12	PSO1	PSO2
CO1	2	3											3	
CO2	3	2											2	
CO3	3	2											2	
CO4	3	2											3	

ADVANCED AERODYNAMICS				
Course Code	18AEE755		**Credits**	3
Hours/Week (L-T-P)	3		**CIE Marks**	50
Total Hrs	39		**SEE Marks**	50
Exam Hrs	3		**Course Type**	Program Elective

COURSE OUTCOMES

Course outcomes: After completion of the course, students will be able to-

1. Describe the Supersonic Flow and its characteristics
2. Describe the Hypersonic Flow: Similarity laws, Oblique shock relations, Simple wave expansion relations, Hypersonic performance
3. Describe the Hodograph method for mixed subsonic-supersonic flow
4. Explain the unsteady wave motion of small amplitude and Flow of Real Gases

TEACHING METHODOLOGY

- Blackboard teaching/PowerPoint presentation (if needed)
- Laboratory experiments will be conducted to understand the concepts

COURSE CONTENTS

UNIT -1- (08 HOURS)

Supersonic flow: Linearization of the Equations.The General Solution for Linearized Supersonic Flow. Geometrical Interpretation of the General Solution. Flow Past a Wave-Shaped Wall. Supersonic Airfoils.Reflection and Intersection of Waves

UNIT -2- (08 HOURS)

Hypersonic Flow: Similarity Laws for HypersonicFlow. Oblique Shock Relations for Hypersonic Flow. Simple-Wave Expansion Relations for Hypersonic Flow. Hypersonic Performance of Two-Dimensional Profiles. Hypersonic Performance of Bodies of Revolution.

UNIT -3- (08 HOURS)

Transonic flow: The Transonic Similarity Law. Applications of the Transonic Similarity Law. Flow in Throat of Converging-Diverging Nozzle. Transonic Flow Past a Wavy Wall. Flow at Mach Number Unity. Slopes of Force Coefficients at M, = 1. Transonic Flow Past Wedge Nose.

UNIT -4- (08 HOURS)

Unsteady Motion: Equations of Motion. Waves of Small Amplitude. Simplified Physical Analysis of Pressure Pulse. Characteristic Curves. 1D flow with heat addition, 1D flow with friction.Unsteady 1-D shockwaves: Moving Normal Shock Waves. Reflected Shock Wave, Wave Propagation.

UNIT -5- (07 HOURS)

Flow of Real Gases: Differential and Integral equations for laminar boundary layer. Flow with Prandtl number unity. Differential and Integral equations for turbulent boundary layer. Shock Boundary Layer Interaction in supersonic flow and Transonic flow. Normal shocks in Ducts.

TEXT BOOKS

SL.NO	Title of the Book	Name of the author/s	Name of the publisher	Edition and year
1	The Dynamic and Thermodynamic of Compressible flow	A.H. Shapiro	John Wiley and Sons	Vol-II 1992

REFERENCE BOOKS'

SL.NO	Title of the Book	Name of the author/s	Name of the publisher	Edition and year
1	Fundamentals of Aerodynamics	John D. Anderson, Jr	McGraw Hill Education	5 edition 201(

ONLINE RESOURCES	Link
NPTEL	https://nptel.ac.in/courses/101/105/101105023/
NPTEL	https://nptel.ac.in/courses/101/105/101105059/
MIT OCW	https://ocw.mit.edu/courses/aeronautics-and-astronautics/16-100-aerodynamics-fall-2005/lecture-notes/

COURSE ASSESSMENT METHOD

Continuous Internal Evaluation (CIE)

Three internals tests (each 30 marks) are conducted, average of best two performances will be considered.

1. Minimum two Assignments/Model making - evaluated through rubrics for 10 marks. Average of two will be considered.

2.Tutorial classes and assessment are carried out/Surprise quiz tests are conducted and evaluated for 10 marks. Average of these two will be considered.

Semester End Examination (SEE)

1. Two Questions are to be set from each unit, carrying 20 Marks each.
2. Students have to answer 5 questions selecting one full question from each unit

Program Outcomes – Articulation matrix:

PO	1	2	3	4	5	6	7	8	9	10	11	12	PSO1	PSO2
CO1	3	2							2	2				3
CO2	3	2							2	2				3
CO3	3	2							2	2				3
CO4	3	2							2	2				3

RELIABILITY ENGINEERING				
Course Code	18AEE756		**Credits**	3
Hours/Week (L-T-P)	3		**CIE Marks**	50
Total Hrs	39		**SEE Marks**	50
Exam Hrs	3		**Course Type**	PE

COURSE OUTCOMES

Course outcomes: After completion of the course, students will be able to-

1. Develop various systems applying reliability networks
2. Evaluate the reliability of simple and complex systems.
3. Estimate the limiting state probabilities of repairable systems.
4. Apply various mathematical models for evaluating reliability of irrepairable systems

TEACHING METHODOLOGY

- Blackboard teaching/PowerPoint presentation (if needed)

COURSE CONTENTS

UNIT -1- (08 HOURS)

BASIC PROBABILITY THEORY: Elements of probability, probability distributions, Random variables, Density and Distribution functions- Binomial distribution- Expected value and standard deviation – Binomial distribution, Poisson distribution, normal distribution, exponential distribution, Weibull distribution. Definition of Reliability: Definition of terms used in reliability, Component reliability, Hazard rate, derivation of the reliability function in terms of the hazard rate. Hazard models – Bath tub curve, Effect of preventive maintenance. Measures of reliability: Mean Time to Failure and Mean Time Between Failures

UNIT -2- (08 HOURS)

NETWORK MODELING AND EVALUATION OF SIMPLE SYSTEMS: Basic concepts- Evaluation of network Reliability / Unreliability – Series systems, Parallel systems- Series-Parallel systems, partially redundant systems- Examples. Network Modeling and Evaluation of Complex systems: Conditional probability method tie set, Cutset approach- Event tree and reduced event tree methods- Relationships between tie and cutsets- Examples

UNIT -3- (08 HOURS)

TIME DEPENDENT PROBABILITY: Basic concepts- Reliability function f(t). F(t), R(t) and h(t) – Relationship between these functions. Network Reliability Evaluation Using Probability Distributions: Reliability Evaluation of Series systems, Parallel systems – Partially redundant systems- determination of reliability measure- MTTF for series and parallel systems – Examples

UNIT -4- (08 HOURS)

DISCRETE MARKOV CHAINS: Basic concepts- Stochastic transitional probability matrix- time dependent probability evaluation- Limiting State Probability evaluation- Absorbing states – Examples Continuous Markov Processes: Modeling concepts- State space diagrams- Unreliability evaluation of single and two component repairable systems

UNIT -5- (07 HOURS

FREQUENCY AND DURATION TECHNIQUES: Frequency and duration concepts, application to multi state problems, Frequency balance approach. Approximate System

Reliability Evaluation: Series systems – Parallel systems- Network reduction techniques- Cut set approach- Common mode failures modeling and evaluation techniques- Examples

TEXT BOOKS

SL.NO	Title of the Book	Name of the author/s	Name of the publisher	Edition and year
1	Reliability Evaluation of Engineering Systems	Roy Billinton and Ronald N Allan	Plenum Press,	1983
2	Reliability Engineering	E. Balagurusamy `	Tata McGraw-Hill Publishing Company Limited	2002

REFERENCE BOOKS'

SL.NO	Title of the Book	Name of the author/s	Name of the publisher	Edition and year
1	Reliability Engineering	K. K. Agarwal	Kluwer Academic Publishers	1993

ONLINE RESOURCES	Link
NPTEL	https://nptel.ac.in/courses/105/108/105108128/
NPTEL	https://nptel.ac.in/courses/114/106/114106041/
MIT OCW	https://ocw.mit.edu/courses/nuclear-engineering/22-38-probability-and-its-applications-to-reliability-quality-control-and-risk-assessment-fall-2005/lecture-notes/

COURSE ASSESSMENT METHOD

Continuous Internal Evaluation (CIE)

Three internals tests (each 30 marks) are conducted, average of best two performances will be considered.

1. Minimum two Assignments/Model making - evaluated through rubrics for 10 marks. Average of two will be considered.

2Tutorial classes and assessment are carried out/Surprise quiz tests are conducted and evaluated for 10 marks. Average of these two will be considered.

Semester End Examination (SEE)

3.Two Questions are to be set from each unit, carrying 20 Marks each.

4.Students have to answer 5 questions selecting one full question from each unit

Program Outcomes – Articulation matrix:

PO	1	2	3	4	5	6	7	8	9	10	11	12	PSO1	PSO2
CO1	3	2										2	3	
CO2	3	2										2	3	
CO3	3	2										2	3	
CO4	3	2										2	3	

SATELLITE DESIGN				
Course Code	18AEE757		**Credits**	3
Hours/Week (L-T-P)	3		**CIE Marks**	50
Total Hrs	39		**SEE Marks**	50
Exam Hrs	3		**Course Type**	Program Elective

COURSE OUTCOMES

Course outcomes: After completion of the course, students will be able to-

1. Explain satellite configuration
2. Describe Satellite Structural Design
3. Describe electric power and hardware of satellite
4. Use Attitude Determination, control system and software's (ADACS)
5. Select satellite Propulsion and Deployment Mechanism

TEACHING METHODOLOGY

- Blackboard teaching/PowerPoint presentation (if needed)
- Laboratory experiments will be conducted to understand the concepts

COURSE CONTENTS

UNIT -1- (08 HOURS)

Satellite Configuration Design

Space mission, Types, Space Environment, Launch Vehicle Configuration, Vehicle selection, Classification and design parameters, Configuration of Satellite, Satellite composition, Mounting Restrictions and integration constrains(payload, attitude determination and control subsystem communication subsystem, Platform command and Data handling subsystem, Power subsystem, Thermal subsystem, structures and mechanisms subsystem, System aspects of the satellite configuration) Configuration Development process

UNIT -2- (08 HOURS)

Satellite Structural Design

Definition and Function, structural requirement primary, secondary and tertiary structure, design procedure used materials, developing structural modules, Iterative process of design development, preliminary analysis-strength analysis cases, design of fastening studs and small sat/lv, Interface bolts, preliminary sizing of structural module, Detailed structure description: base plate, mounting plate, basis unit case, upper frame, lower frame, Rotation Mechanism, Locking and Releasing Mechanism, Fasting and Mounting Elements Launch Vehicle adapt.

UNIT -3- (08 HOURS)

Electric Power Subsystem and Spacecraft Hardware

Required Orbit Average Power (OAP), Battery Capacity and Battery System Design, Battery Capacity, Battery Choice, Solar Arrays Configuration beta angle vs. time, solar cells and cell lay down computer characteristics and selection, Frequency Allocation, Modulation types, Acceleration of Gravity velocity, Period, Position of Spacecraft as a function of time. Space elevation, slant range, CPA , Ground Range, Pointing to a Target on the ground from the space craft, Ballistic coefficient and on orbit life, computing the projection of the Sun on planes on the spacecraft.

UNIT -4- (07 HOURS)
Attitude Determination, control system and software's(ADACS) ADACS Performance Requirements flow down, Description of the most common ADACS systems, Gravity Gradient Stabilization, Pitch Bias Momentum Stabilization, 3-Axis Zero Momentum Stabilization, Magnetic Spin Stabilization **The ADACS Components** Reaction Wheels and Sizing the Wheels, Torque Coils or Rods Momentum Unloading, Star Trackers, GPS Receivers, Other ADACS Components, The ADACS Computer and Algorithms, ADACS Modes, Attitude Control System Design Methodologies, Integration and Test, On orbit Checkout.
UNIT -5- (08 HOURS)
Satellite Propulsion and Deployment Mechanism Deployment mechanisms- Deployment Devices, Hinges, deployable booms, Large Deployable Antennas, Restraint Devices- The Explosive Blot Cutter, Electric Burn Wires, Solenoid Pin Pullers, Paraffin Pin Pushers, Motorized Cams and Doors, Separation System, Dampers, Fluid Dampers, Magnetic Dampers, Constant Speed Governor Dampers, Choosing The Right **Mechanism, Testing Deployable.** Propulsion- The Basics, Propulsion Systems, Cold Gas Propulsion System, Hydrazine Propulsion System, Other Propulsion Systems, Propulsion System Hardware, Propulsion Maneuvers, Maneuvers for Spacecraft in a constellation, Maintaining and getting to Station, Other Propulsion Requirements.

TEXT BOOKS

SL.NO	Title of the Book	Name of the author/s	Name of the publisher	Edition and year
1	Spacecraft Systems Engineering	Fortescue, Peter,	John Wiley England	4th edition,2011,ISBN-13: 978-0470750124
2	Spacecraft Power Systems	Patel, Mukund R,	CRC Press Boca Raton	2nd edition, 2005.

REFERENCE BOOKS'

SL.NO	Title of the Book	Name of the author/s	Name of the publisher	Edition and year
1	Wilbur L. Pritchard and Joseph A.Sciulli,	Satellite Communication Systems Engineering,	Pearson Education India,.	2nd edition,2003,ISBN-13: 978-8131702420
2	Marcel j. sidi, Spacecraft	Dynamics and control, A Practical Engineering Approach	Cambridge University Press, Reprint	Edition,2000,ISBN-13: 978-0521787802.

ONLINE RESOURCES	Link
NPTEL	https://nptel.ac.in/courses/101/105/101105023/
NPTEL	https://nptel.ac.in/courses/101/105/101105077/

MIT OCW	https://ocw.mit.edu/courses/aeronautics-and-astronautics/16-851-satellite-engineering-fall-2003/

COURSE ASSESSMENT METHOD

Continuous Internal Evaluation (CIE)

Three internals tests (each 30 marks) are conducted, average of best two performances will be considered.

1. Minimum two Assignments/Model making - evaluated through rubrics for 10 marks. Average of two will be considered.
2. Tutorial classes and assessment are carried out/Surprise quiz tests are conducted and evaluated for 10 marks. Average of these two will be considered.

Semester End Examination (SEE)

1. Two Questions are to be set from each unit, carrying 20 Marks each.
2. Students have to answer 5 questions selecting one full question from each unit

Program Outcomes – Articulation matrix:

PO	1	2	3	4	5	6	7	8	9	10	11	12	PSO1	PSO2
CO1	3	2											2	2
CO2	3	2											2	2
CO3	3	2											2	2
CO4	3	2											2	2

EXPERIMENTAL STRESS ANALYSIS

Course Code	18AEE758		**Credits**	3
Hours/Week (L-T-P)	3-0-0		**CIE Marks**	50
Total Hrs	39		**SEE Marks**	50
Exam Hrs	3		**Course Type**	Program Elective

COURSE OUTCOMES

Course outcomes: After completion of the course, students will be able to-

1. Explain various phenomenon and properties associated with light and photo elastic materials
2. Identify the principles and uses of different strain measuring instruments
3. Apply the concept of photo elasticity for the calculation of stress in the given component under different loading conditions
4. Illustrate the use of different methods of calibration and compensation to improve the accuracy of strains being measured.

TEACHING METHODOLOGY

- Blackboard teaching/PowerPoint presentation (if needed) /Flipped Classes for specified topics
- Regular review of students by asking questions based on topics covered in the class

COURSE CONTENTS

UNIT -1 (08 HOURS)

EXTENSOMETERS AND DISPLACEMENT SENSORS

Principles of measurements, Accuracy, Sensitivity and range of measurements, Mechanical, Optical, Acoustical and Electrical extensometers and their uses, Advantages and disadvantages, Capacitance gauges, Laser displacement sensors

UNIT -2- (08HOURS)

ELECTRICAL RESISTANCE STRAIN GAUGES

Principle of operation and requirements, Types and their uses, Materials for strain gauges, Calibration and temperature compensation, cross sensitivity, Wheatstone bridge and potentiometer circuits for static and dynamic strain measurements, strain indicators, Rosette analysis, stress gauges, load cells, Data acquisition, six component balance

UNIT -3- (08 HOURS)

PHOTOELASTICITY

Two dimensional photo elasticity, Photo elastic materials, Concept of light - photoelastic effects, stress optic law, Transmission photoelasticity, Jones calculus, plane and circular polariscopes, Interpretation of fringe pattern, Calibration of photoelastic materials, Compensation and separation techniques, Introduction to three dimensional photo elasticity.

UNIT -4- (08 HOURS)

BRITTLE COATING AND MOIRE TECHNIQUES

Relation between stresses in coating and specimen, use of failure theories in brittle coating, Moire method of strain analysis.

UNIT -5- (07 HOURS)

NON – DESTRUCTIVE TESTING

Fundamentals of NDT, Acoustic Emission Technique, Radiography, Thermography, Ultrasonics, Eddy Current testing, Fluorescent Penetrant Testing,

TEXT BOOKS

SL.NO	Title of the Book	Name of the author/s	Name of the publisher	Edition and year
1	Experimental Stress Analysis	Dally, J.W., and Riley, W.F.,	McGraw Hill Inc., New York	1998.
2	Experimental Stress Analysis	Srinath, L.S., Raghava, M.R., Lingaiah, K., Garagesha, G., Pant B., and Ramachandra, K.,	Tata McGraw Hill, New Delhi,	1984.
3	Experimental Stress Analysis	Sadhu Singh,	Khanna Publishers, New Delhi,	1996

REFERENCE BOOKS'

SL.NO	Title of the Book	Name of the author/s	Name of the publisher	Edition and year
1	Hand book of Experimental Stress Analysis	Hetenyi, M.,	John Wiley and Sons Inc., New York,	1972.
2	Acoustic Emission in Acoustics and Vibration Progress,	Pollock A.A.,	Ed. Stephens R.W.B., Chapman and Hall,	1993
3	Photo Elasticity	Max Mark Frocht,	John Wiley and Sons Inc., New York,	1968
4	Applied Stress Analysis",	Durelli. A.J.,	Prentice Hall of India Pvt Ltd., New Delhi,	1970

COURSE ASSESSMENT METHOD

Continuous Internal Evaluation (CIE)

Three internals tests (each 30 marks) are conducted, average of best two performances will be considered.

1.Minimum two Assignments/Model making - evaluated through rubrics for 10 marks. Average of two will be considered.

2.Tutorial classes and assessment are carried out/Surprise quiz tests are conducted and evaluated for 10 marks. Average of these two will be considered.

Semester End Examination (SEE)

1. Two Questions are to be set from each unit, carrying 20 Marks each.
2. Students have to answer 5 questions selecting one full question from each unit

Program Outcomes – Articulation matrix:

PO	1	2	3	4	5	6	7	8	9	10	11	12	PSO1	PSO2
CO1	3	2							3	2			2	
CO2	3	3							3	3			2	
CO3	3	3							3	3			2	
CO4	3	3							3	3			2	

SIMULATION LAB				
Course Code	18AEL77		**Credits**	1
Hours/Week (L-T-P)	0+0+3		**CIE Marks**	50
Total Hrs	39		**SEE Marks**	50
Exam Hrs	03		**Course Type**	Core

COURSE OUTCOMES

Course outcomes: After completion of the course, students will be able to-

1. Develop generic initial solutions for engineering problems using MATLAB/SIMULINK software
2. Apply various analytical modeling techniques to obtain the differential equation describing the system and to solve the same using MATLAB/SIMULINK environment
3. Analyze the performance parameters of an aircraft
4. Calculating Air Speed from a Pitot-static tube , Simulating a bomb drop from an aircraft

TEACHING METHODOLOGY

- Blackboard teaching/PowerPoint presentation (if needed) /Flipped Classes for specified topics

COURSE CONTENTS

PART -A

1. Falling sphere with viscous drag – Investigate velocity versus time plot; &simulate the fall.
2. Frequency response for a spring-mass damper system; simulation of the oscillations.
3. Simulation of landing run.
4. Simulation of glide.

PART -B

1. Simulation of range of an aircraft
2. Simulate a bomb drop from an aircraft on a moving tank for pure – pursuit motion.
3. Simulate an Air Speed Indicator to read air speeds for the pressures read from a Pitot-static tube, with compressibility corrections.
4. Simulate a point take-off from a runaway.

Course Assessment Method:

Record: 30 marks

Test: 15 marks

Viva-voce: 05 marks

SEE - Final Exam: 50 MarksScheme of Examination: Student will be asked to conduct any one experiment from Part A & B

Program Outcomes – Articulation matrix:

PO	1	2	3	4	5	6	7	8	9	10	11	12	PSO1	PSO2
CO1	3	3	3	2	3				3	3				2
CO2	3	3	3	2	3				3	3				2
CO3	3	3	3	2	3				3	3				2
CO4	3	3	3	2	3				3	3				2
CO5	3	3	3	2	3				3	3				2

AIRCRAFT SYSTEM LAB				
Course Code	18AEL78		**Credits**	1
Hours/Week (L-T-P)	0+0+3		**CIE Marks**	50
Total Hrs	39		**SEE Marks**	50
Exam Hrs	03		**Course Type**	Core

COURSE OUTCOMES

Course outcomes: After completion of the course, students will be able to-

1. Analyze the Aircraft Jacking Up and Levelling procedure Apply
2. Analyze flow test, pressure test, functional test
3. Perform Control System Rigging check
4. Develop Brake Torque Load Test on wheel brake units, Maintenance and rectification of snags in hydraulic and fuel systems

TEACHING METHODOLOGY

- Blackboard teaching/PowerPoint presentation (if needed) /Flipped Classes for specified topics

LIST OF EXPERIMENTS

1. Aircraft "Jacking Up" procedure
2. Aircraft "Levelling" procedure
3. Aircraft "Symmetry Check" procedure
4. "fuel flow measurement
5. "Pressure Test" to assess hydraulic External/Internal Leakage
6. "Functional Test" to adjust operating pressure
7. "Pressure Test" procedure on fuel system components
8. "Brake Torque Load Test" on wheel brake units
9. Maintenance and rectification of snags in hydraulic and fuel systems

Course Assessment Method:
Record: 30 marks
Test: 15 marks
Viva-voce: 05 marks
SEE - Final Exam: 50 Marks
Scheme of Examination: Student will be asked to conduct any two experiments

Program Outcomes – Articulation matrix:

PO	1	2	3	4	5	6	7	8	9	10	11	12	PSO1	PSO2
CO1	3	3	3	2	3				3	3				2
CO2	3	3	3	2	3				3	3				2
CO3	3	3	3	2	3				3	3				2
CO4	3	3	3	2	3				3	3				2
CO5	3	3	3	2	3				3	3				2

OPEN ELECTIVE-II

MECHANICS OF FLIGHT				
Course Code	18AEO761		**Credits**	3
Hours/Week (L-T-P)	3-0-0		**CIE Marks**	50
Total Hrs	39		**SEE Marks**	50
Exam Hrs	3		**Course Type**	Open Elective

COURSE OUTCOMES

Course outcomes: After completion of the course, students will be able to-

1. Describe the basic components and various types of aircraft configurations.
2. Discuss the basics of aerodynamics and structure
3. Outline the working of various power plants used in aircraft and mechanical systems involved in aircraft
4. Explain the Aircraft performance, Stability and Control

TEACHING METHODOLOGY

- Blackboard teaching/Power Point presentation
- Videos and animations

COURSE CONTENTS

UNIT -1- (8 HOURS)

Introduction to Aircraft: Types of Aircrafts- Lighter than Air/ Heavier than Air aircrafts Conventional Design configurations based on power plant location, Wing vertical location, intake location, tail unit arrangements, landing gear arrangements. Unconventional configurations- Biplane, variable sweep, canard layout, twin boom layouts, span loaders, blended body wing layout, STOL and STOVL Aircraft, stealth Aircraft. Advantages and disadvantages of these configurations.

UNIT -2- (8 HOURS)

Basic of Aerodynamics and Structures: Airfoil Nomenclature, Types of airfoil, Wing section-Aerodynamic Center, Aspect Ratio, Effects of lift, drag speed, air density on drag. Forces on the airplane, Airflow over wing section, Pressure Distribution over a wing section, Generation of Lift, Drag, Pitching Moments, Types of Drag, Lift curve, Drag Curve, Lift/ Drag Ration Curve, Factors affecting lift and drag, Center of pressure and its effects. Basic components of an Aircraft, structural members, Aircraft Axis system, Aircraft Motions, Control surfaces and high lift devices

UNIT -3- (8 HOURS)

Introduction to Propulsion System: Principles of aircraft propulsion, Types of power plants, basic components in power plants - inlet, compressor, combustion chamber, turbine and nozzle. Types of fuel - Illustration of working of air breathing engines

UNIT -4- (08 HOURS)

Aircraft Mechanical Systems: Types of Mechanical Systems, Environmental control systems (ECS), Pneumatic systems, hydraulic systems, Fuel systems, Landing gear systems, Engine Control systems, Ice and rain protection systems, Cabin pressurization and air conditioning systems, steering and brakes systems auxiliary power unit.

UNIT -5- (07 HOURS)

Stability and Control: Degree of stability- Lateral, Longitudinal and Directional stability and controls of Aircraft. Effects of flaps and Slats on Lift Coefficients, Control tabs, stalling, Landing, Gliding Turning, Speed of Sound, Mach Numbers, Shock Waves.

Aircraft Performance and Maneuvers: Power Curves, Maximum and minimum speeds of horizontal flight, effects of changes of Engine Power, Effects of Altitude on Power Curves, Forces acting on an Airplane during a turn, loads during a Turn, correct and incorrect angles of Bank, Aerobatics, Inverted Maneuvers, Maneuverability.

TEXT BOOKS

SL.NO	Title of the Book	Name of the author/s	Name of the publisher	Edition and year
1	Fundamentals of Flight	Shevell	Pearson Education	2nd Edition
2	Mechanics of Flight	A.C Kermode `	Pearson Education	5th Edition

REFERENCE BOOKS'

SL.NO	Title of the Book	Name of the author/s	Name of the publisher	Edition and year
1	Flight without Formulae	A.C Kermode	Pearson Education	10th Edition
2	Aircraft systems: Mechanical, Electrical & Avionics subsystems integration	lan Moir	Allen Seabridge	1997
3	Gas Turbine Technology	Treager, S	McGraw Hill	1997

ONLINE RESOURCES	Link
NPTEL	www.scribd.com/doc/203462287/Aircraft-Performance-NPTEL
NPTEL	www.nptel.ac.in/courses/101106041/
NPTEL	www.scribd.com/book/282507871/Performance-and-Stability-of-Aircraft
TU Delft	https://ocw.tudelft.nl/course-lectures/1-introduction-flight-mechanics/

COURSE ASSESSMENT METHOD

Continuous Internal Evaluation (CIE)

Three internals tests (each 30 marks) are conducted, average of best two performances will be considered.

1. Minimum two Assignments/Model making - evaluated through rubrics for 10 marks. Average of two will be considered.
2. Tutorial classes and assessment are carried out/Surprise quiz tests are conducted and evaluated for 10 marks. Average of these two will be considered.

Semester End Examination (SEE)

1. Two Questions are to be set from each unit, carrying 20 Marks each.
2. Students have to answer 5 questions selecting one full question from each unit

Program Outcomes – Articulation matrix:

PO	1	2	3	4	5	6	7	8	9	10	11	12	PSO1	PSO2
CO1	3	2							3	2			3	3
CO2	3	2							3	2			3	3
CO3	3	2							3	2			3	3
CO4	3	2							3	2			3	3

MAINTENANCE, OVERHAUL & REPAIR OF AIRCRAFT SYSTEMS				
Course Code	18AEO762		**Credits**	3
Hours/Week (L-T-P)	3-0-0		**CIE Marks**	50
Total Hrs	39		**SEE Marks**	50
Exam Hrs	3		**Course Type**	Open Elective

COURSE OUTCOMES

Course outcomes: After completion of the course, students will be able to-

1. Comprehend the fundamentals of maintenance and certification
2. Acquire the knowledge of documentation for maintenance.
3. Understand the Aircraft Maintenance, safety and trouble shooting
4. Understand hanger maintenance of aircrafts

TEACHING METHODOLOGY

- Blackboard teaching/PowerPoint presentation (if needed) /Flipped Classes for specified topics
- Videos and animation

COURSE CONTENTS

UNIT -1- (8 HOURS)

Fundamentals of Maintenance & Certification Types of maintenance, Redesign, Failure rate pattern, Other aintenance considerations. Aviation industry certification requirements, Type certificate (FAA form 8110.9), Airworthiness certificate (FAA form 8100-2), Aviation maintenance certifications, General, Airframe, Power plant, Avionics courses.

UNIT -2- (8 HOURS)

Documentation for Maintenance Manufacturers documentation, Airplane maintenance manual, Fault insulation manual, Illustrated parts catalogue, structural repair manual, wiring diagram manual, Master minimum equipment, Federal Aviation regulation (FAR), Advisory circulars, Airworthiness direction ATA document standards, Technical policies and procedure manuals (TPPM)

UNIT -3- (8 HOURS)

Aircraft Management Maintenance Structure, Role of aviation management, Line supervi management, Management areas of concern in an airlines, Manager of overhaul shops, maintenance control centre flight line (preflight & post flight), Aircraft Logbook, Maintenance skill requirements

UNIT -4- (8 HOURS)

Hanger Maintenance (on Aircraft) & Material SupportIntroduction, organization of hanger maintenance, Non- routine item, parts availability, cannibalization, Types of shops- sheet metal shop, Aircraft interior shop, Engine shop, Avionics shop, ground support equipment, outsourcing of shop maintenance work, operation of overhaul shops, Material support, Material management inventory control, Support functions of material, Parts ordering, Storage, Issue, control and handling, Parts receiving quality control, calibration program, stock level adjustments, shelf life, exchanges, warranty & modifications of parts.

UNIT -5- (7 HOURS)

Maintenance Safety & Trouble shooting Safety regulations, occupational safety and health standards maintenance safety program, Airlines safety management, General safety rules, Accident & injury reporting, Hazardous materials storage and handling aircraft furnishing practices trouble shooting, Knowledge of malfunctions.

TEXT BOOKS				
SL.NO	**Title of the Book**	**Name of the author/s**	**Name of the publisher**	**Edition and year**
1	Aviation Maintenance Management	Harry A Kinnison, Tariq Siddiqui	Mc Graw Hill education (India) Private Ltd	2013.
2	Aircraft Repair Manual	Kroes, Watkins, Delp Larry Reithmaier `		2013
3	Aircraft maintenance and repair'	Michael J. Kroes Ronald Sterkenburg	Mc Graw Hill	2013

REFERENCE BOOKS'				
SL.NO	**Title of the Book**	**Name of the author/s**	**Name of the publisher**	**Edition and year**
1	Aircraft Maintenance	Brimm. DJ, Bogges, HE	Pitman publishing corp, London	1952

ONLINE RESOURCES	Link
NPTEL	https://nptel.ac.in/courses/101/104/101104071/
MIT OCW	https://ocw.mit.edu/courses/aeronautics-and-astronautics/16-885j-aircraft-systems-engineering-fall-2004/lecture-notes/

COURSE ASSESSMENT METHOD

Continuous Internal Evaluation (CIE)

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Semester End Examination (SEE)

1. Two Questions are to be set from each unit, carrying 20 Marks each.
2. Students have to answer 5 questions selecting one full question from each unit

Program Outcomes – Articulation matrix:

PO	1	2	3	4	5	6	7	8	9	10	11	12	PSO1	PSO2
CO1	3	2							3	2			2	2
CO2	3	2							3	2			2	2
CO3	3	2							3	2			2	2
CO4	3	2							3	2			2	2

INTRODUCTION TO ASTROPHYSICS AND SPACE ENVIRONMENT				
Course Code	18AEO763		**Credits**	3
Hours/Week (L-T-P)	3-0-0		**CIE Marks**	50
Total Hrs	39		**SEE Marks**	50
Exam Hrs	3		**Course Type**	Open Elective

COURSE OUTCOMES

Course outcomes: After completion of the course, students will be able to-

1. Understand the basics of astrophysics and space environment.
2. Describe the relativistic quantum mechanics.
3. Understand sun and solar system.
4. Understand space environment

COURSE CONTENTS

UNIT -1- (08 HOURS)

Introduction: Overview of major contents of universe, Black body radiation, specific intensity, flux density, luminosity, Basics of radiative transfer (Emission/absorption coefficients, source functions), Magnitudes, distance modulus, Color index, Extinction, Color temperature, effective temperature, Brightness temperature, bolometric magnitude/luminosity, Excitation temperature, kinetic temperature, Utility of stellar spectrum.

UNIT -2- (18 HOURS)

Basic knowledge of stellar atmospheres: Binaries, variable stars, clusters, open and globular clusters, Laws of planetary motion, Motions and Distances of Stars, Statistical and moving cluster parallax, Velocity Dispersion, Compact objects (BH-systems, Accretion rate/efficiency, Eddington luminosity), Shape, size and contents of our galaxy, Normal and active galaxies, High energy physics (introduction to X-ray and Gammaray radiation processes), Newtonian cosmology, microwave background, early universe

UNIT -3- (08 HOURS)

Relativistic Quantum Mechanics: Scattering, classical radiation field, creation, annihilation number operators. Quantized radiation field, unified approach to emission, absorption, and scatte of photons by atoms, radiation damping and resonance fluorescence, dispersion relations and causa relativistic wave equation (Klein- Gordon and Dirac equations),
basics of quantum electrodynamics.

UNIT -4- (08 HOURS)

Sun & Solar System: The sun, helioseismology, convection, solar magnetism: flux tubes, sun spots, dynamo, solar cycle, chromosphere, corona, solar wind, physical processes in the solar system; dynamics of the solar system; physics of planetary atmospheres; individual planets; comets, asteroids, and other constituents of the solar system; extra-solar planets; formation of the solar system, stars, and planets.

UNIT -5- (07 HOURS)

Space Environment: Introduction, Vacuum Environments and its effect, Neutral environment and its effects, Plasma environment, Radiation Environment and its effects, Debris Environment and its effects.

TEXT BOOKS

SL.NO	Title of the Book	Name of the author/s	Name of the publisher	Edition and year
1	The Physical Universe	Shu, F	University of California	1981
2	Theoretical Astrophysics	Padmanabhan, T.	Cambridge University Press	south asian edition,2010

REFERENCE BOOKS'

SL.NO	Title of the Book	Name of the author/s	Name of the publisher	Edition and year
1	Advanced Quantum Mechanics	Sakurai, JJ.,	Pearson Education India	1 st edition,2002
2	The Sun: An Introduction	Stix, M`	Springer	Reprinted edition, 2012
3	The Space Environment	Alan C. Tribble	Princeton University Press	Revised edition, 2003

ONLINE RESOURCES	Link
NPTEL	https://nptel.ac.in/courses/115/105/115105046/
MIT OCW	https://ocw.mit.edu/courses/physics/8-282j-introduction-to-astronomy-spring-2006/

COURSE ASSESSMENT METHOD

Continuous Internal Evaluation (CIE)

Three internals tests (each 30 marks) are conducted, average of best two performances will be considered.

1. Minimum two Assignments/Model making - evaluated through rubrics for 10 marks. Average of two will be considered.
2. Tutorial classes and assessment are carried out/Surprise quiz tests are conducted and evaluated for 10 marks. Average of these two will be considered.

Semester End Examination (SEE)

1. Two Questions are to be set from each unit, carrying 20 Marks each.
2. Students have to answer 5 questions selecting one full question from each unit

Program Outcomes – Articulation matrix:

PO	1	2	3	4	5	6	7	8	9	10	11	12	PSO1	PSO2
CO1	3	2											2	2
CO2	3	2											2	2
CO3	3	2											2	2
CO4	3	2											2	2

INTRODUCTION TO ROCKETS & MISSILES

Course Code	18AEO764		**Credits**	3
Hours/Week (L-T-P)	3-0-0		**CIE Marks**	50
Total Hrs	39		**SEE Marks**	50
Exam Hrs	3		**Course Type**	Open Elective

COURSE OUTCOMES

Course outcomes: After completion of the course, students will be able to-

1. Classify rockets and missiles
2. Describe rocket motion in free space and gravitational field
3. Apply aerodynamics for rocket and missiles
4. Explain staging and control of rockets and missiles
5. Identify rocket propulsion systems and materials for rockets and missiles

COURSE CONTENTS

UNIT -1- (08 HOURS)

CLASSIFICATION OF ROCKETS AND MISSILES

History of rockets and missiles, Various methods of classification of missiles and rockets – Basic aerodynamic characteristics of surface to surface, surface to air, air to surface and air to air missiles – Examples of various Indian space launch vehicles and missiles – Current status of Indian rocket and missile programme.

UNIT -2- (08 HOURS)

ROCKET MOTION IN FREE SPACE AND GRAVITATIONAL FIELD

One Dimensional and Two-Dimensional rocket Motions in Free Space and Homogeneous Gravitational Fields – description of Vertical, Inclined and Gravity Turn Trajectories – Determination of range and Altitude, Simple Approximations to Burnout Velocity and altitude estimation of culmination time and altitude.

UNIT -3- (08 HOURS)

AERODYNAMICS OF ROCKETS AND MISSILES

Airframe Components of Rockets and Missiles – Forces Acting on a Missile While Passing Thro Atmosphere – Classification of Missiles – methods of Describing Aerodynamic Forces and Momei Lateral Aerodynamic Moment – Lateral Damping Moment and Longitudinal Moment of a Rock lift and Drag Forces – Drag Estimation.

UNIT -4- (08 HOURS)

STAGING AND CONTROL OF ROCKETS AND MISSILES

Multistaging of rockets and ballistic missiles – Multistage Vehicle Optimization – Stage Separation Dynamics – Stage Separation Techniques in atmosphere and in space, Introduction to aerodynamic and jet control methods – various types of aerodynamic control methods for tactical and short-range missiles- aerodynamic characteristics - various types of rocket thrust vector control methods.

UNIT -5- (07 HOURS)

ROCKET PROPULSION SYSTEMS AND MATERIALS FOR ROCKETS AND MISSILES

Ignition System in rockets – types of Igniters– Design Consideration of liquid Rocket Combustion Chamber, Injector Propellant Feed Lines, Valves, Propellant Tanks Outlet and propellant feed Systems – Propellant Slash and Propellant Hammer – Elimination of Geysering Effect in Missiles – Selection of Materials – Special Requirements of Materials to Perform under Adverse Conditions.

TEXT BOOKS

SL.NO	Title of the Book	Name of the author/s	Name of the publisher	Edition and year
1	Rocket Propulsion and Space Dynamics,	Cornelisse, J.W	Freeman & Co. Ltd., London,	1982
2	Rocket Propulsion Elements,	Sutton, G.P., et al.,	John Wiley & Sons Inc., New York,	1993

REFERENCE BOOKS'

SL.NO	Title of the Book	Name of the author/s	Name of the publisher	Edition and year
1	Gas Turbines and Jet and Rocket Propulsion,	Mathur, M., and Sharma, R.P.,	Standard Publishers, New Delhi	1998
2	Materials for Missiles and Spacecraft	Parker, E.R.,	McGraw-Hill Book Co. Inc.,	1982.

ONLINE RESOURCES	Link
NPTEL	https://nptel.ac.in/courses/101/104/101104078/
MIT OCW	https://ocw.mit.edu/courses/aeronautics-and-astronautics/16-512-rocket-propulsion-fall-2005/

COURSE ASSESSMENT METHOD

Continuous Internal Evaluation (CIE)

Three internals tests (each 30 marks) are conducted, average of best two performances will be considered.

1. Minimum two Assignments/Model making - evaluated through rubrics for 10 marks. Average of two will be considered.
2. Tutorial classes and assessment are carried out/Surprise quiz tests are conducted and evaluated for 10 marks. Average of these two will be considered.

Semester End Examination (SEE)

1. Two Questions are to be set from each unit, carrying 20 Marks each.
2. Students have to answer 5 questions selecting one full question from each unit

Program Outcomes – Articulation matrix:

PO	1	2	3	4	5	6	7	8	9	10	11	12	PSO1	PSO2
CO1	3												2	2
CO2	3	2	2										2	2
CO3	3	2	2										2	2
CO4	3	2	2										2	2
CO5	3	2	2										2	2

AEROSPACE MATERIALS				
Course Code	18AEO765		**Credits**	3
Hours/Week (L-T-P)	3-0-0		**CIE Marks**	50
Total Hrs	39		**SEE Marks**	50
Exam Hrs	3		**Course Type**	Open Elective

COURSE OUTCOMES

Course outcomes: After completion of the course, students will be able to-

1. Identify appropriate aircraft materials for a given application.
2. Explain the properties of super alloys, ablative materials and high energy material.
3. Understand material corrosion process and apply prevention technique.
4. Identify Polymers, Polymeric Materials & Plastics and Ceramics & Glass for given application

TEACHING METHODOLOGY

- Blackboard teaching/PowerPoint presentation (if needed) /Flipped Classes for specified topics
- Videos and animation

COURSE CONTENTS

UNIT -1- (8 HOURS)

Introduction to Aerospace Materials

General properties of materials, Definition of terms, Requirements of aircraft materials, Testing of aircraft materials, Inspection methods, Application and trends in usage in aircraft structures and engines, Selection of materials for use in aircraft.Aluminum alloys, Magnesium alloys, Titanium alloys, Plain carbon and Low carbon Steels, Corrosion and Heat resistant steels, Maraging steels, Copper alloys.

UNIT -2- (8 HOURS)

Super Alloys

General introduction to super alloys, Nickel based super alloys, Cobalt based super alloys, and Iron based super alloys, manufacturing processes associated with super alloys, Heat treatment and surface treatment of super alloys

Composite Materials:

Definition and comparison of composites with conventional monolithic materials, Reinforcing fibers and Matrix materials, Fabrication of composites and quality control aspects, Carbon-Carbon Composites production, properties and applications, inter metallic matrix composites, ablative composites based on polymers, ceramic matrix, metal matrix composites based on aluminum, magnesium, titanium and nickel based composites for engines.

UNIT -3- (8 HOURS)

Polymers, Polymeric Materials & Plastics and Ceramics & Glass

Knowledge and identification of physical characteristics of commonly used polymeric material: plastics and its categories, properties and applications; commonly used ceramic, glass and transparent plastics, properties and applications, adhesives and sealants and their applications in aircraft.

UNIT -4- (8 HOURS)

Ablative Materials

Ablation process, ablative materials and applications in aerospace.

Aircraft Wood, Rubber, Fabrics & Dope and Paint:

Classification and properties of wood, Seasoning of wood, Aircraft woods, their properties and applications, Joining processes for wood, Plywood; Characteristics and definition of terminologies pertaining to aircraft fabrics and their applications, Purpose of doping and commonly used dopes; Purpose of painting, Types of aircraft paints, Aircraft painting process.

UNIT -5- (7 HOURS)

Corrosion and its Prevention
Knowledge of the various methods used for removal of corrosion from common aircraft metals and methods employed to prevent corrosion.
High Energy Materials:
Materials for rockets and missiles. Types of propellants and its general and desirable properties, insulating materials for cryogenic engines. Types of solid propellants: Mechanical characterization of solid propellants using uni-axial, strip-biaxial and tubular tests.

TEXT BOOKS

SL.NO	Title of the Book	Name of the author/s	Name of the publisher	Edition and year
1	"Aircraft Material and Processes",	Titterton G F	English Book Store, New Delhi, , ISBN 13: 9788175980136	1998
2	"Advanced Aerospace Material",	H Buhl	Spring Berlin ISBN: 978-3-642-50161-6	1992
3	"Handbook of Aircraft materials", ISBN 13: 9788172960032.	C G Krishnadas Nair	Interline publishers, Bangalore,	1993

REFERENCE BOOKS'

SL.NO	Title of the Book	Name of the author/s	Name of the publisher	Edition and year
1	Aerospace material	Balram Gupta, S,	Vol. 1,2,3 ARDB, Chand & Co ISBN: 9788121922005	1996,
2	Materials for Missiles and Space	Parker E R,	John Wiley, McGraw-Hill,	1963,
3	The Materials of Aircraft Construction	Hill E T	Pitman London.	

ONLINE RESOURCES	Link
NPTEL	https://nptel.ac.in/courses/101/104/101104010/
MIT OCW	https://ocw.mit.edu/courses/aeronautics-and-astronautics/16-20-structural-mechanics-fall-2002/

COURSE ASSESSMENT METHOD

Continuous Internal Evaluation (CIE)
Three internals tests (each 30 marks) are conducted, average of best two performances will be considered.
1. Minimum two Assignments/Model making - evaluated through rubrics for 10 marks. Average of two will be considered.
2. Tutorial classes and assessment are carried out/Surprise quiz tests are conducted and evaluated for 10 marks. Average of these two will be considered.

Semester End Examination (SEE)

1. Two Questions are to be set from each unit, carrying 20 Marks each.
2. Students have to answer 5 questions selecting one full question from each unit

Program Outcomes – Articulation matrix:

PO	1	2	3	4	5	6	7	8	9	10	11	12	PSO1	PSO2
CO1	3	2											2	
CO2	3	2											2	
CO3	3	2											2	
CO4	3	2											2	

INTRODUCTION TO AEROSPACE ENGINEERING				
Course Code	18AEO766		**Credits**	3
Hours/Week (L-T-P)	3-0-0		**CIE Marks**	50
Total Hrs	39		**SEE Marks**	50
Exam Hrs	3		**Course Type**	Open Elective

COURSE OUTCOMES

Course outcomes: After completion of the course, students will be able to-

1. Describe the evolution of aerospace vehicles and identify the various components of such vehicles
2. Distinguish among various flight vehicle configurations and describe their features
3. Describe the properties and structure of atmosphere, and state the aerodynamic forces and moments acting on aircraft
4. Describe the aerodynamics of wings and aerofoils and express the performance equations
5. Outline the various aerospace power plants and discuss the structures and materials of aerospace structures

TEACHING METHODOLOGY

- Blackboard teaching/PowerPoint presentation (if needed) /Flipped Classes for specified topics
- Videos and animation

COURSE CONTENTS

UNIT -1- (8 HOURS)

HISTORY AND FLIGHT VEHICLES COMPONENTS - Historical evolution of airplanes - Aircraft axes and attitude definitions - Different types of flight vehicles, Components and functions of an airplane and space vehicles, components of rocket and missiles. Parts of helicopter and their functions, Indian aerospace developments

UNIT -2- (8 HOURS)

FLIGHT VEHICLES CONFIGURATIONS- Different types of wing configurations of aircraft, Different types of tail configurations of aircraft, configurations based on speed and engines.

UNIT -3- (8 HOURS)

PRINCIPLES OF FLIGHT - Physical properties and structure of the atmosphere, Tempera Pressure and altitude relationships, stability of the atmosphere, Evolution of lift, drag and mom Different types of drag. Pressure and skin friction coefficient

UNIT -4- (8 HOURS)

AERODYNAMICS AND PERFORMANCE-Airfoil nomenclature, classification of NACA airfoils, Angle of attack, Mach number, pressure distribution over different aerodynamic profile, aero foil characteristics- lift, drag curves - Wing geometry -aspect ratio, wing loading, center of pressure and aerodynamic center - Aircraft Equation of Motions - Aircraft maneuvers..

UNIT -5- (7 HOURS)

PROPULSION AND AIRPLANE STRUCTURES -Basic ideas about piston, turboprop and jet engines, Use of propeller and jets for thrust production, Principle of operation of rocket, Rocket engines types, General types of construction, Monocoque, semi-monocoque. Typical wing and fuselage structure. Metallic and non-metallic materials, Use of aluminum alloy, titanium, stainless steel and composite materials.

TEXT BOOKS				
SL.NO	**Title of the Book**	**Name of the author/s**	**Name of the publisher**	**Edition and year**
1	Introduction to Flight	Anderson, J.D.,	McGraw-Hill Higher Education,	2015, 6th edition,
2	Introduction to Aeronautics: A Design Perspective	Steven Brandt,	3rd edition, AIAA Education series,	2015
3	Interactive Aerospace Engineering and Design.	David J.Newman	McGraw-Hill Higher Education	International student Edition,

REFERENCE BOOKS'				
SL.NO	**Title of the Book**	**Name of the author/s**	**Name of the publisher**	**Edition and year**
1	Introduction to Aeronautics	Gregg Angles,	Random Exports,	2013
2	Fundamentals of Flight Basic Aerodynamics, Aircraft Structures, Aircraft Propulsion,	Lalit Gupta, O P Sharma,	Aircraft Systems (Vol 1 to 4),	1st edition, 2006

ONLINE RESOURCES	Link
NPTEL	https://nptel.ac.in/courses/101/104/101104071/
MIT OCW	https://ocw.mit.edu/courses/aeronautics-and-astronautics/16-885j-aircraft-systems-engineering-fall-2004/lecture-notes/

COURSE ASSESSMENT METHOD

Continuous Internal Evaluation (CIE)

Three internals tests (each 30 marks) are conducted, average of best two performances will be considered.

1. Minimum two Assignments/Model making - evaluated through rubrics for 10 marks. Average of two will be considered.
2. Tutorial classes and assessment are carried out/Surprise quiz tests are conducted and evaluated for 10 marks. Average of these two will be considered.

Semester End Examination (SEE)

1. Two Questions are to be set from each unit, carrying 20 Marks each.
2. Students have to answer 5 questions selecting one full question from each unit

Program Outcomes – Articulation matrix:

PO	1	2	3	4	5	6	7	8	9	10	11	12	PSO1	PSO2
CO1	3	2											2	2
CO2	3	2											2	2
CO3	3	2											2	2
CO4	3	2											2	2
CO5	3	2											2	2

INTRODUCTION TO AERIAL ROBOTICS				
Course Code	18AEO767		**Credits**	3
Hours/Week (L-T-P)	3-0-0		**CIE Marks**	50
Total Hrs	39		**SEE Marks**	50
Exam Hrs	3		**Course Type**	Open Elective

COURSE OUTCOMES

Course outcomes: After completion of the course, students will be able to-

1. Describe the History and basic aerial robot flight concepts
2. Classification of unmanned systems, Parts and function of UAVs, UGV,UWV
3. Describe the applications and payloads of aerial robots
4. Demonstrate the design process of UAVs fixed wig multicopter and flapping wing
5. Describe the navigation and guidance of Aerial Robot

TEACHING METHODOLOGY

- Blackboard teaching/PowerPoint presentation (if needed) /Flipped Classes for specified topics
- Videos and animation

COURSE CONTENTS

UNIT -1- (8 HOURS)

HISTORY AND BASIC AERIAL ROBOT FLIGHT CONCEPTS -History of Aerial Robotics-Taxonomy of unmanned aerial vehicles- Function of an Airplane – Structure of the atmosphere -Force acting on Airplane- Angle of attack –Lift and Drag –Airfoil nomenclature- Airfoil characteristics – Mach number –Propulsion system.

UNIT -2- (8 HOURS)

UNMANNED SYSTEMS Unmanned Aerial Vehicle - Classification of UAVs- Parts and function of fixed wing, Multicopter and flapping wing UAVs, Basics of UAV piloting - Unmanned ground vehicle-, Unmanned Water vehicle – Classificationof UGV and UWV- Parts and function of UGV And UWV- Launching and Recovery of US –Electronics components of US- Amphibious VehicleLighter-Than-Air Systems- Rules and Regulation of Aerial Robots.

UNIT -3- (8 HOURS)

APPLICATIONS AND PAYLOADS OF AERIAL ROBOTS - Applications of Aerial Rol Remote sensing, Aerial mapping, Disaster response, Surveillance Search and rescue, Transporta Payload delivery, Image acquisition for cinematography,Aerial Observations Military Operati Civilian and Private Applications-of Payload -Classification of payloads -Camera –sensors

UNIT -4- (8 HOURS)

DEVELOPMENT AND INTEGRATION OF AERIAL ROBOTS Fixed wing UAVs- Multicopter UAV- Flapping wing UAV- Swarm Robot, Integration of Aerial robot- IOT based Aerial robot- Safety procedure of Aerial Robot- Material for Aerial Robot.

UNIT -5- (7 HOURS)

NAVIGATION AND GUIDANCE SYSTEM OF AERIAL ROBOT Flight Control System – Path planning- Way point Navigation system-GPS – GCS-Telemetry – –Transmitter & Receiver.

TEXT BOOKS

SL.NO	Title of the Book	Name of the author/s	Name of the publisher	Edition and year
1	Small Unmanned Aircraft: Theory and Practice	R. Beard, and T. W. McLain,	Princeton University Press,	2012
2	Basics of R/C model Aircraft design	Andey Lennon	Model airplane news publication	2015
3	Flight Stability and Automatic Control	R.C. Nelson.,	McGraw Hill, New York	1998

REFERENCE BOOKS'

SL.NO	Title of the Book	Name of the author/s	Name of the publisher	Edition and year
1	Unmanned Aviation, a Brief History of Unmanned Aerial Vehicles,	L.R. Newcome.	American Institute of Aeronautics and Astronautics, Reston,	2004
2	Automatic Control Systems	Kuo, B.C	Prentice Hall,	1991

ONLINE RESOURCES	Link
NPTEL	https://nptel.ac.in/courses/101/104/101104073/
MIT OCW	https://ocw.mit.edu/courses/aeronautics-and-astronautics/16-333-aircraft-stability-and-control-fall-2004/lecture-notes/

COURSE ASSESSMENT METHOD

Continuous Internal Evaluation (CIE)

Three internals tests (each 30 marks) are conducted, average of best two performances will be considered.

1. Minimum two Assignments/Model making - evaluated through rubrics for 10 marks. Average of two will be considered.
2. Tutorial classes and assessment are carried out/Surprise quiz tests are conducted and evaluated for 10 marks. Average of these two will be considered.

Semester End Examination (SEE)

1. Two Questions are to be set from each unit, carrying 20 Marks each.
2. Students have to answer 5 questions selecting one full question from each unit

Program Outcomes – Articulation matrix:

PO	1	2	3	4	5	6	7	8	9	10	11	12	PSO1	PSO2
CO1	3	2							2	2			2	2
CO2	3	2							2	2			2	2
CO3	3	2							2	2			2	2
CO4	3	2							2	2			2	2
CO5	3	2							2	2			2	2

ELEMENTS OF AEROSPACE PROPUSLION				
Course Code	18AEO768		**Credits**	3
Hours/Week (L-T-P)	3-0-0		**CIE Marks**	50
Total Hrs	39		**SEE Marks**	50
Exam Hrs	3		**Course Type**	Open Elective

COURSE OUTCOMES

Course outcomes: After completion of the course, students will be able to-

1. Describe the Basic concepts, Scope and Method of Thermodynamics
2. Discuss the 1 D isentropic flows
3. Discuss the fundamental principle of working of rockets and missiles
4. Discuss the Classification of rockets

TEACHING METHODOLOGY

- Blackboard teaching/PowerPoint presentation (if needed) /Flipped Classes for specified topics
- Videos and animation

COURSE CONTENTS

UNIT -1- (8 HOURS)

Introduction to Propulsion: Jet Propulsion, Turbojet, Turbofans, Turboprop, Turboshaft engine, Basic concepts, Scope and Method of Thermodynamics, Zeroth Law and Temperature, First Law and Internal Energy; Second Law – Entropy and Absolute Temperature; Third Law and Absolute Entropy; Thermodynamics of simple compressible systems, State postulate, Fundamental Representations

UNIT -2- (8 HOURS)

1 D isentropic flows, normal and oblique shocks, compressible flows, Rayleigh flow, Fanno flow, elements of combustion, thermochemistry , adiabatic flame temperature, premixed flames, diffusion flames

UNIT -3- (8 HOURS)

Introduction to Missiles and Rockets, fundamental principle of working of rockets and missiles Space propulsive devices and operating principles.

UNIT -4- (8 HOURS)

Classification of rockets: Introduction to chemical, electric, ion and nuclear powered rockets.

UNIT -5- (7 HOURS)

Chemical rockets: Solid and liquid propellant rockets, types of solid and liquid rocket motor propellants, rocket performance parameters, flow through nozzle, real nozzles, equilibrium and frozen flow

TEXT BOOKS

SL.NO	Title of the Book	Name of the author/s	Name of the publisher	Edition and year
1	Elements of Propulsion - Gas Turbines and Rockets,	J. D. Mattingly	AIAA Education series	2006,
2	. Advanced Classical Thermodynamics,	Emmanuel G	AIAA Ed. Series,	1987

REFERENCE BOOKS'

SL.NO	Title of the Book	Name of the author/s	Name of the publisher	Edition and year
1	.Engineering Thermodynamics,	Nag, P.K.	Tata McGraw Hill,	4th edition 2008
2	Mechanics and Thermodynamics of Propulsion,	Hill Philip, Peterson Carl,	Addison Wesly	1992,

ONLINE RESOURCES	Link
NPTEL	https://nptel.ac.in/courses/112/103/112103281/
MIT OCW	https://ocw.mit.edu/courses/aeronautics-and-astronautics/16-50-introduction-to-propulsion-systems-spring-2012/

COURSE ASSESSMENT METHOD

Continuous Internal Evaluation (CIE)

Three internals tests (each 30 marks) are conducted, average of best two performances will be considered.

1. Minimum two Assignments/Model making - evaluated through rubrics for 10 marks. Average of two will be considered.
2. Tutorial classes and assessment are carried out/Surprise quiz tests are conducted and evaluated for 10 marks. Average of these two will be considered.

Semester End Examination (SEE)

1. Two Questions are to be set from each unit, carrying 20 Marks each.
2. Students have to answer 5 questions selecting one full question from each unit

Program Outcomes – Articulation matrix:

PO	1	2	3	4	5	6	7	8	9	10	11	12	PSO1	PSO2
CO1	3	2												3
CO2	3	2												3
CO3	3	2												3
CO4	3	2												3

INTRODUCTION TO JET ENGINES				
Course Code	18AEO768		**Credits**	3
Hours/Week (L-T-P)	3-0-0		**CIE Marks**	50
Total Hrs	39		**SEE Marks**	50
Exam Hrs	3		**Course Type**	Open Elective

COURSE OUTCOMES

Course outcomes: After completion of the course, students will be able to-

1. Understand the working principle of gas turbine engines
2. Understand fundamentals of real cycles and rotating components
3. Identify various combustion systems and nozzles
4. Classify ramjet, scramjet and pulsejet engines

TEACHING METHODOLOGY

- Blackboard teaching/PowerPoint presentation (if needed) /Flipped Classes for specified topics
- Videos and animation

COURSE CONTENTS

UNIT -1- (8 HOURS)

Introduction to Aircraft Propulsion.
The Gas Turbine Engine development for Aircraft Propulsion. How the jet engines makes thrust conceptual basis. Jet engine performance parameters ; Thrust, SFC, Efficiencies, Simple Turbojet and Reheat engines: Low and High bypass Turbofan engines, Single and Multi-spool Gas Turbine based propulsive devices

UNIT -2- (8 HOURS)

Introduction to Real Cycles. Ideal and Real Brayton cycles. Jet engine cycles for aircraft propulsion. Cycle components and component performance: Intake, Compressors & Turbines , Combustion chamber, Afterburner, Nozzle. Analysis of engine real cycles: Turbojet cycle, Reheat engine cycle, Turbofan engine cycle, Turboprop Engines Advanced jet engine cycles: Variable cycle engines.

UNIT -3- (8 HOURS)

Fundamentals of Rotating components. Thermodynamics of Compressors and Turbines Development of parameters for compressor and Turbines.
Compressors and Turbines.
Axial and centrifugal Compressors: A simple two dimensional analytical model, 2-D (cascade) analysis; Loss and Blade performance estimation, Single and Multi-stage Axial compressor characteristics. Elements of centrifugal compressor. Centrifugal Compressor Characteristics: Surging and Choking.

UNIT -4- (8 HOURS)

Combustion Systems. Introduction : Various types of combustion chambers in aircraft engines. Combustion Mechanism and Important Combustion parameters. Development of a practical combustion system and design parameters. Pressure losses ; Combustion efficiency; Combustion intensity. uses and their properties and Fuel injection systems.
Intakes and Propelling Nozzles.
Requirements of an Intake for Powerplant: Transport, Military Aircraft.
Subsonic Intakes, Transonic and Supersonic Intakes. Axi-symmetric and Assymmetric Intakes. Aircraft Intake design considerations.
Propelling Nozzles, Nozzle design considerations: fixed and variable geometry nozzles, C-D nozzle and their use.

UNIT -5- (7 HOURS)

Ramjets, Pulsejets and Scramjets. Use of Ramjets and Pulsejets in Aircraft propulsion. Operating Principles, Thermodynamic Cycle. Design and Performance of a Ramjet. Flow in Diffusers, Combustors and Nozzles. Principles of Scramjet Engines. Future of Aircraft Propulsion

TEXT BOOKS

SL.NO	Title of the Book	Name of the author/s	Name of the publisher	Edition and year
1	Aircraft Powerplants	Kroes Michael J; Wild Thomas W;	Tata-Mcgraw-Hill.,	2010 7th Edition
2	Mechanics and Thermodynamics of Propulsion,	Hill Philip, Peterson Carl,	Addison Wesly	1992
3	Aircraft Propulsion,	Roy Bhaskar,	Elsevier (India)	2008

REFERENCE BOOKS'

SL.NO	Title of the Book	Name of the author/s	Name of the publisher	Edition and year
1	Elements of Propulsion - Gas Turbines and Rockets,	Mattingly J D	AIAA Education series	2006,
2	Gas Turbine Theory,	Saravanamuttoo, H.I.H., Rogers G.F.C., Cohen H.	Pearson.	2001

ONLINE RESOURCES	Link
NPTEL	https://nptel.ac.in/courses/101/101/101101002/
MIT OCW	https://ocw.mit.edu/courses/aeronautics-and-astronautics/16-50-introduction-to-propulsion-systems-spring-2012/

COURSE ASSESSMENT METHOD

Continuous Internal Evaluation (CIE)

Three internals tests (each 30 marks) are conducted, average of best two performances will be considered.

1. Minimum two Assignments/Model making - evaluated through rubrics for 10 marks. Average of two will be considered.
2. Tutorial classes and assessment are carried out/Surprise quiz tests are conducted and evaluated for 10 marks. Average of these two will be considered.

Semester End Examination (SEE)

1. Two Questions are to be set from each unit, carrying 20 Marks each.
2. Students have to answer 5 questions selecting one full question from each unit

Program Outcomes – Articulation matrix:

PO	1	2	3	4	5	6	7	8	9	10	11	12	PSO1	PSO2
CO1	3	2												3
CO2	3	2												3
CO3	3	2												3
CO4	3	2												3

INTERNSHIP/SELF STUDY/MINOR PROJECT				
Course Code	18AEI/S/P79		**Credits**	1
Hours/Week (L-T-P)	3-0-0		**CIE Marks**	50
Total Hrs	36		**SEE Marks**	50
Exam Hrs	3		**Course Type**	Core

COURSE OUTCOMES

Course outcomes: After completion of the course, students will be able to-

1. Identify and define the problem for the project work
2. Apply the knowledge acquired to analyze and estimate the cost and time
3. Examine and use appropriate tools to solve the defined problem in a team
4. prepare an end product and prepare a technical report/paper

INTERNSHIP

A 4-6 weeks' internship in any recognized industries/institutes can be carried out by the students after 2 nd year study of their engineering curriculum. The aim of the internship is to study and gain knowledge about various industrial departments and natures of work and processes. On completion of the internship, students shall prepare a report according to the guidelines and submit it to the authority concerned during their 7th semester. The students present the work through a seminar and performance will be evaluated by the project committee and marks will be awarded..

SELF STUDY

The students can take up self-study assignment under the guidance of a faculty. The topic and syllabus for self-study will be given by the faculty concerned. At the end of the study the student has to take up 3hours long exam. The performance will be evaluated and grades will be awarded for the same by considering the final and CIE marks.

MINOR PROJECT

The goal of the minor project is to learn and apply scientific methods to problems for solutions and prepare necessary documentation. The duration amounts to one semester. The characteristic phases of the scientific work are:

- Analyzing the defined problem
- Determining the existing solutions
- Proposing new solutions
- Evaluating all solutions and deciding on a reasonable solution
- Implementing the solution
- Writing an elaborate report, discussing the results achieved
- Making suggestions if any for further work

COURSE ASSESSMENT METHOD

Continuous Internal Evaluation (CIE)

1. Regular follow-up in terms of presentations for internship and minor projects.
2. Mid semester exam will be conducted for self-study courses

Semester End Examination (SEE)

1. Presentation followed by report submission for internship and minor projects
2. Three hours examination for 100 marks

Program Outcomes – Articulation matrix:

PO	1	2	3	4	5	6	7	8	9	10	11	12	PSO1	PSO2
CO1	3	3	3	3	3	2	2	3	3	3	3	3	3	3
CO2	3	3	3	3	3	2	2	3	3	3	3	3	3	3
CO3	3	3	3	3	3	2	2	3	3	3	3	3	3	3
CO4	3	3	3	3	3	2	2	3	3	3	3	3	3	3

MAJOR PROJECT PHASE-II				
Course Code	18AEP710		**Credits**	1
Hours/Week (L-T-P)	3-0-0		**CIE Marks**	50
Total Hrs	36		**SEE Marks**	50
Exam Hrs	3		**Course Type**	Core

COURSE OUTCOMES

Course outcomes: After completion of the course, students will be able to-

1. Identify and define the problem for the project work
2. Apply the knowledge acquired to analyze and estimate the cost and time
3. Examine and use appropriate tools to solve the defined problem in a team
4. Develop an end product and prepare a technical report/paper

COURSE ASSESSMENT METHOD

Project work: Based on the ability/abilities of the student/s and recommendations of the mentor, a single discipline or a multi disciplinary project can be assigned to an individual student or to a group having not more than 4 students. In extraordinary cases, like the funded projects requiring students from different disciplines, the project student strength can be 5 or 6.

CIE procedure for Project Work Phase - 2:

The CIE marks shall be awarded by a committee consisting of the Head of the concerned Department and senior faculty members of the Department, one of whom shall be the Guide. The CIE marks awarded for the project work phase-2, shall be based on the evaluation of the project work phase -1 Report (covering Literature Survey, Problem identification, Objectives and Methodology), project presentation skill and question and answer session in the ratio 50:25:25..

SEE Procedure for project Work Phase-2

The SEE marks shall be awarded by senior examiners (internal & External). The students have to present/demonstrate the project work carried out. SEE marks awarded for the project work phase -2. The marks will be awarded for the students based on Report (covering Literature Survey, Problem identification, Objectives and Methodology), project presentation skill and question and answer session in the ratio 50:25:25.

Program Outcomes – Articulation matrix:

PO	1	2	3	4	5	6	7	8	9	10	11	12	PSO1	PSO2
CO1	3	3	3	3	3	2	2	3	3	3	3	3	3	3
CO2	3	3	3	3	3	2	2	3	3	3	3	3	3	3
CO3	3	3	3	3	3	2	2	3	3	3	3	3	3	3
CO4	3	3	3	3	3	2	2	3	3	3	3	3	3	3

SEMESTER-VIII

AIRCRAFT DESIGN AND ANALYSIS

Course Code	18AE81		**Credits**	03
Hours/Week (L-T-P)	4+0+0		**CIE Marks**	50
Total Hrs	39		**SEE Marks**	50
Exam Hrs	03 Hours		**Course Type**	Core

COURSE OUTCOMES

Course outcomes: After completion of the course, students will be able to-

1. Describe the conceptual design process of an aircraft, airfoil and wing geometry
2. Describe initial sizing and configuration layout.
3. Explain the application of aerodynamics, propulsion and aircraft structures in design.
4. Discuss the design aspects of sub systems in flight vehicles.

TEACHING METHODOLOGY

- Blackboard teaching/PowerPoint presentation
- Videos and animation

COURSE CONTENTS

UNIT -1 (08 HOURS)

Overview of Design Process: Introduction, Typical requirements for a civil transport and a military fighter aircraft, Phases of design, Aircraft conceptual design process, Take-off weight build up, Empty weight estimation, Fuel fraction estimation, Take- off weight calculation, Trade studies.

Airfoil Selection: Airfoil geometry, Airfoil lift and drag, Airfoil families, Airfoil design, Airfoil lift coefficient, Airfoil thickness, Camber, Stall, Reynolds number effects.

UNIT -2- (08 HOURS)

Geometry: Wing geometry, Aspect ratio, Sweep, Taper ratio, Twist, Incidence, Dihedral, Wing vertical location of wings, Wing tips, Biplane wings, Tail geometry and arrangement

Thrust to Weight Ratio & Wing Loading: Thrust to weight definitions, Power loading, Statistical estimate of T/W. Thrust matching, Wing Loading and its effect on Stall speed, Take-off Distance, Catapult take-off, and Landing Distance. Wing Loading for Cruise, Loiter, Endurance, Instantaneous Turn rate, Sustained Turn rate, Climb, & Glide, Maximum ceiling, Selection of Thrust to Weight Ratio & Wing Loading

UNIT -3- (08 HOURS)

Initial Sizing: Rubber engine sizing, Fixed engine sizing, Geometry sizing – Fuselage, Wing, Tail volume coefficient, and Control surface sizing,

Configuration Layout & loft: Conic lofting, Conic fuselage development, Conic shape parameter, Wing-tail layout & Loft. aerofoil linear interpolation. Aerofoil flat-wrap interpolation. Wing aerofoil layout-flap wrap. Wetted area determination. Special considerations in configuration layout: Aerodynamic, Structural, Detectability. Crew station, Passenger, and Payload arrangements.

UNIT -4- (08 HOURS)

Aerodynamics & Propulsion: A brief overview of aerodynamic coefficients and forces, Types of propulsion systems, Jet engine thrust considerations, Thrust-drag book keeping, Installed thrust methodology, Piston engine performance – propeller performance and piston-prop thrust correction, Turboprop performance

Structural Loads: Structures fundamentals, Loads categories, Air loads – maneuver loads, gust loads, air loads on lifting surface, air loads due to control deflection, Inertial loads, Power-plant loads, Landing gear loads.

UNIT -5- (07 HOURS)

Design Aspects of Subsystems: Flight Control system, Landing Gear and subsystem, Propulsion and Fuel System Integration, Air Pressurization and Air Conditioning System, Electrical & Avionic Systems, Safety constraints, Material selection criteria.

Lab Component: Demonstration of SDOF System & MDOF System &estimation of vibration responses

TEXT BOOKS

Sl.no	Title of the Book	Name of the Author/s	Name of the Publishers	Edition and Year
1	Aircraft Design - A Conceptual Approach	Daniel P. Raymer	AIAA Education Series	IV Edition © 2006.
2	Design of Aircraft	Thomas C Corke	Pearson	Edition. Inc. © 2003

REFERENCE BOOKS'

Sl.no	Title of the Book	Name of the Author/s	Name of the Publishers	Edition and Year
1	Aeroplane Design – Vol: 1 to 9.	J Roskam	DAR corporation	2016
2	Introduction to Aircraft Design	John Fielding	Cambridge University Press	2009
3	Standard Handbook for Aeronautical & Astronautical Engineers,	Editor Mark Davies	Tata McGraw Hill	2010

ONLINE RESOURCES	Link
NPTEL	https://nptel.ac.in/courses/101/106/101106035/
MIT OCW	https://ocw.mit.edu/courses/aeronautics-and-astronautics/16-00-introduction-to-aerospace-engineering-and-design-spring-2003/download-course-materials/

COURSE ASSESSMENT METHOD

Continuous Internal Evaluation (CIE)

Three internals tests (each 30 marks) are conducted, average of best two performances will be considered.

1.Minimum two Assignments/Model making - evaluated through rubrics for 10 marks. Average of two will be considered.
2.Tutorial classes and assessment are carried out/Surprise quiz tests are conducted and evaluated for 10 marks. Average of these two will be considered.

Semester End Examination (SEE)

1. Two Questions are to be set from each unit, carrying 20 Marks each.
2. Students have to answer 5 questions selecting one full question from each unit

Program Outcomes – Articulation matrix:

PO	1	2	3	4	5	6	7	8	9	10	11	12	PSO1	PSO2
CO1	3	3							3	3		2	2	2
CO2	3	3							3	3		2	2	2
CO3	3	3							3	3		2	2	2
CO4	3	3							3	3		2	2	2

PROGRAM ELECTIVE-F

DESIGN OF GAS TURBINE				
Course Code	18AEE821		**Credits**	03
Hours/Week (L-T-P)	3+0+0		**CIE Marks**	50
Total Hrs	39		**SEE Marks**	50
Exam Hrs	03 Hours		**Course Type**	Program elective

COURSE OUTCOMES

Course outcomes: After completion of the course, students will be able to-

1. Identify the types of engines , parts, variations and applications of aircraft
2. Identify the criteria involved in selection of materials
3. Differentiate the design and off-design performance characteristics of aircraft engines.
4. Assess various component and engine level performance tests.

TEACHING METHODOLOGY

- Blackboard teaching/PowerPoint presentation (if needed) /Flipped Classes for specified topics
- Regular review of students by asking questions based on topics covered in the class

COURSE CONTENTS

UNIT -1- (08 HOURS)

Types, Variation & Applications: Types of engines showing arrangement of parts. Operating parameters. Energy distribution of turbojet, turboprop and turbofan engines. Comparison of thrust and specific fuel consumption. Thrust, pressure and velocity diagrams.

Engine Parts: Compressor assembly, types of burners: advantages and disadvantages. Influence of design factors on burner performance. Effect of operating variables on burner performance. Performance requirements of combustion chambers. Construction of nozzles. Impulse turbine and reaction turbine. Exhaust system, sound suppression. Thrust reversal: types, design & systems. Methods of thrust augmentation, afterburner systems.

UNIT -2 (08 HOURS)

Materials and Manufacturing: Criteria for selection of materials. Heat ranges of metals, high temperature strength. Surface finishing. Powder metallurgy. Use of composites and Ceramics. Super-alloys for Turbines. **Systems:** Fuel systems and components. Sensors and Controls. FADEC interface with engine. Typical fuel system. Oil system components. Typical oil system. Starting systems. Typical starting characteristics. Various gas turbine starters.

UNIT -3 (08 HOURS)

Engine Performance: Design & off-design Performance. Surge margin requirements, surge margin stack up. Transient performance. Qualitative characteristics quantities. Transient working lines. Starting process & Wind milling of Engines. Thrust engine start envelope. Starting torque and speed requirements Calculations for design and off-design performance from given test data – (case study for a single shaft Jet Engine). Engine performance monitoring.

UNIT -4 (08 HOURS)

Component Level Testing

Compressor: Compressor MAP. Surge margin, Inlet distortions. Testing and Performance Evaluation. **Combustor:** Combustor MAP, Pressure loss, combustion light up test. Testing and Performance Evaluation. **Turbines:** Turbine MAP. Turbine Testing and Performance Evaluation. **Inlet duct & nozzles:** Ram pressure recovery of inlet duct. Propelling nozzles, after burner, maximum mass flow conditions. Testing and Performance Evaluation.

UNIT -5 (07 HOURS)

Engine Testing: Proof of Concepts: Design Evaluation tests. Structural Integrity. Environmental Ingestion Capability. Preliminary Flight Rating Test, Qualification Test, Acceptance Test. Reliability figure of merit. Durability and Life Assessment Tests, Reliability Tests. Engine testing with simulated inlet distortions and, surge test. Estimating engine-operating limits. Methods of displacing equilibrium lines.

Types of engine testing: Normally Aspirated Testing, Open Air Test Bed ,Ram Air Testing, Altitude Testing, Altitude test facility, Flying Test Bed, Ground Testing of Engine Installed in Aircraft, Flight testing. Jet thrust measurements in flight. Test procedure: Test Schedule Preparation, Test Log Sheets, Test Documents. Type approval.

TEXT BOOKS

Sl.no	Title of the Book	Name of the Author/s	Name of the Publishers	Edition and Year
1	Gas Turbine Engine Technology GLENCOE Aviation Technology Series	Irwin E. Treager	Tata McGraw Hill Publishing Co.Ltd. Print	7th Edition,2003
2	Gas Turbine Performance	P.P Walsh and P. Peletcher	Blackwell Science	1998
3	Aircraft Power Plant GLENCOE Aviation Technology Series	Michael J. Kores , and Thomas W. Wild	Tata McGraw Hill Publishing Co.Ltd	7th Edition,2002

REFERENCE BOOKS'

Sl.no	Title of the Book	Name of the Author/s	Name of the Publishers	Edition and Year
1	Advance Aero-Engine Testing, AGARD-59		Publication MIL –5007 E	Agard,1981
2	Military Specifications: Engine, Aircraft, Turbo Jet & Turbofan; General Specification for Advance Aero Engine testing		US Military Specs/Standards/Handbooks	15th Oct 1973.
3	Experimental methods for Engineers	J P Holman	Tata McGraw –Hill Publishing Co. Ltd	2007
4	Turbomachinery dynamics-Design and operations	A S Rangawala	McGraw –Hill Publishing Co. Ltd,	2007

ONLINE RESOURCES	Link
NPTEL	https://nptel.ac.in/content/storage2/courses/112104117/ui/Course_home-lec16.htm
NPTEL	https://nptel.ac.in/courses/112/103/112103281/

COURSE ASSESSMENT METHOD
Continuous Internal Evaluation (CIE) Three internals tests (each 30 marks) are conducted, average of best two performances will be considered. 1. Minimum two Assignments/Model making - evaluated through rubrics for 10 marks. Average of two will be considered. 2. Tutorial classes and assessment are carried out/Surprise quiz tests are conducted and evaluated for 10 marks. Average of these two will be considered. **Semester End Examination (SEE)** 1. Two Questions are to be set from each unit, carrying 20 Marks each. 2. Students have to answer 5 questions selecting one full question from each unit

Program Outcomes – Articulation matrix:

PO	1	2	3	4	5	6	7	8	9	10	11	12	PSO1	PSO2
CO1	3	2	2										3	3
CO2	3	3	2										2	3
CO3	3	3	2										2	3
CO4	3	2	2										2	3

MISSILE TECHNOLOGY				
Course Code	18AEE822		**Credits**	03
Hours/Week (L-T-P)	4+0+0		**CIE Marks**	50
Total Hrs	39		**SEE Marks**	50
Exam Hrs	03 Hours		**Course Type**	Program elective

COURSE OUTCOMES

Course outcomes: After completion of the course, students will be able to-

1. Describe the Space launch Vehicles and military missiles, function, types etc.
2. Explain the Solid and liquid Propellant Rocket Motor Systems,
3. Describe the aerodynamics of Rockets and Missiles
4. Explain the Launch Vehicle Dynamics and Rocket Testing

TEACHING METHODOLOGY

- Blackboard teaching/PowerPoint presentation (if needed) /Flipped Classes for specified topics

COURSE CONTENTS

UNIT -1- (08 HOURS)

Introduction: Space launch Vehicles and military missiles, function, types, role, mission, mission profile, thrust profile, propulsion system, payload, staging, control and guidance requirements, performance measures, design, construction, operation, similarities and differences. Some famous space launch vehicles and strategic missiles.

UNIT -2 (10 HOURS)

Solid Propellant Rocket Motor Systems: Solid Propellant rocket motors, principal features, applications. Solid propellants, types, composition, properties, performance. Propellant grain, desirable properties, grain configuration, preparation, loading, structural design of grain. Liners, insulators and inhibitors, function, requirements, materials. Rocket motor casing – materials. Nozzles, types, design, construction, thermal protection. Igniters, types, construction. Description of modern solid boosters I Space Shuttle SRB, II the Arienne SRB

Liquid Propellant Rocket Motor Systems: Liquid propellants, types, composition, properties, performance. Propellant tanks feed systems, pressurization, turbo-pumps, valves and feed lines, injectors, starting and ignition. Engine cooling, support structure. Control of engine starting and thrust build up, system calibration, integration and optimization – safety and environmental concerns. Description of the space shuttle main engine. Propellant slosh, propellant hammer, geysering effect in cryogenic rocket engines.

UNIT -3 (08 HOURS)

Aerodynamics of Rockets And Missiles: Classification of missiles. Airframe components of rockets and missiles, Forces acting on a missile while passing through atmosphere, method of describing aerodynamic forces and moments, lateral aerodynamic moment, lateral damping moment, longitudinal moment of a rocket, lift and drag forces, drag estimation, body upwash and downwash in missiles. Rocket dispersion, re-entry body design considerations.

UNIT -4- (07 HOURS)

Launch Vehicle Dynamics: Tsiolskovsky's rocket equation, range in the absence of gravity, vertical motion in the earth's gravitational field, inclined motion, flight path at constant pitch angle, motion in the atmosphere, the gravity turn – the culmination altitude, multi staging. Earth launch trajectories – vertical segment, the gravity turn, constant pitch trajectory, orbital injection. Actual launch vehicle trajectories, types. Examples, the Mu 3-S-II, Ariane, Pegasus launchers. Reusable launch vehicles, future launchers, launch assist technologies. Attitude Control of Rockets And Missiles: Rocket Thrust Vector Control – Methods of Thrusts Vector Control for solid and liquid propulsion systems, thrust magnitude control, thrust termination; stage separation dynamics, separation techniques.

UNIT -5- (08 HOURS)

Rocket Testing: Ground Testing and Flight Testing, Types of Testsfacilities and safeguards, monitoring and control of toxic materials, instrumentation and data management. Ground Testing, Flight Testing, Trajectory monitoring, post -accident procedures. Description of a typical space launch vehicle launch procedure. Materials: Criteria for selection of materials for rockets and missiles, requirements for choice of materials for propellant tanks, liners, insulators, inhibitors, at cryogenic temperatures, requirements of materials at extremely high temperatures, requirements of materials for thermal protection and for pressure vessels.

TEXT BOOKS

Sl.no	Title of the Book	Name of the Author/s	Name of the Publishers	Edition and Year
1	Rocket Propulsion Element	George P Sutton and Oscar Biblarz	John Wiley and Sons Inc	7th edition, 2010.
2	Missile Aerodynamics	Jack N Neilson	AIAA	1st edition, 1988

REFERENCE BOOKS'

Sl.no	Title of the Book	Name of the Author/s	Name of the Publishers	Edition and Year
1	Missile Configuration Design’	S S Chin	McGraw-Hill	1st Edition (1961)
2	Rocket Propulsion and Space-Flight Dynamics	Cornelisse, J.W., Schoyer H.F.R. and Wakker, K.F	Pitman	1979
3	Rocket and Spacecraft propulsion	Turner, M.J.L	Springer	3rd edition, 2010
4	Space Vehicle Dynamics	Ball, K.J., Osborne, G.F	Oxford University Press	1967
5	Materials for Missiles and Spacecraft	Parker, E.R	McGraw Hill	1982

ONLINE RESOURCES	Link
NPTEL	https://nptel.ac.in/courses/101/108/101108054/
NPTEL	https://nptel.ac.in/courses/101/108/101108056/
MIT OCW	https://ocw.mit.edu/courses/aeronautics-and-astronautics/16-512-rocket-propulsion-fall-2005/lecture-notes/

COURSE ASSESSMENT METHOD

Continuous Internal Evaluation (CIE)

Three internals tests (each 30 marks) are conducted, average of best two performances will be considered.

1. Minimum two Assignments/Model making - evaluated through rubrics for 10 marks. Average of two will be considered.
2. Tutorial classes and assessment are carried out/Surprise quiz tests are conducted and evaluated for 10 marks. Average of these two will be considered.

Semester End Examination (SEE)

1. Two Questions are to be set from each unit, carrying 20 Marks each.
2. Students have to answer 5 questions selecting one full question from each unit

Program Outcomes – Articulation matrix:

PO	1	2	3	4	5	6	7	8	9	10	11	12	PSO1	PSO2
CO1	3	3										1	2	2
CO2	3	3										1	2	2
CO3	3	3										1	2	2
CO4	3	2										1	2	2

HIGH TEMPERATURE MATERIALS				
Course Code	18AEE823		**Credits**	3
Hours/Week (L-T-P)	3+0+0		**CIE Marks**	50
Total Hrs	39		**SEE Marks**	50
Exam Hrs	03 Hours		**Course Type**	Program elective

COURSE OUTCOMES

Course outcomes: After completion of the course, students will be able to-

1. Understand creep behaviour, mechanisms and effect of different parameters like stress, temporary, strain rate on creep.
2. Apply laws that would be beneficial in determining the rupture life of a component
3. Identify various types of fracture and its occurrence.
4. Describe Oxidation and Corrosion phenomenon
5. Describe super alloys and other high temperature materials

TEACHING METHODOLOGY

- Blackboard teaching/PowerPoint presentation (if needed) /Flipped Classes for specified topics
- Videos and animation lectures

COURSE CONTENTS

UNIT -1- (08 HOURS)

CREEP : Creep – Creep Strength, Creep Limit, Creep Curve - Stages of Creep, Creep Fracture, Factors influencing creep property of a material, Factors Affecting Creep – Temperature, Stress, Time, Grain Size, Mechanism of Creep – Diffusion Creep & Dislocation Creep, Metallurgical Factors Influencing Creep at High Temperature, Creep Test, Creep resistant materials.

UNIT -2- (10 HOURS)

LAWS TO DETERMINE CREEP: Laws of Creep- Andrade's law, Logarithmic Law, Hyperbolic Law of Transient creep, Secondary creep law,Laws to determine rupture life of component – Larson –Miller Parameter, Monkman Grant Relationship, Creep Mechanism Maps.

UNIT -3- (07 HOURS)

HIGH TEMPERATURE FRACTURE: Fracture – Types of Fracture –Ductile fracture, Brittle fracture, Shearing Fracture, Factors Affecting Fracture, Fracture toughness, Griffith Theory of Brittle Fracture, Blue Brittleness, Orange Peel Effect, Cleavage Fracture, Micro void Coalescence and Dominant Void Growth Modes, Ductile to Brittle Transition (DBT), Bauchinger's effect.

UNIT -4- (08 HOURS)

OXIDATION & CORROSION : Oxidation –Nature of Oxides formed on Metal Surface, Types of Corrosion, Kinetic laws of Oxidation – Parabolic rate law, Linear rate law and Logarithmic rate law, Pilling-Bedworth ratio, Corrosion – Types of Corrosion, Factors Influencing Corrosion, Fluxing Mechanisms – Acidic and Basic Fluxing, Effect of Alloying Element on Hot Corrosion, Corrosion Control - Methods to Combat Hot Corrosion.

UNIT -5- (10 HOURS)

HIGH TEMPERATURE RESISTANT MATERIALS: Super Alloys – Cobalt Base, Nickel base, Iron Base. Ultra High Temperature Ceramics, Inter- metallics, Thermal Barrier Coatings, Hydrogen Embrittlement, Refractory Metals, Structural Heat Resistant Composites.

TEXT BOOKS

Sl.no	Title of the Book	Name of the Author/s	Name of the Publishers	Edition and Year
1	Mechanical Behaviour of Materials	Norman E Dowling	Pearson Publisher	Fourth Edition, 2012
2	High Temperature Deformation and Fracture of Materials	Jun-Shan Zhang	Woodhead Publishing	First Edition,2010

REFERENCE BOOKS'

Sl.no	Title of the Book	Name of the Author/s	Name of the Publishers	Edition and Year
1	Creep Mechanics	J.Betten	Springer	3rd Edition 2008
2	High temperature materials and mechanisms	Yuseph Bar,Cohen	CRC Press	1st edition,2014

ONLINE RESOURCES	Link
NPTEL	https://nptel.ac.in/courses/113/105/113105081/
NPTEL	https://freevideolectures.com/course/4445/nptel-advanced-materials-processes/31
SWAYAM	https://swayam.gov.in/nd1_noc19_mm13/preview

COURSE ASSESSMENT METHOD

Continuous Internal Evaluation (CIE)

Three internals tests (each 30 marks) are conducted, average of best two performances will be considered.

1. Minimum two Assignments/Model making - evaluated through rubrics for 10 marks. Average of two will be considered.
2. Tutorial classes and assessment are carried out/Surprise quiz tests are conducted and evaluated for 10 marks. Average of these two will be considered.

Semester End Examination (SEE)

1. Two Questions are to be set from each unit, carrying 20 Marks each.
2. Students have to answer 5 questions selecting one full question from each unit

Program Outcomes – Articulation matrix:

PO	1	2	3	4	5	6	7	8	9	10	11	12	PSO1	PSO2
CO1	3	2										2		2
CO2	3	2										2		2
CO3	3	2										2		2
CO4	3	2										2		2
CO5	3	2										2		2

AVIONICS AND INSTRUMENTATIONS				
Course Code	18AEE824		**Credits**	3
Hours/Week (L-T-P)	3+0+0		**CIE Marks**	50
Total Hrs	39		**SEE Marks**	50
Exam Hrs	03 Hours		**Course Type**	Program Elective

COURSE OUTCOMES

Course outcomes: After completion of the course, students will be able to-

1. Describe modern Aviation and avionics architecture.
2. Explain the instrument landing systems and distance measuring equipment, the VHF OMNI range navigation
3. Explain the aircraft instruments.
4. Describe the inertial navigation system.

TEACHING METHODOLOGY

- Blackboard teaching/PowerPoint presentation (if needed) /Flipped Classes for specified topics
- Videos and animation

COURSE CONTENTS

UNIT -1- (08 HOURS)

Introduction to Avionics: History and Evolution of Avionics, Significance of Avionics in modern Aviation, what is Basic Six, List of Avionics system on-board a modern aircraft. Block diagram of avionics architecture, Role of individual sub-system in avionics architecture

UNIT -2- (08 HOURS)

Instrument landing systems and distance measuring equipment: Principles of Localizer (LOC) Operation, Principles of Glideslope (GS) Operation, Principles of Marker Beacon (MB) Operation, Navigation Receiver, Automated Test Equipment, Microwave Landing Systems, DME Navigation Concepts, Principles of DME System Operation, DME Transceiver Operation, DME Navigation Procedures

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UNIT -3- (08 HOURS)

Introduction to Navigations Systems: What is Navigation? What are the types of Navigations? Principles of GPS? Definition associated with navigation (e.g. Lat, Long, GPS Coordinate system, Heading, Track, True/Magnetic North, Radial, Bearing, Heading and course etc.) Examples of Navigation systems used in fighters, Transport and Helicopters, VOR Navigation Concepts, Principles of COR, Operation, Receiver Operation, Performance Validation, Operation Procedures.

UNIT -4- (08 HOURS)

Aircraft Instruments. Introduction to Aircraft Instruments. Evolution of Cockpit Displays, Construction and Working Principle of - Air Data Reference System, Pressure Measurement, Pitot Static System, Altimeter, Air Speed Indicator, Rate of Climb Indicator, Mach Meter, Temperature Measurement, RPM Measurement, Fuel Gauge, Accelerometer and Fatigue Meter, Artificial Horizon, Turn and Slip Indicator, Compass and Directional Gyros Magnetic Heading Reference Systems and Introduction to Flight Data Recorder and Cockpit Voice Recorder.

UNIT -5- (07 HOURS)

Inertial Navigation System. Sensors in Inertial Navigational System (INS), Types of INS and Fundamentals of Stabilized Platform. Introduction to Strap-Down INS. Principles of Modern Gyros (Vibrating Mass, Optical Ring Laser Gyros, Fiber Optics Gyros, Solid State Gyros)

TEXT BOOKS

Sl.no	Title of the Book	Name of the Author/s	Name of the Publishers	Edition and Year
1	Introduction to Avionics system	Collinson	Springer Verilag	3 edition (23 June 2011)
2	Avionics Navigation System	Myron Kayton	Wiley and Sons Ltd., New Delhi.	Second edition (17 November 2009)

REFERENCE BOOKS'

Sl.no	Title of the Book	Name of the Author/s	Name of the Publishers	Edition and Year
1	Fundamentals of Navigation and Inertial Sensors	Amita Bose	PHI.	2014
2	Introduction to Modern Navigation Systems	Esmat Bekir	Cambridge University Press	2010
3	Introduction to Avionics	Dale R Cundy	Pearson.	2010
4	Civil Avionics Systems	Ian Moir & Seabridge	Wiley India.	17 April 2012
5	Military Avionics Systems	Ian Moir & Seabridge	Wiley India.	(24 February 2006

ONLINE RESOURCES	Link
MIT OCW	https://ocw.mit.edu/courses/aeronautics-and-astronautics/16-682-prototyping-avionics-spring-2006/
MIT OCW	https://ocw.mit.edu/courses/aeronautics-and-astronautics/16-885j-aircraft-systems-engineering-fall-2005/download-course-materials/

COURSE ASSESSMENT METHOD

Continuous Internal Evaluation (CIE)

Three internals tests (each 30 marks) are conducted, average of best two performances will be considered.

1. Minimum two Assignments/Model making - evaluated through rubrics for 10 marks. Average of two will be considered.
2. Tutorial classes and assessment are carried out/Surprise quiz tests are conducted and evaluated for 10 marks. Average of these two will be considered.

Semester End Examination (SEE)
1. Two Questions are to be set from each unit, carrying 20 Marks each.
2. Students have to answer 5 questions selecting one full question from each unit

Program Outcomes – Articulation matrix:

PO	1	2	3	4	5	6	7	8	9	10	11	12	PSO1	PSO2
CO1	3													2
CO2	3	2												2
CO3	3	2												2
CO4	3	2												2

SMART MATERIALS & NANO TECHNOLOGY				
Course Code	18AEE825		**Credits**	3
Hours/Week (L-T-P)	3+0+0		**CIE Marks**	50
Total Hrs	39		**SEE Marks**	50
Exam Hrs	03 Hours		**Course Type**	Program Elective

COURSE OUTCOMES

Course outcomes: After completion of the course, students will be able to-

1. Identify the characteristics of various smart materials.
2. Explain the Optics and Electromagnetic principles
3. Apply principles of vibrations and perform modal analysis
4. Understand the importance of nanotechnology and quantum mechanics.

TEACHING METHODOLOGY

- Blackboard teaching/PowerPoint presentation (if needed) /Flipped Classes for specified topics
- Videos and animation

COURSE CONTENTS

UNIT -1- (08 HOURS)

Introduction: Characteristics of composites and ceramics materials, Electro-magnetic materials and shape memory alloys-processing and characteristics Sensing and Actuation Principles of electromagnetic, acoustics, chemical and mechanical sensing and actuation, Types of sensors and their applications..

UNIT -2- (08 HOURS)

Optics and Electromagnetic: Principles of optical fiber technology, characteristics of active and adaptive optical system and components Design and manufacturing principles. Structures: Principles of drag and turbulence control through smart skins, applications in environment such as aerospace and transportation vehicles, manufacturing, repair and maintainability aspects

UNIT -3- (08 HOURS)

Principles of Vibration and Modal Analysis: PZT Actuators, MEMS, Magnetic shape Memory Alloys, Characteristics and Applications.Principles of structural acoustic control

UNIT -4- (08 HOURS)

Introduction to Nanotechnology:
Importance of Nanotechnology-History of Nanotechnology-Opportunity at the nano scale-length and time scale in structures-energy landscapes-Interdynamic aspects of intermolecular forces -classification based on the dimensionality- nano particles nanoclusters-nanotubes-nanowires and nanodots- Semiconductor nanocrystals carbon nanotubes- Influence of Nano structuring on Mechanical, optical, electronic, magnetic and chemical properties.

UNIT -5- (07 HOURS)

Basics Of Quantum Mechanics: Introduction to Quantum Mechanics - Schrodinger equation time dependent and time independent equations Operators and observables - Commutation relations - Hermitian operators Expectation values of observables - Solutions of the Schrodinger equation free particle - particle in a box one and three dimensions - particle in a finite well - Penetration through a barrier Tunnel effect Single step barrier

TEXT BOOKS

Sl.no	Title of the Book	Name of the Author/s	Name of the Publishers	Edition and Year
1	A textbook of Nanoscience and Nanotechnology	Pradeep.T	Tata McGraw Hill education private ltd	1st January, 2012
2	Introduction to Quantum Mechanics	David. J, Griffiths	Pearson	2nd Edition, 2009
3	Introductory Quantum Mechanics	Richard. L, Liboff	Pearson	3rd Edition, 2003

REFERENCE BOOKS'

Sl.no	Title of the Book	Name of the Author/s	Name of the Publishers	Edition and Year
1	An Introduction to Thermodynamics and Statistical Mechanics	Keith Stowe	Cambridge University, Newyork	2nd Edition, 2007
2	Statistical Physics	Claudine Herman	Springer, New York	2005 edition (26 January 2006)
3	Introduction to Solid State Physics	Kittel. C	Wiley India Pvt. Ltd	2007
4	Nanomaterials chemistry	Rao. C. N, Muller. A, Cheetham. A. K	Wiley-VCH	2007

ONLINE RESOURCES	Link
NPTEL	https://nptel.ac.in/courses/112/104/112104251/
NPTEL	https://nptel.ac.in/courses/112/104/112104173/
NPTEL	https://nptel.ac.in/courses/118/104/118104008/
MIT OCW	https://ocw.mit.edu/courses/mechanical-engineering/2-674-micro-nano-engineering-laboratory-spring-2016/

COURSE ASSESSMENT METHOD

Continuous Internal Evaluation (CIE)

Three internals tests (each 30 marks) are conducted, average of best two performances will be considered.

1.Minimum two Assignments/Model making - evaluated through rubrics for 10 marks. Average of two will be considered.

2.Tutorial classes and assessment are carried out/Surprise quiz tests are conducted and

evaluated for 10 marks. Average of these two will be considered.
Semester End Examination (SEE)
1. Two Questions are to be set from each unit, carrying 20 Marks each.
2. Students have to answer 5 questions selecting one full question from each unit

Program Outcomes – Articulation matrix:

PO	1	2	3	4	5	6	7	8	9	10	11	12	PSO1	PSO2
CO1	3												1	3
CO2	3												1	3
CO3	3												1	3
CO4	3												1	3

HELICOPTER ENGINEERING				
Course Code	18AEE826		**Credits**	3
Hours/Week (L-T-P)	3+0+0		**CIE Marks**	50
Total Hrs	39		**SEE Marks**	50
Exam Hrs	03 Hours		**Course Type**	Program elective

COURSE OUTCOMES

Course outcomes: After completion of the course, students will be able to-

1. Explain the Configurations based on torque reaction and methods of control.
2. Describe the ideal rotor theory.
3. Explain the Induced, profile and parasite power requirements.
4. Describe the Lift, Propulsion and Control of VISTOL Aircraft and ground effect machines.

TEACHING METHODOLOGY

- Blackboard teaching/PowerPoint presentation (if needed) /Flipped Classes for specified topics
- Regular review of students by asking questions based on topics covered in the class

COURSE CONTENTS

UNIT -1- (08 HOURS)

ELEMENTS OF HELICOPTER AERODYNAMICS; Configurations based on torque reaction-Jet rotors and compound helicopters- Methods of control — Collective and cyclic pitch changes - Lead - Lag and flapping hinges.

UNIT -2- (08 HOURS)

IDEAL ROTOR THEORY: Hovering performance - Momentum and simple blade element theories - Figure of merit - Profile and induced power estimation - Constant chord and ideal twist rotors.

UNIT -3- (08 HOURS)

POWER ESTIMATES: Induced, profile and parasite power requirements in forward flight-Performance curves with effects of altitude- Preliminary ideas on helicopter stability

UNIT -4- (08 HOURS)

LIFT, PROPULSION AND CONTROL OF V/STOL AIRCRAFT: Various configuration - Propeller, rotor, ducted fan and jet lift - Tilt wing and vectored thrust - Performance of VTOL and STOL aircraft in hover, transition and forward motion.

UNIT -5- (07 HOURS)

GROUND EFFECT MACHINES: Types - Hover height, lift augmentation and power calculations for plenum chamber and peripheral jet machine - Drag of hovercraft on land and water. Applications of hovercraft.

TEXT BOOKS

Sl.no	Title of the Book	Name of the Author/s	Name of the Publishers	Edition and Year
1	Aerodynamics of Helicopter	Gessow, A., and Myers, G, C	Macmillan & Co., N.Y.	1987
2	Aerodynamics of V/STOL Flight	McCormick, B,W.,	Academic Press	1987

REFERENCE BOOKS'

Sl.no	Title of the Book	Name of the Author/s	Name of the Publishers	Edition and Year
1	Helicopter Theory	Johnson, W	Princeton University Press	1980.
2	Aerodynamics, Aeronautics and Flight Mechanics	McCormick, B, W	John Wiley	2^{nd} Edition,1995
3	Helicopter Engineering	Gupta, L	Himalayan Books	1996

ONLINE RESOURCES	Link
NPTEL	https://nptel.ac.in/courses/101/104/101104017/
MIT OCW	https://www.youtube.com/watch?v=OlQie93CwLY

COURSE ASSESSMENT METHOD

Continuous Internal Evaluation (CIE)

Three internals tests (each 30 marks) are conducted, average of best two performances will be considered.

1. Minimum two Assignments/Model making - evaluated through rubrics for 10 marks. Average of two will be considered.
2. Tutorial classes and assessment are carried out/Surprise quiz tests are conducted and evaluated for 10 marks. Average of these two will be considered.

Semester End Examination (SEE)

1. Two Questions are to be set from each unit, carrying 20 Marks each.
2. Students have to answer 5 questions selecting one full question from each unit

Program Outcomes – Articulation matrix:

PO	1	2	3	4	5	6	7	8	9	10	11	12	PSO1	PSO2
CO1	3													3
CO2	3													3
CO3	3													3
CO4	3													3

WIND ENGINEERING

Course Code	18AEE827		**Credits**	3
Hours/Week (L-T-P)	3		**CIE Marks**	50
Total Hrs	39		**SEE Marks**	50
Exam Hrs	3		**Course Type**	Program Elective

COURSE OUTCOMES

Course outcomes: After completion of the course, students will be able to-

1. Describe the atmospheric motion and classify terrains.
2. Compute properties of atmospheric boundary layer.
3. Examine oscillatory flow patterns and turbulent flow
4. Analyze the wind loading characteristics.
5. Analyze wind structure interaction

TEACHING METHODOLOGY

- Blackboard teaching/PowerPoint presentation (if needed)
- Hands on sessions

COURSE CONTENTS

UNIT -1- (08 HOURS)

THE ATMOSPHERE

Atmospheric Circulation – Stability of atmospheres – definitions & implications – Effects of friction – Atmospheric motion – Local winds, Building codes, Terrains different types.

UNIT -2- (08 HOURS)

ATMOSPHERIC BOUNDARY LAYER

Governing Equations – Mean velocity profiles, Power law, logarithmic law wind speeds, Atmospheric turbulence profiles – Spectral density function – Length scale of turbulence, Roughness parameters simulation techniques in wind tunnels.

UNIT -3- (08 HOURS)

BLUFF BODY AERODYNAMICS

Governing Equations – Boundary layers and separations – Wake and Vortex formation two dimensional – Strouhal Numbers, Reynolds numbers – Separation and Reattachments Oscillatory Flow patterns Vortex sheding flow switching – Time varying forces to wind velocity in turbulent flow – Structures in three dimensional

UNIT -4- (08 HOURS)

WIND LOADING

Introduction, Analysis of loading coefficients, local & global coefficients pressure shear stress coefficients, force and moment coefficients – Assessment methods – Quasi steady method – Peak factor method – Extreme value method

UNIT -5- (07 HOURS)

AEROELASTIC PHENOMENA

Vortex shedding and lock in phenomena in turbulent flows, across wind galloping wake galloping - Torsional divergence, along wind galloping of circular cables, cross wind galloping of circular cables, Wind loads & their effects on tall structures – Launch vehicles.

TEXT BOOKS

Sl.no	Title of the Book	Name of the Author	Name of the Publishers	Edition and Year
1	Wind effects on structures - fundamentals and applications to design,	Emil Simiu & Robert H Scanlan	John Wiley & Sons Inc New York,	1996.
2	Aerodynamics Imperial College	Tom Lawson Building	Press London,	2001

REFERENCE BOOKS'

Sl.no	Title of the Book	Name of the Author	Name of the Publishers	Edition and Year
1	Design Guides to wind loading of buildings structures Part I & II.	N J Cook,	Butterworths London,	1985
2	IS: 875 Part III Wind loads, Indian Standards for Building codes			1987

ONLINE RESOURCES	Link
NPTEL	https://nptel.ac.in/content/storage2/courses/121106014/Week8/lecture24.pdf
MIT OCW	https://ocw.mit.edu/courses/edgerton-center/ec-711-d-lab-energy-spring-2011/wind-micro-hydro/

COURSE ASSESSMENT METHOD

Continuous Internal Evaluation (CIE)

Three internals tests (each 30 marks) are conducted, average of best two performances will be considered.

1. Minimum two Assignments/Model making - evaluated through rubrics for 10 marks. Average of two will be considered.
2. Tutorial classes and assessment are carried out/Surprise quiz tests are conducted and evaluated for 10 marks. Average of these two will be considered.

Semester End Examination (SEE)

1. Two Questions are to be set from each unit, carrying 20 Marks each.
2. Students have to answer 5 questions selecting one full question from each unit

Program Outcomes – Articulation matrix:

PO	1	2	3	4	5	6	7	8	9	10	11	12	PSO1	PSO2
CO1	3	3												2
CO2	3	3												2
CO3	3	3												2
CO4	3	3												2
CO-5	3	3												2

FLIGHT TESTING				
Course Code	18AEE828		**Credits**	3
Hours/Week (L-T-P)	3-0-0		**CIE Marks**	50
Total Hrs	39		**SEE Marks**	50
Exam Hrs	3		**Course Type**	Program Elective

COURSE OUTCOMES

Course outcomes: After completion of the course, students will be able to-

1. Identify the purpose, scope and working of various instruments employed for flight-testing.
2. Examine the performance of flight at different operating conditions
3. Illustrate the stability and control aspects at various flight condition
4. Explain the various regulations and recovery techniques

TEACHING METHODOLOGY

- Blackboard teaching/PowerPoint presentation (if needed) /Flipped Classes for specified topics
- Videos and animation

COURSE CONTENTS

UNIT -1- (08 HOURS)

Introduction: Purpose and scope of flight-testing, basic definition, types of flight tests, sequence of flight testing, planning the test program, governing regulations. Aircraft weight and center of gravity, flight testing tolerances. Method of reducing data uncertainty in flight test data -sources and magnitudes of error, avoiding and minimizing errors.

UNIT -2- (08 HOURS)

Flight Test Instrumentation: Planning flight test instrumentation, sensing and transducing techniques. Measurement of linear and angular displacements, velocities and accelerations, vibration, force, temperature - onboard and ground based data acquisition system. Radio telemetry

UNIT -3- (08 HOURS)

Performance Flight Testing - Range, Endurance and Climb: Airspeed – in flight calibration. Level flight performance for propeller driven aircraft and for Jet aircraft - Techniques and data reduction. Range and endurance estimation of propeller and jet aircraft. Climb performance methods.

Performance Flight Testing -Take-Off, Landing, Turning Flight: Turning performance limitati
Drag estimation. Take-off and landing - methods, procedures and data reduction

UNIT -4- (08 HOURS)

Stability and Control - Longitudinal and Manoeuvring: Flight test Methods: Static longitudinal stability; Dynamic longitudinal stability. Data reduction. Maneuvering stability methods & data reduction.

Stability and Control - Lateral & Directional: Flight Test methods: - Lateral and directional static stability: Lateral and directional dynamic stability. Regulations and data reduction.

UNIT -5- (07 HOURS)

Flying Qualities: MIL and FAR regulations. Cooper-Harper scale. Pilot rating .Flight test procedures.
Hazardous Flight Testing: Stall and spin- regulations, test and recovery techniques. Dive testing for flutter, vibration and buffeting.

TEXT BOOKS

SL.NO	Title of the Book	Name of the author/s	Name of the publisher	Edition and year
1	Flight Testing of Fixed Wing Aircraft	.Ralph D Kimberlin	AIAA educational Series	2003

REFERENCE BOOKS'

SL.NO	Title of the Book	Name of the author/s	Name of the publisher	Edition and year
1	Flight Test Manual	AGARD,	Vol. I to IV	

ONLINE RESOURCES	Link
NPTEL	https://nptel.ac.in/courses/101/104/101104066/
NPTEL	https://nptel.ac.in/courses/101/106/101106042/

COURSE ASSESSMENT METHOD

Continuous Internal Evaluation (CIE)

Three internals tests (each 30 marks) are conducted, average of best two performances will be considered.

1. Minimum two Assignments/Model making - evaluated through rubrics for 10 marks. Average of two will be considered.
2. Tutorial classes and assessment are carried out/Surprise quiz tests are conducted and evaluated for 10 marks. Average of these two will be considered.

Semester End Examination (SEE)

1. Two Questions are to be set from each unit, carrying 20 Marks each.
2. Students have to answer 5 questions selecting one full question from each unit

Program Outcomes – Articulation matrix:

PO	1	2	3	4	5	6	7	8	9	10	11	12	PSO1	PSO2
CO1	3													2
CO2	3													2
CO3	3													2
CO4	3													2

MAJOR PROJECT WORK				
Course Code	18AEP83		**Credits**	10
Hours/Week (L-T-P)	3-0-0		**CIE Marks**	50
Total Hrs	36		**SEE Marks**	50
Exam Hrs	3		**Course Type**	Core

COURSE OUTCOMES

Course outcomes: After completion of the course, students will be able to-

1. Identify and define the problem for the project work
2. Apply the knowledge acquired to analyze and estimate the cost and time
3. Examine and use appropriate tools to solve the defined problem in a team
4. Develop an end product and prepare a technical report/paper

COURSE CONTENTS

The goal of the project work is to learn and apply scientific methods to problems, including the necessary documentation. The duration amounts to one semester.
The characteristic phases of the scientific work are:

1. Analyzing the defined problem
2. Determining the existing solutions
3. Proposing new solutions
4. Arriving at for the best solution
5. Writing an elaborate report based on the results achieved
6. Making suggestions for further work

The project work shall be on a topic in the area specified by the guide and/or identified by the student. The students will be divided into different batches; each batch consisting of 2-4 students. The project work will be carried out under the supervision of an internal guide. On completion of the project work,
the batch will prepare a report as per the guidelines and submit to the authority concerned for evaluation and certification.
The students are supposed to finalize the topic of the project work at the beginning of the 6th semester.
The work will be done in different phases as follows:

1. Literature survey
2. Progress of the project
3. Final Presentation

Each phase of the work will be assessed by a project committee and suggestions called for if any will be advised.

COURSE ASSESSMENT METHOD

For the final year project and Viva – Voce end semester examination, the student shall submit a Project Report in the prescribed format issued by the Institute. The first three reviews will be conducted by a Committee constituted by the Head of the Department. The end – semester assessment will be based on the project report and a viva on the project conducted by a Committee constituted by the Registrar / Controller of examination. This may include an external expert.
For final year Project / Dissertation the assessment will be done on a continuous basis as given below table.

Sl No.	Review / Examination scheme	Weightage
1	First Review	10%
2	Second review	10%
3	Third review	20%
4	Project report and Viva – Voce	50%

Program Outcomes – Articulation matrix:

PO	1	2	3	4	5	6	7	8	9	10	11	12	PSO1	PSO2
CO1	3	3	3	3	3	2	2	2	3	3	3	3	3	3
CO2	3	3	3	3	3	2	2	2	3	3	3	3	3	3
CO3	3	3	3	3	3	2	2	2	3	3	3	3	3	3
CO4	3	3	3	3	3	2	2	2	3	3	3	3	3	3

NITTE MEENAKSHI INSTITUTE OF TECHNOLOGY

(An Autonomous Institute, Affiliated to VTU, Belagavi)

DEPARTMENT OF MANAGEMENT STUDIES

Outcome Based Education Curriculum
(For the Academic year 2020 - 2022)

I to IV SEMESTER - MBA

Nitte Meenakshi Institute of Technology
Yelahanka, Bengaluru – 560 064.

Approved Scheme and Syllabus of I, II, III & IV Semester MBA

(2020-2022)

About the Institution:

Nitte Meenakshi Institute of Technology (NMIT) is an Autonomous Institution affiliated to the Visvesvaraya Technological University (VTU), with the approval of UGC
NMIT got accredited by the National Board of Accreditation [NBA] under Tier-1 status (for 4 Programs) and Grade-A status by National Assessment and Accreditation Council [NAAC - UGC].

It is the youngest engineering college in the country to be conferred the prestigious Autonomous Status by UGC/Govt. of Karnataka, New-Delhi in the year 2007 and the only unaided private engineering college in Karnataka State to be selected by the Govt. of India for World Bank Funding under TEQIP Phase II-Subcomponent 1.1 in the year 2011.

The institution has a strong focus on excellence in education, research and promotion of Innovation and entrepreneurship. Innovation and Entrepreneurship Development Centre was established in the year 2010 and funded (to the tune of Rs. 45 lakhs) by the Department of Science and Technology (NSTEDB), New Delhi.

NMIT has established Business Incubator supported by MSME (Micro, Small and Medium Enterprises), Govt. of India and also an Innovation Club supported by Visvesvaraya Technological University and Govt. of Karnataka with seed money of Rs 5Lakhs. Some of the prominent sponsored projects sanctioned by different reputed National Funding Agencies such as DST, DIT, AICTE, DRDO Labs, VGST, IEEE, VTU etc

NMIT is a unique institution which has established five multi-disciplinary research centres viz for Small Satellites, Robotics, Nanomaterial & MEMS, Computational Fluid Dynamics and Design Engineering & Process Simulation. It is also the first college in India to introduction of Robotics Engineering-Lego Mindstorms and TETRIX Course with Laboratory for II Year B.E Students in AY 2015-16. The course is on the lines of few US/European Universities.

It is recognised by ISRO as a Centre for Small Satellite Research (CSSR) for undertaking collaborative research on space technology and satellite development. NMIT has led a consortium that designed and built STUDSAT-1, a satellite of PICO category. Launched by ISROs PSLV-C15 on 12 July 2010. This success is listed in the Limca Book of records. NMIT has a unique Scheme of Deputing UG Students to Industry, R&D Organizations, IISc, IITs and NID for a minimum period of 6 weeks internship leading to academic credits.

NMIT offers wide range of academic programs comprising of seven UG and eight PG programs in Engineering besides MBA and MCA. Ten Departments of NMIT offer doctoral programs of VTU / Mysore University.

Highly qualified and experience faculty comprising 55+Ph.Ds primarily from IISc, IITs & NITs. An additional 60+ Faculty are pursuing Ph.Ds in different research centers of NMIT as well as in other Institutions of eminence.

NMIT has well equipped laboratories with more than 1600+ computers. NMIT has advanced software, library resources and high speed Internet connectivity 100 Mbps (leased line - 1:1).
NMIT is identified as Regional Nodal Centres of IIT-B/ IIT-KGP for faculty development programs under National Mission on Education through ICT (NMEICT), under MHRD, Govt. of India.

NMIT has an active and dynamic Training and Placement cell. The Placement cell successful attracted a large number of reputed well known organizations for on-campus placement. The Placement cell conducts programs to improve the background and competence of students by enhancing soft skills / analytical abilities / problem solving capabilities/ attitudinal and leadership qualities.

About the Department:

Having successfully launched its engineering programs in 2001, NMIT established its MBA program in 2004, affiliated to Visvesvaraya Technological University and approved by AICTE. The program became a notable success within a short span of time. Today NMIT's MBA program stands out amidst other MBA programs in quality of pedagogy, curriculum, learning environment, academic life, and infrastructure and placement results. What clearly distinguishes NMIT's program from others is the quality and diligence of faculty and administration in enhancing the students' learning experience. Starting with an intake of 40 students in 2004, the MBA program has now matured into a well-respected and well-received program with an approved intake of 120 students. We are proud of diversity in the student's enrolments and faculty recruitments.

During the first year of the MBA program, students learn the basic principles of business management and core courses in Marketing, Finance, and Human Resources as well as Quantitative Techniques. During the second year of the program, students specialize in two areas that include Finance, Human Resources, Marketing, Supply chain management and Business Analytics. Between the third and fourth semesters, students embark on a project in their area of specialization and complete it in the fourth semester. Placement interviews commence at the end of the third semester.

In addition to the MBA program, the Department of Management Studies offers several additional programs such as SPSS, ISO Certification programs (IRCA approved), Six Sigma Certification programs (Govt. Of .India, Ministry of MSME approved), Aptitude and Soft-Skills sessions from T.I.M.E.S, FDPs, MDPs, EDPs and Workshops on current management topics. A one day MDP on Case Analysis has been conducted during odd semester in addition to a two days workshop on management skills will be offered for our students in their even semester.
The department undertakes industry-sponsored research projects and consulting engagements. Very recently, the department has made an academic partnership with IIMBx, a MOOC offered by the prestigious Indian Institute of Management, Bangalore. MOOC on strategic management for sustainability and financial markets (beginning from the coming academic year) will be offered by IIMBx to the students for a duration of two months through proctored examinations.

The Department offers industry specific and function specific programs at various stages in their professional career. The Department is an approved/recognized centre by Visvesvaraya Technological University, Belagavi and University of Mysore, Mysore for guidance of Ph.D scholars.

Apart from regular class room teaching and continuous evaluation of students, our faculty members are actively engaged in a wide-spectrum of activities ranging from student's mentoring, administrative tasks at the Departmental, Institutional and University levels, guiding Project Works, advising students in the conduct of extra-curricular and co-curricular activities, being in touch with the industry, communicating with the alumni, attending conferences, workshops, seminars, MDPs and FDPs, conducting FDPs and pursuing research with focused goals. In-house training programs for faculty and "Research Colloquium Series" are conducted regularly to enhance analytical skills of faculty and research scholars.

BOARD OF STUDIES MEMBERS (2020-22)

Sl. No.	Name	Designation	Organization	Position
1	Dr. S Harish Babu	Professor & HoD	NMIT	ChairPerson
2	Dr. P.V Raveendra	Professor & HoD.	Ramaiah Institute of Technology, Bengaluru	VTU Nominee
3	Dr. DNS Kumar	Vice chancellor	Ansal University, Gurgaon	Member (Academician) Nominated by Academic Council
4	Dr.M.Jayadev	Professor	Indian Institute of Management Bangalore	Member (Academician) Nominated by Academic Council
5	Mr. Ravi Omkari	Former Associate Vice President	HSBC, Bangalore	Member (Industry) Nominated by Academic Council
6	Mr. Aditya Hegde	Head – Finance	Reliable Holdings Limited Bangalore	Member (Alumni) Nominated by the Principal
7	Dr. Shilpa Ajay	Associate Professor	NMIT	Member
8	Dr.Malini.T.N	Associate Professor	NMIT	Member
9	Dr. Eti Khatri	Associate Professor	NMIT	Member
10	Mr.Kiran Kumar.N	Associate Professor	NMIT	Member
11	Ms. Arpitha M.P	Assistant Professor	NMIT	Member Secretary

Vision, Mission and Quality Policy of NMIT:

Vision:
To excel in management education, research and engagement thereby developing ideas and leaders that transforms the society.

Mission:
To develop Nitte Meenakshi Institute of Technology through Quality, Innovative and State-of-art educational initiatives into a centre of academic excellence that will turn out youth with well-balanced personality & commitment to rich cultural heritage of India and who will successfully face the Scientific and Technological challenges in the fast-evolving Global scenario with a high degree of credibility, integrity and ethical standards.

Quality Policy:
To bring about constant and Continuous Improvement in the Quality of Education Imparted and Turning out High Quality Professionals with Balanced and Globally Competitive Personality through Regular Monitoring of the Academic/ Administrative Activities of the Institution and Implementing Corrective Actions in the Best Ethical and Transparent Traditions.

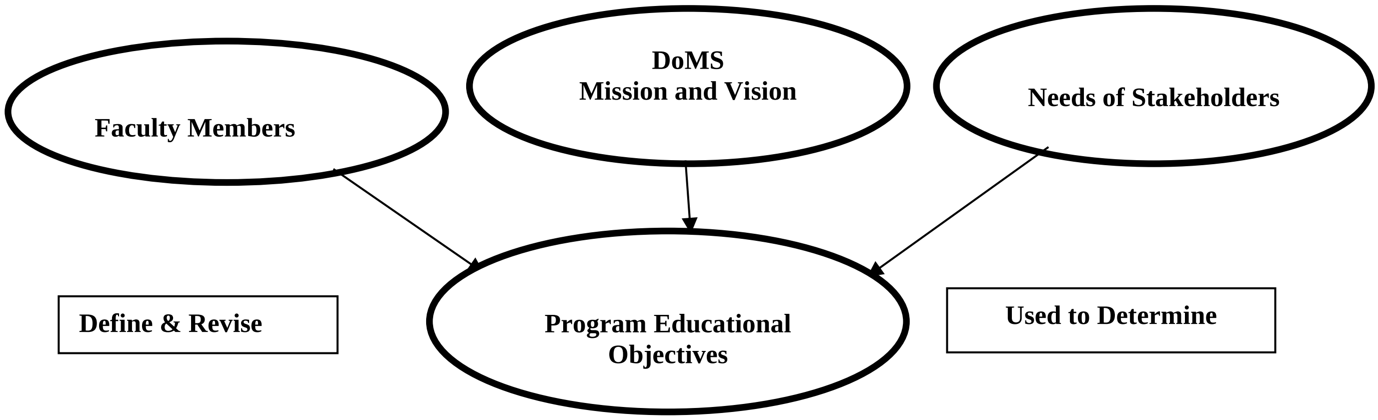
Vision and Mission of the Department of Management Studies (MBA):

Vision:
To become a top-notch management institute recognized internationally for its excellence in creation of an intellectual capital of high thinking management professionals, entrepreneurs and socially responsible citizens.

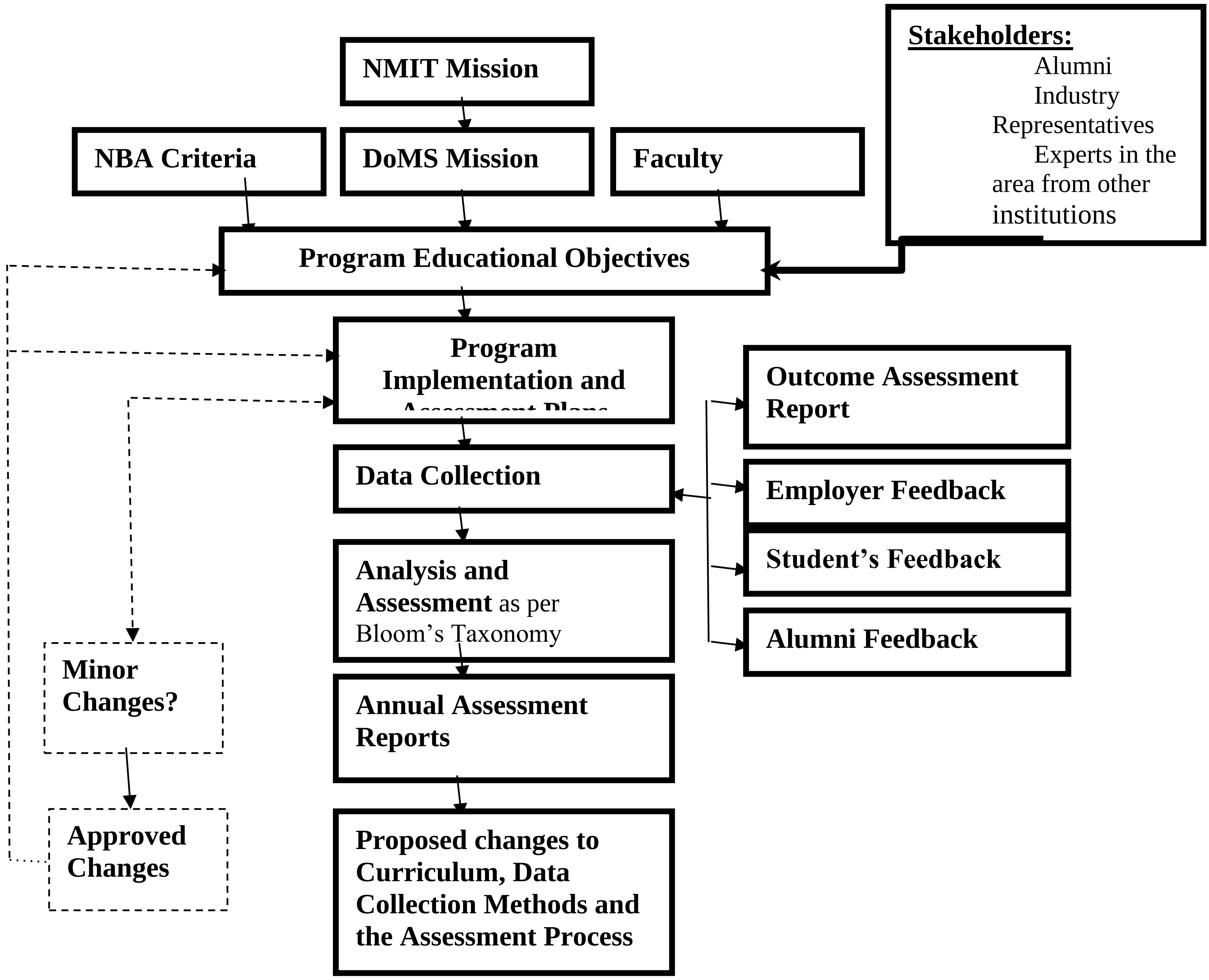
Mission:

- To nurture the future business leaders through imparting high quality value-based learning, research and practical based training that meets industry expectations.
- To foster a passion for learning and creative thinking among the student and teaching community.
- To prepare management professionals with global mindset having high professional competence, outstanding leadership qualities and impeccable personal integrity.

Development of Program Educational Objectives:



Process of Deriving the Program Educational Objectives (PEOs)



PEOs of the Program offered:

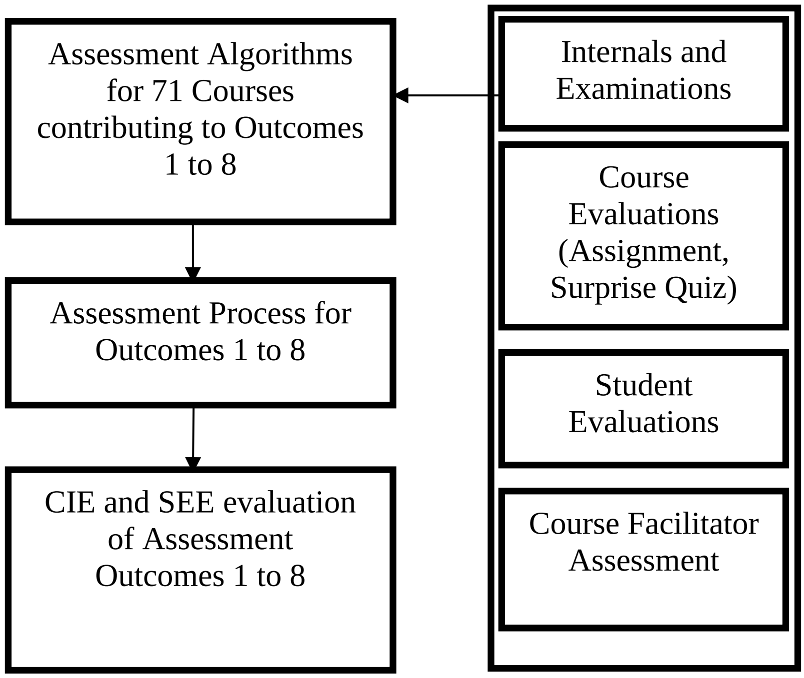
PEO-1: Post Graduate students of the program will contribute to the creation, transmission and application of knowledge in the field of management

PEO-2: Post Graduate students of the program will be equipped with quantitative and qualitative skills to identify, analyze, design and create business opportunities in a global dynamic environment.

PEO-3: Post Graduates of the program will acquire necessary managerial skills to think strategically and to lead, motivate and manage teams thereby enhancing managerial effectiveness.

PEO-4: Post Graduates of the program will be able to implement corporate governance and societal values in the real life situation with professional ethics.

Process of deriving the Program Outcomes (POs)



POs of the MBA Program offered:

PO.1: Apply knowledge of Management theories and practices to solve business problems.

PO.2: Foster Analytical and critical thinking abilities for data-based decision making.

PO.3: Ability to develop Value based Leadership.

PO.4: Ability to understand, analyze and communicate global, economic, legal, and ethical aspects of business.

PO.5: Ability to lead themselves and others in the achievement of organizational goals, contributing effectively to a team environment.

PO.6: Ability to showcase positive cognition during setbacks and crisis.

PO.7: Ability to promote research skills and their applications in the areas of Management.

PO.8: Promote self-confidence to build excellence in career and business of their choice.

PSOs of the MBA Program offered:

In addition to the above outcomes, the MBA program of NMIT shall demonstrate the following capability defined by the two PSO's.

PSO 1- Possess Skill Set to create, transmit and apply the knowledge in the field of Management through Multidisciplinary approach for societal benefits.

PSO 2- Acquire Managerial skills to successfully lead the organization towards the welfare of stakeholders by considering the current industry/business requirements through case studies, internships and capstone projects.

The correlation between the Program Outcomes and Program Educational objectives are mapped in the Table shown below:

Correlation between the POs and the PEOs

Sl.No	Program Educational Objectives	Program Outcomes							
		PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8
1	Post Graduates of the program will contribute to the creation, transmission and application of knowledge in the field of management	X					X	X	

2	Post Graduates of the program will be equipped with quantitative and qualitative skills to identify, analyze, design and create business opportunities in a global dynamic environment.		X		X	X			X
3	Post Graduates of the program will acquire necessary managerial skills to think strategically and to lead, motivate and manage teams thereby enhancing managerial effectiveness			X		X	X		X
4	Post Graduates of the program will be able to implement corporate governance and societal values in the real life situation with professional ethics.			X	X				

Curriculum Mapping

Sl.No	Course	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
1	**Management and Organization Behavior**	X	X	X	X	X			
2	**Economics for Managers**	X	X		X				
3	**Accounting for Managers**	X	X						X
4	**Marketing Management**				X	X	X	X	X
5	**Statistics for Managers**	X	X				X		
6	**Business Communication**		X		X	X			X
7	**Entrepreneurship development.**	X			X		X		X
8	**Seminar-I**	X		X	X				
9	**Business Research Methods**	X	X	X	X	X	X		
10	**Financial Management**		X		X	X	X	X	X
11	**Information Technology for Managers**	X	X	X	X	X	X	X	X
12	**Operations Research**	X	X	X	X	X	X		
13	**Business Law**	X		X	X		X		X
14	**Human Resource Management**	X	X		X				
15	**Strategic Management**	X	X		X			X	
16	**Seminar-II**	X		X	X			X	
17	**Organization study**	X	X		X			X	X
18	**Employee Staffing Management (D)**		X		X				
19	**Performance and Compensation Management (D)**	X		X		X	X	X	X

20	**Personal Growth and Interpersonal Effectiveness (D)**		X		X	X	X		X
21	**Conflict and Negotiation Management**	X				X			
22	**Talent Management**	X		X					
23	**Advanced HRM**	X		X			X		X
24	**Industrial Relation and Labor Laws (D)**		X		X			X	
25	**International HRM (D)**	X			X	X			
26	**Employee Training and Development (D)**		X		X	X	X	X	X
27	**Ethics at Workplace**	X		X	X				
28	**Organization Structure, Process and Design**	X	X		X				
29	**OD and Change Managemen t**	X	X			X			
30	**Consumer Behavior (D)**	X	X						
31	**Sales and Retail Management (D)**	X	X	X	X	X	X	X	X
32	**E-Marketing (D)**	X	X	X	X	X	X	X	X
33	**Business Marketing**	X	X		X				
34	**Strategic Brand Management**	X	X		X				
35	**Green Marketing**	X	X	X	X	X	X	X	X
36	**Integrated Marketing Communications (D)**	X	X	X	X	X	X	X	X
37	**International Marketing Management (D)**	X	X	X	X	X	X	X	X
38	**Service Marketing (D)**	X	X	X	X	X	X	X	X
39	**Rural Marketing**	X	X		X				
40	**Digital Marketing**		X	X	X	X	X	X	X
41	**Customer Relationship Management**	X	X	X	X	X	X	X	X
42	**Investment Analysis and Portfolio Management (D)**	X	X	X	X		X		
43	**Banking and Financial Services (D)**	X	X		X		X		X
43	**Direct Taxation (D)**	X	X		X	X	X		X

45	**Cost Manage ment**	**X**	**X**	**X**	**X**				**X**
46	**Micro Finance**	**X**	**X**		**X**	**X**			**X**
47	**Business Valuation Analysis**	**X**	**X**		**X**		**X**		**X**
48	**International Financial Management (D)**	**X**	**X**		**X**	**X**	**X**		**X**
49	**Financial Derivatives and Insurance (D)**	**X**	**X**	**X**	**X**			**X**	**X**
50	**Goods and Service Tax (D)**	**X**	**X**	**X**	**X**			**X**	**X**
51	**Advanced Financial Management**	**X**	**X**		**X**		**X**		**X**
52	**Strategic Credit Management**	**X**	**X**		**X**		**X**	**X**	**X**
53	**Project Appraisal, Planning and Control**	**X**	**X**	**X**		**X**	**X**		**X**
54	**Supply Chain and Logistics Management (D)**	**X**	**X**	**X**					
55	**Information System in SCM (D)**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**
56	**Operations Management (D)**		**X**		**X**				
57	**Freight Transport System**	**X**	**X**		**X**	**X**			**X**
58	**Enterprise Resource Planning**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**
59	**Retail Supply chain Management**	**X**	**X**	**X**					
60	**Global Supply Chain and Logistic Management(D)**	**X**	**X**		**X**				
61	**Logistics and Warehouse Management (D)**		**X**		**X**				
62	**Strategic Procurement and Quality Management (D)**	**X**	**X**	**X**	**X**		**X**		**X**
63	**Internet Technology and SCM**	**X**	**X**	**X**	**X**		**X**	**X**	**X**
63	**Customer Relationship Management**		**X**		**X**	**X**		**X**	
64	**E-Marketing**	**X**	**X**		**X**				
65	**Introduction to Data Management**		**X**		**X**				
66	**Data Mining Techniques with R**		**X**	**X**	**X**				

67	**Applied Business Statistics and Data Visualization**		**X**		**X**				
68	**Advanced Analytics**		**X**						
69	**Marketing Analytics**		**X**		**X**				
70	**Supply chain Analytics**		**X**	**X**	**X**				
71	**Capstone Project**	**X**	**X**	**X**	**X**	**X**	**X**		

Curriculum breakdown structure:

The curriculum of MBA is so structured to include all the courses and subjects to satisfy the requirements of a comparable MBA program at the National and International level. The course code, course title, the number of contact hours and number of credit for each course are given in the following table. The courses are grouped in the major components of the curriculum namely professional core courses, electives and specialization courses, Industry exposure and project work, seminar and soft skills for employability.

Break up of Credits for the MBA Degree Curriculum 2020 – 2022:

Sl. No.	**Sem**	**Total No of subjects**	**Core / Elective / Seminar / Lab / Project Work & Internship**	**Credit Distribution**		**Total Credits**	**Total Credits for Semester**
				Credits	**No. of Subjects**		
1	I	7	7 core	3	5	15	**25**
				4	2	8	
			Seminar-I	2		2	
2	II	7	7 Core	3	5	15	**25**
				4	2	8	
			Seminar-II	2		2	
3	III	6	6 Electives	3	6	18	**22**
			1 Organization Study and Internship Project	4		4	
4	IV	6	6 Electives	3	6	18	**28**
			1 Project Work	10		10	
TOTAL CREDITS							**100**

Note: *The student must earn a total of 100 credits for the award of MBA Degree. Hence, the student must choose electives for a total of 36 credits spread over semesters III and IV.*

Scheme of Teaching I Semester MBA 2020 – 2022:

Sl. No.	Subject code	Name of the subject	No. of Credits	Exam Duration Hours	Max Marks CIE	Max Marks SEE
1	20MBA101	Management and Organization Behavior	03	03	50	50
2	20MBA102	Economics for Managers	03	03	50	50
3	20MBA103	Accounting for Managers	04	03	50	50
4	20MBA104	Marketing Management	03	03	50	50
5	20MBA105	Statistics for Managers	04	03	50	50
6	20MBA106	Business Communication	03	03	50	50
7	20MBA107	Entrepreneurship development.	03	03	50	50
8	20MBA108	Seminar-I	02		50	50
		TOTAL	**25**			

Scheme of Teaching II Semester MBA 2020 – 2022:

Sl. No.:	Subject code	Name of the subject	No. of Credits	Exam Duration Hours	Max Marks CIE	Max Marks SEE
1	20MBA201	Business Research Methods	03	03	50	50
2	20MBA202	Financial Management	04	03	50	50
3	20MBA203	Information Technology for Managers	03	03	50	50
4	20MBA204	Operations Research	04	03	50	50
5	20MBA205	Business Law	03	03	50	50
6	20MBA206	Human Resource Management	03	03	50	50
7	20MBA207	Strategic Management	03	03	50	50
8	20MBA208	Seminar-II	02		50	50
		TOTAL	**25**			

Scheme of Teaching III Semester MBA 2020– 2022:

Sl. No.:	Subject code	Name of the subject	No. of Credits	Exam Duration Hours	Max Marks CIE	Max Marks SEE
1		Elective 1	03	03	50	50
2		Elective 2	03	03	50	50
3		Elective 3	03	03	50	50
4		Elective 4	03	03	50	50
5		Elective 5	03	03	50	50
6		Elective 6	03	03	50	50
8	20MBA307	Organization Study and Internship Project	04		50	50
		TOTAL	**22**			

Note:

A student taking single specialization has to choose 6 subjects in III semester

A student taking dual specialization has to choose 3 dual subjects from each specialization in III semester

Scheme of Teaching IV Semester MBA 2020 – 2022:

Sl. No.:	Subject code	Name of the subject	No. of Credits	Exam Duration Hours	Max Marks	
					CIE	SEE
1		Elective 1	03	03	50	50
2		Elective 2	03	03	50	50
3		Elective 3	03	03	50	50
4		Elective 4	03	03	50	50
5		Elective 5	03	03	50	50
6		Elective 6	03	03	50	50
7	20MBA407	Project and Viva-Voce	10		50	50
		TOTAL	**28**			

Note:

- *A student taking single specialization has to choose 6 subjects in IV semester*
- *A student taking dual specialization has to choose 3 dual subjects from each specialization in IV semester*

List of Electives – Human Resource Management

	Name of the subject	No. of Credits
III Semester		
20MBAHR301	Employee Staffing Management (D)	03
20MBAHR302	Performance and Compensation Management (D)	03
20MBAHR303	Personal Growth and Interpersonal Effectiveness (D)	03
20MBAHR304	Conflict and Negotiation Management	03
20MBAHR305	Talent Management	03
20MBAHR306	Advanced HRM	03
IV Semester		
20MBAHR401	Industrial Relation and Labor Laws (D)	03
20MBAHR402	International HRM (D)	03
20MBAHR403	Employee Training and Development (D)	03
20MBAHR404	Ethics at Workplace	03
20MBAHR405	Organization Structure, Process and Design	03
20MBAHR406	OD and Change Management	03

Note: *Dual subjects are specified by (D)*

List of Electives – Marketing

Subject code	Name of the subject	No. of Credits
III Semester		
20MBAMM301	Consumer Behavior (D)	03
20MBAMM302	Sales and Retail Management (D)	03
20MBAMM303	E-Marketing (D)	03
20MBAMM304	Business Marketing	03
20MBAMM305	Strategic Brand Management	03
20MBAMM306	Green Marketing	03
IV Semester		

20MBAMM401	Integrated Marketing Communications (D)	03
20MBAMM402	International Marketing Management (D)	03
20MBAMM403	Service Marketing (D)	03
20MBAMM404	Rural Marketing	03
20MBAMM405	Digital Marketing	03
20MBAMM406	Customer Relationship Management	03

Note: *Dual subjects are specified by (D)*

List of Electives - Finance

Subject code	Name of the subject	No. of Credits
	III Semester	
20MBAFM301	Investment Analysis and Portfolio Management (D)	03
20MBAFM302	Banking and Financial Services (D)	03
20MBAFM303	Direct Taxation (D)	03
20MBAFM304	Cost Management	03
20MBAFM305	Micro Finance	03
20MBAFM306	Business Valuation Analysis	03
	IV Semester	
20MBAFM401	International Financial Management (D)	03
20MBAFM402	Financial Derivatives and Insurance (D)	03
20MBAFM403	Goods and Service Tax (D)	03
20MBAFM404	Advanced Financial Management	03
20MBAFM405	Strategic Credit Management	03
20MBAFM406	Project Appraisal, Planning and Control	03

Note: *Dual subjects are specified by (D)*

List of Electives in Supply Chain Management

Subject Code	Name of the subject	No.of. Credits
	III Semester	
20MBASC301	Supply Chain and Logistics Management (D)	03
20MBASC302	Information System in SCM (D)	03

20MBASC303	Operations Management (D)	03
20MBASC304	Freight Transport System	03
20MBASC305	Enterprise Resource Planning	03
20MBASC306	Retail Supply chain Management	03
	IV Semester	
20MBASC401	Global Supply Chain and Logistic Management(D)	03
20MBASC402	Logistics and Warehouse Management (D)	03
20MBASC403	Strategic Procurement and Quality Management (D)	03
20MBASC404	Internet Technology and SCM	03
20MBASC405	Customer Relationship Management	03
20MBASC406	E-Marketing	03

Note: *Dual subjects are specified by (D)*

List of Electives in Business Analytics.

Subject Code	Name of the subject	No.of. Credits
	III Semester	
20MBASC301	Introduction to Data Management (D)	03
20MBASC302	Data Mining Techniques with R (D)	03
20MBASC303	Applied Business Statistics and Data Visualization (D)	03
	IV Semester	
20MBASC401	Advanced Analytics(D)	03
20MBASC402	Marketing Analytics (D)	03
20MBASC403	Supply chain Analytics (D)	03

Note: *Dual subjects are specified by (D)*

I SEMESTER

Subject	**MANAGEMENT and ORGANIZATION BEHAVIOUR**		
Subject Code	**20MBA101**		
Credits	3:0:0	**CIE Marks**	50
Total No. of Lecture Hours	39	**SEE Marks**	50

Course Objectives:

1. To help the students gain understanding of the functions and responsibilities of the manager, provide them tools and techniques to be used in the performance of managerial job.
2. To enable them to analyze and understand the environment of the organization
3. To assist students in understanding the field of organizational behavior and its applications in managing corporate human resources.
4. To create awareness about group dynamics at workplace
5. To appraise the students on the application oriented case studies on functions of management and behavioral processes.

Course Outcomes: At the end of the course, the students will be able to:

1. Demonstrate their conceptual skills, understanding and application of principles and functions of management.
2. Demonstrate an ability to understand the dynamics of functions of management and offer creative solution to business problems
3. Identify key theoretical aspects and practical applications of organizational and individual behavior.
4. Understand and leverage one's own traits and OB competencies for success in the modern workplace and in life and develop as a potential organizational leader.

FOUNDATIONS OF MANAGEMENT

Unit I: **(8 Hours)**

Management – Introduction: Definition of management, nature, purpose and functions, level and types of management, Managerial Roles and Skills, Key personal characteristics for Managerial success. Evolution and various schools to management thoughts, Characteristics of 21st century Executives.

Unit II: **(8 Hours)**

Planning: Meaning and nature of planning, types of plans, steps in planning process; MBO, Decision making.
Organizing: Organizing as managerial function – organization structure.
Staffing: meaning, nature, importance, elements of staffing process.
Controlling – Control function in management, the basic control process. Types of control. Factors in control effectiveness.

TEXT BOOKS:

1. Management and Behavioral processes – B.Janakiram and Vijay N Rao – Excel Books, 2009
2. Management-Concepts and Cases-V.S.P.Rao, Excel Books, 2012

REFERENCE BOOKS:

1. Foundations of Management Harold koontz and Heinz Weihrich essentials of management- An International Perspective-Tata Mcgraw hill-2009
2. Management – Stephen P. Robbins, M. Caulter, Pearson, PHI, 9e, 2008.
3 Fundamentals of Management-Stephen P Robbins et all, Pearson Publications, Fifth edition, 2007

ORGANIZATIONAL BEHAVIOUR

Unit III: **(10 Hours)**
Organizational Behavior: Introduction to Organizational Behaviour, definition, historical development, fundamental principles of OB, contributing disciplines, Models of OB, challenges and opportunities, the future of OB.
Individual Behaviors: Introduction, foundation of individual behavior:
Personality: Definition, determinants, personality traits , personality attributes influencing OB.
Perception: Meaning, factors influencing perception, Process of perception, perceptual errors
Attitudes: Definition, sources of attitudes, types of attitudes, relation between attitude and behavior.

Unit IV: **(9 Hours)**
Motivation: Meaning, Theories of motivation
Leadership: Meaning, styles of leadership, leadership theories, transactional and transformation leadership.
Interpersonal Behavior:
Conflict in organization and **Stress Management.**
Group development: Group properties, types of groups, stages in formation of groups,

Unit V: **(4 Hours)**
Case Analysis – Compulsory questions for 20 marks. Review and recap of case studies discussed from unit I to IV

TEXT BOOKS:

1. Organizational Behavior - V.S.P.Rao, Excel Books, 2009.
2. Text Book of Organisational Behaviour Dr.C B Gupta S Chand 2014

REFERENCE BOOKS:

1. 1 Organizational Behavior - Stephen P Robbins, Timothy A. Judge, Seema Sanghi Pearson Education, 12th Edition, PHI, 2009
2. Organizational Behavior, Fred Luthans, 11th edition, Mc-Graw Hill International, 2011
3. Understanding Organizational Behaviour – Uday Parek; Oxford Press, 2011

Mapping Course Outcomes with Program Outcomes:

Course Outcomes	Program Outcomes								PSO	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2
CO1	3								3	
CO2	2	2							3	
CO3	2	1	1							1
CO4			2		1					1

Assessment Pattern Based on Bloom’s Taxonomy:

Sl. No	Bloom’s Category	Test 1	Test 2	Test 3	Assignment	Seminar Surprise Quiz	SEE
1	Remember	10	10	10	5		20

2	**Understand**	**20**	**20**	**20**		**5**	**30**
3	**Apply**	**20**	**10**	**10**			**30**
4	**Analyze**	**20**	**30**	**30**	**10**		**50**
5	**Evaluate**	**20**	**20**	**20**			**50**
6	**Create**						
Total		**90**	**90**	**90**	**15**	**5**	**180**

Curriculum Mapping

Course	**Program Outcomes**							
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**
Management and Behavioral Process	X	X	X		X			

Subject	**ECONOMICS FOR MANAGERS**		
Subject Code	**20MBA102**		
Credits	3:0:0	**CIE Marks**	50
Total No.: of Lecture Hours	39	**SEE Marks**	50

Course Objectives:

1. To make the students familiar with the basic economic concepts & its implications on the business.
2. To make the students to know the various microeconomic aspects to be considered by the manager for effective decision making.
3. To make the students familiar with the current aspects of macro economy and Indian policy system relevant to the business.
4. To make the students understand and analyze the economic policies and global environment for business development.
5. To make the student to understand the infrastructural and human resource capacities in the nation.

Course Outcomes: At the end of the course, the students will be able to:

1. Demonstrate the importance of managerial economics and demand analysis for the business.
2. Apply the concepts market structure, cost concepts and revenue for better business decisions making .
3. Asses the economic environment of the nation and its implication on the business.
4. Understand the economic policies of the nation and can predict the impact on the business environment.
5. Analyze the Indian infrastructure and human resources for the taking appropriate business decisions.

Unit I: **(8 Hours)**

Introduction: Meaning and Definition of Managerial Economics, Nature, Significance of Managerial Economics, Basic concepts of economics, **Demand Analysis:** Demand, Demand determinants – Law of demand, exception to law of demand- Elasticity of demand – price, Income, cross & advertisement elasticity of demand, Demand forecasting-meaning and significance.

Unit II: (9 Hours)

Production and cost: Concepts, Production function, short run & long run production function, return to scale – Law of variable proportion, Iso quant & Iso Cost. Cost Revenue analysis: Concepts, Short & long run cost curve, Economies & diseconomies of scale- Revenue concepts, function and Break even analysis, Uses of **Market structure & pricing:** Perfect competition-features, price determination, Monopoly- Features, types of Monopoly, pricing under monopoly, price discrimination, Oligopoly – Features, Kinked demand curve, Price leadership, Monopolistic competition- features, price determination,

Unit III: (8 Hours)

Introduction: Development of the Indian economy, Factors of economic development, Agriculture, Industry and Services, Open and closed economy.

National Income :Concept, Per capita income, GDP, Measurement of national Income, **Business Cycle:** Meaning, Phases of Business cycle, **Inflation**: Meaning, Types of inflation, Causes, measurement.

Unit IV: (7 Hours)

Business Enterprise Growth and economic reforms: Introduction to Industrial Policy, New Industrial Policy 1991: Introduction to Liberalization, Globalization and privatization.

/ Banking and policy system: Reserve bank of India: Role of reserve bank of India, Monetary Policy: Objectives, tools for credit control. **Fiscal Policy**: Objectives, Instruments, Union Budget.

Unit V: (7 Hours)

Infrastructure: Infrastructure and economic growth, Infrastructure development in India, Transportation Development in India, Energy Resources, Energy Problems India,

Poverty & Inequality: Nature and causes of Poverty, Measures to reduce poverty. Importance of Human resources development - Measures of Human development, Human Development index.

TEXT BOOKS:

1. Managerial Economics, D.N Dwivedi, 6th ed., S Chand Publication, 2017
2. Managerial Economics: A Problem-solving Approach, Wilkinson, Nick,Cambridge University Press, 2005
3. **The Indian Economy**: Environment and Policy – Ishwar C Dhingra – Sultan Chand Publisher, 25 edition, 2010.
4. Development Issues of Indian Economy – Misra & Puri , Himalaya publishing House, Fourth revised Edition.

REFERENCE BOOKS:

1. Managerial Economics – Geetika, Priyanka Gosh, - Tata McGraw Hill. Second Edition, 2011
2. **Indian Economy –** Ruddar Dutt & K P K Sudharam –S.Chand & Company, Fifty first edition.
3. Managerial Economics – Principles and worldwide applications, Dominick Salvatore, 6e, Oxford Publication, 2010

4. Managerial Economics - Paul A. Samuelson and William D. Nordhaus, Economics, Tata McGraw Hill, 10th Edition, 2009
5. Business Economics, ML Jhingan and Upadhyaya, Vrinda Publications, 2004
6. Indian Economy – Ramesh Singh – Tata Mc Graw Hill publishing, 2008

Mapping Course outcome with program outcome:

Course outcome	Program Outcome								PSO	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2
CO1	3								2	
CO2	3	2							2	
CO3				2					2	
CO4				2					2	
CO5		2		2					2	

Assessment Pattern Based on Bloom's Taxonomy:

Sl. No.:	Bloom's Category	Test 1	Test 2	Test 3	Assignment	Seminar Surprise Quiz	SEE
1	Remember	20	20	20			30
2	Understand	20	20	20	5		35
3	Apply	25	25	25	5		45
4	Analyze	25	25	25		10	45
5	Evaluate	10	10	10			45
6	Create						
Total		**100**	**100**	**100**	**10**	**10**	**200**

Curriculum Mapping

Course	Program Outcomes							
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
Economics for Managers	X	X		X				

Subject	**ACCOUNTING FOR MANAGERS**

Subject Code	20MBA103		
Credits	4:0:0	CIE Marks	50
Total No. of Lecture Hours	52	SEE Marks	50

Course Objectives:

1. To make students understand the need and types of Accounting
2. To help students understand the mechanisms involved in preparation of final accounts of companies.
3. To expose students to the tools and techniques of analyzing financial reports of companies.
4. To expose students to IFRS and to the emerging issues in Accounting.

Course Outcomes: At the end of the course, the students will be able to:

1. acquire in-depth knowledge of Accounting and prepare books of account such as journal, ledger for a set of business transactions.
2. prepare financial reports using financial statements which help in analyzing the financial position of the business.
3. use Ratio Analysis, Cash flow analysis in interpreting the financial reports of joint stock companies.
4. Study IFRS, its process and relevance to India.
5. study emerging issues in Accounting and apply concepts learnt to demonstrate the understanding of the published reports of business firms and companies and also demonstrate the ability to draw meaningful conclusions about the financial performance of business firms and companies.

Unit I **(14 Hours)**

Introduction to Accounting: Need and Types of Accounting, Users of Accounting, Concepts and Conventions of Accounting, Double entry book keeping - Classification of Accounts: Personal Accounts, Real Accounts and Nominal Accounts – Principles of Debit and Credit for these three categories - Passing of Journal entries – Writing narrations – Posting of Journal entries to ledger, Trial Balance – Purpose and Importance (Problems on Journal entries, ledger and Trial Balance)

Preparation of Subsidiary books: Maintaining Cash books – Sales books – Purchase Books – Sales Returns – Purchase Returns – Cash Transactions – Credit Transactions, three column cash book. (Problems on Three column cash book)

Unit II **(12 Hours)**

Preparation of Final Accounts: Understanding Trading Account – Profit and Loss Account – Balance sheet- Preparation of final accounts – both horizontal & vertical form of financial statements. (Theory and basic problems on Final accounts of companies)

Unit III **(10 Hours)**

Understanding financial statement: Comparative, common size, trend analysis, Ratio analysis, Preparation of financial statements using ratios, Preparation of cash flow statement (only indirect method). (Theory and problems)

Unit IV: **(10 Hours)**

Accounting Standards and IFRS: Meaning of IFRS -relevance of IFRS to India; merits and limitations of IFRS; process of setting IFRS-Practical challenges in implementing IFRS; a brief theoretical study of International financial reporting standards (IFRS) 1 –15 -List of International accounting standards issued by IASB, Elements of financial statements as per IFRS.

Emerging issues in Accounting: Corporate Governance and the clause 49 of the listing agreement, Human Resource Accounting, Forensic Accounting, Window Dressing – Sustainability Reporting. (Only theory)

UNIT V: (6 Hours)

Case Analysis - Compulsory question for 20 Marks. Review and recap of case studies and problems discussed from unit I to unit IV

TEXT BOOKS:

1. A Text book of Accounting for Management, Maheswari S. Maheswari Sharad K. Maheswari, 2/e, Vikas Publishing house ltd.
2. Accounting for managers, Venkataraman R, Krishnamurthy M. G, Dr. S. Harish Babu, Himalaya Publishing House,2/e, ISBN: 978-93-142-970-8

REFERENCE BOOKS:

1. Financial Accounting: A Managerial Perspective, Narayanaswamy R, 5/e, PHI, 2014
2. Introduction to Financial Statement Analysis, Ashish K Bhattacharya, Elsevier India.
3. Accounting for Management, Arora M.N, Himalaya Publishing House.
4. IFRS Guidebook: 2015 Edition-Kindle Edition by Steven M Bragg
5. IFRS concepts and applications by Kamal Garg, Bharath law house private limited.
6. IFRS: A quick reference guide by Robert J Kirk, Elsevier Ltd.

Mapping Course Outcomes with Program Outcomes:

Course Outcomes	**Program Outcomes**								**PSO**	
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PSO1**	**PSO2**
CO1	2								2	
CO2		**3**							**2**	
CO3		**3**							**2**	**1**
CO4								**1**	**1**	
CO5	**1**								**1**	

Assessment Pattern Based on Bloom's Taxonomy:

Sl. No	**Bloom's Category**	**Test 1**	**Test 2**	**Test 3**	**Assignment**	**Seminar / Surprise Quiz**	**SEE**
1	Remember	20	20	20			30
2	Understand	30	20	20			40
3	Apply	20	20	20	10		50
4	Analyze	10	20	20	10		40
5	Evaluate	10	10	10			20
6	Create						
Total		**90**	**90**	**90**	**20**		**180**

Curriculum Mapping

Course	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**
Accounting for Managers	X	X						X

Subject	**MARKETING MANAGEMENT**		
Subject Code	**20MBA104**		
Credits	3:0:0:0	**CIE Marks**	50
Total No. of Lecture Hours	39	**SEE Marks**	50

Course Objectives:

1. To develop the modern marketing skills in the students so as to utilize effectively all marketing management tools and concepts in the present corporate world and its application in business organization.
2. To develop the students in understanding that the decision making for marketing managers requires in knowing about the buyers, the internal and external forces operating in the enterprise and in the environment that are relevant for decisions.
3. To familiarize the concepts in developing a Product and Product Life Cycle, Pricing, Promotion and Channel Decisions.
4. To prepare the students to understand and leverage on Integrated Marketing Communication and to develop skill sets for promoting sustainability causes.

Course Outcomes: At the end of the course, the students will be able to:

1. Demonstrate their conceptual understanding for analyzing and synthesizing marketing concepts in the present century of the corporate world.
2. Apply foster critical strategic thinking in marketing environment and to apply the same in the corporate.
3. Analyze marketing functions, Product Development, Pricing, Channel Decisions, Promotions
4. Evaluate, analyze and implement key performance indicators in Marketing Management at the corporate.

Unit I **(10 Hours)**

Introduction to Marketing Management: Definition of Marketing;
Understanding the market place & customer needs – Customer needs, wants & demands; Market offerings - Products, Services & Experiences; Customer value & Satisfaction; Exchanges & Relationship; Markets.

.

Analyzing Marketing Environment and Competition – Company's Micro-environment: Company's Macro Environment:
Consumer Market & Consumer Buyer Behavior:– Characteristics Affecting Consumer Behavior –Cultural Factors, Social Factors, Personal Factors, Psychological Factors

.

Unit II **(10 Hours)**

Market Segmentation, Targeting, Differentiation & Positioning:
Market segmentation –Concept of Market Segmentation, Benefits, Requisites of Effective Segmentation, Bases for Segmenting Consumer Markets; Requirements for Effective Segmentation
Market Targeting – Evaluating Market Segments; Selecting Target Market Segments
Differentiation & Positioning for competitive Advantage –Meaning, Positioning Maps, Choosing a Differentiation & Positioning Strategy
Product Management: Introduction to Product –Concept, Products Experience; Levels of products, Product classifications
Branding – Concept of Branding, Types, Brand Equity,.
Product Classification – Individual Product Decisions, Product Line Decisions,
New Product Development Strategy – New Product Development Strategies and Product Extension Strategies; Product Life Cycle Strategies
Packaging – Packing as a Marketing tool, Role of Labeling in packing.

Unit III **(08 Hours)**

Pricing; Understanding &, Pricing Strategies: Introduction to Pricing –Factors to consider while setting prices;; Other Internal & External Considerations Affecting Price Decisions

New product pricing Strategies – Market Skimming-Pricing, Market Penetration-Pricing

Place: (Marketing Channels) Nature & Importance of Marketing Channels – Meaning, Purpose, Factors Affecting Cannel Choice, Channel Design, Channel Management Decision, Channel Conflict and Management

Number of Channel Levels – Wholesaling and Retailing

Unit IV **(08 Hours)**

Integrated Marketing Communication and Marketing Planning: IMC – Meaning and importance of marketing communication

Advertising – Objectives, Ad Budget, AIDA Model, Advertising Copy, Deciding Media, Evaluating Advertising Effectiveness

Promotion Decisions – Kinds of Promotion, Tools and Techniques of Sales Promotion, Push and Pull Strategies

Sales and Personal Selling – Concept, Features, Functions and steps involved in Personal Selling

Publicity – Meaning, Objectives, Types,

Direct Marketing – Meaning, Features, Functions, Basic Concepts of E-Commerce, E- Business

Marketing Planning – Meaning, Concepts, and Steps involved in Marketing Planning

Marketing Audit – Meaning, Features, Various components of Marketing Audit

Green Marketing – Meaning and Features

Digital Marketing – Meaning and Features

Unit V **(03 Hours)**

Case Analysis - Compulsory question for 20 marks, Review and recap of case studies discussed from unit I to IV.

TEXT BOOKS:

1. *M*arketing Management: A South Asian Perspective – Kotler, Keller, Koshy & Jha, Pearson Education, 14/e, 2014
2. Marketing Management – Text and Cases – Tapan Panda 2/e Excel Books
3. Marketing Management: Indian Cases, Gupta Prachi and Ashita Aggarwal, 1/e

REFERENCE BOOKS:

1. Case studies in Markets - The Indian context, R Srinivasan, Prentice Hall of India Publications, Edition 2014.
2. Marketing Management – R S N Pillai and Bagavathi, S Chand, 1/e, 2017
3. Marketing Management – Ramaswamy V S & Namakumar S, McGraw Hill, 5/e, 2013.
4. Marketing Management – Rajan Saxena, Cengage Learning Publications, 4/e, 2010.

Mapping Course Outcomes with Program Outcomes:

Course Outcomes	Program Outcomes								PSO	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2
CO1				2						2
CO2								2	1	
CO3					1		3		1	
CO4				2		2				2

Assessment Pattern Based on Bloom's Taxonomy:

Sl.	Bloom's	Test 1	Test 2	Test 3	Assignme	Seminar	SEE

No:	Category				nt		
1	**Remember**	30	20	10			40
2	**Understand**	30	20	20			40
3	**Apply**	10	10	30	5		40
4	**Analyze**	10	20	20		5	40
5	**Evaluate**	10	20	10	5	5	20
6	**Create**						
Total		**90**	**90**	**90**	**10**	**10**	**180**

Curriculum Mapping

Course	Program Outcomes							
Marketing Management	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**
				X	X	X	X	X

Subject	**STATISTICS FOR MANAGERS**		
Subject Code	**20MBA105**		
Credits	4:0:0	**CIE Marks**	50
Total No. of Lecture Hours	52	**SEE Marks**	50

Course Objectives:

1. To make the students learn about the applications of statistical tools and techniques in decision making.
2. To emphasize the need for statistics and decision models in solving business problems.
3. To enhance the knowledge on descriptive and inferential statistics.
4. To develop statistical literacy skills in students in order to comprehend and practice statistical ideas at many different levels.

Course Outcomes: At the end of the course, the students will be able to:

1. Facilitate objective solutions in business decision making under subjective conditions.
2. Demonstrate different statistical techniques in business/real-life situations.
3. Understand the importance of probability in decision making.
4. Understand and apply inferential statistical methods of estimation and testing of hypothesis

Unit I **(15 Hours)**

Introduction to Statistics: Meaning and Definition, functions, scope and limitations, Collection and presentation of data, frequency distribution, measures of central tendency - Mean, Median, Mode, Geometric mean, Harmonic mean, **Measures of dispersion:** Range – Quartile Deviation – Mean Deviation - Standard Deviation – Variance-Coefficient of Variance - Comparison of various measures of Dispersion

Unit II **(12 Hours)**

Correlation and regression: Scatter Diagram, Karl Pearson's coefficient of Correlation (One way table only), Rank Correlation, Concurrent Deviation - Regression: Method of Least Squares. Linear and Non-linear Regression equations.

Unit III **(10 Hours)**

Time Series Analysis: Introduction, Objectives of time series, identification of trend- variations in Time series: secular Variation, Cyclical variation, Seasonal variation, and Irregular Variation – Methods of estimating trends. Index Numbers: Definition; uses; types; Simple Aggregate Method and Weighted Aggregate Method – Laspeyre's, Paasche's, Fisher's and CPI. (Theory and problems)

Unit IV **(12 Hours)**

Formulation of Hypothesis: Testing of hypothesis and inferences: Procedure of testing hypothesis, Type I and Type II Errors.

Parametric tests: Z-Test, t-test, F-test, ANOVA (One way Only) Chi-Square test (Problems).

Unit V **(03 Hours)**

Case Analysis - Compulsory question for 20 marks, Review and recap of case studies discussed from unit I to IV.

TEXT BOOKS:

1. Fundamentals of Statistics, S. C. Gupta, Himalaya Publishing House, 7/e, 2012..
2. Business Research Methods–Donald R. Cooper & Pamela S Schindler, 9/e, TMH, 2007.

REFERENCE BOOKS:

1. S. P. Gupta, Statistical Methods, Sultan Chand & Sons, 2002.
2. Richard I Levin, Statistics for Management, Pearson Education/PHI, 17th Edition, 2000.
3. Aczel and Sounderpandian, Complete Business Statistics, Tata-McGraw Hill, 6th Edition, 2005.
4. G C Beri, Business Statistics, Tata-McGraw Hill, 3rd Edition, 2008.
5. Ken Black, Business Statistics for Contemporary decision-making, John Wiley, 4th Edition, 2004.
6. Applied Logistics Regression – David.W.Hosmer, 3rd Edition, Wiley, 2013

Mapping Course Outcomes with Program Outcomes:

Course Outcomes	Program Outcomes								PSO	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO-1	PSO_2
CO1		1		3					2	
CO2	1	3								1

CO3		2							1	
CO4		1				2				2

Assessment Pattern Based on Bloom's Taxonomy:

Sl. No	Bloom's Category	Test 1	Test 2	Test 3	Assignment	Seminar /Surprise Quiz	SEE
1	Remember	20	20	20			30
2	Understand	20	20	20		5	40
3	Apply	20	20	20	5		50
4	Analyze	20	20	20	10		40
5	Evaluate	10	10	10			20
6	Create						
Total		**90**	**90**	**90**	**15**	**5**	**180**

Subject	**BUSINESS COMMUNICATION**		
Subject Code	**20MBA106**		
Credits	3:0:0:0	**CIE Marks**	50
Total no. of Lecture Hours	39	**SEE Marks**	50

Course Objectives:

1. To provide a fundamental understanding of communication, process, its functions and practices.
2. To enable the students to enhance their communication skills and sensitize their potential to become successful managers
3. To introduce them to some of the practices in managerial communication that are in vogue.
4. To help students of the course to acquire some of the necessary skills to handle day-to-day managerial responsibilities, such as controlling one-to-one communication, enriching group activities and processes, giving effective presentations, writing letters, memos, minutes, reports, advertising etc.
5. To build their confidence and to instill competitiveness by projecting a positive image of themselves and of their future.

Course Outcomes: At the end of the course, the students will be able to:

1. Demonstrate their fundamental skills, understanding and application of principles and functions of business communication.
2. Demonstrate an ability to transform their communication abilities by honing their oral, written and non-verbal communication skills imperative for modern organization.

3. Demonstrate an ability to hone interpersonal skills to lead and facilitate team work and to achieve organizational goals.
4. Demonstrate economic, political, legal, ethical, and socially aware strategies in their personal and professional communication styles with both local and global audiences.
5. Employ critical-thinking skills in selecting communication strategies that are appropriate considering the diversity of the audience.

Unit I **(8 Hours)**

Principles of Communication – Definition, Purpose of communication, Process of communication, Elements of communication, Components of communication, Communication structure in organization, Seven Cs of communication, Conditions for successful communication, Role of a manager in effective communication, Types of communication, Communication in conflict resolution, Communication in current global scenario.

Unit II **(9 Hours)**

Verbal Communication –Meaning, Principles of successful oral communication, Conversation control-Reflection and Empathy: Two sides of effective oral communication, communicating in a diverse environment, Barriers of Communication, Ethnic issues and gender issues in communication, listening as a communication skill, Process of Listening

Non Verbal Communication: Types of Non-verbal communication, communicating with people with disabilities.

Written Communication –Purpose of Writing, Principles of Effective writing, 3*3 Writing process, Writing Business Letters– Formats, Styles, Types – Request, Enquiry, Placing Order, Instruction, Action, Complaint, Adjustment, Sales, Reference, Good News & Bad News, Acknowledgement.

Unit III **(8 Hours)**

Internal and External Business Communication– Circulars, Memos, Agenda and Minutes, Resume/CV, Electronic Mail.

Report Writing – Purpose, Types of Reports, Objectives of Reports,-Organizing and Preparing Reports.

Presentation Skills: Meaning, Elements of Presentation, Designing and Delivering Business Presentations.

Unit IV **(10 Hours)**

Public Speaking: Meaning, Skills for effective speaking.
Interview: Types, Conducting oneself during Interview, Group discussion.
Business Networking: Meaning, Importance.
Business Etiquettes: Basic Business Etiquettes, Meeting Etiquettes, Dining Etiquettes, Social Media Etiquettes.
Communication in a virtual Team: Team, Virtual teams, Global teams, Communication challenge in a Virtual team, Toolkit for effective communication in a virtual team.
Cultural sensitivity: Meaning, Meetings and social visits, Group behavior, addressing others.
Intercultural communication Skills: Importance, Examples of cultural diversity: Japan, France, US, Guidelines for Intercultural Communication.

Unit V **(4 Hours)**

Case Analysis - Compulsory question for 20 marks. Review and recap of case studies discussed from unit I to IV.

TEXT BOOKS:

1. Chaturvedi P.D and Chaturvedi M.-Business Communication: Concepts, cases and applications: Pearson, 2011, 2/e
2. Raymond V Lesikar et al Business Communication McGraw Hill Education; 13 e 2017

REFERENCE BOOKS:

1. Bonet, Diana. The Business of Listening: Third Edition. New Delhi: Viva Books, 2004.

2. Bovee, Courtland L, John V. Thill & Barbara E. Schatzman. Business Communication Today: Tenth Edition. New Jersey: Prentice Hall, 2010.
3. Blundell J. A & Middle N. M. G.: Career – English for the Business and Commercial World, Oxford University Press, 2008, 1/e
4. Meenakshi Raman, Prakash Singh – Business Communication: Oxford Higher Education, 2/e

Mapping Course Outcomes with Program Outcomes

Course Outcomes	Program Outcomes								PSO	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2
CO1				3					2	
CO2					2					3
CO3					2					3
CO4				3				3	2	
CO5		2								3

Assessment Pattern Based on Bloom's Taxonomy:

Sl. No	Bloom's Category	Test 1	Test 2	Test 3	Assignment	Seminar /Surprise Quiz	SEE
1	Remember	20	20	10		5	30
2	Understand	30	20	30			40
3	Apply	20	20	20	10	5	30
4	Analyze	20	20	20			50
5	Evaluate						20
6	Create		10	10			10
Total		**90**	**90**	**90**	**10**	**10**	**180**

Curriculum Mapping

Course	Program Outcomes							
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
Business Communication		X		X	X			X

Subject	ENTREPRENEURSHIP DEVELOPMENT

Subject Code	20MBA107		
Credits	3:0:0:0	CIE Marks	50
Total No. of Lecture Hours	39	SEE Marks	50

Course Objectives:

1. To trigger an entrepreneurial culture and inculcate entrepreneurial values in society at large and influence the mind-set of people towards entrepreneurship.
2. To demystify the start up process by motivating educated youth, scientists, and technologists to consider entrepreneurship as a lucrative, preferred and viable career and build innovative business models.
3. To ensure adequate availability and flow of finance and flow of information to potential entrepreneurs, eliminate entry and exit barriers and create a business friendly environment.
4. To foster social enterprises to address the needs of the population at the 'bottom of the pyramid'.

Course Outcomes: At the end of the course, the students will be able to:

1. Demonstrate their conceptual understanding of basic aspects of entrepreneurial values in society at large and analyze the mind-set of people towards entrepreneurship so as to evaluate business opportunity from the perspective of an entrepreneur.
2. Demonstrate their conceptual understanding for executing a business model after applying their critical thinking skills necessary to make sound decisions in business and personal arenas.
3. Demonstrate their conceptual skills for analyzing to identify the most recognized sources of potential funding and financing for business start-ups from Government agencies.
4. Demonstrate their Family Business conceptual skills for analyzing to identify the source of Succession plan in global business firms.

Unit I **(8 Hours)**

Entrepreneurship: Introduction, Entrepreneurship, Entrepreneur, Types of Entrepreneur, Stages in Entrepreneurial Process, Role of Entrepreneurs in Economic development, Intrapreneur, Difference between Entrepreneur and Intrapreneur, Barriers in Entrepreneurship, Functions of an Entrepreneur.

Unit II **(7 Hours)**

Creativity and Innovation: Meaning, Techniques for fostering Creativity, Source of New Idea, Seven Principles of Small Innovations, Ideas into opportunities.

Creative problem solving: Heuristics, Brainstorming, Synectics, Value analysis.

Unit III **(10 Hours)**

Business Planning Process: Introduction, Business plan process, Types of Plan, Final project report with feasibility study, preparing a Model Report.

Institutions supporting Entrepreneurs: Role of SMEs in Economic Development, Government policy towards SME, KIADB, KSSIDC, NSIC, NABARD, NSIC, KSFC, DIC, Single window.

Unit IV **(10 Hours)**

Family Business: Importance, Types of Family business, Succession, Advantages and Pitfalls, Strategies for improving the capability of family business, Improving family business performance.

International Entrepreneurship Opportunities: FDI, Importance of International Business to the Firm, Barriers to International trade.

Informal risk capital and venture capital: Informal risk capital market, Venture capital, nature and overview, venture capital process, locating venture capitalists, approaching venture capitalists.

Unit V **(4 Hours)**

Case Study -Compulsory question for 20 marks. Review and recap of case studies discussed from Unit I to Unit IV.

TEXT BOOKS ENTREPRENEURSHIP:

1. Entrepreneurship Development, Hisrich, Manimala, Peters, Shepherd, McGraw Hill, 9/e – 2014.
2. Getting Beyond Better: How Social Entrepreneurship Works – Roger.L.Martin, Sally Osberg, Ariana Huffington, 2015

REFERENCE BOOKS ENTREPRENEURSHIP:

1. Entrepreneurship Development – Sangeeta Sharma, Prentice Hall India, 1/e, 2016
2. Technology Strategy for Managers and Entrepreneurs, Scott Shane, Pearson Education, 2014
3. Business Model Generation: A Handbook for Visionaries, Game Changers, and Challengers- Alexander Osterwalder and Aug Pigneur, 2010
4. Recasting India: How Entrepreneurship is Revolutionizing the World's Largest Democracy: Hindol Sengupta, 2014

Mapping Course Outcomes with Program Outcomes:

Course Outcomes	Program Outcomes								PSO	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2
CO1				2					1	
CO2	1									2
CO3						3			1	
CO4								2		2

Assessment Pattern Based on Bloom's Taxonomy:

Sl. No	Bloom's Category	Test 1	Test 2	Test 3	Assignment	Seminar	SEE
1	Remember	30	30	20	5		50
2	Understand	30	30	10		5	40
3	Apply	10	10	30	5		30
4	Analyze	10	10	20			30
5	Evaluate	10	10	10		5	30
6	Create						

Total	90	90	90	10	10	180

Curriculum Mapping

Course	Program Outcomes							
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
Entrepreneurship	X			X		X		X

Subject	**SEMINAR- I**		
Subject Code	20MBA108		
Credits	2	**CIE Marks**	50
		SEE Marks	50

Course Objectives:

1. To enable the students in pooling knowledge and enhancing their oral communication skills, presentation skills, and leadership skills.
2. To make them confident to access to skills needed to accomplish goals more effectively and efficiently
3. To make them understand extensively with the methodology of their chosen topic and also to allow them to interact with examples of the practical problems that always occur during research work.
4. To make them aware about the creative approaches in designing and delivering the contents.
5. To help them in managing the time in their topic presentation.

Course Outcomes: At the end of the course, the students will be able to:

1. locate, gather, organize, summarize and present a body of work and gain practice in the art of presentation skills.
2. demonstrate their conceptual understanding of the subject knowledge and their presentation skills and leadership skills.
3. think and create using multiple thinking strategies to examine real business issues, explore creative avenues of expression, solve problems, and make consequential delivery.
4. Critique global and ethical aspects of business
5. learn time management skills in their seminar presentation and submitting the seminar report

Seminar Guidelines:

The topics for seminar will be on Business Ethics and Indian Ethos.

1. A Case study on Business Ethics and Indian Ethos will be valued for 20 marks.

2. A panel consisting of faculty members drawn from the faculty list along with the guide on a specified date.
3. The faculty member in the panel will value the seminar for a maximum of 50 marks jointly. This will be treated as external evaluation.
4. CIE marks will be given by the Guide and will be for 50 marks (20 marks for case study report and 30 marks for seminar presentation)
5. A faculty may not be required to guide more than 12 students for the purpose of seminar.
6. HOD Head of the Department will form a committee of faculty members for evaluating the seminar presentations which will form the external component (SEE)

I) Nature of Seminar Report:

A written seminar report of the presentation also needs to be prepared and submitted. This is an important part of the student's responsibility, and the quality of the seminar report is considered in determining the grade. A seminar report is a self-contained summary of the presentation. It should describe the important new observations, state how they were made, and summarize the conclusions drawn. Preparing the seminar report will also help in preparing the oral presentation by highlighting the important points of the presentation.

II)Choosing a Topic: The choice of topic is up to the students, with guidance from their supervisor.

III)Duration of Seminar- The seminar report shall be of 3 weeks in the I semester.

IV)Guide: Students must ensure that they maintain regular contact with their guide.

V)Submission of the Report- The students are expected to submit a spiral bound hard copy and soft copy of the report.

VI)Guidelines for preparing report:

The entire seminar report (headings, body and references) should be for 5 to 8 pages and a specific format is recommended .

The seminar report should include:

- Presenter's name
- University Seat No
- Heading of the Presentation
- Body of seminar report
- References

An index heading is a short phrase placed at the top which indicates the general subject of the paper.

The body of the seminar report should be a concise statement of the principal contents of the presentation. Students shall include the following concepts in main body of the report:

- The background (Reason)of the Study
- The aim and scope of the presentation
- Presentation subject
- Conclusions of the Presentation
- References- APA referencing styles can be used to write the Bibliography

CIE & SEE Components:

1. The marks given by guide will be considered as CIE component.
2. The marks given by Faculty Committee will be considered as SEE component.

Criteria for allotting marks by the guide:

Seminar Evaluation Form by the Internal Guide

Student Name: ________________________USN_________________

Topic: ____

S.No	Criteria	Level 1 (40-49)	Level 2 (50-69)	Level 3 (70-79)	Level 4 (80-100)
1	Knowledge and content (5 Marks)	limited knowledge of topic with little accuracy	some knowledge of topic with a degree of accuracy	standard knowledge of topic, usually accurate info	detailed knowledge of topic with consistently accurate info
2	Background of the seminar (5 marks)	Material not clearly related to topic	Material sufficient for clear understanding but not clearly presented	Material sufficient for clear understanding and effectively presented	Material sufficient for clear understanding and exceptionally presented
3	Relevance of the presentation (5 marks)	No Relevance	Moderate Relevance	Relevance	High Relevance
4	Logic and coherence of report (5 marks)	No logic and coherence	Some logic and coherence	Logical and coherent	Highly Logical and highly coherent
5	Clarity of the report (5 Marks)	Not clearly prepared	Moderately clear	Well prepared	Exceptionally prepared with all information
6	Timely submission (5 marks)	Submitted with a delay of 10 days	Submitted with a delay of 7 days	Submitted with a delay of 3 days	On time submission

Criteria for allotting marks by the faculty committee:

Presentation Evaluation Form

Student Name: ________________________USN_________________
Topic: ____

S.No	Criteria	Level 1 (40-49)	Level 2 (50-69)	Level 3 (70-79)	Level 4 (80-100)	Marks 5 each
1	Introduction	Topic is mentioned	Topic and some of the subtopics are stated	Topic and all subtopics are stated	Topic and all subtopics are stated in proper order	
2	Knowledge of Topic	Limited knowledge of topic with little accuracy	Some knowledge of topic with a degree of accuracy	Standard knowledge of topic, usually accurate info	Detailed knowledge of topic with consistently accurate info	
3	Connection to Chapter Topic & Theme	Limited connection made between evidence, subtopics, topic & theme	Some connection made between evidence, subtopics, topic & theme	Usually connection made between evidence, subtopics, topic & theme	Consistent connection made between evidence, subtopics, topic & theme	
4	Organization	Unclear agenda with illogical sequencing & unhelpful handout	Scant agenda & handout with somewhat useful handout	Clear, logical agenda is usually shown / followed with useful handout	Clear, logical, thorough agenda is shown & followed combined w/ very useful handout	
5	Conclusion	Little summary of subtopics	Topic and some subtopics summarized	Topic and all subtopics summarized	Topic all subtopics summarized in proper order	
6	Creativity / Enthusiasm	Little color or variety used & no smiles	Somewhat bored, with some variety & colour	Usually smiling, appropriately dressed, variety	Unique, colorful, stimulating presentation with extra effort	
7	Eye Contact	Little contact, dependent on notes	Some eye contact & dependence on notes	usually makes eye contact	consistent eye contact with little dependence on notes	
8	Voice Audibility	Monotone and too quiet	Some inflection and at times clear	Usually clear & inflects voice	Proper inflection, clarity and volume	
9	Use of Time / Pace	Seminar is too short/long and moves too quickly/slow	Sometimes seminar moves too quickly / slowly and at times is off topic	Starts / finishes on time covering relevant info	Starts / finishes on time covering relevant info in an interesting manner	
10	Discussion & Questions and Answers	Little discussion generated from closed-ended, repetitive questions	Some discussion generated from somewhat relevant questions that require superficial thought	Three relevant questions generate discussion that requires thought	Three relevant, open-ended questions generate much discussion, insight, analysis & evaluation	
	Total					50

Signature of Committee of
Faculty Member

Mapping Course Outcomes with Program Outcomes:

Course Outcomes	Program Outcomes								
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2
CO1								2		3
CO2			3							3
CO3	3	2								3
CO4				3						3
CO5			3							3

Curriculum Mapping

Course	Program Outcome							
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
Seminar	X	X	X	X				X

II SEMESTER

Subject	**BUSINESS RESEARCH METHODS**		
Subject Code	**20MBA201**		
Credits	3:0:0	**CIE Marks**	50
Total No. of Lecture Hours	39	**SEE Marks**	50

Course Objectives:

1. To develop a research orientation among students and thereby making decision process scientific.
2. To expose the students to the principles of scientific methodology in business enquiry
3. To develop analytical skills of business research, also to develop the skills for scientific communications.
4. To provide a knowledge base on steps in a research process needed to conceptualize, define and execute a business research project.
5. To develop and make understand students with various data analysis techniques.

Course Outcomes: At the end of the course, the students will be able to:

1. Become aware of importance of research in business applications and acquaint with the scientific methodology in business research domain.
2. Understand different phases of a research process in a research project.
3. Develop appropriate data collection instruments and become analytically skillful
4. Enable students with data compilation, data preparation, data summary and appropriate analysis using descriptive and inferential statistical methods (univariate/ bivariate/multivariate).

UNIT I

(8 Hours)

Introduction to Management Research – Definition, Nature and role of Management Research, Types of Research based on Purpose, Process, Outcome, Nature, Action and Logic, Features of a good Research Study, Scientific approach of research, ethical issues in business research.-Steps involved in preparing business research process
Business Research Design: Exploratory, Descriptive, & Causal research

UNIT II

(8 Hours)

Research Problem, Research Hypothesis

Identification and Selection of the Problem, Definition and Statement of the Problem, Criteria and Sources for Identifying the Problem, Process of Defining the Problem, Characteristics of Good Hypothesis, Types of hypothesis, Hypothesis Formulation.
Sampling: Concept of Sample and Target Population, Sample frame, Sample unit and Sample size, Characteristics of a Good Sample, Steps in Sampling process, Types of Sampling - Probability and non probability Sampling Techniques. Sampling v/s Non probability sampling, Sampling Error.

UNIT III **(9 Hours)**

Scaling Techniques & Hypothesis Testing: Nominal Scale, Ordinal Scale, Interval Scale, Rating Scale, attitude measurement – Likert's Scale, Semantic Differential Scale, – Simple Attitude Scales, Category Scales, Method of Summated Ratings: The Likert Scale, Semantic Differential, Numerical Scales, Stapel Scale, Constant-Sum Scale, Graphic Rating Scales, Thurstone Interval Scale
Data Preparation- Field Validation, Data editing, Coding, Content Analysis, Classification and Tabulation of Data
Data collection: Primary and Secondary data – Sources –, Advantages & Disadvantages
Data collection Methods – **Observations-** Classification of Observation Methods, Advantages and Limitations of Observation Techniques , **Survey**- Classification of Survey methods, Evaluation Criteria for Survey Methods, and **Questionnaire**-Criteria for Questionnaire Designing; Types of Questionnaire, components of Questionnaire, Questionnaire Design Procedure, Merits & Demerits, **Interview**- Meaning & Types, **Schedule**- Meaning, & Types, **Qualitative Data Collection Techniques**- Meaning Types- In-depth interview, Focus groups, Ethnographic research, Content analysis, Case study research, Projective Analysis

UNIT IV

(8 Hours)

Descriptive & Inferential statistics (Theory only) :: Descriptive Statistics, Univariate Bivariate Analysis (Chi-square only), Multivariate Analysis - Factor Analysis, Cluster Analysis, ANOVA – One-way & Two-way classification (Conditions for applicability, Implementation and statistical Inferences).
Hypothesis Testing (Theory Only)- Parametric & Non-Parametric Tests; Null & Alternative Hypothesis, Error in Testing of Hypothesis, Critical Region, Degrees of Freedom, One Tailed & Two Tailed Tests Parametric and Nonparametric test: T-test, Z-test, F-test classification (Conditions for applicability, Implementation and statistical Inferences).
Research report: Oral report, Written reports, Advantages/Disadvantages of oral and written reports, Components of written research report.

UNIT V **(6 Hours)**
Case Study Compulsory question for 20 marks. Review and recap of case studies discussed from Unit I to Unit IV

TEXT BOOKS:

1. Business Research Methods – William G Zikmund, Barry J.Babin, Jon C.Carr, Atanu Adhikari, Mitch Griffin- Cengage Learning, 8/e,2016

2. Business Research Methods–Donald R. Cooper & Pamela S Schindler,TMH,/9e/2007
3. Business Research Methods- S.N.Murthy/U.Bhojanna.0- Excel Books/2e/2007.

REFRENCE BOOKS:

1. Research Methodology- C R Kothari- Vishwa Prakashan, 2002
2. Research Methods – William M C Trochim-Biztantra,2/e, 2007
3. Marketing Research – A Parasuraman, Dhruv Grewal – Biztantra, 2004
4. Business Research Projects – Jimme Keizer, Piet Kempen, 2006
5. Methodology of Research in Social Sciences – O R Krishnaswami, M Ranganatham, HPH, 2007
6. Marketing Research – Naresh K Malhotra – Pearson Education /PHI/5e/2007

Mapping Course Outcomes with Program Outcomes:

Course Outcomes	Program Outcomes								PSO	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO 2
CO1	3	2		1					1	
CO2		3		2					2	
CO3			1		3		3		2	
CO4				2		1	3		2	

Assessment Pattern Based on Bloom's Taxonomy:

Sl. No	Bloom's Category	Test 1	Test 2	Test 3	Assignment	Seminar /Surprise Quiz	Semester End Examination (approx)
1	Remember	30	20	10	5		50
2	Understand	20	30	20	5		40
3	Apply	20	20	20		5	30
4	Analyze	10	10	20	5		30
5	Evaluate	10	10	20			30
6	Create						
Total		90	90	90	15	5	180

Curriculum Mapping:

Course	Program Outcomes							
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
Business Research Methods	X	X	X	X	X	X	X	

Subject	**FINANCIAL MANAGEMENT**		
Subject Code	**20MBA202**		
Credits	4:0:0:0	**CIE Marks**	50
Total No. of Lecture Hours	52	**SEE Marks**	50

Course Objectives:

1. To make students understand the nature of financial management, time value of money and cost of capital of the firm
2. To make students understand the nuances of
3. decision, project evaluation techniques and conceptual knowledge about capital structure
4. To apprise the students about the various sources of funds and leverage
5. To expose the students to working capital and dividend decisions
6. To appraise the students on the leading practical application oriented case studies – relevant and updated and doing case study analysis & arriving at conclusions facilitating business decisions

Course Outcomes: At the end of the course, the students will be able to :

1. Demonstrate ability to understand the Interface of Financial Management with other functional areas and conceptually understand the various steps involved in raising, allocation and sources of funds in the market.
2. Evaluate capital budgeting and capital structure decisions of the firm.
3. Determine the working capital requirements and the implications of dividend decisions.
4. Determine cost of capital of the firm and also understand about leverages.
5. Acquire knowledge on emerging issues in financial management with global perspective.

Unit I: **(10 Hours)**

Financial management – Introduction to financial management, objectives of financial management – profit maximization and wealth maximization. Changing role of finance managers. Interface of Financial Management with other functional areas, Organisation functions of finance Managers, and Functions of Financial Management **Indian financial system** – Primary market, Secondary market – stocks & commodities market, Difference between primary market and secondary market, Money market, Forex markets. (Theory Only). Sources of Financing: Shares, Debentures, Term loans, Lease financing, Hybrid financing, Venture Capital, Angel investing and private equity, Warrants and convertibles (Theory Only)

Unit II: **(12 Hours)**

Time value of money –Future value of single cash flow & annuity, present value of single cash flow, annuity &perpetuity. Simple interest & Compound interest, Capital recovery & loan amortization.**Cost of Capital**– basic concepts. Cost of debenture capital, cost of preferential capital, cost of term loans, cost of equity capital (Dividend discounting and CAPM model). Cost of retained earnings. Determination of Weighted average cost of capital (WACC) and Marginal cost of capital. (Problems & Theory)

Unit III: **(12 Hours)**

Investment decisions –Factors affecting Investment Decisions, Investment Decision Process, Investment evaluation techniques – Net present value, Internal rate of return, Modified internal rate of return, Profitability index, Payback period, discounted payback period, accounting rate of return. Estimation of cash flow for new project, replacement projects.

Capital structure and dividend decisions – Planning the capital structure. (No capital structure theories to be covered) Leverages – Determination of operating leverage, financial leverage and total leverage. Dividend policy – Factors affecting the dividend policy - dividend policies- stable dividend, stable payout. (No dividend theories to be covered). (Problems & Theory)

Unit IV: **(12 Hours)**

Working capital management – factors influencing working capital requirements. Types of Working Capital, Current asset policy and current asset finance policy. Determination of operating cycle and cash cycle. Estimation of working capital requirements of a firm, Cash, Inventory & Receivables Management (Problems & Theory)Emerging Issues in Financial management: Derivatives, Mergers and Acquisitions, Behavioral Finance, Financial Modeling, Financial engineering, risk management. (Theory Only).

Unit V: **(6 Hours)**

Case Analysis: Compulsory question for 20 Marks. Review and recap of case studies discussed from Unit I to Unit

IV

TEXT BOOKS:

1. Financial Management - Prasanna Chandra, 8/e, TMH, 2011.
2. Financial Management, Pralhad Rathod, N. Babitha Thimmaiah. S. Harish Babu, Himalaya Publishing House,1/e, ISBN: 978-93-5202-438-4, 2016

REFERENCE BOOKS:

1. Financial Management, V K Bhalla, 1st Edition- S Chand 2014
2. Financial Management, Khan M. Y.& Jain P. K, 6/e, TMH, 2011.
3. Fundamentals of Financial Management, Brigham & Houston, 10/e, Cengage Learning
4. Financial Management , I M Pandey, 10th Edition, Vikas Publishing House -2014

Mapping of Course Outcomes with Program Outcomes:

Course Outcomes	Program Outcomes								PSO	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2
CO1				1					1	
CO2		2							2	
CO3		2			3				2	
CO4		2				2			3	
CO5				3			3	3		3

Assessment Pattern Based on Bloom's Taxonomy:

Sl. No	Bloom's Category	Test 1	Test 2	Test 3	Assignment	Seminar /Surprise Quiz	SEE
1	Remember	20	20	30			30
2	Understand	20	10	20			40
3	Apply	20	30	10	10		50
4	Analyze	20	20	20	10		40
5	Evaluate	10	10	10			20
6	Create						
Total		**90**	**90**	**90**	**20**		**180**

Curriculum Mapping

Course	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
Financial Management		X		X	X	X	X	X

Subject	**INFORMATION TECHNOLOGY FOR MANAGERS**		
Subject Code	**20MBA203**		
Credits	3:0:0:0	**CIE Marks**	50
Total No. of Lecture Hours	39	**SEE Marks**	50

Course Objectives:

1. To provide an introduction to the field of management of information systems (MIS).
2. To demonstrate the role of information systems in influencing decision making processes.
3. To familiarize students with the technical and managerial aspects related to the utilization of information technology in business organizations.
4. To identify the principal management challenges posed by the ethical and social impact of information systems and management solutions.

Course Outcomes: **At the end of the course, the students will be able to:**

1. develop an understanding of the role of computer applications for business purposes for sound decision making.
2. use MIS as a tool to implement business strategies and gain competitive advantage, not merely to support business operations.
3. understand the developments of electronic commerce and the role of Internet
4. become familiar with ethical and social issues related to information systems.

Unit I **(10 Hours)**

Foundation Concepts: Foundation of information system (IS) in business: Meaning of Data, Information and Knowledge. Information System- Activities of Information System - Benefits of Information System to Business ,Information as a Resource, Information in organizational functions - Information need at different level of Management , System concept, Types of Systems-Component of an IS resources-fundamental roles of IS application in business.

Kind of Information Systems: Operation Support System and Management Support System- Transaction Processing System(TPS)-Management Information System(MIS)-Decision Support System(DSS) , EIS.

Unit II **(8 Hours)**

Computer fundamentals, telecommunication and networks: Computer System- Introduction – Characteristics - Block Diagrams -Generation of Computers- - Types of Computers Systems- Latest Input and Output Devices - Software-System s/w and Application s/w , Communication Media, Modems & Channels – LAN, MAN & WAN-Network Topologies, Internet, Intranet and Extranet.

Unit III (**8 Hours)**

Systems analysis and development and models: Control System Model-Need for System analysis Structured SAD and tools like DFD, Context Diagram Decision Table and Structured Diagram. System Development Models: Water Flow, Prototype, Spiral, RAD –Roles and responsibilities of System Analyst, Database Administrator and Database Designer.

Unit IV **(8 Hours)**

Enterprise system: Introduction to Cross-Functional Business Process **-**Enterprise Resources Planning (ERP): Meaning, Features, selection criteria, challenges in Implementation, merits and demerits - Supply Chain Management (SCM): Features ,– Customer Relationship Management (CRM): Phases.

Security and ethical challenges: Security and ethical challenges: Ethical responsibilities of Business Professionals-, Computer crime – Hacking, cyber theft-Unauthorized Use at Work.

Unit V: **(5 Hours)**

Case study: Compulsory question for 20 Marks. Review and recap of case studies discussed from Unit I to Unit IV.

TEXT BOOKS:

1. Management Information Systems by Obrien, Marakas and Ramesh Behl, TMGH
2. Management Information Systems by Jawadekar TMGH, 4 th Edition

REFERENCE BOOKS:

1. Management Information Systems By Bagchi Nirmalya Vikas Publishing House Pvt Ltd
2. Cases in Management Information Systems by Mohapatra, PHI Learning, 978-81-203-3614-8

Mapping Course Outcomes with Program Outcomes:

Course Outcomes	Program Outcomes								PSO	
	PO1	PO2	PO3	PO4	PO5	PO 6	PO7	PO8	PSO-1	PSO-2
CO1				2	1		3		2	
CO2		2						2	3	
CO3		2		1		1				1
CO4	3		1		1				2	

Assessment Pattern Based on Bloom's Taxonomy:

Sl. No	Bloom's Category	Test 1	Test 2	Test 3	Assignment	Seminar /Surprise Quiz	SEE
1	Remember	30	30	30	10		40
2	Understand	30	30	30		5	40
3	Apply	20	10	10	5		40
4	Analyze	10	10	10			40
5	Evaluate		10	10			20
6	Create						
Total		**90**	**90**	**90**	**15**	**5**	**180**

Curriculum Mapping

Course	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
Computer Application for Business	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**

Subject	**OPERATIONS RESEARCH**		
Subject Code	**20MBA204**		
Credits	4:0:0	**CIE Marks**	50
Total No. of Lecture Hours	52	**SEE Marks**	50

Course Objectives:

1. To equip the students with the various Operations Research Models
2. To facilitate the students to find out optimal solution for transportation and assignment problems
3. To empower with the knowledge of network analysis
4. To demonstrate the game theory and simulation technique

Course Outcomes: At the end of the course, the students will be able to,

1. understand the nature, models, benefits and limitations of Operations Research
2. Demonstrate the transportation and assignment models in business problems
3. Illustrate the use of network techniques for successful project implementation.
4. apply the concept of Game theory and simulation techniques in a business enterprise.

Unit I **(12 Hours)**

Introduction to Operations Research: Introduction to OR; Scope, Techniques, Characteristics and Limitations of Operation Research; Methodology and Models in OR (only theory)
Linear Programming Problem (LPP): Application of LPP in Management, Advantages of LPP. Formulation of LPP, Solution of LPP by Graphical method: Formulation of Dual of a LPP.

Unit II **(14 Hours)**
Transportation Models: General Structure; Various methods for finding initial solution: Maximization and Minimization problems North West Corner Method, Least Cost Method, Vogel's Approximation Method; Finding Optimal Solution: Modified Distribution method; Variations: Unbalanced Transportation Problem, Theoretical concept of Degeneracy only; Assignment problems; General Structure; Finding Optimal Solution; Maximization problem, Restrictions on Assignments.

Unit III **(14 Hours)**
Network Analysis: Terminology; Networking Concepts; Rules for drawing network diagram; CPM Computations: CPM Terminology, Finding critical path - Different Floats; PERT Computations: Computation of earliest and latest allowable times, Probability of meeting the scheduled dates; difference between PERT and CPM.

Unit IV **(12 Hours)**
Theory of Games: Terminology; Two person zero sum game; Solution to games: Saddle point, dominance rule, Value of the game, mixed strategy, Graphical method of solving a game – (2 x n) and (m x 2) games.
Sequence: Introduction-Definition: Terminology and Notations, Principal Assumptions,
Type I: Problems with n Jobs through Two Machines, Processing n jobs, through Three Machines.

TEXT BOOKS:

1. Quantitative Techniques in Management, N D Vohra, Tata McGraw Hill Publishing Co. Ltd, 4th Edition,2012.
2. Operations Research: Theory and Applications - Sharma J. K, 4/e , Macmilan, 2010.

REFERENCE BOOKS:

1. Operations Research: Theory, Methods and Applications - Sharma S. D, Kedar Nath, Ram Nath & Co, 2010
2. Anderson, et al, Quantitative Methods for Business, Thomson Publishing, 12th Edition, 2013.
3. Tulisian, Quantitative Techniques theory and problems, Pearson,PHI, 2011
4. S. D. Sharma, "Operations Research", Kedar Nath and Ram Nath &Co. Ltd, 2010
5. C. R. Kothari, "Quantitative Techniques", Vikas Publishing House,3/e, 2004
6. Operations Research: An Introduction - Taha H. A, 9/e, PHI, 2012
7. Optimization in Operations Research – Rardn.R.L Pearson, 2005

Mapping Course Outcomes with Program Outcomes:

Course Outcomes	Program Outcomes								PSO	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO-1	PSO-2
CO1		2		2		1			1	

CO2	1	1								2
CO3		2		1		3			2	
CO4	1	3	1							2

Assessment Pattern Based on Bloom's Taxonomy:

Sl. No	Bloom's Category	Test 1	Test 2	Test 3	Assignment	Seminar /Surprise Quiz	SEE
1	Remember	20	20	20			30
2	Understand	20	20	20		5	40
3	Apply	20	20	20	5		50
4	Analyze	20	20	20	10		40
5	Evaluate	10	10	10			30
6	Create						
Total		**90**	**90**	**90**	**15**	**5**	**200**

Curriculum Mapping

Course	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
Operations Research	**X**	**X**	**X**	**X**	**X**	**X**		

Subject	**BUSINESS LAW**		
Subject Code	20MBA205		
Credits	3:0:0:0	**CIE Marks**	50
Total No. of Lecture Hours	39	**SEE Marks**	50

Course Objectives:

1. To trigger a Legal culture and inculcate legal and ethical values in society at large and influence the mind-set of people.
2. To demystify the start up process by motivating educated youth, scientists, and technologists to consider business law as a lucrative, preferred and viable career and build innovation.
3. To ensure adequate availability and flow of legal information to potential entrepreneurs, eliminate entry and exit barriers and create a business friendly environment.
4. To foster social legal enterprises to address the needs of the population.

Course Outcomes: At the end of the course, the students will be able to:

1. Demonstrate their conceptual understanding of basic aspects of Legal values in society at large and analyze the mind-set of people towards professional entrepreneurship so as to evaluate business opportunity from the perspective of an ethical entrepreneur.
2. Demonstrate their conceptual understanding for executing a legal business model after applying their critical thinking skills necessary to make sound decisions in business and personal arenas.
3. Demonstrate their legal conceptual skills for analyzing and to identify the most recognized sources of potential legal business start-ups.
4. Demonstrate their conceptual understanding about the relevance of business law to individuals and businesses and the role of law in an economic, political and social context.

Unit I **(12 Hours)**

Introduction to Business Law: Jurisprudence; Rule of the Law, structure of the Indian Legal System (Organs of the Government) – source of law

Fundamentals of Contract Laws – Meaning, agreement, essential elements of a valid contract, Consideration, performance of contract, Discharge of contract, breach of contract – Quasi Contracts.

Unit II **(10 Hours)**

Law of Agency – Meaning, Principal – Agent, creation and termination of agency, Bailment and Pledge – Meaning, rights and duties of Bailor and Bailee, Pledge, Guarantee and Indemnity.

Negotiable Instruments Act – Meaning, Kinds of Negotiable Instruments, Discharge and Dishonour of Negotiable Instrument

Unit III **(8 Hours)**

Sale of Goods Act – Principles of Sale of Goods Sales V/s Agreement to sell, Goods, Condition and warranties, express and implied condition, "Doctrine of Caveat Emptor", Rights and Duties of Unpaid Seller, Transfer of Ownership and Property.

Introduction to Companies Act, Introduction to Partnership Act and Introduction to Shops and Establishment Act.

Unit IV **(5Hours)**

Introduction to Intellectual Property Rights – Introduction to Trade Marks Act, 1999, Introduction to Patents Act, 1970, Introduction to Copyrights Act, 1957, Geographical Indications.

Unit V **(4 Hours)**

Case Study -Compulsory question for 20 marks. Review and recap of case studies discussed from Unit I to Unit IV

TEXT BOOKS BUSINESS LAW:

1. Elements of Mercantile Law, N D Kapoor, Sultan Chand and Sons, 32/e, 2011.
2. Mercantile Law, M.C. Shukla, S. Chand Publishing 13/e, 2010

REFERENCE BOOKS BUSINESS LAW:

1. Business Law & Policy, HPH, S Harish Babu and Santosh, 1/e, 2017
2. Business Law, M C Kuchhal & Vivek Kuchhal, Vikas Publishing 5/e, 2010
3. Business Law, S S Gulshan, Excel Books, 3/e, 2006.
4. Business Law for Managers, Goel P K, Biztantra 2012
5. Business Law for Management, K R Bulchandani HPH 4/e, 2006

Mapping Course Outcomes with Program Outcomes:

Course Outcomes	Program Outcomes								PSO	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2

CO1				3					1	
CO2	2									2
CO3						2			1	
CO4			2					3		2

Assessment Pattern Based on Bloom's Taxonomy:

Sl. No	Bloom's Category	Test 1	Test 2	Test 3	Assignment	Seminar	SEE
1	Remember	30	30	20	5		50
2	Understand	30	30	10		5	40
3	Apply	10	10	30	5		30
4	Analyze	10	10	20			30
5	Evaluate	10	10	10		5	30
6	Create						
Total		**90**	**90**	**90**	**10**	**10**	**180**

Curriculum Mapping

Course	Program Outcomes							
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
Business Law	X		X	X		X		X

Subject	**HUMAN RESOURCE MANAGEMENT**		
Subject Code	**20MBA206**		
Credits	3:0:0:0	**CIE Marks**	50
Total No. of Lecture Hours	39	**SEE Marks**	50

Course Objectives:

1. To familiarize students with the basic concepts and frameworks of human resource management (HRM), and understand the role that HRM has to play in effective business administration
2. To enhance students' effectiveness for optimizing the human resource potential of their organization in order to achieve business and strategic objectives.
3. To improve students' ability to think about how HRM should be used as a tool to execute strategies.

4. To enable students to demonstrate an ability to discuss how the external and internal elements in the organization relate to the various parts of HRM, such as HR policy, organizational structure, HR systems (recruitment, placement, evaluation, compensation and development) and organizational culture.

Course Outcomes: At the end of the course, the students will be able to:

1. Align HR systems with the strategic business objectives of a firm
2. Evaluate the context of workplace issues, policies, and management decisions.
3. Contribute to the development, implementation, and evaluation of employee recruitment, selection, and training and development of employees.
4. Exhibit the ability to make reasoned, ethical decisions based on professional standards and practices for ethical conduct, legal requirements, and regulatory guidelines in human resource management that are in the best interest of the individual, the organization, the environment, and society as a whole.

Unit I **(8 Hours)**
Introduction to Human Resource Management: Concept of HRM, Nature, Scope, Functions, Objectives, Processes, Importance and Evolution of HRM, Roles and Responsibilities of HR managers. Challenges and HRM

Unit II **(8 Hours)**
Job Analysis and Evaluation: Meaning, process of Job Analysis, methods of collecting job analysis data, Job Description and Job Specification,
Human Resource Planning: Objectives, Importance and process of Human Resource Planning.

Unit III **(10 Hours)**
Recruitment: Definition, Constraints and Challenges, Sources and Methods of Recruitment
Selection: Definition and Process of Selection, Interview and Test in selection
Placement: Meaning, Induction/Orientation, Internal Mobility, Employee Separation, Downsizing.
Training and development: Training process, Training Methods, Management Development, Career and Succession Planning.

Unit IV **(9 Hours)**
Performance Appraisal: Performance Appraisal Process, Methods of Performance Appraisal, problems
Compensation: Wage and Salary Administration, components, Factors Influencing Compensation Levels, job evaluation, Compensation Pay Structure in India,
Industrial Relation: Overview of industrial relation, approaches of industrial relation, factors affecting industrial relations, provisions regarding employee welfare

Unit V **(4 Hours)**
Case Analysis - Compulsory question for 20 marks. Review and recap of case studies discussed from Unit I to Unit IV

TEXT BOOKS:

1. HRM by Rao VSP, Excel Books, 2010
2. Human Resource Management, P Jyothiand D.N Venkatesh, Oxford university press

REFERENCE BOOKS:

1. Human Resource Management & Industrial relations, P.Subba Rao, Himalaya Publishing House, Mumbai, 2010
2. Human Resource Management - John M. Ivancevich, 10/e, McGraw Hill, 2010
3. Human Resource Management in practice - Srinivas R. Kandula, PHI, 2009
4. Human Resource Management – Strategic Analysis text and cases – Raj Kumar, I.K International Publishing House Pvt. Ltd. New Delhi 2012.
5. Human Resource Management, Dessler et al, Pearson Education, 2008

Mapping Course Outcomes with Program Outcomes:

Course Outcomes	Program Outcomes								PSO	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2
CO1	2			2					1	
CO2		3		1					1	
CO3				1						2
CO4				1						2

Assessment Pattern Based on Bloom's Taxonomy

Sl. No.:	Bloom's Category	Test 1	Test 2	Test 3	Assignment	Seminar/ Surprise Quiz	Semester End Examination (approx)
1	Remember	10	10	10			25
2	Understand	20	10	10	5	5	30
3	Apply	20	20	20			35
4	Analyze	20	30	30	5	5	50
5	Evaluate	20	20	20			40
6	Create						
Total		**90**	**90**	**90**	**10**	**10**	**180**

Curriculum Mapping

Course	Program Outcome							
Human Resource Management	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
	X	X		X				

Subject	**STRATEGIC MANAGEMENT**		
Subject Code	20MBA207		
Credits	3:0:0	**CIE Marks**	50
Total No. of Lecture Hours	39	**SEE Marks**	50

Course Objectives:

1. To provide insights into the core concepts of strategic management.
2. To expose students to various perspectives and concepts in the field of Strategic Management
3. To evaluate various business strategies in dynamic market environments.
4. To gain insights into various strategic management models.
5. To help students develop skills for applying these concepts to the solution of business problems

Course Outcomes: At the end of the course, the students will be able to:

1. Students should get clear idea about the concept of Strategic Management, its relevance, Characteristics, process

nature and purpose.
2. Student to acquire an understanding of how firms successfully institutionalize a strategy and create an organizational structure for domestic and overseas operations and gain competitive advantage.
3. To give the students an insight on strategy at different levels of an organization to gain competitive advantage.
4. To help students understand the strategic drive in multinational firms and their decisions in different markets.
5. To enable the students to gain knowledge of strategy implementation and the control measures for effective decision-making.

Unit I **(08 Hours)**

Introduction to Strategic Management : Meaning and Nature of Strategic Management , Importance and relevance, Characteristics of Strategic Management, Importance of strategy in the success of organisation, Basic model of strategic management, , The strategy Making Process, Strategic Decision making, Strategic Leadership. Strategic Managers: Corporate level, Business Level and Functional Level, Roles and Responsibilities.

Unit II **(10 Hours)**

Strategy Formulation- Understand strategic management process business definition & Organization values that build mission statement. Describe strategic vision, mission, goals, and long term objectives. Strategy Implementation and control: Process of Implementation, Stages of corporate development, Staffing and Leading,. Organizational design, structures and controls. Importance of integrating strategy implementation and strategy formulation. Organizational structures used to implement different business level strategies. Organizational structures used to implement different corporate level strategy.

Unit III **(08 Hours)**

External Environmental Analysis: Meaning and Importance of External analysis, porters Five force Model, Competitors analysis, Assessing future conditions of Industry and environment, Competitive Environment Analysis ,Competitive intelligence , forecasting, Factors driving the Industry change, Key factors for future competitive success.

Unit IV: **(08 Hours)**

Analysing a company's resources and competitive position – Analysis of a Company's present strategies - SWOT Analysis – Value Chain Analysis - Benchmarking. Generic Competitive Strategic – Low cost provider Strategy - Differentiation Strategy - Best cost provider Strategy – Focused Strategy - Strategic Alliance and Collaborative Partnerships – Mergers and Acquisition Strategic - Outsourcing Strategic - International Business level.

Unit V **(05 Hours)**

Case Analysis - Compulsory question for 20 Marks. Review and recap of Industrial real time case studies related to topics discussed from unit I to IV

TEXT BOOKS:

- Crafting and executing Strategy. A Thompson Jr, Margaret A. and John E Gamble. Mc Graw Hill Publication, New Delhi.
- Essentials of strategic management: J David Hunger, Thomas L Wheelen
- Strategic Management – Dr K Govinda Bhat , N R Govinda sharma, (HPH)
- Strategic Management : Charles W L Hill, Gareth R Jones

REFERENCE BOOKS:

- Strategy and the Business Landscape – Pankaj Ghemawat.
- Strategic Management – Competitiveness and Globalization: Michael A. Hitt, Duane Ireland, Robert E. Hokinson, : South Western, Thomson Learning.
- Crafting and Executing Strategy, Arthur Thompson, A.J.Strickland, Arun Jain, Mc Grawhill

Mapping Course Outcomes with Program Outcomes:

Course Outcomes	Program Outcomes								PSO	
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PSO1**	**PSO2**
CO1							3		1	
CO2					**2**				**3**	
CO3				**1**						**2**
CO4		**2**							**2**	
C05	**3**									**1**

Assessment Pattern Based on Bloom's Taxonomy:

Sl. No	Bloom's Category	Test 1	Test 2	Test 3	Assignment	Seminar / Surprise Quiz	SEE
1	Remember	20	20	20			30
2	Understand	30	20	20	10		40
3	Apply	20	20	20	10		50
4	Analyze	10	20	20			40
5	Evaluate	10	10	10			20
6	Create						
Total		**90**	**90**	**90**	**20**		**180**

Curriculum Mapping

Course	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
Strategic management	X	X		X	X		X	

Subject	**SEMINAR- II**		
Subject Code	20MBA208		
Credits	2	**CIE Marks**	50
		SEE Marks	50

Course Objectives:

6. To enable the students in pooling knowledge and enhancing their oral communication skills, presentation skills, and leadership skills.
7. To make them confident to access to skills needed to accomplish goals more effectively and efficiently.
8. To make them understand extensively with the methodology of their chosen topic and also to allow them to interact with examples of the practical problems that always occur during research work.
9. To make them aware about the creative approaches in designing and delivering the contents.
10. To help them in managing the time in their topic presentation.

Course Outcomes: At the end of the course, the students will be able to:

6. locate, gather, organize, summarize and present a body of work and gain practice in the art of presentation skills.
7. demonstrate their conceptual understanding of the subject knowledge and their presentation skills and leadership skills.
8. Identify management theories and apply the same in contemporary issues
9. Critique global and ethical aspects of business
10. Utilize research skills in contemporary issues

Seminar Guidelines:

The topics for seminar will be on Leadership and Team Work.

7. A Case study on Leadership and Team Work will be valued for 20 marks.
8. A panel consisting of faculty members drawn from the faculty list along with the guide on a specified date.
9. The faculty member in the panel will value the seminar for a maximum of 50 marks jointly. This will be treated as external evaluation.
10. CIE marks will be given by the Guide and will be for 50 marks (20 marks for case study report and 30 marks for seminar presentation)
11. A faculty may not be required to guide more than 12 students for the purpose of seminar.
12. HOD Head of the Department will form a committee of faculty members for evaluating the seminar presentations which will form the external component (SEE)

I) Nature of Seminar Report:

A written seminar report of the presentation also needs to be prepared and submitted. This is an important part of the student's responsibility, and the quality of the seminar report is considered in determining the grade. A seminar report is a self-contained summary of the presentation. It should describe the important new observations, state how they were made, and summarize the conclusions drawn. Preparing the seminar report will also help in preparing the oral presentation by highlighting the important points of the presentation.

II)Topic Selection: The choice of topic is up to the students, with guidance from their supervisor. The area of seminar shall be related to Leadership and Team work.

III)Duration of Seminar- The seminar report shall be of 3 weeks in the I semester.

IV)Guide: Students must ensure that they maintain regular contact with their guide.

V)Submission of the Report- The students are expected to submit a spiral bound hard copy and soft copy of the report.

VI)Guidelines for preparing report:

The entire seminar report (headings, body and references) should be for 5 to 8 pages and a specific format is recommended .

The seminar report should include:

- Presenter's name
- University Seat No
- Heading of the Presentation
- Body of seminar report
- References

An index heading is a short phrase placed at the top which indicates the general subject of the paper.
The body of the seminar report should be a concise statement of the principal contents of the presentation. Students shall include the following concepts in main body of the report:

- The background (Reason)of the Study
- The aim and scope of the presentation
- Presentation subject
- Conclusions of the Presentation
- References- APA referencing styles can be used to write the Bibliography

CIE & SEE Components:

3. The marks given by guide will be considered as CIE component.

4. The marks given by Faculty Committee will be considered as SEE component.

Criteria for allotting marks by the guide:

Seminar Evaluation Form by the Internal Guide

Student Name: ________________________USN_________________

Topic: ____

S.No	Criteria	Level 1 (40-49)	Level 2 (50-69)	Level 3 (70-79)	Level 4 (80-100)
1	Knowledge and content (5 Marks)	limited knowledge of topic with little accuracy	some knowledge of topic with a degree of	standard knowledge of topic, usually	detailed knowledge of topic with consistently

			accuracy	accurate info	accurate info
2	Background of the seminar (5 marks)	Material not clearly related to topic	Material sufficient for clear understanding but not clearly presented	Material sufficient for clear understandin g and effectively presented	Material sufficient for clear understanding and exceptionally presented
3	Relevance of the presentation (5 marks)	No Relevance	Moderate Relevance	Relevance	High Relevance
4	Logic and coherence of report (5 marks)	No logic and coherence	Some logic and coherence	Logical and coherent	Highly Logical and highly coherent
5	Clarity of the report (5 Marks)	Not clearly prepared	Moderately clear	Well prepared	Exceptionally prepared with all information
6	Timely submission (5 marks)	Submitted with a delay of 10 days	Submitted with a delay of 7 days	Submitted with a delay of 3 days	On time submission

Criteria for allotting marks by the faculty committee:

Presentation Evaluation Form

Student Name: ________________________USN_________________
Topic: ____

S.No	Criteria	Level 1 (40-49)	Level 2 (50-69)	Level 3 (70-79)	Level 4 (80-100)	Marks 5 each
1	Introduction	Topic is mentioned	Topic and some of the subtopics are stated	Topic and all subtopics are stated	Topic and all subtopics are stated in proper order	
2	Knowledge of Topic	Limited knowledge of topic with little accuracy	Some knowledge of topic with a degree of accuracy	Standard knowledge of topic, usually accurate info	Detailed knowledge of topic with consistently accurate info	
3	Connection to Chapter Topic & Theme	Limited connection made between evidence, subtopics, topic & theme	Some connection made between evidence, subtopics, topic & theme	Usually connection made between evidence, subtopics, topic & theme	Consistent connection made between evidence, subtopics, topic & theme	
4	Organization	Unclear agenda with illogical sequencing & unhelpful handout	Scant agenda & handout with somewhat useful handout	Clear, logical agenda is usually shown / followed with useful handout	Clear, logical, thorough agenda is shown & followed combined w/ very useful handout	
5	Conclusion	Little summary of subtopics	Topic and some subtopics summarized	Topic and all subtopics summarized	Topic all subtopics summarized in proper order	
6	Creativity / Enthusiasm	Little color or variety used & no smiles	Somewhat bored, with some variety &	Usually smiling, appropriately dressed, variety	Unique, colorful, stimulating presentation with	

			colour		extra effort	
7	Eye Contact	Little contact, dependent on notes	Some eye contact & dependence on notes	usually makes eye contact	consistent eye contact with little dependence on notes	
8	Voice Audibility	Monotone and too quiet	Some inflection and at times clear	Usually clear & inflects voice	Proper inflection, clarity and volume	
9	Use of Time / Pace	Seminar is too short/long and moves too quickly/slow	Sometimes seminar moves too quickly / slowly and at times is off topic	Starts / finishes on time covering relevant info	Starts / finishes on time covering relevant info in an interesting manner	
10	Discussion & Questions and Answers	Little discussion generated from closed-ended, repetitive questions	Some discussion generated from somewhat relevant questions that require superficial thought	Three relevant questions generate discussion that requires thought	Three relevant, open-ended questions generate much discussion, insight, analysis & evaluation	
	Total					50

Signature of Committee of Faculty Member

Mapping Course Outcomes with Program Outcomes:

Course Outcomes	Program Outcomes								PSO	
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PSO 1**	**PSO 2**
CO1								2		2
CO2			3							2
CO3	3	2								3
CO4				3						2
CO5			3				2			2

Curriculum Mapping

Course	Program Outcome							
Seminar	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**
	X	X	X	X			X	X

III SEMESTER

Subject	**ORGANIZATION STUDY**

Subject Code	20MBA307		
Credits	4	**CIE Marks**	50
Duration	8 weeks	**SEE Marks**	100

GUIDELINES FOR ORGANIZATIONAL STUDY FOR MBA III SEMESTER STUDENTS

INTRODUCTION: The Organization Study is intended to facilitate better understanding of the area-wise subjects taught in their Business Management Program. This should also prepare the students with enough understanding about business organization so as to enable them to identify problems to be solved as 'Final Year Project' later in their course.

Course Objectives:

1. To familiarize the students with a business organization to relate theory with practice.
2. To familiarize the students with an organization structure and its functioning
3. To familiarize them with the different departments in the organization and their functions and activities.
4. To enable the students to understand how the key business processes are carried out in an Organization.
5. To study the financial performance of the organization by doing financial analysis
6. To understand the extent of technology adoption including ICT, in the organization for various functions/activities.

Course outcomes: At the end of this study, students should be able to

1. Broad understanding of working of an organization and its specific departments.
2. Identify the organizational processes discussed under Mc-Kinsey Framework
3. Carry out competitive environment analysis through SWOT.
4. Exhibit Identify problem to be solved as part of their Final Year project.
5. Demonstrate understanding of financial health of the organization.

How to Choose an Organization:

Students may do the organization study either by doing an internship or from secondary sources of data. The company should be listed in an Indian stock exchange. They should identify an organization with all functional departments, where they will be able to understand: Operations & Systems, Accounts & Finance, Personnel & HR, marketing Functions and their interactions with each other. The organization chosen should have all the above functional areas to study.

How to conduct the Study:

a) Data pertaining to Organization study can be collected by visiting the organization or by collecting secondary data.

b) Prior to gathering, information, a student should ideally make the organization chart for the organization and try to identify the key functions of each department and understand how it is carried out (the process).

c) Make records of the findings.

Guidelines for preparing report:

The procedure during the organization study and writing of report thereafter will have to be based on the

The information should be arranged sequentially as follows.–

- Cover page
- Certificate from the Organization (scanned copy)
- Certificate from the guide, HOD and Head of the Institution (scanned copy) indicating bonafide performance of Organisation study by the student.
- Declaration by the student (scanned copy)
- Acknowledgement
- Table of contents
- List of tables and graphs
- Executive Summary
- Main body of Report
- References –APA referencing styles.

The report should be well documented and supported by given detailed information-

PART-A

1. **INDUSTRY PROFILE:** Concise overview of the industry, nature, growth potential, influencing economic factors, competitors' analysis, market share, governmental regulations.

2. **COMPANY PROFILE**
   a. Background and inception of the company.
   b. Promoters information
   c. Nature of the business carried.
   d. Vision, Mission and Quality Policy
   e. Achievements/Awards if any
   f. Product/ Services Profile
   g. Area of Operation — Global / National / Regional
   h. Future growth and prospectus.

PART-B

McKinsey's 7S frame work with special reference organization under study

Structure:
Overall organizational structural details — Board of Directors/ Functional heads etc.
Sub structure detailing with each functional discipline. Detailed study of various departments & their function.

Skill:
Classification of skill or study of skill matrix: Detail the steps taken to impact necessary skills – on the job/off the job training.

Style:
Top down / Bottom up

Authoritarian / participative

Any one decision making parameter should be studied pertaining to day-to-day operation, to conclude the style of functioning.

Strategy:

Any one strategy adopted by the company should be considered to explain, "How it is implemented" e.g. — pricing/waste elimination etc.

System:

System followed in any one department in the organization should be detailed.

E.g: Inventory control system / order execution system / Merit rating system etc.

Staff:

Classification/Duties and responsibility of various groups of staff. E.g.: Technical / supervisory / Clerical.

Shared value:

Study of implementing shared value in the company by an illustration, where the company has implemented its stated objective.

PART - C

Internal and External Environment Analysis i.e. SWOC Analysis of the company

PART - D

Financial Statement with Ratio Analysis.

PART - E

Learning experience gained by the candidate during the organizational study.

The student shall seek the guidance of the internal guide on a continuous basis.

Format of the report:

On completion of the project work, student shall prepare a report with the following format:

i. The report shall be prepared using word processor.

ii. The letters should be Times New Roman font ,12" size with 1.15" space between lines.

iii. The major headings should be 16" size and sub headings 14" size. All subsection should be numbered like 1,1, 1,2,1.3 etc…..(for subsections of chapter 1).

iv. All the report shall be printed in the A4 size 1" margin on all side.

v. The report shall be hard-bound facing sheet (only white colour), indicating the title of the report., name and registration number of the student, name of the guide, name of the college and month & year of admission (Spiral binding not permitted)

vi. An undertaking by the student to the effect, that the work is independently carried out by him/her

vii. Acknowledgement.

The total number of pages of the organizational study report shall not exceed 50 pages.

PLAGIARISM: The report is checked for plagiarism using plagiarism software identified by the college from time to time. Plagiarism index should be < 25%.

Guideline for allocation of IA marks and valuation of the report.

SECTION	MARKS ALLOTTED
Overall presentation of the report, regarding understanding Various aspects of the Company	**05**
Industry Profile	**05**
Company Profile	**05**
Product and service Profile	**05**
Detailing of 7S models with illustration	**10**
SWOT Analysis of the Company	**05**
Financial Analysis	**05**
Expression of Learning experience — How closely theory & practice are dovetailed / interfaced in the report	**10**
TOTAL	**50**

Guide line for allocation of marks in viva-voce examination

The viva for this will be held by guide and by an examiner selected from a panel of internal faculty members and approved by HOD.

SECTION	MARKS ALLOTTED
Company and Industry Profile	**10**
McKinsey 7S Framework	**10**
SWOT	**05**
Financial Analysis	**05**
Learning Experience	**10**
Communication and Expression	**10**

Submission of report:

The candidate shall submit 2 hard copies (Royal Blue Color) and 1 soft copy (in PDF file Un-editable Format) in CD of the report one month before the commencement of III semester examinations.

MARKS DISTRIBUTION FOR ORANIZATIONAL STUDY REPORT EVALUATION

SI. No.	**Particulars**	**Max. Marks**
1	Overall Presentation of the report, with regard to understanding various aspects of the company	05
2	Industry Profile	05
3	Company Profile	05
4	Product Profile	05
5	Detailing of 75 Model with Illustration	10
6	SWOT Analysis of the Company	05
7	Financial Analysis	05
8	Expression of Learning Experience — How closely theory practices are Dovetailed/interfaced in the report	10
	TOTAL MARKS	**50**

ORANIZATION STUDY REPORT EVALUATION MARKS SHEET

SI. No.	University Seat Number	Marks Awarded							Marks out of 50
		A	B	C	D	E	F	G	

MARKS DISTRIBUTION FOR ORANIZATION STUDY VIVA-VOCE EXAMINATION

SI. No.	**Particulars**	Max. Marks
A	Brief presentation of the Organization Study undertaken	10
B	Understanding of the managerial practices	10
C	Presentation of Learning Experiences	10
D	Communication Expression	10
E	Overall Presentation	10
	Total Marks	**50**

ORGANIZATION STUDY VIVA-VOCE MARKS SHEET

Date of Viva-Voce Exam:

Sl.No	**University Seat Number**	**Marks Awarded**					**Marks Out of 50**
		A	**B**	**C**	**D**	**E**	
1							
2							
3							
4							
5							

TO BE JOINTLY EVALUATED BY BOTH THE EXAMINERS

The internal marks given by the guide for 50 marks and the viva examination for 50 marks will be taken for 100 marks in total. The Viva Voce Examiners will be nominated by Chairman BOE internally.

Mapping Course Outcomes with Program Outcomes:

Course Outcomes	**Program Outcomes**								**PSO**	
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PSO 1**	**PSO 2**
CO1	3			2				3	3	
CO2				3			2		3	
CO3		3		3					3	
CO4	3								3	
CO5				2					3	

Assessment Pattern Based on Bloom's Taxonomy:

Sl.No	Bloom's Category	SEE
1	Remember	
2	Understand	
3	Apply	30
4	Analyze	30
5	Evaluate	20
6	Create	20
Total		**100**

Curriculum Mapping

Course	Program Outcome							
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**
Organisation Study	X	X		X			X	X

HUMAN RESOURCE SPECIALIZATION

Subject	**EMPLOYEE STAFFING MANAGEMENT**		
Subject Code	**20MBAHR301**		
Credits	3:0:0:0	**CIE Marks**	50
Total No. of Lecture Hours	39	**SEE Marks**	50

Course Objectives:

1. To facilitate basic understanding of the theory, practice, principles, concepts of employee selection, recruitment, career management and succession management.
2. To develop an understanding of recruitment, staffing and career management processes and how these elements interrelate.
3. To enhance students' effectiveness for optimizing the human resource potential of their organization in order to achieve business and strategic objectives.
4. To enable students to develop an integrated recruitment and selection strategy in both traditional and new economy organizational environments.
5. To enable students to effectively develop a complete, professional hiring plan.

Course Outcomes: **At the end of the course, the student will be able to:**

1. Identify Knowledge, Skills, Abilities & Other (KSA&O) human qualities required to perform a job successfully, and develop sound job descriptions, job specifications.
2. Synthesize knowledge regarding the effectiveness of recruitment of employees
3. Identify legal and ethical concerns in selection of candidates and apply their knowledge to develop a complete, professional hiring plan

4. Acquire knowledge about induction, orientation, career and succession planning of employees in an organization.

Unit- I

(8 Hours)

Introduction to Staffing Management: Concepts of Staffing, Factors affecting Staffing, Staffing Process, Staffing models. Strategic staffing, how it is different from traditional staffing, components of strategic staffing.
Human resource planning; Concepts, process
Strategic job analysis and compentency modeling –Concepts of job analysis and strategy behind it, job description and personal specification, Process and Methods, competency modeling
Job Design – Introduction, Definition, Modern Techniques, Factors affecting Job Design, Contemporary Issues in Job Designing.

Unit-II

(9 Hours)

Recruitment -Meaning, Definition, Importance, Factors affecting Recruitment**, Source or Type of Recruitment** – a) Direct/Indirect, b) Internal/ External. **Internal** – Notification, Promotion – Types, Transfer – Types, Reference, **External** – Campus Recruitment, Advertisement, Job Boards – Website/Portals, Internship, Placement Consultancies. Traditional: In-House, Internal Recruitment, On Campus, Employment and Traditional Agency. Modern: Recruitment Books, Niche Recruitments, Internet Recruitment, Service Recruitment, Website and Job, Search Engine, Social Recruiting and Candidate Paid Recruiters, head hunting.
Techniques of Recruitment – Traditional Vs Modern – Recruitment. Recruitment outsourcing-Introduction, process.

Unit-III **(10 Hours)**

Selection – Concept of Selection, Criteria for Selection, Process, Application (Blank Format).Screening – Pre and Post Criteria for Selection, Steps of Selection Interviewing– Types and Guidelines for Interviewer& Interviewee, Types of Selection Tests, Effective Interviewing Techniques. Selection Hurdles and Ways to Overcome Them.
Current trends in Recruitment and Selection Strategies – with respect to Service, Finance, I.T., Law and Media Industry
Appointment and joining: Appointment - Meaning and significance, offer of appointment and acceptance, appointment order, contents of appointment order and its acceptance. Bond for minimum service, bond for good conduct.
Joining- Fixing a joining date. Joining day formalities, verification and collection of certificate copies, collecting photos, PAN number and passport copy. Providing access to enter and exit. Providing place to work, providing furniture, stationary, equipment, entering name in the muster roll, opening the personal file etc.

Unit-IV **(8 Hours)**

Induction – Concept, Types-Formal /Informal, Advantages of Induction, How to make Induction Effective
Orientation & On boarding- Designing orientation program, Types, Process, Difference between orientation and onboarding, Designing onboarding program, Socialization- Types and Tactics.
Career and Succession Management: Definition and Meaning, Need for Career and Succession Planning, Career and Succession Planning: Career Stage, Career Management, The 5-Stage Process of Succession Planning.

Unit-V **(4 Hours)**

Case analysis based on the concepts learnt from Unit-I through IV

TEXT BOOKS

1. Gatewood, Field and Barrick (2016), Human Resource Selection, 8th Ed, Cengage Learning, ISBN-13: 9781305102682
2. Heneman, Herbert G., III, & Judge, Timothy A. (2009). Staffing Organizations, Sixth Edition. Middleton, WI: Mendota House/McGraw-Hill Irwin.

REFERENCE BOOKS

1. Strategic staffing, Jean M Philips & Stanley M Gully, Pearson prentice Hall.
2. Recruitment And Selection : Theories And Practices Dipak Kumar Bhattacharyya, Cengage India , 2016
3. Armstrong, Michael & Baron Angela. (2005). Handbook of Strategic HRM (1st ed.). New Delhi: Jaico Publishing House.
4. Ulrich, Dave, Smallwood, Norm. (2011), Top-grading: How Leading Companies Win By Hiring, Coaching And Keeping The Best People. Paramus, New Jersey: Prentice Hall. ISBN: 0735200491

Mapping Course Outcomes with Program Outcomes

Course Outcomes	Program Outcomes								PSO	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2
CO1				2					2	
CO2				2					1	
CO3		3		2					2	
CO4				2						3

Assessment Pattern Based on Bloom's Taxonomy

Sl. No	Bloom's Category	Test 1	Test 2	Test 3	Assignment	Seminar /Surprise Quiz	SEE
1	Remember	10	10	10		5	10
2	Understand	20	10	10			20
3	Apply	20	20	20	5		40
4	Analyze	30	30	30	5		60
5	Evaluate	10	20	20		5	40
6	Create						10
Total		**90**	**90**	**90**	**10**	**10**	**180**

Curriculum mapping

Course	Program Outcomes							
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
Employee Staffing Management		**X**		**X**				

Subject	**PERFORMANCE AND COMPENSATION MANAGEMENT**		
Subject Code	**20MBAHR302**		
Credits	3:0:0:0	**CIE Marks**	50
Total no. of Lecture Hours	39	**SEE Marks**	50

Course Objectives:

1. To make the students identify the importance and the process of performance management.
2. To impart the different performance appraisal method and issues and problems associated with performance appraisal.
3. To educate the students about the concepts of ethical performance appraisal and strategic performance management.
4. To educate the students on the concepts of compensation and benefit system followed nationally as well as internationally.

Course Outcomes: At the end of the course, students will be able to:

1. Demonstrate an understanding of various concepts of performance management and their implications for organizational development
2. Apply Performance and Compensation management concepts in addressing organizational problems to come up with optimal, feasible solutions.
3. Demonstrate the concept on compensation and benefits from national and international context.
4. Analyze the compensation and benefit system of the industry and construct suitable compensation structure as per the organization requirement.

Unit I **(8 Hours)**

Performance Management: Meaning of performance, Definition of performance management, Objectives and benefits of performance management, Importance of performance management, Characteristics of performance management, and elements of effective Performance Management.
Performance counseling: Introduction, definition, performance counseling for higher job performance, Performance counseling skills.
Performance management process: Introduction, predictions for the successful Institution of performance, Performance management Process.

Unit II **(9 Hours)**

Performance Appraisal: Meaning, Objectives, barriers to performance appraisal, who can appraisal, when to appraise, performance appraisal process, traditional and Modern performance appraisal methods, Balance scorecard, Outcome merits- Economic value added, Other economic measures, Building a high performance culture
Performance consulting: concept, need & role, designing and using performance relationship map.
Ethics in Performance Management: Introduction, Meaning, Principles of ethics in performance management, objectives and significance of ethics in performance , ethical issues and dilemmas in performance management, Ethical strategies in Performance management.

Unit III **(9 Hours)**

Compensation: Meaning of compensation, contrasting perspectives of compensation, objectives of compensation planning, components of compensation, factors affecting compensation, compensation determination process, Forms of pay, Financial and non-financial pay, pay model, Internal and external equity in compensation systems, Similarities and differences in strategies, , strategic pay Decisions, team based reward
Designing pay levels, mix and pay structure: specify competitive pay policy, the purpose of a survey, design the survey, Interpret survey results and construct a market line.

Unit IV **(9 Hours)**

Incentives – Incentive Plan, individual incentives, Pay for performance, Pay Discrimination, compensation of special group.
Benefits: Benefit determination Process, Legally required benefits: Retirement, medical and other benefits, Employee profit sharing, employee stock option, gain sharing
International Compensation: challenges faced by international managers, Guide to international compensation, Recognizing variation, the social contract, Culture and pay, Preliminary considerations of international compensation, Strategic choice in global compensation, Expatriate pay, Repatriation Pay issues.

Unit V **(4 Hours)**

Case Analysis: Compulsory question for 20 marks. Review and recap of case studies discussed from unit 1 to unit 4.

TEXT BOOKS:

1. Performance Management, A S Kohli, T Deb, Oxford Publication, Fifth edition,2010
2. Performance Management, Robert L Cardy, PHI Publication,
3. Compensation, George T Milkovich, Jerry M Newman, C S Venkata Ratnam, 9th edition, McGraw-Hill, 2009.

REFERENCE BOOKS:

1. Performance management, Prem chandha, Macmillan publication
2. Compensation and Benefit design, Bashker D biswas, FT Press, 2012.
3. Compensation management, Er soni shyam singh, Excel Books.
4. Compensation and Benefit Design, Bashker D, Biswas, FT Press, 2012
5. Strategic Compensation, Joseph J Martocchio, 6th edition, Pearson.
6. Compensation & Reward Management, B D Singh, 2nd edition, Excel Book

Mapping Course outcome with program outcome:

Course Outcomes	Program Outcomes								PSO	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2
CO1	2								1	
CO2					2		2		1	
CO3			1			1			1	
CO4	3							2		2

Assessment Pattern Based on Bloom's Taxonomy

Sl. No	Bloom's Category	Test 1	Test 2	Test 3	Assignment	Seminar /Surprise Quiz	SEE
1	Remember	20	30	10	10	5	40
2	Understand	30	20	20	5		50
3	Apply	10	10	20			35
4	Analyze	20	20	20			35
5	Evaluate	10	10	20			20
6	Create						
Total		**90**	**90**	**90**	**15**	**5**	**180**

Curriculum Mapping

Course	Program Outcomes							
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
Performance and Compensation Management	X		X		X	X	X	X

Subject	**PERSONAL GROWTH AND INTERPERSONAL EFFECTIVENESS**		
Subject Code	**20MBAHR303**		
Credits	3:0:0:0	**CIE Marks**	50
Total no. of Lecture Hours	39	**SEE Marks**	50

Course Objectives:

1. To make the student identify the strength and weakness within individual for the well being of the individual and organization.
2. To make the students familiar with their behavior as individual, in a group and in the organization and alter according to the need.
3. To make the students familiar with the interpersonal skills for the effectiveness of the team building and organizational development.
4. To make the students familiar with the importance of relationships and social adjustment with peers at workplace.

Course Outcomes: At the end of the course, the students will be able to:

1. Enhance knowledge and skills to develop an appreciation and sensitivity to individual differences that impact personal, social and professional success.
2. Demonstrate an understanding of group dynamics and effective teamwork and exhibit the ability to work effectively with those different from themselves
3. Develop interpersonal skills including communication and cooperation and build meaningful relationships with peers, leaders, and community members
4. Demonstrate the ability to think reflectively and implement effective goal setting and action planning strategies for decision making under stressful situations.
5. Implement successful strategies for enhancing self-image, self-esteem, emotional IQ and other factors and developing individualized action plans for improvement of overall personal well-being.
6. Demonstrate the ability to maintain ideal relationships and adjust themselves to the different scenarios occurring at workplace.

Unit I: (8 Hours)

Personal: Self-awareness, Developing self-awareness, Relationship between self-awareness and self-esteem, Role, Role and the individual , Life roles , Organizational roles, dimensions of life roles, Role efficacy, Role stress, NLP Test, Emotional Intelligence, Positive Cognitive States and Processes: Optimism- How optimism works; variation of optimism and pessimism; Spirituality and well-being.

Unit II (9 Hours)

Personal growth: Meaning, nature and scope of personal Growth, Stages of personal growth, Activities promoting personal growth, Ego states, types of transactions and Time structuring. Life position,Scripts and Games, Strokes and Stamps.

Personal effectiveness-I: Understanding our Thinking Process, Managing our Internal
Dialogue, Convergent Thinking, Divergent thinking, Perceptual Positions for Assertiveness, Managing Conflicts, Creating Rapport, Powerful Persuasion Strategies.

Unit III: (9 Hours)

Personal effectiveness-II: Personality Typing using Enneagram, Carl Jung\'s theory of personality types and Myers Briggs Type Indicator test (MBTI), Trait theories-Guilford Peogut, Seven Habits of Highly Effective People , Spiritual Foundations of Personal Effectiveness Interpersonal relations and personal growth: Interpersonal needs, motivation and behaviour-FIRO-B and Johari Window, Defense Mechanism in groups, T-Group, Human process labs.

Unit IV: (9 Hours)

Nurturing Relationships: Meaning of relationship, Changing concepts and roles in relationships, Relationship with self–self-concept, self-acceptance, self-esteem, Types of self-esteem, self-confidence, Power of self-Talk. Relationship with others – Cultivating open communication, Adjustments, Relationship between social adjustment and self-acceptance, compromises, give and take, Empathy& Prioritization.

Unit V (4 Hours)

Case Analysis: Compulsory question for 20 marks. Review and recap of case studies discussed from unit I to unit IV.

TEXT BOOKS:

1. Human Relations in organizations - Robert N. Lussier, 6/e, McGraw Hill Education.
2. Understanding Organization B. Udai Pareek, Oxford University Press, 3rd edition,2012.

REFERENCE BOOKS:

1. Handbook of positive psychology. (eds.), Snyder, C.R. & Lopez, S.J. (2002), New York: Oxford University Press.
2. Science: Achieving behavioral excellence for success, Singh, A. (2013). Behavioral. New Delhi: Wiley India Pvt. ltd.
3. Theories of Personality- Calvin S Hall, 4/e, Wiley India Pvt. Ltd.
4. Seven habits of highly effective people - Stephen R Covey, Pocket BOOKS.
5. Development of Management Skills - Whetten & Cameron, 8/e, PHI.
6. Competency Mapping Assessment and Growth - Naik G. P, IIHRM, 2010.
7. Training in interpersonal Skills- Stephen Robbins, Pearson Education.

Mapping Course Outcomes with Program Outcomes

Course Outcomes	Program Outcomes								PSO	
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PSO1**	**PSO2**
CO1		2				3			2	2
CO2				3						3
CO3					2	3				3
CO4		2				3			2	
CO5						3		2	2	
CO6					2					3

Assessment Pattern Based on Bloom's Taxonomy

Sl. No	Bloom's Category	Test 1	Test 2	Test 3	Assignment	Seminar /Surprise Quiz	SEE
1	Remember	20	30	10	10	5	40
2	Understand	30	20	20	5		50
3	Apply	10	10	20			40
4	Analyze	30	20	20			30
5	Evaluate		10	20			20
6	Create						
Total		**90**	**90**	**90**	**15**	**5**	**180**

Curriculum Mapping

Subject	Program Outcomes							
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**
Personal Growth and Interpersonal Effectiveness		**X**		**X**	**X**	**X**		**X**

Subject	**CONFLICT AND NEGOTIATION MANAGEMENT**

Subject Code	20MBAHR304		
Credits	3:0:0:0	CIE Marks	50
Total no. of Lecture Hours	39	SEE Marks	50

Course Objectives:

1. To understand the nature of various dimensions of conflict.
2. To learn various strategies and techniques to manage conflicts.
3. To understand the importance and role of negotiation in conflict resolution.
4. To understand the issues in negotiation and the importance of ethics in negotiation.

Course Outcomes: At the end of the course, the students will be able to:

1. Demonstrate and understand the components, dimensions and approaches of conflict and apply it to the organizational and real life problem solving.
2. Acquire the necessary skills for conflict resolution with realistic constraints and offer solution to the organizational problem.
3. Recognize the need for and the ability to operate in multidisciplinary team and ethically negotiate across domains for organizational development.
4. Understand the challenges in negotiating with a team and to exercise the underlying ethics involved.

Unit I: (8 Hours)

Introduction: Understanding conflict, components, types of conflict, models of conflict – Process and Structural Models, functional & dysfunctional conflict, relationship between conflict and performance in team, levels of conflict – intrapersonal, interpersonal, group & organizational conflicts, sources of conflict - intrapersonal, interpersonal, group & organizational sources, conflict and creativity, dimensions of cost of conflict.

Unit II: (10 Hours)

Conflict Management Design: Nature of conflict Management, contingency approach, conflict management process,conflict and group decision making, work force diversity and conflict group, the conflict domain, conflict trends, conflict distribution, conflict mapping and tracking.

Managing Conflict: Managing interpersonal conflict:
collaboration & conflict resolution, dealing with difficult subordinates, boss & colleagues, 1 to 1 dispute resolution.

Managing team & organization conflict: techniques to resolve team conflict, strategies to resolve organizational conflict, negotiation as a tool for conflict resolution, Conflict resolution models, framework model,

Unit III: (8 Hours)

Negotiations-Meaning, Types of Negotiations, negotiation process, factors for successful negotiations, intra organizational negotiation, tricks used in negotiation process, Techniques of negotiation, Strategy and tactics for distributive bargaining, bargaining and problem solving, strategy and tactics for integrative negotiation, Ethics in negotiation.

Unit IV: (8 Hours)

Managing difficult negotiations: Third party approaches: Third party interventions, formal intervention methods, justice in negotiation – Arbitration, Mediation and Process Consultation, Best practices in negotiation, structures of escalation in negotiation Tactics for managing difficult negotiations.

Unit V: (5 Hours)

Case Analysis: Compulsory question for 20 marks. Review and recap of case studies discussed from unit I to unit IV.

TEXT BOOKS:

1. Corporate Conflict Management - Concepts and Skills, Eirene Leela Rout, Nelson Omiko, Prentice India, 2007.
2. Contemporary Conflict Resolution, Oliver Ramsbotham, Hugh Miall, Tom Woodhouse, 3rd edition, Polity publishers, ISBN 0745649734, 9780745649733, 2011.

REFERENCE BOOKS:

1. Managing conflict and negotiation, B.D. Singh, 1st edition, Excel books, 2008.
2. Conflict Management: Practical guide to develop negotiation strategies, Barbara A Budjac Corvette, Pearson Prentice Hall, 2006, ISBN: 8174466428, 9788174466426
3. Managing Conflict in Organizations, M. Afzalur Rahim, 4th Edition, Transaction Publishers, 2011, ISBN 1412844258, 9781412844253.
4. Negotiations, Roy J. Lewicki, David M. Saunders, Bruce Barry, 5/e, Mc Graw Hill, 2005.
5. Handling Conflict and Negotiation, Manchester Open Learning, illustrated edition, Kogan Page, 1993, ISBN 0749411406, 9780749411404

Mapping Course outcome with Program Outcomes

Course Outcomes	Program Outcomes								PSO	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2
CO1	3				2				2	
CO2	3				2				2	
CO3	3				2				2	
CO4	3				2				2	

Assessment Pattern Based on Bloom's Taxonomy

Sl. No	Bloom's Category	Test 1	Test 2	Test 3	Assignment	Seminar urprise Quiz	SEE
1	Remember	20	30	10	10	5	40
2	Understand	30	20	20	5		50
3	Apply	10	10	20			40
4	Analyze	30	20	20			30
5	Evaluate		10	20			20
6	Create						
Total		90	90	90	15	5	180

Curriculum Mapping

Course	Program Outcomes							
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
Conflictand Negotiation Management	X				X			

Subject	TALENT MANAGEMENT		
Subject Code	**20MBAHR305**		
Credits	3:0:0:0	**CIE Marks**	50
Total no. of Lecture Hours	39	**SEE Marks**	50

Course Objectives:

1. To make students to understand the concepts of talent management
2. To explain various competency methods adopted in talent management
3. To enable the students to understand the major talent management practices of performance management, employee engagement, succession and career planning.

Course Outcomes: **At the end of the course, students will be able to:**

1. Demonstrate the knowledge on talent management.
2. Apply the concepts of competency methods in talent management.
3. Analyze the prominence of performance management in managing the talent.
4. Gain the insights of various talent management practices like performance management, employee engagement, succession and career planning.

Unit I **(8 Hours)**

Talent Management: Meaning and significance of talent management. Aligning HRM goals to business**,** attracting talent, Talent acquisition, Retaining talent, Becoming the best employer by employer, branding activities, inculcating performance culture, Employee Downsizing, Right sizing the workforce, Employee outsourcing: Employee Moon lighting, work life balance, Diversity management, providing HR leadership to business.

Unit II **(10 Hours)**

Competency Mapping & Methods of Data Collection: Features of competency methods, historical development, definitions, approaches to mapping and case studies in competency mapping. Competency mapping procedures and steps- business strategies, performance criteria, criteria sampling, tools for data collection, data analysis, validating the competency models, short cut method, mapping future jobs and single incumbent jobs, using competency profiles in HR decisions.
Methods of data collection for mapping.-Observation, repertory grid, critical incidence technique, expert panels, surveys, automated expert system, job task analysis, behavioral event interview. Developing competency models from raw data- data recording, analyzing the data, content analysis of verbal expression, validating the competency models.

Unit III **(8 Hours)**

Performance management & employee development: Introduction, Personal Development plans, 360 Degree feedback as a developmental tool, Career planning & development, performance management & reward systems: performance linked remuneration system, Pay for performance, performance linked career planning & promotion policy.

Unit IV **(8 Hours)**
Employee Engagement, Succession Planning- meaning and significance, constituents of engagement, conceptual framework of engagement, behaviors associated with engaged employees, engaged, not engaged, actively disengaged, parameters to measure employee engagement, Q 12 model of Gallup, employee satisfaction survey .
Succession and Career planning: Identifying managerial positions which are critical for the business. Identifying second line of leaders and developing their capabilities to occupy the critical positions in the event of the exit of current incumbents.

Unit V **(5 Hours)**

Case Study Compulsory Question for 20marks.Review and Recap of Case studies and problems discussed from Unit I to Unit IV.

TEXT BOOKS:
1. Competence at work - Lyle M. Spencer, Signe M. Spencer. John Wiley 1993
2. Competency mapping, Assessment and Growth - Naik G.P, IIHRM, 2010

REFERENCE BOOKS:
1**.** Performance Management - Dixit Varsha, 1/e, Vrinda Publications Ltd
2**.** A Handbook of Competency Mapping – Seema Sangi, Response Performance Management - Herman Aguinis, Pearson Education, 2007.
4. The Talent Management Hand Book - Lance A. Berger & Dorothy R. Berger, Tata McGraw Hill.
5. Appraising & Developing Managerial Performance- Rao T. V, Excel Books

Mapping Course Outcomes with Program Outcomes:

Course Outcomes	**Program Outcomes**							
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**
CO1	2		3					
CO2			3		2			
CO3	2							
CO4			3					

Assessment Pattern Based on Bloom's Taxonomy

Sl. No	**Bloom's Category**	**Test 1**	**Test 2**	**Test 3**	**Assignment**	**Seminar /Surprise Quiz**	**SEE**
1	Remember	20	30	10	10	5	40
2	Understand	30	20	20	5		50
3	Apply	20	10	20			35
4	Analyze	20	20	20			35
5	Evaluate		10	20			20
6	Create						
Total		**90**	**90**	**90**	**15**	**5**	**180**

Curriculum Mapping

Subject	**Program Outcomes**							
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**
Talent Management	**X**		**X**		**X**			

Subject	**ADVANCED HRM**		
Subject Code	**20MBAHR306**		
Credits	3:0:0:0	**CIE Marks**	50
Total no. of Lecture Hours	39	**SEE Marks**	50

Course Objectives:

1. To help students understand the transformation in the role of HR functions from being a support function to strategic function.
2. To understand the concepts of Career and Competency Development
3. To understand the role of HR in Employee Counseling and Employee Coaching.
4. To understand the various practices and issues in HRM in the context of Multi-national organizations.

Course Outcomes: At the end of the course, the students will be able to:

1. Comprehend the strategic tools and techniques used by organizations
2. Meet and resolve challenges in human resource management.
3. Gain insights in career and competency development.
4. Gain insights on how to manage human resource in international context.

Unit I

(08 Hours)

Human Resource Development: Meaning – Strategic framework for HRM and HRD – Vision, Mission and Values – Importance –Challenges to Organizations – HRD Functions - Roles of HRD Professionals - HRD Needs Assessment HRD practices – Measures of HRD performance – Links to HR, Strategy and Business Goals – HRD Program Implementation and Evaluation – Recent trends – Strategic Capability , Bench Marking and HRD Audit, Strategic HRM and Global scenario, Sustainable HRM.

Unit II

(10 Hours)

E-HRM & cross cultural HRM :e- Employee profile– e- selection and recruitment - Virtual learning and Orientation – e - training and development – e- Performance management and Compensation design – Development and Implementation of HRIS – Designing HR portals Employee surveys online.

Domestic Vs International HRM - Cultural Dynamics - Culture Assessment - Cross Cultural Education and Training Programs – Leadership and Strategic HR Issues in International Assignments - Current challenges in Outsourcing, Cross border Mergers and Acquisitions - Repatriation etc - Building Multicultural Organization -

Unit III:

(09 Hours)

Career & Competency development : Career Concepts – Roles – Career stages – Career planning and Process – Career development Models– Career Motivation and Enrichment –Managing Career plateaus- Designing Effective Career Development Systems – Competencies and Career Management – sources of competency information, Competency Mapping Models – Equity and Competency based Compensation, competency based application.

Unit IV:

(09 Hours)

Employee coaching & counselling : Need for Coaching – Role of HR in coaching – Coaching and Performance – Skills for Effective Coaching – Coaching Effectiveness, couching traps and problems.Need for Counseling – Role of HR in Counseling - Components of Counseling Programs – Counseling Effectiveness- counseling dilemma. Employee Health and Welfare Programs – Work Stress, Sources - Consequences
Stress Management Techniques.- Eastern and Western Practices - Self Management and Emotional Intelligence

Unit V **(04 Hours)**

Case Study Compulsory Question for 20marks. Review and Recap of Case studies and problems discussed from Unit I to Unit IV

TEXT BOOKS :

1.Randy L. Desimone, Jon M. Werner – David M. Mathis, Human Resource Development, Cengage Learning, 2007. 2.Paul Boselie. Strategic Human Resource Management. Tata McGraw Hill. 2011

REFERENCE BOOKS:

1. Human Relations in organizations - Robert N. Lussier, 6/e, McGraw Hill Education.
2. Competency Mapping Assessment and Growth - Naik G. P, IIHRM, 2010.

Mapping Course Outcomes with Program Outcomes:

Course Outcomes	Program Outcomes								PSO	
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PSO1**	**PSO2**
CO1	2								2	
CO2	2		2						2	
CO3	3								2	
CO4	2					3		1	2	

Assessment Pattern Based on Bloom's Taxonomy

Sl. No	Bloom's Category	Test 1	Test 2	Test 3	Assignment	Seminar /Surprise Quiz	SEE
1	Remember	20	30	10	10	5	40
2	Understand	30	20	20	5		50

3	Apply	10	10	20			40
4	Analyze	30	20	20			30
5	Evaluate		10	20			20
6	Create						
Total		**90**	**90**	**90**	**15**	**5**	**180**

Curriculum Mapping

Subject	**Program Outcomes**							
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**
Advanced HRM	X		**X**			X		X

MARKETING SPECIALIZATION

Subject	**CONSUMER BEHAVIOUR**		
Subject Code	**20MBAMM301**		
Credits	3:0:0:0	**CIE Marks**	50
Total No. of Lecture Hours	39	**SEE Marks**	50

Course Objectives:

1. To provide an understanding the concept of consumer behavior, decision making by consumers, behavior variables and influences on consumer behavior.
2. To provide comprehend the social and cultural dimensions of consumer behavior, factors impacting attitudes and behavior.
3. To provide arm to the budding marketers with an insight of the psychological and behavioral concepts of consumers thus enabling them to achieve their objectives and excel.
4. To enable students with various dynamics of opinion leadership

Course Outcomes: At the end of the course, students will be able to:

1. Acquire an understanding of the concepts and meaning of consumer behavior, decision making by consumers, behavior variables and influences on consumer behavior.
2. Analyze the importance of psychological and behavioral concepts of consumers thus formulate them to achieve their objectives and excel.

3. Demonstrate comprehensive and integrative nature social cultural dimensions of consumer behavior, factors impacting attitudes and behavior.
4. Make understand the various concepts of diffusion of innovation and role of opinion leadership in consumer buying behaviour.

Unit I **(10 Hours)**

Introduction to the study of Consumer Behavior: Meaning & Definition of CB, Difference between consumer & Customer, Nature & characteristics of Indian Consumers.

Models of Consumer Behavior: Input-Process-Output Model, Nicosia Model, Howard Sheth Model, Engel-Kollat-Blackwell Models of Consumer Behavior

Levels of Consumer Decision Making: Consumer Buying Decision Process, levels of consumer decision making, Views of consumer decision making

Unit II **(9Hours**)

Individual Influences on Consumer Behaviour and CRM:

Motivation: Basics of Motivation, Motivation Process, Arousal of motives, Motivation Theories and Marketing Strategy – Maslow's Hierarchy of Needs, McGuire's Psychological Motives **Personality:** Basics of Personality, Theories of Personality and Marketing Strategy (Freudian Theory, Neo-Freudian Theory, Trait Theory), Brand Personality (Brand Personification, Gender, Geography, Colour), Self and Self-Image (One or Multiple selves, The extended self, Altering the self).

Perception: Basics of Perception & Marketing implications, Elements of Perception Dynamics of Perception

Learning: Elements of Consumer Learning, Behavioural learning theory

Unit III **(8Hours)**

External Influences on Consumer Behavior:

Social Class: Social Class Basics, Features of Social Class, Five Social-Class Categories in India

Culture and Subculture: Major Focus on Indian Perspective Culture: Basics, Meaning, Characteristics, Factors affecting culture, Role of customs, values and beliefs in Consumer Behaviour. Subculture: Meaning, Subculture division and consumption pattern in India, Types of subcultures

Groups: Meaning and Nature of Groups, Types of groups.

Unit IV **(7Hours)**

Consumer Influence and Diffusion of Innovations Opinion Leadership: Dynamics of opinion leadership process, Measurement of opinion leadership, Market Mavens, Opinion Leadership & Marketing Strategy, Diffusion of Innovations: Diffusion Process, Adoption process.

Unit V **(5 Hours)**

Case Study Compulsory question for 20 Marks. Review and recap of case studies discussed from Unit I to Unit IV

TEXT BOOKS:

1. Consumer Behavior - Leon Schiff man, Lesslie Kanuk,10/e, Pearson, 2010.
2. Consumer Behavior: Building Marketing Strategy – Del I. Hawkins, & Others, 11/e TMH.

3. Consumer Behavior: The Indian Context (Concepts and Cases) – S.Ramesh Kumar. Paperback, 2017

REFERENCE BOOKS:

1. Consumer Behavior - Henry Asseal, Cenage Learning.
2. Consumer Behavior in Indian Perspective – Suja Nair, Himalaya Publications
3. Consumer Behavior: Text and Cases – Satish Batra and S.H.H.Kazmi, Paperback, 2008
4. Customer Behavior: A Managerial Perspective – Sheth, Mittal, Cengage Learning.

Mapping Course Outcomes with Program Outcomes:

Course Outcomes	Program Outcomes								PSO	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2
CO1	2	3								3
CO2	2								1	
CO3	1								2	
CO4	1								2	

Assessment Pattern Based on Bloom's Taxonomy:

Sl. No	Bloom's Category	Test 1	Test 2	Test 3	Assignment	Seminar /Surprise Quiz	SEE
1	Remember	10	10	10		5	10
2	Understand	20	10	10			20
3	Apply	20	20	20	5		40
4	Analyze	30	30	30	5		60
5	Evaluate	10	20	20		5	40
6	Create						10
Total		**90**	**90**	**90**	**10**	**10**	**180**

Curriculum Mapping:

Course	Program Outcomes							
Consumer Behavior	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
	X	X						

Subject	SALES AND RETAIL MANAGEMENT		
Subject Code	20MBAMM302		
Credits	3:0:0:0	CIE Marks	50
Total No. of Lecture Hours	39	SEE Marks	50

Course Objectives:

1. To provide students an understanding of the concepts, techniques and approaches required for effective decision making in the area of sales management and to emphasize on the practicing manager's problems and dilemmas.
2. To ensure students to develop skills that are critical for generating, evaluating and selecting sales strategies
3. To provide students an understanding of the contemporary retail management issues, strategies and trends in retailing.
4. To highlight the significance of retailing and its role in the success of modern world.

Course Outcomes: At the end of the course, students will be able to:

1. Demonstrate their conceptual understanding of the different concepts, techniques and approaches required for effective decision making in the area of sales management
2. Display their skills and knowledge that are critical for generating, evaluating and selecting sales strategies for the company.
3. Explain and appreciate an understanding of the contemporary retail management issues, strategies and trends in retailing.
4. Demonstrate the significance of retailing and its role in the success of modern world and apply knowledge and insights of retailing to solve an organization's problem.

Unit 1 **(12 Hours)**

Introduction to sales management: Meaning, Evolution, Importance, Personal Selling, Emerging Trends in Sales Management, elementary study of sales organizations, qualities and responsibilities of sales manager. **Selling skills & Selling strategies:** Selling and business Styles, selling skills, situations, selling process, sales presentation, Handling customer objections, Follow-u action.

Management of Sales Territory & Sales Quota: Sales territory, meaning, size, designing, sales quota, procedure for sales quota. Types of sales quota, methods of setting quota, Recruitment and selection of sales force, Training of sales force

Unit II **(07 Hours)**

Sales force motivation and compensation: Nature of motivation, Importance, Process and factors in the motivation, Compensation-Meaning, Types of compensation plans and evaluation of sales force by performance and appraisal process.

Sales management job: Standard sales management process-international sales management - international market selection-market survey approach or strategy – Sales Analytics – Social and Ethical Concerns in Sales

Sales Manager and Sales Person: Role of sales manager and sales people; functions of sales manager, functions of sales person, types and characteristics of sales manager and sales people-Time management for sales manager and sales person.

Unit III **(08 Hours)**

Retail Management: Introduction, meaning, Characteristics, Retail industry India, role of retailing Trends in Retailing, Emergence of organizations of retailing, FDI in retail, Retail Location and Layout plan, careers in Retailing.

Retail Market segmentation: Introduction to Market segment, Criteria for effective segmentation, Dimensions of segmentation, Understanding Shoppers.

Unit IV **(10 Hours)**

Retailing Channels: Products and merchandise management, structure, nature and channel, criteria for selection of suppliers, Channel choice, product movement, merchandising plans, Store management Supply Chain Management in Retailing, E-Retaling

Retail Pricing: Factors and pricing, Retail pricing strategies, Retail promotion strategies, Retail sales promotion, publicity.

Relationship Marketing in Retailing: Management of Relationship, Evaluation of Relationship Marketing, Relationship, Marketing Strategies, Retail Research and Retail Audits

Unit V: **(02 Hours)**

Case Study : Compulsory question for 20 Marks. Review and recap of case studies discussed from Unit I to Unit IV

TEXT BOOKS:

1. Sales Management by Charles, Futrell, 6/e, Thomson South Western, 2003.
2. Sales & Distribution Management, Tapan K.Panda & Sunil Sahadev, 6/e, Oxford University Press.
3. Retail Management - Levy & Weitz, 8/e, TMH, 2012.
4. Retail Management: Text and Cases – U.C.Mathur

REFERENCE BOOKS:

1. Managing of Sales Force by Spiro Stanton Rich, 11/e, TMH, 2003.
2. Sales & Retail Management, an Indian perspective by Dr.S.L Gupta, 1/e, Excel Books, 2007.
3. Salesmanship and Sales Management-P.K Sahu & K C Raut, 3/e, Vikas Publishing House.
4. Principles of Retail Management - Rosemary Varley, Mohammed Rafiq, Palgrave Macmillan, 2009.
5. Integrated Retail Management - James R. Ogden & Denise Trodden, Biztantra, 2003.

Mapping Course Outcomes with Program Outcomes:

Course Outcomes	Program Outcomes								PSO	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2
CO1	2							2	1	
CO2		1				2				2
CO3			2						2	
CO4		1				1	3			1

Assessment Pattern Based on Bloom's Taxonomy:

Sl. No	Bloom's Category	Test 1	Test 2	Test 3	Assignment	Seminar /Surprise Quiz	SEE
1	Remember	20	30	10	5		40
2	Understand	30	20	20	5		50
3	Apply	10	10	20		5	40
4	Analyze	30	20	20		5	30

5	Evaluate		10	20			20
6	Create						
Total		**90**	**90**	**90**	**10**	**10**	**180**

Curriculum Mapping

Course	**Program Outcomes**						
Sales and Retail Management	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**
	X	X	X			X	X	X

Subject	**E-MARKETING**		
Subject Code	**20MBAMM303**		
Credits	3:0:0:0	**CIE Marks**	50
Total no. of Lecture Hrs	39	**SEE Marks**	50

Course Objectives:

1. To familiarize the students with the preliminary aspects of e-commerce
2. To enable the use of different electronic media for constructing marketing activities
3. To make the students to learn the importance of data and the application of marketing knowledge in social media.
4. To help the students to understand and analyze e-commerce websites based on their content, design, usability, attractiveness and other website properties.
5. To enable students to identify Internet marketing implications and creation of customer value.

Course Outcomes: At the end of the course, students will be able to:

1. Understand and remembering the preliminary aspects of e-commerce
2. Demonstrate their knowledge and apply different electronic media for constructing marketing activities
3. Analyze and apply the importance of data and the application of marketing knowledge in social media.
4. Analyze e-commerce websites based on their content, design, usability, attractiveness and other website properties so as to implement in the present system.
5. Demonstrate their conceptual skills about Internet marketing implications & creation of customer value.

Unit I: **(9 Hours)**

Introduction to E-Marketing:

Past-Present-Future- Internet Marketing Paradigm – Internet Infrastructure Stack, Strategic drivers of the Internet Economy, E-Business Models,

E-Marketing Plan:

Overview of the E-Marketing Planning Process, Creating an E-marketing Plan, A Seven step E-Marketing Plan

Unit II: **(10 Hours)**

E-Marketing Environment:

Overview of Global E-Marketing Issues, Country and Market Opportunity analysis, Technological readiness influences marketing, Wireless Internet access, The Digital Divide Ethical and Legal Issues, Privacy, Digital property, Online Expression,

E-Marketing Research:

Data driven strategy, Marketing Knowledge Management, Monitoring Social Media, Technology enabled approaches, Real space approaches, Marketing Databases and Data Warehouses, Data Analysis and Distribution

Unit III: **(7 Hours)**

E-Marketing Management:

Products on Internet, Creating customer value online, E-marketing enhanced product development, Pricing, Payment options, Online channel intermediaries, Internet advertising, Marketing Public relations, Sales promotion offers, Direct and Personal Selling, Social Media strategies.

Unit IV: **(9 Hours)**

Evaluating Performance and Opportunities:

Measuring and evaluating web marketing programs, Social and Regulatory issues, Privacy, Security, Mobile Marketing, Online Governance and ICANN.

Unit V: **(4 Hours)**

Case Study: Compulsory question for 20 marks. Review and recap of case studies and problems discussed from unit I to unit IV.

TEXT BOOKS:

1. E-Marketing – Judy Strauss and Raymond Frost, Prentice Hall
2. Internet Marketing: Integrating Online and Offline Strategies – M.L.Roberts and Debra Zahay, Cengage Publishing
3. E-Commerce: Fundamentals and Applications – Chan.h.Lee, R.Dillon, and Chang.E

REFERENCE BOOKS:

1. Global Electronic Commerce – Theory and Case Studies, J.Christopher Westland and Theodore.H.K.Clark, Oxford University Press
2. The Future of E-Markets – Martin Bichler, Cambridge Press
3. E-Commerce: A Manager's Guide to E-Business – Diwan.P and Sharma, Vanity Books International
4. E-Commerce: An Indian Perspective – Joseph.P.T, PHI
5. Electronic Commerce- A Managerial Perspective: Efraim Turban, Tae Lee, David King and H.Michael Chung, Pearson Education Asia

Mapping Course Outcomes with Program Outcomes:

Course Outcomes	**Program Outcomes**	**PSO**

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2
CO1								2	1	
CO2		3								2
CO3				2			1		1	
CO4						3				2
CO5	2								1	

Assessment Pattern Based on Bloom's Taxonomy

Sl. No	Bloom's Category	Test 1	Test 2	Test 3	Assignment	Seminar /Surprise Quiz	SEE
1	Remember	30	20	20	5	5	60
2	Understand	20	20	20			40
3	Apply	10	20	20	5		30
4	Analyze	20	20	20			20
5	Evaluate	10	10	10		5	30
6	Create						
Total		**90**	**90**	**90**	**10**	**10**	**180**

Curriculum Mapping

Course	Program Outcomes							
E-Marketing	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**
	X	X		X		X	X	X

Subject	**BUSINESS MARKETING**		
Subject Code	**20MBAMM304**		
Credits	3:0:0:0	**CIE Marks**	50
Total No. of Lecture Hours	39	**SEE Marks**	50

Course Objectives:

1. To facilitate students to understand the various concepts of Business Marketing, this helps to develop sound marketing policies for Industrial goods.

2. To prepare students for careers in the areas of marketing of Business products & services.
3. To enhance the ability of the students to understand the nature of Business to Business marketing & the process involved in practice.
4. To equip students to Develop of Business to Business Strategies and their implementation.

Course Outcomes: At the end of the course, students will be able to:

1. Demonstrate their conceptual understanding of the various concepts of Business Marketing, and to acquaint sound marketing policies for Industrial goods.
2. Demonstrate and apply class room learning in the real corporate world by marketing Business products and services.
3. Analyze and demonstrate their conceptual Business to Business marketing & the process involved in practice.
4. Demonstrate and develop the Strategies for implementing in the Business to Business Marketing.

Unit I **(12 Hours)**

Nature of Business Marketing: Introduction to Business Marketing, Market Opportunity Identification, Business vs. Consumer Marketing, Economics of Industrial demand, Types of Industrial Markets, Types of Business Customers, customer Analysis, Classifying Industrial Products and Services, Business customers purchase orientations, Organizational Procurement Characteristics, Environment Analysis in Business Marketing.

Organizational Buying Behavior: Organizational Buying Process, Types of purchases / buying situations, Decision making units, Buying behaviour model.

Unit II **(08Hours)**

Strategy Formulation in Industrial Market:

Formulating Product Planning: Developing Product Strategy, Strategic Innovation and New Product Development.

Formulating Channel Strategy: Nature of Business Marketing channels, Intermediaries, Direct and Indirect Channels

Buyer – Seller Relationship: Relationship in Business Marketing, Types of Relationships, Developing & Implementing effective relationship marketing strategies, CRM.

Unit III **(08Hours)**

Market Segmentation: Segmenting, Targeting and Positioning of Business Market, Value based segmentation, Model for segmenting the organizational Market.

Product & Brand Strategy: Developing Product Strategy, Analyzing Industrial Product Life Cycle, Developing Strategies for new and existing products, Branding process & Brand strategy.

Pricing Strategies: Price Determinants, Factors that Influence the Pricing Strategies, Pricing Methods, concept of learning curves, Pricing Strategies, Pricing Policies, Terms of Payment, Competitive Bidding, Leasing

The Promotional Strategies: Communication Objectives, Role of B2B Advertising, Sales Promotion in Industrial Markets.

Unit IV **(07 Hours)**

Management of Sales Force: Personal Selling, The Selling Process, Key Account Management, Managing the

Industrial Sales Force, Organizing and controlling the industrial sales force activity planning for sales force Deployment, Measuring the Effectiveness of Sales Force, Customer relationship Management Strategies for Business Markets.

Unit V: Case Study **(04 Hours)**

Compulsory question for 20 Marks. Review and recap of case studies discussed from Unit I to Unit IV

TEXT BOOKS:

1. Industrial Marketing – Krishna K Havaldar; Latest Edition; Tata McGraw Hill Publication.
2. Industrial Marketing – Robert R Reeder & Reeder; Latest Edition; Prentice-Hall International Publication.
3. Business Marketing Management – Michael D Hutt, Thomas W Speh, Latest Edition, Cengage Learning Publication.

REFERENCE BOOKS:

1. Business Marketing – Frank G Bingham Jr., Latest Edition; Tata McGraw Hill Publication.
2. Industrial Marketing – Mukherjee H S; Latest Edition; Excel BOOKS Publication.
3. Industrial Marketing – PK Ghosh, Latest Edition; Oxford University Press.

Mapping Course Outcomes with Program Outcomes:

Course Outcomes	Program Outcomes								PSO	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2
CO1	2			2					2	
CO2		1							1	
CO3		1							2	
CO4		1								2

Assessment Pattern Based on Bloom's Taxonomy:

Sl. No	Bloom's Category	Test 1	Test 2	Test 3	Assignment	Seminar /Surprise Quiz	SEE
1	Remember	10	10	10		5	10
2	Understand	20	10	10			20
3	Apply	20	20	20	5		40
4	Analyze	30	30	30	5		60
5	Evaluate	10	20	20		5	40
6	Create						10
Total		90	90	90	10	10	180

Curriculum Mapping

Course	Program Outcomes							
Business Marketing	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
	X	X		X				

Subject	**STRATEGIC BRAND MANAGEMENT**		
Subject Code	**20MBAMM305**		
Credits	3:0:0:0	**CIE Marks**	50
Total No. of Lecture Hours	39	**SEE Marks**	50

Course Objectives:

1. To provide various issues related to Brand Management and appreciate the importance of this strategic asset.
2. To create awareness about the relationship between Corporate Strategy and Brand Management'
3. To provide basic understanding in strategies and tactics involved in brand building, leveraging in different sectors.
4. To help students to analyze the various methods of valuating brands and their implications in business transactions
5. To create awareness about global branding strategies and management of brands.

Course Outcomes: At the end of the course, students will be able to:

1. Demonstrate their conceptual skills in identifying various issues related to Brand Management and appreciate the importance of this strategic asset.
2. Analyze the relationship between Corporate Strategy and Brand Management'
3. Apply the basic understanding of strategies and tactics involved in brand building, in different sectors.
4. Evaluate various methods of valuating brands and their implications in business transactions
5. Apply the global branding strategies and management of brands in the organization.

Unit I (7 Hours)

Introduction: Definition of Brand, Importance of Brands, Brand Identity, Brand Equity Concept, service branding.

Branding: Creation of Brands through goods, services, people, organization, retail stores, places, online, entertainment, ideas, Steps in Brand Management Process, luxury brands.

Unit II **(9 Hours)**

Brand Equity: Sources, Steps in building brands, Brand building blocks, David Aaker's Brand equity Model

Brand Identify and Positioning: Need for identification and Positioning, Dimensions of Brand equity, Brand identity prism, identity and image, facets of identity.

Unit III **(9 Hours)**

Choosing Brand Elements to build Brand Equity: Criteria for choosing brand elements, Options and tactics for brand elements – Brand Name, guidelines and procedure, Brand Associations, Logos and Symbols, Slogans , Packaging
Leveraging Brand Knowledge: Meaning, Dimensions of Brand Knowledge, Brand Extension: Types of Brand extention, Brand Licensing, Co-Branding, Brand Architecture and Portfolio Management

Brand Value Chain: Designing Brand Tracking studies, Establishing Brand Equity Management Systems

Unit IV: **(9 Hours)**

Designing and Sustaining Brand Strategies: Brand Hierarchy, Branding Strategy, Brand Revitalization and Rejuvenation, Branding Industrial Products, Brand portfolio and market segmentation, Building Brands Online.
Brand Imitation: Meaning, Kinds of Imitations, Factors affecting Brand Imitation, Imitation vs Late market Entry,

Imitation Strategies, problems of brand separability.

Branding Across Boundaries: Geographic Extension, Sources of Opportunities and Barriers for Global Branding, Managerial Global Brands, conditions favoring global brands,

Unit V: **(5 Hours)**
Case Study:Compulsory question for 20 marks. Review and recap of case studies and problems discussed from unit I to unit IV.

TEXT BOOKS:

1. Strategic Brand Management – Building, Measuring and Managing Brand Equity: Kevin Lane Keller, PHI/Pearson Education
2. Strategic Brand Management: Jean, Noel. Kapferer, Kogan Page India
3. Brand Management: Tapan.K.Panda, Excel Publication
4. Strategic Brand Management: Rosenbaum-Elliot, R.Percy, Pervan.S, Oxford University Press

REFERENCE BOOKS:

1. Building Strong Brands, Aaker.D, Simon and Schuster
2. The Seven Principles of Brand Management, Gupta.N.R, Tata McGraw-Hill Education
3. Compendium of Brand Management, Chunnawala, HPH
4. Product and Brand Management, U.C.Mathur, Excel Books
5. Creating Passion Brands, Helen Edwards, Kogan Page Publishers
6. Brand Management – Principles and Practices, Dutta.K, Oxford University Press

Mapping Course Outcomes with Program Outcomes:

Course Outcomes	**Program Outcomes**								**PSO**	
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PSO1**	**PSO2**
CO1	3								2	
CO2	3								2	
CO3		2							2	
CO4	3								**2**	

CO5				2					2	

Assessment Pattern Based on Bloom's Taxonomy

Sl.No	Bloom's Category	Test 1	Test 2	Test 3	Assignment	Seminar /Surprise Quiz	SEE
1	Remember	30	20	20	5	5	60
2	Understand	20	20	20			30
3	Apply	10	20	20	5		30
3	Analyze	20	20	20			20
5	Evaluate	10	10	10		5	30
6	Create						
Total		**90**	**90**	**90**	**10**	**10**	**180**

Curriculum Mapping:

Course	Program Outcomes							
Strategic Brand Management	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**
	X	**X**		**X**				

Subject	**GREEN MARKETING**		
Subject Code	**20MBAMM306**		
Credits	3:0:0:0	**CIE Marks**	50
Total No. of Lecture Hours	39	**SEE Marks**	50

Course Objectives:

1. To facilitate students to understand the various concepts of green marketing and its importance to the environment from the perspective of consumers, businesses, and other stake holders.
2. To prepare students to demonstrate sufficient knowledge of the current state of the environment resulting from past and current practices of human consumption.
3. To enhance the ability of the students in analyzing the issues pertaining to the planning, development, and implementation of green marketing strategies to enhance positive effects of human consumption on the environment

4. To equip students to develop evidence of a comprehensive understanding of evolving green consumer segments and how marketers are responding to their needs.

Course Outcomes: At the end of the course, students will be to:

1. Demonstrate their conceptual understanding green marketing and its importance to the environment from the perspective of consumers, businesses, and other stake holders.
2. Apply their sufficient knowledge of the current state of the environment resulting from past and current practices of human consumption.
3. Demonstrate and analyze the issues pertaining to the planning, development, and implementation of green marketing strategies to enhance positive effects of human consumption on the environment
4. Demonstrate the evidence of understanding the evolving green consumer segments and how marketers are responding to their needs.

Unit I: (9 Hours)

An Overview of Green Marketing: Introduction to Green Marketing, Why study Green marketing, Green Marketing Stakeholders, Ethics and Social Responsibility for Green Marketing, Influences and Significance of Ethics of Green Marketing. Evolution of Green Marketing - Importance of green marketing - Benefits of Green Marketing- Adoption of Green Marketing- Green Marketing Mix – Strategies to Green Marketing

Strategic Green Planning: Green Marketing Planning, Incorporating Green Perspective into the Mission Statement, Integrating a Green Mission into Objectives, Strategy, and Marketing Tactics, Interaction between Strategy and the Environment, Delivering Value to Stakeholders.

Unit II: (9 Hours)

The Environment and Consumption: Human influences on Climate, Atmosphere, Water, Land and Biodiversity, Marketing Actions designed to influence the Supply and Demand for Energy, Reduce Climate Change, and Human Impact on the Atmosphere, Water, Land and Biodiversity.

The Role of Household Consumption: Influences of Households on Energy Consumption, Consumer Decision Making Process, and Sustainable Marketing Action designed to influence Pre-purchase Decisions, Purchases, Consumption, and Post-Purchase Decisions.

Unit III: (9 Hours)

Discovering Green Marketing Value via Market Analysis: Green Marketing Strategy, Green marketing positioning, Green Prices, Green Logistics and Distribution, Green Promotion, Market Segmentation, Target Marketing, and Market Positioning, Communicating Green Marketing Value, Integrated Green Marketing Communications – Message strategy, Green Branding, Certification labelling, and De-marketing.

Unit IV: (8 Hours)

Delivering Value via Green Marketing Supply Cycle Strategies: Delivering value in retailing and distribution, the Role of retailing in Supply Cycles and Logistic Needs, marketing Sustainable Product Lines, Marketing sustainable Consumption, Diagnosing the elements of Sustainable Supply Cycles, Benefits of Sustainable Supply Cycles, Sustainable Logistics, ISO – 14000.

Unit V : **(4 Hours)**

Case Study: Compulsory question for 20 Marks. Review and recap of case studies discussed from Unit I to Unit IV

TEXT BOOKS:

1. Green Marketing Management: Robert Dahlstrom, Cengage Learning
2. Green to Gold: How Smart Companies use Companies Environmental Strategy to Innovate, Create Value, and Build Competitive Advantage.

REFERENCE BOOKS:

1. Building Strong Brands, Aaker.D, Simon and Schuster
2. The Seven Principles of Brand Management, Gupta.N.R, Tata McGraw-Hill Education.
3. Compendium of Brand Management, Chunnawala, HPH
4. Product and Brand Management, U.C.Mathur, Excel Books
5. Creating Passion Brands, Helen Edwards, Kogan Page Publishers

Mapping Course Outcomes with Program Outcomes:

Course Outcomes	Program Outcomes								PSO	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2
CO1	2	2							1	
CO2		1	2	1					1	
CO3				2		1	3		1	
CO4		2		2	3			2		2

Assessment Pattern Based on Bloom's Taxonomy:

Sl. No	Bloom's Category	Test 1	Test 2	Test 3	Assignment	Seminar /Surprise Quiz	SEE
1	Remember	20	30	10	5		40
2	Understand	30	20	20	5		50
3	Apply	10	10	20		5	40
4	Analyze	30	20	20		5	30
5	Evaluate		10	20			20
6	Create						
Total		90	90	90	10	10	180

Curriculum Mapping

Course	Program Outcomes							
Green Marketing	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
	X	X	X	X	X	X	X	X

FINANCE SPECIALIZATION

Subject	**INVESTMENT ANALYSIS AND PORTFOLIO MANAGEMENT**		
Subject Code	**20MBAFM301**		
Credits	3:0:0:0	**CIE Marks**	50
Total No. of Lecture Hours	39	**SEE Marks**	50

Course Objectives:

1. To inculcate the knowledge about investment process and financial markets.
2. To understand the concept of risk, return and its calculations
3. To inculcate the knowledge about Fundamental analysis and Technical analysis and usage of charts for investments.
4. To acquaint knowledge about portfolio construction & evaluation and mutual fund evaluation.
5. To appraise the students on the leading practical application oriented case studies-relevant and update and doing case study analysis & arriving at conclusions facilitating business decisions.

Course Outcomes: **At the end of the course, students will be able to:**

1. Understand how the firms can benefit from various investment avenues in the financial markets
2. Calculate the risk and return of various securities
3. Make use of fundamental analysis and technical analysis.
4. Construct their own portfolio and can do portfolio revision and portfolio evaluation.

Unit I: **(09 Hours)**

Introduction to Investment: Basic concepts. Various investment avenues – financial and non-financial Instruments. Financial markets. Risk-return trade off. Measurement of historical risk & returns. Expected risk &returns.
Securities Market: Primary Market - Factors to be considered to enter the primary market, Modes of raising funds, Secondary Market- Major Players in the secondary market, Functioning of Stock Exchanges, Trading and Settlement Procedures, Leading Stock Exchanges in India. International Portfolio Investments: Investment avenues for foreign portfolio investors, risks and returns associated with such investment. Mutual Fund Operations: Mutual funds as a key financial intermediary, mobilizing savings and investing them in capital markets. (Theory Only)
Analysis of Risk &Return: Concept of total risk, systematic risk, unsystematic risk, default risk, interest rate risk, market risk, management risk, purchasing power risk.

Unit II **(09 Hours)**
Analysis & Valuation of Debt Securities: Bond pricing theorems. Yield curve. Duration & immunization. Analysis of convertible bonds. Bond portfolio management. Valuation of equity shares. Balance sheet based valuation. Dividend discount model. Capital Asset Pricing Model. (Theory and problems).

Unit III **(09 Hours)**
Analysis of Equity Investments: Fundamental analysis. Economy-industry-firm analysis – Financial & non-financial

factors to be considered. Technical analysis – basic concepts. Various technical tools & charts like Rate of Change Indicator (ROC), Relative Strength Indicator (RSI), Moving Average Convergence & Divergence (MACD), Oscillators, Japanese candle sticks etc.
Behaviour of Stock Market Prices: Market efficiency – various forms of market efficiency. Testing the efficiency. Random walk hypothesis. (Theory and problems)

Unit IV **(08 Hours)**
Modern Portfolio Theory:. Asset allocation decision. Markowitz model. Sharpe's single index model. Optimum portfolio selection. Portfolio Management. Steps in portfolio creation. Active & passive portfolio management. Portfolio evaluation. Sharpe's ratio, Treynor & Jenson measure. Portfolio revision – various methods, regulations of asset managers, Behavioral Finance: Meaning of Behavioral finance, deals with when, how and why psychology influences investment decisions (theory and problems)

Unit V **(04 Hours)**
Case study: Compulsory question for 20 Marks. Review and recap of case studies discussed from Unit 1 to Unit 4

TEXT BOOKS:
1. Investment Analysis and Portfolio management – Prasanna Chandra, 3/e,TMH, 2010.
2. Investments – ZviBodie, Kane, Marcus & Mohanty, 8/e, TMH, 2010.
3. Investment Management – V K Bhallan(S. Chand & Co)
4. Security Analysis & Portfolio Management- Punithavathy Pandian

REFERENCE BOOKS:
1. Security Analysis & Portfolio Management – Fisher and Jordan, 6/e, Pearson, 2011.
2. Fundamentals of Investment – Alexander, Sharpe, Bailey, 3/e, PHI, 2001.
3. Security Analysis & Portfolio Management – Nagarajan K & Jayabal G , 1/e, New Age international, 2011.
4. Investment – An A to Z Guide, Philip Ryland, 1/e, Viva Publishers, 2010.

Mapping Course Outcomes with Program Outcomes:

Course Outcomes	Program Outcomes								PSO	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2
CO1	1	2		2					2	
CO2		3				2			3	
CO3		2	1							2
CO4	3	1								1

Assessment Pattern Based on Bloom's Taxonomy:

Sl. No	Bloom's Category	Test 1	Test 2	Test 3	Assignment	Seminar /Surprise Quiz	SEE
1	Remember	30	30	30			40
2	Understand	30	30	30	10		40
3	Apply	20	10	10	10		40
4	Analyze	10	10	10			40
5	Evaluate		10	10			20
6	Create						
Total		**90**	**90**	**90**	**20**		**180**

Curriculum mapping

Course	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
Investment Analysis And Portfolio Management	**X**	**X**	**X**	**X**		**X**		

Subject	**BANKING AND FINANCIAL SERVICES**		
Subject Code	**20MBAFM302**		
Credits	3:0:0	**CIE Marks**	50
Total no. of Lecture Hours	39	**SEE Marks**	50

Course Objectives:

1. To discuss the banking system structure in India, nature of banker & customer relationship.
2. To comprehend the technological up gradation and application in banking.
3. To provide an understanding of International banking system.
4. To provide an understanding of the functioning of investment banking and role of depositories and custodians.
5. To provide an in depth understanding of the financial services like underwriting, leasing & hire purchase and venture capital, credit rating, factoring, forfeiting and NPA management.

Course Outcomes: **At the end of the course, students will be to:**

1. Demonstrate an understanding of banks and other financial institutions.
2. Demonstrate an understanding of Indian capital market, depositories and custodians.
3. Have an in depth understanding of various financial services like underwriting, leasing & hire purchase etc
4. Demonstrate an understanding of concepts and developments in, NPA, credit rating, factoring, forfeiting and NPV management.

Unit I: (08 Hours)

Banking system and structure in India- Evolution of Indian Banks-Types of banks –Public Sector, Regional Banks, Performance of Public Sector banks, Private Sector Banks. Commercial banking: Structure, Functions - Primary & secondary function, Role of commercial banks in socio economic development, Services rendered. Credit creation and Deployment of Funds.-Role of Reserve Bank and GOI as regulator of banking system –Provisions of Banking Regulation Act & Reserve Bank of India Act.

Unit II: (10 Hours)

Banking Technology- Concept of Universal Banking-Home banking – ATMs- Internet banking – Mobile banking-Core banking solutions – Debit, Credit, and Smart cards – Electronic Payment systems-MICR- Cheque Truncation-ECS- EFT – NEFT-RTGS, Innovations and recent trends in banking

International banking – International Banking: Exchange rates and Forex Business, Correspondent banking and NRI Accounts, Letters of Credit, Foreign currency Loans, Facilities for Exporters and Importers, Role of ECGC, RBI and EXIM Bank.

Unit III: (09 Hours)

Banker as lender – Types of loans – Overdraft facilities – Discounting of bills – Financing book Debts and supply bills- Charging of Security bills- pledge – mortgage – assignment.

Asset Liability Management (ALM) in banks: Components of Liabilities and Components of Assets, Significance of Asset Liability management, Purpose and objectives. Prerequisites for ALM, Assets and Liabilities Committee (ALCO) - Activities of ALCO.

NPA management – Introduction- Identification of NPAs- Asset classification- Prudential Norms- Capital adequacy-effect of NPA on profitability- Willful defaulters.

Unit IV: **(08 Hours)**
Leasing: Concept-steps in leasing transaction-types of lease.
Hire Purchasing: Concepts-hire purchase agreement-comparison of hire purchase with credit sale. **(Problems on Leasing & Hire purchase)**
Venture Capital: Concept-features-Origin and the current Indian Scenario. Private equity Investment banking perspectives in private equity
Credit rating: Definition and meaning, Process of credit rating of financial instruments, Rating methodology, Rating agencies, Rating symbols of different companies. Rating agencies for SMEs.
Factoring: Origin, Types, Factoring mechanism, advantages, factoring charges, Factoring in India
Forfeiting: Origin, characteristics, benefits, difference between factoring and forfeiting, growth of forfeiting in India.

Unit V: **(4 Hours)**
Case Analysis: Compulsory question for 20 Marks. Review and recap of case studies discussed from Unit I to IV

TEXT BOOKS:

1. Principles and Practices of Banking - IIBF, 2/e, Macmillan, New Delhi.
2. Elements of Banking & Insurance – JyothsnaSethi & Nishwan Bhatia, PHI, 2009.
3. Financial services- Khan M.Y, 6/e, McGraw Hill, 2011.

REFERENCE BOOKS:

1. Banking Theory, Law and practice - Sunderaram and Varshney, Sultan Chand & Sons, New Delhi.
2. Banking and Financial System - Prasad K, Nirmala, Chandradas J. Himalaya Publishing House, Mumbai.
3. Management of Banking and Insurance – Sondhi N. K, Vrinda Publications.
4. Banking and Insurance – Aggarwal O. P, HPH.

Mapping Course Outcomes with Program Outcomes:

Course Outcomes	Program Outcomes								PSO	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2
CO1	2								2	
CO2				3					1	
CO3		2								2
CO4						1		2		3

Assessment Pattern Based on Bloom's Taxonomy:

Sl. No	Bloom's Category	Test 1	Test 2	Test 3	Assignment	Seminar /Surprise Quiz	SEE
1	Remember	20	20	20			50
2	Understand	20	20	20			50
3	Apply	20	20	20	10		30
4	Analyze	20	20	20	10		30
5	Evaluate	10	10	10			20
6	Create						
Total		**90**	**90**	**90**	**20**		**180**

Curriculum Mapping

Course	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8

Banking And Financial Services	**X**	**X**		**X**		**X**		**X**

Subject	**DIRECT TAXATION**		
Subject Code	**20MBAFM303**		
Credits	3:0:0:0	CIE Marks	50
Total no. of Lecture Hrs	39	SEE Marks	50

Course Objectives:

1. To make students understand the basic concepts of income tax such as residential status, tax incidence.
2. To make students understand the income tax provisions involved in determination of income from salary,
3. To help students understand the determination of tax liability of corporate
4. To make students understand GST and basic aspects of International taxation
5. To help students in application of theoretical concepts to practical situations involving several cases.

Course Outcomes:

1. The student will be able to understand and comprehend the aspects of individual tax planning and tax management of different assesses.
2. The student will be able to understand and analyze the corporate taxation policies..
3. The student will be analyze the current taxation framework in India.
4. The student will be able to apply the basic aspects of GST.

Unit I **(08 Hours)**

Basic concepts: assessment year, previous year, person, assesse, Income, charges on income, gross total income, capital and revenue receipts, residential status, receipt and accrual of income, connotation of income deemed to accrue or arise in India, incidence of tax, Tax Planning, Tax Evasion, Tax Management.

Unit II **(09 Hours)**

Explanation under various heads of income: Income from salary: Basic Elements of Salary, Basis of charge [Sec.15], **Allowances, Valuation & Taxability of Perquisites, Death cum Retirement benefits** Computation of Salary, Gratuity, Leave Salary Encashment, Pension [Sec. 17(1)(ii)] Allowances Perquisite [Sec. 17(2)] , method of filing of returns, due dates, TDS, TCS etc.

Unit III **(08 Hours)**

Corporate Taxation: Income under the head profit and gains of business or professions and its computation- basis- method of accounting- scheme of business deductions/ allowance- deemed profits- maintenance of books, Depreciation (Both Theory & Problems) special provisions relating to 44AD, 44AE& 44AF. Problems on computation of income from business/ profession.

Unit IV **(10 Hours)**

Income from Capital gains: Basis of Charge Capital Asset [Sec. 2(14)] Types of Capital Asset Transactions not regarded as transfer (Sec. 46 & 47) Computation of Capital Gains [Sec. 48] Computation of Long Term Capital Gain (LTCG) & Short Term Capital Gains (LTCG) (Theory and problems) Income from house property, Income from other sources (Theory only).

Goods and Services Tax (GST) : Definition, Importance, Merits and Demerits, Implementation.

International Taxation: Basic concepts of international taxation- An overview from Indian perspective, issues concerning residence of tax payers, sources of income, tax heavens, domestic tax reforms, double taxation relief, taxation inbound transactions, taxation outbound transactions.

Unit V

Case study: (4 Hours)
Compulsory question for 20 Marks. Review and recap of case studies discussed from Unit 1 to Unit 4

RECOMMENDED BOOKS:
1. Direct Tax – Lal & Vashisht – Pearson Ed. 28E.
2. Vinod Singhania- Students Guide to Income Tax – Taxman Publications
3. V S Datey, Indirect Taxes, Taxman Publications, (latest edition)..

REFERENCE BOOKS:
1. Vinod Singhania – Direct Taxes – Taxman Publications
2. Mehrotra- Direct Tax – Sahitya Bhavan
3. T N Manoharan- Students Guide to Income Tax – Snow White
4. Income Tax Law & Practice, Mahesh Chandra & Shukla – Pragathi Publications
5. VAT – Dr. Pillai – Jaico Publications, (Latest edition)
6. E A Srinivas, Corporate Tax Planning, McGraw Hill Education Ltd., Noida, (latest edition).
7. Roy Rohatgi, Basic International Taxation, Kluwer Law International Ltd., New Delhi, (latest edition).
8. Mehrotra, Direct Tax, Sahitya Bhavan, (latest edition).
9. Dr. Sanjeev Kumar, Systematic Approach to Indirect Taxes Bharat Law House, New Delhi, latest edition.

Mapping Course Outcomes with Program Outcomes:

Course Outcomes	**Program Outcomes**								**PSO**	
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PSO1**	**PSO2**
CO1	2								3	
CO2				3					1	
CO3		1								2
CO4						2		2		3
CO5		3			2					2

Assessment Pattern Based on Bloom's Taxonomy:

S.No	Bloom's Category	Test 1	Test 2	Test 3	Assignment	Seminar /Surprise Quiz	Semester-End Examination (SEE)(approx)
1	Remember	20	20	20			30
2	Understand	20	20	20			40
3	Apply	20	20	20	10		50
4	Analyze	20	20	20	10		40
5	Evaluate	10	10	10			20
6	Create						
Total		**90**	**90**	**90**	**20**		**180**

Course Mapping

Course	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**

DIRECT TAXATION	**X**	**X**		**X**	**X**	**X**		**X**

Subject	**COST MANAGEMENT**		
Subject Code	20MBAFM304		
Credits	3:0:0:0	**CIE Marks**	50
Total no. of Lecture Hours	39	**SEE Marks**	50

Course Objectives

1. To describe the cost concepts, cost behaviors, and cost accounting techniques that are applied to manufacturing and service businesses
2. To provide an understanding of the use of cost information in support of different strategies
3. To demonstrate costing methods and techniques appropriate to a variety of businesses
4. To prepare and interpret budgets and operating results through variance analysis

Course Outcomes: At the end of the course, students will be to:

1. Understand the cost concepts, cost behaviors and cost accounting techniques.
2. Make use of cost information and develop a report by using various costing techniques.
3. Use balanced scorecard and explain how the balanced scorecard supports strategic cost management.
4. Demonstrate the costing methods and techniques appropriate to a variety of businesses.

Unit I **(08 Hours)**

Introduction to Cost Management- Cost Accounting to Cost Management- Elements of costs Classification of costs-Methods of costing-Cost Management Tools- A Strategic View to Cost Management- Preparation of a cost sheet Overheads, Classification and Collection, Difference between Cost Allocation and Cost Apportionment, (Full fledged Problems on Primary and secondary distribution, Simultaneous equations, Absorption of Overhead, Theory on Under and Over absorption of Overhead)

Unit II **(10 Hours)**

Marginal Costing – Nature and Scope- Applications-Break even charts and Point, Decision Making (all types with full problems) Differential Cost Analysis, Advantages and Disadvantages of Marginal Costing.

Demerits of Traditional Costing, Activity Based Costing, Cost Drivers, Cost Analysis Under ABC (Unit level, Batch Level and Product Sustaining Activities), Benefits and weaknesses of ABC, (theory and problems)

Unit III **(09 Hours)**

Budgetary Control:- Objectives of Budgetary control, Functional Budgets, Master Budgets, Key Factor Problems on Production Budgets and Flexible Budgets. Standard Costing:- Comparison with Budgetary control, analysis of Variances, Simple Problems on Material and Labour variances only. (Theory and problems)

Unit IV **(08 Hours)**

Cost Audit,-objectives,, Advantages, Areas and Scope of Cost Audit , Cost Audit in India -- Practical—Read the contents of the report of Cost Audit and the annexure to the Cost Audit report.

Management Audit- Aims and the objectives, Scope of Management Audit. Reporting to Management – Purpose of reporting-Requisites of a good report.

Unit V **(04 Hours)**

Case Analysis: Compulsory question for 20 Marks. Review and recap of case studies discussed from Unit I to IV

TEXT BOOKS:

1. Cost Accounting – Khan M. Y and Jain P. K, TMH.
2. A Text book of Cost and Management Accounting – Arora M. N, 11/e, Vikas.

REFERENCE BOOKS:

1. Principles and Practice of Cost Accounting - Bhattacharyya, 3/e, PHI.
2. Cost and Management Accounting- Arora M. N, 3rd enlarged and Rev. ed., HPH.
3. Managerial Accounting- James Jiambalvo, 2/e, Wiley India Pvt. Ltd.

4. Management Accounting - Khan M. Y and Jain P. K, 6/e, McGraw Hill, 2012.
5. Advanced Cost Accounting – Madegowda J, HPH.
6. Cost and Management Accounting – Arora M. N, 3/e, HPH.

Mapping Course Outcomes with Program Outcomes:

Course Outcomes	Program Outcomes								PSO	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2
CO1	2		3						2	
CO2		1							3	
CO3		2		1				3	1	
CO4		3		2						2

Assessment Pattern Based on Bloom's Taxonomy:

Sl. No	Bloom's Category	Test 1	Test 2	Test 3	Assignment	Seminar /Surprise Quiz	SEE
1	Remember	30	30	30			40
2	Understand	30	30	30			40
3	Apply	20	10	10	10		40
4	Analyze	10	10	10	10		40
5	Evaluate		10	10			20
6	Create						
Total		**90**	**90**	**90**	**20**		**180**

Curriculum Mapping:

	Course	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
	COST MANAGEMENT	X	X	X	X				X

Subject	**MICROFINANCE**		
Subject Code	20MBAFM305		
Credits	3:0:0:0	**CIE Marks**	50
Total no. of Lecture Hours	39	**SEE Marks**	50

Course Objectives:
1. To provide basic understanding of problems in credit markets, principles of Micro Finance products and services.

2. To provide an institutional structure of Micro Finance in India and emergence of private Micro Finance industry in India
3. To create an awareness about the regulatory framework affecting the functioning and consequences of delivery models in India
4. To impart the analytical tools for evaluating the performance of Micro Finance Institutions, measurement of credit risks and hedging credit risk through risk management tools and techniques in Micro Finance

Course Outcomes: At the end of the course, students will be able to:
1. Understand the Micro Finance products and services.
2. Understand regulatory framework of Micro Finances in India
3. Analyze the tools for evaluating the performance of Micro Finance Institutions.
4. Credit risks and hedging credit risk through risk management tools and techniques in Micro Finance

Unit I: (08 Hours)
Nature and Scope of Microfinance
Three classic problems in Credit Markets: Selection, Monitoring and Enforcement. The Rationale and genesis of micro credit/microfinance, the nature of microfinance: microcredit vs. microfinance, Principles of microfinance and role of microfinance in poverty alleviation and empowerment of the poor, The concept of Bottom of Pyramid.
Products and Services in Microfinance
Financial Services: Credit Products – Microcredit, Micro-leasing, Micro-venture capital. Savings, Payment Services and Insurance Products, New frontiers in Microfinance Services.
Unit II: (10 Hours)
Institutional Structure of Microfinance in India
NABARD and Microfinance: strategy, Capacity Building Support to Government, Bankers, MFI's ,NGOs,SHGs and Trainers Training. Microfinance Development and Equity Fund (MFDEF),SHG- Bank Linkages.
SIDBI and Microfinance: Approach, Capacity Building Support for Microfinance, on lending, Liquidity Management, Loan to Micro-enterprises, Rating of MFIs.
Role of RMK in Microfinance Development in India. Role of Commercial banks, RRBs, Cooperative banks, Private Banks, NBFCs, and MFIs in the Development of Microfinance.
Emergence of Private Microfinance Industry
Nature and features of MFIs. Market Size and Growth ; types and working of various MFIs in India- For profits MFIs , Cooperative MFIs model ,Not –for profit MFIs SKS, BASIX, SEWA,PRADAN, SKDRDP, Gramee Koota, Sanghamithra. Associations for Micro finance: Sa-Dhan,AKMI. SHPIs: Nature and features of SHPIs: Importance's of SHPIs in microfinance development.
Unit III: (10 Hours)
Regulatory Frameworks for MFIs
Principles of Regulation ,Regulations Vs Supervision ,Determinants for regulating microfinance ,Costs of regulation, Constraints to regulating ,Self –regulation in India: Concerns and Prospects, Objectives and benefits of self –regulation Need for microfinance regulation in India, Microfinance Bill.
Microfinance Delivery Models In India
The Grameen Model: Nature and features, Development of Grameen Model in Bangladesh and its replicators in India, Advantages and disadvantages.
Self-Help Groups (SHGs): Nature and features, Advantages and disadvantageous SHG clusters and Federations. India SHG : Problems and Issues ,Difference between SHG and JLG Model
SHG –Bank Linkages Program: Role of NABARD under SHG-Bank Linkage Programme. Role of Commercial banks, RRBs, DCCBs, NGO and Farmer's clubs. Status and Progress of Self-Help Groups in the country.
Unit IV: (07 Hours)
Accounting and Financial Aspects of Microfinance
Accounting for client transactions; Accrued loan interest revenue; Loan write-offs; Purchase, Depreciation, Sale or disposal of fixed assets; Grants and donations etc. Accounting procedures at SHGs/Clusters/Federations/MFIs, etc.
Financial Statements of MFIs; The portfolio and operational reports; Disclosure of financial information; consolidating financial statements of branches. Closing entries; Accounting systems/reporting formats etc. at Cooperatives/NGOs etc. Financial Statement Analysis; Financial ratios; Comparative analysis; Cash Flow Analysis.
Credits Planning, Appraisal, Deployment, Monitoring and Follow up Credits: Meaning and types of credits proposals, Lending norms and policies of micro financial Institutions, Documentation, Credit counseling and financial supervision.
Risk Management in Microfinance: types of risk in microfinance-strategy for risk minimization, Credit rating Models-GIRAFE,PEARLS,CAMEL,CRSIL.
Non –performing assets –Classification of over dues, recovery management.
Unit V: (04 Hours)
Case Study: Compulsory question for 20 Marks. Review and recap of case studies discussed from Unit I to Unit IV

TEXT BOOKS:

1. Rural Credit and Self-help Groups: Microfinance Needs and Concepts in India, K.G Karmakar, Sage Publications, New Delhi,2008
2. Indian Microfinance: The Challenges of rapid growth – Prabhu Ghate, Sage Publications, New Delhi,2007
3. The Economics of Microfinance, Beatriz Armendariz de Aghion, Jonathan Morduch (2005), The MIT Press, Cambridge.
4. Microfinance, Maro La Torre and Gianfranco A.Vento (2006), Palgrave Macmillan Publication, New York.

Mapping of Course Outcomes with Program Outcomes:

Course Outcomes	Program Outcomes								PSO	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2
CO1	2								2	
CO2		3							1	
CO3		2			1			3		2
CO4		2		2						3

Assessment Pattern based on Bloom's Taxonomy:

Sl. No	Bloom's Category	Test 1	Test 2	Test 3	Assignment	Seminar /Surprise Quiz	SEE
1	Remember	30	30	30	10		40
2	Understand	30	30	30		5	40
3	Apply	20	10	10	5		40
4	Analyze	10	10	10			40
5	Evaluate		10	10			20
6	Create						
Total		90	90	90	15	05	180

Curriculum Mapping:

Course	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
MICROFINANCE	X	X		X	X			X

Subject	BUSINESS VALUATION ANALYSIS		
Subject Code	20MBAFM306		
Credits	3:0:0:0	CIE Marks	50
Total No. of Lecture Hours	39	SEE Marks	50

Course Objectives:

1. To make students understand the corporate merger and acquisition activity and restructurings
2. To help students understand the role that Mergers & Acquisitions.
3. plays in the contemporary corporate world, and its use as strategic tool to provide growth, enhance competitive position, transform a company and create shareholder value
4. To help students to understand the various forms of corporate restructuring

Course Outcomes: At the end of the course, students will be able to:

1. Understand theories of mergers, internal and external change forces contributing to Mergers & Acquisitions activities.
2. Assess human and cultural aspects of Mergers & Acquisitions.
3. Analyze the importance of due diligence and involve themselves in the acquisition and carryout the process
4. Understand about merger process, Takeovers and legal aspects of Mergers/amalgamations and acquisitions/takeovers.

Unit I **(08 Hours)**

Mergers – types of merger – theories of mergers – operational, financial and managerial synergy of mergers – value creation in horizontal, vertical and conglomerate mergers – internal and external change forces contributing to M & A activities –Impact of M & A on stakeholders, strategic approaches to M & A

Unit II **(08 Hours)**

Corporate restructuring – significance – forms of restructuring – joint ventures – sell off and spin off – divestitures – equity carve out – leveraged buy outs (LBO) – management buy outs – master limited partnerships – Limited liability partnership (LLP) in India – De merger – strategic alliance – buyback of shares – ESOP

Unit III **(10 Hours)**

Merger Process: Dynamics of M & A process – identification of targets – negotiation – closing the deal. Five-stage model- Due diligence - Types – due diligence strategy and process - due diligence challenges. Methods of financing mergers – cash offer, share exchange ratio – mergers as a capital budgeting decision

Takeovers – types, takeover strategies – Takeover defenses – financial defensive measures – methods of resistance – anti-takeover amendments – poison pills

Unit IV **(09 Hours)**

Accounting for amalgamation – amalgamation in the nature of merger and amalgamation in the nature of purchase – pooling of interest method, purchase method – procedure laid down under Indian companies act of 1956

Legal aspects of Mergers/amalgamations and acquisitions/takeovers-Combination and competitive Act – Competition Commission of India (CCI) – CCI procedure in regard to the transactions of Business relating to combination of Regulations 2011(theory and problems)

Unit V **(04 Hours)**

Case Analysis: Compulsory question for 20 Marks. Review and recap of case studies discussed from Unit I to IV

TEXT BOOKS:

1. Mergers, Restructuring and Corporate Control, Fred Weston, Kwang S Chung, Susan E Hoag, 4/e, Pearson Education.
2. Corporate Finance – Theory and Practice – Ashwath Damodaran – John Wiley and Sons.

REFERENCE BOOKS:

1. Mergers Acquisitions & Corporate Restructuring – Chandrashekar Krishna Murthy & Vishwanath S R – Sage publication.
2. Mergers, Ramanujam et al, TMH, 2003.
3. Handbook of International Mergers & Acquisitions, Gerard Picot, Palgrave Publishers Ltd.
4. Mergers, Acquisitions and Corporate Restructuring, Nishikant Jha, Himalaya Publishing House, 2011
5. Value Creation from Mergers and Acquisitions, Sudi Sudarsanam – 1/e, Pearson Education, 2003.

Mapping Course Outcomes with Program Outcomes:

Course Outcomes	**Program Outcomes**								**PSO**	
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PSO1**	**PSO2**
CO1	2	3							3	
CO2		1							1	
CO3				2		2				2
CO4	1	2						2		2

Assessment Pattern Based on Bloom's Taxonomy:

Sl. No	Bloom's Category	Test 1	Test 2	Test 3	Assignment	Seminar /Surprise Quiz	SEE
1	Remember	30	30	30			50
2	Understand	30	30	30		5	50
3	Apply	20	10	10	5		30
4	Analyze	10	10	10	10		30
5	Evaluate		10	10			20
6	Create						
Total		**90**	**90**	**90**	**10**	**10**	**180**

Curriculum Mapping

Course	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
BUSINESS VALUATION ANALYSIS	**X**	**X**		**X**		**X**		**X**

SUPPLY CHAIN SPECIALIZATION

Subject	**SUPPLY CHAIN AND LOGISTICS MANAGEMENT**		
Subject Code	**20MBASC301**		
Credits	3:0:0:0	**CIE Marks**	50
Total No. of Lecture Hours	39	**SEE Marks**	50

Course Objectives:

1. To introduce process and functions of supply chain management
2. Appreciate the design and network in supply chain management
3. To understand the role of coordination in supply chain management
4. To introduce process and functions of logistics system

Course Outcomes: **At the end of the course, students will be able to:**

1. Understand the fundamental Concepts of supply chain and logistics management.
2. Analyze the concepts on supply chain network design, demand forecasting and inventory management.
3. Identify the prominence of Logistic for the effective supply chain performance.
4. Apply the concepts of transportation, warehousing and Coordination in the corporate.

Unit I: (9 Hours)

Introduction to Supply Chain Management- Introduction to Supply chain, Logistics and supply chain management, objectives, importance, SCOR model of supply chain, decision phases, process view , competitive and supply chain strategies, achieving strategic fit, supply chain drivers, obstacles, framework, facilities, inventory, transportation, information, sourcing, pricingBusiness Environment and supply chain competencies, recent trends in Supply chain management- lean SC, Agile SC, Green SC, SC analytics, Digital SC.

Unit II: (9 Hours)

Designing the Supply Chain Network- Designing the distribution network – role of distribution – Factors influencing

distribution – design options – e-business and its impact – distribution networks in Practice – network design in the supply chain – role of network – factors affecting the network design Decisions.
Demand forecasting and planning- Meaning, Role of forecasting in supply chain, Steps in forecasting, forecasting error, Forecasting methods.
Planning and Managing Inventories- Introduction, Types of Inventory, role in supply chain, Factors affecting the level of safety inventory, Impact of supply Uncertainty.

Unit III: (9 Hours)
Introduction to logistics management- Definition, Importance of logistics management, Functions of logistic Management, Integrated logistics, Integrated logistics information system, Activities of integrated logistics system, barriers to logistic integration and Measures to overcome these barriers.
Procurement: Meaning, Role of Purchasing, Procurement process, Managing the procurement process, Supplier relationship. **Sourcing Decision In supply chain**– Role of Sourcing, In-house or Outsource – Supplier evaluation and selection, 3rd and 4th PLs. Ethical sourcing practices. make or buy decision.

Unit IV: (9 Hours)
Transportation Networks and Sourcing- Role of transportation – modes of transportation and their performance – transportation participants, transportation principle- design options and their trade-offs – Tailored transportation. **Ware housing:** Role, objectives, benefits ,types of warehousing, Warehouse strategies, Automation in warehousing.
Coordination in a Supply Chain-Introduction, Lack of supply chain coordination and the Bullwhip effect , Effect on the performance of Lack of Coordination, Obstacle to coordination – managerial levers to achieve coordination – building partnerships and trust.

Unit V: (3 Hours)
Case study: Compulsory question for 20 Marks. Review and recap of case studies discussed from Unit I to Unit IV

TEXT BOOKS:
1. Sunil Chopra, Peter Meindl & Dharam Vir Kalra, Supply Chain Management – strategy, planning and operation, PHI, 6th Edition, 2016
2. David J Closs, Donald J Bowersox & M Bixby Cooper, Supply chain Logistic Management, McGraw Hill 3rd Edition,2016.
3. K Shridhara Bhat, Logistic Management , Himalaya Publishing House, Second edition, 2018

REFERENCE BOOKS:
1. Essentials Of Logistic & supply chain Management, K Shridhara Bhat, Fourth edition, Himalaya Publishing House.
2. Wisner, Keong Leong and Keah-Choon Tan, principles of supply chain management a balanced approach, Thomson Press.
3. David Simchi-Levi et al, designing and managing the supply chain – concepts, strategies, and case studies, McGraw Hill International Edition
4. Coyle, Bardi, Longley, the management of business logistics – a supply chain perspective, Thomson Press, 2006
5. Robert B. Handfield, Ernest Nichols (2016), "Introduction to Supply Chain Management", 1st Edition, Pearson Education, New Delhi.
6. Michael H. Hugos (2011), "Essentials of Supply Chain Management", 3rd Edition, Wiley Publications, US.
7. Donal J Bowersox, David J Closs, M Bixby Cooper (2008), "Supply Chain Logistics Management", 2nd Edition, Tata McGraw Hill, New Delhi.

Mapping Course Outcomes with Program Outcomes

Course outcome	Program Outcome								PSO	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2
CO1	3								2	
CO2	3		2						2	
CO3	3	2							2	
CO4	3	2							2	

Assessment Pattern Based on Bloom's Taxonomy:

Sl. No	Bloom's Category	Test 1	Test 2	Test 3	Assignment	Seminar /Surprise Quiz	SEE
1	Remember	25	25	25			35
2	Understand	25	25	25	5		35
3	Apply	15	15	15	5	5	40
4	Analyze	15	15	15		5	35
5	Evaluate	10	10	10			35
6	Create						
Total		**90**	**90**	**90**	**10**	**10**	**180**

Curriculum Mapping

COURSE	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
SUPPLY CHAIN AND LOGISTICS MANAGEMENT	**X**	**X**	**X**					

Subject	**INFORMATION SYSTEM IN SUPPLY CHAIN MANAGEMENT**		
Subject Code	**20MBASC302**		
Credits	3:0:0:0	**CIE Marks**	50
Total No. of Lecture Hours	39	**SEE Marks**	50

Course Objectives:

1. To enable students to learn the role of IT in supply chain
2. To provide conceptual and application of supply chain information system design
3. To analyze the various IT practices in supply chain.
4. To understand human aspects in technology management

Course Outcomes: **At the end of the course, students will be able to:**

1. Understand the importance of Information system in SCM.
2. Identify and evaluate the various applications of supply chain information system design.
3. Understand the various information technology practices in supply chain.
4. Enable the various aspects in technology management

Unit I: (9 Hours)

Introduction to SCM -The Concept of SCM- Value chain for Supply Chain Management - Integrated Supply Chain-Goals of Supply Chain informationTechnology- Role of IT in SCM- Impact of Internet on SCM - SCM Information System Classification: Supply Chain Planning Software Solutions - Supply Chain Collaboration Software Solutions - Supply Chain Execution Software Solutions– Challenges in implementing Supply Chain Information System - Benefits of supply chain information systems.

Unit II: (9Hours)

Application of IT in SCM –Application Areas in SCM- Supply Chain Process Automation -Technology Devices in SCM- Personal Computers -Bar coding and Scanning – RFID Introduction- RFID Applications-Business Benefits - Electronic Data Interchange standards – Benefits -Artificial Intelligence– Communications : RF-Satellite communication-E-Commerce–E-Business –Recent trends in SCM-Data Mining-Application areas of DM in supply chain-Machine Learning-Uses of ML in SC-E-procurement-benefits in SC.

Unit III: **(9Hours)**

ERP: Enterprise Resource Planning System–Development of ERPS- Planning -Growth-Implantation-Advantages and Disadvantages of ERPS– ERPS Applications-Software Providers- Importance of Business Processes –Components - Business Processes Reengineering- DSS - Structure of DSS
Information Forecasting: Introduction-Meaning –Process - Introduction to forecasting techniques-forecasting software- CPRF

Unit IV: **(7Hours)**

Logistics Information: LIS – Introduction - Information functionality - activities involved - Principles of designing or evaluating LIS applications.
LIS Architecture: Components - Two forms of activities - Planning and co-ordination flows and operating flows - Flow and use of integrated logistics information.

Unit V: **(5 Hours)**
Case study: Compulsory question for 20 Marks. Review and recap of case studies discussed from Unit 1 to Unit 4

TEXT BOOKS:
1. David Simchi-Levi , Designing and Managing the Supply Chain , Tata McGraw-Hill , 2008
2. Dr. R.P Mohanty& Dr.S.G.Deshmukh, Essentials of Supply chain Management , Jaico Publishing House,2004
3. N. Chandrasekaran, Supply Chain Management, Oxford University Press, New Delhi 2010

REFERENCE BOOKS:
1. Satish C. Ailawadi&Rakesh Singh. Logistics Management. Prentice-Hall of India Pvt Ltd., New Delhi, 2005
2. Wisner Tan Leong, Supply Chain Management,Cengage Learning, 3rd Edition,2012
3.

Course Outcomes				**Program Outcomes**					**PSO**	
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PSO-1**	**PSO-2**
CO1	2			1				1	2	
CO2		3		2			3		3	
CO3			1		1	1			2	
CO4				2			1	1	2	

Assessment Pattern Based on Bloom's Taxonomy:

Sl. No	**Bloom's Category**	**Test 1**	**Test 2**	**Test 3**	**Assignment**	**Seminar /Surprise Quiz**	**SEE**
1	Remember	30	30	30	10		40
2	Understand	30	30	30		5	40
3	Apply	20	10	10	5		40
4	Analyze	10	10	10			40
5	Evaluate		10	10			20
6	Create						
Total		**90**	**90**	**90**	**15**	**5**	**180**

Curriculum Mapping

Course	Program Outcomes							
IS in Supply Chain Management	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
	X	X	X	X	X	X	X	X

Subject	OPERATIONS MANAGEMENT		
Subject Code	20MBASC303		
Credits	3:0:0:0	CIE Marks	50
Total No. of Lecture Hours	39	SEE Marks	50

Course Objectives:

1. To understand how operations management helps companies create dramatic improvements in customer service and reductions in cost.
2. To gain an insight of process analysis- a basic skill needed to understand how a business operates.
3. To recognize the contributions of MRP based planning and control system from custom job shops to assembly-line production.
4. To recognize the contribution of inventory systems towards operations management in terms of meeting production and customer service requirements through cost reduction techniques.

Course Outcomes: At the end of the course, the students will be able to:

1. Articulate how operations management contributes to the achievement of an organization's strategic objectives.
2. Reinforce the process analysis skills in decision making tools for operations tasks.
3. Demonstrate the importance of MRPs in through its implementation in different operation management scenarios.
4. Apply various inventory control techniques in a value chain in order to make it robust.

Unit I **(8 Hours)**

Operations Management: Meaning, ten principles of operations management Input-Transformation-Output relationships for typical systems, Operations Management decisions at three levels of decision-making, Current issues in Operations Management, Recent trends of operations management, Operations strategy, Strategic Fit: Fitting operational activities to strategy, Operations Strategy framework: From customer needs to order fulfillment, Operations Strategy in Services-Business Process Reengineering (BPR) , Lean and agile manufacturing, Six Sigma, Reconfigurable manufacturing system (RMS) & Employee involvement, Productivity measurement.

Unit II **(10 Hours)**

Process Analysis: Types of Processes-Based on Stages, Based on Order, Buffering,blocking, starving, Measuring process performance, Process throughput time reduction.

Process Selection: Process flow structures- Job Shop, Batch Shop, Assembly Line, Continuous Flow, Product-Process matrix.

Facility Layout: Meaning, Objectives, Basic production layout formats, Process layout, Product layout, Group Technology (cellular) layout, Fixed-position layout, Computerized Layout Techniques- CRAFT

Unit III **(7 Hours)**

Materials Requirement Planning (MRP) I: Meaning, Objectives, MRP System Structure: (MPS, BoM, IRF), master Schedule

Manufacturing Resource Planning (MRP) II: Difference between MRP and MRP II,Industry Applications and Expected Benefits, ERP-Meaning purpose, features, Functions, ERP v/s MRP

Unit IV **(9 Hours)**

Inventory Control: Definition, Purposes of Inventory, Inventory Costs, Independent versus Dependent Demand, Inventory Systems: Single-period and Multiple-period inventory systems, Fixed-order quantity Models: Establishing Safety Stock Levels, Fixed-order Quantity Model with Safety Stock, Inventory Control and Supply Chain Management: Three Simple Inventory Systems, ABC Inventory Planning, Inventory on a Grand scale, Inventory Control in Services.

Unit V: **(5 Hours)**

Case study: Compulsory question for 20 Marks. Review and recap of case studies discussed from Unit I to Unit IV

TEXT BOOKS:

1. Chase, Richard & J. Aquilano, Nicholas & Jacobs, F.Agarwal,Nitin (2006). Operations Management for Competitive Advantage, McGraw-Hill, 11/e
2. Byron.J.Finch- Operations Now, TATA Mc-Graw Hill

REFERENCE BOOKS:

1. Norman Gaither & Gregory Frazier South- Operations Management, Western; 8/e, 2001
2. K.E. Kurbel, Enterprise Resource Planning and Supply Chain Management, Progress in IS, DOI 10.1007/978-3-642-31573-2_2, # Springer-Verlag Berlin Heidelberg 2013

Mapping Course Outcomes with Program Outcomes:

Course Outcomes	**Program Outcomes**								**PSO**	
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PSO 1**	**PSO 2**
CO1					3				1	
CO2		3							2	
CO3				2					2	
CO4									1	

Assessment Pattern Based on Bloom's Taxonomy:

Sl. No	Bloom's Category	Test 1	Test 2	Test 3	Assignment	Seminar /Surprise Quiz	SEE
1	Remember	20	20	20	10		40
2	Understand	30	30	30		10	40
3	Apply	20	20	20			40
4	Analyze	10	10	10			40
5	Evaluate	10	10	10			20
6	Create						
Total		**90**	**90**	**90**	**10**	**10**	**180**

Curriculum Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
Operations Management		**X**		**X**	**X**			

Subject	**FREIGHT TRANSPORT SYSTEM**		
Subject Code	**20MBASC304**		
Credits	3:0:0:0	**CIE Marks**	50
Total no. of Lecture Hours	39	**SEE Marks**	50

Course Objectives:

1. To give students an opportunity, both orally and in writing, to critically describe, analyze, and recommend improvements in Freight Transport system.
2. For students to analytically solve problems related to transportation management.
3. To discuss the case studies and show how the concepts can be applied.
4. To understand the methodology and impact of creating an integrated Freight transport system in the organisation.

Course Outcomes: Upon completion of this course, the student will be able to:

1. Understand the basic issues in Transportation management.
2. Understand the transport functionalities and the suitable modes of transports for different products.
3. Identify the different transportation formats for better operations.
4. Identify areas for improvement in freight transport system.

Unit I: **(10 Hours)**

Economic Factors of Transportation, Pricing Strategy in Transportation, Rating Systems-Class Rates, Commodity Rates, Special Rate, Freight – All kind Rates. Transport Documentation – Bill of Lading, Freight Bill, Shipping Manifest. Responsibilities of Traffic Department. Urban Travel Characteristics, Private and Public Behavior analysis, Transportation demand Surveys.

Unit II: **(8 Hours)**

Transport Functionality- Product Movement, Product Storage, Participants in Transportation Decision – Shippers, Carriers, Government, Public .Modes of Transport – Rail, Water, Pipeline, Air, Motor Carriers. Pros and cons and its implementation .Importance of transportation, transportation planning methodology, hierarchical levels of planning and its relation to rural, urban areas.

Unit III: **(7 Hours)**

Transportation Formats – Common Carriers, Contact Carriers, Private Carriers, Exempt Carriers. Suppliers of Transportation Services – Single Mode Operator, Specialized Carrier, Transportation Systems Multi modal transportation system; Characteristics of Mass Transit systems including technical, demand operational and economic problems, fixed Track Facility, Mass Rapid Transit System Elevated, Surface and Underground construction , Express Bus System, integrated Operating Characteristics of Terminal and Transfer facilities

Unit IV: **(9 Hours)**

Management, Organization and Information Systems - The Global Supply Chain Performance Cycle length, operations, system integration, Alliances, Views of Global Logistics –Importing & Exporting, Main force. Logistics Organizations – Traditional approaches, The Logistics Information System – Concepts, The Global Logistics Information Systems.

Unit V: **(5 Hours)**

Case study: Compulsory question for 20 Marks. Review and recap of case studies discussed from Unit I to IV

TEXT BOOKS:

1. Philip.B.Schary, tageSkjott-Larsen, Managing the Global Supply Chain, Viva Publishing
2. Donald. J. Bowersox& Donald. J. Claoss, TATA Mc-Graw Hill
3. Supply Chain Management – Sunil Chapra& Peter Meindl, PHI

REFERENCE BOOKS:

1. Sunil Chopra & Peter Meindl, Supply Chain Management, PHI
2. Dr. R.P.Mohanty& Dr. S.G.Deshmukh, Essentials of Supply Chain Management, Jaico Student Edition.

Mapping Course Outcome with Program Outcome:

Course Outcomes	Program Outcomes								PSO	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2
CO1	2	3							2	
CO2	1	1		2	2				3	
CO3		3		2						1
CO4				1				2		2

Assessment Pattern Based on Bloom's Taxonomy

Sl. No	Bloom's Category	Test 1	Test 2	Test 3	Assignment	Seminar /Surprise Quiz	SEE
1	Remember	30	30	30	10		40
2	Understand	30	30	30		5	40
3	Apply	20	10	10	5		40
4	Analyze	10	10	10			40
5	Evaluate		10	10			20
6	Create						
Total		**90**	**90**	**90**	**15**	**5**	**180**

Curriculum Mapping

COURSE	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
Freight Transport System	**X**	**X**		**X**	**X**			**X**

Subject	**ENTERPRISE RESOURCE PLANNING**		
Subject Code	**20MBASC305**		
Credits	3:0:0:0	**CIE Marks**	50
Total No. of Lecture Hours	39	**SEE Marks**	50

Course Objectives:

1. To Introduce the concept of enterprise resource planning
2. To explain the different modules of ERP
3. To explain the issues in ERP implementation and maintenance
4. To explain the advantages and disadvantages of different ERP products available in the market.

Course Outcome: At the end of the course, students will be able to:

1. Understand the fundamentals of enterprise resource planning.

2. Demonstrate the importance of implementing ERP
3. Understand the advantages and disadvantages of different ERP products available in the market
4. Apply ERP Programs, map the ERP requirements with business process requirements, and understand outputs of ERP.

Unit I: **(10 Hours)**
INTRODUCTION TO ERP: Overview of ERP,MRP,MRPII and Evolution of ERP, BusinessFunctions and Business Process, Integrated Management Information, Reasons for the growth of ERP,Role of ERP in Business, Business Modelling, Integrated Data Model, Common ERP Myths, Systems Integration, Benefits of System Integration,Limitations of System Integration , Obstacles of applying IT , ERPMARKET.ERP & Competitive advantage, Basic Constituents of ERP.

Unit II: **(8 Hours)**
BUSINESS PROCESS RE-ENGINEERING (BPR): BPR Process, Characteristics of BRP, , Technology Enabled Reengineering, Myths regarding BPR.
Business Intelligence Systems-Data Mining, Data Warehousing, On-line Analytical Processing (OLAP).

Unit III: **(8Hours)**
ERP MODULES: Finance, Controlling, Accounting System, Manufacturing and Production Systems; Sales andDistribution Systems, Human Resource Systems; Plant Maintenance System, Material Management System, Quality Management System, ERP SystemOptions and Selection, ERP proposal Evaluation.

Unit IV: **(8Hours)**
ERP IMPLEMENTATION AND MAINTENANCE: Implementation Strategy Options, Features of Successful ERP Implementation, Strategies to Attain Success, User Training, Maintaining ERP and IS.
ERP PRODUCTS: SAP, Oracle, Microsoft Dynamic, People Soft.

ERP and E-business: Introduction, e-Business Process Model , ERP/e-Business Integration

Unit V: **(5 Hours)**
Case study: Compulsory question for 20 Marks. Review and recap of case studies discussed from Unit 1 to Unit 4

TEXT BOOKS:
1. Motiwala, Enterprise Resource Systems,,Pearson,2009
2. Alexis Leon,Enterprise Resource Planning, TMH,2008
3. Enterprise Resource Planning and MIS,VenugopalRao, Excel,2009.

REFERENCE BOOKS:
1. Vinod Kumar Kardandd NK VenkataKristean,ERP concepts & Practice, PHI,2008
2. Concepts in ERP,Monk,2/e Thomson,2009
3. Vaman,ERP in Practice, TMH,2008
4. MahadeoJaiswal& Ganesh Vanapalli,Enterprise Resource PlanningMacmillan,2008
5. David L.Olson,Managerial Issues of ERP, TMH,2009

Mapping Course Outcomes with Program Outcomes:

Course Outcomes	Program Outcomes								PSO	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2
CO1	2			2					2	
CO2		1	3						3	
CO3						2		2		1
CO4					1		3			2

Assessment Pattern Based on Bloom's Taxonomy:

Sl. No	Bloom's Category	Test 1	Test 2	Test 3	Assignment	Seminar /Surprise Quiz	SEE
1	Remember	30	30	30			40
2	Understand	30	30	30	10	5	40
3	Apply	20	10	10	5		40
4	Analyze	10	10	10			40
5	Evaluate		10	10			20
6	Create						
Total		**90**	**90**	**90**	**15**	**5**	**180**

Curriculum Mapping:

Course	**Program Outcome**							
Enterprise Resource Planning	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**
	X	X	X	X	X	X	X	X

Subject	**RETAIL SUPPLY CHAIN MANAGEMENT**		
Subject Code	**20MBASC306**		
Credits	3:0:0:0	**CIE Marks**	50
Total No. of Lecture Hours	39	**SEE Marks**	50

Course Objectives:

1. To enable the student to understand the basic concepts, processes and key elements of a supply chain and how they interact in supply chains.
2. To provides information regarding the strategies for establishing efficient, effective, and sustainable supply chains.
3. To explain the critical roles of technology in supply chain planning, visibility, and execution.

Course Outcomes: At the end of the course, students will be able to:

1. Exemplify the importance of the retail supply chain and the key drivers of retail supply chain management.
2. Apply the concept of assortment and space management for effective demand management for the better decision making.
3. Analyze the retail supply chain performance for better customer service.
4. Evaluate the logistic activities of the retail industry for preparing the effective strategies implementation.

Unit I: **(9 Hours)**

Introduction; More than Stores; Defining the terms: Supply Chain and Supply Chain Management; the Importance of Customer Segments; Adding Value along the Chain; Introduction to Retail Supply chain management:, How retail supply chain is different from manufacturing supply chain, Elements of retail supply chain, Drivers of Retail Supply Chain Change, Importance of Drivers; Innovation Driver; Strategic, tactical, operational and execution view of retail supply chain, Retail supply chain maturity.

Unit II: **(9 Hours)**

Assortment and space management: Introduction, Assortment management framework, Assortment selection and plan, space Management and its benefits, different stages of space planning, concept of plan grams,Retail product lifecycle management: Product design, Product label, Retail packaging, shelf ready packaging, green design and packaging.

Unit III: **(9 Hours)**

Retail Distribution and replenishment: Retail distribution, Retail replenishment, Retail packing, shelf ready packaging, Direct store delivery, Managing retail home delivery, measures for retail distribution and replenishment. Product Tracking Along Retail Supply Chains: Low-Tech Retailing, Beyond Basic Bar Codes, Radio Frequency Identification, Retail ERP, Retail analytics, Tracking in Transit, The Future of Product Tracking.
Retail Return Loops: Introduction, Types of Returns, Opportunities in Returns, Reduced Returns, Collaboration with Partners, Customer Feedback, Material Source. Environmental Mitigation, Cash-to-Cash Cycle Reduction, Process Standardization.

Unit IV: **(9 Hours)**

Retail logistics: Retail transport, retail warehousing, Managing retail shrinking, managing logistic service provider, , Green retailing. Green information system, Retail supplier relationship membership: Retail sourcing, Global sourcing, Green sourcing,. Retail customer relationship management: Introduction, order management, multi channel retailing, Retail Kiosk, Retail returns and reverse logistics, Recent trends in retail supply chain.

Unit V: **(3 Hours)**

Case study: Compulsory question for 20 Marks. Review and recap of case studies discussed from Unit I to Unit IV

TEXT BOOKS:

1. Retail Supply chain Management, James B. Ayers, Mary Ann Odegaard, Auerbach Publications, 2016.
2. Retail supply chain Management, Rajesh Ray, Tata McGraw Hill publications, 2011

REFERENCE BOOKS:

1. Retail Supply chain management, James B. Ayers, Mary Ann Odegaard,CRC Press, 2018.
2. Logistics and Retail Management: Emerging Issues and New Challenges in the Retail Supply Chain, John Fernie,Leigh Sparks, Kogan Page publication, 2014.

Mapping Course Outcomes with Program Outcomes:

Course outcome	**Program Outcome**								**PSO**	
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PSO 1**	**PSO 2**
CO1	3								1	
CO2	3									3
CO2		1							3	
CO4			2						2	

Assessment Pattern Based on Bloom's Taxonomy:

Sl. No	**Bloom's Category**	**Test 1**	**Test 2**	**Test 3**	**Assignment**	**Seminar /Surprise Quiz**	**SEE**
1	Remember	30	30	30			35
2	Understand	30	30	30	10		30
3	Apply	20	10	10	5	5	45

4	Analyze	10	10	10			45
5	Evaluate		10	10			25
6	Create						
Total		**90**	**90**	**90**	**15**	**5**	**180**

Curriculum Mapping

Course	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**
Retail supply chain management	**X**	**X**	**X**					

BUSINESS ANALYTICS SPECIALIZATION

Subject	**INTRODUCTION TO DATA MANAGEMENT**		
Subject Code	20MBABA301		
Credits	3:0:0:0	**CIE Marks**	50
Total No.: of Lecture Hours	39	**SEE Marks**	50

Course Objectives:

1. This course will make the student to understand and learn foundational data skills, gain an understanding.

2. This course will enable the student to learn data management concepts and functions.

Course Outcomes: At the end of the course, the students will be able to:

1. In this course, student will learn about data analysis and types and concepts introduction.
2. In this course, student will learn the business analytics framework and its impact.
3. This course will enable the student to gain the knowledge on data management techniques.
4. In this course, student will learn what are the various types of data management analysis.

Unit I: **(13 Hours)**

Introduction to Data Analysis: Introduction – What is Analytics, Types of Analytics, need for Analytics in Specific Domain. Introduction to Data Management – Properties & Types of Data, Conceptual Models, Data Behavioral- Customer Relationship Management in Analytics, RFMPT - Recency, Frequency, Monitory, Price & Tenure, Short term data, Medium term data & Long term data, Psycho graphic Data, Social/Structural Data, Time series data, Sequence data, ER data model, Dimensional data model.

Unit II: **(10 Hours)**

Data Management : Data Collection- Through servers, excel files, big data technology, test files, Data Formats- CSV, Excel, Word, Image, Video, Audio, Text, Data base data, Data validation – Reading data, understanding the data, Writing the data, validating the data, Data Cleaning – Outline detection , missing values, invalid formats.

Unit III: **(08 Hours)**

Introduction to Business Analytics framework: CRISP DM for Analytics -- Business Objectives, Data Understanding, Data sources, Data mapping, Data preparation, Customer Analytics Data, Product Analytics Data mart, Social Analytics Data mart.

Unit IV: **(08 Hours)**

Data Management and Analysis: Customer Base Analysis, Performance Analysis, Contribution analysis, Migration Analysis, Domain based feature selection, Principal Component Analysis.

TEXT BOOKS:

1. A data structure for customer insights - Jim Porzak

REFERENCE BOOKS:

Mapping Course Outcomes with Program Outcomes:

Course Outcomes	Program Outcomes								PSO	
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PSO-1**	**PSO-2**
CO1	2			2					1	
CO2		2						2	1	
CO3		2		3						2
CO4			2				2		2	

Assessment Pattern Based on Bloom's Taxonomy:

Sl. No.:	Bloom's Category	Test 1	Test 2	Test 3	Assignment	Seminar Surprise Quiz	SEE
1	Remember	30	25	20			45
2	Understand	30	25	30	5		45
3	Apply	10	20	20	5		40
4	Analyze	10	10	10	5	5	30
5	Evaluate	10	10	10			20
6	Create						
Total		**90**	**90**	**90**	**15**	**5**	**180**

Curriculum Mapping

Course	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
INTRODUCTION TO DATA MANAGEMENT	X	X	X	X			X	X

Subject	**DATA MINING TECHNIQUES WITH R**		
Subject Code	20MBABA302		
Credits	3:0:0:0	**CIE Marks**	50
Total No.: of Lecture Hours	39	**SEE Marks**	50

Course Objectives:

1. This course will make the student to understand and learn data mining techniques with practical experience.
2. This course will enable the student to learn R tool to understand the statistical computing.

Course Outcomes: At the end of the course, the students will be able to:

5. In this course, student will learn about data analysis and types and concepts introduction.
6. In this course, student will learn the business analytics framework and its impact.
7. This course will enable the student to gain the knowledge on data management techniques.
8. In this course, student will learn what are the various types of data management analysis.

Unit I: **(08 Hours)**
Data Mining Methodology: Introduction to supervised, unsupervised and semi-supervised modeling/learning, Model Building – What is model building and its importance, Types of Data Mining Techniques – Clustering, Association, Sequencing, Classification

Unit II: **(12 Hours)**
Data Mining Techniques: Regression – Simple Liner Regression- Coefficient of determination, Significance tests, Residual analysis, Confidence and Prediction Intervals, Multiple Linear Regression- Coefficient of multiple coefficients of determination, Interpretation of regression coefficients, Categorical variables, Heteroscedasticity, Multicollinearity, Outliers, Auto regression and transformation of variables, Regression model building.

Unit III: **(08 Hours)**
Logistic and Multinomial Regression: Logistic function, Estimation of probability using logistic regression, Deviance, Wald Test, Hosmer Leme show Test, Classification table, Gini coefficient; Classification and Regression Tree (CART), Decision Tree modeling

Unit IV: **(11 Hours)**
Application of Predictive Analytics : Time Series Analysis – Forecasting, Moving Average, Exponential Smoothing, Casual Models, Auto-Regressive Integrated Moving Average (ARIMA), Holts Winter method, Application of predictive analytics in retail, direct marketing, health care, financial services, insurance, supply chain, etc.

TEXT BOOKS:

2. Data Mining Techniques, Gordon S. Linoff, Michael J.A. Berry, Third Edition
3. Introduction To Data Mining , Pang Ning Tan and Vipin Kumar and Michael Steinbach, Pearson, Latest Edition

REFERENCE BOOKS:

1. Data Mining For Business Intelligence, Galit Shmueli and Nitin R Patel and Peter C Bruce, John Wiley, Latest Edition

Mapping Course Outcomes with Program Outcomes:

Course Outcomes	Program Outcomes								PSO	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO-1	PSO-2
CO1	3			1						2
CO2		1			1				1	
CO3		3		2				2		2
CO4			1						1	

Assessment Pattern Based on Bloom's Taxonomy:

Sl. No.:	Bloom's Category	Test 1	Test 2	Test 3	Assignment	Seminar Surprise Quiz	SEE
1	Remember	30	25	20			45
2	Understand	30	25	30	5		45
3	Apply	10	20	20	5		40
4	Analyze	10	10	10	5	5	30
5	Evaluate	10	10	10			20
6	Create						
Total		**90**	**90**	**90**	**15**	**5**	**180**

Curriculum Mapping

Course	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
Data Mining Techniques with R	X	X	X	X	X			X

Subject	**APPLIED BUSINESS STATISTICS AND DATA VISUALIZATION**		
Subject Code	20MBABA303		
Credits	3:0:0:0	**CIE Marks**	50
Total No.: of Lecture Hours	39	**SEE Marks**	50

Course Objectives:

1. This course will make the student to understand and learn basics of business statistics and probability techniques.
2. This course will enable the student to learn types of data visualization tools and its importance in business.

Course Outcomes: At the end of the course, the students will be able to:

1. Student will learn about basic statistics and its importance in the line of analytics business.
2. Student will understand the probability measures and different types of test and areas of usage in analytics.
3. This course will enable the student to gain the knowledge of probability distribution fitting procedures importance in business analytics.
4. In this course, student will learn end to end of tool utilization : Tableau & Excel Add-ins. Build practical hands on skill on all types of tables and charts and its area of importance in business
5. Student will build market demand skills like Dashboard & Reports preparation along with storytelling with the help of data.

Unit I: **(08 Hours)**

Introduction to Basic Statistics : Measures of Central Tendency– Mean, Median, Mode and their implications, Measure of Dispersion- Range, Mean deviation, Standard deviation, Coefficient of Variation, Skewness, Kurtosis.

Unit II: **(10 Hours)**

Introduction to Probability: Concept of probability and its uses in business decision-making, Introduction to sampling distributions- Sampling distribution of mean and proportion, Sampling techniques. Estimation Theory and Hypothesis Testing- Sampling theory; Formulation of Hypotheses; Application of Z-test, t-test, F-test, Chi-Square test, ANOVA one and two way.

Unit III: **(07 Hours)**

Probability Distribution : Fitting Probability Distribution, Plotting, Statistical Graphics, Box plots, Scatter plots, Heat map, Pivot Tables and Power Pivot.

Unit IV: **(14 Hours)**

Data Visualization with Tableau : Why Tableau? Why Visualization? - The Tableau Product Line, Things you should know about Tableau, Tables & Graphs- Horizontal / vertical bar charts, Multiple bar charts, Stacked bar charts, Histogram, Pie charts, Special Charts- Circular network diagram, Sunburst diagram, Tree Map, Streamgraph, Circle packing, Introduction of Infographic and examples. Dashboards and reports with storytelling.

TEXT BOOKS:

1. Statistics for Management , T N Srivastava, Shailaja Rego, Tata McGrawhill, Latest edition.
2. Statistical Methods, S P Gupta, Sultan Chand & Sons, Latest edition.
3. Business Statistics using Excel, Glynn Davis and Branko Pecar Oxford University press, Latest edition.
4. Fundamentals of Business Statistics, J. K. Sharma, Vikas Publication, Latest edition.

REFERENCE BOOKS:

1. Fundamentals of Statistics, SC Gupta, Himalaya Publications.2013.
2. Business Statistics, N.D. Vohra, Tata McGrawHill, 2013

Mapping Course Outcomes with Program Outcomes:

Course Outcomes	Program Outcomes								PSO	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO-1	PSP-2
CO1	2			1					2	
CO2		2					2		2	
CO3		2		1						2
CO4			2					1	1	

Assessment Pattern Based on Bloom's Taxonomy:

Sl. No.:	Bloom's Category	Test 1	Test 2	Test 3	Assignment	Seminar Surprise Quiz	SEE
1	Remember	30	25	20			45
2	Understand	30	25	30	5		45
3	Apply	10	20	20	5		40
4	Analyze	10	10	10	5	5	30
5	Evaluate	10	10	10			20
6	Create						

Curriculum Mapping

Course	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8

Data Mining Techniques with R	X	X	X	X			X	X

IV SEMESTER
HUMAN RESOURCE MANAGEMENT

Subject	**INDUSTRIAL RELATIONS AND LABOR LAWS**		
Subject Code	20MBAHR401		
Credits	3:0:0:0	**CIE Marks**	50
Total no. of Lecture Hours	39	**SEE Marks**	50

Course Objectives:

1. To provide a conceptual basis of Industrial Relations.
2. To enable students to grasp and apply the principles of IR and develop an awareness of the significance of industrial peace.
3. To give an understanding of the components and meaning of sustaining Industrial peace anchored on harmonious Employee-Management relations.
4. To impart the legal provisions that governs labor– management issues.

Course Outcomes: At the end of the course, the students will be able to:

1. Demonstrate descriptive knowledge of the field of industrial relations.
2. Analyze and evaluate the key processes of industrial relations at the workplace level and their relationships to the institutions in a global, economic and social context.
3. Investigate solutions to industrial relations problems based on research and assessment of current practices
4. Familiarize with the legal requirements to maintain industrial relations.

Unit I: **(7 Hours)**

Introduction: Background of Industrial Relations - Changing Dimensions of IR in India Impact of globalization on IR, factors affecting IR, participants of IR, approaches to Industrial relations, forms of industrial relations, theories of industrial relations, Evoluation of industrial relations in India, International Labour Organization – objectives, principles, structure, and its influence on Legal enactments in India.

Unit II: **(7 Hours)**

Collective Bargaining in India: Definition, functions of collective bargaining, collective bargaining process, prerequisites for collective bargaining, Negotiation- types, process, techniques.

Trade Unions: Introduction, functions of trade unions, objectives of important trade unions, procedure for registration, rights and privileges of registered trade unions, problems of trade unions, measures to strengthen trade union movement in India, paradigm shift in Trade Union Environment in India.

Unit III: **(8 Hours)**

Grievance procedure and Discipline management: Grievance, meaning and forms, approaches to grievance machinery, model grievance procedure. Discipline - Judicial approach to discipline, Domestic enquiries, Disciplinary procedures, approaches to manage discipline in Industry, principle of Hot stove rule, Code of disciplines in industry.
Industrial Conflicts: Nature of conflicts and its manifestations causes and types of Industrial conflicts, prevention of Industrial conflicts and settlement of Industrial conflicts,

Unit IV: **(13 Hours)**

Industrial legislations: An overview of the following labor enactments covering the definitions, applicability, provisions, penalties:

- Factories Act 1948
- Industrial disputes act 1947.
- Industrial employment (standing order) Act 1946.
- Maternity Benefit Act, 1961
- Contract Labor Act, 1970
- Payment of Wages Act, 1936,

- Payment of Gratuity Act 1972
- Payment of Bonus Act, 1965.
- Employees provident fund act 1952.

Unit V: **(4 Hours)**

Case study – compulsory questions for 20 marks. Review and recap of case studies discussed from unit I to IV

TEXT BOOKS:

1. Dynamics of Industrial Relations, Mamoria & Mamoria, Himalaya Publications, 2012
2. Industrial Relations and Labor laws, 5th Edition, SC Srivatava, Vikas Publications

REFERENCE BOOKS:

1. Industrial Relations, Trade Unions & Labour Legislation, P R N Sinha Indu Bala Sinha, Seema, P.S, Pearson Education, 2013
2. R S Davar - Personnel Management and Industrial Relations, Vikas Publishing House, Mumbai, 2005
3. Industrial Relations and Labour Laws, Arun Monappa, Ranjeet Nambudiri, Patturaju Selvaraj, Tata McGraw Hill Publishing House.
4. Elements of Mercantile Law, N.D Kapoor, Sultan Chand, 2014

Mapping Course outcomes with Program outcomes:

Course Outcomes	**Program Outcomes**								**PSO**	
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PSO1**	**PSO2**
CO1	3			2					3	
CO2		2		2					2	
CO3		2		2					1	
CO4				2						1

Assessment Pattern Based on Bloom's Taxonomy

Sl. No	**Bloom's Category**	**Test 1**	**Test 2**	**Test 3**	**Assignment**	**Seminar /Surprise Quiz**	**SEE**
1	Remember	10	10	10	10	5	20
2	Understand	20	20	20	5		30
3	Apply	10	10	20			40
4	Analyze	30	30	30			50
5	Evaluate	20	20	20			40
6	Create						
Total		**90**	**90**	**90**	**15**	**5**	**180**

Curriculum Mapping

Course	**Program Outcomes**							
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**
Industrial Relations and Labour Laws		**X**		**X**			**X**	

Subject	**INTERNATIONAL HRM**		
Subject Code	20MBAHR402		
Credits	3:0:0:0	**CIE Marks**	50
Total no. of Lecture Hours	39	**SEE Marks**	50

Course Objectives:

1. To enable the basic understanding of fundamental concepts of IHRM, its special features and emergence.
2. To make students aware about recruitment and selection processes in a global business corporation
3. To make students understand the training and development and compensation management practices in MNCs.
4. To make students aware about industrial relations issues and international HRM strategies.
5. To help the students on the application oriented case analysis on IHRM

Course Outcomes: At the end of the course, students will be to:

1. demonstrate their conceptual understanding of fundamental concepts of IHRM, its special features and emergence.
2. demonstrate their conceptual knowledge of the recruitment and selection processes in a global business corporation.
3. demonstrate their conceptual knowledge of and compensation management practices in MNCs.
4. demonstrate their conceptual skill of industrial relations issues and international HRM strategies.
5. apply their conceptual knowledge of the IHRM in real time problems

Unit I: **(8 Hours)**

Introduction to IHRM: Definition, The different setting of International Human Resource Management, Difference between IHRM and Domestic HRM. Models of IHRM, Approaches to IHRM, Socio-cultural context - Role of culture in International HRM, Culture and employee management issues, culture and specific HRM issues.

Unit II: **(10 Hours)**

Recruitment, Selection and staffing in International context: International Managers- PCN, HCN, AND TCN, , recruitment methods using head-hunters, cross-national advertising, e-recruitment; different selection methods, Selection criteria and techniques, different approaches to multinational staffing decisions international staffing issues, Current scenario in international training and development, expatriate training, repatriate training.

Unit III: **(10 Hours)**

Performance Management: A conceptual background, performance management cycle, models, performance and appraisal in IHRM appraisal of expatriate, third and host country employees, issues and challenges in international performance management, country specific performance management practices.

International Compensation: Forms of compensation and factors that influence compensation policy, key components of international compensation, Approaches to international compensation, compensation practices across the countries.

Unit IV: **(7 Hours)**

International labour relations and International HRIS: Key issues, response of labour unions to MNCs. Social dumping, IHRIS: Meaning, Role of IT in HR, Designing of HRIS, HRIS model, Applications of HRIS in Employee Management, Limitation of HRIS.

Unit V: **(4 Hours)**

Case study – compulsory questions for 20 marks. Review and recap of case studies discussed from unit I to IV

TEXT BOOKS:

1. International Human Resource Management-Peter J Dowling, Denice E Welch, Cengage Learning
2. International Human Resource Management - Monir H Tayeb – Oxford University Press - 2005.

REFERENCE BOOKS:

1. International Human Resource Management - Anne-Wil Harzing, Joris Van Ruysseveldt - SAGE, 2004
2. International Human Resource Management, K Aswathappa, Sadhna Das, Mc Graw Hill Companies
3. International Human Resource Management, Tony Edwards, Chris Rees, Person Education
4. International Human Resource Management: Policies and Practices by Dennis Briscoe, Randall Schuler, Ibraiz Tarique, Taylor & Francis, 4/e, 2012.
5. International Human resource Management – PL Rao, Excel Books

Mapping Course Outcomes with Program Outcomes:

Course Outcomes	Program Outcomes							
	PO1	PO2	PO3	PO4	PO5	PO6		
CO1	X			X				
CO2				X	X			
CO3	X				X			
CO4				X				
CO5				X	X			

Assessment Pattern Based on Bloom's Taxonomy

Sl. No	Bloom's Category	Test 1	Test 2	Test 3	Assignment	Seminar /Surprise Quiz	SEE
1	Remember	20	30	10	10	5	30
2	Understand	30	20	20	5		50
3	Apply	10	10	20			30
4	Analyze	30	20	20			40
5	Evaluate		10	20			30
6	Create						
Total		**90**	**90**	**90**	**15**	**5**	**180**

Curriculum Mapping

Course	Program Outcomes							
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
International HRM	**X**			**X**	**X**			

Subject	**EMPLOYEE TRAINING AND DEVELOPMENT**		
Subject Code	20MBAHR403		
Credits	3:0:0:0	**CIE Marks**	50
Total no. of Lecture Hours	39	**SEE Marks**	50

Course Objectives:

1. To make the students identify the importance and benefits of training and development.
2. To impart the skill to identify the training need and designing the training programme.
3. To make the students to identify the required method for training and evaluating the training program.
4. To make the student to identify the significance of Managerial development.

Course Outcomes: At the end of the course, the students will be able to:

1. Demonstrate the understanding of scope, objectives and benefits of employee training and development for achieving organizational goal.
2. Identify the training need and design the suitable training and development methods to align with organizational goal.
3. Determine the training outcomes and evaluate the effectiveness of the training.
4. Demonstrate the importance, Need and Approaches to Management development.

Unit I: **(10 Hours)**

Introduction: Definition, Meaning, Need for training, Scope, Objectives of Training, Difference between training

and Development, Benefits of training, problems of training, designing effective training, Roles, competencies & positions of training professionals, Future trends in training.
Training Needs Analysis: Assessment of Training needs, Methods and Process of training need assessment, Approaches to TNA, Competency Model.

Unit II: **(10 Hours)**
Designing Training Programs: Organizational Constraints, Developing objectives, Budget for training, facilitation of learning, Facilitation of learning: focus on training design.
Learning And Training Methods: Overview of Training methodologies – Principles of learning, learning process, Learning Curve, Criteria for method selection, skills of an effective trainer, classification of training methods
Presentation Method – Lecture, Audio visual, Hands on Methods – On the job training, simulation, case study, Business games, Role play, behavior modeling ,In basket Techniques.Group Building Methods: Adventure learning, Team training, Action learning, E- learning-Computer based training, Developing effective online learning, Blended learning, mobile technology & Training Methods, Distance Learning.
Unit III: **(7 Hours)**
Evaluation of Training and Development: Introduction, Need for evaluating Training and development programs, Overview of the evaluation process, Evaluation planning and data collection, Outcomes used in the evaluation of training programs, Models of evaluating effectiveness of Training Efforts, Problems of Measurement and Evaluation,; Kirkpatrick Model of Training Effectiveness.
Unit IV: **(8 Hours)**
Management Development: Meaning, Need and Importance of Management development, process, methods of management development, Approaches to Management Development, Development planning process, Succession Planning: Introduction, Importance, Steps, Advantages of succession planning, Sources of Knowledge / Skill acquisition, Management Development implications. Increased use of new technologies for learning.
Unit V : **(4 Hours)**
Case Analysis: Compulsory question for 20 marks. Review and recap of case studies discussed from unit I to unit IV.

TEXT BOOKS:

1.Training and Development, Dr.B.Janakiraman, Biztantra publisher, 2011
2. Employee Training and Development, Noe A Raymond, Fifth edition, Mc Graw hill publication, 2012.

REFERENCE BOOKS:

1. Training for development– Rolf Lynton & Udai Pareek, Sage Publications, 2011.
2. Effective Training systems: System, Strategies & practices, P. Nick Blanchard, James W Thacker, II ed, PHI
3. Effective HR Training Development Strategy – Ratan Reddy, HPH, 2005.
4. Training in organizations – Goldstein, 4^{th} Edition, Cengage learning.
5. Training and Development Methods, Dr. Rishipal, 1^{st} Edition, S. Chand, 2011.

Mapping Course Outcomes with Program Outcomes:

Course Outcomes	**Program Outcomes**								**PSO**	
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PSO1**	**PSO2**
CO1				1					1	
CO2		2			2				2	
CO3		2				1		2	2	
CO4				3			2			3

Assessment pattern

Sl. No	**Bloom's Category**	**Test 1**	**Test 2**	**Test 3**	**Assignment**	**Seminar /Surprise Quiz**	**SEE**
1	Remember	20	30	20	10	5	40
2	Understand	30	20	20	5		50
3	Apply	10	10	20			40
4	Analyze	20	20	20			30
5	Evaluate	10	10	10			20

6	Create						
Total		**90**	**90**	**90**	**15**	**05**	**180**

Curriculum Mapping

Course	Program outcomes							
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**
Employee Training and Development		X		X	X	X	X	X

Subject	**Ethics at workplace**		
Subject Code	20MBAHR404		
Credits	3:0:0:0	**CIE Marks**	50
Total no. of Lecture Hours	39	**SEE Marks**	50

Course Objectives:

4. To make students to understand the concepts the importance of ethics at workplace.
5. TO make the students understand the role and functions of ethics in Human resource activities.
6. To make the students realize the value of professionalism at work place.
7. To impart the knowledge of harassment and legal compliance related to harassment.

Course Outcomes: At the end of the course, students will be able to:

1. Demonstrate the need and importance of the ethics and professionalism at workplace.
2. Apply the ethical concepts in human resource practices in the organization.
3. Identify the reason for unethical behavior of the employee and construct the measure to avoid the unethical behaviors.
4. Demonstrate the ethical guidelines towards discrimination and harassment.

Unit I **(9 Hours)**

Workplace Ethics: Introduction, Needs, Ethical Principles,Personal ethical development Stake holders ethics, Workplace Ethics for Employees-Ethical behavior in workplace- Professionalism, Ethical violations by employees, Employee Etiquettes. Benefits of ethics at Workplace, employee commitment, investors' loyalty, customer satisfaction profits.

Unit II **(9 Hours)**

Ethical issues in human resource management- The principal of ethical hiring, Firing, worker safety, whistle blowing, Equality of opportunity, Discrimination, Ethics and remuneration, Ethical issues in leading, Ethics in retrenchment. Ethical issues in global business, corporate responsibility of employers.

Unit III **(9 Hours)**

Professionalism at Workplace: Unethical Conduct for employees and employers. Character traits of excellent employee, Factors leading to Unethical Behaviors. Measures to control unethical behaviors. Rewarding ethical behavior, Watching what you say and what you do in the workplace, Hardware, Software and Spyware, Plagiarism and Computer Crimes, privacy law, drug test and polygraph exams.

Unit IV **(9 Hours)**

Work place Harassment: Ethical dilemma and reasoning, logical fallacies and ethical reasoning, Discrimination, Types of Discrimination, Harassment: Introduction, Types of Harassment, sexual harassment, ASME code of ethics creating awareness about workplace harassment,–Supreme Court directions, Compulsory workplace guidelines.

Unit V **(3 Hours)**

Case Study: Compulsory Question for 20marks.Review and Recap of Case studies and problems discussed from Unit I to Unit IV

TEXT BOOKS:

1. Ethics in the work place, craig E Johnson, Sage publication 2007
2. Ethics in the workplace, Dean A Bredeson and Keith Gorce, Cengage learning, 3rd edition, 2012.

REFERENCE BOOKS:

1. Ethics in the workplace: A systems perspective, William F Roth, Pearson Publication
2. Work place morality: Behavioral ethics in organization, Muel Kaptein, Emerald group publishing ltd. First edition, 2013.

Mapping Course Outcome with Program Outcome:

Course outcome	Program Outcome									
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2
CO1	2			2					2	
CO2	2			2					2	
CO3			2	2					2	
CO4			2	2					2	

Assessment Pattern Based on Bloom's Taxonomy

Sl. No	Bloom's Category	Test 1	Test 2	Test 3	Assignment	Seminar /Surprise Quiz	SEE
1	Remember	20	30	10	10	5	40
2	Understand	30	20	20	5		50
3	Apply	20	10	20			40
4	Analyze	20	20	20			30
5	Evaluate		10	20			20
6	Create						
Total		**90**	**90**	**90**	**15**	**5**	**180**

Curriculum Mapping

Subject	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
Ethics at work place	X		X	X				

Subject	**ORGANIZATION STRUCTURE, PROCESS AND DESIGN**		
Subject Code	20MBAHR405		
Credits	3:0:0:0	**CIE Marks**	50
Total no. of Lecture Hours	39	**SEE Marks**	50

Course objectives:

1. To enable students to understand the nature and scope of organization, structure and approaches to measure organizational effectiveness.
2. To make students understand the fundamentals of organization's workflow, organizational design and matching strategy and structure
3. To make students understand the power politics and conflicts of organization.
4. To make students aware about organizational cultural issues and ways of managing them
5. To help the students on the application oriented case analysis organizational design and effectiveness.

Course outcomes: At the end of the course, students will be to:

1. Demonstrate their conceptual knowledge of the fundamentals of organization's workflow, organizational structure, organizational design and matching strategy and structure

2. Demonstrate their conceptual understanding about the organizational effectiveness and approaches to measure organizational effectiveness
3. Demonstrate their skill of organizational cultural issues and ways of managing them
4. Acquire knowledge about the power, politics and conflicts of the organization.

Unit I: **(10 Hours)**

Organization: Introduction, Definitions, nature, scope, Evolution of Organization theory, images of Organization, Organizations structure: types, dimensions, determinates.

Organization Design: Determinant of organizational design, components of organization design, Approaches to organizational design, Organizational designs for different excellences. - Organizational decision making – types of organizational decisions, influences on organizational, decisions, different approaches of organizational decisions

Unit II: **(8 Hours)**

Organizational effectiveness: Definition, importance, approaches to organizational effectiveness – goal attainment approach, the system approach, the strategic approach, constituencies approach, competing values approach, relative comparison of approaches. Organizational processes: organizational work flow processes/business processes, process re-engineering, work flow as the basis for organizational design.

Unit III: **(8 Hours)**

Managing organizational culture: Essence of organization culture: Definition, functions, types, characteristics. Creating sustaining and transmitting culture, organization culture and strategy, strong and weak culture, how culture differs: the competing value perspective.

Unit IV: **(8 Hours)**

Organizational power, conflict and politics: Importance of power and politics in organization, structural determinants of organizational power. Managing organizational conflict: definition, conflict and organizational effectiveness, sources of organizational conflict, conflict resolution techniques, conflict stimulation techniques

Unit V: **(5 Hours)**

Case Study: Compulsory questions for 20 marks. Review and recap of case studies discussed from unit I to IV

TEXT BOOKS:

1. Organization Structure, Design and applications: Stephen Robbins – Pearson, PHI, 3/e
2. Understanding Organizations, Madhukar Shukla, PHI.

REFERENCE BOOKS:

1. Organizational design and development – concepts and application Dr. Bhupen Srivastava.
2. Organization Theory & Design, Richard L Daft, Cengage Learning, 8th Edition
3. Organizations: Structure, Processes & Outcomes, Richard Hall, Pearson.

Mapping Course Outcomes with Program Outcomes:

Course Outcomes	**Program Outcomes**								**PSO**	
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PSO1**	**PSO2**
CO1	1	2							2	
CO2	1			2					1	
CO3	1								1	
CO4	1									2

Assessment Pattern Based on Bloom's Taxonomy

Sl.No	**Bloom's Category**	**Test 1**	**Test 2**	**Test 3**	**Assignment**	**Seminar /Surprise Quiz**	**SEE**
1	Remember	10	10	10		5	10
2	Understand	20	10	10			20
3	Apply	20	20	20	5		40
4	Analyze	30	30	30	5		60
5	Evaluate	10	20	20		5	40
6	Create						10

Total	90	90	90	10	10	180

Curriculum Mapping

Course	Program Outcomes							
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
Organization Structure, Process and Design	X	X		X				

Subject	OD AND CHANGE MANAGEMENT		
Subject Code	20MBAHR406		
Credits	3:0:0:0	CIE Marks	50
Total no. of Lecture Hours	39	SEE Marks	50

Course Objectives:

1. To encourage an exploration of the concepts of organization development and change.
2. To articulate and discuss the history, main concepts, and theories of the field of Organization Development
3. Recognize common symptoms and reactions to change in the workplace and recommended interventions to address the reactions/resistance.
4. Develop an awareness and fundamental knowledge of the need for change, why organizations change or fail to change, and how to plan for, manage and measure change

Course outcomes: At the end of the course, students will be to:

1. apply key concepts and tools of organizational development and change management
2. develop basic understanding and appreciation for the issues and conditions creating the need for change in modern organizations.
3. explore some of the ethical issues associated with change and organizational development.
4. apply OD model to design a change strategy that will promote organizational effectiveness.
5. propose solutions to organizational issues using organizational development interventions

Unit I **(12Hours)**

Introduction to organizational Development: Conceptual frame work of OD, History of OD, Definition, characteristics of OD, First order and second order Change, Theories of planned change, general model of planned change, different types of panned change and critique of planned change,

Managing the OD Process: Components of OD Process, Diagnosis, Action & Program Management; Diagnosis: Diagnosing the System, its subunits and Processes, Diagnosis using the Six-box Organizational Model, Third Wave Consulting: The Action Component: nature of OD intervention, analyzing discrepancies: The Program Management Component: Phases of OD Programs, model for managing change, creating parallel learning structures

Unit II: **(11 Hours)**

Designing OD interventions: Human process interventions - coaching, training and development, process consultation, third part intervention, and team building. Organization confrontation meeting, intergroup relations intervention and large group intervention. Techno structural interventions:- Structural design , downsizing, reengineering, employee involvement, work design, socio technical systems approach.

The Future and OD: The changing environment, Fundamental strengths of OD, Implications of OD for the client, ethical standards in OD, OD's future. OD Consultant's role, issues in consultant-client relationship, Power, Politics & OD, Research on OD

Unit III: **(6 Hours)**

Organizational change- Introduction, nature of change, Internal & External changes, change need analysis, types and styles of change, Models of change- Lewis's Force field, Systems Model, Action research model

Unit IV: **(6 Hours)**

Organizational change management: Transformation planning, Resistance to change- reasons for the resistance, overcoming resistance for the change, cognitive dimension of managing change, affective dimensions of managing change, systematic approach to making change- factors for effective change, skills of leaders in change management, designing the change.

Unit V: **(4 Hours)**

Case study – compulsory questions for 20 marks. Review and recap of case studies discussed from unit I to IV

TEXT BOOKS:

1. Organization Development, behavioral science interventions for Organization Improvement, Wendell L.French, Cecil H.Bell, Veena,Jr, Pearson, PHI.
2. Organizational Development – C.G.C. Krishnamacharyulu & Lalitha Ramakrishnan, PHI 2013

REFERENCE BOOKS:

1. Organizational Development and Change - Cummings T.G. and Worley C. G., Cengage Learning, 2005.
2. Organizational development - Ramnarayan S and Rao T V, Sage Publicatin, 2011.
3. Change Management - Radha Sharma, Tata McGraw Hill, 2007.
4. Managing organizational change Palmer, I., Dunford, R., & Akin, G 2nd Ed. McGraw-Hill
5. Organizational design and development – concepts and application Dr. Bhupen Srivastava.
6. An Experietial Approach to organization Development - Donald R. Brown and Don Harvey, Prentice Hall

Mapping Course Outcomes with Program Outcomes:

Course Outcomes	Program Outcomes							
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	X							
CO2					X			
CO3	X				X			
CO4		X						
CO5					X			

Assessment Pattern Based on Bloom's Taxonomy

Sl. No	Bloom's Category	Test 1	Test 2	Test 3	Assignment	Seminar /Surprise Quiz	SEE
1	Remember	20	30	10	10	5	30
2	Understand	30	20	30	5		40
3	Apply	10	10	10			30
4	Analyze	30	20	20			40
5	Evaluate		10	20			40
6	Create						
Total		**90**	**90**	**90**	**15**	**5**	**180**

Curriculum Mapping

Course	Program Outcomes							
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
OD and Change Management	X	X			X			

MARKETING

Subject	INTEGRATED MARKETING COMMUNICATIONS

Subject Code	20MBAMM401		
Credits	3:0:0:0	**CIE Marks**	50
Total no. of Lecture Hours	39	**SEE Marks**	50

Course Objectives:

1. To enable the students to build a comprehensive framework that fully integrates the various aspects of managerial decision making related to marketing communications strategy and tactics.
2. To provide the students to learn an integrative approach to the study of the promotion mix, including advertising, publicity, personal selling, and sales promotion.
3. To ensure students to increase knowledge in emerging trends in advertising in global environment.
4. To discuss the case studies and show how the concepts can be applied.

Course Outcomes: At the end of the course, students will be to:

1. Demonstrate and explain comprehensive framework that fully integrates the various aspects of managerial decision making related to marketing communications strategy and tactics.
2. Display the skills in analyzing an integrative approach to the study of the promotion mix, including advertising, publicity, personal selling, and sales promotion.
3. Contribute the concepts of IMC to the advertising in global environment.
4. Apply the IMC concepts to a given business communication.

Unit I: **(8Hours)**

Role of IMC in marketing process, IMC planning model, Marketing and promotion process model, steps involved in developing IMC program, Effectiveness of marketing communications, Purpose, Role, Functions, Types.

Advertising Agency: Type of agencies, Services offered by various agencies,

Advertising objectives and Budgeting: Goal setting – DAGMAR approach, various budgeting methods used.

Unit II: **(8Hours)**

Media Planning: Developing Media plan, Problems encountered, Media Evaluation – Print, Broadcast media, Support media in advertising.

Direct Marketing: Features, Functions, Growth, Advantages / Disadvantages, Direct Marketing Strategies.

Unit III: **(9Hours)**

Promotion: Meaning, Importance, tools used, Conventional/unconventional, drawbacks, push pull strategies, Integration with advertising and publicity

Public relation / Publicity: Meaning, Objectives, tools of public relations, Public relation strategies, Goals of publicity, Corporate Advertising – Role, Types, Limitations, PR Vs Publicity.

Monitoring, Evaluation and control: Measurement in advertising, various methods used for evaluation

Unit IV: **(9Hours)**

International Advertising: Global environment in advertising, Decision areas in international advertising

Internet advertising: Meaning, Components, Advantages and Limitations, Types of Internet advertising

Industrial advertising: B 2 B Communication, Special issues in Industrial selling.

Unit V: **(5 Hours)**

Case Study: Compulsory question for 20 marks. Review and recap of case studies and problems discussed from unit

I to unit IV.

TEXT BOOKS:

1. Advertising and Promotions IMC Perspectives: Belch and Belch, 9/e, Tata McGraw Hill, 2012.
2. Advertising & Integrated Brand Promotion - O'Guinn, Allen, Semenik, Cenage Learning.
3. Integrated Advertising, Promotion, and Marketing Communications, Clow, Baack, 3/e, Pearson Education, 2007.
4. Integrated Marketing Communications – Niraj Kumar, HPH.

REFERENCE BOOKS:

1. Foundations of Advertising, Chynawalla & Sethia, HPH, 2007
2. Advertising management - Rajeev Batra, John G Myers & Aaker, 5/e, PHI, 2007.
3. Event marketing and management- Sanjaya Singh, Vikas Publication, 2003.
4. Advertising Basics, Vilanilam, Varghese, Response Books, 2007
5. Advertising, Sangeeta Sharma & Raghuvir Singh, PHI,2006.

Mapping Course Outcomes with Program Outcomes:

Course Outcomes	**Program Outcomes**								**PSO**	
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PSO1**	**PSO2**
CO1	2		1				1			2
CO2				2	3					2
CO3			2						1	
CO4				3				2		2

Assessment Pattern Based on Bloom's Taxonomy

	Bloom's Category	**Test 1**	**Test 2**	**Test 3**	**Assignment**	**Seminar /Surprise Quiz**	**SEE**
1	Remember	30	20	20	5	5	60
2	Understand	20	20	20			30
3	Apply	10	20	20	5		30
3	Analyze	20	20	20			20
5	Evaluate	10	10	10		5	30
6	Create						
Total		**90**	**90**	**90**	**10**	**10**	**180**

Curriculum Mapping:

Course	**Program Outcomes**							
Integrated Marketing Communication	**PO1**		**PO3**	**PO3**	**PO5**	**PO6**	**PO7**	**PO8**
	X		X	X	X		X	X

Subject	**INTERNATIONAL MARKETING MANAGEMENT**

Subject Code	20MBAMM402		
Credits	3:0:0:0	**CIE Marks**	50
Total No. of Lecture Hours	39	**SEE Marks**	50

Course Objectives:

1. To facilitate the students in understanding the concept of international marketing management process, design and theories
2. To enable the students to learn the major initiatives and skills relating to the design of international marketing strategy
3. To ensure specifying the essential ingredients of developing international marketing strategy
4. To familiarize basic knowledge about export – import business and countrywide implications.

Course Outcomes: At the end of the course, students will be to:

1. Demonstrate their conceptual understanding international marketing management process, design and theories
2. Apply the major concepts and initiatives relating to the design of international marketing strategy.
3. Analyze and apply the import and essential ingredients for developing international marketing strategy
4. Analyze concept of export – import business and countrywide implications

Unit I: (8 Hours)

Framework of International Marketing: Definition – scope and challenges – difference between international marketing and domestic marketing – the dynamic environment of international trade – transition from domestic to international markets - Competition in International Business.

Unit II: (10 Hours)

Developing a global vision through marketing research: Breadth and scope of international marketing research – problems in availability and use of secondary data – problems in gathering primary data – multicultural research – a special problem – research on internet – a new opportunity – estimating market demand – problems in analyzing and interpreting research information – responsibility for conducting marketing research – communicating with decision makers. Identifying foreign markets

Global Marketing Management – Planning and Organization: Global perspective – global gateways – global marketing management– planning for global markets – alternative market entry strategies – organizing for global competition.

Unit III: (7 Hours)

Social and Cultural Environment: Basic aspects of society and culture, Approaches to cultural factors, impact of Social and cultural environment on marketing industrial and consumer products.

Product and services for consumers: Quality – Green marketing and product development, products and culture – analyzing product components for adaptation – products for consumers in global markets, product development, product adaptation, product standardization, marketing consumer services globally – marketing of services, branding Strategies

Unit IV: (9 Hours)

Licensing, Strategic Alliances, FDI: Licensing, strategic alliances, manufacturing subsidiaries, entry modes and marketing control, optimal entry strategies

Global Distribution: Introduction, distribution strategies for International Marketing, rationalizing local channels, wholesaling, International Retailing, - Format - Pricing Decisions: International Pricing strategies framework, pricing basics, INCO terms. IMC in International Context: Promotions – international advertising – sales promotion in international markets –direct mailing – personal selling – exhibition – generic promotion in international marketing, Future of International Marketing.

Unit V: **(5 Hours)**

Case Study: Review and recap of case studies discussed from Unit I to IV

TEXT BOOKS:

1. International Marketing, Philip Cateora and John Graham,Tata Mc Graw Hill, New Delhi.
2. International Marketing Management – An Indian Perspective, Varshney and Bhattacharya, Sultan Chand & Sons, New Delhi.

REFERENCE BOOKS:

1. Global Marketing Management, Keegan, Prentice Hall of India, New Delhi.
2. Import and Export Documentation Mannule Nab+i
3. Essentials of International Marketing, Donald L. Brady, 1st Edition, Jaico Publishing House, 2011
4. Export: What, Where, How, Para Ram, Anupam Publishers, Delhi.

Mapping Course Outcomes with Program Outcomes:

Course Outcomes	Program Outcomes								PSO	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2
CO1	1						2		1	
CO2		2				3			1	
CO3			1		2					2
CO4			2	2				2	1	

Assessment Pattern Based on Bloom's Taxonomy:

Sl. No	Bloom's Category	Test 1	Test 2	Test 3	Assignment	Seminar /Surprise Quiz	SEE
1	Remember	20	30	10	5		40
2	Understand	30	20	20	5		50
3	Apply	10	10	20		5	40
4	Analyze	30	20	20		5	30
5	Evaluate		10	20			20
6	Create						
Total		**90**	**90**	**90**	**10**	**10**	**180**

Curriculum Mapping

International Marketing Management	Program Outcomes							
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
	X	X	X	X	X	X	X	X

Subject	SERVICES MARKETING

Subject Code	20MBAMM403		
Credits	3:0:0:0	**CIE Marks**	50
Total No. of Lecture Hours	39	**SEE Marks**	50

Course Objectives:

1. The purpose of this course is to develop the knowledge to the students in uniqueness of the services characteristics and its marketing implications.
2. To discuss the measure and analyze several facets in the area of services marketing essential for the success of a service sector firm.
3. To enable students to acquaint with the various models and their applications.
4. To appraise the students on the leading practical application oriented case studies – relevant and update and doing case study analysis and arriving at conclusions facilitating business decisions.

Course Outcomes: At the end of the course, the students will be able to:

1. Demonstrate the knowledge and understand the uniqueness of services characteristics and its marketing implications
2. Apply concepts, measure and analyze several facets in the area of services marketing essential for the success of a service sector firm.
3. Analyze and interpret the knowledge of principal models of service marketing and their applications in the service sector firm.
4. Recognize the challenges faced in services delivery as outlined in the services gap model

Unit I: (8 Hours)

Introduction to services: Concepts, contribution and reasons for the growth of services sector, difference in goods and service in marketing, myths about services, characteristics of services, concept of service marketing triangle, service marketing mix, GAP models of service quality. Marketing challenges in service industry.

Consumer Behavior in Services: Search, Experience and Credence property, consumer expectation of services, two levels of expectation, Zone of tolerance, Factors influencing customer expectation of services. Customer perception of services-Factors that influence customer perception of service, Service Quality, Five dimensions of service quality, Service encounters, Customer satisfaction, Strategies for influencing customer perception.

Unit II : (10 Hours)

Understanding customer expectation through market research: Key reasons for GAP 1, using marketing research to understand customer expectation, Types of service research, Building customer relationship through retention strategies – Relationship marketing, Evaluation of customer relationships, Benefits of customer relationship, levels of retention strategies, Market segmentation-Basis & targeting in services. **Customer defined service standards:** "Hard" & "Soft" standards, process for developing customer defined standards Leadership & Measurement system for market driven service performance-key reasons for GAP 2 service leadership- Creation of service vision and implementation, Service quality as profit strategy, Role of service quality In offensive and defensive marketing. Service design and positioning-Challenges of service design, new service development-types, stages. Service blue printing-Using & reading blue prints. Service positioning-positioning on the five dimensions of service quality, Service Recovery.

Unit III: (9 Hours)

Employee role in service designing: Importance of service employee, Boundary spanning roles, Emotional labour, Source of conflict, Quality- productivity trade off, Strategies for closing GAP 3. Customer's role in service delivery Importance of customer & customer's role in service delivery, Strategies for enhancing – Customer participation, Delivery through intermediaries – Key intermediaries for service delivery, Intermediary control strategies.

Role of marketing communication: Key reasons for GAP 4 involving communication, four categories of strategies to match service promises with delivery, Methodology to exceed customer expectation.

Unit IV: **(7 Hours)**

Pricing of services: Role of price and value in provider GAP 4, Role of non monitory cost, Price as an indicator of service quality –Approaches to pricing services, pricing strategies

Physical evidence in services: Types of service spaces- Role of service scapes, Frame work for understanding service scapes & its effect on behaviour-Guidance for physical evidence strategies.

Unit V: **(5 Hours)**

Compulsory question for 20 Marks. Review and recap of case studies discussed from Unit I to Unit IV

TEXT BOOKS:

1. Services Marketing-Valarie A Zeithmal & Mary Jo Bitner 5/e, TMH, 2011
2. Services Marketing-Christopher Lovelock, Pearson Education, 2004
3. Services Marketing: Operation, Management and Strategy-Kenneth E Clow & David L. Kurtz, 2/e, Biztantra, 2007

REFERENCE BOOKS:

1. Services Marketing - Rajendra Nargundkar, 3/e, TMH, 2010
2. Services Marketing - Govind Apte, Oxford, 2007
3. Services Marketing - Hoffman & Bateson, 4/e, Cengage Learning-2007
4. Services Marketing: The Indian Perspective-Ravi Shankar, Excel Books, 2006

Mapping Course Outcomes with Program Outcomes:

Course Outcomes	**Program Outcomes**								**PSO**	
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PSO1**	**PSO2**
CO1		2		2					1	
CO2		3		2	1		1			2
CO3		2	3	2		2				2
CO4	2	1	2	3	3	2		2	1	

Assessment Pattern Based on Bloom's Taxonomy:

Sl. No	**Bloom's Category**	**Test 1**	**Test 2**	**Test 3**	**Assignment**	**Seminar /Surprise Quiz**	**SEE**
1	Remember	20	30	10	5		40
2	Understand	30	20	20	5		50
3	Apply	10	10	20		5	40
4	Analyze	30	20	20		5	30
5	Evaluate		10	20			20
6	Create						
Total		**90**	**90**	**90**	**10**	**10**	**180**

Curriculum Mapping

Course	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
Services Marketing	X	X	X	X	X	X	X	X

Subject	DIGITAL MARKETING		
Subject Code	20MBAMM404		
Credits	3:0:0:0	CIE Marks	50
Total no. of Lecture Hours	39	SEE Marks	50

Course Objectives:

1. To provide the students to gain a solid understanding of Digital Marketing topics and the knowledge to navigate in this evolving industry.
2. To provide basic understanding of evaluate marketing impact qualitatively and quantitatively.
3. To help students to display advertising, search advertising, social media and mobile touch points at tactical and strategic levels.
4. To create awareness in the students about varied topics such mobile marketing, media planning, privacy issues and digital as fraud.

Course Outcomes: At the end of the course, students will be to:

1. Demonstrate the application of concepts of Digital Marketing and to navigate in the industry.
2. Demonstrate and evaluate marketing impact qualitatively and quantitatively
3. Apply the advertising, search advertising, social media and mobile touch points at tactical and strategic levels.
4. Analyze the varied topics such mobile marketing, media planning, privacy issues and digital as fraud.

Unit I: **(8 Hours)**

Introduction: Meaning of Digital Marketing, History, Digital Marketing Channels and Classifications, Relationship to Purchase Funnel, Benefits of Digital marketing, Digital vs. Real Marketing, Creating initial digital marketing plan, Digital Marketing Tools. Latest Digital marketing trends

Fundamental Ideas underlying Digital Marketing: Search costs, Data-enabled Capabilities, Internet "Law of Gravity"

The "Dark Side": Digital ad fraud.

Unit II: **(10 Hours)**

Display Advertising: Industry Structure and Economics, Programmatic and Traditional Buying, Ad targeting, Ad retargeting, User ad annoyance.

Measuring Impact, Randomized Experiments, Sample size issues

Search Advertising: Sponsored Search, Search Engine Optimization, Evaluation Metrics, Strategic aspects of "Broad Match" and Automation tools, "Poaching" on keywords.

Measuring Effectiveness, Spillovers from display to search, Attribution

Unit III: **(7 Hours)**

Social Media Marketing: Why use Social Media Marketing, Social Media Strategy, Facebook Marketing, Facebook marketing strategy, Facebook business page setup, User Engagement on Social Networks, Social Advertising, Web 2.0, Social Media Analytics, Online Word-of-Mouth, Impact of Online Reputation

Unit IV: **(9 Hours)**

Mobile Marketing: "Geo-fencing" and "Geo conquesting", Differences from PC, Impact of "form" and manner use on ad effectiveness.

Privacy: User response to Privacy concerns, Data sharing paradox, Impact of privacy regulation on ad targeting and effectiveness

Unit V: **(5 Hours)**

Case Study: Compulsory question for 20 marks. Review and recap of case studies and problems discussed from unit I to unit IV.

TEXT BOOKS:

1. Digital Marketing – Vandana Ahuja, Oxford Higher Education
2. SEO 2010: Search engine optimization, Internet Marketing, Strategies and Content Marketing – J.P.Richarsson, Digital Book Guru
3. Understanding Digital Marketing: Marketing Strategies for Engaging the Digital Generation: Damian Gyan, Kogan Page

REFERENCE BOOKS:

1. Convert! Designing websites for Traffic and Conversion – Ben Hunt, Wiley Publication
2. Global Content Marketing – Pam Didner , McGraw Hill Education
3. Digital Marketing Management: A Handbook for the Current (or Future) CEO – Debra Zahay, Business Expert Press
4. Digi marketing: The Essential Guide to New Media and Digital Marketing – Kent Wertime, Ian Fenwick, Wiley Publication
5. E-marketing Excellence: Planning and Optimizing your Digital Marketing – Dave Chaffey and PR Smith, Routledge

Mapping Course Outcomes with Program Outcomes:

Course Outcomes	Program Outcomes								PSO	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2
CO1				2					2	
CO2		1	2							2
CO3			2			3	3			3
CO4				2	3	2		3		3

Assessment Pattern Based on Bloom's Taxonomy

	Bloom's Category	Test 1	Test 2	Test 3	Assignment	Seminar /Surprise Quiz	SEE
1	Remember	30	20	20	5	5	60
2	Understand	20	20	20			40
3	Apply	10	20	20	5		30

4	Analyze	20	20	20			20
5	Evaluate	10	10	10		5	30
6	Create						
Total		**90**	**90**	**90**	**10**	**10**	**180**

Curriculum Mapping

Course	**Program Outcomes**							
Digital Marketing	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**
		X	X	X	X	X	X	X

Subject	**RURAL MARKETING**		
Subject Code	20MBAMM404		
Credits	3:0:0:0	**CIE Marks**	50
Total no. of Lecture Hours	39	**SEE Marks**	50

Course Objectives:

1. To provide conceptual understanding of Rural Marketing with special reference to Indian context and develop skills required for planning of Rural Products so as to apply in the corporate.
2. To create an awareness about the applicability of the concepts, techniques and processes of marketing in rural context.
3. To familiarize with the special problems related to sales in rural markets.
4. To familiarize with the demographic patterns of rural market.

Course Outcomes: At the end of the course, the students will be able to:

1. Demonstrate their conceptual understanding rural Marketing with reference to Indian context and able to develop skills required for planning of Rural Products so as to apply in the corporate.
2. Analyze the concepts, techniques and processes of marketing in rural context which are relevant for the marketing
3. Demonstrate and evaluate the special problems related to sales in rural markets and implement the solutions in the real time.
4. Analyze the rural demographic patterns and implement the solutions to develop infrastructure facilities.

Unit I: (9 Hours)

The Rural Marketing: A conceptual framework: Introduction to rural marketing, Evoluation of rural marketing, Rural marketing model, Rural marketing in India, Classification and identification of needs of rural markets, Myths about rural marketing, Career in rural marketing.

Rural Market Research: Planning the rural research, Process, Tools, Challenges, Role of rurla marketing consulting agencies.

Unit II: (10 Hours)

Rural Marketing Environment: Population, Occupation pattern, Income generation, Location of rural population, Expenditure pattern, Literacy level, Land distribution and Land use pattern, Irrigation, Development patterns, Infrastructure facilities, Rural credit institutions, Rural communication system, Problems in rural marketing

Rural Consumer Behaviour: Factors affecting Consumer Behaviour – STEP, Characteristics of Rural Consumer - Consumer Buying Process, Opinion leadership process, Diffusion of Innovation, Brand Loyalty, PRA Approach.

Unit III: (7 Hours)

Rural Marketing of FMCGs: Rural Marketing of FMCGs and Challenges. Issues related to consumer durables, Opportunities and Challenges in marketing strategies for banking services

Marketing of Agricultural Produce: Challenges and Strategies in marketing and promotion of agricultural produce.

Marketing of Rural Artisan Produce: Characteristics and Challenges of rural artisan sector, Marketing strategies for the development of rural artisan sector

Unit IV: (9 Hours)

Distribution Strategy: Accessing and Coverage status of rural markets, Rural retail system, C-operative societies channel behaviour, Prevalent Rural Distribution Models.

Communication Strategy: Determining Communication objectives, designing the message, Selection of Communication channels, Advertising for rural audiences, Rural media, Influence of Consumer behaviour on Communication strategies.

Unit V: (4 Hours)

Case Study: Compulsory question for 20 marks. Review and recap of case studies and problems discussed from unit I to unit IV.

TEXT BOOKS:

1. Rural Marketing – R.V.Badi and N.V.Badi. HPH
2. Rural Marketing – Pradeep Kashyap and Siddhartha Raut, Biztantra

REFERENCE BOOKS:

1. Rural Marketing: Concepts and Practices – Dogra.B and Ghuman.K. Tata McGraw-Hill Education
2. Rural marketing in India – K.S. Habeeb-ur-Rahman, HPH
3. Rural Marketing: Texts and Cases – Krishnamacharyulu and Ramakrishnan, Pearson
4. Cases in Rural Marketing: An Integrated Approach - Krishnamacharyulu and Ramakrishnan, Pearson

Mapping Course Outcomes with Program Outcomes:

Course Outcomes	Program Outcomes								PSO	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2
CO1	2			2					2	
CO2		1							1	
CO3		1								1
CO4	2			2					2	

Assessment Pattern Based on Bloom's Taxonomy

	Bloom's Category	Test 1	Test 2	Test 3	Assignment	Seminar /Surprise	SEE

Sl. No						Quiz	
1	Remember	10	10	10		5	10
2	Understand	20	10	10			20
3	Apply	20	20	20	5		40
4	Analyze	30	30	30	5		60
5	Evaluate	10	20	20		5	40
6	Create						10
Total		**90**	**90**	**90**	**10**	**10**	**180**

Curriculum Mapping

Course	Program Outcomes							
Rural Marketing	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**
	X	X		X				

Subject	**CUSTOMER RELATIONSHIP MANAGEMENT**		
Subject Code	20MBAMM406		
Credits	3:0:0:0	**CIE Marks**	50
Total no. of Lecture Hours	39	**SEE Marks**	50

Course Objectives:

1. To make the students to understand the basic concepts of customer relationship management.
2. To make the students to familiar with concepts related to customers and relationship.
3. To make the students to understand the concepts of CRM structures.
4. To impact the concepts of planning and implementing the CRM.

Course Outcomes: At the end of the course, students will be to:

1. Demonstrate the concepts of customer relationship management and its role in marketing.
2. Analyze the current role and position of CRM in an organization.
3. Apply the concepts of CRM in the system for competing in the dynamic business world.
4. Apply the CRM with better planning and implementation for the organization success.

Unit I: INTRODUCTION **(9Hours)**

Definitions - Concepts and Context of relationship Management - Transactional Vs Relationship Approach – CRM as a strategic marketing tool – CRM significance to the stakeholders, Model of CRM, strategic CRM, commercial context of CRM.

Unit II: UNDERSTANDING CUSTOMERS AND RELATIONSHIP **(9Hours)**

Customer information Database – Customer Profile Analysis –Creating value for customers, customization, Customer perception, Expectations analysis – Customer behavior in relationship perspectives; individual and group customer‘s - Customer life time value Relationship: relationship quality, relationship with customers, customer satisfaction, loyalty and business performance.

Unit III:CRM STRUCTURES **(8 Hours)**

Elements of CRM – CRM Process – Strategies for Customer acquisition – Retention and Prevention of defection– CRM road map for business applications.

Customer experience: meaning, experiential marketing strategies and tactics, customer experience and role of CRM, features of CRM software application influence customer experience.

Unit IV:CRM PLANNING AND **IMPLEMENTATION** (8Hours)

CRM Implimentation process: Develop, Build, Need specification and partner selection, Project Implimentation, Evaluation performance, Strategic CRM planning process – Implementation issues – CRM Tools- Analytical CRM – Operational CRM

– Call center management – Role of CRM Managers.

Unit V: **(5Hours)**

Case Study: Compulsory question for 20 marks. Review and recap of case studies and problems discussed from unit I to unit IV.

TEXT BOOKS:

1. G.Shainesh, Jagdish, N.Sheth, Customer Relationships Management Strategic Prespective, Macmillan 2005.
2. Alok Kumar et al, Customer Relationship Management : Concepts and applications, Biztantra, 2008
3. Kumar, Customer Relationship Management - A Database Approach, Wiley India, 2007. 5. Francis Buttle,

REFERENCES:

1. H.Peeru Mohamed and A.Sahadevan, Customer Relation Management, Vikas Publishing 2005.
2. Jim Catheart, The Eight Competencies of Relatioship selling, Macmillan India, 2005.
3. Assel, Consumer Behavior, Cengage Learning, 6th Edition.

3 Customer Relationship Management : Concepts & Tools, Elsevier, 2003. 6. Zikmund. Customer Relationship Management, Wiley 2012 .

7. Mohammed Hp/Sagadevan.A Customer Relationship Management- A step by step approach, Iedition. 8. G.Shainesh, J.Jagdish N Seth. Customer Relationship Management.

Mapping Course Outcomes with Program Outcomes:

Course Outcomes	Program Outcomes								PSO	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSo2
CO1	3			1					2	
CO2	3									3
CO3			2						2	
CO4	3									1
CO5		2							1	

Assessment Pattern Based on Bloom’s Taxonomy

	Bloom’s Category	Test 1	Test 2	Test 3	Assignment	Seminar /Surprise Quiz	SEE

1	Remember	30	20	20	5	5	60
2	Understand	20	20	20			30
3	Apply	10	20	20	5		30
3	Analyze	20	20	20			20
5	Evaluate	10	10	10		5	30
6	Create						
Total		**90**	**90**	**90**	**10**	**10**	**180**

Curriculum Mapping:

Course	**Program Outcomes**							
Customer Relationship Management	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**
	X	X	X	X				

FINANCE SPECIALIZATION

Subject	**INTERNATIONAL FINANCIAL MANAGEMENT**		
Subject Code	20MBAFM401		
Credits	3:0:0:0	**CIE Marks**	50
Total no. of Lecture Hours	39	**SEE Marks**	50

Course Objectives:

1. To provide an understanding the international financial environment, markets and instruments
2. To explain the foreign exchange rate determination, including the foreign exchange and derivatives markets.
3. To describe foreign exchange exposure measurement and management.
4. To provide an understanding of the financial management aspects of the MNC.
5. To explain the functioning of world financial markets and institutions.

Course Outcomes: At the end of the course, students will be able to:

1. Understand the role of foreign exchange market in international financial management and the key determinants of exchange rate.
2. Gain knowledge about the foreign exchange exposure and management.
3. Explain the functioning of world financial markets and institutions.
4. Gain knowledge about foreign exchange risk management
5. Demonstrate the significance of financial management in the global context.

UNIT I: (08 Hours)

International financial Environment- The Importance, rewards & risk of international finance- Goals of MNC- International Business methods – Exposure to international risk- International Monetary system- Multilateral financial institution International Monetary system:-

International Financial Markets and Instruments: - Foreign Portfolio Investment. International Bond & Equity market. GDR, ADR, International Financial Instruments: Foreign Bonds & Eurobonds, Global Bonds. Floating rate Notes, Zero coupon Bonds, International Money Markets, Forward Rate Agreements International Flow of Funds: (Theory)

UNIT II: (09 Hours)

Foreign Exchange Market: Function and Structure of the Forex markets, Foreign exchange market participants, Determination of Exchange rates in Spot markets. Exchange rates determinations in Forward markets. Exchange rate behaviour-, Swift Mechanism. Balance of Payments (BoP), Fundamentals of BoP, Accounting components of BOP, Factors affecting International Trade and capital flows, Equilibrium & Disequilibrium. Trade deficits. Capital account convertibility (problems on BOP) (Theory and problems)

UNIT III: (09 Hours)

International Parity Relationships & Forecasting Foreign Exchange rate: - Measuring exchange rate movements- Exchange rate equilibrium – Factors affecting foreign exchange rate- Forecasting foreign exchange rates .Interest Rate Parity, Purchasing Power Parity & International Fisher effect. Covered Interest Arbitrage Cross Rates- Arbitrage profit in foreign exchange markets

International Capital Budgeting: Concept, Evaluation of a project, Factors affecting, Risk Evaluation, Impact on Value, Adjusted Present Value Method

UNIT IV: (09 Hours)

Foreign exchange risk Management: **Foreign Exchange exposure**: - Management of Transaction exposure- Management of Translation exposure- Management of Economic exposure - Management of Interest rate exposure. Hedging against foreign exchange exposure – Forward Market- Futures Market- Options Market- Hedging through currency of invoicing- Hedging through mixed currency invoicing –Country Risk analysis. (Theory and problems)

UNIT V (04 Hours)

Case Analysis: Compulsory question for 20 marks. Review and recap of case studies and problems discussed from unit I to unit IV.

TEXT BOOKS:

1. International Financial Management – Madhu Vij, Excel Books, 2010.
2. International financial Management – B. Janakiram, S.P Srinivasan, 3/e, 2015, Dreamtech press

REFERENCE BOOKS:

1. Multinational Financial Management–Alan C. Shapiro, 10/e, Wiley India Pvt. Ltd., 2011.
2. International Financial Management – Siddaiah T, 1/e, Pearson, 2011.
3. International Finance – Imad Moosa, 3/e, Tata McGraw Hill, 2011.
4. International Financial Management – Apte P. G, 6/e, TMH, 2011.
5. International Financial Management - Jeff Madura, Cengage Learning 2008

Mapping Course Outcomes with Program Outcomes:

Course Outcomes	Program Outcomes								PSO	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO-1	PSO-2
CO1	1								2	
CO2				3					2	
CO3		1								1
CO4						2		2	2	
CO5					2	1				

Assessment Pattern Based on Bloom's Taxonomy:

Sl. No	Bloom's Category	Test 1	Test 2	Test 3	Assignment	Seminar /Surprise Quiz	SEE
1	Remember	20	20	20			50
2	Understand	20	20	20			50
3	Apply	20	20	20	10		30
4	Analyze	20	20	20	10		30
5	Evaluate	10	10	10			20

6	Create						
Total		**90**	**90**	**90**	**20**		**180**

Course Mapping

Course	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
INTERNATIONAL FINANCIAL MANAGEMENT	X	X		X	X	X		X

Subject	**FINANCIAL DERIVATIVES AND INSURANCE**		
Subject Code	20MBAFM402		
Credits	3:0:0:0	**CIE Marks**	50
Total No. of Lecture Hours	39	**SEE Marks**	50

Course Objectives:
1. To describe the characteristics of the financial derivative instruments
2. To Explain the use of options and futures contracts for tactical portfolio strategies Purpose
3. To provide an understanding of pricing financial of derivatives.
4. To explain the fundamentals of Insurances services and products

Course Outcomes: **At the end of the course, students will be able to:**
1. Understand the financial derivative instruments
2. Demonstrate the understanding of hedging risks using Futures, Options and Swaps
3. Demonstrate the understanding of pricing financial of derivatives
4. Apply the concepts learnt in practical situations involving several cases.

Unit I: **(12 Hours)**

Financial Derivatives - Introduction, economic benefits of derivatives - Types of financial derivatives - Features of derivatives market - Factors contributing to the growth of derivatives -functions of derivative markets - Exchange traded versus OTC derivatives - traders in derivatives markets - Derivatives market in India

Futures and forwards - differences-valuation of futures, valuation of long and short forward contract. Mechanics of buying & selling futures, Margins, Hedging using futures -specification of futures - Commodity futures, Index futures, interest rate futures - arbitrage opportunities. (Theory and problems)

Unit II: **(12 Hours)**

Options: Types of options, option pricing, factors affecting option pricing – call and put options on dividend and non-dividend paying stocks put-call parity-mechanics of options- stock options- options on stock index- options on futures – interest rate options.

Hedging & Trading strategies involving options, valuation of option: basic model, one step binomial model, Black and Scholes analysis, option Greeks. Arbitrage profits in options.

Unit III: **(06 Hours)**

Commodity derivatives: commodity futures market-exchanges for commodity futures in India, Forward Market Commissions and regulation-commodities traded – trading and settlements – physical delivery of commodities.

Credit Derivatives: credit risk; concept, assessment; Credit Derivatives instruments CDS, TRS, Credit options, Credit linked notes, benefits of Credit derivatives **Swaps**: Mechanics of interest rate swaps –volatility of interest rate swaps –currency swaps –valuation of currency swaps. (Theory and problems)

Unit IV: **(05 Hours)**

Insurance : Definition, Types of Insurance, Functions of Insurance, Principles of Insurance, Essential of Insurance contract, Reforms in Indian Insurance sector, FDI policy in Insurance sector, Insurance and Tax benefits, Insurance services and Products: Introduction to Insurance, Insurance act 1938, Insurance Regulatory and Development Authority (IRDA), IRDA Regulations, Insurance Products/Services, Recapitulation

Unit V: **(04 Hours)**

Case study: Compulsory question for 20 Marks. Review and recap of case studies discussed from Unit I to Unit IV

TEXT BOOKS:

1. Options Futures & Other Derivatives- John C.Hull - (Pearson Education), 6/e 2010
2. Options & Futures- Vohra & Bagri - (TMH), 2/e 2011

REFERENCE BOOKS:

1. Risk Management & Derivative – Shulz – Thomson / Cengage Learning.
2. Introduction to Derivatives and Risk Management – Chance – Thomson Learning, 6/e, 2004
3. Derivatives & Financial Innovations – Bansal - TMH. 2010

Mapping Course Outcome with Program Outcome:

Course Outcomes	**Program Outcomes**								**PSO**	
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PSO-1**	**PSO-2**
CO1	1	3		1					1	
CO2		2					3			2
CO3		1		2			2			2
CO4		1	2					1	1	

Assessment Pattern Based on Bloom's Taxonomy: CIE

Sl. No	**Bloom's Category**	**Test 1**	**Test 2**	**Test 3**	**Assignment**	**Seminar /Surprise Quiz**	**SEE**
1	Remember	20	20	20		10	30
2	Understand	30	30	20	10		40
3	Apply	20	20	20			50
4	Analyze	20	20	30			40
5	Evaluate						20
6	Create						
Total		**90**	**90**	**90**	**10**	**10**	**180**

Course	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**
Financial Derivatives and Insurance	**X**	**X**	**X**	**X**			**X**	**X**

Subject	**GOODS AND SERVICES TAX (GST)**		
Subject Code	20MBAFM403		
Credits	3:0:0:0	**CIE Marks**	50
Total No. of Lecture Hours	39	**SEE Marks**	50

COURSE OBJECTIVES:

At the end of the course, the students will be able to:

1. To provide an overview of GST in India.
2. To provide an understanding of levy and collection of GST.

3. To give an overview of customs duty in India.
4. To provide an understanding of valuation for customs duty.

COURSE OUTCOMES: At the end of the course, the students are able to:

1. Have clarity about GST system in India.
2. Understanding of levy and collection of GST in India.
3. Have an overview of customs duty in India.
4. Understanding of valuation for customs duty.

Unit I **(08 Hours)**

Introduction to Goods and Services Tax (GST): Goods and Services Tax Act & Rules, Need for GST in India, Dual GST Model - Central Goods and Services Tax Act, 2017 (CGST) State Goods and Services Tax Act, 2017 (SGST) Union Territory Goods and Services Tax Act, 2017 (UTGST) Integrated Goods and Services Tax Act, 2017 (IGST) Goods and Services Tax Network (GSTN), GST Council Guiding principle and Functions of the GST Council. (Theory).

Unit II **(10 Hours)**

Levy and Collection of Tax: Scope of Supply, Composite and Mixed Supplies , Levy and Collection, Composition Levy , Exemptions Person Liable to pay GST, Exemption from tax. (Simple problems on calculation of value of taxable supply and GST Levy). (Theory and Problems).

Time and Value of supply: Time of Supply, Change in Rate of Tax in respect of Supply of Goods or Services, Place of Supply and Value of Supply. (Simple problems on Time of supply, place of supply and value of supply) (Theory and Problems).

Unit III **(08 Hours)**

Input Tax Credit: Introduction and Eligibility to avail Input Tax Credit (ITC). Registration under GST: Persons not liable for Registration, Compulsory Registration in Certain Cases, Procedure for Registration, Deemed Registration. Returns under GST: Furnishing of Returns, First Return , Revision of Returns and Penalty/Late Fee. (Theory).

Unit IV **(09 Hours)**

Introduction to Customs Duty: Definitions, Circumstances of Levy of Customs Duties and Types of Duties and Exemption from Customs Duty. Valuation under customs: Valuation of Imported Goods and Valuation of Export Goods. (Problems on Valuation of Imported Goods). (Theory and Problems).

Import and Export Procedure under Customs: Introduction to Baggage and General Free Allowance. Provisional Assessment of Duty, Due Dates for Payment of Duty, Penalties under Customs, Seizure of Goods , Confiscation of Goods. (Theory).

Unit V: **(04 Hours)**

Case study: Compulsory question for 20 Marks. Review and recap of case studies discussed from Unit I to Unit IV

Question Paper: 60 % Theory 40% problems

TEXT BOOKS:

1. Indirect Taxes Law and practices, V S Datey, Taxmanns
2. GST & Customs Law (University Edition), K.M Bansal, Taxmanns.

REFERENCE BOOKS:

1. Principles of GST & Customs Law, V.S. Datey and Dr. Krishnan Sachdeva, Taxmanns
2. Goods & Services Tax (GST) in India , B. Viswanathan UBS Publishers

Course Outcomes	Program Outcomes								PSO	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO-1	PSO-2
CO1	1	2		3					2	
CO2							2		2	
CO3				2			2			1
CO4		2	1					1	2	

3. **Assessment Pattern Based on Bloom's Taxonomy: CIE**

Sl. No	Bloom's Category	Test 1	Test 2	Test 3	Assignment	Seminar /Surprise Quiz	SEE
1	Remember	20	20	20	10		30
2	Understand	30	30	20	10		40
3	Apply	20	20	20			50
4	Analyze	20	20	30			40
5	Evaluate						20
6	Create						
Total		**90**	**90**	**90**	**20**		**180**

Course	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
INDIRECT TAXATION	X	X	X	X			X	X

Subject	**ADVANCED FINANCIAL MANAGEMENT**		
Subject Code	20MBAFM404		
Credits	3:0:0:0	**CIE Marks**	50
Total no. of Lecture Hours.	39	**SEE Marks**	50

Course Objectives:

1. To manifest the students to various areas of managing current assets like inventory, cash and receivables.
2. To inculcate the knowledge about the capital structure and dividend policy of the firm.
3. To enable the student to appreciate the role of financial management in an Organization.
4. To develop planning and monitoring skill in financial management functions effectively and to calculate EVA.

Course Outcomes: At the end of the course, students will be able to:

1. Illustrate the management of various current assets: Inventory, receivables and cash.
2. Become familiar with the capital structure and dividend policy of the firm.
3. Appreciate the role of financial management in an Organization.
4. Apply the appropriate management strategy to face the company challenges and demonstrate the conceptual application of EVA.

Unit I: (**08 Hours**)

Cash Management and Receivables Management

Cash Management: Meaning, Forecasting cash flows – Cash budgets, long-term cash forecasting, monitoring collections and receivables, optimal cash balances – Baumol model, Miller-Orr Model, Strategies for managing surplus fund.

Receivables Management

Credit management through credit policy variables, marginal analysis, and Credit evaluation: Numerical credit scoring and discriminate analysis. Control of accounts receivables.

Unit II: **(10 Hours)**

Inventory Management

Determinations of inventory control levels: ordering, reordering, danger level. EOQ model. Pricing of raw material. Monitoring and control of inventories, ABC Analysis.(Problems on EOQ and ABC analysis)

Approaches to value measurement: Economic Value Added (EVA) - concept, components of EVA, Market Value Added (MVA), Agency problem and consideration, effect of inflation on: Asset value, Firm value, returns.

Unit III: **(10 Hours)**

Capital structure decisions

Meaning of capital, capital structure & market value of a firm. Theories of capital structure – NI approach, NOI approach, Modigliani Miller approach, traditional approach. Arbitrage process in capital structure and reverse arbitrage process. Planning the capital structure: EBIT and EPS analysis. (Theory and problems)

Unit IV: **(07 Hours)**

Dividend policy

Theories of dividend policy: Walter's & Gordon's model, Modigliani & Miller approach. Dividend policies – Stable dividend, stable payout and growth. Bonus shares and stock split corporate dividend behavior. Legal and procedural aspects of dividends Corporate Dividend Tax.

Unit V : **(04 Hours)**

Case Study: Compulsory question for 20 marks. Review and recap of case studies and problems discussed from unit I to unit IV.

TEXT BOOKS:

1. Financial Management - Prasanna Chandra, 8/e, TMH, 2011.
2. Advanced Financial Management- Harish Babu, 1/e, Himalaya Publishing House, 2014

REFERENCE BOOKS:

1. Financial Management - M.Y. Khan & P.K. Jain, 6/e, TMH, 2011.
2. Financial Management - I.M. Pandey, 10/e, Vikas, 2011.
3. Financial Management: Theory & Practice - Brigham & Ehrhardt, 10/e, Cenage learning, 2004.
4. Corporate Finance: Ross, Westerfield & Jaffe,– TMH – 8/e, 2010

Mapping Course Outcomes with Program Outcomes:

Course Outcomes	**Program Outcomes**								**PSO**	
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PSO-1**	**PSO-2**
CO1	2	1							1	
CO2		3								2
CO3				1		3				2
CO4	1	3						2	2	

Assessment pattern

Sl.No	**Bloom's Category**	**Test 1**	**Test 2**	**Test 3**	**Assignment**	**Seminar /Surprise Quiz**	**SEE**
1	Remember	30	30	30			40

2	Understand	30	30	30		5	50
3	Apply	20	10	10	5		30
4	Analyze	10	10	10	10		40
5	Evaluate		10	10			20
6	Create						
Total		**90**	**90**	**90**	**15**	**5**	**180**

Curriculum Mapping

Course	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
ADVANCED FINANCIAL MANAGEMENT	**X**	**X**		**X**		**X**		**X**

Subject	**STRATEGIC CREDIT MANAGEMENT**		
Subject Code	20MBAFM405		
Credits	3:0:0:0	**CIE Marks**	50
Total no. of Lecture Hours	39	**SEE Marks**	50

Course Objectives:

1. To provide an overview of the sound lending decisions by a bank
2. To explain the process of evaluation of the loan proposal
3. To provide an insight into the different types of loans
4. To explain the process of financing small scale and large scale industries
5. To describe the aspects of NPA management

Course Outcomes: At the end of the course, students will be able to:

1. Understand the nature and rationale behind credit management in Banks.
2. Demonstrate the understanding of credit appraisal procedures in respect of different forms of lending by Banks.
3. Demonstrate the understanding of financing small and large scale industries.
4. Apply tools and techniques to measure financial performance of banks and their NPA management.

Unit I: **(08 Hours)**

Credit management in banks-Screening of applications-Appraisal of credit-Sanction limit Post sanction compliance – Monitoring supervision –Review- Government policies for credit extension- Credit institutions- Principles of good lending- Borrower study and bankers opinion- Credit policy by banks- Government regulation of credit -Prudential norms.

Over view of credit policy and loan characteristics-The credit process –Characteristics of different types of loans- Evaluating commercial loan requests – Financial statement analysis Cash flow analysis- Projections-Management of the firm and other factors –Feasibility study – Fundamental credit issues - Credit analysis-Different types of borrowers.

Unit II: **(10 Hours)**

Evaluating consumer loans – Types- Credit analysis of consumer loans- Risk–return analysis of consumer loans- Customer profitability analysis and loan pricing- Fixed Vs floating rates

Loan and advances against pledge- Hypothecation- Mortgage – Lien- Advances against goods- Document to title to goods – Life insurance policies – Stock exchange securities Fixed deposit receipts –Book debts- Supply bills- Real estates – Advance against collateral securities.

Unit III: **(09 Hours)**

Financing to small scale industries and large scale industries- Term lending- Syndicated loan system- Role of development banks in industrial finance- Working capital finance Turnover method – Modified version of MPBF Cash budget approach- Long term finance Project financing –Industrial sickness and BIFR. Agricultural finances and Retail lending- Crop loans- Crop insurance schemes- Dairy Sericulture- Poultry- Animal husbandry Horticulture –

Gobar gas – Kissan credit cards – NABARD initiatives – Lead bank schemes – Retail banking advances – Concept – Retail banking products – Consumer credit financing

Unit IV: **(08 Hours)**

NPA management – Introduction- Identification of NPAs- Asset classification- Prudential norms- Capital adequacy – International Banking Regulation-Basel II – asset classification provisioning – effect of NPA on profitability - Assessment procedure- Pre-sanction appraisal – Post sanction supervision- Monitoring systems for existing and likely NPAs—Tools to manage NPAs –Compromise scheme, Lok Adalats, Debt Recovery Tribunals, Corporate Debt Restructuring, Willful defaulters, SARFAESI Act, Asset Reconstruction Companies CIBIL

Unit V: **(04 Hours)**

Case Analysis: Compulsory question for 20 Marks. Review and recap of case studies discussed from Unit I to Unit IV

TEXT BOOKS:

1. Strategic Credit Management in Banks, Popli.G.S. And Puri S. K., PHI, 2013
2. Bank Credit Management, G. Viajayaragavan, Himalaya Publishing House, 2009

REFERENCE BOOKS:

1.Industrial Finance - Vishwanathan R, Macmillan, New Delhi.
2.Banking and Financial System - Prasad K, Nirmala and Chandradas. Himalaya Publishing House, Mumbai.
3.Managing Banking Risks - Cade, Eddic, Woodhead Publishers, England.
4.Banking Theory and Practice - Shekar and Shekar, 19/e, Vikas Publishing House, 2009.

Mapping Course Outcomes with Program Outcomes:

Course Outcomes	Program Outcomes								PSO	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO-1	PSO-2
CO1							1	1	2	
CO2		3							1	
CO3				2		3			2	
CO4	1	3						2		1

Assessment Pattern Based on Bloom's Taxonomy:

S.No	Bloom's Category	Test 1	Test 2	Test 3	Assignment	Seminar /Surprise Quiz	SEE
1	Remember	30	30	30			40
2	Understand	30	30	30		5	50
3	Apply	20	10	10	5		40
4	Analyze	10	10	10	10		30
5	Evaluate		10	10			20
6	Create						
Total		**90**	**90**	**90**	**15**	**5**	**180**

Curriculum Mapping

Course	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
STRATEGIC CREDIT MANAGEMENT	**X**	**X**		**X**		**X**	**X**	**X**

Subject	PROJECT APPRAISAL, PLANNING AND CONTROL		
Subject Code	20MBAFM406		
Credits	3:0:0:0	CIE Marks	50
Total no. of Lecture Hours	39	SEE Marks	50

Course Objectives:

1. To gain knowledge on the Generation of ideas, Market and demand analysis, Technical analysis and planning.
2. To make the students to predict cash flows using relevant techniques
3. To gain insights on the project cash flows, project management and review techniques and appraisal criteria.
4. To gain knowledge on the linear programming model, Network techniques for project management- PERT and CPM models

Course Outcomes: At the end of the course, students will be able to:

1. Demonstrate an understanding of various phases of project management.
2. To analyze & predict the cash flows to the firm
3. Demonstrate project implementation and review.
4. Apply techniques for project management using PERT and CPM models.

Unit I: **(09 Hours)**

Planning & Analysis Overview: Phases of capital budgeting – Levels of decision making – objective.

Resource Allocation Framework: Key criteria for allocation of resource –elementary investment strategies – portfolio planning tools – strategic position and action evaluation – aspects relating to conglomerate diversification – interface between strategic planning and capital budgeting.

Unit II: **(08 Hours)**

Project cash flows: Basic principles of measurement of cash flows –components of the cash flow streams – viewing a project from different points of view – definition of cash flows by financial institutions and planning commission – biases in cash flow estimation.

Appraisal criteria: Net Present Value – benefit cost ratio – internal rate of returns urgency – payback period – accounting rate of returns – investment appraisal in practice. (Theory and problems)

Unit III: **(10 Hours)**

Project financing in India: Means of finance – norms and policies of financial institutions – SEBI guidelines – Sample financing plans – structure of financial institutions in India – schemes of assistance – term loans procedures – project appraisal by financial institutions.

Project review and administrative aspects: Initial review – performance evaluation – abandonment analysis – administrative aspects of capital budgeting – evaluating the capital budgeting system of an organization.

Unit IV: **(08 Hours)**

Project Management: Forms of project organization – project planning – project control – human aspects of project management – prerequisites for successful project implementation.

Network techniques for project management – development of project network – time estimation – determination of critical path – scheduling when resources are limit – PERT and CPM models – Network cost system (Only problems on resources allocation and resources leveling)

Unit V **(04 Hours)**

Case Study: Compulsory question for 20 marks. Review and recap of case studies and problems discussed from unit I to unit IV.

TEXT BOOKS:

1. Prasanna Chandra – Project Planning: Analysis, Selection, Implementation and Review – TMH, 5/e
2. Narendra Singh – Project Management and Control – HPH, 2003

REFERENCE BOOKS:

1. Nicholas – Project Management for Business and Technology: Principles and Practice – Pearson / PHI
2. Gray & Larson – Project Management: The Managerial Process – TMH, 3/e , 2005
3. Vasant Desai – Project Management – HPH

4. Bhavesh M Patel – Project Management – Vikas
5. Chitkara – Construction Project Management, Planning, Scheduling and Control – TMH, 1/e

Mapping Course Outcomes with Program Outcomes:

Course Outcomes	Program Outcomes								PSO	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO-1	PSO-2
CO1			2						2	
CO2		1							2	
CO3	2					3				1
CO4		1			2			1	2	

Assessment Pattern Based on Bloom's Taxonomy:

S.No	Bloom's Category	Test 1	Test 2	Test 3	Assignment	Seminar/ Surprise Quiz	SEE
1	Remember	30	30	30			40
2	Understand	30	30	30	5	5	50
3	Apply	20	10	10	5		40
4	Analyze	10	10	10	5		30
5	Evaluate		10	10			20
6	Create						
Total		**90**	**90**	**90**	**15**	**5**	**180**

Curriculum Mapping

Course	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
PROJECT APPRAISAL, PLANNING AND CONTROL	X	X	X		X	X		X

SUPPLY CHAIN MANAGEMENT SPECIALIZATION

Subject	**GLOBAL SUPPLY CHAIN AND LOGISTICS MANAGEMENT**		
Subject Code	20MBASC401		
Credits	3:0:0:0	**CIE Marks**	50
Total no. of Lecture Hours	39	**SEE Marks**	50

Course Objectives:

1. To understand supply chain and logistics management from the global prospective.
2. To analyze global market demand and manage the global logistics.
3. To demonstrate the concepts of key supply chain drivers from global scenario.
4. To learn the concepts of outsourcing and performance management in global scenario.

Course Outcomes: At the end of the course, the students will be able to:

1. Demonstrate the concepts of global supply chain management.
2. Apply the concepts of demand analysis and sustainability for the organizational growth.
3. Apply the concepts of International purchasing, operations management and transportation for taking better decision..
4. Analyze the outsourcing and performance of supply chain functions in the global business.

Unit I: (9 Hours)

Introduction: Role of the Supply Chain, Managing the Supply Pipeline for Global Trade Flows, Comparison between National (Domestic) and International Logistics, Factors Driving Global Supply Chain Management, Problems and Challenges facing global supply chain & logistic management, Customs and Global Supply Chain Management, , Advantages of globalized Supply chain, Forces of Global Supply chain, Factors Contributing to the Development of Logistics, Global Logistic Management process, Latest trend in global supply chain management.

Unit II: (9 Hours)

Demand analysis: The emergence of the value-conscious customer, Market Environment, Market Entry Strategy, Constituents of the Export Sales Contract, Market Development Strategy with Global Logistics Focus. Elements of logistics customer service; Strategies for logistics customer service,.

Delivering sustainability through supply chain management: Purchasing or procurement; Production or manufacturing; Distribution and ware housing ; Use and maintenance; Dispose or reuse and recycle? ; Managerial and financial sustainability.

Unit III: (9 Hours)

International Procurement Systems: Introduction, Procurement process , Types of purchasing., Just in time relationship management, Engineering Techniques, Levels in Global purchasing.

Operations Management: Supply chain globalization in manufacturing**,** Benchmarking – Supply Chain, Supply Chain Cycle Time Management Reduction. Supply chain globalization in service sector.

International Transport: Introduction, Trade-Offs Inherent in International Logistics – Multi-Modalism, Key Factors in a Transport Mode(s) Trade-Off, Speed, Frequency, Packing, Insurance, Warehousing, Assessing the utilization of vehicle fleets; Factors constraining vehicle utilization ; Measures to improve vehicle utilization

Unit IV: (9 Hours)

Outsourcing: Definition; Reasons for outsourcing the pitfalls in outsourcing; Global supply chains and the outsourcing risks, Risk management and the supply chain.

Coordination: Introduction, Coordination of supply chains with information technology, Stages and influential factors.

Software in the Supply Chain Process

Performance measurement and management in the supply chain: The balanced scorecard – the standard for goal setting and measurement; Fundamental concepts of supply chain management and measurement; mastering the complexity of supply chain and logistics performance management

Unit V: (3 Hours)

Case study: Compulsory question for 20 Marks. Review and recap of case studies discussed from Unit I to Unit IV

TEXT BOOKS:

1. Global Supply Chain Management and International Logistics, Alan E. Branch, Routledge Publisher.
2. Global Logistics – New direction in supply chain management, Donald waters, 6th edition, Kogan Page

REFERENCE BOOKS:

1. Supply chain management: A global Prospect, Nada R Sanders, Wiley publisher.
2. Global Supply Chain Management, Matt Drake, first edition,Business Express press.
3. Global supply chain Management: Leveraging processes, measurements and tools for strategic corporate advantage, G.Tomas M Hult, David Closs and David Frayer, Mc Graw Hill Publisher 2nd edition.

Mapping Course Outcomes with Program Outcomes:

Course outcome	Program Outcome								PSO	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2
CO1	3			3					2	
CO2		2		3					2	
CO3	3			3					2	

CO4				3					2	

Assessment Pattern Based on Bloom's Taxonomy

Sl. No	Bloom's Category	Test 1	Test 2	Test 3	Assignment	Seminar /Surprise Quiz	SEE
1	Remember	20	20	20	5		35
2	Understand	20	20	20	5		35
3	Apply	20	20	20	5	5	40
4	Analyze	15	15	15			40
5	Evaluate	15	15	15			30
6	Create						
Total		**90**	**90**	**90**	**15**	**5**	**180**

Curriculum Mapping

Subject	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
GLOBAL SUPPLY CHAIN AND LOGISTICS MANAGEMENT	3	2		3				

Subject	**LOGISTICS AND WAREHOUSE MANAGEMENT**		
Subject Code	20MBASC402		
Credits	3:0:0:0	**CIE Marks**	50
Total no. of Lecture Hours	39	**SEE Marks**	50

Course Objectives:

1. To understand the role of logistics in competitive environment.
2. To enable students with outsourcing logistics and its modal characteristics.
3. To identify various applications in warehouse management system and its performance
4. To know importance of distribution channels for logistics management.

Course Outcomes: At the end of the course, the students will be able to:

1. understand the various roles of logistics in competitive strategy.
2. understand the transport functionalities and the suitable modal characteristics of logistics.
3. implement different applications in warehouse management for better operations.
4. identify areas for improvement and devise proper distribution channels.

Unit I: (**9Hours)**

INTRODUCTION TO LOGISTICS MANAGEMENT: Definition – Objectives of Logistics Management Types of Logistics, Scope of Logistics, Importance of Logistics Management, 7R's of Logistics Management, Need & Development, Functions, Role of logistics in Competitive strategy, Role of Logistics in the supply chain management – Role of Logistics in the Economy , Role of Logistics in the organization, E-Logistics-Components , advantages , Green Logistics

Unit II: **(8Hours)**

DISTRIBUTION CHANNELS, OUTSOURCING AND REVERSE LOGISTICS :

Distribution channel structure- channel members, channel strategy –Support in distribution channels - Logistics requirements of channel members – Distribution Requirement Planning, Benefits of DRP, Distribution Resource Planning-meaning & Components, Differentiated between DRP I and DRP II

Logistics outsourcing –Reasons, Pros & Cons of Outsourcing, Supply Chain Integration-Third Party Logistics, Fourth Party Logistics-Benefits & Functions.

Reverse Logistics: Types of reverse logistics

Unit III: **(9Hours)**

TRANSPORTATION, MATERIAL HANDING AND PACKAGING

Transportation Management– Transportation Infrastructure, Transport functionality and principles , Role of Transportation Logistics, Traffic and transportation strategy, Single mode operators – specialized carriers – Intermodal Operators – Non operating intermediaries.

Transportation Management – Basic Transport economics and pricing , Factors affect the Choice of Transportation Mode, Criteria for Carrier Selection. Carrier Selection Process, Carrier Selection Determinants

Material Handling – Objectives, Functions & Importance of Materials Handling, material handling principles, Managing the warehouse resource – Handling requirements – Storage requirements – Basic Handling considerations Packaging – Perspectives- Consumer Packaging- Industrial Packaging. Damage protection

Unit IV: **(8Hours)**

WAREHOUSE MANAGEMENT

Warehousing functions, Benefits of Warehousing, Warehousing Principles, Types, Importance , Relationship with other functions stores systems and procedures, incoming - materials control-stores accounting and stock verification, operational efficiency productivity- cost effectiveness-performance measurement, Factors Affecting WarehousingWarehouse facility development , kinds of storage, warehouse management systems

Unit V: **(5 Hours)**

Case study: Compulsory question for 20 Marks. Review and recap of case studies discussed from Unit I to IV

TEXT BOOKS:

1. Bowersox Donald J, Logistics Management – The Integrated Supply Chain Process,Tata McGraw Hill, 2010
2. ShridharaBhat K, Logistics Management, Himalaya Publishing House, 3rd Edition, 2018.

REFERENCE BOOKS:

1. Coyle et al., The Management of Business Logistics, Thomson Learning, 7th Edition, 2004.
2. Ailawadi C Sathish&Rakesh Singh, Logistics Management, PHI, 2005.
3. Bloomberg David J et al., Logistics, Prentice Hall India, 2005.
4. Pierre David, International Logistics, Biztantra, 2003.
5. Ronald H. Ballou, Business Logistics and Supply Chain Management, Pearson Education, 5th Edition, 2007..
6. A.K.Chitale and R.C.Gupta, Materials Management, Text and Cases, PHI Learning, 2nd Edition, 2006.
7. SopleVinod V, Logistics Management – The Supply Chain Imperative, Pearson Education, 3rd Edition, 2012.
8. J.R.Tony Arnold, Stephen N. Chapman, Lloyd M. Clive, Materials Management, Pearson,

Mapping Course Outcome with Program Outcomes:

Course Outcomes	**Program Outcomes**								**PSO**	
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PSO 1**	**PSO 2**
CO1				3					2	
CO2	1			2					2	
CO3	2	3							2	
CO4	1								2	

Assessment Pattern Based on Bloom's Taxonomy

Sl. No	**Bloom's Category**	**Test 1**	**Test 2**	**Test 3**	**Assignment**	**Seminar /Surprise Quiz**	**SEE**
1	Remember	20	20	20	10		40
2	Understand	20	20	20		10	40
3	Apply	20	20	20			40
4	Analyze	20	20	20			40
5	Evaluate	10	10	10			20
6	Create						
Total		**90**	**90**	**90**	**10**	**10**	**180**

Curriculum Mapping:

Course	Program Outcome							
Logistics and Warehouse Management	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
	X	X		X				

Subject	STRATEGIC PROCUREMENTAND QUALITY MANAGEMENT		
Subject Code	20MBASC403		
Credits	3:0:0:0	CIE Marks	50
Total no. of Lecture Hours	39	SEE Marks	50

Course Objectives:

1. To develop competencies and excellence in procurement management
2. To explain how procurement is influenced by the business environmental factors and has increasingly become visible in a world where supply is a major determinant of corporate survival and success.
3. To provide a synopsis of the different quality management philosophies
4. To imbibe a culture of managing quality across the entire supply chain.
5. To have exposure to challenges in Quality Improvement Programs.

Course Outcomes: At the end of the course, students will be able to:

1. Examine the key processes of procurement management in order to assess their roles in a business system.
2. Apply the knowledge of procurement to make appropriate procurement decisions in different business situations
3. Recommend sourcing strategies through supplier evaluation systems for the acquisition of different products and services.
4. Apply key elements of quality management in areas of leadership, customer focus and satisfaction, supplier partnership, employee involvement, performance measures etc
5. Analyze the process of quality management and reduce variations thereby.

Unit I: **(8 Hours)**

Procurement Management: An overview, changing role of purchasing, Purchase orders(PO): Product PO and service PO, Procurement management process, Tools and techniques, Strategic purchasing, Globalization and strategic purchasing, Strategic purchasing process, Internal aspects, Vertical internal alignment, Horizontal internal alignment, Horizontal integration and the role of purchasing, Preventing a misalignment,Price cost Analysis in Purchasing,.

Unit II: **(10 Hours)**

Sourcing strategies: Traditional sourcing, Global sourcing, Elements of strategic outsourcing ,Category management, Portfolio models, Kraljic matrix, Effects of Globalization, Supplier Selection, Single vs multiple sourcing, Supplier relationship management, Supply chain networks, Supplier involvement, Contract management, Purchasing profession, Development of skills for a purchasing department, Importance of purchasing services, Ethical sourcing and corporate social responsibility.

Unit III: **(7 Hours)**

TQM Framework, benefits, awareness and obstacles, Quality- Vision, Mission and Policy statements, Customer Focus- Customer perception of quality, Customer Retention, Kano Model, Dimensions of product and service quality, Cost of quality.

Contributions of Deming, Juran, Crosby, Masaaki Imai, Feigenbaum, Ishikawa, Taguchi Loss Function,

Unit IV: **(9 Hours)**

Quality Requirements for suppliers, Quality Function Deployment, Process, benefits, Quality councils in TQM,Voice of Customer, FMEA, Seven Quality Control Tools – Old and New, Business Process Reengineering, Benchmarking, Supplier quality certifications : CSQP,CQPA, CQIA, Six sigma : Six sigma Green Belt and Six sigma Black Belt.

Unit V: **(05 Hours)**

Case study: Compulsory question for 20 Marks. Review and recap of case studies discussed from Unit I to IV

TEXT BOOKS:

1. Baily, P, Farmer, D, Crocker, B, Jessop, D and Jones, D (2008) *Procurement Principles and Management*, 10th edn, Prentice-Hall, Pearson Education Limited, England.
2. Dale H.Besterfield et al, Total Quality Management, Third edition, Pearson Education. (First Indian Reprints 2004).
3. ShridharaBhat K, Total Quality Management – Text and Cases, Himalaya Publishing House, First Edition 2002.

REFERENCE BOOKS:

1. Benton, Jr. W C (2007) *Purchasing and Supply Management*, 1st edn, New York: McGraw-Hill Irwin.

2. Handfield, R B, Monczka, R M, Giunipero, L C and Patterson, J L (2009) *Sourcing and Supply Chain Management*, 4th edn, Canada: South- Western, Cengage Learning.
3. Baily, P., Farmer, D., Crocker, B., Jessop, D., Jones, D. (2008) Procurement Principles and Management. (10th ed.) London: Pearson Education Limited.
4. Janakiram.B, Gopal.R.K, (2006), Total Quality Management, 1st Edition, Prentice Hall India Learning Private Limited
5. Evans.R.James, (2017), Quality and Performance Excellence, 8th Edition, Cengage Learning,

Mapping Course Outcomes with Program Outcomes:

Course Outcomes	Program Outcomes								PSO	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2
CO1	2								2	
CO2		3							3	
CO3				1				1	1	
CO4			2					2	2	
CO5				2		3				2

Assessment Pattern Based on Bloom's Taxonomy

Sl. No	Bloom's Category	Test 1	Test 2	Test 3	Assignment	Seminar /Surprise Quiz	SEE
1	Remember	30	30	30	10		40
2	Understand	30	30	30		5	40
3	Apply	20	10	10	5		40
4	Analyze	10	10	10			40
5	Evaluate		10	10			20
6	Create						
Total		**90**	**90**	**90**	**15**	**5**	**180**

Curriculum Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
Procurement and Quality Management	X	X	X	X		X		X

Subject	**INTERNET TECHNOLOGY AND SCM**		
Subject Code	20MBASC404		
Credits	3:0:0:0	**CIE Marks**	50
Total no. of Lecture Hours	39	**SEE Marks**	50

Course Objectives:

1. To enable students to understand the impact of Internet Technology (IT) and Information Systems (IS) in international business operations.
2. To develop the students' ability to identify sources of information through decision-making process by leveraging IT and networking.
3. To learn the concept of System architecture, ERP and Decision support system.

4. To develop practical applications as well as the ability to recommend how IS and IT should be used in global business.

Course Outcomes:At the end of the course, students will be able to:

1. Understand the role and impact of IT in supply chain process..
2. Analyze the various tools and techniques useful in implementing new Internet technologies in the organizations
3. Understand the concept of System architecture, ERP and Decision Support System
4. Learn the various Technological Excellence tools to compete in global market.

Unit I: **(9Hours)**

The role of IT in Supply chain .Uses of IT in inventories, transportation & facilities within a supply chain .The Supply Chain IT frame Work-macro Processes

The future of IT in the Supply Chain. Internal Supply Chain management, Supply relationship management, The Transaction Management Foundation .Data mining

Unit II: **(7 Hours)**

Goals of Supply Chain information Technology, Supply chain Management System Components, Standardization, information Technology infrastructure – Presentation Devices, Communication Devices , System architecture.

Unit III: **(9 Hours)**

The Supply chain IT in Practice, Integrating Supply chain information Technology, Stage of Development, Implementation of ERP & DSS. Structure of DSS,Selection of Supply Chain DSS. Supply chain master Planning. Supply chain information System Design –Planning,Capacity, Performance requirement manufacturing requirement, Operation,Transportation, Inventory development, E-Business - Role in Supply chain, Framework, Impact on Cost.

Unit IV: **(9Hours)**

Technological Excellence - Technology and its importance in global manufacturing, manufacturing innovations: Productivity & Incremental Innovation. Crucial issues of Flexible Technology- Strategic Evaluation of Technological Investments

Unit V: **(5 Hours)**

Case study: Compulsory question for 20 Marks. Review and recap of case studies discussed from Unit I to IV

TEXT BOOKS:

1. Designing& Managing –The Supply Chain David Simchi Levi Philip KaminskyEditSimchi – Levi (Tata McGraw-Hill)
2. P N Rastogi, Management of Technology andInnovation: Competing Through Technological Excellence 2nd Edition, Response Books.

REFERENCE BOOKS:

1. Alan L. Porter, Scott W. Cunningham, Jerry Banks, A. Thomas Roper, Thomas W. Mason, 56 Frederick A. Rossini, Forecasting and Management of Technology, 2nd Edition, Wiley
2. Carl M. Chang, C. M. Chang, Achieving Service Excellence: Maximizing Enterprise Performance through Innovation and Technology, Business Expert Press
3. Frankel Ernst G. Professor, In Pursuit of Technological Excellence: Engineering Leadership, Technological Change, and Economic Development, Praeger Frederick A

Mapping Course Outcomes with Program Outcomes:

Course Outcomes	Program Outcomes							PSO	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO-1	PSO-2
CO1	2		1						2	
CO2		3		1					2	
CO3						1		1		1
CO4				2			2		2	

Assessment Pattern Based on Bloom's Taxonomy

Sl. No	Bloom's Category	Test 1	Test 2	Test 3	Assign ment	Seminar /Surprise Quiz	SEE
1	Remember	30	30	30	10		40
2	Understand	30	30	30		5	40
3	Apply	20	10	10	5		40
4	Analyze	10	10	10			40
5	Evaluate		10	10			20
6	Create						
Total		**90**	**90**	**90**	**15**	**5**	**180**

Curriculum Mapping:

Course	**Program Outcomes**							
Internet Technology and SCM	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**
	X	**X**	**X**	**X**		**X**	**X**	**X**

Subject	**CUSTOMER RELATIONSHIP MANAGEMENT**		
Subject Code	20MBASC405		
Credits	3:0:0:0	**CIE Marks**	50
Total no. of Lecture Hours	39	**SEE Marks**	50

Course Objectives:

1. The course provides the direct response perspectives on customer relationship and creates an awareness of interactive communication platforms.
2. It also seeks to assess the factors considered in, and procedures used for, buying direct mail assess and the strategies for delivering effective messages via direct-response techniques.
3. It provides the knowledge about the customer relationship management at national and global prospect.
4. To enable the students understand the technological and human issues relating to implementation of Customer Relationship Management in the organizations.

Course Outcomes: At the end of the course, students will be able to:

1. Understand the management components of Customer relationship management.
2. Apply the tools and techniques useful in implementing effective Customer relationship management system.
3. Analyze the advantages of promoting the products through Internet advertising.
4. Demonstrate the knowledge of the customer relationship management cycle from acquisition to retention.

Unit I: **(9 Hours)**

Customer Relationship Management (CRM) in B2B: Introduction, Strategic CRM, Relationship Marketing, Buyer – Seller, Connector, Managing Buyer – Seller Relationships, Customer Relationship Management, Advantages of gaining a Customer Relationship, CRM constituencies.

Customer relationship management value chain: Introduction, Primary stage of the CRM value chain, The supporting conditions of CRM value chain.

Unit II: **(9 Hours)**

Customer Relationship and Database Marketing: A Media Perspective - Customer Relationship Marketing- CRM Techniques- Database Marketing- Life Time Value Concept Behavioral Mapping- Customer Loyalty.
Information technology for CRM, Introduction to M Commerce and Blogging - Concept- Advantages- Challenges Mobile Mass Media concept- M Commerce as an advertising Medium- Interactive Media Concept- Blog as a communication Medium

Unit III: **(9 Hours)**

Direct response: Catalog Marketing- B2B and Consumer Magazines- Negative Option direct response - DRTV- Advantages- Challenges DRTV Formats- TV Shopping networks- Per Inquiry concept- Contemporary Market Scenario
Internet Advertising and E Commerce - Online advertising – Types of ads- Formats Cost and response rates- Integrating Internet with PR and Sponsorship Programs- Measuring Online Marco mm- Current Internet Scenario. Concept- Advantages- Internet barriers and concerns- Offline advertising in ecommerce- Contemporary E commerce advertising.

Unit IV: **(9 Hours)**

Managing the customer life cycle : customer acquisition, customer value estimates, key performance indicates of customer acquisition programs, Using customer data to guide customer acquisition. Economies of customer retention, Strategies for customer retention, Key performance indicators of customer retention programs.
Organizing for customer relationship management: introduction, strategic goals of CRM, conventional customer management structures, person to person contacts.

CRM Implementation: Choosing the right CRM Solution; Framework for Implementing CRM: a Step-by-Step Process: Five Phases of CRM Projects: Development Customizations; Beta Test and Data Import; Train and Retain; Roll out and System Hand-off; Support.

Unit V: **(3 Hours)**

Case study: Compulsory question for 20 Marks. Review and recap of case studies discussed from Unit I to Unit IV

TEXT BOOKS:

1. Integrated Marketing Communications by David Pickton, Amanda Broderick, pearson
2. Database Marketing- Analyzing and Managing Customers by Blattberg, Robert C., Kim, Byung, Springer.
3. Customer Relationship Management: concepts and tools, Francis Buttle, second edition, Elsevier Butterworth – Heinemann.

REFERENCE BOOKS:

1. Customer Relationship Management (Briefcase Books Series) by Kristin L. Anderson and Carol J. Kerr (1 October 2001), McGraw-Hill Professional
2. M-Commerce: Technologies, Services, and Business Models by Norman Sadeh, John Wiley & Sons
3. E-Commerce and Mobile Commerce Technologies by Rahul Srivastava, S. Chand Publisher.
4. Customer Relationship Management : A global prospect, Gerhard Raab, Riad. Ajami, Vidyaranya B, Jason Goddard,Routledge publisher, 2016.

Mapping Course Outcomes with Program Outcomes:

Course Outcomes	Program Outcomes								PSO	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2
CO1				2					1	
CO2		3					2		3	
CO3					1				2	
CO4				3						3

Assessment Pattern Based on Bloom's Taxonomy

Sl. No	Bloom's Category	Test 1	Test 2	Test 3	Assignment	Seminar /Surprise Quiz	SEE
1	Remember	30	30	30	10		40
2	Understand	30	30	30		5	40

3	Apply	20	10	10	5		40
4	Analyze	10	10	10			40
5	Evaluate		10	10			20
6	Create						
Total		**90**	**90**	**90**	**15**	**5**	**180**

Curriculum Mapping

Course	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
Customer Relationship Management		**X**		**X**	**X**		**X**	

Subject:	**E-MARKETING**		
Subject Code:	20MBASC306		
Credits:	3:0:0:0	**CIE Marks**	50
Total no. of Lecture Hours:	39	**SEE Marks**	50

Course Objectives:

1. To understand the important concepts related to e-marketing
2. To learn the use of different electronic media for constructing marketing activities.
3. To introduce to the students the current tools in e-marketing space.

Course Outcomes: At the end of the course, students will be able to:

1. appreciate the challenges required for effective E- Marketing Management.
2. understand and apply the tools and techniques used in E-Marketing.
3. anticipate E-Marketing problems and issues common in the modern workplace.
4. increase overall knowledge of creative e- marketing concepts and practices

Unit I: (8 Hours)

Introduction to E-Marketing: Landscape – Past – Today – Future – Internet Marketing Paradigm – Internet Infrastructure Stack Business Models & Strategies: Strategic Planning – Strategy to Electronic Planning – Strategic Drivers of the Internet Economy – Business Models to E-Business Models – E business Models – level of commitment to E-business Performance Metrics – The Balanced Scorecard

E-Marketing Plan: Overview of the E-Marketing Planning Process – Creating an E Marketing Plan – A Seven-Step E-Marketing Plan

Unit II: (10 Hours)

The E-Marketing Environment: Overview of Global E-Marketing Issues – Country and Market Opportunity Analysis – Technological Readiness Influences Marketing – Wireless, Internet Access – The Digital Divide Ethical and Legal Issues – Privacy – Digital Property – Online Expression

E-Marketing Research: Data Drive Strategy – Marketing Knowledge Management – Monitoring Social Media- Social media Measurement Pyramid-Awareness & Exposure, Brand health, Engagement, Action, Innovation- – Technology-Enabled Approaches – Real-Space Approaches – Marketing Databases and Data Warehouses – Data Analysis and Distribution – Knowledge Management Metrics - Consumer Behaviour Online – Segmentation-Important Geographic Segmentation of E-Marketing – Targeting – Differentiation – Positioning Strategies

Unit III: (9 Hours)

E-Marketing Management: Product – Products on Internet – Creating Customer Value Online – Product Benefits – E-Marketing Enhanced Product Development – Price – Pricing Objectives, Change in Pricing Strategies – Buyer and Seller Perspectives – Payment Options — Distribution – Online Channel Intermediaries – Distribution Channel Length and Functions — Distribution Channel Metrics – Promotion – Integrated Marketing Communication (IMC)-AIDA Model – Internet Advertising – Marketing Public Relations – Sales Promotion Offers – Direct Marketing – Personal Selling – IMC Metrics

Unit IV: (6 Hours)

Emerging Issues:- Online Governance and ICANN – Jurisdiction – Fraud – Consumer Loyalty of Website-Services – The Quadratic Effect of Flow – Role of Technology Readiness in Developing Trust and Loyalty for E-Services in Developing Countries.

Unit V: (6 Hours)

Case study: Compulsory question for 20 Marks. Review and recap of case studies discussed from Unit I to IV

TEXT BOOKS:

1. E-Marketing, Judy Strauss and Raymond Frost, Prentice Hall, 7th Edition, 2013
2. Internet Marketing: Integrating Online and Offline Strategies. M. L. Roberts and Debra Zahay, Cengage Publishing, 3rd edition, 2013
3. Digital Marketing: Strategy, Implementation and Practice, Chaffey D., Ellis- Chadwick F., Pearson, 5th Edition, 2012

REFERENCE BOOKS:

1. The Essential Guide to Online Marketing, Rob Strokes, Quirk, ISBN: 9781936126323
2. The New Rules of Marketing and PR: How to Use Social Media, Blogs, News Releases, Online Video, and Viral Marketing to Reach Buyers Directly, David Meerman Scott, 2nd Edition, Jan 2010
3. E-Commerce: An Indian Perspective, P. T. Joseph, Prentice Hall, 4th Edition, 2013

Mapping Course Outcome with Program Outcome:

Course Outcomes	Program Outcomes								PSO	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PS0 2
CO1		2							2	
CO2	3								3	
CO3	3			3					2	
CO4	3	2							1	

Assessment Pattern Based on Bloom's Taxonomy

Sl. No	Bloom's Category	Test 1	Test 2	Test 3	Assignment	Seminar /Surprise Quiz	SEE
1	Remember	20	20	20	10		40
2	Understand	30	30	30		10	40
3	Apply	20	20	20			40
4	Analyze	10	10	10			40
5	Evaluate	10	10	10			20
6	Create						
Total		**90**	**90**	**90**	**10**	**10**	**180**

Curriculum Mapping

Course	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
E-Marketing	X	X		X				

BUSINESS ANALYTICS SPECIALIZATION

Subject	**ADVANCED ANALYTICS**		
Subject Code	20MBABA401		
Credits	3:0:0:0	**CIE Marks**	50
Total No.: of Lecture Hours	39	**SEE Marks**	50

Course Objectives:

1. Learn the advanced analytics across upcoming industries with real time case studies and understand it's applications.

Course Outcomes: At the end of the course, the students will be able to:

1. Gain Understanding of Strategic to Tactical application of Analytics. Applying Predictive and Prescriptive Analytics in advanced fields.

Unit I: **(13 Hours)**
Procurement and Logistics: Procurement -Category Management, Strategic Sourcing, Spend Analytics, Supplier Selection using AHP and ANP, Category Management with Case Study, Case Study - Spend Analytics, Exercise- Spend Analytics. Logistics and Warehouse management, Network Design, Case Study - Logistics Analytics. Exercise - Logistics Analytics, Basics of Inventory management.

Unit II: **(07 Hours)**
Project Case Study : A case study will be provided which the class needs to solve and present in groups.

Unit III: **(13 Hours)**
People Analytics : People Analytics and HR Analytics, Workforce Analytics, Talent Acquisition Analytics, Talent Retention Analytics, Performance Management Analytics,Disruption in HR, Future of Work, Engagement in the new era, Trends in HR functions, Coping with Pandemic and post, AI and Blockchain in HR, Social Media and HR.

Unit IV: **(06 Hours)**
Project Case Study : A case study will be provided which the class needs to solve and present in groups.
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TEXT BOOKS:

1. Analytics 3.0 – Thomas Davenport – HBR.
2. A Marketing Analytics framework for CMOs – Gartner.
3. Advanced Analytics – Predictive, Collaborative and Pervasive – Gartner.
4. Gartner's Business Analytics Framework.

REFERENCE BOOKS:

1. People Styles at work…Beyond , Robert Bolton and Dorothy Grover Bolton, Latest Edition
2. The Employee Experience - How to attract talent, Retain top performers, and Drive Results, Tracy

Mapping Course Outcomes with Program Outcomes:

Course Outcomes	Program Outcomes							PSO	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO-1	PSO-2
CO1	2			2					1	
CO2		2							2	
CO3		1					1		1	

CO4			2			2			1	

Assessment Pattern Based on Bloom's Taxonomy:

Sl. No.:	Bloom's Category	Test 1	Test 2	Test 3	Assignment	Seminar Surprise Quiz	SEE
1	Remember	30	25	20			45
2	Understand	30	25	30	5		45
3	Apply	10	20	20	5		40
4	Analyze	10	10	10	5	5	30
5	Evaluate	10	10	10			20
6	Create						
Total		**90**	**90**	**90**	**15**	**5**	**180**

Curriculum Mapping

Course	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
ADVANCED ANALYTICS	X	X	X	X		X	X	

Subject	**MARKETING ANALYTICS**		
Subject Code	20MBABA402		
Credits	3:0:0:0	**CIE Marks**	50
Total No.: of Lecture Hours	39	**SEE Marks**	50

Course Objectives:

1. To study the key concepts, tools, basic statistics & practical applications of all the knowledge.
2. This course should make the student to understand the importance of analytics in marketing department along with data skills, gain an in-depth understanding of Business Marketing Analytics.

Course Outcomes: At the end of the course, the students will be able to:

9. In this course, student will learn about CLV, CST, Positing and analyzing the customer need and satisfactions.
10. In this course, student will gain complete knowledge on management frameworks in business.
11. Student will gain hands on practice experience using statistical tool R Studio/Excel for end to end model building.
12. In this course, student will acquire individual capabilities and build Market Basket Analysis and Customer Churn Prediction in Telecom Industry.

Unit I: **(06 Hours)**

Introduction to Marketing Analytics: Introduction, Segmentation and Targeting, Positioning, Analyzing customer satisfaction, Customer lifetime value, Customer choice, Conjoint analysis.

Unit II: **(10 Hours)**

Management Framework: Structured Problem Solving, Find and Target Most Attractive Customer Segment, Evaluate Macro And Environment Factors, Evaluate Company's Competitive Position, Evaluate Industry's Attractiveness, Product & Market Expansion, Product Portfolio Management, Go To Market Strategy, Business Strategy Development, Organizational Analysis, Product Management, Purchase Funnel

Unit III: **(13 Hours)**

Data Mining Using RFM Analysis: Introduction, RFM analysis, Data mining + RFM - Clustering using RFM, Classification using RFM, Association rule mining using RFM, Case study – Data Preprocessing, RFM model, Customer segmentation, Customer behavior prediction, Product recommendation &Conclusion

Unit IV: **(10 Hours)**

Real Time Case Study: MBA- Market Basket Analysis and Predict the customer churn for a telecom company.

TEXT BOOKS:

1. An Introduction to Statistical Learning With Applications In R ,Gareth James, Daniela Witten, Trevor Hastie and Robert Tibshirani.
2. Reference material of Analytics Edge - Marketing Analytics and Marketing Mix Analysis Case Study.

REFERENCE BOOKS:

1. The Complete GuideTo A/B Testing, latest version doc.

Mapping Course Outcomes with Program Outcomes:

Course Outcomes	Program Outcomes								PSO	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO-1	PSO-2
CO1	2			2					2	
CO2		1								1
CO3		3		2			1		2	
CO4			1			1			1	

Assessment Pattern Based on Bloom's Taxonomy:

Sl. No.:	Bloom's Category	Test 1	Test 2	Test 3	Assignment	Seminar Surprise Quiz	SEE
1	Remember	30	25	20			45
2	Understand	30	25	30	5		45
3	Apply	10	20	20	5		40
4	Analyze	10	10	10	5	5	30
5	Evaluate	10	10	10			20
6	Create						
Total		**90**	**90**	**90**	**15**	**5**	**180**

Curriculum Mapping

Course	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
MARKETING ANALYTICS	X	X		X		X	X	

Subject	**SUPPLY CHAIN ANALYTICS**

Subject Code	20MBABA403		
Credits	3:0:0:0	**CIE Marks**	50
Total No.: of Lecture Hours	39	**SEE Marks**	50

Course Objectives:

1. Learn the Fundamentals of Supply Chain and applying Analytics.

Course Outcomes: At the end of the course, the students will be able to:

1. Gain Understanding of Strategic to Tactical application of Analytics.
2. Applying Predictive and Prescriptive Analytics to Supply Chain.

Unit I: (14 Hours)

Introduction and Procurement: Introduction - Supply Chain Analytics, Business - Supply Chain Strategy Connect, Supply Chain Measures - KPI, Leading and Lagging, Exercise - Supply chain entities and KPIs, Procurement -Category Management, Strategic Sourcing, Spend Analytics, Supplier Selection using AHP and ANP, Category Management with Case Study, Case Study - Spend Analytics, Exercise- Spend Analytics.

Unit II: (13 Hours)

Logistics & Inventory: Logistics and Warehouse management, Network Design, Case Study - Logistics Analytics. Exercise - Logistics Analytics, Basics of Inventory management, Classification, Types of Inventory, Inventory Framework. Case Study - Inventory management, Exercise - Live case study

Unit III: (06 Hours)

Applications : Supply Chain connect with Marketing Analytics, Customer Analytics, Social Media Analytics and Pricing Analytics. (Pricing exercise). Blockchain, AI / ML applications in Supply Chain. Weather Analytics, The Customer Centric Value Chain, Disruption and Digital Transformation.

Unit IV: (06 Hours)

Project Case Study: A case study will be provided which the class needs to solve and present in groups.

TEXT BOOKS:

3. Big Data Driven Supply Chain Management: A framework for Implementing Analytics and Turning Information into Intelligence, Nada R Sanders. Pearson FT Press; 1 edition ,2014
4. The Applied Business Analytics Casebook: Applications in Supply Chain Management, Operations Management, and Operations Research , FT Analytics ,Matthew J Drake.
5. Analytics Across the Enterprise: How IBM Realizes Business Value from Big Data and Analytics (IBM Press), by Brenda L. Dietrich, Emily C. Plachy and Maureen F. Norton, 2014.
6. Analytics 3.0 – Thomas Davenport , HBR, 2013.

REFERENCE BOOKS:

5. How HP Visualizes its Supply Chain – Jozo Acksteiner and Claudia Trautmann , Supply Chain Management Review , 2013
6. Supply Analytics and Overlooked opportunity, Pierre Mitchell, Supply Chain Management Review ,2012.

Mapping Course Outcomes with Program Outcomes:

Course Outcomes	**Program Outcomes**								**PSO**	
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PSO-1**	**PSO-2**
CO1		2		2					2	
CO2	2						2		2	
CO3		2				1				1

CO4			1					2	2	

Assessment Pattern Based on Bloom's Taxonomy:

Sl. No.:	Bloom's Category	Test 1	Test 2	Test 3	Assignment	Seminar Surprise Quiz	SEE
1	Remember	30	25	20			45
2	Understand	30	25	30	5		45
3	Apply	10	20	20	5		40
4	Analyze	10	10	10	5	5	30
5	Evaluate	10	10	10			20
6	Create						
Total		**90**	**90**	**90**	**15**	**5**	**180**

Curriculum Mapping

Course	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
SUPPLY CHAIN ANALYTICS	X	X	X	X		X	X	X

Subject	**CAPSTONE PROJECT WORK**		
Subject Code	20MBA407		
Credits	10	**CIE Marks**	50
Duration	10 weeks	**SEE Marks**	100

Course Objectives:

1. To provide an opportunity for students to apply theoretical concepts in real life situations at the work place
2. To sensitize students to the nuances of corporate culture and familiarize them with the corporate code of behavior and in the process discover their professional strengths and weaknesses and align them with the changing business environment
3. To enable students to manage resources, work under deadlines, identify and carry out specific goal oriented tasks thereby imbibing traits of a manager.
4. To enhance the research and analytical skills of the students
5. To sharpen domain knowledge and provide cross functional skills
6. To explore real-time experience based on their theoretical concepts learnt in their course

Course Outcomes: At the end of the course, students will be able to:

1. demonstrate their fundamental skills, understanding and application of principles and functions of management in a corporate setting.
2. demonstrate managerial traits of working under uncertainty, optimum utilization of resources meeting deadlines.

3. demonstrate an ability to hone interpersonal skills to lead and facilitate team work and to achieve organizational goals.
4. demonstrate analytical and problem solving skills.
5. employ critical-thinking skills in selecting strategies that are appropriate in addressing organizational problems.
6. apply learning experience with their real-time work done in their organization

Introduction

All the students of Master of Business Administration (MBA) are required to undertake a major individual piece of project work the aim of which is to give students the opportunity to learn independently so that they can identify, define and analyse problems and issues and integrate knowledge in a business context.

The project should be an ordered critical exposition, which affords evidence of reasoning power and knowledge of the relevant literature in an approved field falling **within the subject matter of the programme - Management**. The emphasis should be on application of concepts and the investigation of some practical problem or issue related to the situation in which an organization or system operates.

General Guidelines

Unlike any other academic assignment, Project provides the opportunity to judge the student’s time and self-management skills and his/her ability to successfully undertake a long and in-depth study of an applied nature, synthesizing various elements, yet pursing one area of interest in depth. The report should highlight what the student has attempted and why; the methods used to collect, collate and analyze the information obtained; the mode of evaluation etc. Any suggestions made should be supported by the evidence presented and by logical argument using deductive and inductive reasoning.

A. Nature of Project Work:

The student will have to carry out their project work in their area of specialization. Project work is an In-plant where a student needs to give an in-depth portrayal of the issues or situations from the business environment.

B. Choosing a Topic:

The choice of topic is up to the students, with guidance from their supervisor. The ideas can come from personal experience, observation of events and issues of current interests. Initial ideas are likely to originate in a vague form and may lack a clear focus. These then need to be developed into something manageable and practical by consideration of available literature/ texts and discussion with project supervisors once allocated. Whatever the source of your project idea, familiarity with the area is imperative for the successful completion of the project.

B. Duration of the Project Work

The Project Work shall be for a period of 10 weeks between 3rd and 4th semester. Students are expected to take up the preliminary work such as identifying the organization, finalization of topic and review of literature before the commencement of the 4th semester.

C. Guide:

Students must ensure that they maintain regular contact with their guide and also that they provide the guide with drafts of their work at regular intervals.

Internal guide of the Project Work will be a fulltime faculty member from the department with minimum of three years of experience.

D. Students Capstone Project Work will be checked with Plagiarism Check, which should be less than the prescribed limit as per the course regulations.

E. Activity Chart for Preliminary Work:

ACTIVITY	**TIME LINE**	**REMARKS**
• Identifying the organization • Briefing about Industry and Company Profile	First two weeks of 3rd semester	Student individually identifies an organization
• McKinsey's 7S frame work with special reference organization under study • Problem Identification		Student identifies the problem according to his/her study based on his/her interest
• SWOT Analysis • Problem Statement	Third week of 3rd semester	His/her interests are discussed with selected guide(s)
Research Design	Fourth week of 3rd semester	Discussion with internal guide on suitable research design
Synopsis Preparation	Fifth and Sixth week of 3rd semester	Preparation of synopsis* with his/her objectives
Presentation of Synopsis	Seventh and Eighth week of 3rd semester	The student will present synopsis with the detailed execution plan to the project work committee* who will review and may: a) approve b) approve with modification c) Reject for fresh synopsis
Approval Status	Ninth and Tenth week of 3rd semester	The approval status is submitted to HoD who will officially give concurrence for execution of the project work

***Synopsis: It is a 3 page document / hard copy to be submitted to the HoD with the signatures of Guide and the Student.**

Page1	Title, contact addresses of student - with details of internal & External Guide
Page 2	Short Introduction with objectives and summary (300 words), Review of articles/literature about the topic with source of information.
Page 3	Time-Activity Chart

****Composition of the Project Work committee**

1. Director/HOD
2. Domain expert from the department
3. Internal Guide

F. Schedule to be followed during Project Work

Activity	Timeline	Remark
Briefing about Industry and Company Profile Understanding Structure, Culture and functioning of the organization	First 2 weeks of project work	Student should understand Products / services and the problems of the organization.
Preparation of Research instrument for data collection	3rd and 4th week of project work	Discussion with the guide for finalization of research instrument in his / her domain and present the same to the guide. **(First Presentation)**
Data collection	5th & 6th week of project work	Date collected to be edited, coded, tabulated and presented to the guide for suggestions for analysis. **(Second Presentation)**
Analysis and finalization of report	7th & 8th week of project work	Students must use appropriate and latest statistical tools and techniques for analyzing the data. (It is must to use Statistical Package whose result should be shown in the report) **(Third Presentation)**
Submission of Report	9th and 10th week of Capstone Project work	Final Report should be submitted to the University before one week of the commencement of theory examination

G. Evaluation:

- **Internal Evaluation:** Internal evaluation will be done by the internal guide.
- **External evaluation:** External evaluation shall be done by a faculty member of other institute with minimum of 05 years' of experience.
- **Viva-voce / Presentation**: The viva-voce examination will be conducted by the respective HOD / Professors of the department and an expert drawn from other institutions with minimum of 05 years of experience as appointed by the COE.
- **Capstone Project Work** carries 100 marks consisting of 50 marks for internal evaluation by the internal guide(CIE), And 100 marks for external evaluation (SEE) wherein 50 marks for viva-voce examination and 50 marks for project report is allocated which would be converted back together to 50 marks.
- **Format of the Capstone Project Work report**: The Project Work report shall be prepared using word processor, using Times New Roman font sized 12 for body text, 16/14 font size for heading and sub-heading respectively on a page layout of A4 size with 1" margin on all sides and 1.5 line spacing and paragraph spacing. The Project Work report shall not exceed 80 pages.

H. Submission of report: Students should submit 2 hard copies of the Project Work report (Royal Blue Color) and one in electronic data form, in PDF file (Un-editable format) to the Institute within 6 weeks of the commencement of 4th semester.

I. **Publication of research findings:** Students are expected to present their research findings in seminars / conferences / technical fests or publish their research work in journals in association with their internal guide. Appropriate weightage should be given to this in the internal evaluation of the project report

Contents of the Capstone Project Work (Project) Report

- Cover page
- A certificate from the Organization (Scanned copy of the certificate)
- A certificate from the guide, HOD and Head of the Institution (Scanned copy of the certificate) indicating the bonafide performance of Project Work by the student.
- Declaration (Scanned copy of the declaration) – An undertaking by the student to the effect that the work is independently carried out by him/her.
- Acknowledgement
- Table of contents
- List of Tables and Graphs
- Executive summary
- Main Body of the Report
- References
- Annexure

Report should be document and supported by given detail information-

3. **Chapter 1: Industry profile**-Introduction to the Industry, History and evolution of industry, nature, growth potential, influencing economic factors, competitors' analysis, market share, governmental regulations.

4. **Chapter 2: Company profile-** Introduction about the organization and Capstone elements, company profile: (Promoters, Vision, Mission & Quality Policy, Products / Services profile, Areas of Operation(Concepts Learnt in the Subject), Competitors' information, Future growth and prospects and Financial Statement

- McKinsey's 7S frame work with special reference organization under study: Structure: **Overall organizational structural details — Board of Directors/ Functional heads etc. Sub structure detailing with each functional discipline. Detailed study of various departments & their function.** Skill: **Classification of skill or study of skill matrix: Detail the steps taken to impact necessary skills – on the job/off the job training.** Style: **Top down / Bottom up Authoritarian / participative Any one decision making parameter should be studied pertaining to day-to-day operation, to conclude the style of functioning.** Strategy: Any one strategy adopted by the company should be considered to explain, "How it is implemented" e.g. — pricing/waste elimination etc. System: System followed in any one department in the organization should be detailed. E.g: Inventory control system / order execution system / Merit rating system etc. Staff: Classification/Duties and responsibility of various groups of staff. E.g.: Technical / supervisory / Clerical. Shared value: Study of implementing shared value in the company by an illustration, where the company has implemented its stated objective.

  Internal and External Environment Analysis i.e. SWOT Analysis of the company

- **Chapter 3: Research Methodology**-Introduction about the Capstone Project Work, Topic chosen for study, Need for the study, Detailed Literature Review, Research Gaps, Statement of the Problem, Objectives of the study, Hypothesis, Scope of the study, Methodology adopted, Limitations of the study.

- **Chapter 4**: **Data Analysis**- Analysis and interpretation of the data Collected with relevant tables and graphs. Results obtained by using statistical tools must be included.

- **Chapter 5:** Summary of Findings, Suggestions, Conclusion, Learning Experience

- **Bibliography:**APA referencing styles can be used to write the Bibliography.
- Annexure relevant to the project such as figures, graphs, photographs etc.

Marks allocation for IV Semester Project Work report (18 MBA407P)

Evaluation by Internal Guide

Sl No	Aspects	Marks
1	First presentation	10
2	Second presentation	10
3	Third presentation	15
	Introduction about the Organization, Industry & Company Profile, Mckinsey's 7s Framework, SWOT Analysis	10
4	Introduction about the study, Literature Review, Statement of the Problem, Objectives and Methodology	15
6	Data Analysis and interpretation	25
7	Summary of Findings, suggestions, Learning Experience and Conclusion	15
	Total	**50**

Evaluation by a External Faculty Member

Sl No	Aspects	Marks
1	Introduction about the Organization, Industry & Company Profile, Mckinsey 7s Framework, SWOT Analysis	15
2	Introduction about the study, Literature Review, Statement of the Problem, Objectives and Methodology	10
3	Data Analysis and Interpretation	15
4	Summary of Findings, suggestions, Learning Experience and Conclusion	10
	Total	**50**

Viva-voce conducted by HOD and an expert drawn from other institutions as selected by COE

Sl No	Aspects	Marks
1	Presentation Skills	5
2	Communication Skills	5
3	Subject Knowledge	10
4	Objective of the study/Methodology	10
5	Analysis using Statistical tools and Statistical Packages	10

6	Learning Experience, Findings and appropriate suggestions	10
	Total	**50**

Formats for Project Work Report and Evaluation

- Format of Cover Page
- Format of certificate by College/Institution
- Format of Declaration Page
- Format of Contents
- Format of List of Tables and Charts
- Format of Bibliography
- Format for Internal Evaluation, External Evaluation and Viva voce

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Mapping of Course Outcomes with Program Outcomes:

Course Outcomes	Program Outcomes								PSO	
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PSO 1**	**PSO2**
CO1	3			3						3
CO2			2			3				3
CO3					3					3
CO4	3	3								3
CO5	3	3								3
CO6	3									3

Assessment Pattern Based on Bloom's Taxonomy

Sl.No	Bloom's Category	Project Work and Viva Voce Examination
1	Remember	
2	Understand	10
3	Apply	20
4	Analyze	40
5	Evaluate	20
6	Create	10
Total		**100**

Curriculum Mapping

Course	Program Outcomes							
Capstone Project Work	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**
	X	X	X	X	X	X		

NITTE MEENAKSHI INSTITUTE OF TECHNOLOGY

(Autonomous Institution, Affiliated to VTU, Belgaum, Approved by AICTE & State Govt. of Karnataka)

Yelahanka, Bangalore – 560064

DEPARTMENT OF MCA

KNOWLEDGE ★ CHARACTER ★ UNITY

MCA SCHEME & SYLLABUS

2022-2024

VISION

To prepare students for challenging global careers with a focus on innovation and entrepreneurship to meet the demands of the ever-changing IT industry and for the development of society.

MISSION

- To provide quality and industry-oriented education in applied Computer Science through well-defined teaching learning process and best practices.
- To promote creativity among students through projects and practical perception
- To inculcate leadership and entrepreneurial skills through holistic development of students.

PROGRAM EDUCATIONAL OBJECTIVES (PEO'S)

- Design and develop the computer applications to meet the end customer end and also to adapt for ever changing IT technologies
- Effective and efficient leader of a team in IT/ITES industry and engage in lifelong learning.
- Develop a positive attitude towards social and cultural issues and imbibe integrity and ethical values.

PROGRAM OUTCOMES (PO’s)

1. **Computational Knowledge:** To equip students with core theoretical knowledge, technical, analytical, practical skills and managerial abilities to compete in a global environment
2. **Problem Analysis:** To equip students with the ability to analyze, design and assess software systems to meet users requirements
3. **Design / Development of Solutions:** To equip students with an ability to apply development principles in creating software systems for diverse customers
4. **Modern Tool Usage:** To equip students with the ability to use current techniques and tools for computing practices
5. **Conduct investigations of complex problems:** To equip students to with an ability to analyze and interpret data and provide valid conclusions.
6. **Project management and finance:** Students will have the ability to employ effective project management skills to develop a project plan, monitor and track development efforts
7. **Individual and team work:** Students will have an ability to work as members of multidisciplinary teams to achieve a common goal
8. **Communication:** To equip students with an ability to communicate effectively with a wide range of audiences
9. **Life-long learning:** Students will have the ability for self-improvement through continuous professional development and life-long learning
10. **Innovation and Entrepreneurship:** To equip students with leadership qualities and interpersonal skills through various co-curricular and extra-curricular activities
11. **Environment and sustainability:** An ability to analyze the local and global impact of computing on individuals, organizations, and society
12. **Ethics:** To mould students as ethical, socially-committed individuals who will act with honesty and integrity and contribute to the betterment of the society and nation

PROGRAM SPECIFIC OUTCOMES (PSO's)

1. The ability to analyse, design and develop computer applications using programming tools, algorithms and data structures.
2. The ability to apply standard tools, techniques and practices of software engineering, testing and project management to deliver efficient and quality applications

NITTE MEENAKSHI INSTITUTE OF TECHNOLOGY
Department of Master of Computer Applications

COURSE STRUCTURE

Course Category	Number of Credits
Core Courses	**54** Credits
Elective Courses	**18** Credits
Skill Enhancement Courses	**05** Credits [Mini Project + MOOC+ Technical Seminar + Aptitude & Soft skills]
Out Reach Programme: (Conferences / Symposiums / Technical Meets / Workshops / Etc.,)	**23** Credits [Internship + Project work]
Total	**100 Credits**

NITTE MEENAKSHI INSTITUTE OF TECHNOLOGY
Department of Master of Computer Applications

M.C.A.CURRICULUM- 202 2

BRIDGE COURSES

S. No.	Course Title	Total Hours*
1.	Fundamentals of Computers	12
2.	Introduction to Problem Solving	12
3.	Introduction to Computer Programming	12

***6 Days x 6 Hours per day of 03 subjects above = 36 Hours (Each Subject 02 hours per day)**

22MCA 001: FUNDAMENTALS OF COMPUTERS

Objectives:

- To get familiar with the fundamental concepts of Computers.

Outcomes:

- Ability to gain basic knowledge in computer science domain.

MODULE-I

Computer Basics: Simple Model of a Computer, Characteristics of Computers – Computer classifications and generations - Data Representation.

MODULE-II

Introduction to Microprocessor - Input / Output Units – Computer Memory – Storage – DatabaseManagement Systems - Binary Arithmetic – Logic Circuits.

MODULE-III

Introduction to Operating Systems – Programming languages – Multimedia - Computer Networks.

Text Book:

1. V. Rajaraman, Neeharika Adabala : Fundamentals of Computers, Prentice Hall India LearningPrivate Limited; 6th Revised Edition (2014)

22MCA 002: INTRODUCTION TO PROBLEM SOLVING

Objectives:

- To get familiar with various problem solving techniques.

Outcomes

- Ability to solve problems using various approaches.

MODULE-I

Introduction to problem solving – Top-down design – Implementation of algorithms – program verification – efficiency & analysis of algorithms.

MODULE-II

Basic problem solving approaches: Factoring methods – Array techniques – Merging, Sorting & Searching.

MODULE-III

Text processing - Pattern searching – Dynamic Data Structures - Recursive algorithms.

Text Book:

1. R. G. Dromey, How to Solve it by Computer, Pearson Education India; 1st edition (2006).

22MCA003: INTRODUCTION TO COMPUTER PROGRAMMING

Objectives:

- To develop C Programs using basic programming constructs
- To develop C programs using arrays, strings, functions, structures & Files.

Outcomes:

- Ability to code in C Language.

MODULE - I

Introduction to programming paradigms - Structure of C program - C programming: Data Types – Storage classes - Constants – Enumeration Constants - Keywords – Operators: Precedence and Associativity - Expressions - Input/Output statements, Assignment statements – Decision making statements - Switch statement - Looping statements – Pre-processor directives - Compilation process.

MODULE - II

Introduction to Arrays: Declaration, Initialization – One dimensional array – Two dimensional arrays

– String operations: length, compare, concatenate and copy – Introduction to functions: Function prototype, function definition, function call, Built-in functions (string functions, math functions) – Recursive function.

MODULE - III

Structure - Nested structures – Pointer and Structures – Array of structures – Files – Create, Open, Close, Processing of file content.

Text Book:

1. Reema Thareja, Programming in C, Oxford University Press, Second Edition, 2016.
2. Kernighan, B.W and Ritchie, D.M., The C Programming language, Pearson Education, Second Edition, 2006.

NITTE MEENAKSHI INSTITUTE OF TECHNOLOGY
Department of Master of Computer Applications
2022 SCHEME OF TEACHING AND EXAMINATION OF MCA FIRST SEMESTER

I SEMESTER									**CREDIT BASED**
Subject Code	**Name of the Subject**	**Teaching hours/week**			**Duration of Exam in Hours**	**Marks for**		**Total marks**	**Credits**
		Lecture	**Tutorials**	**Practical**		**CIE**	**SEE**		
22MCA101	Object Oriented Programming using C++/JAVA	4	-	-	3	50	50	100	4
22MCA102	Data Structures and Algorithms	4	-	-	3	50	50	100	4
22MCA103	Operating System with UNIX/LINUX	4	-	-	3	50	50	100	4
22MCA104	Database Management System	3		-	3	50	50	100	3
22MCA105	Operations Research	3	1	-	3	50	50	100	3
22MCA106	Research Methodology & Professional Ethics	3	-	-	3	50	50	100	3
22MCA107L	Object Oriented Programming Using C++/JAVA Laboratory	-	-	2	3	50	50	100	1
22MCA108L	Data Structures And Algorithms Laboratory	-	-	2	3	50	50	100	1
22MCA109L	UNIX/LINUX Laboratory	-	-	2	3	50	50	100	1
22MCA110L	Database Management System Laboratory	-	-	2	3	50	50	100	1
22MCA111B	Principles of Programming	3	-	-	3	50	50	100	0
22MCA112P	Aptitude & Soft skills	3			3	50	50	100	1
Total		**27**	**01**	**08**	**36**	**600**	**600**	**1200**	**26**

*Subject Code (L=Laboratory, B= Bridge Course,P=Placement)

NITTE MEENAKSHI INSTITUTE OF TECHNOLOGY
Department of Master of Computer Applications

2022 SCHEME OF TEACHING AND EXAMINATION OF MCA SECOND SEMESTER

II SEMESTER **CREDIT BASED**

Subject Code	Name of the Subject	Teaching hours/week			Duration of Exam in Hours	Marks for		Total marks	Credits
		Lecture	Tutorials	Practical		CIE	SEE		
22MCA201	Python Programming	4	-	-	3	50	50	100	4
22MCA202	Web Programming	4	-	-	3	50	50	100	4
22MCA203	Mobile Applications	4			3	50	50	100	4
22MCA204E	**DS Elective – 1**	3	-	-	3	50	50	100	3
22MCA205E	**DS Elective – 2**	3		-	3	50	50	100	3
22MCA206E	**DS Elective – 3**	3	-	-	3	50	50	100	3
22MCA207L	Python Programming Laboratory	-	-	2	3	50	50	100	1
22MCA208L	Web Programming Laboratory			2	3	50	50	100	1
22MCA209L	Mobile Applications in Android Laboratory	-		2	3	50	50	100	1
22MCA210S	Technical Seminar		2		3	50	50	100	1
Total		**24**	**01**	**08**	**33**	**500**	**500**	**1000**	**25**

STREAM	DS Elective – 1		DS Elective – 2		DS Elective – 3	
CLOUD AND IOT	22MCA2041E	Computer Networking & Communication	22MCA2051E	Cloud Computing	22MCA2061E	IOT System Design and Development
ARTIFICIAL INTELLIGENCE AND DATA SCIENCES	22MCA2042E	Introduction to Data Science	22MCA2052E	Artificial Intelligence & Expert Systems	22MCA2062E	Machine Learning
CYBER SECURITY	22MCA2043E	Fundamentals of Cryptography & Network Security	22MCA2053E	Cyber security	22MCA2063E	Mobile & Digital Forensics

*Subject Code (L=Laboratory, E= Elective Course, S=Seminar), *DS- Domain Specific

*Note: Students need to select one subject each from the DS elective set of same or different stream of their choice.

NITTE MEENAKSHI INSTITUTE OF TECHNOLOGY
Department of Master of Computer Applications

2022 SCHEME OF TEACHING AND EXAMINATION OF MCA THIRD SEMESTER

III SEMESTER **CREDIT BASED**

Subject Code	Name of the Subject	Teaching hours/week			Duration of Exam in Hours	Marks for		Total marks	Credits
		Lecture	Tutorials	Practical		CIE	SEE		
22MCA301	Programming Using C# and .NET	4	-	-	3	50	50	100	4
22MCA302	Full Stack Web Development	4	-	-	3	50	50	100	4
22MCA303	Software Engineering & Software Testing – **Integrated Lab**	4	2	-	3	50	50	100	4
22MCA304E	**DS Elective - 4**	3	-	-	3	50	50	100	3
22MCA305E	**DS Elective - 5**	3		-	3	50	50	100	3
22MCA306E	**DS Elective - 6**	3		-	3	50	50	100	3
22MCA307L	Programming Using C# and .NET Laboratory	-	-	2	3	50	50	100	1
22MCA308L	Full Stack Web Development Laboratory	-	-	2	3	50	50	100	1
22MCA309P	Mini Project - IOT	-	2	2	3	50	50	100	2
TOTAL		**24**	**01**	**08**	**33**	**450**	**450**	**900**	**25**

STREAM	DS Elective – 4		DS Elective – 5		DS Elective – 6	
CLOUD AND IOT	22MCA3041E	Web Services Computing	22MCA3051E	AWS Cloud Computing	22MCA3061E	IOT Data Analytics
ARTIFICIAL INTELLIGNENCE AND DATA SCIENCES	22MCA3042E	Data Mining & Business Intelligence	22MCA3052E	Robotic Process Automation	22MCA3062E	Big Data Analytics
APPLICATION DEVELOPMENT	22MCA3043E	Block Chain Technology	22MCA3053E	DevOps	22MCA3063E	User Interface and User Experience

*Subject Code (L=Laboratory, E= Elective Course, P=Project), *DS- Domain Specific
*Note: Students need to select one subject each from the DS elective set of same or different stream of their choice.

NITTE MEENAKSHI INSTITUTE OF TECHNOLOGY
Department of Master of Computer Applications
2022 SCHEME OF TEACHING AND EXAMINATION OF MCA FOURTH SEMESTER

IV SEMESTER								**CREDIT BASED**
Sl. No.	**Course Code**	**Course Title**	**Examination**					**Credits**
			Duration in hours	**SEE Marks**	**CIE Marks**	**Total Marks**		
1	22MCA401C	MOOC Course	-	-	50	50		1
2	22MCA402I	Industry Internship (6 weeks)	-	-	50	50		3
3	22MCA403P	Project Work (During IV semester 16 weeks)	3	100	100	200		20
Total			**3**	**100**	**200**	**300**		**24**
Grand Total (I to IV Semesters): 3400 Marks : 100 Credits								

*Subject Code (C=Course, I=Internship, P=Project)
*MOOC = Massive Open Online Course

GENERAL GUIDELINES OF THE MCA COURSE

Course Title: Project Work, Course Code: 22MCA403P

Dissertation Work Guidelines

- The student shall carry out the project work in the same Institution or in any Industry / R&D labs based on software tools and technologies learnt in MCA Course/Internship for a minimum period of 16 weeks.
- The dissertation work shall be carried out by each candidate independently under the guidance of one of the faculty members of the Department.
- If dissertation is carried out in any Industry/R&D Labs, outside the campus, the name of external guide at the organization shall be intimated to the Head of the Department.
- Project work may be application oriented or research oriented as per student and guide‘s interest. Therefore the project reports will vary depending on whether it is application oriented project or research based project.
- Project work dairy should be maintained by the students, signed by the external guide and internal guide.
- At the end of the semester each candidate shall prepare a draft report of the dissertation work and submit it for plagiarism check (Plagiarism≤20%) using facility in NMIT library.
- The report shall be duly approved by the internal guide after the plagiarism check.
- The candidate shall submit two hard bound copies and the soft copy of the dissertation work to the Head of the Department.
- A separate calendar of events for submission of dissertation and viva-voce shall be fixed by the examination section and shall be notified.
- The candidates who fail to submit the dissertation work with in the stipulated time have to submit the same at the time of next ensuing examination.
- The internal examiners and the external examiners shall be appointed by the COE / Principal for the Final Evaluation of the project.
- A copy of the dissertation shall be sent to the external examiners by the Chairman of BOE.
- If there port is rejected, internal guide has to communicate to the candidate for modification as per the suggestions made by the External Examiner and resubmit.
- Internal guide and External Examiners shall carry out the evaluation of Dissertation reportfor50 marks individually.
- Dissertation assessment by the internal guide will be considered as **CIE** and dissertation assessment by the external examiner will be considered as **SEE.**
- The students shall give poster presentation of their project before the SEE.
- The students shall also prepare a research paper of their project in the prescribed format and submit it to their guides before SEE.

Internal Evaluation and Viva Voce Guidelines:

- Internal assessment (CIE) shall be evaluated by both the **internal and external guide** for 50 marks individually. The average of the marks allotted by the internal and external guides shall be the final marks for the Internal Evaluation.
- The project presentation and Viva-Voce (SEE) shall be evaluated jointly by both the **Internal and External examiners** for 50 marks.

Industry Internship Guidelines (Subject Code: 22MCA402I)

- All the students have to undergo mandatory internship of 06 weeks duration during the vacation of **III** semester.
- Students have to undergo the Internship in any Institute of National repute or any reputed / well-known Industry.
- The Industry Internship shall be carried out by each candidate independently under the guidance of one of the faculty members of the Department.
- On completion of Internship they shall submit a brief report to the department.
- Internship shall be considered as a head of passing and shall be considered for the award of degree.
- Those, who do not take-up/complete the internship shall be declared as **fail** in internship course and have to complete the same during the subsequent semester.
- After satisfying the internship requirements the degree will be awarded .However, student can carry out 4thsemester project without completing the internship.

MOOC COURSE Guidelines (Subject Code: 22MCA401C)

- A self-study certification course i.e. Massive Open Online Course (MOOC) of 02 credits shall be completed by all the students during the course for the award of the degree.
- The course duration for 02 credits shall be of 08 Weeks only.
- The students will have to register and take up proctored exam only through **NPTEL** under **SWAYAM** portal.
- **The certificate taken from any other online certification course other than NPTEL for MOOC is considered to be invalid.**
- The list of courses under computer Science will be recommended by the department after NPTEL has announced the list of upcoming courses in SWAYAM portal.
- The certificate obtained after taking up the proctored exam will be submitted and the marks obtained will be considered for CIE.
- However there will be no separate SEE for the MOOC course.
- The student can take up the MOOC course any time during the entire duration of the MCA course.
- The student will be considered as fail in MOOC Course in case he/she
  - Scores less than 50 out of 100 in the proctored examination.
  - Fails to submit the certificate in the IV semester.

Mini Project-IoT Guidelines (Subject Code: 22MCA310P)

A Mini Project based on IOT will be implemented and presented by a group of students (group size about Two to Six)

- The mini project will be carried out by the group of students under the guidance of one of the faculty members of the department.
- The team must submit a brief project report containing at-least (20-30 pages).
- An open house project exhibition will be conducted before SEE and the students shall give the demonstration of their working projects.
- The mini project examination will be conducted jointly by the internal and external examiners and marks shall be awarded jointly.

Technical Seminar Guidelines (Subject Code: 22MCA110S)

- Students should present the seminar on Cutting Edge/Emerging/State of the art technologies in the field of Computer Science and Applications.
- The seminar shall be carried out by each candidate independently under the guidance of one of the faculty members of the Department.
- The topic of the seminar shall be chosen by the candidate in consultation with the guide.
- Duration of the seminar should be approximately 30 minutes.
- At the end of the semester each candidate shall submit the report on the seminar title containing at-least 20 pages.
- The seminar examination will be conducted jointly by the internal and external examiners and marks shall be awarded jointly.

NITTE MEENAKSHI INSTITUTE OF TECHNOLOGY
Department of Master of Computer Applications
2022-SYLLABUS OF TEACHING AND EXAMINATION OF MCA FIRST SEMESTER

Object Oriented Programming using C++/JAVA
[As per Choice Based Credit System (CBCS) scheme]
SEMESTER – I

Subject Code	22MCA101	CIE Marks	50
Number of Lecture Hours/Week	04	SEE Marks	50
Total Number of Lecture Hours	50	SEE Hours	03

Credits – 04

COURSE DESCRIPTION

This course introduces computer programming using the JAVA programming language with object-oriented programming principles. Emphasis is placed on event-driven programming methods, including creating and manipulating objects, classes, and using object-oriented tools such as the class debugger.

PREREQUISITES

- Familiar with Object Oriented Principles.

COURSE OBJECTIVES

- To understand the basic concepts and fundamentals of platform independent object oriented language.
- To demonstrate skills in writing programs using exception handling techniques and Multithreading.
- To understand streams and efficient user interface design techniques.

COURSE CONTENTS

Modules	**Teaching Hours**
Module 1	**10 Hours**
Introduction To Java: How java changed the internet; Byte Code; Object oriented programming; First Simple Java program, Introducing Classes: Classes Fundamentals; Declaring Objects, Assigning Object Reference Variable; Introducing Methods; Inheritance Basics- using Super; Creating Multilevel Hierarchy**, Constructors:** When constructors are called?, method overloading, Dynamic Method Dispatch, Abstract classes, final with inheritance, method Overriding.	
Module 2	**10 Hours**
Packages and Interfaces, Exception handling in java: Packages, Access Protection, importing packages, interfaces. Exception Handling Fundamentals, Exception types, uncaught Exception, using try and catch, multi catch clause, nested try catch, throw, throws, finally, java’s built in exceptions, creating your own exception subclasses, chained exceptions, using exceptions.	
Module 3	**10 Hours**
Multi-Threaded Programming ; The java tread model, The main thread, Creating thread, creating multiple threads, Using isAlive() and join(), Thread priorities, Synchronization, Inter thread communication; Suspending , resuming and stopping threads. Introduction to I/O classes and class hierarchy.	

Module 4	10 Hours
Event Handling: Two event handling mechanisms; The delegation event model; Event classes; Sources of events; Event listener interfaces; Using the delegation event model; Adapter classes; Inner classes. Working with Windows, Graphics, and Text, Using AWT Controls, Layout Managers, and Menus. Swings: The origins of Swing; Two key Swing features; Components and Containers; The Swing Packages; A simple Swing Application;	
Module 5	**10 Hours**
Collections: The collection interfaces and classes, accessing collection via iterator, storing user defined classes in collections, the random access interface, working with maps, comparators, the collection algorithms, arrays, the generic collections, Introduction to client/server architecture, Java Servlets and JDBC with sample programs.	

Question paper pattern:

- The question paper will have ten questions.
- Each full question consists of 20 marks.
- There will be 2 full questions from each module.
- Each question will have questions covering all the topics under a module.
- The students will have to answer 5 full questions, selecting one full question from each module

Text Books:

1. Java: The Complete Reference, Eleventh Edition, Herbert Schildt, McGrawHill, December 2018, ISBN: 9781260440249.

Reference Books:

1. Core Java Volume I Fundamentals, Eleventh Edition, Cay S. Horstmann, Pearson, August 2018, ISBN: 9780135167199.
2. Java: A Beginner's Guide, 8th Edition, Herbert Schildt, McGraw-Hill, November 2018, ISBN: 9781260440225.
3. Java Performance, 2nd Edition, Scott Oaks, O'Reilly Media, Inc., February 2020, ISBN: 9781492056119

TEACHING METHODS

- PPTs
- Blackboard
- Hands-On Sessions Based Teaching using Netbeans IDE

ASSESSMENT METHODS

- Three Internals will be conducted for 30 Marks each and weightage of 40%, 40% and 20% from 1st, 2nd and 3rd internals respectively will be taken.
- Evaluation of Learning Activity based on Programming Assignments / Mini Projects for 20 Marks.
- Final Examination will be conducted for 100 Marks and Evaluated for 50 Marks

Course Outcome (CO): At the end of this course, the students will be able to

CO1: Define the concepts of object oriented programming like Encapsulation, Abstraction and polymorphism to solve the real-life problems.
CO2: Demonstrate the usage of Interfaces, packages and Exception handling.
CO3: Apply the concepts event handling and applets for the internet programming.
CO4: Learn and apply the concepts of Collections and maps
CO5: Analyze the software requirements needed to develop an Enterprise Application.

CO-PO-PSO Mapping

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	3							1	1				3	
CO2	2	2	2	2					1				3	
CO3		2	2	2					1				3	
CO4	3	2	2	1					1				3	
CO5		2	2	1				1	1				3	

Data Structures and Algorithms [As per Choice Based Credit System (CBCS) scheme] **SEMESTER – I**			
Subject Code	22MCA102	CIE Marks	50
Number of Lecture Hours/Week	04	SEE Marks	50
Total Number of Lecture Hours	50	SEE Hours	03
CREDITS – **04**			

COURSE DESCRIPTION

This course provides an in-depth knowledge of structures, pointers and dynamic memory allocation in C. The course also provides the knowledge of different data structures and their applications in solving real-world problems. This course introduces basic methods for the design and analysis of efficient algorithms emphasizing methods which are useful in practice. The computational problems for sorting, searching, Divide and Conquer, dynamic programming and greedy algorithms are discussed.

PREREQUISITES

- Computer Concepts and C Programming.
- Students should know data structures
- Students should know the usage of summation formulae and recurrences in mathematics

COURSE OBJECTIVES

- To understand the concept of pointers and, allocate and de allocate memory dynamically to pointers.
- To understand working principle of different types of data structures
- To identify and apply the appropriate data structure to solve a given problem.
- To understand the basic concepts and notations used in the design and analysis of algorithms.
- To solve problems using appropriate algorithms.
- To analyze and compare the performance of algorithms.

COURSE CONTENTS

Modules	**Teaching Hours**
Module 1	**8 Hours**
Classification of Data Structures: Primitive and Non- Primitive, Linear and Nonlinear; Data structure Operations, Stack: Definition, Representation, Operations and Applications: Polish and reverse polish expressions, Infix to postfix conversion, evaluation of postfix expression, infix to prefix, postfix to infix conversion.	
Module 2	**6 Hours**
Recursion - Factorial, GCD, Fibonacci Sequence, Tower of Hanoi. Queue: Definition, Representation, Queue Variants: Circular Queue, Priority Queue, Double Ended Queue; Applications of Queues. Programming Examples.	
Module 3	**10 Hours**
Linked List: Limitations of array implementation, Memory Management: Static (Stack) and Dynamic (Heap) Memory Allocation, Memory management functions. Definition, Representation, Operations: getnode() and Freenode() operations, Types: Singly Linked List. Linked list as a data Structure, Inserting and removing nodes from a list, Linked implementations of stacks, Header nodes, Array implementation of lists. **Double Linked List**: Inserting and Deleting	

Nodes, Queue as doubly linked lists, such as insert into position, Delete a specified element.	
Module 4	**6 Hours**
Introduction, Fundamentals of the Analysis of Algorithm Efficiency Notion of Algorithm, Fundamentals of Algorithmic Problem Solving, Important Problem Types, Analysis Framework, Asymptotic Notations and Basic efficiency classes, Mathematical analysis of Recursive and Non-recursive algorithms.	
Module 5	**12 Hours**
Brute Force: Selection Sort and Bubble Sort, Sequential Search, Exhaustive search and String Matching. Divide-and-Conquer Mergesort, Quicksort, Binary Search, Binary tree Traversals and related properties. Decrease-and-Conquer Insertion Sort, Depth First and Breadth First Search, Topological sorting. Greedy Technique Prim's Algorithm, Kruskal's Algorithm, Dijkstra's Algorithm.	

Question paper pattern:

- The question paper will have ten questions.
- Each full question consists of 20 marks.
- There will be 2 full questions from each module.
- Each question will have questions covering all the topics under a module.
- The students will have to answer 5 full questions, selecting one full question from each module

Text Books:

1. Data Structures Using C and C++ by Yedidyah Langsam and Moshe J. Augenstein and Aaron M Tenanbanum, 2nd Edition, Pearson Education Asia,2002
2. Programming in ANSI C, Balaguruswamy, McGraw Hill Education.
3. Introduction to the Design and Analysis of Algorithms. Anany Levitin, Pearson Education, 2nd Edition.
4. Introduction to Data Structure and Algorithms with C++ by Glenn W.Rowe.

TEACHING METHODS

- PPTs
- Hands-On Sessions
- Blackboard

ASSESSMENT METHODS

- Three Internals will be conducted for 30 Marks each and weightage of 40%, 40% and 20% from 1st, 2nd and 3rd internals respectively will be taken.
- Evaluation of Learning Activity based on Programming Assignments / Quiz / Mini Projects for 20 Marks.
- Final Examination will be conducted for 100 Marks and Evaluated for 50 Marks

Course Outcome (CO): At the end of this course, the students will be able to:

CO1: Demonstrate different data structures, its operations using C programming.
CO2: Analyze the performance of Stack, Queue, Lists, Searching and Sorting techniques.
CO3: Implement some applications of data structures in a high-level language such as C/C++
CO4: Design and apply appropriate data structures for solving computing problems.
CO5: Compute the efficiency of algorithms in terms of asymptotic notations for the given problem.

CO-PO-PSO Mapping

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	2	2	2		2				1				3	1
CO2	2	2	2		2				1				3	1
CO3	2	2	2		2				1				3	1
CO4	2	2	2		2				1				3	1
CO5	2	2	2		2				1				3	1

Operating System with UNIX /LINUX [As per Choice Based Credit System (CBCS) scheme] SEMESTER – I			
Subject Code	22MCA103	CIE Marks	50
Number of Lecture Hours/Week	04	SEE Marks	50
Total Number of Lecture Hours	50	SEE Hours	03
CREDITS – 04			

COURSE DESCRIPTION

This course provides an in-depth knowledge of Process, Threads and resource management. This course gives the basic knowledge of Unix Operating System platform and API level introduction to concepts like files & directories in the Unix. The subject also introduces types of users and privileges supported to the users. Covers the different filters used in Unix.

PREREQUISITES

- Student should have some basic knowledge on Unix Shell Programming and Windows operating system.

COURSE OBJECTIVES

- To understand the basic functionalities of Operating System, Process and Threads.
- To understand the implementation of memory management and virtual memory.
- To understand the fundamental design of the UNIX operating system.
- To be able to design and build an application/service over the UNIX operating system

COURSE CONTENTS

Modules	Teaching Hours
Module 1	**10 Hours**
Introduction to Operating System, Process Management What is an Operating System, Mainframe Systems, Desktop Systems, Multiprocessor Systems, Distributed Systems, Clustered Systems, Real- Time Systems, Handheld Systems, System Components, System Calls, System Programs, Operating System Structure, Virtual Machines. Process Concept; Process Scheduling; Operations on Processes; Cooperating Processes; Inter Process Communication.	
Module 2	**12 Hours**
Threads, Process Scheduling, Deadlocks: Multi – Threaded Programming: Overview, Multithreading Models, CPU Scheduling: Basic Concepts, Scheduling Criteria, Scheduling Algorithms, Multiple Processor Scheduling, Mutual Exclusion, Hardware Support: Semaphores, Monitors, Readers/Writers Problem. System model; Deadlock Characterization, Methods for Handling Deadlocks; Deadlock Prevention; Deadlock Avoidance; Deadlock Detection and Recovery from Deadlock.	
Module 3	**8 Hours**
Memory Management, Virtual Memory Memory Management Memory Management Strategies: Background, Swapping; Contiguous Memory Allocation; Paging; Segmentation; Virtual Memory Management; Background; Demand Paging; Page Replacement; Allocation of Frames; Thrashing.	
Module 4	**12 Hours**
The File System: The File, What's in a File name? The Parent-Child Relationship,	

The HOME Variable: The Home Directory, pwd, cd, mkdir, rmdir, Absolute Pathnames, Relative Pathnames, The Unix File System. **Basic File Attributes:** ls options, File Ownership, File Permissions, chmod, Directory Permissions, Changing the File Ownership More File Attributes: File Systems and Inodes, Hard Links, Symbolic Links, The Directory, umask, Modification and Access Times, find. **Filters** Pr, head, tail, cut, paste, sort, uniq, tr commands, Filters using Regular Expression: grep & sedgrep, Regular Expression, egrep, fgrep, sed instruction, Line Addressing, Inserting and Changing Text, Context addressing, writing selected lines to a file, the –f option, Substitution, Prosperities of Regular Expressions Context addressing, writing selected lines to a file, the –f option, Substitution, Properties of Regular Expressions.	
Module 5	**8 Hours**
Essential Shell Programming: Shell Variables, Environment Variables, Shell Scripts, read, Using Command Line Arguments, exit and exit status of command, 16 The Logical Operators, The if Conditional, using test and [] to Evaluate Expression, The case Conditional, expr, while: looping, for: looping with a list, set and shift, trap, Debugging Shell Scripts with set – x Laboratory Students shall implement programs which supplement the theory concepts.	

Question paper pattern:

- The question paper will have ten questions.
- Each full question consists of 20 marks.
- There will be 2 full questions from each module.
- Each question will have questions covering all the topics under a module.
- The students will have to answer 5 full questions, selecting one full question from each module

Text Books:

1. Silberschatz, Galvin, Gagne, "Operating System Concepts" John Wiley, Sixth Edition, 2004
2. William Stallings, "Operating System Internals and Design Principles" Pearson, 6th edition, 2012.
3. UNIX-The Ultimate Guide, Sumitabha Das, Tata Mc GrawHill,2001
4. The UNIX Programming Environment by Kernighan and pike, Pearson, 2005

TEACHING METHODS

- PPTs
- Hands-On Sessions Based Teaching

ASSESSMENT METHODS

- Three Internals will be conducted for 30 Marks each and weightage of 40%, 40% and 20% from 1st, 2nd and 3rd internals respectively will be taken.
- Evaluation for learning activity based on Programming Assignments / Case studies/ Mini Projects for 20 Marks.
- Final Examination will be conducted for 100 Marks and Evaluated for 50 Marks

Course Outcome (CO): At the end of this course, the students will be able to:

CO1: Understand the Basics of Computer and Operating System Structure

CO2: Realize the concept of Process Management and Mutual Exclusion

CO3: Understand the concepts of the Deadlock and different approaches to memory management

CO4: Demonstrate the working of basic commands of Unix environment including file processing, filters.

CO5: Demonstrate the usage of different shell commands, shell programming concepts.

CO-PO-PSO Mapping

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	2	2	2	1	2				1				3	1
CO2	2	2	2	1	2				1				3	1
CO3	2	2	2	1	2				1				3	1
CO4	2	2	2	1	2				1				3	1
CO5	2	2	2	1	2				1				3	1

Database Management System
[As per Choice Based Credit System (CBCS) scheme]
SEMESTER -I

Subject Code	22MCA104	CIE Marks	50
Number of Lecture Hours/Week	03	SEE Marks	50
Total Number of Lecture Hours	40	SEE Hours	03

Credits – 03

COURSE DESCRIPTION

This course provides an understanding of Database management systems. The course also provides the knowledge of ER-diagram design, Relational Algebra and RDBMS, SQL for querying the database and Normalization for the good database design.

PREREQUISITES

- Students should know basics of Discrete Mathematics.
- Students should know basic programming concepts.

COURSE OBJECTIVES

- To understand the fundamentals of Relational database management systems.
- To design database using ER-modeling, Normalization and querying the database using SQL.
- To understand the fundamentals of transactions, locking mechanisms, database recovery.

COURSE CONTENTS

Modules	Teaching Hours
Module 1	**8 Hours**
Introduction: Introduction to DBMS, Characteristics of Database approach, Actors on the Scene, Workers behind the scene, Advantages of using DBMS approach, Data models, schemas and instances, Three –schema architecture and data independence, Database languages and interfaces. Entity-Relationship Model: Conceptual Database using high level conceptual data models for Database Design, A Sample Database Application, Entity types, Entity sets, Attributes and Relationship types, Relationship Sets, Role names and Structural Constraints and Weak Entity Types.	
Module 2	**8 Hours**
Relational Model: Relational Model Concepts and Constraints , Relational Database Schema Update Operations, Unary Relational operations, Relational Algebra Operations from Set Theory, Binary Relational Operations, JOIN and DIVISION, Additional Relational Operations, Relational Database Design Using ER-to-Relational Mapping(7step algorithm)	
Module 3	**8 Hours**
Introduction to SQL: SQL Data Types and Schemas, SQL Data Definition commands, SQL Data Manipulation commands, Basic structure of SQL Queries, Additional Basic Operations, Null values, Aggregate Functions, Nested and co-related nested quires , Join Expressions, Views in SQL.	

Module 4	8 Hours
Database Design: Informal Design Guidelines for Relation Schemas, Functional Dependencies, Closure of a functional dependency and canonical cover of functional dependency calculations and Armstrong (inference) Rules. Introduction to Normalization, Working of 1st Normal Form 2nd and 3rd Normal Forms, Boyce Codd Normal Forms, Multivalued Dependencies and IV Normal Forms, Join Dependencies and V Normal Forms	
Module 5	**8 Hours**
Transaction Management: Introduction to transaction processing, Transaction and system Concept, Transaction properties Atomicity and Durability, Serializability and isolation (ACID properties). Concurrency Control: Lock Based Protocols-Types of Locks, Simplistic Lock Protocol, Pre-claiming Lock Protocol, Two-Phase Locking (2PL) and Strict Two-Phase Locking. Deadlock Handling-deadlock prevention schemes, Deadlock Avoidance.	

Question paper pattern:

- The question paper will have ten questions.
- Each full question consists of 20 marks.
- There will be 2 full questions from each module.
- Each question will have questions covering all the topics under a module.
- The students will have to answer 5 full questions, selecting one full question from each module

Text Books:

1. Elmasri and Navathe: Fundamentals of Database Systems, 5th Edition, Addison - Wesley, 2011.
2. Silberschatz, Korth and Sudharshan Data base System Concepts,6th Edition, Tata McGraw Hill, 2011.

Reference Books:

1. Raghu Ramakrishnan and Johannes Gehrke: Database Management Systems, 3rd Edition, McGraw-Hill, 2003
2. Database Principles Fundamentals of Design, Implementation and Management by Coronel, Morris, Rob- Cengage Learning 2012

TEACHING METHODS

- PPTs
- Hands-On Sessions Based Teaching

ASSESSMENT METHODS

- Three Internals will be conducted for 30 Marks each and weightage of 40%, 40% and 20% from 1st, 2nd and 3rd internals respectively will be taken.
- Evaluation for learning activity based on Programming Assignments / Case studies/ Mini Projects for 20 Marks.
- Final Examination will be conducted for 100 Marks and Evaluated for 50 Marks

COURSE OUTCOMES

At End of the Course Student will Be Able to

CO1: Apply the basic concepts of database management in designing the database for the given problem.

CO2: Design entity-relationship diagrams to the given problem to develop database application with appropriate fields and validations by using a Relational model. **CO3:** Formulate SQL queries in Oracle to the given problem. **CO4:** Illustrate concept of functional dependencies and determine normalization techniques to improve the database design to the given problem. **CO5**: Analyze and implement transaction processing, concurrency control and database recovery protocols in databases

CO-PO-PSO Mapping:

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	2	1	2					1	1				3	
CO2	1	2	2	2				1	1				3	
CO3	2	3	2	2				1	1				3	
CO4	1	2	2	2				1	1				3	
CO5		2	2	2				1	1				3	

Operations Research [As per Choice Based Credit System (CBCS) scheme] **SEMESTER – I**			
Subject Code	22MCA105	CIE Marks	50
Number of Lecture Hours/Week	03 + 01 Hr Tutorial	SEE Marks	50
Total Number of Lecture Hours	40	SEE Hours	03
CREDITS – 03			

COURSE DESCRIPTION

Operations research helps in solving problems in different environments that needs decisions. The module cover topics that include: linear programming, Transportation, Assignment, and sequencing problems.

PREREQUISITES

- **None**

COURSE OBJECTIVES

This course aims to introduce students to use quantitative methods and techniques for effective decisions–making; model formulation and applications that are used in solving business decision problems.

COURSE CONTENTS

Modules	**Teaching Hours**
Module 1	**08 Hours**
Introduction: Definition of Operations research, Quantitative approach, Features of OR, problem solving Methodology of OR. **Linear programming Problem:** Introduction, Generalized LPP, Formulation of problems as L.P.P., Solutions to LPP by graphical method (Two Variables).	
Module 2	**08 Hours**
Linear programming Problem: Simplex method, Canonical and Standard form of LP problem, slack, surplus and artificial variables, Solutions to LPP by Simplex method, Big-M Method and Two Phase Simplex Method.	
Module 3	**08 Hours**
LPP: Duality in linear programming, Formulation of dual linear programming and examples. **Assignment problem:** Formulation, Solutions to assignment problems by Hungarian method.	
Module 4	**08 Hours**
Transportation problem: Formulation of transportation problem, types, initial basic feasible solution using North-West Corner rule, Least cost method, Vogel’s Approximation method. Optimality in Transportation problem by Modified Distribution (MODI) method.	
Module 5	**08 Hours**
Theory of games: Introduction, Two-person zero sum games, Pure strategies (Min-Max and Max-Min principles), Mixed strategies. The rules of principles of dominance, algebraic method to solve games without saddle point, graphical methods to solve games. **Sequencing problems:** Processing n-jobs through two machines (Johnson’s procedure).	

Question paper pattern:

- The question paper will have ten questions.
- Each full question consists of 20 marks.
- There will be 2 full questions from each module.
- Each question will have questions covering all the topics under a module.
- The students will have to answer 5 full questions, selecting one full question from each module

Text Books:

1. J.K. Sharma, "Operations Research Theory and Applications", 5th edition, MacMillan publisher India.

Reference Books:

1. S.D Sharma, Himanshu Sharma, "Operations Research: Theory, Methods and Applications", Kedarnath Ramnath (Publisher).
2. H A Taha , "Operations Research An Introduction", Low price edition 7th edition, 2006.
3. Hiller and Liberman, "Introduction to operation Research", McGraw Hill, 5th edition, 2001.
4. Prem Kumar Gupta, D S Heera , "Operations Research", S Chand Pub., New Delhi, 2007.

TEACHING METHODS

- PPTs
- Black Board

ASSESSMENT METHODS

- Three Internals will be conducted for 30 Marks each and Weightage of 40%, 40% and 20% from 1st, 2nd and 3rd internals respectively will be taken.
- Evaluation for Learning Activity based Assignments for 20 Marks.
- Final Examination will be conducted for 100 Marks and Evaluated for 50 Marks.

COURSE OUTCOMES: At End of the Course Student will Be Able to

CO1: Understand the meaning, definitions, scope, phases and techniques of operations research.
CO2: Formulate as L.P.P and derive optimal solutions to linear programming problems by graphical method, Simplex method and Big-M method.
CO3: Formulate as Transportation and Assignment problems and derive optimum solutions for transportation, Assignment problems.
CO4: Solve problems on game theory for pure and mixed strategy under competitive environment.
CO5: Determine minimum processing times for sequencing of n jobs -2 machines using Johnson's algorithm.

CO-PO-PSO Mapping

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	3			2	2				1					2
CO2	3			2	2				1					2
CO3	3			2	2				1					2
CO4	3			2	2				1					2
CO5	3			2	2				1					2

Research Methodology & Professional Ethics
[As per Choice Based Credit System (CBCS) scheme]
SEMESTER – I

Subject Code	22MCA106	CIE Marks	50
Number of Lecture Hours/Week	03	SEE Marks	50
Total Number of Lecture Hours	40	SEE Hours	03

Credits – 03

COURSE DESCRIPTION

This course provides an importance of Research, Intellectual Property Rights and Professional ethics. This course gives detailed knowledge of Defining the Research Problems, conducting detailed literature survey, Data Collection, Research Design, Drafting of Research Paper, Publication of papers in Journals, Impact factors. This Course also provides brief contents on Intellectual Property Rights and Professional ethics.

PREREQUISITES

- Students should have basic skill of English grammar and also should have interest in exploring & discovering the novel ideas.
- Students should know theoretical concepts of application development.

COURSE OBJECTIVES

- To understand the fundamentals of Research & Development activities.
- To write the research papers on specific areas.
- To understand the concepts of IPR and ethical issues.

COURSE CONTENTS

Modules	Teaching Hours
Module 1	**08 Hours**
Introduction - Meaning of research, Objectives of Research, Types of research, Research Process, Criteria of Good Research. **Defining the research problem-** Selecting the problem, necessity of defining the problem, techniques involved in defining the problem.	
Module 2	**08 Hours**
Reviewing the literature: Collection of Primary data, Collection of Secondary Data, Review of the literature, searching the existing literature, writing about the literature reviewed. **Meaning of Research Design:** Need for Research Design, features of a Good Design, Important Concepts Relating to Research Design, Different Research Designs.	
Module 3	**08 Hours**
Research Paper Writing - Interpretation of Data and Paper Writing – Layout of a Research Paper, Journals in Computer Science, Impact factor of Journals, When and where to publish? Ethical issues related to publishing, Plagiarism and Self-Plagiarism	
Module 4	**08 Hours**
Intellectual Property Rights: Patents, Designs, Trade and Copyright. Process of Patenting and Development: technological research, innovation, patenting, Procedure for grants of patents.	
Module 5	**08 Hours**
Ethics – An overview: Meaning of ethics, Ethics and morality, Principles of Professional ethics, what is corporate ethics	

Workplace Ethics: Introduction, Needs, Principles, Development of Personal Ethics, Workplace Ethics for Employees-Ethical behavior in workplace-Professionalism, Ethical violations by employees, Employee Attitude and Ethics, Employee Etiquettes. Ethics in Information Technology: Ethics for IT Professionals and IT users- The Ethical behavior of IT professionals**.**	

Question paper pattern:

- The question paper will have ten questions.
- Each full question consists of 20 marks.
- There will be 2 full questions from each module.
- Each question will have questions covering all the topics under a module.
- The students will have to answer 5 full questions, selecting one full question from each module

Text Books:

1. Kothari CR, "Research Methodology Methods and Techniques ", New Age International, 2014, 3rd. Edition, ISBN: 978-81-224-3623-5.
2. Business Ethics an Indian Perspective, A.C.Fernando, Pearson
3. Ethics in the work place, Craig E Johnson, Sage Publication, 2007
4. George Reynolds: Ethics in Information Technology, 2nd Edition, Thomson Course Technology, 2007

Reference Books:

1. Krishnaswami KN, Sivakuma AI and Mathiarajan, "Management Research Methodology", Pearson Education, 2009, ISBN.
2. DebiragE. Bouchoux: "Intellectual Property". Cengage learning, New Delhi, 2010
3. M.Ashok Kumar and Mohd.Iqbal Ali: "Intellectual Property Right" Serials Pub,2009.
4. Ethics in the workplace, Dean A Bredeson and Keith Gorce, Cengage learning, 3rd edition, 2012.
5. Ethics in the workplace: A systems perspective, William F Roth, Pearson Publication

TEACHING METHODS

- ICT based Teaching Learning Methods.
- Presentation Methods.
- Self-Learning by assigned activities.

ASSESSMENT METHODS

- Three Internals, 30 Marks each will be conducted. 40% each of first two internals and 20% of third internals will be consolidated out of 30 marks.
- Case study / Research Paper is considered as a part of Learning Activity for 20 Marks.
- Final Examination will be conducted for 100 Marks and Evaluated for 50 Marks.

COURSE OUTCOMES : At End of the Course Student will Be Able to

CO1: Understand and explain the underlying principles of quantitative and qualitative research and defining the research problem.

CO2: Choose the most appropriate references in the form of survey to address and design a particular research problem.

CO3: Applying the Principles of Research & drafting the research paper, identification of Journals for publication, ethical issues related to publication.

CO4: Understanding the concepts of Filing Patents, Designs, Trade and Copyright. Process of Patenting and Development.

CO5: To understand the basics of ethics and ethics for IT Professionals and its need for and importance at workplace.

CO-PO-PSO Mapping

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	3							1	1					
CO2	1	2	2		2	1	1	1	1	2		2		
CO3	2	2	2	2	2		1	1	1	2				
CO4	1	2	2	1			1	1	1	2		2		
CO5	2	2					1	1	1	2		2		

Object Oriented Programming using C++/JAVA Laboratory
[As per Choice Based Credit System (CBCS) scheme]
SEMESTER – I

Subject Code	22MCA107L	CIE Marks	50
Number of Hours/Week	02 Hrs Laboratory	SEE Marks	50
		SEE Hours	03

CREDITS – 01

COURSE DESCRIPTION

To develop software development skills in java programming and Students will have the proficiency to develop projects in java programming. The course helps the students to solve the inter-disciplinary applications through java programming.
To write programs for solving real world problems using java collection frame work.

PREREQUISITES

- Basic understanding of Principles of Programming.

COURSE OBJECTIVES

- Practice object-oriented programs and build java applications.
- Implement java programs for establishing interfaces.
- Implement sample programs for developing reusable software components.
- Create database connectivity in java and implement GUI applications.

Laboratory Experiments:

1.	a. Write a JAVA Program to demonstrate Constructor Overloading and Method Overloading. b. Write a JAVA Program to implement Inner class and demonstrate its Access protection.
2	Write a program in Java for String handling which performs the following: i) Checks the capacity of String Buffer objects. ii) Reverses the contents of string given on console and converts the resultant string in upper case. iii) Reads a string from console and appends it to the resultant string
3	a. Write a JAVA Program to demonstrate Inheritance. b. Simple Program on Java for the implementation of Multiple inheritance using interfaces to calculate the area of a rectangle and triangle.
4	Write a JAVA program which has i) A Class called Account that creates account with 500Rs minimum balance, a deposit() method to deposit amount, a withdraw() method to withdraw amount and also throws LessBalanceException if an account holder tries to withdraw money which makes the balance become less than 500Rs. ii) A Class called LessBalanceException which returns the statement that says withdraw amount (Rs) is not valid. iii) A Class which creates 2 accounts, both account deposit money and one account tries to withdraw more money which generates a LessBalanceException take appropriate action for the same.
5	Write a JAVA program using Synchronized Threads, which demonstrates Producer Consumer concept.
6	Write a JAVA program to implement a Queue using user defined Exception Handling (also make use of throw, throws.).

7	Complete the following: i) Create a package named shape. ii) Create some classes in the package representing some common shapes like Square, Triangle, and Circle. iii) Import and compile these classes in other program.
8	Write a JAVA Program Create an enumeration Day of Week with seven values SUNDAY through SATURDAY. Add a method is Workday( ) to the DayofWeek class that returns true if the value on which it is called is MONDAY through FRIDAY. For example, the call DayOfWeek.SUNDAY.isWorkDay ( ) returns false.
9	Write a JAVA program which has i) A Interface class for Stack Operations ii) A Class that implements the Stack Interface and creates a fixed length Stack. iii) A Class that implements the Stack Interface and creates a Dynamic length Stack. iv) A Class that uses both the above Stacks through Interface reference and does the Stack operations that demonstrates the runtime binding.
10	Write a JAVA program to print a chessboard pattern.
11	Write a JAVA Program which uses FileInputStream / FileOutPutStream Classes.
12	Write JAVA programs which demonstrates utilities of LinkedList Class.
13	Write a JAVA program to implement JDBC operations.

TEACHING METHODS

- PPTs
- Hands-On Sessions Based Teaching

ASSESSMENT METHODS

Experiment Write up + Execution + Viva	20
Lab Record Writing	15
Lab Internals Test	15
Total	50

- Final Exam will be conducted for 50 marks (SEE)

Course Outcomes(CO):

CO1: Understand Java programming language fundamentals and run time environment.
CO2: Gain knowledge and skill necessary to write java programs.
CO3: Learn the object oriented concepts and its implementation in Java.
CO4: Implement the multithreading and client side programming.
CO5: To understand the working procedure of JDBC

CO-PO-PSO Mapping

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	2	2	2	1	2				1					
CO2	2	2	2	1	2			1	1				3	
CO3	2	2	2	1	2				1				3	
CO4	2	2	2	1	2			1	1				3	
CO5	2	2	2	1	2				1				3	

Data Structures and Algorithms Laboratory
[As per Choice Based Credit System (CBCS) scheme]
SEMESTER – I

Subject Code	22MCA108L	CIE Marks	50
Number of Hours/Week	02 Hrs Laboratory	SEE Marks	50
		SEE Hours	03

CREDITS – 1

COURSEDESCRIPTION

This course introduces students with various data structures and their implementation.

PREREQUISITES

Students should have basic knowledge of C programming constructs and should be able to write basic C programs

Course Objective:

- To understand working principle of different types of data structures
- To identify and apply the appropriate algorithms to solve a given problem.

Laboratory Experiments:

1	Write a C program to Implement the following searching techniques a. Linear Search b. Binary Search.
2	Write a C program to implement the following sorting algorithms using user defined functions: a. Bubble sort (Ascending order) b. Selection sort (Descending order).
3	Write a C Program implement STACK with the following operations a. Push an Element onto Stack b. Pop an Element from Stack
4	Implement a Program in C for converting an Infix Expression to Postfix Expression.
5	Implement a Program in C for evaluating an Postfix Expression.
6	Write a C program to simulate the working of a singly linked list providing the following operations: a. Display & Insert b. Delete from the beginning/end c. Delete a given element
7	Obtain the Topological ordering of vertices in a given graph with the help of a c Programming.
8	Check whether a given graph is connected or not using DFS method using C Programming.
9	From a given vertex in a weighted connected graph, find shortest paths to other vertices Using Dijkstra's algorithm (C programming)
10	Find Minimum Cost Spanning Tree of a given undirected graph using Kruskal's algorithm (C programming)

ASSESSMENT METHODS

Experiment Write up + Execution + Viva	20
Lab Record Writing	15
Lab Internals Test	15
Total	50

Final Exam will be conducted for 50 marks (SEE)

Course Outcome (CO): At the end of this course, the students will be able to:

CO1: Perform various sorting and searching techniques.
CO2: Implement various types of data structures, operations and algorithms.
CO3: Work with Stacks, Queues, Circular Queues, Linked Lists, and Trees.
CO4: Design and apply appropriate algorithms for solving computing problems
CO5: Analyze the efficiency of algorithms.

CO-PO-PSO Mapping

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	2	2	2	1	2				1				3	1
CO2	2	2	2	1	2				1				3	1
CO3	2	2	2	1	2				1				3	1
CO4	2	2	2	1	2				1				3	1
CO5	2	2	2	1	2				1				3	1

UNIX/LINUX Programming Laboratory [As per Choice Based Credit System (CBCS) scheme] **SEMESTER – I**			
Subject Code	22MCA109L	CIE Marks	50
Number of Hours/Week	02Hrs Laboratory	SEE Marks	50
		SEE Hours	03
CREDITS – 1			

COURSE DESCRIPTION:
This course introduces students with basic shell programming concepts.

PREREQUISITES

- Students should have knowledge of basic Unix commands.

Course Objective:

- To understand the fundamental design of the UNIX shell programming.
- To be able to design the shell scripts.

Laboratory Experiments:

Explore the Unix environment and Explore vi editor with vim tutor. Perform the following operations using vi editor, but not limited to:
1. Insert character, delete character, replace character
2. save the file and continue working
3. save the file and exit the editor
4. quit the editor
5. quit without saving the file
6. rename a file
7. insert lines, delete lines,
8. setline numbers
9. search for a pattern
10. move forward and backward

1	Develop a shell script that takes a valid directory name as an argument and recursively descend all the subdirectories, finds the maximum length of any file in that hierarchy and writes this maximum value to the standard output.
2	Develop shell script to implement terminal locking (similar to the lock command). It should prompt the user for a password. After accepting the password entered by the user, it must prompt again for the matching password as confirmation and if match occurs, it must lock the keyword until a matching password is entered again by the user, Note that the script must be written to disregard BREAK, control-D. No time limit needed to be implemented for the lock duration.
3	Develop a shell script that displays all the links to a file specified as the first argument to the script. The second argument, which is optional, it can be used to specify in which the search is to begin. If this second argument is not present, the search is to begin in current working directory. In either case, the starting directory as well as all of its sub directories at all levels must be searched. The script need not include any error checking.
4	Write a shell script that accept one or more file names as argument and convert all of them to uppercase, provided they exists in current directory.
5	Implement a shell script to list all the files in a directory whose filename is at least 10 characters. (us expr command to check the length)
6	Develop a shell script that accept a list of filenames as its argument, count and report occurrence of each word that is present in the first argument file on other Argument files.

7	Develop a shell script that reports the logging in of a specified user within one minute after he/she login. The script automatically terminate if specified user does not login during a specified period of time.
8	Develop a shell script that folds long lines into 40 columns. Thus any line that exceeds 40 characters must be broken after 40th, a “\” is to be appended as the indication of folding and the processing is to be continued with the residue. The input is to be supplied through a text file created by the user.
9	Write a shell script that accepts the filename, starting and ending line number as an argument and display all the lines between the given line number.
10	Write a shell script that accepts two file names as arguments, checks if the permissions or these files are identical and if the permissions are identical, output common permissions and otherwise output each file name followed by its permissions

ASSESSMENT METHODS

Experiment Write up + Execution + Viva	20
Lab Record Writing	15
Lab Internals Test	15
Total	50

- Final Exam will be conducted for 50 marks (SEE)

Course Outcome (CO): At the end of this course, the students will be able to:

CO1: Understand the Unix programming environment.
CO2: Be fluent in the use of Vi editor.
CO3: Be able to design and implement shell scripts to manage users with different types of permission and file based applications.
CO4: Be fluent to write shell scripts.
CO5: Evaluate different commands with sample shell scripts

CO-PO-PSO Mapping

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	2	2	2	1	2				1				3	1
CO2	2	2	2	1	2				1				3	1
CO3	2	2	2	1	2				1				3	1
CO4	2	2	2	1	2				1				3	1
CO5	2	2	2	1	2				1				3	1

Database Management Systems Laboratory
[As per Choice Based Credit System (CBCS) scheme]
SEMESTER – I

Subject Code	22MCA110L	CIE Marks	50
Number of Hours/Week	02 Hrs Laboratory	SEE Marks	50
		SEE Hours	03

CREDITS – 1

COURSE DESCRIPTION

This lab course is to understand the practical applicability of database management system concepts. Working on existing database systems, designing of database, creating relational database, analysis of table design. To explain basic database concepts, applications, data models, schemas and instances.

PREREQUISITES

1. Students should know basics of Discrete Mathematics.
2. Students should know basic programming concepts.

COURSE OBJECTIVES

- Students get practical knowledge on designing and creating relational database systems. Understand various advanced queries execution such as relational constraints, joins, set operations, aggregate functions, trigger views and embedded SQL.
- To demonstrate the importance of normalization in databases.

DBMS Lab Experiments: Instructions for the Exercises:

1. Draw ER diagram based on given scenario with various Constraints.
2. Create Relational Database Schema based on the above scenario using Mapping Rules.
3. Perform the given queries using any RDBMS Environment.
4. Suitable tuples have to be entered so that queries are executed correctly
5. The results of the queries may be displayed directly

Laboratory Experiments:

1. Create the following tables with properly specifying Primary keys, Foreign keys and solve the following queries.

BRANCH(Branchid,Branchname,HOD)

STUDENT(USN,Name,Address,Branchid,sem)

BOOK(Bookid,Bookname,Authorid,Publisher,Branchid)

AUTHOR(Authorid,Authorname,Country,age)

BORROW(USN,Bookid,Borrowed_Date)

Queries:

1. List the details of Students who are all studying in 2nd sem MCA.
2. List the students who are not borrowed any books.
3. Display the USN, Student name, Branch_name, Book_name, Author_name, Books_Borrowed_Date of 2nd sem MCA Students who borrowed books.
4. Display the number of books written by each Author.
5. Display the student details who borrowed more than two books.
6. Display the student details who borrowed books of more than one Author.
7. Display the Book names in descending order of their names.
8. List the details of students who borrowed the books which are all published by the same Publisher.

2. Design an ER-diagram for the following scenario, Convert the same into a relational model and then solve the following queries.

Consider a Cricket Tournament "ABC CUP" organized by an organization. In the tournament there are many teams are contesting each having a Teamid, Team_Name, City, a coach. Each team is uniquely identified by using Teamid. A team can have many Players and a captain. Each player is uniquely identified by Playerid, having a Name, and multiple phone numbers, age. A player represents only one team. There are many Stadiums to conduct matches. Each stadium is identified using Stadiumid, having a stadium_name, Address (involves city, area_name, pincode).A team can play many matches. Each match played between the two teams in the scheduled date and time in the predefined Stadium. Each match is identified uniquely by using Matchid. Each match won by any of the one team that also wants to record in the database. For each match man_of_the match award given to a player.

Queries:

1. Display the youngest player (in terms of age) Name, Team name, age in which he belongs of the tournament.
2. List the details of the stadium where the maximum number of matches were played.
3. List the details of the player who is not a captain but got the man_of _match award at least in two matches.
4. Display the Team details who won the maximum matches.
5. Display the team name where all its won matches played in the same stadium.

3. Consider the following Scenario and design an ER-Diagram, map the designed ER-diagram into a Relational model.

Consider an organization "ABC" having many employees. An employee works for one department. Each employee identified by using Empid, having Name, address (described as House_no, city, district, state, pin code) and more than one phone numbers. Department identified by using Dno, having Dname, Dlocation. Each Department having a manager . Each department having many employees. There are many Projects, each project is controlled by the department. Each Project uniquely identified by Pno, having Project_name,Project_location. An employee works on many Projects. Number of hours per week worked on each project by an Employee also needs to be recorded in the database. A project is worked by many employees. Each employee supervised by the supervisor. Employee having many dependents. Dependents having the dependent_name, gender, age, address. Dependents are identified by Empid.

T1(Empid, Emp_Name,city, district, state, pin_code, phoneno, Dno,Dname,Dlocation, Dept_mgr_id, Pno, Project_name, Project_location, Number_of_Hours,Supervisor_Empid, Dependent_name, gender, address)

Deduce the above Relation T1 into the 3NF and then solve the following queries.

Queries:

1. Display the details of the employees who are working on both the projects having project_no 5 and 10.
2. Display the details of employees having atleast two dependents.
3. Display the project name on which more number of employees are working.
4. Retrieve the employees who do not have any dependents.

5. Display the Employee details whose total number of hours per week working on various projects is maximum than all other employees.
6. create a view to display the number of employees working in each department

4. Design an ER-diagram for the following scenario, Convert the same into a relational model, normalize Relations into a suitable Normal form and then solve the following queries.

A country can have many Tourist places. Each Tourist place is identified by using tourist_place_id, having a name, belongs to a state, Number of kilometers away from the capital city of that state, history. There are many Tourists visits tourist places every year. Each tourist is identified uniquely by using Tourist_id, having a Name, age, Country and multiple emailids. A tourist visits many Tourist places, it is also required to record the visted_date in the database. A tourist can visit a Tourist place many times at different dates. A Tourist place can be visited by many tourists either in the same date or at different dates.

Queries:

1. List the state name which is having maximum number of tourist places.
2. List details of Tourist place where maximum number of tourists visited.
3. List the details of tourists visited all tourist places of the state “KARNATAKA”.
4. Display the details of the tourists visited at least one tourist place of the state, but visited all states tourist places.
5. Display the details of the tourist place visited by the tourists of all country.

ASSESSMENT METHODS

Experiment Write up + Execution + Viva	20
Lab Record Writing	15
Lab Internals Test	15
Total	50

- Final Exam will be conducted for 50 marks (SEE)

Course Outcome (CO): At the end of this course, the students will be able to:

CO1: Apply the basic concepts of Database Systems and Applications.
CO2: Use the basics of SQL and construct queries using SQL in database creation and interaction.
CO3: Design a commercial relational database system (Oracle) by writing SQL using the system.
CO4: Perform embedded and nested queries and implement normal forms.
CO5: Take up real world problems independently

CO-PO-PSO Mapping

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	2	2	2	1	2				1				3	1
CO2	2	2	2	1	2				1				3	1
CO3	2	2	2	1	2				1				3	1
CO4	2	2	2	1	2				1				3	1
CO5	2	2	2	1	2				1				3	1

Principles of Programming (Bridge Course – Non-credit)
[As per Choice Based Credit System (CBCS) scheme]
SEMESTER – I

Subject Code	22MCA111B	CIE Marks	50
Number of Lecture Hours/Week	04	SEE Marks	50
Total Number of Lecture Hours	50	SEE Hours	03

Credits – 00

COURSE DESCRIPTION

This course provides an understanding C and C++. The course also provides about the structure of c programming with problems as case studies. The course also covers details on structures, unions and pointers in details with descriptive examples. A part of the course consists of C++ where concepts of object oriented programming like inheritance, classes, objects, standard IO operations, exception handling, and operator overloading.

PREREQUISITES

- Student should know the concepts of algorithms, computer basics, and computer architectures.
- Student should know about fundamentals of Data flow diagrams and pseudo codes.

COURSE OBJECTIVES

- To understand the fundamentals of C programming language.
- To understand the fundamentals of C++ programming language.

COURSE CONTENTS

Modules	**Teaching Hours**
Module 1	**10 Hours**
C Programming: decision making, control structures and arrays Decision making with if statement, simple if statement, the if..else statement, nesting of if..else statements, the else..if ladder, the switch statement, the ?: operator, the goto statement, the break statement, programming examples. The while statement, the do...while statement, the for statement, nested loops, jumps in loops, the continue statement, programming examples. one dimensional and two dimensional arrays, declaration and initialization of arrays, reading , writing and manipulation of above types of arrays.	
Module 2	**10 Hours**
Structures Defining a structure, declaring structure variables, accessing structure members, structure initialization, copying and comparing structure variables, operations on individual members, array of structures, structures within structures, structures and functions, Unions, size of structures.	
Module 3	**10 Hours**
Pointers Pointers in C, Declaring and accessing pointers in C, pointers in C++, Pointer as function arguments, Dynamic Allocation Operators new and delete, Initializing Allocated Memory, Allocating Arrays, Allocating Objects. Overloading, overloading operators.	
Module 4	**10 Hours**
Classes & Objects: Introduction, Class Specification, Class Objects, access members, defining member functions, data hiding, constructors, destructors, parameterized constructors, static data members, static member functions, scope resolution operator, Passing Objects to Functions, Returning Objects, Object	

Assignment. **Pointers and dynamic memory allocation:** Pointers, Pointer as function arguments, Dynamic Allocation Operators new and delete, Initializing Allocated Memory, Allocating Arrays, Allocating Objects **Operator overloading:** Operator overloading as member functions and using friend functions. Overloading of binary operators like +, -, *. Creating Prefix and Postfix forms of ++, -- Operators, Operator Overloading Restrictions, Operator Overloading Using a Friend Function to Overload ++ or – –, Overloading ( ). **Inheritance:** Base Class, Inheritance & protected members, protected base class inheritance, inheriting multiple base classes, Constructors, Destructors & Inheritance. Passing parameters to base Class Constructors, Granting access, Virtual base classes.	
Module 5	**10 Hours**
Standard C++ I/O Classes: Old vs. Modern C++ I/O, C++ Streams, The C++ Stream Classes, C++'s Predefined Streams, Formatted I/O, Formatting Using the ios Members, Setting the Format Flags, Clearing Format Flags, Overloading << and >>, manipulators. Exception Handling: Exception Handling, Fundamentals, Catching Class Types, Using Multiple catch Statements, Handling Derived- Class Exceptions, Exception Handling Options, Catching All Exceptions, Restricting Exceptions, Rethrowing an Exception, Understanding terminate( ) and unexpected( ), uncaught_exception( ) Function, The exception and bad_exception Classes, Applying Exception Handling	

Question paper pattern:

- The question paper will have ten questions.
- Each full question consists of 20 marks.
- There will be 2 full questions from each module.
- Each question will have questions covering all the topics under a module.
- The students will have to answer 5 full questions, selecting one full question from each module

Text Books:

1. Object oriented programming with C++, E. Balaguruswamy, Tata McGrawHill.
2. Herbert Schildt: C++ The Complete Reference, 4th Edition, Tata McGraw Hill,2014.
3. K R Venugopal, Rajkumar Buyya,T Ravishanker: Mastering C++

Reference Books:

1. Programming in ANSI C, E Balaguruswamy, 7th Edition, McGraw Hill.
2. The Complete Reference, Herbert Schild,4th Edition, MacGrawhill.

TEACHING METHODS

- PPTs
- Hands-On Sessions Based Teaching

ASSESSMENT METHODS

- Three Internals are conducted for 30 Marks each and weightage of 40%, 40% and 20% from 1st, 2nd and 3rd internals respectively are taken.
- Evaluation of learning activity based on Programming Assignments for 20 Marks.
- Final Examination will be conducted for 100 Marks and Evaluated for 50 Marks

Course Outcome(CO):At end of this Course, student will be able to
CO1: Identify special features introduced in C++ when compared to C and illustrate the difference between structure and class using C++ program.
CO2: Apply the Concepts of inheritance, polymorphism for the given problem and develop the C++ program.
CO3: Implement the concept of overloading, default parameters, Constructors and destructors in a C++ program.
CO4: Analyse the working of I/O operations with C++ files.
CO5: Demonstrate the Exception handling and template for a given problem.
CO6: Demonstrate the concepts of data abstraction, information hiding and encapsulation by writing C++ program.

CO-PO-PSO Mapping

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	2							1	1					
CO2	1	2		2			1	1	1					
CO3	2	2					1	1	1					
CO4	1	2		2			1	1	1					
CO5	2	2		2			1	1	1					
CO6	2	2		2			1	1	1					

Python Programming

[As per Choice Based Credit System (CBCS) scheme]

SEMESTER – II

Subject Code	22MCA201	CIE Marks	50
Number of Lecture Hours/Week	04	SEE Marks	50
Total Number of Lecture Hours	50	SEE Hours	03

CREDITS – 04

COURSE DESCRIPTION:

This course provides an in-depth knowledge of basic Python Programming Language and also provides an insight on Python data structures, working of and arrays, numerical analysis and data manipulation in python.

PREREQUISITES

- Students should have a basic knowledge of any programming language
- Students should know basic data visualization techniques**.**

Course Objective:

- To acquire programming skills in core Python.
- To acquire Object Oriented Skills in Python
- To develop the skill of designing Graphical user Interfaces in Python
- To develop the ability to write database applications in Python

COURSE CONTENTS

Modules	**Teaching Hours**
Module 1	**10 Hours**
Python Basic Concepts and Programming: Program Structure, Identifiers, Keywords, Variables, Operators, Precedence and Associativity, Mutable and Immutable Data Types, Indentation, Comments, Reading Input, User Input, Print Output, the type () Function and Is Operator. **Statements:** Control flow statements, Iterative statements, Conditional statements, the continue and break Statements, Built-In Functions, Commonly Used Modules. **Function Definition and Calling** the Function, The return Statement and void Function, Scope and Lifetime of Variables, Positional Arguments, Keyword arguments, Variable length arguments Default Parameters, Command Line Arguments. Anonymous Functions, Generators and Decorators.	
Module 2	**10 Hours**
Data Structures: List, dictionary, set and generator-comprehensions. Basic List Operations, Indexing and Slicing in Lists, Built-In Functions Used on Lists, List Methods. Strings- Creating and Storing Strings, Basic String Operations, Accessing Characters in String by Index Number, String Slicing and Joining, String Methods, Formatting Strings, Creating Sets, Tuples and Dictionaries and basic methods. **File handling: Basic** file handling methods, reading and writing files, File Input/output, deleting and copy functions. **Exception Handling**: Errors, Python Try Except, finally. Rising of an exception, Many Exceptions, working of else with exception.	
Module 3	**10 Hours**
OOP's Programming with python: Classes, objects, Constructors and Destructors, self and del keywords, access to Attributes and Methods, geattr and hasattr attributes, Data abstraction, Encapsulation, Inheritance and types, Overloading, Polymorphism, Python	

Iterators. **Working with modules:** Creating and importing modules, Built-in modules, dir () function, RegEx module and function with metacharacters, Python JSON module, JSON string conversions. Introduction to Package and working of pip.	
Module 4	**10 Hours**
Numerical Analysis with Numpy Arrays: Introduction to Numpy, Array Creation with Numpy, Array Indexing, Array Slicing, A Multidimensional array objects, Computation on Numpy object. Numpy Data types, Numpy copy vs view, Array Iteration. Numpy Array Join, Split, Search and filter. **Universal functions in Numpy:** Introduction to ufunc, Creation, Arithmetic functions, Log, Trigonometric functions, Aggregate functions, Set operations with Numpy. **Web Scraping:** Data Acquisition by Scraping web applications –Submitting a form - Fetching web pages – Downloading web pages through form submission, Difference between Web scraping and Web crawling.	
Module 5	**10 Hours**
Data Manipulation with Pandas: Introduction to pandas, Panda's Series, creating a Series object with list, dictionary and ndarrays, indexing and Labeling. Introduction to pandas Dataframe, Load files in to Dataframe, Index objects. **Pandas Analyzing Data:** Reading of CSV files, Reading of JSON files. Viewing the data and info, head (), tail (), iloc () methods. **Data Cleaning with Pandas:** Handling Empty sets, Data in wrong format, Wrong data, Handling Duplicates. Data Correlations with Pandas and its types **Data Visualization with Pandas:** Matplotlib package – Plotting Graphs – Controlling Graph.	

Question paper pattern:

- The question paper will have ten questions.
- Each full question consists of 20 marks.
- There will be 2 full questions from each module.
- Each question will have questions covering all the topics under a module.
- The students will have to answer 5 full questions, selecting one full question from each module

Text Books:

1. Introducing Python- Modern Computing in Simple Packages – Bill Lubanovic, O 'Reilly Publication
2. Wes Mc Kinney, "Python for Data Analysis", O'Reilly Media, 2012.
3. Jake Vander plas, "Python Data Science Handbook: Essential tools for working with data", O 'Reilly Publishers, I Edition.

Reference Books:

1. Learning Python, Mark Lutz, Fifth Edition, O'Reilly Publication,2017
2. Exploring Python, Timothy A. Budd, Mc Graw Hill Education, 2011
3. How to Think Like a Scientist –Learning with Python ", Allen Downey, Jeffrey Elkner, Chris Meyers, Green Tea Press, 2002, First Edition.
4. llen B. Downey, "Think Python: How to Think Like a Computer Scientist '', 2nd edition, Updated for Python 3, Shroff/O'Reilly Publishers, 2016 (http://greenteapress.com/wp/thinkpython/)

TEACHING METHODS

- PPTs
- Hands-On Sessions Based Teaching

ASSESSMENT METHODS
• Three Internals, 30 Marks each will be conducted and the weightage of 40%, 40% and 20% from 1st, 2nd, and 3rd internals will be taken. • Evaluation for Learning Activity based on Programming Assignments for 20 Marks. • Final Examination will be conducted for 100 Marks and Evaluated for 50 Marks.
Course Outcome (CO): At the end of this course, the students will be able to: **CO1**: Understand and Comprehend the Basics Concepts of Python Programming. **CO2:** Understand the working of Python Data structures, File handling and Exception Handling. **CO3**: Apply Python Collection Objects, Object-Oriented Features, Python modules to develop Python Applications. **CO4**: Implement Numpy Arrays for Numerical Analysis and perform Data Scraping with Python. **CO5:** Implement Data Manipulation and Data Visualization with Pandas.

CO-PO-PSO Mapping

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	3							1	1				3	1
CO2	3							1	1				3	1
CO3	1	3	1	3			1	1	1				3	1
CO4	1	3	1	1			1	1	1				3	1
CO5	1	3	1	1			1	1	1				3	1

<table>
<tr><td colspan="4" align="center">Web Programming
[As per Choice Based Credit System (CBCS) scheme]
SEMESTER – II</td></tr>
<tr><td>Subject Code</td><td>22MCA202</td><td>CIE Marks</td><td>50</td></tr>
<tr><td>Number of Lecture Hours/Week</td><td>04</td><td>SEE Marks</td><td>50</td></tr>
<tr><td>Total Number of Lecture Hours</td><td>50</td><td>SEE Hours</td><td>03</td></tr>
<tr><td colspan="4" align="center">CREDITS – 04</td></tr>
<tr><td colspan="4">COURSE DESCRIPTION
The course enables students to develop various Web applications and gain knowledge of current and emerging technologies and practices.</td></tr>
<tr><td colspan="4">PREREQUISITES
• Students should know the basics of Object oriented programing concepts and html.</td></tr>
<tr><td colspan="4">COURSE OBJECTIVES
To familiarize the students with client and server-based Web scripting and dynamic Web application development.</td></tr>
</table>

Modules	Teaching Hours
Module 1	**10 Hours**
Introduction to XHTML and CSS: Basic syntax, Standard structure, Basic text mark-up, Images, Hypertext Links. Lists, Tables, Forms, Frames, Syntactic differences between HTML and XHTML. **Cascading Style Sheets:** Introduction, Levels of style sheets, Style specification formats, Selector forms, Property value forms, Font properties, List properties, Colour, Alignment of text, The box model, Background images, The <span> and <div> tags, Conflict resolution.	
Module 2	**12 Hours**
The basics of JavaScript: Overview of JavaScript, Object orientation and JavaScript, general Syntactic Characteristics, Primitives, Operations and Expressions, Screen Output and Keyboard Input, Control Statements, Object Creation and Modification, Arrays, Functions, Constructors, Pattern matching using Regular Expressions, Errors in Scripts. **Java Script and XHTML Documents:** The JavaScript Execution Environment, The Document Object Model, Elements Access in Java Script, Events and Event Handling, Handling Events from Body Elements, Handling Events from Text Box and password Elements, The DOM2 Event Model, The navigator Object, Dom Tree Traversal and Modification.	
Module 3	**08 Hours**
Introduction to XML: Introduction, Syntax, Document Structure, Document type definitions, Namespaces, XML schemas, displaying raw XML documents, Displaying XML documents with CSS, XSLT style sheets, XML processors, Web services.	
Module 4	**10 Hours**
Introduction to PHP and Building Web applications with PHP: Origins and uses of PHP, Overview of PHP, General syntactic characteristics, Primitives, operations and expressions, Output, Control statements, Arrays, Functions, Pattern matching, Form handling, Files, Tracking users, cookies, sessions, Using Databases, Handling XML.	

Module 5	10 Hours
Introduction to Angular JS: Directives, Expressions, Directives, Controllers, Filters, Services, Events, Forms, Validations, Examples.	

Question paper pattern:

- The question paper will have ten questions.
- Each full question consists of 20 marks.
- There will be 2 full questions from each module.
- Each question will have questions covering all the topics under a module.
- The students will have to answer 5 full questions, selecting one full question from each module.

Text Books:

1. Robert W. Sebesta: Programming the World Wide Web, 4^{th} Edition, Pearson education, 2012.
2. Complete Angular Js Guide with Examples by Krishna Rungta

Reference Books:

1. Chris Bates: Web Programming Building Internet Applications, 3rd Edition, Wiley India, 2006.
2. M. Deitel, P. J. Deitel, A. B. Goldberg: "Internet & World Wide Web How to Program", 3^{rd} Edition, Pearson Education/PHI, 2004.
3. Jeffrey C. Jackson: Web Technologies-A Computer Science Perspective, Pearson Education, 7thImpression, 2012.

TEACHING METHODS

- PPTs
- Hands-On Sessions
- Black Board

ASSESSMENT METHODS

- Three Internals will be conducted for 30 Marks each and Weightage of 40%, 40% and 20% from 1^{st}, 2^{nd} and 3^{rd} internals respectively will be taken.
- Evaluation for Learning Activity based on Programming Assignments/ Mini Project for 20 Marks.
- Final Examination will be conducted for 100 Marks and Evaluated for 50 Marks.

Course Outcome (CO): At the end of this course, the students will be able to:

CO1: Learn to write well-structured, easily maintained, standards-compliant, web pages using XHTML and CSS code.
CO2: Use JavaScript to add dynamic content to pages that meet specific needs and interests.
CO3: Use XML for enhanced web interaction and applications
CO4: Create dynamic web applications using PHP and MYSQL
CO5: Use AngularJS to create dynamic pages.

CO-PO-PSO Mapping

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	3	2	2	1				1	1				3	
CO2	2	2	2	2				1	1				3	
CO3	2	2	2	2				1	1				3	
CO4	2	2	2	2				1	1				3	
CO5	2	2	2	2				1	1				3	

Mobile Applications

[As per Choice Based Credit System (CBCS) scheme]

SEMESTER – II

Subject Code	22MCA203	CIE Marks	50
Number of Lecture Hours/Week	04	SEE Marks	50
Total Number of Lecture Hours	50	SEE Hours	03

CREDITS – 04

COURSE DESCRIPTION

This course is intended to provide students with the skills required to design software artifacts by using latest technologies, Android Frameworks for designing Mobile Apps, Flutter framework for Android and iOS Applications.

PREREQUISITES

- Students should know basics of XML.
- Students should know C, C++, and Java Programming Concepts.

COURSE OBJECTIVES

Android Application Development course is designed to quickly get you up to speed with writing apps for Android devices. The student will learn the basics of Android and Flutter Frameworks and get to understand the application lifecycle.

Modules	Teaching Hours
Module 1	**10 Hours**
Introduction Preliminary Considerations – Cost of Development, Importance of Mobile Strategies in the Business World, Effective use of Screen Real Estate, Understanding Mobile Applications Users, Understanding Mobile Information Design, Understanding Mobile Platforms, Using the Tools of Mobile Interface Design.	
Module 2	**10 Hours**
Getting Started with Android Programming What is Android? Obtaining the required tools, Anatomy of an Android Application, Components of Android Applications, Activities, Fragments, Utilizing the Action Bar.	
Module 3	**10 Hours**
Android UI Design and Location Based Services Views and View Groups, Basic Views, Displaying Maps, Getting Location Data, Preparing for Publishing, Deploying APK Files.	
Module 4	**10 Hours**
Android Messaging and Networking: SMS Messaging, Sending Email, Networking , Downloading Binary Data, Text files, Accessing Web Services, Performing Asynchronous Call, Creating your own services, Communicating between a service and an activity, Binding activities to services.	
Module 5	**10 Hours**
Flutter and IOS : Flutter: Introduction, Installation, Creating Simple Application in Android Studio, Architecture Application, Introduction to Dart Programming, Widgets, Layouts, Gestures.	

IOS: Obtaining the tools and SDK, Components of XCODE, Architecture of iOS, Objective C and Swift Programming Languages.

Question paper pattern:

- The question paper will have ten questions.
- Each full question consists of 20 marks.
- There will be 2 full questions from each module.
- Each question will have questions covering all the topics under a module.
- The students will have to answer 5 full questions, selecting one full question from each module.

Text Book:

1. Jeff McWherter and Scott Gowell, "Professional Mobile Application Development", 1st Edition, 2012.
2. Wei-Meng Lee, "Beginning Android Application Development", Wiley 2011.

Reference Books:

1. Reto Meier, "Professional Android 4 Application Development", Wrox Publications 2012.
2. Rap Payne, "Beginning App Development with Flutter: Create Cross-Platform Mobile Apps", 1st Edition, Publications 2019.

TEACHING METHODS

- PPTs
- Hands-On Sessions
- Black Board

ASSESSMENT METHODS

- Three Internals will be conducted for 30 Marks each and Weightage of 40%, 40% and 20% from 1st, 2nd and 3rd internals respectively will be taken.
- Evaluation for Learning Activity based on Programming Assignments/ Mini Projects/ Case Studies for 20 Marks.
- Final Examination will be conducted for 100 Marks and Evaluated for 50 Marks.

COURSE OUTCOMES

At End of the Course Student will Be Able to

CO1: Illustrate effective user interfaces that leverage evolving mobile device capabilities.
CO2: Develop applications using different SDK frameworks and toolkits.
CO3: Establish various methods to integrate database and server-side technologies.
CO4: Design and develop open source software based mobile applications.
CO5: Build and deploy competent mobile development solutions.

CO-PO-PSO Mapping

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	2	1	2					1	1				3	
CO2	1	3	1	2			1	1	1				3	
CO3	2	2	1				1	1	1				3	
CO4	1	2	2	2			1	1	1				3	
CO5	1	3	1	3			1	1	1				3	

Computer Networking & Communications [As per Choice Based Credit System (CBCS) scheme] **SEMESTER - II**			
Subject Code	22MCA2041E	CIE Marks	50
Number of Lecture Hours/Week	03	SEE Marks	50
Total Number of Lecture Hours	40	SEE Hours	03
CREDITS – 03			

COURSE DESCRIPTION

This course is aimed to introduce the modern network architectures, Layered models, IP addresses. It also covers all protocols, transmission media and Routing concepts.

PREREQUISITES

- Students should know Topologies of Network.
- Students should know basic knowledge of Computer Hardware and Networking Components.

COURSE OBJECTIVES

- To Develop An Understanding Of Modern Network Architectures From A Design And Performance Perspective.
- To Introduce The Student To The Major Concepts Involved In Wide-Area Networks (WANs), Local Area Networks (WLANs) And Wireless LANs (WLANs).
- To Provide An Opportunity To Do Network Programming
- To Provide A WLAN Measurement Ideas.

COURSE CONTENTS

Modules	**Teaching Hours**
Module 1	**08 Hours**
Introduction: Network Applications, Network Hardware. Reference Models: OSI reference model, TCP/IP reference model. **The Physical Layer:** Guided Transmission Media, Wireless Transmission Media, Digital modulation and Multiplexing, Mobile telephone systems (1G, 2G, 3G and 4G).	
Module 2	**08 Hours**
Data Link layer: Data link layer design issues, Error Detection Schemes: Parity, Checksum, CRC. Data Link Protocols: Simplex, Simplex Stop and Wait for an error-free channel and Noisy channel, Sliding window protocols: one bit sliding window, Go Back N and Selective repeat.	
Module 3	**08 Hours**
Medium Access Control Sub Layer: The Channel Allocation Problem, Multiple access protocols: ALOHA, Collision free protocols: Bit Map and Token Passing; RFID: EPC Gen 2 Architecture, EPC Gen 2 Physical Layer, EPC Gen 2 Tag Identification Layer, Tag Identification Message Formats.	
Module 4	**08 Hours**
Network Layer: Network Layer Design issues, Routing algorithms: Optimality Principle, Shortest Path, Flooding, Distance Vector Link State; Internetworking, The Network Layer in the Internet: IPV4, IP addresses, IPV6.	
Module 5	**08 Hours**
The Transport Layer: Elements of Transport Protocols: Error Control and Flow Control, Multiplexing, Crash Recovery; Congestion Control; UDP: Remote Procedure Call Real-Time Transport Protocols; TCP: TCP Service Model, TCP Protocols.	

The application Layer: Introduction, DNS: Domain Name Space, Domain Name Records, Name Servers; The World Wide Web: web applications, HTTP, mobile web; Content Delivery: Server Farms and Web Proxies.	

Question paper pattern:

- The question paper will have ten questions.
- Each full question consists of 20 marks.
- There will be 2 full questions from each module.
- Each question will have questions covering all the topics under a module.
- The students will have to answer 5 full questions, selecting one full question from each module

Text Books:

1. "Computer Networks" by Andrew S Tanenbaum, David J Wetheral, 5th Edition, Pearson 2011
2. "Data and Computer Communications" by William Stallings , Above 7th Edition , 2004

Reference Books:

1. Behrouz A. Forouzan, Data Communications and Networking, Tata McGraw-Hill 5th Edition, 2017.
2. James F. Kurose and Keith W. Ross, Computer Networking- A Top-Down Approach featuring the Internet, 7th Edition, Pearson, 2016.

TEACHING METHODS

- Black Board –Microteaching Method
- Hands-On Sessions Based Teaching
- PowerPoint Presentation

ASSESSMENT METHODS

- Three Internals will be conducted for 30 Marks each and Weightage of 40%, 40% and 20% from 1st, 2nd and 3rd internals respectively will be taken.
- Evaluation for Learning Activity is based on Seminars/ Case Studies for 20 Marks.
- Final Examination will be conducted for 100 Marks and Evaluated for 50 Marks.

COURSE OUTCOMES: At End of the Course Student will Be Able to

CO1: Understand the various applications & Communication medias.

CO2: Compare various Error detection and Correction techniques, Understand Internet Control protocols and Internet transport protocols in computer network.

CO3: Comprehend different network layer functionalities. Compare various Routing and Congestion control algorithms.

CO4: Analyze the working of transport layer and application layer.

CO5: Understand the concept of packet tracer

CO-PO-PSO Mapping

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	3							1	1					3
CO2	3	2						1	1					3
CO3	3	2		2				1	1					3
CO4	2	2	2	2				1	1					3
CO5	2			2				1	1					3

Introduction to Data Science
[As per Choice Based Credit System (CBCS) scheme]
SEMESTER – II

Subject Code	22MCA2042E	CIE Marks	50
Number of Lecture Hours/Week	03	SEE Marks	50
Total Number of Lecture Hours	40	SEE Hours	03

CREDITS – 03

COURSE DESCRIPTION

- This course provides an insight of Data Science and the data analysis process

PREREQUISITES

- Students should know basics terminology of Data Science
- Students should know basics of DBMS and ML concepts.

COURSE OBJECTIVES:

- Understand Data Science process
- Be aware of the Exploratory data analysis techniques
- Understand ML algorithms and its applications.

COURSE CONTENTS

Modules	**Teaching Hours**
Module 1	**08 Hours**
Introduction: What is Data Science? Big Data and Data Science hype – and getting past the hype, why now? – Datafication, Current landscape of perspectives, Skill sets. Needed Statistical Inference: Populations and samples, Statistical modelling, probability distributions, fitting a model, - Introduction to R	
Module 2	**08 Hours**
Exploratory Data Analysis and the Data Science Process: Basic tools (plots, graphs and summary statistics) of EDA, Philosophy of EDA,The Data Science Process, Case Study: Real Direct (online real estate firm). Three Basic Machine Learning Algorithms: Linear Regression, k-Nearest Neighbours (kNN), k-means	
Module 3	**08 Hours**
One More Machine Learning Algorithm and Usage in Applications: Motivating application: Filtering Spam, Why Linear Regression and k-NN are poor choices for Filtering Spam, Naive Bayes and why it works for Filtering Spam, Data Wrangling: APIs and other tools for scrapping the Web	
Module 4	**08 Hours**
Feature Generation and Feature Selection (Extracting Meaning from Data): Motivating application: user (customer) retention. Feature Generation (brainstorming, role of domain expertise, and place for imagination), Feature Selection algorithms. Filters; Wrappers; Decision Trees; Random Forests. Recommendation Systems: Building a User-Facing Data Product, Algorithmic ingredients of a Recommendation Engine, Dimensionality Reduction, Singular Value Decomposition, Principal Component Analysis, Exercise: build your own recommendation system	
Module 5	**08 Hours**

Mining Social-Network Graphs: Social networks as graphs, Clustering of graphs, Direct discovery of communities in graphs, Partitioning of graphs, Neighborhood properties in graphs, Data Visualization: Basic principles, ideas and tools for data visualization. Data Science and Ethical Issues, Discussions on privacy, security, ethics, Next-generation data scientists	

Question paper pattern:

- The question paper will have ten questions.
- Each full question consists of 20 marks.
- There will be 2 full questions from each module.
- Each question will have questions covering all the topics under a module.
- The students will have to answer 5 full questions, selecting one full question from each module.

Text Books:

1. Doing Data Science Cathy O'Neil and Rachel Schutt, Straight Talk from The Frontline O'Reilly 2014
2. Mining of Massive DatasetsV2.1 Jure Leskovek, Anand Rajaraman and Jeffrey Ullman Cambridge University Press, 2nd Edition 2014
3. Data Mining: Concepts and Techniques Jiawei Han, Micheline Kamber and Jian Pei Morgan Kauffman, Third Edition, 2012

TEACHING METHODS

- PPTs
- Hands-On Sessions Based Teaching

ASSESSMENT METHODS

- Three Internals, 30 Marks each will be conducted and the weightage of 40%, 40% and 20% from 1st, 2nd, and 3rd internals will be taken.
- Evaluation of Programming Assignments for 20 Marks.
- Final Examination will be conducted for 100 Marks and Evaluated for 50 Marks.

Course Outcome (CO): At the end of this course, the students will be able to:

CO1: Understand and explain the underlying principles of Data Science

CO2: Understand the Exploratory Data Analysis and Data Science Process

CO3: Impart knowledge about Machine Learning Algorithms and its tools

CO4: Understand the adequate knowledge of feature generation and feature extraction methods

CO5: Understand the basics of Social Mining

CO-PO-PSO Mapping

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	3							1	1				3	
CO2	3							1	1				3	
CO3	3			2				1	1				3	
CO4	3			2				1	1				3	
CO5	3							1	1				3	

Fundamentals of Cryptography and Network Security
[As per Choice Based Credit System (CBCS) scheme]
SEMESTER – II

Subject Code	22MCA2043E	CIE Marks	50
Number of Lecture Hours/Week	03	SEE Marks	50
Total Number of Lecture Hours	40	SEE Hours	03

Credits – 03

COURSE DESCRIPTION

This course provides an in-depth knowledge of definitions of cryptography and network security, conventional cryptographic algorithms, block cipher cryptosystems, public cryptosystems, key management systems, authentication techniques to provide secure communication.

PREREQUISITES

- Students should have the knowledge of Computer Networks
- Students should have knowledge of Mathematics and Algorithm Concepts.

COURSE OBJECTIVES

- To Understand the basic concepts of cryptography and network security and classify attacks on a network.
- To Understand and analyze the different process for hiding the information with conventional cryptographic algorithms.
- To Understand various block cipher cryptosystems
- To Analyze public cryptosystems and key management Systems
- To Understand and apply authentication techniques to provide secure communication

COURSE CONTENTS

Modules	**Teaching Hours**
Module 1	**08 Hours**
Introduction: Service mechanisms and attacks, The OSI security architecture, A Model for Network Security. Symmetric Ciphers: Symmetric cipher model, substitution techniques.	
Module 2	**08 Hours**
Symmetric Ciphers: Transposition techniques, Steganography. Block Ciphers and DES: Simplified DES. Block cipher principles, DES, Strength of DES, Block cipher design principles.	
Module 3	**08 Hours**
Block cipher modes of operation. AES Cipher-Substitute Bytes Transformation, Shift Row Transformation, Mix Column Transformation, Add Round Key Transformation, AES key expansion.	
Module 4	**08 Hours**
Public key cryptography and RSA: Principles of public key cryptosystems, RSA algorithm. Other public key cryptosystems and key management: key management, Diffie-Hellman key exchange. Elliptic Curve Cryptography.	
Module 5	**08 Hours**
Network Security Applications: Authentication Applications: Kerberos, X.509 Authentication Service. Electronic Mail Security: PGP.	

Question paper pattern:

- The question paper will have ten questions.
- Each full question consists of 20 marks.
- There will be 2 full questions from each module.
- Each question will have questions covering all the topics under a module.
- The students will have to answer 5 full questions, selecting one full question from each module.

Text Books:

1. Cryptography and Network Security: William Stallings, Pearson Education, 2003
2. Behrouz A Forouzan, Debdeep Mukhopadhyay: Cryptography and Network Security, 2nd Edition, Special Indian edition, Tata McGraw-Hill, 2011.

Reference Books:

1. Network Security and Cryptography, Bernard Meneges, Cengage Learning
2. Cryptography and Network Security, Atul Kahate, TMH, 2003

TEACHING METHODS

- Black Board –Microteaching Method
- Hands-On Sessions Based Teaching
- PowerPoint Presentation

ASSESSMENT METHODS

- Three Internals will be conducted for 30 Marks each and Weightage of 40%, 40% and 20% from 1st, 2nd and 3rd internals respectively will be taken.
- Learning Activity will be based on Assignments/ Case Studies for 20 Marks.
- Final Examination will be conducted for 100 Marks and Evaluated for 50 Marks.

Course Outcome (CO): At the end of this course, the students will be able to:

CO1: Understand the basic concepts of cryptography and network security and classify attacks on a network, symmetric ciphers and substitution techniques.

CO2: Understand and Analyze the different process for hiding the information with Conventional cryptographic algorithms, transposition techniques and block ciphers.

CO3: Illustrate the various block cipher cryptosystems like DES and AES

CO4: Analyze public cryptosystems and key management Systems.

CO-PO-PSO Mapping

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	3							1	1				3	
CO2	3	3	2	2			1	1	1				3	
CO3		3		2			1	1	1	1			3	
CO4	3		2				1	1	1				3	

Cloud Computing [As per Choice Based Credit System (CBCS) scheme] SEMESTER – II			
Subject Code	22MCA2051E	CIE Marks	50
Number of Lecture Hours/Week	03	SEE Marks	50
Total Number of Lecture Hours	40	SEE Hours	03
Credits – 03			

COURSE DESCRIPTION

This course provides a method to delivery different types of computing services—including servers, storage, databases, networking, software, analytics, and intelligence—over the Internet ("the cloud") to offer faster innovation, flexible resources, and economies of scale

PREREQUISITES

- Students should know basics of architecture and programming in cloud services.
- Students should know the Knowledge of Agile Development

COURSE OBJECTIVES

- To explain cloud computing, virtualization and classify services of cloud computing
- To analyze the components of cloud computing and its business perspective.
- To Demonstrate different features of cloud platforms used in Industry
- To describe the platforms for development of cloud applications and List the application of cloud.

COURSE CONTENTS

Modules	**Teaching Hours**
Module 1	**08 Hours**
Introduction. Overview of Computing Paradigm - Recent trends in Computing - Grid Computing, Cluster Computing, Distributed Computing, Utility Computing, Cloud Computing - Evolution of cloud computing - Cloud Computing (NIST Model). High-performance computing, Introduction to GreenCloud.	
Module 2	**08 Hours**
Introduction to virtualization Definition, virtualization, Different approaches to virtualization. Hypervisors, Basics of VMWare, advantages of VMware virtualization, using VMware workstation, creating virtual machines-understanding virtual machines, create a new virtual machine on local host, cloning virtual machines, virtualize a physical machine, starting and stopping a virtual machine.	
Module 3	**08 Hours**
Infrastructure as a Service (IaaS). Introduction- IaaS, Machine Image, Virtual Machine(VM) - Resource Virtualization – Server, Storage, Network, Virtual Machine(resource) provisioning and manageability, storage as a service, Data storage in cloud computing (storage as a service) - Examples - Amazon EC2 - Renting, EC2 Compute Unit, Platform and Storage, pricing, customers – Eucalyptus	
Module 4	**08 Hours**
Platform as a Service (PaaS) & Software as a Service (SaaS) Introduction, Service Oriented Architecture (SOA) - Cloud Platform and Management – Computation, Storage – Examples - Google App Engine,	

Microsoft Azure, SalesForce.com, Force.complatform-Software as a Service (PaaS)-Introduction to SaaS-Webservices-Web2.0- WebOS-Case Study on SaaS.	
Module 5	**08 Hours**
Cloud Simulators- CloudSim and GreenCloud. Introduction to Simulator, understanding CloudSim simulator, CloudSim Architecture(User code, CloudSim, GridSim, SimJava) Understanding Working platform for CloudSim, Introduction to IoT cloud platforms like Open Shift, KaaS.	

Question paper pattern:

- The question paper will have ten questions.
- Each full question consists of 20 marks.
- There will be 2 full questions from each module.
- Each question will have questions covering all the topics under a module.
- The students will have to answer 5 full questions, selecting one full question from each module

Text Books:

1. Rajkumar Buyya, James Broberg, Andrzej M. Goscinski, Cloud Computing: Principles and Paradigms, Wiley, 2011.
2. Ronald L.Krutz, Russell Dean Vines, Cloud Security: A Comprehensive Guide to Secure Cloud Computing, Wiley- India, 2010.

Reference Books:

1. Rajkumar Buyya, Christian Vecchiola, S. Thamarai Selvi, Mastering Cloud Computing, Mc Graw Hill Education, 2013.
2. Nikos Antonopoulos, Lee Gillam, Cloud Computing: Principles, Systems and Applications, Springer, 2012.
3. Barrie Sosinsky, Cloud Computing Bible, Wiley-India, 2010.

TEACHING METHODS

- Black Board –Microteaching Method
- Hands-On Sessions Based Teaching
- PowerPoint Presentation

ASSESSMENT METHODS

- Three Internals will be conducted for 30 Marks each and Weightage of 40%, 40% and 20% from 1st, 2nd and 3rd internals respectively will be taken.
- Evaluation for Learning Activity based on Case Studies for 20 Marks.
- Final Examination will be conducted for 100 Marks and Evaluated for 50 Marks.

Course Outcome (CO): At the end of this course, the students will be able to:

CO1: Understand the cloud computing delivery model and the enabling technologies.

CO2: Explain and cloud computing platforms, key technology drivers and cloud programming/software environments

CO3: Identify the need for cloud computing model and compare various key enabling Technologies.

CO4: Analyze and choose an appropriate programming environment for building cloud Applications

CO-PO-PSO Mapping

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	3							1	1					3
CO2	3							1	1					3
CO3	3							1	1					3
CO4	2	2	2	2				1	1					3

Artificial Intelligence & Expert Systems [As per Choice Based Credit System (CBCS) scheme] **SEMESTER – II**			
Subject Code	22MCA2052E	CIE Marks	50
Number of Lecture Hours/Week	03	SEE Marks	50
Total Number of Lecture Hours	40	SEE Hours	03
Credits – 03			

COURSE DESCRIPTION

This course provides an understanding of Artificial Intelligence Systems, and its Applications. The course also provides the knowledge of Knowledge representation, Problems, Logic, Statistical Reasoning, Symbolic Reasoning and Expert Systems for the development of AI Systems.

PREREQUISITES

- Students should know basics of Mathematical Structures, basics of Statistics and basic models.
- Students should know theoretical concepts of application development.

COURSE OBJECTIVES

- To understand the fundamentals of Artificial Intelligence systems.
- To design AI applications using Algorithms and Intelligent Systems.
- To understand the logic, reasoning and theories of AI & Expert Systems.

COURSE CONTENTS

Modules	**Teaching Hours**
Module 1	**08 Hours**
What is Artificial Intelligence: The AI Problems, The Underlyingassumption, AI Technique, The Level of the model, Criteria for Success **Problems, problem spaces, and search**: Defining, the problem as a statespace search, Production systems, Problem characteristics, Production system characteristics, Issues in the design of search programs, Additional Problems.	
Module 2	**12 Hours**
Knowledge representation issues: Representations and mappings, Approaches to knowledge representation, Issues in knowledge representation, The frame problem. **Inference** – Backward chaining, forward chaining, Rule value approach, Fuzzy reasoning. **Using predicate logic**: Representing simple facts in logic, representing instance and ISA relationships, Computable functions and predicates, Resolution, Natural Deduction.	
Module 3	**08 Hours**
Expert Systems: Expert Systems – Architecture of Expert Systems, Roles of Expert Systems – Knowledge Acquisition – Meta Knowledge, Heuristics. Typical Expert Systems – MYCIN, DART, XCON, Expert Systems Shells.	
Module 4	**12 Hours**
Learning in Neural Networks: Fundamentals of neural networks – model of an artificial neuron – neural network architectures – Learning methods – Taxonomy of Neural network architectures – Standard back propagation algorithms – selection of various parameters – variations Applications of back propagation algorithms.	

Question paper pattern:

- The question paper will have ten questions.
- Each full question consists of 20 marks.
- There will be 2 full questions from each module.
- Each question will have questions covering all the topics under a module.
- The students will have to answer 5 full questions, selecting one full question from each module

Text Books:

1. Elaine Rich, Kevin Knight, Shivashankar B Nair: Artificial Intelligence, Tata McGraw Hill 3rd edition. 2013.
2. Dan W. Patterson, “Introduction to AI and ES”, Pearson Education, 2007.

Reference Books:

1. Nils J. Nilsson: “Principles of Artificial Intelligence”, Elsevier, ISBN-13:9780934613101.
2. Stuart Russel, Peter Norvig: Artificial Intelligence A Modern Approach, Pearson 3rd edition 2013.
3. Peter Jackson, “Introduction to Expert Systems”, 3rd Edition, Pearson Education, 2007.
4. http://nptel.ac.in (Web Reference)

TEACHING METHODS

- ICT based Teaching Learning Methods.
- Presentation Methods.
- Self-Learning by assigned activities.

ASSESSMENT METHODS

- Three Internals will be conducted for 30 Marks each and Weightage of 40%, 40% and 20% from 1st, 2nd and 3rd internals respectively will be taken.
- Learning Activity will be based on Case study for 20 Marks.
- Final Examination will be conducted for 100 Marks and Evaluated for 50 Marks.

Course Outcome (CO): At the end of this course, the students will be able to:

CO1: Identify problems that are amenable to solution by AI methods.

CO2: Identify Issues and Approaches for Knowledge representation.

CO3: Applying the Principles of Probabilistic methods for solving AI Problems.

CO4: Using Expert Systems for Knowledge Representation and Heuristics.

CO5: Apply Learning Methods to Solve AI Problems.

CO-PO-PSO Mapping

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	3							1	1				3	
CO2	3							1	1				3	
CO3		2		2			1	1	1	1		1	3	
CO4		2		2			1	1	1	1	1	1	3	
CO5		2		2			1	1	1	1	1	1	3	

Cyber Security
[As per Choice Based Credit System (CBCS) scheme]
SEMESTER – II

Subject Code	20MCA2053E	CIE Marks	50
Number of Lecture Hours/Week	03	SEE Marks	50
Total Number of Lecture Hours	40	SEE Hours	03

CREDITS – 03

COURSE DESCRIPTION

Cyber security is the practice of protecting networks, computer systems, and data from malicious attacks. This course helps students develop a deeper understanding of modern information and cyber security challenges, mitigation techniques and tools.

PREREQUISITES

- Basics of computer networks
- Basic unix/linux commands

COURSE OBJECTIVES

- The courses presents the basic cyber security concepts and security tools used.
- Students will learn how to defend against cyber threats and attacks and study existing techniques for managing security issues and maintaining the working environment.

COURSE CONTENTS

Modules	Teaching Hours
Module 1	**08 Hours**
Introduction to Cybercrime and Laws Introduction, Cybercrime: Definition and Origins of the word, Cybercrime and information Security, Who are Cybercriminals? Classifications of Cybercrimes. How Criminals Plan Them – Introduction, How Criminals Plan the Attacks, Cybercafé and Cybercrimes, Botnets, Attack Vector, The Indian IT ACT 2000 and amendments.	
Module 2	**08 Hours**
Tools and Methods used in Cybercrime Introduction, Proxy Server and Anonymizers, Password Cracking, Key loggers and Spyware, Virus and Warms, Trojan and backdoors, Steganography, DOS and DDOS attack, SQL injection, Buffer Overflow.	
Module 3	**08 Hours**
Systems Vulnerability Scanning Overview, Open Port/Service Identification, Banner/Version Check, Traffic Probe, Vulnerability Probe, Vulnerability Examples, OpenVAS, Metasploit. File System Monitoring: File System Metadata	
Module 4	**08 Hours**
Command-Line Environments: Unix Command Lines, Windows Power Shell Netcat: Net Cat Commands, Net Cat Uses, Port Forwarding and Redirection: SSH, Data Pipe, Fpipe, Network Reconnaissance – Nmap, Network Snifers and Injectors: Tcpdump and winDump	
Module 5	**08 Hours**
Network Defense tools Firewalls and Packet Filters: Firewall Basics, Packet Filter Vs Firewall, How a Firewall Protects a Network, Packet Characteristic to Filter, Stateless Vs	

Stateful Firewalls, Network Address Translation (NAT) and Port Forwarding, the basic of Virtual Private Networks, Linux Firewall, Windows Firewall, Snort: Intrusion Detection System,	

Question paper pattern:

- The question paper will have ten questions.
- Each full question consists of 20 marks.
- There will be 2 full questions from each module.
- Each question will have questions covering all the topics under a module.
- The students will have to answer 5 full questions, selecting one full question from each module.

Text Book:

1. Mike Shema, "Anti-Hacker Tool Kit (Indian Edition)", McGraw Hill Education.
2. Nina Godbole, Sunit Belpure, "Cyber Security: Understanding Cyber Crimes, Computer Forensics and Legal Perspectives", Publication Wiley.

Reference Books:

1. Marjie T. Britz, "Computer Forensics and Cyber Crime: An Introduction", Pearson.
2. Chwan-Hwa Wu and J. David Irwin, "Introduction to Computer Networks and Cyber security", CRC Press.
3. Amelia Phillips, Bill Nelson, Christopher Steuart, "Guide to Computer Forensics and Investigations", Cengage Learning.

TEACHING METHODS

- PPTs
- Black Board

ASSESSMENT METHODS

- Three Internals will be conducted for 30 Marks each and Weightage of 40%, 40% and 20% from 1st, 2nd and 3rd internals respectively will be taken.
- Evaluation for Learning Activity is based on Quiz/ Case studies/ Seminars for 20 Marks.
- Final Examination will be conducted for 100 Marks and Evaluated for 50 Marks.

Course Outcome (CO): At the end of this course, the students will be able to:

CO1: Know the source of information on cyber-crimes.

CO2: Describe Information Technology act and Related Legislation.

CO3: Describe typical threats to modern digital systems, and to outline techniques of defense against each threat

CO4: Learn the vulnerability exploits.

CO5: Learn the usage of tools for everything from improving command-line skills to testing the security of operating systems, networks, and applications.

CO-PO-PSO Mapping

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	3								1				3	
CO2	3						1	1	1				3	
CO3	3						1	1	1				3	
CO4	3			2			1	1	1				3	
CO5	3			3			1	1	3				3	

IOT System Design and Development
[As per Choice Based Credit System (CBCS) scheme]
SEMESTER –II

Subject Code	22MCA2061E	CIE Marks	50
Number of Lecture Hours/Week	03	SEE Marks	50
Total Number of Lecture Hours	40	SEE Hours	03

Credits – 03

COURSE DESCRIPTION

This Course focuses on IoT concepts such as sensing, actuation and communication. It covers the development of Internet of Things (IoT) prototypes—including devices for sensing, actuation, processing, and communication—to help you develop skills and experiences. .

PREREQUISITES

- Basic knowledge of C or C++ or any programming language or programming fundamentals. Familiarity with command-line interface.
- Basic knowledge of Operating system concepts.

COURSE OBJECTIVES

- After the completion of the course, the students will be able design some IOT based prototypes

COURSE CONTENTS

Modules	Teaching Hours
Module 1	**08 Hours**
Introduction to IOT IOT Architecture and protocols, Real time Examples of IoT, Microprocessor, Types of Processors, Architecture Types. CISC & RISC. Sensors & Actuators.	
Module 2	**08 Hours**
Hardware componenets of IoT Microcontroller, Simulators, Emulators, Choosing Microcontroller, Analog and Digital Sensors, Interfacing of Temperature, Humidity and Motion Sensor with Arduino. Interfacing of Relay Switch and Servo Motor with Arduino	
Module 3	**08 Hours**
INTRODUCTION TO RTOS: Introduction to Operating System: Computer Hardware Organization, BIOS and Boot Process, Multi-threading concepts, Processes, Threads and Scheduling.	
Module 4	**08 Hours**
Working with Arduino Arduino Uno Architecture, Setup the IDE, Writing Arduino Software Arduino Libraries, Basics of Embedded C programming for Arduino Interfacing LED, push button and buzzer with Arduino, Interfacing Arduino with LCD	
Module 5	**08 Hours**
Cloud Platforms for IOT Virtualization concepts and Cloud Architecture, Cloud computing, benefits Cloud services -- SaaS, PaaS, IaaS, Cloud providers & offerings, Study of IOT Cloud platforms, ThingSpeak API and MQTT, Interfacing ESP8266 with Web services	

Question paper pattern:

- The question paper will have ten questions.
- Each full question consists of 20 marks.
- There will be 2 full questions from each module.
- Each question will have questions covering all the topics under a module.
- The students will have to answer 5 full questions, selecting one full question from each module

Text Books

1. Internet of Things - A Hands-on Approach, Arshdeep Bahga and Vijay Madisetti, Universities Press, 2015, ISBN: 9788173719547
2. Getting Started with Raspberry Pi, Matt Richardson & Shawn Wallace, O'Reilly (SPD), 2014, ISBN: 9789350239759
3. Raspberry Pi Cookbook, Software and Hardware Problems and solutions, Simon Monk, O'Reilly (SPD), 2016, ISBN 7989352133895

Reference Books:

1. Peter Waher, 'Learning Internet of Things', Packt Publishing, 2015 3. Editors Ovidiu Vermesan
2. Peter Friess,'Internet of Things – From Research and Innovation to Market Deployment',
3. River Publishers, 2014
4. N. Ida, Sensors, Actuators and Their Interfaces, SciTech Publishers, 2014.

TEACHING METHODS

- PPTs
- Hands-On Sessions Based Teaching

ASSESSMENT METHODS

- Three Internals will be conducted for 30 Marks each and Weightage of 40%, 40% and 20% from 1st, 2nd and 3rd internals respectively will be taken.
- Evaluation for Learning Activity based on Case Studies/ Seminars for 20 Marks.
- Final Examination will be conducted for 100 Marks and Evaluated for 50 Marks.

Course Outcome (CO): At the end of this course, the students will be able to:

CO1: Understanding of IoT value chain structure (device, data cloud), application areas and technologies involved.

CO2: Understand IoT sensors and technological challenges faced by IoT devices, with a focus on wireless, energy, power, and sensing modules

CO3: Market forecast for IoT devices with a focus on sensors

CO4: Understanding the implementation of web-based services on IoT devices

CO-PO-PSO Mapping

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	3							1	1				3	
CO2	3							1	1				3	
CO3	2	2	1	3				1	1				3	
CO4	3	2	2	3				1	1				3	

Machine Learning [As per Choice Based Credit System (CBCS) scheme] **SEMESTER – II**			
Subject Code	22MCA2062E	CIE Marks	50
Number of Lecture Hours/Week	03	SEE Marks	50
Total Number of Lecture Hours	40	SEE Hours	03
Credits – 03			

COURSE DESCRIPTION

This course provides an understanding of various algorithms of Machine Learning models. The course also provides how models are evaluated and selected.

PREREQUISITES

- Students should know basics of Statistics and Mathematical Models.
- Students should know programming in Python or R

COURSE OBJECTIVES

- To understand the fundamentals of learning for data
- To understand predictive and classification model.
- To learn how to assess quality of model, model bias and variance and select appropriate right model for the use case.
- To learn how to combine two or more models to improve prediction

COURSE CONTENTS

Modules	**Teaching Hours**
Module 1	**08 Hours**
Introduction: Well posed learning problems, Designing a Learning system, Perspective and Issues in Machine Learning. Supervised and Unsupervised Learning **Concept Learning:** Concept learning task, Concept learning as search, Find-S algorithm, Version space and Candidate Elimination algorithm, Inductive Bias. **Data Types**: Nominal, Ordinal, Interval, Ratio	
Module 2	**08 Hours**
Regressions: Linear regression models and least squares, Multiple regression, Multiple outputs, Subset selection, Ridge regression, Linear Discriminant Analysis, Logistic regression	
Module 3	**08 Hours**
Classification Models: Decision tree representation, Appropriate problems for decision tree learning, Basic decision tree learning algorithm, hypothesis space search in decision tree learning, Inductive bias in decision tree learning, Issues in decision tree learning, **Random forests,** Association rules **Bayesian Learning:** Introduction, Bayes theorem, Bayes theorem and concept learning, ML and LS error hypothesis, Naive Bayes classifier, \	
Module 4	**08 Hours**
Model Assessment and Selection: Bias, Variance, and model complexity, Bias-variance trade off, Optimism of the training error rate, Estimate of In-sample prediction error, Effective number of parameters, Bayesian approach and BIC, Cross- validation, Boot strap methods.	
Module 5	**08 Hours**
Additive Models, Trees, and Boosting: Generalized additive models, Regression and classification trees, Boosting methods-exponential loss and	

Ada-Boost, Numerical Optimization via gradient boosting, Examples (California housing, New Zealand fish, Demographic data)	

Question paper pattern:

- The question paper will have ten questions.
- Each full question consists of 20 marks.
- There will be 2 full questions from each module.
- Each question will have questions covering all the topics under a module.
- The students will have to answer 5 full questions, selecting one full question from each module

Text Books:

1. Tom M. Mitchell, “Machine Learning”, McGraw-Hill Education (INDIAN EDITION), 2013.

2. Trevor Hastie, Robert Tibshirani, Jerome Friedman, “The Elements of Statistical Learning- Data Mining, Inference, and Prediction”, Second Edition , Springer Verlag, 2009.

Reference Books:

1. EthemAlpaydin, “Introduction to Machine Learning”, 2nd Ed., PHI Learning Pvt. Ltd., 2013.
2. T. Hastie, R. Tibshirani, J. H. Friedman, “The Elements of Statistical Learning”, Springer; 1st edition, 2001.
3. C.M. Bishop, “Pattern Recognition and Machine Learning”, Springer, 2011
4. L.Wasserman, “All of Statistics: A Concise Course in Statistical Inference”, Springer

TEACHING METHODS

- ICT based Teaching Learning Methods.
- Presentation Methods.
- Self-Learning by assigned activities.

ASSESSMENT METHODS

- Three Internals, 30 Marks each will be conducted. 40% each of first two internals and 20% of third internals will be consolidated out of 30 marks.
- Case study is considered as a part of Learning Activity for 20 Marks.
- Final Examination will be conducted for 100 Marks and Evaluated for 50 Marks.

Course Outcome (CO): At the end of this course, the students will be able to:

CO1: Choose the learning techniques and investigate concept learning

CO2: Learn how to predict using regression techniques

CO3: Identify the concepts of decision trees and solve problems associated with it

CO4: Select and Evaluate the predictive performance of all kinds of models

CO5: Learn how to generalize and combine models.

CO-PO-PSO Mapping

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	3							1	1				3	
CO2	2			2			1	1	1	1			3	
CO3		2	1	2			1	1	1	1			3	
CO4		2	1	2			1	1	1	1			3	
CO5		2	1	2	2		1	1	1	1			3	

Mobile and Digital Forensics [As per Choice Based Credit System (CBCS) scheme] SEMESTER –II			
Subject Code	22MCA2063E	CIE Marks	50
Number of Lecture Hours/Week	03	SEE Marks	50
Total Number of Lecture Hours	42	SEE Hours	03
Credits – 03			

COURSE DESCRIPTION

This course helps to understand the processes involved in mobile and digital forensics.
And to Understand the Basics of wireless technologies and security

PREREQUISITES

- Knowledge of Computer Networks and information security

COURSE OBJECTIVES

- Understand the Basics of wireless technologies and security
- Become Knowledgeable in mobile phone forensics and Android Forensics
- Learn the methods of investigation using Digital Forensic techniques

COURSE CONTENTS

Modules	Teaching Hours
Module 1	**8 Hours**
Introduction to Wireless Technologies Overview of wireless technologies and security: Personal Area Networks, Wireless Local Area Networks, Metropolitan Area Networks, Wide Area Networks. Wireless threats, vulnerabilities and security: Wireless LANs, War Driving, War Chalking, War Flying, Common Wi-Fi security recommendations, PDA Security, Cell Phones and Security, Wireless DoS attacks, GPS Jamming, Identity theft.	
Module 2	**10 Hours**
Security Framework for Mobile Systems CIA triad in mobile Phones-Voice, SMS and Identification data interception in GSM: Introduction, practical setup and tools, implementation- Software and Hardware Mobile phone tricks: Netmonitor, GSM network service codes, mobile phone codes, catalog tricks and AT command set- SMS security issues.	
Module 3	**8 Hours**
Mobile Phone Forensics Crime and mobile phones, evidences, forensic procedures, files present in SIM card, device data, external memory dump, evidences in memory card, operators systems- Android forensics: Procedures for handling an android device, imaging android USB mass storage devices, logical and physical techniques.	
Module 4	**8 Hours**
Introduction to Digital Forensics Digital forensics: Introduction – Evidential potential of digital devices: closed vs. open systems, evaluating digital evidence potential- Device handling: seizure issues, device identification, networked devices and contamination.	
Module 5	**10 Hours**
Analysis of Digital Forensic Techniques	

Digital forensics examination principles: Previewing, imaging, continuity, hashing and evidence locations- Seven element security model- developmental model of digital systems- audit and logs- Evidence interpretation: Data content and context.	

Question paper pattern:

- The question paper will have ten questions.
- Each full question consists of 20 marks.
- There will be 2 full questions from each module.
- Each question will have questions covering all the topics under a module.

The students will have to answer 5 full questions, selecting one full question from each module

Text Books

1. Iosif I. Androulidakis, "Mobile phone security and forensics: A practical approach", Springer publications, 2012.
2. Andrew Hoog, "Android Forensics: Investigation, Analysis and Mobile Security for Google Android", Elsevier publications, 2011.

Reference Books:

1. Angus M. Marshall, "Digital forensics: Digital evidence in criminal investigation", John – Wiley and Sons, 2008
2. Gregory Kipper, "Wireless Crime and Forensic Investigation", Auerbach Publications.

TEACHING METHODS

- PPTs
- Hands-On Sessions Based Teaching
- Arduino IDE

ASSESSMENT METHODS

- Three Internals will be conducted for 30 Marks each and Weightage of 40%, 40% and 20% from 1st, 2nd and 3rd internals respectively will be taken.
- Rubrics for the Evaluation of Case studies for 20 Marks.

Final Examination will be conducted for 100 Marks and Evaluated for 50 Marks..

Course Outcome (CO): At the end of this course, the students will be able to:

CO1: Ability to understand the processes involved in mobile and digital forensics.

CO2: Acquiring skills to analyse mobile and digital forensics techniques.

CO3: Understanding the implementation of web-based services on Forensic devices

CO-PO-PSO Mapping

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO1	2	1	2										3	2	
CO2	2	2	1										3	2	
CO3	2	2	1										3	2	
CO4	2	2	2	1									3	2	
CO5	2	2	2	1									3	2	

Python Programming Laboratory [As per Choice Based Credit System (CBCS) scheme] **SEMESTER –II**			
Subject Code	22MCA207L	CIE Marks	50
Number of Hours/ Week	02 Hrs Laboratory	SEE Marks	50
		SEE Hours	03
CREDITS – 01			

COURSE DESCRIPTION

This course is intended to provide students with the skills required to understand the basic working of Python Programming. It demonstrates the Real-time Object-oriented programming concepts with respect to handling database and Data Frames with panda's library.

PREREQUISITES

- Students should know basics of Programming.
- Students should know C, C++, and Java Programming Concepts.

Course Objectives:

- To be able to introduce core programming basics and program design with functions using Python programming language.
- To understand a range of Object-Oriented Programming, as well as in-depth data and information processing techniques.

PART A - Laboratory Experiments

1	a. Implement a python program to search an element using linear search. b. Implement a python program to search an element using binary search.
2	a. Implement a python program to insert an element into a sorted list. b. Implement a python program to simulate stack.
3	Write a python program using object-oriented programming to demonstrate a. encapsulation b. overloading c. inheritance.
4	a. Implement a Python Program for file operations. b. Implement a python program to demonstrate data wrangling functions.
5	a. Implement a python program to Importing Datasets and demonstrate the basic operations on them w.r.t Pandas. b. Implement a Python program to demonstrate the working of DataFrames using Pandas.
6	a. Implement a python program to demonstrate the following using NumPy: a) Array manipulation, Searching, Sorting and splitting. b. Broadcasting and Plotting NumPy arrays using matplotlib library.

PART B - MINI PROJECT

Develop a mini project using the python programming using the concepts learning during the theory class.

Note:

1. *In the examination each student should pick one program from Part-A,*
2. *A team of two or three students must develop the mini project. However during the examination, each student must demonstrate the project individually.*
3. *The team must submit a brief project report (15-20 pages)*

ASSESSMENT METHODS	
Experiment Write up + Execution + Viva	20
Lab Record Writing	10
Lab Internals Test	10
Mini Project	10
Total	50

Final Exam will be conducted for 50 marks (SEE)

Course Outcome (CO): At the end of this course, the students will be able to:

CO1: Develop python program to perform search/sort on a given data set.
CO2: Demonstrate object-oriented Programming, File handling and exception handling in Python.
CO3: Demonstrate Data Cleaning and Data Manipulation using Numpy and Pandas.
CO4: Demonstrate data visualization using Numpy
CO5: Perform array broadcasting using Numpy.

CO-PO-PSO Mapping

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	2	1	2						1				3	
CO2	2	2	1						1				3	
CO3	2	2	1						1				3	
CO4	2	2	2	1					1				3	
CO5	2	2	2	1					1				3	

Web Programming Laboratory
[As per Choice Based Credit System (CBCS) scheme]
SEMESTER – II

Subject Code	20MCA208L	CIE Marks	50
Number of Hours/Week	02 Hrs. Laboratory	SEE Marks	50
		SEE Hours	03

CREDITS – 01

1	Write a HTML Page to create a Student registration form that collects various student information such as first name, last name, Roll No., email id, mobile number, etc and a two buttons: submit and reset. Apply different CSS properties
2	a. Develop and demonstrate a XHTML file that includes JavaScript script for the following problems: i) Accept a number n obtained using prompt and display the first n Fibonacci numbers using alert ii) Accept a number n obtained using prompt, and display a table of numbers from 1 to n and their squares using alert() b. Develop and demonstrate using JavaScript, a XHTML document that displays random numbers (integers).
3	Write a JavaScript program to generate n number of random numbers and store them in an array. Sort the generated numbers in ascending order using array sort method. Develop separate functions to find mean and median of numbers that are in the array. Display the results with appropriate messages.
4	a. Develop and demonstrate, using JavaScript script, a XHTML document that collects the USN (the valid format is: A digit from 1 to 4 followed by two uppercase characters followed by two digits followed by two uppercase characters followed by three digits; No embedded spaces allowed) of the user. Event handler must be included for the Form element that collects this information to validate the input. Messages in the alert windows must be produced when errors are detected. b. Modify the above program to get the current semester also (restricted to be a number from 1 to 6).
5	Develop using JavaScript script, an XHTML document that use of onload and onfocus events.
6	a. Design an XML document to store information about a student in an engineering college affiliated to VTU. The information must include USN, Name, Name of the College, Brach, Year of Joining, and e-mail id. Make up sample data for 3 students. Create a CSS style sheet and use it to display the document. b. Create an XSLT style sheet for one student element of the above document and use it to create a display of that element.
7	a. Create XHTML forms with Name, address line1, address line2 and email text fields. On submitting, store the values in MySQL table. Retrieve and display the data based on name. b. Implement a PHP program to read student data from an XML file and store into the MySQL database. Retrieve and display using SEARCH function.
8	Implement the following web applications using AngularJS: A simple calculator web application that takes two numbers and an operator (+, -, /, * and %) from an HTML page and returns the result page with the operation performed on the operands
9	Implement the following web applications using AngularJS: A user validation web application, where the user submits the login name and password to the server. The name

	and password are checked if the data matches, a successful login page is returned. Otherwise a failure message is shown to the user.
10	Implement the following web applications using PHP: A user validation web application, where the user submits the login name and password to the server. The name and password are checked against the data already available in Database and if the data matches, a successful login page is returned. Otherwise a failure message is shown to the user.

ASSESSMENT METHODS

Experiment Write up + Execution + Viva	20
Lab Record Writing	10
Lab Internals Test	10
Mini Project	10
Total	50

- Final Exam will be conducted for 50 marks (SEE)

Course Outcome (CO): At the end of this course, the students will be able to:

CO1: Use HTML and CSS to design web pages.
CO2: Infer the role of XML in web applications and use them.
CO3: Apply the concepts of JavaScript to perform client side validation and create dynamic web pages.
CO4: Create server side applications using PHP.
CO5: Create web application using AngularJS.

CO-PO-PSO Mapping

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	2	1	2					1	1				3	
CO2	2	2	1					1	1				3	
CO3	2	2	1					1	1				3	
CO4	2	2	2	2				1	1				3	
CO5	2	2	2	2				1	1				3	

Mobile Application in Android Laboratory [As per Choice Based Credit System (CBCS) scheme] SEMESTER – II			
Subject Code	20MCA209L	CIE Marks	50
Number of Hours/Week	02 Hrs Laboratory	SEE Marks	50
		SEE Hours	03
CREDITS – 01			

COURSE DESCRIPTION

Covers introductory mobile application development for the Android and iOS Operating System using XML, C, C++, and Java. Includes developing simple applications that could run on Android and Apple phones and tablets. Covers Android and iOS application development phases, terminologies, application design, and coding.

PREREQUISITES

- Students should know basics of XML.
- Students should know C, C++, and Java Programming Concepts.

COURSE OBJECTIVES

Mobile Application Development course is designed to quickly get you up to speed with writing apps for Android and iOS devices. The student will learn the basics of Android and Flutter Frameworks and get to understand the application lifecycle.

Part-A

Sl. No.	Laboratory Experiments
1	Develop a mobile application to display user profile with 3 UI activities using intents.
2	Design an application that contains Phone Contacts in vertical linear manner. Selected contact appears at the top of the list with a large italicized font and a blue background
3	Create an application that uses Layout Managers and Event Listeners
4	Develop a mobile application to list the tourist places of Karnataka using List View.
5	Develop a mobile application to register a form in first activity and display the registered information in second activity using intents.
6	Develop a standard calculator application to perform basic calculations like addition, subtraction, multiplication and division
7	Devise an application that draws basic graphical primitives (rectangle, circle) on the screen
8	Build an mobile application that create, save, update and delete data in a database
9	Devise an application that implements Multi-threading
10	Develop a mobile application that uses GPS location information
11	Create an application that writes data to the SD card.
12	Implement an application that creates an alert upon receiving a message.
13	Devise a mobile application that creates alarm clock

Part-B

Develop a Mini Project on Flutter Framework

Note:

1. *In the examination each student should pick one program from Part-A,*
2. *A team of two or three students must develop the mini project. However during the examination, each student must demonstrate the project individually.*
3. *The team must submit a brief project report (15-20 pages)*

ASSESSMENT METHODS	
Experiment Write up + Execution + Viva	20
Lab Record Writing	10
Lab Internals Test	10
Mini Project	10
Total	50

Final Exam will be conducted for 50 marks (SEE)

Course Outcome (CO): At the end of this course, the students will be able to:

CO1: Illustrate effective user interfaces that leverage evolving mobile device capabilities.
CO2: Develop applications using software development kits (SDKs), frameworks and toolkits.
CO3: Establish various methods to integrate database and server-side technologies.
CO4: Design and develop open source software based mobile applications.
CO5: Build and deploy competent mobile development solutions.

CO-PO-PSO Mapping

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	2	1	2	1			1	1	1				3	
CO2	2	2	1				1	1	1				3	
CO3	2	2	1				1	1	1				3	
CO4	2	2	2	2			1	1	1				3	
CO5	2	2	2	2			1	1	1				3	

Technical Seminar [As per Choice Based Credit System (CBCS) scheme] SEMESTER – II			
Subject Code	22MCA210S	CIE Marks	50
Number of Hours/Week	02 Hrs	SEE Marks	50
		SEE Hours	03
CREDITS – 01			

Course outcomes:

CO 1: The students will be able to recall existing technologies in the area of computer science.
CO 2: The students will be able to describe, compare and evaluate different technologies.
CO 3: The students will be able to decide the area of interest
CO 4: The students will be able to develop their communication skills.
CO 5: The students will be able to write technical reports.

General Guidelines

- Students should present the seminar on cutting edge/emerging/state of the art technologies in the field of Computer Science and Applications.
- Duration of the seminar should be approximately 45 minutes.
- Student should submit the write up on seminar topic containing at least 10 pages

Report format:

1. **Cover Page**
2. **Acknowledgement**
3. **Abstract**

Table of Contents:

Sl. No	Description	Page No.
1.	Introduction	
2.	Literature Survey	
3	Topic Specific Description	
4	Conclusions	
5	Bibliography	

Guidelines for Report Writing:

1) Put page borders
2) Main Heading font size 17pt (Times New Roman)
3) Subheading : font size 14pt (Times New Roman)
4) Text: font size 12pt (Times New Roman)
5) Figures should have Fig numbers at the bottom of the figure e.g. Fig 3.2 is second figure in 3rd chapter
6) Tables should have table numbers at the top example Table 5.1 i.e, 1st table in 5th chapter
7) Paragraph spacing 1.5

CO-PO-PSO Mapping

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	3						1	2	1	1		2		3
CO2	3						1	2	1	1		1		3
CO3	3						1	2	1	2				3
CO4							1	2	1	2				3
CO5							1	2	1			1		3

Programming Using C# and .NET [As per Choice Based Credit System (CBCS) scheme] SEMESTER –III			
Subject Code	22MCA301	CIE Marks	50
Number of Lecture Hours/Week	04	SEE Marks	50
Total Number of Lecture Hours	50	SEE Hours	03
Credits – 04			

COURSE DESCRIPTION

This course is an introduction to computer programming for Windows. Emphasis will be on the fundamentals of structured design, development and implementation, including C# programming language syntax, data and file structures, input/output devices, files, and databases

PREREQUISITES

- Basic knowledge of C or C++ or any programming language or programming fundamentals. Familiarity with command-line interface.
- The OOP concept makes for a short learning curve of C#

COURSE OBJECTIVES

- Recognize, diagram, and implement introductory programming concepts using C#
- Determine logical alternatives with C# decision structures utilizing iteration, class methods, fields, and properties.
- Assemble forms, classes, and controls into C# solutions utilizing arrays and file/database access methods

COURSE CONTENTS

Modules	Teaching Hours
Module 1	**10 Hours**
Introducing C#: Creating a Simple C# Console Application, Identifiers and Keywords. System Data Types, Variables and Constants: Value Types, Reference Types, Understanding Type Conversions, Boxing and UnBoxing. Namespaces, The System namespace, .NET Array Types	
Module 2	**10 Hours**
Classes, Objects and Object Oriented Programming: Classes and Objects: Creating a Class, Creating an Object, Using this Keyword, Creating an Array of Objects, Using the Nested Classes, Defining Partial Classes and Method, Returning a Value from a Method and Describing Access Modifiers. Static Classes and Static Members, Properties: Read-only Property, Static Property, Indexers, Structs: Syntax of a struct and Access Modifiers for structs, System.Object Class. **Encapsulation:** Encapsulation using accessors and mutators, Encapsulation using Properties. Inheritance: Inheritance and Constructors, Sealed Classes and Sealed Methods, Extension methods. **Polymorphism:** Compile time Polymorphism/ Overloading, Runtime Polymorphism/ Overriding. Abstraction: Abstract classes, Abstract methods. Interfaces: Syntax of Interfaces, Implementation of Interfaces and Inheritance.	
Module 3	**10 Hours**
Delegates, Events, Exception Handling and ADO.NET **Delegates:** Creating and using Delegates, Muticasting with Delegates. Events: Event Sources, Event Handlers, Events and Delegates, Multiple Event Handlers.	

Exception Handling: The try/catch/throw/finally statement, Custom Exception. System.Exception, Handling Multiple Exception **Data Access with ADO.NET:** Understanding ADO.NET: Describing the Architecture of ADO.NET, ADO.NET,ADO.NET Entity Framework. Creating Connection Strings: Syntax for Connection Strings. Creating a Connection to a Database: SQL Server Database. Working with Data Adapters: Creating DataSet from DataAdapter.	
Module 4	**10 Hours**
Graphical User Interface with Windows Forms and WPF **Windows Forms:** Introduction, Windows Forms, Event Handling: A Simple Event- Driven GUI, Control Properties and Layout, Labels, Text Boxes and Buttons, Group Boxes and Panels, Check Boxes and Radio Buttons, ToolTips, Mouse-Event Handling, Keyboard-Event Handling. Menus, Month Calendar Control, Link Label Control, List Box Control, Combo Box Control, Tree View Control, List View Control, Tab Control and Multiple Document Interface (MDI) Windows.	
Module 5	**10 Hours**
Web App Development and Data Access using ADO.NET: Introduction, Web Basics, Multitier Application Architecture, Your First Web Application: Building Web-Time Application, Examining Web-Time.aspx's Code- Behind File, Understanding Master pages, Standard Web Controls: Designing a Form, Validation Controls, Grid View Control, Drop Down List, Session Tracking, ASP.NET	

Question paper pattern:

- The question paper will have ten questions.
- Each full question consists of 20 marks.
- There will be 2 full questions from each module.
- Each question will have questions covering all the topics under a module.
- The students will have to answer 5 full questions, selecting one full question from each module.

Text Books

1. .NET 4.0 Programming (6-in-1), Black Book, Kogent Learning Solutions Inc., Wiley-Dream Tech Press. (Chapters: 1,10,11,12,13,14 and 19).
2. Paul Deitel and Harvey Deitel: C# 2010 for Programmers, 4th Edition, Pearson Education. (Chapters: 14,15,19 and 27.3)

Reference Books:

1. Andrew Trolsen: Pro C# 5.0 and the .NET 4.5 Framework, 6th Edition, Wiley-Appress.
2. Bart De Smet: C# 4.0 Unleashed, Pearson Education- SAMS Series.
3. Herbert Schildt: Complete Reference C# 4.0, Tata McGraw Hill, 2010.

TEACHING METHODS

- PPTs
- Hands-On Sessions Based Teaching

ASSESSMENT METHODS

- Three Internals will be conducted for 30 Marks each and Weightage of 40%, 40% and 20% from 1st, 2nd and 3rd internals respectively will be taken.
- Evaluation for Learning Activity is based on Assignments, Case studies, Mini Projects for 20 Marks.
- Final Examination will be conducted for 100 Marks and Evaluated for 50 Marks

Course Outcome (CO): At the end of this course, the students will be able to:
CO1: Understand C# and client-server concepts using .Net Frame Work Components.
CO2: Apply delegates, event and exception handling to incorporate with ASP, Win Form, ADO.NET.
CO3: Analyze the use of .Net Components depending on the problem statement.
CO4: Implement & develop a web based and Console based application with Database connectivity

CO-PO-PSO Mapping

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	3							1	1				3	
CO2	2	2	1	1				1	1				3	
CO3	2	2	1					1	1				3	
CO4	2			2			1	1	1				3	
CO5		2		3			1	1	1	1			3	

FULL STACK WEB Development [As per Choice Based Credit System (CBCS) scheme] SEMESTER – III			
Subject Code	22MCA302	CIE Marks	50
Number of Lecture Hours/Week	04	SEE Marks	50
Total Number of Lecture Hours	50	SEE Hours	03
Credits – 04			

COURSE DESCRIPTION:

This course prepares the learner for creating single-page or mobile applications and creates reusable components for web pages and mobile applications. It also covers building RESTful APIs, MongoDB, and React Router. Basic elements include introduction, JSX overview, environmental setup, real-time applications, forms and UI, Component Lifecycle, Event Handling, and Styles.

PREREQUISITES:

- The student should be acquainted about programming terms such functions, objects, arrays, and to a lesser extent classes.
- Students should be familiar with HTML, CSS, and JavaScript on a basic level.

COURSE OBJECTIVES

- Recognize the new classes, modules, and arrow functions in the JavaScript language.
- Articulate what React is and why it is useful.
- Making use of controlled components, create and verify forms.
- Use a JavaScript package manager (either npm or Yarn).s
- Making HTTP requests to read or modify data.
- Students can understand how callbacks and MongoDB function.
- Students able to create CRUD operations, routing mechanisms, and UI components.

COURSE CONTENTS

Modules	Teaching Hours
Module 1	**08 Hours**
Introduction to the MERN stack: Introduction, The MVC architectural Pattern, MERN Components React, Node.js, Express, MongoDB, Advantages of MERN, Isomorphic. **Welcome to React**- Obstacles and Roadblocks, Reacts Future	
Module 2	**10 Hours**
Understanding React and Web Server: Server setup, NVM, Node Js, Project, NPM, Express, Build time JSX compilation- Separate Script File, Transform, Automate, React Library, React Components-React classes, Composing components, passing data- using properties ,property validation, using children’s Dynamic composition.	
Module 3	**10 Hours**

Understanding React State: React State – Setting state, Event handling, communicating from child to parent, Stateless components, Designing Components-state vs props, component hierarchy communication, Stateless components.	
Module 4	**12 Hours**
Building RESTful APIs and Mongo DB: REST , HTTP method as Actions, JSON, Express, Routing Hander function , Request Object, Response objects, Middleware, The list API , The create API, Using the LIST API, Using the Create API, Error Handling. **Mongo DB:** Basics, Schema initialization , MongoDB Node.JS Driver, callbacks, promises, Reading from MongoDB, Writing to MongoDB	
Module 5	**10 Hours**
Working with React Router and forms: Routing Techniques, Simple Routing, Route parameters, Route Query String, Programmatic Routing, Nested Routes, Browser history, Forms, Filter form, Get API, Edit page, UI Components, update API, Delete API.	

Question paper pattern:

- The question paper will have ten questions.
- Each full question consists of 20 marks.
- Here will be 2 full questions from each module.
- Each question will have questions covering all the topics under a module.
- The students will have to answer 5 full questions, selecting one full question from each module

Text Books:

2. Pro MERN Stack, Vasan Subramanian, 2019, ISBN-13(pbk):978-1-4842-2653-7
3. MERN Quick Start Guide, Eddy Wilson Iriarte Koroloiva, 2018, PACKT Publication, ISBN 978-1-78728-108-0

Reference Books:

1. Full stack React, Anthony Accomazzo, Ari Lerner, Nate Murray, Clay Allsopp, David Gutman, and Tyler McGinnis, 2017.

TEACHING METHODS

- PPTs
- Hands-On Sessions Based on Concepts.

ASSESSMENT METHODS

- Three Internals are conducted for 30 Marks each and Weightage of 40%, 40% and 20% from 1st, 2nd and 3rd internals respectively will be taken.
- Evaluation for Learning Activity is be based on Assignments, Case studies, Mini Projects for 20 Marks.
- Final Examination will be conducted for 100 Marks and Evaluated for 50 Marks

Course Outcome (CO): At the end of this course, the students will be able to:

CO1: Understand the concepts of MVC components and architecture and Implement node js, Express and MongoDB.
CO2: Understand difference between SPA and server side rendering using React.
CO3: Understand the need of JSX transformations and importance of recompiling code automatically.

CO4: Understand the concept of using React classes instead of simple elements or placeholders.
CO5: Understand how to use state and make changes to it on user interactions and how child can communicate with its parent via callbacks.
CO6: Understand routing mechanisms and Implementations of CRUD operations and UI Components.

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	3							1	1				3	
CO2	3			2				1	1				3	
CO3	3	2		2			1	1	1				3	
CO4	3	2		2			1	1	1				3	
CO5	2	2		2			1	1	1				3	
CO6	2	2		2			1	1	1				3	

CO-PO-PSO Mapping

Software Engineering & Software Testing
[As per Choice Based Credit System (CBCS) scheme]
SEMESTER – III

Subject Code	22MCA303	CIE Marks	50
Number of Lecture Hours/Week	04 + 02 Hrs Lab	SEE Marks	50
Total Number of Lecture Hours	50	SEE Hours	03

CREDITS – 04

COURSE DESCRIPTION

To acquaint the students with the basic and advanced concepts of Software Engineering and Software testing. The course also gives a fair idea about the Automation tool Selenium and running test scripts written in Java language.

PREREQUISITES

- Students should have a basic understanding of the software development life cycle (SDLC).
- Students should know basic programming in Java for executing the automation lab programs

COURSE OBJECTIVES

- To study fundamental concepts in software testing
- To discuss various types and techniques of software testing.
- To expose the automation tool Selenium & execution of test scripts
- To develop the interest among students to pursue Software testing as a career

COURSE CONTENTS

Modules	Teaching Hours
Module 1	**08 Hours**
Software Engineering: Introduction: Professional Software Development Attributes of good software, IEEE/ ACM code of software engineering ethics. Software Process models: Software Development Life Cycle, waterfall model, Incremental development **Agile Software Development**: Agile methods, Plan-driven and Agile Development, Extreme Programming, Rapid Application Development.	
Module 2	**08 Hours**
Requirements Engineering: Functional and non-functional requirements, The software requirements document, Requirements specification, Requirements engineering processes, Requirement elicitation and analysis, Requirements validation. **System Modeling**: Context models, Interaction models, Structural models, Behavioral models, Model-driven engineering Design and implementation: Design: Design concepts, Function oriented design, detailed design	

Software Quality Concepts: Software quality assurance, Software reviews, SEI Capability Maturity Model	
Module 3:	**10 Hours**
Introduction to Testing: Humans, Errors and Testing, Software Quality; Fundamentals of Testing, Requirements, Testing and Debugging; Software Test Life Cycle, Test Planning, Test cases, Identifying test cases, Levels of Testing. Defect Management: Defect Management Process, Defect Life Cycle. **INTRODUCTION TO AUTOMATION TESTING – SELENIUM:** Software Test Automation: Fundamentals of Test Automation, Manual Testing Vs Test Automation. Introduction to Selenium, Installation and configuration of Eclipse, Java and Selenium Learning, Introduction to Webdriver, How to run tests in IE, Firefox and Google Chrome. Introduction to Locators and object finding: Importance of Locator Identifiers in Selenium, Identifying locators(ID, Name, ClassName, LinkText) with developer tools	
Module 4	**08 Hours**
White box testing, Black box testing, Functional, Integration Testing, System testing, CSS locators, Selenium Webdriver, End to End Automation using Selenium Web Elements :Types of Testing- White Box testing, Black Box Testing, Integration Testing, Regression Testing, Validation Testing, Alpha Testing, Beta Testing, Acceptance Testing, Static testing. White box testing: Loop Testing, Basis path testing, Condition Testing, Role of testing in Agile, Types of testing, Introduction to Functional testing, separating integration and system testing. Identifying CSS locators and xpath in chrome and Firefox Browsers, Generating customized xpath from html attributes. Selenium Webdriver->Techniques to automate Web elements: End to End Automation using all UI Elements with selenium	
Module 5	**08 Hours**
CSS locators, Selenium Webdriver, End to End Automation using Selenium Web Elements , Testing in Agile, Introduction to Smoke, Regression, Exploratory testing, Compatibility: Identifying CSS locators and xpath in chrome and Firefox Browsers, Generating customized xpath from html attributes. Selenium Webdriver->Techniques to automate Web elements: End to End Automation using all UI Elements with selenium. Testing in Agile, Introduction to Smoke, Regression, Exploratory testing, Compatibility, Database Testing, Security Testing, UAT, Ad-hoc testing, API testing. Examples: Design test scenarios and test cases for a Web/Mobile application.	
Question paper pattern: • The question paper will have ten questions. • Each full question consists of 20 marks. • There will be 2 full questions from each module. • Each question will have questions covering all the topics under a module. • The students will have to answer 5 full questions, selecting one full question from each module	
Text Books: 1. Ian Sommerville : Software Engineering, 9th edition, Person Education Ltd, 2011. 2. Pankaj Jalote: Software Engineering, Wiley India Pvt Ltd, 2010	

3. Rex Black, Erik Van Veenendaal, Dorothy Graham"Foundations of Software Testing – ISQTB Certification", Third Edition
4. Paul C Jorgensen, "Software Testing A Craftsman's Approach", Aueredach publications, 3rd edition, 2011

Reference Books:

1. Roger S Pressman: Software Engineering-A Practitioners approach, 6th Edition, McGraw-Hill, 2010.
2. Hans Van Vliet: Software Engineering Principles and Practices, 3rd Edition, Wiley–India, 2010
3. Rex Black: Advanced Software Testing—Vol. 2, Shroff Publishers, Gundecha Unmesh: Selenium Testing Tools Cook Book, PACKT PUBLISHING, 2012.

TEACHING METHODS:

- Black-board teaching
- PPT
- Demonstration based teaching

ASSESSMENT METHODS:

- Three Mid-Semester examinations (MSE) will be conducted for 30 Marks each. The weightage of MSE-1, 2 & 3 will be 40%, 40% and 20% respectively.
- Evaluation for Learning Activity will be based on Programming Assignments, Case studies and Viva.
- Final Examination will be conducted for 100 Marks and Evaluated for 50 Marks.

Course Outcome (CO): At the end of this course, the students will be able to:

CO1: Understand the various software development process models and their suitability along with professional ethics and responsibilities.

CO2: Understand and evaluate the requirements for a software system and applying the techniques of software engineering in the design and implementation of software applications.

CO3: Analyze the process of Software Testing Life Cycle, the various types of testing, Test Case design techniques.

CO4: Design Test Cases using the testing tool Selenium IDE and Web Driver and understand and analyze the difference between functional testing and structural testing.

CO5: Understand and analyze the process of Database testing, API testing and documentation testing.

Laboratory Experiments:

1	Design and develop a script in any language of your choice and run it using Selenium: Open google.com in Chrome Browser and verify that title is Google and verify that it is redirected to google.co.in
2	Design and develop a script in any language of your choice and run it using Selenium: Open Google in multiple browser(Chrome/Firefox/IE) and click on Gmail
3	Design and develop a script in any language of your choice and run it using Selenium: Search of 'Software Testing' key word in Google and click on the first link visible
4	Design and develop a script in any language of your choice and run it using Selenium: Login to Gmail application with valid Username and Password and Logout
5	Design and develop a script in any language of your choice and run it using Selenium: Identify 'Price' of any mobile present in Flipkart.com using Xpath
6	Design and develop a script in any language of your choice and run it using Selenium: • Login to Amazon.in • Add multiple products to Shopping Cart

	• Cancel and Logout of the web page

CO-PO-PSO Mapping

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	2	2	2					1	1			2	3	2
CO2	2	2	2				1	1	1				3	2
CO3	2	2	1	1	1		1	1	1				3	2
CO4	2	2	2	1	1		1	1	1				3	2
CO5	2	2	2	1			1	1	1				3	2

<table>
<tr><td colspan="4">Web Services Computing
[As per Choice Based Credit System (CBCS) scheme]
SEMESTER –III</td></tr>
<tr><td>Subject Code</td><td>22MCA3041E</td><td>CIE Marks</td><td>50</td></tr>
<tr><td>Number of Lecture Hours/Week</td><td>03</td><td>SEE Marks</td><td>50</td></tr>
<tr><td>Total Number of Lecture Hours</td><td>40</td><td>SEE Hours</td><td>03</td></tr>
<tr><td colspan="4">Credits – 03</td></tr>
<tr><td colspan="4">COURSE DESCRIPTION
This course introduces students to software architectures designed to enable computer programs to communicate over a network using open standard Internet protocols (Web Services). The course covers the standards that enable SOAP based Web Services: XML Schema, SOAP (Simple Object Access Protocol), WSDL (Web Service Definition Language), and UDDI (Universal Description Discovery and Integration). Students will also learn how to implement Web Services using a REST (Representational State Transfer) based architecture (RESTful). The course describes proper design of Web Services and applications to implement a service-oriented architecture (SOA).</td></tr>
<tr><td colspan="4">PREREQUISITES
• Good knowledge on XML, HTTP, TCP/IP concepts.</td></tr>
<tr><td colspan="4">COURSE OBJECTIVES
• To Understand Web Services and implementation model for SOA
• To Understand the SOA, its Principles and Benefits
• To Understand XML concepts
• To Understand paradigms needed for testing Web Services
• To explore different Test Strategies for SOA-based applications</td></tr>
<tr><td colspan="4">COURSE CONTENTS</td></tr>
<tr><td colspan="3">Modules</td><td>Teaching Hours</td></tr>
<tr><td colspan="3">Module 1</td><td>08 Hours</td></tr>
<tr><td colspan="3">Evolution and Emergence of Web Services – Evolution of distributed computing. Core distributed computing technologies – client/server, CORBA, JAVA RMI, Micro Soft DCOM, MOM, Challenges in Distributed Computing, Introduction to Web Services – The definition of web services, basic operational model of web services, tools and technologies enabling web services, benefits and challenges of using web services.</td><td></td></tr>
<tr><td colspan="3">Module 2</td><td>08 Hours</td></tr>
<tr><td colspan="3">Web Service Architecture – Web services Architecture and its characteristics, core building blocks of web services, standards and technologies available for implementing web services, web services communication, basic steps of implementing web services.</td><td></td></tr>
</table>

Module 3	08 Hours
Brief Over View of XML – XML Document structure, XML namespaces, Defining structure in XML documents, Reuse of XML schemes, Document navigation and transformation. SOAP : Simple Object Access Protocol, Inter-application communication and wire protocols, SOAP as a messaging protocol, Structure of a SOAP message, SOAP envelope, Encoding, Service Oriented Architectures, SOA revisited, Service roles in a SOA, Reliable messaging,	
Module 4	**08 Hours**
Describing Web Services – WSDL introduction, non functional service description, WSDL1.1 Vs WSDL 2.0, WSDL document, WSDL elements, WSDL binding, WSDL tools, WSDL port type, limitations of WSDL.	
Module 5	**08 Hours**
Cloud Platforms for IOT Registering and Discovering Services : The role of service registries, Service discovery, Universal Description, Discovery, and Integration, UDDI Architecture, UDDI Data Model, Interfaces, UDDI Implementation	

Question paper pattern:

- The question paper will have ten questions.
- Each full question consists of 20 marks.
- There will be 2 full questions from each module.
- Each question will have questions covering all the topics under a module.
- The students will have to answer 5 full questions, selecting one full question from each module

Text Books

1. Web Services & SOA Principles and Technology, Second Edition, Michael P Papazoglou.
2. Developing Java Web Services, R. Nagappan, R. Skoczylas, R.P. Sriganesh, Wiley India.
3. Developing Enterprise Web Services, S. Chatterjee, J. Webber, Pearson Education.

Reference Books:

1. XML, Web Services, and the Data Revolution, F.P.Coyle, Pearson Education.
2. Building web Services with Java, 2nd Edition, S. Graham and others, Pearson Education.
3. Java Web Services, D.A. Chappell & T. Jewell, O‟Reilly, SPD.
4. McGovern, et al., "Java web Services Architecture", Morgan Kaufmann Publishers, 2005.

TEACHING METHODS

- PPTs
- Hands-On Sessions Based Teaching

ASSESSMENT METHODS

- Three Mid-Semester examinations (MSE) will be conducted for 30 Marks each. The weightage of MSE-1, 2 & 3 will be 40%, 40% and 20% respectively.
- Evaluation of Learning Activity based on Case study, Mini Project for 20 Marks.
- Final Examination will be conducted for 100 Marks and Evaluated for 50 Marks.

Course Outcome (CO): At the end of this course, the students will be able to:
CO1: Understand the principles of SOA
CO2: Efficiently use market leading environment tools to create and consume web services
CO3: Identify and select the appropriate framework components in creation of webservice solution

CO4: Apply OOP principles to creation of webservice solutions.

CO-PO-PSO Mapping

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	3							1	1				3	
CO2	1	2		2				1	1	1			3	
CO3	2	2		2				1	1	1			3	
CO4		2	1	2				1	1	1			3	

Data Mining & Business Intelligence

[As per Choice Based Credit System (CBCS) scheme]

SEMESTER – III

Subject Code	22MCA3042E	CIE Marks	50
Number of Lecture Hours/Week	03	SEE Marks	50
Total Number of Lecture Hours	40	SEE Hours	03

CREDITS – 03

Course Description:

This course is designed to introduce students to business intelligence concepts and provide students with an understanding of data mining along with associated techniques and their benefits to organizations of all sizes.

PREREQUISITES

- Knowledge of statistics
- Basic programming language

Course Objectives:

- To introduce the concept of data Mining as an important tool for enterprise data management and as a cutting edge technology for building competitive advantage.
- To enable students to effectively identify sources of data and process it for data mining.
- To make students well versed in all data mining algorithms, methods, and tools.
- Learning how to gather and analyze large sets of data to gain useful business understanding.
- To impart skills that can enable students to approach business problems analytically by identifying opportunities to derive business value from data.

COURSE CONTENTS

Modules	**Teaching Hours**
Module 1	**08 Hours**
Introduction to Data Mining What Is Data Mining, Kinds of Data Can Be Mined, Kinds of Patterns Can Be Mined, Technologies Used, Kinds of Applications Are Targeted, Major Issues in Data Mining, KDD Process, Types of Attribute Types, Measuring Data Similarity and Dissimilarity. **Data Pre-processing:** Why preprocessing, Data cleaning: Missing Values, Noisy Data; Data Integration, Data Reduction: Attribute Subset Selection; Data Transformation and Data Discretization: Normalization, Binning, Histogram Analysis, Concept Hierarchy Generation.	
Module 2	**08 Hours**
Classification Basic Concepts; Decision Tree Induction: Decision Tree Induction, Attribute Selection Measures, Tree Pruning; Bayes Classification Methods: Bayes' Theorem, Naive Bayesian Classification; Model Evaluation and Selection: Metrics for Evaluating Classifier Performance	

Module 3	08 Hours
Clustering Techniques Cluster analysis: Basic Concepts; Partitional Methods: K-Means; Hierarchical Methods: Agglomerative, Divisive, BIRCH; Density-Based Methods: DBSCAN.	
Module 4	**08 Hours**
Association Analysis: Basic Concepts and Algorithms **Basic Concepts:** Frequent Itemsets, Closed Itemsets, and Association Rules; Frequent Itemset Mining Methods: Apriori Algorithm - Finding Frequent Itemsets by Confined Candidate Generation, Generating Association Rules from Frequent Itemsets	
Module 5	**08 Hours**
Data Mining for Business Intelligence Applications: What is BI? Business intelligence architectures; Definition of decision support system; Development of a business intelligence system using Data Mining for business Applications like Fraud Detection, Clickstream Mining, Market Segmentation, retail industry, telecommunications industry, banking & finance CRM etc.	

Question paper pattern:

- The question paper will have ten questions.
- Each full question consists of 20 marks.
- There will be 2 full questions from each module.
- Each question will have questions covering all the topics under a module.
- The students will have to answer 5 full questions, selecting one full question from each module.

Text Books:

1. Jiawei Han, Micheline Kamber, Jian Pei "Data Mining Concepts and Techniques", 3rd Edition, Morgan Kaufmann Publisher.
2. Pang-Ning Tan, Michael Steinbach, Vipin Kumar " Introduction to Data Mining", Pearson, First impression.
3. G. Shmueli, N.R. Patel, P.C. Bruce, "Data Mining for Business Intelligence: Concepts, Techniques, and Applications in Microsoft Office Excel with XLMiner", 1st Edition, Wiley India.
4. Carlo Vercellis, "Business Intelligence: Data Mining and Optimization for Decision Making", Wiley India Publications

Reference Books:

1. Paulraj Ponnian, "Data Warehousing Fundamentals", John Willey.
2. M. Dunham, "Data Mining: Introductory and Advanced Topics", Pearson Education.

TEACHING METHODS

- PPT
- Black Board

ASSESSMENT METHODS

- Three Internals will be conducted for 30 Marks each and Weightage of 40%, 40% and 20% from 1st, 2nd and 3rd internals respectively will be taken.
- Learning Activity will be based on Assignments / Case Studies/ Seminars for 20 Marks.
- Final Examination will be conducted for 100 Marks and Evaluated for 50 Marks.

Course Outcome (CO): At the end of this course, the students will be able to:

CO1: To understand of the concepts of importance of data mining, and the principles of business intelligence

CO2: To Organize and Prepare the data needed for data mining using pre preprocessing techniques

CO3: To Implement the appropriate data mining methods like classification, clustering, or Frequent Pattern mining on data sets.
CO4: To Define and apply metrics to measure the performance of various data mining algorithms.
CO5: Analyze data mining for various business intelligence applications for the given problem

CO-PO-PSO Mapping

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	3								1				3	
CO2	2	2	2	2	1			1	1	1			3	
CO3		2	2	1	1			1	1				3	
CO4	3	2		2	1			1	1				3	
CO5		2	2	2				1	3				3	

Block Chain Technology [As per Choice Based Credit System (CBCS) scheme] **SEMESTER – III**			
Subject Code	22MCA3043E	CIE Marks	50
Number of Lecture Hours/Week	03	SEE Marks	50
Total Number of Lecture Hours	40	SEE Hours	03
CREDITS – 03			

COURSE DESCRIPTION

Blockchain is an emerging technology platform for developing decentralized applications and data storage. This course introduces the fundamentals of blockchain technology, distributed systems, cryptography and how it keeps data secure.

PREREQUISITES

- Data Structures and Algorithms
- Object-Oriented Programming

COURSE OBJECTIVES

- This course enables the students to familiarize the various aspects of blockchain, bitcoins, smart contracts and ethereum.

COURSE CONTENTS

Modules	**Teaching Hours**
Module 1	**08 Hours**
Blockchain 101: The growth of blockchain technology, Distributed systems History of blockchain and Bitcoin, types of blockchain, Benefits and limitations of blockchain.	
Module 2	**08 Hours**
Decentralization and Cryptography: Decentralization using blockchain, Methods of decentralization, Routes to decentralization: Cryptographic primitives, Asymmetric cryptography, Public and private keys	
Module 3	**08 Hours**
Bitcoin and Alternative Coins : Bitcoin, Transactions, Blockchain, Bitcoin payments, Alternative Coins, Theoretical foundations, Bitcoin limitations, Namecoin, Litecoin, Primecoin, Zcash	
Module 4	**08 Hours**
Smart Contracts and Ethereum 101: Smart Contracts: Definition, Ricardian contracts. Ethereum 101: Introduction, Ethereum blockchain, Elements of the Ethereum blockchain	
Module 5	**08 Hours**

Alternative Blockchains:
Blockchains, Blockchain-Outside of Currencies: Internet of Things, Government, Health, Finance, Media

Question paper pattern:

- The question paper will have ten questions.
- Each full question consists of 20 marks.
- There will be 2 full questions from each module.
- Each question will have questions covering all the topics under a module.
- The students will have to answer 5 full questions, selecting one full question from each module.

Text Book:

1. "Mastering Blockchain - Distributed ledgers, decentralization and smart contracts", Imran Bashir, Packt Publishing Ltd, Second Edition, ISBN 978-1- 78712-544-5, 2017

Reference Books:

- Arvind Narayanan, Joseph Bonneau, Edward Felten, Andrew Miller and Steven Goldfeder, "Bitcoin and Cryptocurrency Technologies: A Comprehensive Introduction", Princeton University Press (2016)
- "Blockchain Basics: A Non-Technical Introduction in 25 Steps", Author- Daniel Drescher, Apress, First Edition, 2017

TEACHING METHODS

- PPTs
- Black Board

ASSESSMENT METHODS

- Three Internals will be conducted for 30 Marks each and Weightage of 40%, 40% and 20% from 1st, 2nd and 3rd internals respectively will be taken.
- Evaluation based on case study/ seminar for 20 Marks.
- Final Examination will be conducted for 100 Marks and Evaluated for 50 Marks.

COURSE OUTCOMES: At End of the Course Student will Be Able to
CO1: Understand the types, benefits and limitation of blockchain.
CO2: Explore the blockchain decentralization and cryptography concepts.
CO3: Enumerate the Bitcoin features and its alternative options.
CO4: Describe and deploy the smart contracts
CO5: Summarize the blockchain features outside of currencies.

CO-PO-PSO Mapping

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	3							1	1					2
CO2	3							1	1					2
CO3	3							1	1					2
CO4	3			1				1	1					2
CO5	3			1				1	1					2

AWS Cloud Computing [As per Choice Based Credit System (CBCS) scheme] SEMESTER –III			
Subject Code	22MCA3051E	CIE Marks	50
Number of Lecture Hours/Week	03	SEE Marks	50
Total Number of Lecture Hours	40	SEE Hours	03
Credits – 03			

COURSE DESCRIPTION

AWS Academy Cloud Developing is designed to help students gain technical expertise in development using cloud technologies and prepare them to take the AWS Certified Developer – Associate level AWS Certification exam.

PREREQUISITES

- Cloud Basics.
- System and Network Architecture.

COURSE OBJECTIVES

- Understanding fundamentals of Cloud and its basic infrastructure
- Learn about account management, billing and pricing
- Acquire knowledge on security model and compliance concepts
- Learn how to use different core services of Cloud

COURSE CONTENTS

Modules	Teaching Hours
Module 1	**08 Hours**
Introduction to Cloud Computing & AWS What is Cloud Computing, Cloud Service & Deployment Models, How AWS is the leader in the cloud domain, Various cloud computing products offered by AWS, Introduction to AWS S, EC, VPC, EBS, ELB, AMI., AWS architecture and the AWS Management Console, virtualization in AWS (Xen hypervisor) What is auto-scaling, AWS EC best practices and cost involved.	
Module 2	**08 Hours**
Elastic Compute and Storage Volumes Introduction to EC, Regions & Availability Zones(AZs), Pre-EC, EC instance types, Comparing Public IP and Elastic IP, Demonstrating how to launch an AWS EC instance, Introduction to AMIs, Creating and Copying an AMI Introduction to EBS, EBS volume types, EBS Snapshots.	
Module 3	**08 Hours**
Load Balancing, Auto scaling and DNS Introduction to Elastic Load Balancer, Types of ELB – Classic, Network and Application, Load balancer architecture, Cross-zone load balancing, Introduction to Auto Scaling, vertical and horizontal scaling, the lifecycle of Auto Scaling	

Components of Auto Scaling, scaling options and policy, instance termination Using load balancer with Auto Scaling,	
Module 4	**08 Hours**
Virtual Private Cloud What is Amazon VPC, VPC as a networking layer for EC, IP address and CIDR notations, Components of VPC – network interfaces, route tables, internet gateway, NAT, Security in VPC – security groups and NACL, types of VPC,	
Module 5	**08 Hours**
Storage – Simple Storage Service (S) Introduction to AWS storage, Pre-S – online cloud storage, API, S consistency models, Storage hierarchy, buckets in S, Objects in S, metadata and storage classes, object versioning, object lifecycle management, S pricing.	

Question paper pattern:

- The question paper will have ten questions.
- Each full question consists of 20 marks.
- There will be 2 full questions from each module.
- Each question will have questions covering all the topics under a module.
- The students will have to answer 5 full questions, selecting one full question from each module

Text Books:

1. Amazon Web Services in Action. Michael Wittig and Andreas Wittig Foreword by Ben Whaley September 2015 ISBN 9781617292880
2. Learning Amazon Web Services (AWS): A Hands-On Guide to the Fundamentals of AWS Cloud | First Edition | By Pearson Paperback – 1 November 2019

Reference Books:

1. AWS Cookbook. Book by John Culkin and Mike Zazon. Released December 2021 Publisher(s): O'Reilly Media, Inc. ISBN: 9781492092605
2. by John Culkin, Mike Zazon. Serverless Architectures on AWS. Peter Sbarski, Yan Cui, Ajay Nair. February 2022 ISBN 9781617295423

TEACHING METHODS

- PPTs
- Hands-On Sessions Based Teaching
- AWS Web

ASSESSMENT METHODS

- Three Mid-Semester examinations (MSE) will be conducted for 30 Marks each. The weightage of MSE-1, 2 & 3 will be 40%, 40% and 20% respectively.
- Evaluation of learning activity based on Programming Assignments, Case studies, Mini Projects for 20 Marks.
- Final Examination will be conducted for 100 Marks and Evaluated for 50 Marks.

Course Outcome (CO): At the end of this course, the students will be able to:

CO1: AWS cloud values and Implement different policies using its services
CO2: Analyze and manage billing and pricing used for the resources
CO3: Design and deployment of different applications using its services
CO4: Leads to the next level of preparation i.e. Associate and Professional level

CO-PO-PSO Mapping

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2

CO1	2	2	1	2			1	1	1					2
CO2	2	2	1				1	1	1					2
CO3	2	2	1	2			1	1	1					2
CO4	2	2	2	1			1	1	1					2

Robotic Process Automation

[As per Choice Based Credit System (CBCS) scheme]

SEMESTER – III

Subject Code	20MCA3052E	CIE Marks	50
Number of Lecture Hours/Week	03	SEE Marks	50
Total Number of Lecture Hours	40	SEE Hours	03

CREDITS – 03

COURSE DESCRIPTION

Robotic Process Automation (RPA) is software technology that’s easy for anyone to use to automate digital tasks. RPA Course Syllabus is enhancing the students to perform the robotic process automation jobs using various tools like Blue Prism, UiPath, or Automation Anywhere. The course covers key important concepts such as Introduction to RPA, RPA platforms, Advanced RPA concepts, Deploying and maintain the bot.

PREREQUISITES

- Basic Programming Concepts

COURSE OBJECTIVES

This course enables the students to:

- Outline the benefits of RPA and various platforms available on the market.
- Understand to store and manipulate data in a more persistent way
- Understand Image, Text and Data Tables Automation
- Make use of exception handling techniques to handle the log errors
- Experiment with workflow in a manner to get the optimized output from a Bot

COURSE CONTENTS

Modules	**Teaching Hours**
Module 1	**08 Hours**
INTRODUCTION TO ROBOTIC PROCESS AUTOMATION: Scope and techniques of automation, Robotic process automation - What can RPA do? Benefits of RPA, Componentsof RPA, RPA platforms, The future of automation. **RPA BASICS:** History of Automation - What is RPA - RPA vs Automation - Processes & Flowcharts - Programming Constructs in RPA - What Processes can be Automated - Types of Bots - Workloads which can be automated - RPA Advanced Concepts - Standardization of processes - RPA Development methodologies - Difference from SDLC - Robotic controlflow architecture - RPA business case - RPA Team - Process Design Document/Solution Design Document - Industriesbest suited for RPA - Risks & Challenges with RPA - RPA and emerging ecosystem.	
Module 2	**08 Hours**

RPA Platforms- Components of RPA- RPA Platforms-About Ui Path- About UiPath - The future of automation - Record and Play - Downloading and installing UiPath Studio -Learning Ui Path Studio- - Task recorder - Step-by step examples using the recorder.	
Module 3	**08 Hours**
ADVANCED AUTOMATION CONCEPTS & TECHNIQUES: RPA Challenge - Image, Text & Advanced Citrix Automation – Introduction to Image & Text Automation - Image based automation - Keyboard based automation - Information Retrieval - Advanced Citrix Automation challenges - Best Practices - Using tab for Images - Starting Apps - Excel Data Tables & PDF - Data Tables in RPA - Excel and Data Table basics - Data Manipulation in excel – Extracting, Data from PDF - Extracting a single piece of data - Anchors - Using anchors in PDF	
Module 4	**08 Hours**
HANDLING USER EVENTS & ASSISTANT BOTS, EXCEPTION HANDLING: What are assistant bots? - Monitoring system event triggers - Hotkey trigger - Mouse trigger - System trigger - Monitoring image and element triggers - An example of monitoring email - Example of monitoring a copying event andblocking it - Launching an assistant bot on a keyboard event. **EXCEPTION HANDLING:** Debugging and Exception Handling - Debugging Tools - Strategies for solving issues - Catching errors.	
Module 5	**08 Hours**
DEPLOYING AND MAINTAINING THE BOT: Publishing using publish utility - Creation of Server - Using Server to control the bots - Creating a provision Robotfrom the Server - Connecting a Robot to Server - Deploy the Robot to Server - Publishing and managing updates - Managing packages - Uploading packages - Deleting packages.	

Question paper pattern:

- The question paper will have ten questions.
- Each full question consists of 20 marks.
- There will be 2 full questions from each module.
- Each question will have questions covering all the topics under a module.
- The students will have to answer 5 full questions, selecting one full question from each module.

Text Book:

1. Alok Mani Tripathi, "*Learning Robotic Process Automation*", Packt Publishing, 2018

Reference Books:

1. Frank Casale , Rebecca Dilla, Heidi Jaynes , Lauren Livingston, "*Introduction to Robotic Process Automation: a Primer*", Institute of Robotic Process Automation,1st Edition 2015.
2. Richard Murdoch, *Robotic Process Automation: Guide To Building Software Robots, Automate RepetitiveTasks & Become An RPA Consultant"*, Independently Published, 1st Edition 2018.
3. Srikanth Merianda, "Robotic Process Automation Tools, Process Automation and their benefits: Understanding RPA and Intelligent Automation", Consulting

Opportunity Holdings LLC, 1st Edition 2018.

4. Lim Mei Ying, "*Robotic Process Automation with Blue Prism Quick Start Guide: Create software robots andautomate business processes*", Packt Publishing, 1st Edition 2018.

Web References:

1. https://www.uipath.com/rpa/robotic-process-automation
2. https://www.academy.uipath.com

TEACHING METHODS

- PPTs
- Black Board

ASSESSMENT METHODS

- Three Internals will be conducted for 30 Marks each and Weightage of 40%, 40% and 20% from 1st, 2nd and 3rd internals respectively will be taken.
- Evaluation for Learning Activity will be based on Case studies for 20 Marks.
- Final Examination will be conducted for 100 Marks and Evaluated for 50 Marks.

Course Outcome (CO): At the end of this course, the students will be able to:

CO1: Describe RPA, where it can be applied and how it's implemented.

CO2: Describe the different types of variables, Control Flow and data manipulation techniques.

CO3: Identify and understand Image, Text and Data Tables Automation.

CO4: Describe how to handle the User Events and various types of Exceptions and strategies.

CO5: Understand the Deployment of the Robot and to maintain the connection.

CO-PO-PSO Mapping

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	3							1	1					2
CO2	3			2			1	1	1					2
CO3	2	2		2			1	1	1					2
CO4	2	2	2	1			1	1	1					2
CO5	2	2	1	2			1	1	1					2

DevOps
[As per Choice Based Credit System (CBCS) scheme]
SEMESTER – III

Subject Name	22MCA3053E	CIE Marks	50
Number of Lecture Hours/Week	03	SEE Marks	50
Total Number of Lecture Hours	40	SEE Hours	03

Credits – 03

COURSE DESCRIPTION

This course is designed to offer deep insights and knowledge into various tools such as Ansible, Puppet, Nagios, Jenkins and Docker. With the a depth learning of DevOps course a student will be able to become a trained practitioner in the integration and monitoring of software throughout their development cycle.

PREREQUISITES

- Basic understanding of Linux/Unix system concepts and administration.
- Familiarity with command-line interface.
- Knowing how build and deployment process works.

COURSE OBJECTIVES

- The objectives of the DevOps methodology are to speed up the time to market, apply incremental improvements in response to the changing environment, and create a more streamlined development process.

COURSE CONTENTS

Modules	Teaching Hours
Module 1	**08 Hours**
Introduction to Devops- What Is Devops, History of Devops, Devops definition, DevOps Main Objectives, DevOps and Software Development Life Cycle- Waterfall Model and Agile Model **Continuous Integration & Deployment-** Jenkins, Containers and Virtual Development- Docker and Vagrant **Configuration Management Tools**-Ansible, Puppet and Chef.	
Module 2	**08 Hours**
Cloud Computing- What is Cloud?, Evolution of Cloud Computing, IAAS (Infrastructure as a Service), SAAS (Software as a Service), PAAS (Platform as a Service), Private, Public and Hybrid Cloud, Public Clouds- Amazon Web Services, Microsoft Azure and Google Cloud Services. **LINUX Basic and Admin-** Linux OS Introduction, Importance of Linux in DevOps, Linux Basic Command Utilities, Linux Administration and Environment Variables	
Module 3	**08 Hours**
Shell Scripting - Introduction, Variables, Flow Controls, Loops, Functions, Lists, Manipulating Strings, Reading and Writing Files and Positional Parameters.	

Version Control- Overview of SVN, GIT Features, 3-Tree Architecture, GIT – Clone /Commit / Push, GIT Hub Projects, GIT Hub Management, GIT Rebase & Merge, Reset, Checkout ,GIT Clone, Fetch and Pull .	
Module 4	**08 Hours**
Continuous Integration – Jenkins- Introduction to Jenkins , Continuous Integration with Jenkins , Configure Jenkins, Jenkins Management , Scheduling build Jobs - POLL SCM and Build Periodically **ANSIBLE** - Introduction to Ansible, Infrastructure Management , SSH Connection in Ansible Master	
Module 5	**08 Hours**
Playbooks- Variables, Conditionals, Loops, Blocks, Handlers and Templates **Docker**- How to get Docker Image? , What is Docker Image, Working with Docker Containers- What is Container, Docker Engine, Creating Containers with an Image, Working with Images and Docker Command Line Interphase	

Question paper pattern:

- The question paper will have ten questions.
- Each full question consists of 20 marks.
- There will be 2 full questions from each module.
- Each question will have questions covering all the topics under a module.
- The students will have to answer 5 full questions, selecting one full question from each module.

Text Books:

1. Let's Get Started to DevOps- Hary Cahyono
2. Practical DevOps – Joakim Verona, PACKT Publisher
3. DevOps for Developers – Michael Huttermann, APress

TEACHING METHODS

- PPTs
- Hands-On Sessions Based Teaching

ASSESSMENT METHODS

- Three Internals will be conducted for 30 Marks each and Weightage of 40%, 40% and 20% from 1^{st}, 2^{nd} and 3^{rd} internals respectively will be taken.
- Evaluation for Learning Activity is based on Assignments/ Case studies for 20 Marks.
- Final Examination will be conducted for 100 Marks and Evaluated for 50 Marks.

Course Outcome (CO): At the end of this course, the students will be able to:

CO1: Understand overall structure of Devops with its Lifecycle
CO2: Understand the different application managed service options in the cloud using LINUX
CO3: Demonstrate DevOps workflow with GitLab learning Shell Script
CO4: Discover practical skills of Continuous Integration to improve the speed, stability, availability and security for software delivery capability
CO5: Apply practical skills needed for integrating container

CO-PO-PSO Mapping

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	3							1	1					2
CO2	3							1	1					2
CO3		2		3			1	1	1	1				2
CO4	2	2		2			2	1	1					2

CO5		2	2	2			1	1	1	1				2

IOT Data Analytics

[As per Choice Based Credit System (CBCS) scheme]

SEMESTER –III

Subject Code	22MCA3061E	CIE Marks	50
Number of Lecture Hours/Week	03	SEE Marks	50
Total Number of Lecture Hours	40	SEE Hours	03

Credits – 03

COURSE DESCRIPTION

This Course focuses on IoT concepts such as sensing, actuation and communication. It covers the development of Internet of Things (IoT) prototypes—including devices for sensing, actuation, processing, and communication—to help you develop skills and experiences.

PREREQUISITES

- Basic knowledge of C or C++ or any programming language or programming fundamentals. Familiarity with command-line interface.
- Basic knowledge of Operating system concepts.

COURSE OBJECTIVES

- After the completion of the course, the students will be able design some IOT based prototypes

COURSE CONTENTS

Modules	Teaching Hours
Module 1	**08 Hours**
Fundamentals of IoT Introduction to Internet of Things- The Internet of Things Today, Towards the IoT Universe, Internet of Things Vision, IoT Concepts, IoT Standards, Components of IoT System, Domain Specific IoTs –IoT Applications-Home, Cities, Environment, Energy Systems, Retail, Logistics, Industry, Agriculture, Health and Lifestyle.	
Module 2	**08 Hours**
IoT Design Methodology IoT design system management-On-chip communications Protocols - USART, I2C, SPI. Industrial Networking - RS482 and MODBUS, Vehicle Networking Standards, NodeMCU (ESP8266 based IoT Board), Arduino Programming. Introduction to MATLAB	
Module 3	**08 Hours**
Building IoT With Microcontroller Various Real time applications of IoT – Connecting IoT to cloud – CLOUD STORAGE FORIOT – Data Analytics for IoT – Software & Management Tools for IoT, Multimedia Technology and Industrial IoT Implementations. Building IoT With Microcontroller	

Various Real time applications of IoT – Connecting IoT to cloud – CLOUD STORAGE FORIOT – Data Analytics for IoT – Software & Management Tools for IoT, Multimedia Technology and Industrial IoT Implementations**.**	
Module 4	**08 Hours**
IoT Analytics Models -Collect, Process, Store, Analyse, Build, Private and Public Data Channels, Data- Sensor Data, Machine Data, Master Data, Data Analysis and Data Visualization, Event scheduling, Alerts, Actions, App integrations, Introduction MATLAB ,Real time analytics Use cases Smart agriculture Proactive replenishing of supplies Process efficiency scoring	
Module 5	**08 Hours**
Case Studies and Advanced Topics Case Study on: Home, Cities, Environment ,Energy Systems, Retail, Logistics, Industry, Agriculture, Health and Lifestyle. Project: Smart-home Industrial IoT Implementation.	

Question paper pattern:

- The question paper will have ten questions.
- Each full question consists of 20 marks.
- There will be 2 full questions from each module.
- Each question will have questions covering all the topics under a module.
- The students will have to answer 5 full questions, selecting one full question from each module

Text Books

1. IoT Fundamentals - Networking Technologies, Protocols and Use Cases for the Internet of Things (English, Paperback, Rowan Trollope, David Hanes, Patrick Grossetete, Jerome Henry, Rob Barton, Gonzalo Salgueiro)
2. Arshdeep Bahgaand Vijay Madisetti, “Internet of Things - A Hands on Approach”, Universities Press, 2015.
3. Foundational Elements of an IoT Solutions : The Edge, The Cloud Application Development, Joe Bironand Jonathan Follett..

Reference Books:

1. Rethinking the Internet of Things: A Scalable Approach to Connecting Everything, by Francis daCosta, ISBN: 978-1-4302-5740-0, 2013
2. Architecting the Internet of Things, by Dieter Uckelmann, Mark Harrison and Florian Michahelles, ISBN: 978-3-642-19157-2, 2011.

TEACHING METHODS

- PPTs
- Hands-On Sessions Based Teaching

ASSESSMENT METHODS

- Three Mid-Semester examinations (MSE) will be conducted for 30 Marks each. The weightage of MSE-1, 2 & 3 will be 40%, 40% and 20% respectively.
- Evaluation of learning activity based on Case studies/ Mini Projects for 20 Marks.
- Final Examination will be conducted for 100 Marks and Evaluated for 50 Marks.

Course Outcome (CO): At the end of this course, the students will be able to:

CO1: Understanding of IoT value chain structure (device, data cloud), application areas and technologies involved.

CO2: Understand IoT sensors and technological challenges faced by IoT devices, with a focus on wireless, energy, power, and sensing modules

CO3: Market forecast for IoT devices with a focus on sensors

CO4: Understanding the implementation of web-based services on IoT devices

CO-PO-PSO Mapping

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	2	1	2										3	2
CO2	2	2	1										3	2
CO3	2	2	1										3	2
CO4	2	2	2	1									3	2

Big Data Analytics

[As per Choice Based Credit System (CBCS) scheme]

SEMESTER – III

Subject Code	22MCA3062E	CIE Marks	50
Number of Lecture Hours/Week	03	SEE Marks	50
Total Number of Lecture Hours	40	SEE Hours	03

Credits – 03

COURSE DESCRIPTION

This course provides an understanding of Big Data Analytics. The course also provides details about the structure and magnitude of the big data, sources of bigdata. The course comprises of operating big data with algorithms and various methods, and descriptions of tool Hadoop and its uses. The course highlights the techniques involved in Hadoop like HDFS and Map Reduce techniques.

PREREQUISITES

- Student should know the concepts DBMS, Algorithms and applied mathematical concepts.
- Students should know basic programming concepts.
- Student should know about distributed systems and basic programming concepts.

COURSE OBJECTIVES

- To understand the fundamentals Big data concepts.
- To understand various operations involved in big data analysis.
- To understand the fundamentals of Hadoop concepts.
- To understand the basic working of HDFS and Map Reduce techniques.

COURSE CONTENTS

Modules	**Teaching Hours**
Module 1	**08 Hours**
Big Data and Analytics: Example Applications, Basic Nomenclature, Analysis Process Model, Analytical Model Requirements , Types of Data Sources, Sampling, Types of Data Elements, Data Exploration, Exploratory Statistical Analysis, Missing Values, Outlier Detection and Treatment, Standardizing Data Labels, Categorization	
Module 2	**08 Hours**
Big Data Technology: Hadoop's Parallel World, Data discovery, Open source technology for Big Data Analytics, Cloud and Big Data, Predictive Analytics, Mobile Business Intelligence and Big Data, Crowd Sourcing Analytics, Inter- and Trans-Firewall Analytics.	
Module 3	**08 Hours**

Meet Hadoop: Data, Data Storage and Analysis, Comparison with Other Systems, RDBMS, Grid Computing, Volunteer Computing, A Brief History of Hadoop, Apache Hadoop and the Hadoop Ecosystem Hadoop Releases Response.	
Module 4	**08 Hours**
The Hadoop Distributed File system: Design of HDFS; HDFS Concepts; The Command-Line Interface; Basic Filesystem Operations; Hadoop File systems Interfaces; The Java Interface: Reading Data, Writing Data, Querying the File system, Deleting Data; Anatomy of a File Read, Anatomy of a File Write; Parallel Copying with distcp; Keeping HDFS Cluster Balanced; Hadoop Archives.	
Module 5	**08 Hours**
MAPREDUCE APPLICATIONS : Writing a Unit Test; Running locally on Test data; MapReduce workflows; Anatomy of MapReduce job run: Classic Map-reduce, YARN; Failures in classic Map-reduce and YARN; Job scheduling; Shuffle and sort; Task execution; MapReduce types and formats: MapReduce types, Input formats, Output formats.	

Question paper pattern:

- The question paper will have ten questions.
- Each full question consists of 20 marks.
- There will be 2 full questions from each module.
- Each question will have questions covering all the topics under a module.
- The students will have to answer 5 full questions, selecting one full question from each module.

Text Books:

1. Bart Baesens, "Analytics in a Big Data World: The Essential Guide to Data Science and its Applications", Wiley.
2. Michele Chambers, AmbigaDhiraj, and Michael Minelli, "Big Data, Big Analytics: Emerging Business Intelligence and Analytic Trends for Today's Businesses", 1st Edition, Wiley CIO Series, 2013.
3. Tom White, "Hadoop: The Definitive Guide", 3rd Edition, O'Reilly, 2012

Reference Books:

1. 1. Boris Lublinsky, Kevin T. Smith, Alexey Yakubovich, "Professional Hadoop Solutions", Wiley, ISBN: 9788126551071, 2015.
2. Chris Eaton, Dirk deroos et al., "Understanding Big data: Analytics for Enterprise Class Hadoop and Streaming Data", McGraw Hill, 2012.
3. VigneshPrajapati, "Big Data Analytics with R and Hadoop", Packet Publishing.

TEACHING METHODS

- PPTs
- Hands-On Sessions Based Teaching

ASSESSMENT METHODS:

- Three Internals will be conducted for 30 Marks each and Weightage of 40%, 40% and 20% from 1st, 2nd and 3rd internals respectively will be taken.
- Evaluation for Learning Activity is based on Seminar/ Quiz / Case Studies for 20 Marks.
- Final Examination will be conducted for 100 Marks and Evaluated for 50 Marks.

Course Outcome (CO): At the end of this course, the students will be able to:

CO1: To Identify the business problem for a given context and frame the objectives to solve it through data analytics tools.
CO2: To Apply various algorithms for handling large volumes of data..
CO3: To Understand the usage of Hadoop for big data management.
CO4: To Illustrate the architecture of HDFS and explain functioning of HDFS clusters
CO5: To Analyze the usage of Map-Reduce techniques for solving big data problems

CO-PO-PSO Mapping

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	3							1	1		1	1		2
CO2		2	1	2			1	1	1	1				2
CO3	3			2			1	1	1					2
CO4	3						1	1	1					2
CO5	1	2	2	2			1	1	1					2

<table>
<tr><td colspan="4">User Interface and User Experience
[As per Choice Based Credit System (CBCS) scheme]
SEMESTER – III</td></tr>
<tr><td>Subject Code</td><td>20MCA3063E</td><td>CIE Marks</td><td>50</td></tr>
<tr><td>Number of Lecture Hours/Week</td><td>03</td><td>SEE Marks</td><td>50</td></tr>
<tr><td>Total Number of Lecture Hours</td><td>40</td><td>SEE Hours</td><td>03</td></tr>
<tr><td colspan="4">CREDITS – 03</td></tr>
<tr><td colspan="4">COURSE DESCRIPTION
This course introduces the principles of user interface development, focusing on the areas of Design, Implementation, and Evaluation.</td></tr>
<tr><td colspan="4">PREREQUISITES
• Students should know the elements of Software Development</td></tr>
<tr><td colspan="4">COURSE OBJECTIVES
• To understand the principles of designing user interfaces and the importance of User Experience (UX).
• To understand the role of user interface in Human-Computer Interaction (HCI)</td></tr>
<tr><td colspan="4">COURSE CONTENTS</td></tr>
<tr><td colspan="3">Modules</td><td>Teaching Hours</td></tr>
<tr><td colspan="3">Module 1</td><td>08 Hours</td></tr>
<tr><td colspan="3">Introduction: Usability of Interactive Systems: Introduction, Usability Goals and Measures, Usability Motivation, Universal Usability, Goals for our profession.
Guideline, principles, and theories: Introduction, Guidelines, principles, Theories.
User Experience (UX): Introduction, User Interface v/s User Experience, Why is User Experience Important, What is good usability, User interaction with products.
Development Processes: Managing Design Processes: Introduction, The Four Pillars of Design, Development methodologies: Ethnographic Observation, Participatory Design, Scenario Development</td><td></td></tr>
<tr><td colspan="3">Module 2</td><td>08 Hours</td></tr>
<tr><td colspan="3">Information Architecture and Application Structure: Purpose, Definition, Approach, Ways to Organize and Categorize Content, Designing for Task and Workflow-Dominant Apps, Designing a System of Screen Types, The Patterns – Feature, Search and browse, News Stream, Picture Manager, Dashboard, Canvas Plus Palette, Wizard, Setting Editor, Alternative Views, Many Workspaces. Help Systems
Visual Style and Aesthetics: Same content, Different styles, The Basics of</td><td></td></tr>
</table>

Visual Design, What This Means for Desktop Applications **The Patterns:** Deep Background, Few Hues, Many Values, Corner Treatments, Borders That Echo Fonts, Hairlines, Contrasting Font Weights, Skins and Themes.	
Module 3	**08 Hours**
Mobile Interfaces: The Challenges and Opportunities of Mobile Design, How to Approach a Mobile Design, The Patterns **Design and UX:** Users Vs Life Cycles, Visual Design, Web standards, Potential Barriers to sustainable UX **Designing for Emerging Technologies:** Design for Disruption, Eight Design Tenets for Emerging Technology, Changing Design and Designing Change **Fashion with Function**: Designing for wearable devices, the next big wave in technology, the wearable market segments, Wearable are notable, UX (and Human) Factors to consider.	
Module 4	**08 Hours**
An Ecosystem of connected device: The concept of an Ecosystem, The 3Cs Frame work: Consistent, Continuous and Complementary, Single Device Design is History **The Consistent Design Approach:** What is consistent Design, Consistency in Minimal Interface, Beyond Device Accessibility, Devices are means not an end	
Module 5	**08 Hours**
The Continuous and Complementary Design Approach: The continuous Design Approach: What is Continuous Design? Single Activity flow and the Sequenced Activity Flow. What is Complementary Design? Collaboration: Must-Have, Collaboration: Nice to have, Control: Nice to Have, Fascinating Use Cases: What do they mean for my work? Integrated Design Approaches: 3 Cs as building blocks: Beyond the Core Devices: The Internet of Things, The Internet of Things already there?	

Question paper pattern:

- The question paper will have ten questions.
- Each full question consists of 20 marks.
- There will be 2 full questions from each module.
- Each question will have questions covering all the topics under a module.
- The students will have to answer 5 full questions, selecting one full question from each module.

Text Book:

1. Ben Shneiderman, Plaisant, Cohen, Jacobs: Designing the User Interface, 5th Edition, Pearson, Education, 2010.
2. Jenifer Tidwell, “Designing Interfaces”, 2 nd Edition, Oreilly, 2015.
3. Jonathan Follet, “Designing for Emerging Technologies- UX for Genomics, Robotics and The Internet of Things”, 1st Edition, Oreilly, 2014.
4. Tim Frick, “Designing for Sustainability”, 1st Edition, Oreilly 2016.

Reference Books:

1. Eberts: User Interface Design, Prentice Hall, 1994
2. Wilber O Galitz: The Essential Guide to User Interface Design- An Introduction to GUI Design, Principles and Techniques, Wiley-Dreamtech India Pvt Ltd, 2011
3. Ian Pouncey, Richard York: Beginning CSS: Cascading Style Sheets for Web Design, Wiley India

4. The Elements of User Experience: User-Centred Design for the Web by Jesse James 5. Unger and Chandler, "A Project Guide to UX Design", 2 nd Edition, New Riders, 2012
TEACHING METHODS • Black-board teaching • PPTs • Video-based teaching
ASSESSMENT METHODS • Three Internals will be conducted for 30 Marks each and Weightage of 40%, 40% and 20% from 1st, 2nd and 3rd internals respectively will be taken. • Evaluation for Learning Activity is based on Assignments, Case studies, Mini Projects for 20 Marks. • Final Examination will be conducted for 100 Marks and Evaluated for 50 Marks.
Course Outcome (CO): At the end of this course, the students will be able to: **CO1:** Explain the concepts related to User interface or User Experience **CO2:** Apply the knowledge of features, approach, patterns for designing User Interface or User Experience for a given scenario. **CO3:** Understand mobile interfaces & current trends in UX design **CO4:** Understand the ecosystem of connected devices **CO5:** Analyse the best design approach with the help of use cases

CO-PO-PSO Mapping

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	3							1	1				3	2
CO2	2	2	3	3			2	1	1				3	2
CO3	3							1	1				3	2
CO4	3							1	1				3	2
CO5	2	2	2	2				1	1				3	2

Programming Using C# and .NET Laboratory
[As per Choice Based Credit System (CBCS) scheme]
SEMESTER – III

Subject Code	22MCA307L	CIE Marks	50
Number of Hours/Week	02 Hrs Laboratory	SEE Marks	50
		SEE Hours	03

CREDITS – 01

COURSE DESCRIPTION

To develop software development skills in C# programming and Students will have the proficiency to develop projects in C# programming. The course helps the students to solve the interdisciplinary applications through C# programming.
To write programs for solving real world problems using .NETcollection framework.

PREREQUISITES

- Basic understanding of Principles of Programming.
- Basic understanding of Operating System, Networking, RDBMS and Files

COURSE OBJECTIVES

- Practice object-oriented programs and build .NET applications.
- Implement C# programs for establishing interfaces.
- Implement sample programs for developing reusable software components.
- Create database connectivity in C# and implement GUI applications.

Laboratory Experiments:

SECTION A

1.Write a Program in C# to demonstrate Command line arguments processing for
the following.
a) To find the square root of a given number.
b) To find the sum & average of three numbers.

2.Write a Program in C# to demonstrate the following
a) Boxing and Unboxing b) Invalid Unboxing.

3. Write a program in C# to add Two complex numbers using Operator overloading .

4. Write a Program in C# to find the sum of each row of given jagged array of 3 inner arrays.

5. Write a Program in C# to demonstrate Array Out of Bound Exception using Try, Catch and Finally blocks.

6.Write a Program to Demonstrate Use of Virtual and override key words in C# with a simple program.

7. Write a Program in C# to create and implement a Delegate for any two arithmetic operations

8. Write a Program in C# to demonstrate abstract class and abstract methods in C#.

9. Write a program to Set & Get the Name & Age of a person using Properties of C# to illustrate the use of different properties in C#.

10. Write a Program in C# Demonstrate arrays of interface types (for runtime polymorphism).

11. Consider the Database db_EMS (Employee Management System) consisting of the following tables :
tbl_Designations (IdDesignation: int, Designation: string)
tbl_EmployeeDetails (IdEmployee: int, Employee Name: string, Contact Number: string, Id Designation: int, IdReportingTo: int)
Develop a suitable window application using C#.NET having following options.
1. Enter new Employee details with designation & Reporting Manager.
2. Display all the Project Leaders (In a Grid) reporting to selected Project Managers (In a Combo box).
3. Display all the Engineers (In a Grid) reporting to selected Project Leader (In a Combo box).
4. Display all the Employees (In a Grid) with their reporting Manager (No Value for PM).

12.Consider the Database db_LSA (Lecturer Subject Allocation) consisting of the following tables:

tbl_Subjects(IdSubject: int, SubjectCode: string, SubjectName: string)
tbl_Lecturers(IdLecturer: int, LecturerName: string, ContactNumber: string)
tbl_LecturerSubjects(IdSubject: int, SubjectCode: string, IdLecturer: int)
Develop a suitable window application using C#.NET having following options.
1. Enter new Subject Details.
2. Enter New Lecturer Details.
3. Subject Allocation with Lecturer Name in a Combo box and subjects to be allocated in Grid with checkbox Column.
4. Display all the subjects allocated (In a Grid) to the selected Lecturer (In a Combo Box).

13. Consider the database db_VSS (Vehicle Service Station) consisting of the following tables:

tbl_VehicleTypes(IdVehicleType: int, VehicleType: string, ServiceCharge: int)
tbl_ServiceDetails(IdService: int, VehicleNumber: string, ServiceDetails: string, IdVehicleType: int)
Develop a suitable window application using C#.NET having following options.
1. Enter new Service Details for the Selected Vehicle Type (In a Combo Box).
2. Update the Existing Service Charges to Database.
3. Total Service Charges Collected for the Selected Vehicle (In a Combo box) with total amount displayed in a text box.

TEACHING METHODS

- PPTs
- Hands-On Sessions Based Teaching
- Visual Studio 2008 and above

ASSESSMENT METHODS

Experiment Write up + Execution + Viva	20
Lab Record Writing	15
Lab Internals Test	15
Total	50

Final Exam will be conducted for 50 marks (SEE).

Course Outcome (CO): At the end of this course, the students will be able to:

CO1: Understand C# and client-server concepts using .Net Frame Work Components

CO2: Apply delegates, event and exception handling to incorporate with ASP, Win Form, ADO.NET

CO3: Analyze the use of .Net Components depending on the problem statement

CO4: Implement & develop a web based and Console based application with Database connectivity

CO-PO-PSO Mapping

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	3							1	1				3	
CO2	2	2		3			1	1	1	1			3	
CO3	2	2		2			1	1	1	1			3	
CO4		2		3			1	1	1	1			3	

FULL STACK WEB DEVELOPMENT LABORATORY [As per Choice Based Credit System (CBCS) scheme] SEMESTER III			
Subject Code	22MCA308L	CIE Marks	50
Number of Lecture Hours/Week	02 Hrs Laboratory	SEE Marks	50
		SEE Hours	03

CREDITS – 01

COURSE DESCRIPTION: This course prepares the students to create single-page or mobile applications and also creates reusable components for web pages and mobile applications. They also get knowledge on Basic elements include JSX overview, environmental setup, real-time applications, forms and UI, Component Lifecycle, Event Handling, and Styles.

PREREQUISITES:

- The student should be acquainted about programming terms such functions, objects, arrays, and to a lesser extent classes.
- Students should be familiar with HTML, CSS, and JavaScript on a basic level.

COURSE OBJECTIVES

- Understand the need for server side rendered apps.
- Use a JavaScript package manager (either npm or Yarn).
- Making HTTP requests to read or modify data.
- Students can understand how callbacks and MongoDB function.
- Students able to create CRUD operations, routing mechanisms, and UI components.

Laboratory Experiments:

1	Design a resume of a job aspirant using React components like Classes and Functions. Style the resume by applying CSS
2	Build Student Registration Portal using entities like component, State and Props
3	Demonstrate Node Js Application to perform CRUD operation for online Book Cart.
4	Design an employee Management system using RESTFULL APIs in React.
5	Deploy connectivity between React and Node Application for Inventory Management system
6	Development of an application using RESTFULL API’s

ASSESSMENT METHODS

Experiment Write up + Execution + Viva	20
Lab Record Writing	15
Lab Internals Test	15

Total	50

Final Exam will be conducted for 50 marks (SEE)

Course Outcome (CO): At the end of this course, the students will be able to:
CO1: Understand the concepts of Model, view and controller for developing applications using ReactJS.
CO2: Able to develop various types of React Js Components.
CO3: Design web application using MERN Framework.
CO4: Understand and design MongoDB model and view.
CO5: Demonstrate MVC Framework for real application.

CO-PO-PSO Mapping

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	3			2				1	1				3	2
CO2	1	2		2			1	1	1	1			3	2
CO3		2		3			1	1	1	1			3	2
CO4		2		3			1	1	1	1			3	2

MINI PROJECT - IOT [As per Choice Based Credit System (CBCS) scheme] SEMESTER III			
Subject Code	22MCA309P	CIE Marks	50
Number of Lecture Hours/Week	02 Hrs Laboratory	SEE Marks	50
Tutorials	02 Hrs	SEE Hours	03
CREDITS – 02			

COURSE OBJECTIVES

- To select a problem which addresses some basic home, office or other real life applications.
- To Apply new technologies & design techniques concerned for devising a solution for a given problem statement
- To Gain project management skill
- Work with teammates, sharing due and fair credits and collectively apply effort for making project successful.
- To Develop skill at conveying activities and achievements

Guidelines:

- A team of five to six students must develop the mini project. Each team shall carry out the project under the guidance of one of the faculty members of the Department.
- At the end of the Semester, the team must submit a brief report (15-20 pages spiral bound) on the work they have pursued through the Semester.
- During the examination, each group must demonstrate the project.

ASSESSMENT METHODS

- Evaluation will be done based on Synopsis Submission, Reviews and final Demonstration of the working project for 50 marks.
- Final Exam will be conducted for 50 marks (SEE)

Course Outcome (CO): At the end of this course, the students will be able to:

CO1: To identify a problem in the real world that needs to be addressed.
CO2: To review the literature and carry out the design.
CO3: To apply current technologies, create systems and solve problems.
CO4: To Show an attitude of team work and independent working on problems.
CO5: To demonstrate the project with effective writing and communication skills.

CO-PO-PSO Mapping

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2

CO1	3					1	1	1	1	3	2	2	3	
CO2	3					1	1	1	1	3	2	2	3	
CO3	1	3	2	3	3	2	1	1	1	3	2		3	
CO4						1	3	1	1				3	
CO5							3	1	1			2	3	

FOURTH SEMESTER

Sl. No.	Course Code	Course Title	Examination				Credits
			Duration in hours	SEE Marks	CIE Marks	Total Marks	
1	22MCA401C	MOOC course	-	-	50	50	1
2	22MCA402I	Industry Internship (6 Weeks)	-	-	50	50	3
3	22MCA403P	Project Work (During IV semester 16 weeks)	3	100	100	200	20
Total			**3**	**100**	**200**	**300**	**25**
Grand Total (I to IV Semesters): 3300 Marks : 100 Credits							

Massive Open Online Course (MOOC) [As per Choice Based Credit System (CBCS) scheme] **SEMESTER – IV**			
Subject Code	22MCA401C	CIE Marks	50
CREDITS – 02			

Guidelines for MOOC:

- A self-study certification course (MOOC) of 02 credits shall be completed by all the students during the course for the award of the degree.
- The course duration for 02 credits shall be of 08 Weeks only.
- The students will have to register and take up proctored exam only through NPTEL under SWAYAM portal.
- The certificate taken from any other online certification course other than NPTEL for MOOC is considered to be invalid.
- The list of courses under computer Science will be recommended by the department after NPTEL has announced the list of upcoming courses in SWAYAM portal.
- The certificate obtained after taking up the proctored exam will be submitted and the marks obtained will be considered for CIE.
- However there will be no separate SEE for the MOOC course.
- The student can take up the MOOC course any time during the entire duration of the MCA course.
- The student will be considered as fail in MOOC Course in case he/she
    - Scores less than 50 out of 100 in the proctored examination.
    - Fails to submit the certificate in the semester.

Course Outcomes (COs):

CO1: Identify the course/technology to learn.
CO2: Demonstrate the concepts/technology learnt.
CO3: Apply the concepts in solving real world problems.

CO-PO-PSO Mapping

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	3		2		2		1	1	1					

CO2	1	2	3		2	1	1		1					
CO3	1	2	2	2	2		1	1	1	1				

Industry Internship [As per Choice Based Credit System (CBCS) scheme] SEMESTER – IV			
Subject Code	22MCA402I	CIE Marks	50
CREDITS – 03			

Guidelines for Industry Internship:

- All the students have to undergo mandatory internship of 06 weeks duration during the vacation of III semester.
- Students have to undergo the Internship in any Institute of National repute or any reputed / well-known industry.
- The Industry Internship shall be carried out by each candidate independently under the guidance of one of the faculty members of the Department.
- On completion of Internship they shall submit a brief report to the department.
- Internship shall be considered as a head of passing and shall be considered for the award of degree.
- Those, who do not take-up/complete the internship shall be declared as fail in internship course and have to complete the same during the subsequent semester.
- After satisfying the internship requirements the degree will be awarded. However, student can carry out 4thsemester project without completing the internship.

Course Outcomes: After completing this course, students will able to:

CO 1: Understand the process of applying the knowledge related to IT in order to solve industrial problems.
CO 2: Develop skills through relevant training to industrial requirement
CO 3: Communicate effectively and work in teams.
CO 4: Ability to write technical documents
CO 5: Imbibe ethical practices and develop it as a life skill

CO-PO Mapping

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2

CO1	3	1	2					1	1	2	2	3	3	2
CO2	3	2	3	3	2	1	1	1	2	1	2	2	3	2
CO3						3	3	3	3			1	3	2
CO4								3	3			1	3	2
CO5												3	3	2

Project Work [As per Choice Based Credit System (CBCS) scheme] **SEMESTER – IV**			
Subject Code	22MCA403P	CIE Marks	100
No of Hours/Week	03	SEE Hours	03
		SEE Marks	100
CREDITS – 20			

<u>Dissertation Work Guidelines:</u>

- The student shall carry out the project work in the same institution or in industry / R&D labs based on software tools and technologies learnt in MCA course / Internship for a minimum period of 16 weeks.
- The dissertation work shall be carried out by each candidate independently under the guidance of one of the faculty members of the Department.
- If dissertation is carried out in any industry/ R&D Labs, outside the campus, the name of external guide at the organization shall be intimated to the head of the department.
- Project work may be application oriented or research oriented as per student and guide‘s interest. Therefore, the project reports will vary depending on whether it is application-oriented project or research based project.
- The students, signed by the external guide and internal guide, should maintain project work dairy.
- At the end of the semester, each candidate shall prepare a draft report of the dissertation work and submit it for plagiarism check (Plagiarism ≤ 20%) using facility in NMIT library.
- The internal guide shall duly approve the report after the plagiarism check.
- The candidate shall submit two hard-bound copies and the soft copy of the dissertation work to the head of the Department.
- A separate calendar of events for submission of dissertation and viva-voce shall be fixed by the examination section and shall be notified.
- The candidates who fail to submit the dissertation work with in the stipulated time have to submit the same at the time of next ensuing examination.
- The COE / Principal shall appoint both the internal examiners and External examiners for the Final Evaluation of the project.
- A copy of the dissertation will be sent to the external examiners by the chairperson of BOE.

- If the report is rejected, internal guide has to communicate to the candidate for modification as per the suggestions made by the External Examiner and resubmit.
- Internal guide and External Examiners shall carry out the evaluation of Dissertation report for 50 marks individually.
- Dissertation assessment by the internal guide will be considered as CIE and dissertation assessment by the external examiner will be considered as SEE**.**
- The students shall give poster presentation of their project before the SEE.
- The students shall also prepare a research paper of their project in the prescribed format and submit it to their guides before SEE. However, it is not mandatory requirement for the student to publish the research paper in the indexed journal / conference by the student for taking up the SEE.

Internal Evaluation and Viva Voce Guidelines:

- Internal assessment (CIE) shall be evaluated by both the **internal and external guide** for 50 marks individually. The average of the marks allotted by the internal and external guides shall be the final marks for the Internal Evaluation.
- The project presentation and Viva-voce (SEE) shall be evaluated jointly by both the **Internal and external examiners** for 50 marks.

Course Outcomes: After completing this course, students will able to
CO 1: Identify and finalize the problem relevant to Computer Applications with an attention to real life problems faced by the society
CO 2: Review the literature, Model and design the solution for framed problem statement.
CO 3: Implement the design, verify, validate and analyze the results.
CO 4: Document and communicate the project work efficiently
CO 5: Manage as an individual or in a team in development of technical projects.

CO-PO Mapping

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	3	1	2					1	1	2	2	3	3	2
CO2	3	2	3	3		1	1	1	2	1	2	2	3	2
CO3		3	3	3	3	2	2					1	3	2
CO4								3	3			1	3	2
CO5						3	3					1	3	2

ACADEMIC CALENDARS

NITTE EDUCATION TRUST

NITTE MEENAKSHI INSTITUTE OF TECHNOLOGY

(An Autonomous Institution Approved by AICTE,
Affiliated to Visvesvaraya Technological University, Belagavi)
Yelahanka, Bangalore - 560 064

KNOWLEDGE • CHARACTER • UNITY

TENTATIVE UG AND PG ACADEMIC CALENDAR – ODD SEMESTER (NOV 2022 - APRIL 2023)(3rd Semester)

Week	Month	Sun	Mon	Tue	Wed	Thu	Fri	Sat	Activities and Holiday
1.	OCT/NOV	30	31	*01 H	02	03 REG	04	05	*01st November 2022 Kannada Rajyostava Day 03rd November 2022 Registration for 3rd Semester
2.	NOV	06	07	08	09	10	*11 H	12	11th November 2022 Kanakadasa Jayanthi
3.	NOV	13	14	15	16	17	18	19 DO	19th November 2022 Subject Dropout
4.	NOV	20	21	22	23	24	25	26	
5.	NOV/DEC	27	28	29	30	01	02	03	
6.	DEC	04	05	06	07	08	09	10	
7.	DEC	11	12	13	14	15 MSE I	16 MSE I	17 MSE I	15th to 19th December 2022 MSE I
8.	DEC	18	19 MSE I	20	21 LA I	22 LA I	23 LA I	24	21st to 23rd December 2022 LA I
9.	DEC	25	26	27	28	29	30	31	
10.	JAN	01	02	03	04	05	06	07	
11.	JAN	08	09	10	11	12	13	14	
12.	JAN	*15 H	16	17	18	19 LA II	20 LA II	21 LA II	*15th January 2023 Makara Sankranthi 19th to 21st January 2023 LA II
13.	JAN	22	23	24	25	*26 H	27	28	*26th January 2023 Republic Day
14.	JAN/FEB	29	30	31	01	02 MSE II	03 MSE II	04 MSE II	02nd to 06th February 2023 MSE II
15.	FEB	05	06 MSE II	07	08	09	10	11	
16.	FEB	12	13	14	15	16	17	*18 H	*18th February 2023 Maha Shivararthri
17.	FEB	19	20	21	22	23	24	25	
18.	FEB/MAR	26	27	28	01	02 MSE III	03 MSE III	04 MSE III	02nd to 06th March 2023 MSE III
19.	MAR	05	06 MSE III	07 WD	08	09	10 LWD CIA Ledger Submission	11	07th March 2023 Subject Withdraw 10th March 2023 Last working Day and CIA Ledger Submission
20.	MAR	12	13	14	15	16 Commencement of SEE Theory	17	18	16th March 2023 Commencement of SEE Theory
21.	MAR	19	20	21	*22 H	23	24	25	22nd March 2023 Ugadi and Ramzan
22.	MAR/APR	26	27	28	29	30 Commencement of SEE Practicals	31	01	30th March 2023 Commencement of SEE Practicals
23.	APR	02	03	04	05	06	*07 H	08	*07th April 2023 Good Friday
24.	APR	09	10 TAOR	11	12	13	*14 H	15	10th April 2023 Tentative Announcement of Results *14th April 2023 Dr. B .R Ambedkar Jayanthi
25.	APR	16	17 REG	18 REG	19 REG	20	21	22	17th to 19th April 2023 Registration for Even Semester

MSE Portions and weightages:

MSE	Units to be covered	Maximum Marks	Weightage
1	1 and 2	30	40%
2	3 and 4	30	40%
3	5	30	20%

Note: Saturday allocated to carry out activities to carry Activity Points.

MSE – Mid Semester Examination
LA – Learning Activity
LWD – Last Working Day

AOR- Announcement of Results
H-Holiday
DO-Subject Drop out

REG-Registration
SEE-Semester End Examination
CIE – Continuous Internal Evaluation

WD-Subject Withdraw

Controller of Examinations 18/10/22

Dean Academic 18.10.22

Principal 19/10/22

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Dept. of ECE, Department Activity Plan

UG ACADEMIC CALENDER- ODD SEMESTER SEPTEMBER 2022/ FEBRUARY 2022-2023 (5th & 7th Semester)

Week	Month	Sun	Mon	Tue	Wed	Thu	Fri	Sat	Activities and Holiday
1	Sep	18	19	20	21	22	23	24	19th September 2022 commencement of classes for 5th and 7th semester
2	Sep/Oct	25	26	27	28	29	30	1	26th and 27th September ,Internship initial phase presentation
3	Oct	2	3	4	5	6	7	8	4th October 2022 Ayudha Pooja // 5th October 2022 Vijayadashami 1st DUGC Meeting 7th October 2022
4	Oct	9	10	11	12	13	14	15	Dept meeting all Thursday October 12th Plan to have workshop on ANN
5	Oct	16	17	18	19	20	21	22	
6	Oct	23	24	25	26	27	28	29	24th October Naraka Chaturdashi //25th October Deepavali
7	Oct/NOV	30	31	1	2	3	4	5	1st November 2022 Rajyotsava Day // 4th-7th November MSE-1
8	NOV	6	7	8	9	10	11	12	11th November 2022 Kanakadasa jayanthi // Project phase II,11th and 12th October Technical talk week// 11th Nov 2nd DUGC meeting Initiation for BoE Process
9	NOV	13	14	15	16	17	18	19	1st parents - teachers meeting on 19th November
10	NOV	20	21	22	23	24	25	26	21st to 23rd November 2022 LA1
11	NOV/Dec	27	28	29	30	1	2	3	29th and 30th November phase 1 internship presentation
12	Dec	4	5	6	7	8	9	10	10th-13th December MSE-2
13	Dec	11	12	13	14	15	16	17	Students training program 14th to 20th December//10th December 3rd DUGC meeting
14	Dec	18	19	20	21	22	23	24	Project phase III - 22nd and 23rd December Commencement of CIE Practical's BoE Meeting
15	Dec	25	26	27	28	29	30	31	26th to 28th December 2022 LA2// 2nd parents -teachers meeting on 31st December
16	Jan	1	2	3	4	5	6	7	5th to 7th Jan 2023 MSE-3
17	Jan	8	9	10	11	12	13	14	**14th January Last working Day& Submission of CIA Ledger**
18	Jan	15	16	17	18	19	20	21	15Th Jan Makara Sankranti // 16th Jan 4th DUGC meeting
19	Jan	22	23	24	25	26	27	28	23rd Jan 2023 commencement of SEE //26th January 2023 Republic Day
20	Jan/Feb	29	30	31	1	2	3	4	
21	Feb	5	6	7	8	9	10	11	6th Feb Commencement of SEE Practical's
22	Feb	12	13	14	15	16	17	18	15th Feb Tentative AOR 16th to 18th Feb Registration for Supplementary exams

MSE- Mid Semester Examination **AOR- Announcement of Results** **REG- Registration / WD - Subject Withdraw**
LA- Learning Activity **H- Holiday** **SEE- Semester End Examination**

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HoD, ECE

NITTE MEENAKSHI INSTITUTE OF TECHNOLOGY

DEPARTMENT OF MCA

CALENDAR OF EVENTS FOR 2022-23 (SEMESTER - 3)

SL NO	ACTIVITY	DATE
1	COMMENCEMENT OF III SEMESTER	03/10/2022
2	MSE 1 - 3RD SEMESTER	15/12/2022 - 17/12/ 2022
3	MSE 2 - 3RD SEMESTER	02/02/2023 - 06/02/2023
4	MSE 2 - 3RD SEMESTER	02/03/2023 - 06/03/2023
5	LA 1 SUBMISSION	21/12/2022 - 23/12/2022
6	LA 2 SUBMISSION	19/01/2023 - 21/01/2023
7	LAST WORKING DAY & CIE LEDGER SUBMISSION	10/03/2023
8	COMMENCEMENT OF THEORY EXAMINATION	16/03/2023
9	COMMENCEMENT OF PRACTICAL EXAMINATION	30/03/2023
10	COMMENCEMENT OF EVEN SEMESTER	17/04/2023
11	DEPARTMENT MEETINGS	EVERY FRIDAY AT 2 PM
12	IOT EXHIBITION	08/04/2023
14	INDUSTRY TRAINING / WORKSHOPS / SEMINAR	EVERY SATURDAY

COORDINATOR **H. O. D.**

NITTE MEENAKSHI INSTITUTE OF TECHNOLOGY

(AN AUTONOMOUS INSTITUTION RECOGNIZED BY UGC)

Department of Computer Science & Engineering

DEPARTMENT ACTIVITY PLAN

ODDSEMESTER:-3, 5, 7 **2022-2023**

Week	Month	SUN	MON	TUE	WED	THU	FRI	SAT	EVENTS
Week1	Sept	18	19	20	21	22	23	24	19th September 2022 Commencement of classes for 5th and 7thSemeseter
Week2	Sept/Oct	25	26	27	28	29	30	01	Technical Talk on 28th September 2022
Week3	Oct	02	03	04	05	06	07	08	4th October 2022 Ayudha Pooja 5th October 2022 Vijayadashmi
Week4	Oct	09	10	11	12	13	14	15	Industrial Visit on 12th October 2022
Week5	Oct	16	17	18	19	20	21	22	Technical Talk on 18th October 2022
Week6	Oct	23	24	25	26	27	28	29	29th October 2022 – Colloquium, 24th October 2022 Naraka Chaturadashi26th October 2022 Deepavali
Week7	Oct/Nov	30	31	01	02	03	04 MSE1	05 MSE 1	1st November 2022 Kannada Rajyotsava Day
Week8	Nov	06	07 MSE 1	08	09	10	11	12	Inauguration and Freshers Day on 12th November 2022 11th November 2022 Kanakadas Jayanti
Week9	Nov	13	14	15	16	17	18	19	
Week10	Nov	20	21 LA1	22 LA1	23 LA1	24	25	26	21st to 23rd November 2022 LA 1 24th and 25th November 2022 - FDP
Week11	Nov/Dec	27	28	29	30	01	02	03	29th December 2022 Colloquium
Week12	Dec	04	05	06	07	08	09	10 MSE 2	*16th November 2020 Deepavali, 18th to 20th November 2020 MSEII
Week13	Dec	11	12 MSE 2	13 MSE 2	14	15	16	17	Placement Training on 17th December 2022
Week14	Dec	18	19	20	21	22	23	24	22nd to 31st December 2022 Conduction of Lab internals, DAC Meeting on 26th December 2022
Week15	Dec	25	26 LA2	27 LA2	28 LA2	29	30	31	Alumni Meet on 29th December 2022, Colloquium 29th December 2022
Week16	Jan	01	02	03	04	05 MSE 3	06 MSE 3	07 MSE 3	Motivational Talk on 3rd January 2023
Week17	Jan	08	09	10	11	12	13	14 LWD	LWD and CIE Ledger Submission 14th January 2023
Week18	Jan	15	16	17	18	19	20	21	PAC meeting on 18th January 2023
Week19	Jan	22	23 SEE	24	25	26	27	28	Republic day 26th January 2023
Week20	Jan/Feb	29	30	31	01	02	03	04	DAC meeting on 1st February 2023
Week21	Feb	05	06 Lab Exam Final	07	08	09	10	11	SEE Laboratory from 6th February 2023
Week22	Feb	12	13 Practical	14	15	16	17	18	

General Holiday

HoD, CSE

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Department of Information Science and Engineering

ISE DEPARTMENT ACTIVITY PLAN

ODDSEMESTER:-3, 5, 7 2022-2023

Week	Month	SUN	MON	TUE	WED	THU	FRI	SAT	EVENTS
Week1	Sept	18	19	20	21	22	23	24	19th September 2022 Commencement of classes for 5th and 7thSemeseter
Week2	Sept/Oct	25	26	27	28	29	30	01	Talk on How to file Indian Copyright (26th October 2022) for 3rd year students
Week3	Oct	02	03	04	05	06	07	08	4th October 2022 Ayudha Pooja 5th October 2022 Vijayadashmi
Week4	Oct	09	10	11	12	13	14	15	Unisys Tech Talk on 12th October 2022
Week5	Oct	16	17	18	19	20	21	22	
Week6	Oct	23	24	25	26	27	28	29	24th October 2022 Naraka Chaturadashi 26th October 2022 Deepavali 1 Day FDP/SDP on "Faculty Professional Skills and Practices Program" 27th October, 2022
Week7	Oct/Nov	30	31	01	02	03	04 MSE1	05 MSE 1	1st November 2022 Kannada Rajyotsava Day
Week8	Nov	06	07 MSE 1	08	09	10	11	12	Invited Technical-I Talk by Industry Experts
Week9	Nov	13	14	15	16	17	18	19	Unisys Tech Talk on 16th November 2022
Week10	Nov	20	21 LA1	22 LA1	23 LA1	24	25	26	21st to 23rd November 2022 LA 1 24th and 25th November 2022 Quant-A- Maze
Week11	Nov/Dec	27	28	29	30	01	02	03	Technical Talk under the banner IEEE Student chapter on 30th November,2022
Week12	Dec	04	05	06	07	08	09	10 MSE 2	*16th November 2020 Deepavali, 18th to 20th November 2020 MSEII
Week13	Dec	11	12 MSE 2	13 MSE 2	14	15	16	17	Unisys Tech Talk on 14th December 2022 Invited Technical-II Talk by Industry Experts
Week14	Dec	18	19	20	21	22	23	24	
Week15	Dec	25	26 LA2	27 LA2	28 LA2	29	30	31	
Week16	Jan	01	02	03	04	05 MSE 3	06 MSE 3	07 MSE 3	Lab Internals from 2nd to 4th December 2022
Week17	Jan	08	09	10	11	12	13	14 LWD	Unisys Tech Talk on 11th January, 2023 LWD and CIE Ledger Submission 14th Jan
Week18	Jan	15	16	17	18	19	20	21	
Week19	Jan	22	23 SEE	24	25	26	27	28	Republic day 26th January 2022
Week20	Jan/Feb	29	30	31	01	02	03	04	Technical Talk under the banner IEEE Student chapter on 1st February,2023
Week21	Feb	05	06 Lab Exam Final	07	08	09	10	11	SEE Laboratory from 6th February 2022

Week22	Feb	12	13 Practical	14	15	16	17	18	Unisys Tech Talk on 15th February, 2023

	General Holiday

HoD, ISE

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Yelahanka, Bangalore - 560 064.

TENTATIVE UG ACADEMIC CALENDAR – ODD SEMESTER FIRST YEAR (2022-2023) (w.e.f)

Week	Month	Sun	Mon	Tue	Wed	Thu	Fri	Sat	Activities and Holiday
1.	Nov/Dec	27	28	29	30	01	02	03	01st December 2022 First year Classes start and induction Program
2.	Dec	04	05	06	07	08	09	10	
3.	Dec	11	12	13	14	15	16	17	
4.	Dec	18	19	20	21	22	23	24	
5.	Dec	25	26	27	28	29	30	31	
6.	Jan	01	02	03	04	05	06	07	
7.	Jan	08	09	10	11 MSE I	12 MSE I	13 MSE I	14	11th to 13th January 2023 MSE I
8.	Jan	*15	16	17	18	19	20	21	*15th January 2023 Makara Sankranti
9.	Jan	22	23	24	25	*26 H	27	28	*26th January 2023 Republic Day
10.	Jan/ Feb	29	30	31	01	02	03	04	
11.	Feb	05	06	07	08	09	10	11	
12.	Feb	12	13	14	15	16	17 MSE II	*18 H	17th to 21st February 2023 MSE II *18th February 2023 Maha Shivararthri
13.	Feb	19	20 MSE II	21 MSE II	22	23	24	25	
14.	Feb/ Mar	26	27	28	01	02	03	04	
15.	Mar	05	06	07	08	09	10 MSE III	11 MSE III	10th to 13th March 2023 MSE III
16.	Mar	12	13 MSE III	14	15	16 CIE Ledger Submiss ion and LWD	17	18	16th March 2023 CIE Ledger Submission and Last Working Day
17.	Mar	19	20	21	*22 H	23	24	25	*22nd March 2023 Ugadi and Ramzan
18.	Mar/April	26	27 Commencement of SEE Theory	28	29	30	31	01	27th March 2023 Commencement of SEE Theory
19.	April	02	03	04	05 Commenc ement of SEE Practical's	06	*07 H	08	05th April 2023 Commencement of SEE Practical's 07th April 2023 Good Friday
20.	April	09	10	11	12	13 TAOR	*14 H	15	13th April 2023 Tentative Announcement of Results *14th April 2023 Dr. B R Ambedkar Jayanthi
21.	April	16	17	18	19	20	21	22	
22.	April	23	24	25	26	27	28	29	
23.	April/May	30	01 REG	02	03	04	05	06	01st May 2023 Registration for Even Semester

MSE – Mid Semester Examination AOR- Announcement of Results REG-RegistrationWD-Subject Withdraw
LA – Learning ActivityH-HolidaySEE-Semester End Examination
LWD – Last Working Day DO-Subject Drop out CIE – Continuous Internal Evaluation

Controller of Examinations **Dean Academic** **Principal**

NITTE MEENAKSHI INSTITUTE OF TECHNOLOGY Yelahanka BANGALORE

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Department of Management Studies

DEPARTMENT ACTIVITY PLAN

2022-2023

ODD SEMESTER: III

Week	Month	SUN	MON	TUE	WED	THU	FRI	SAT	EVENTS
Week1	OCT/NOV	30	31	*01	02	03 REG	04	05	*01 November 2022 Kannada Rajyostava Day *03 November 2022 Registration for 3rd semester (Organisation Study commencement)
Week2	NOV	06	07	08	09	10	*11	12	11th November 2022 Kanakadasa Jayanthi
Week3	NOV	13	14	15	16	17	18	19 DO	19th November 2022 Subject Dropout 16th – 20th November 2022 Five FDP on "Research Publication &Ethics"
Week4	NOV	20	21	22	23	24	25	26	23nd November 2022 commencement of 3rd semester class after completion of Organisation Study(OS) 25th &26th November 2022 Two-Day International Conference ERMA -2022 on Transforming Business Practices through Disruptive Technologies 26th November 2022 Case Study competition
Week5	NOV/DEC	27	28	29	30	01	02	03	28th November 2022 seminar on "The Future of Management Education- A Global Perspective" 29th November 2022 Orientation on Specialisations to students by Respective subject Faculty experts
Week6	DEC	04	05	06	07	08	09	10	05th December 2022 orientation on LMS
Week7	DEC	11	12	13	14	15	16	17	13th December Orientation about "Smart Board"
Week8	DEC	18	19	20	21 LA I	22 LA I	23 LA I	24	21st December 2022 Guest talk on "Entrepreneurship and Innovation as Career Opportunity" by Prof B Thyagaraj, Corporte Trainer 22nd December 2022 Guest talk on "Campus to Corporate" Mr. Sunder Rajan, Corporate Trainer 21st to 23rd December 2022 LA1
Week9	DEC	25	26	27	28	29 MSE I	30 MSE I	31 MSE I	28th December 2022 Industrial Visit to " Ikea,Bengaluru" for MBA 3rd Sem 29th December 2022 to o2nd January 2023 MSE 1 to MBA 3rd Sem Students
Week10	JAN	01	02 MSE I	03	04	05	06	07	Industrial visit to "Gokaldas Exports ltd, Bengaluru" on 06th Jan 2023
Week11	JAN	08	09	10	11	12	13	14	Industry Visit to "Unibic Factory", Bengaluru on 10th Jan 2023
Week12	JAN	*15 H	16	17	18	19 LA II	20 LA II	21 LA II	*15th January 2023 Makara Sankranthi 19th to 21st January 2023 LA II
Week13	JAN	22	23	24	25	*26 H	27	28	*26th January 2023 Republic Day
Week14	JAN/FEB	29	30	31	01	02 MSE II	03 MSE II	04 MSE II	02nd to 06th February 2023 MSE II 03rd February 2023 Inter Industry Business Quiz "Master Minds" in association with FKCCI
Week15	FEB	05	06 MSE II	07	08	09	10	11	Guest talk on "Importance of analyzing KSA" by Mr. Girinarayan, Past Chairman, NIPM

Week16	FEB	12	13	14	15	16	17	*18 H	*18[th] February 2023 Maha Shivarathri
Week17	FEB	19	20	21	22	23	24	25	Guest on "Employability skills" by Mr. Hemanth Kumar, Senior Accounts Officer, World Bank
Week18	FEB/MAR	26	27	28	01	02 MSE III	03 MSE III	04 MSE III	02nd to 06th March 2023 MSE III
Week19	MAR	05	06 MSE III	07 WD	08	09	10 LWD CIA Ledger Submission	11	07[th] March 2023 Subject Withdraw Organize Leadership C onclave On 09[th] March 2023 10[th] March 2023 Last working Day and CIA Ledger Submission
Week20	MAR	12	13	14	15	16 Commencement of SEE Theory	17	18	16th March 2023 Commencement of SEE Theory
Week21	MAR	19	20	21	*22 H	23	24	25	22nd March 2023 Ugadi and Ramzan
Week22	MAR/APR	26	27	28	29	30	31	01	
Week23	APR	02	03	04	05	06	*07 H	08	*07th April 2023 Good Friday
Week24	APR	09	10 TAOR	11	12	13	*14 H	15	10th April 2023 Tentative Announcement of Results *14th April 2023 Dr. B R Ambedkar Jayanthi
Week25	APR	16	17 REG	18 REG	19 REG	20	21	22	17th to 19th August 2023 Registration for Even Semester

General Holiday

Commencement and Last Working day

MSE I , II, III, and SEE Theory exam

EVENTS

LA1 AND LA2

HoD, MBA
Head of the Department
Department of Management Studies
Nitte Meenakshi Institute of Technology
(An Autonomous Institute Affiliated to VTU)
Yelahanka, Bengaluru - 560 064

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Yelahanka, Bangalore - 560 064

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TENTATIVE PG ACADEMIC CALENDAR – ODD SEMESTER (NOV 2022 - APRIL 2023)(3rd Semester)(MBA)

Week	Month	Sun	Mon	Tue	Wed	Thu	Fri	Sat	Activities and Holiday
1.	OCT/NOV	30	31	*01 H	02	03 REG	04	05	*01st November 2022 Kannada Rajyostava Day 03rd November 2022 Registration for 3rd Semester
2.	NOV	06	07	08	09	10	*11 H	12	11th November 2022 Kanakadasa Jayanthi
3.	NOV	13	14	15	16	17	18	19 DO	19th November 2022 Subject Dropout
4.	NOV	20	21	22	23	24	25	26	
5.	NOV/DEC	27	28	29	30	01	02	03	
6.	DEC	04	05	06	07	08	09	10	
7.	DEC	11	12	13	14	15	16	17	
8.	DEC	18	19	20	21 LA I	22 LA I	23 LA I	24	21st to 23rd December 2022 LA I
9.	DEC	25	26	27	28	29 MSE I	30 MSE I	31 MSE I	29th December 2022 to 02nd January 2023 MSE 1 for MBA 3rd Semester Students
10.	JAN	01	02 MSE I	03	04	05	06	07	
11.	JAN	08	09	10	11	12	13	14	
12.	JAN	*15 H	16	17	18	19 LA II	20 LA II	21 LA II	*15th January 2023 Makara Sankranthi 19th to 21st January 2023 LA II
13.	JAN	22	23	24	25	*26 H	27	28	*26th January 2023 Republic Day
14.	JAN/FEB	29	30	31	01	02 MSE II	03 MSE II	04 MSE II	02nd to 06th February 2023 MSE II
15.	FEB	05	06 MSE II	07	08	09	10	11	
16.	FEB	12	13	14	15	16	17	*18 H	*18th February 2023 Maha Shivararthri
17.	FEB	19	20	21	22	23	24	25	
18.	FEB/MAR	26	27	28	01	02 MSE III	03 MSE III	04 MSE III	02nd to 06th March 2023 MSE III
19.	MAR	05	06 MSE III	07 WD	08	09	10 LWD CIA Ledger Submission	11	07th March 2023 Subject Withdraw 10th March 2023 Last working Day and CIA Ledger Submission
20.	MAR	12	13	14	15	16 Commencement of SEE Theory	17	18	16th March 2023 Commencement of SEE Theory
21.	MAR	19	*20	21	*22 H	23	24	25	22nd March 2023 Ugadi and Ramzan
22.	MAR/APR	26	27	28	29	30	31	01	
23.	APR	02	03	04	05	06	*07 H	08	*07th April 2023 Good Friday
24.	APR	09	10 TAOR	11	12	13	*14 H	15	10th April 2023 Tentative Announcement of Results *14th April 2023 Dr. B .R Ambedkar Jayanthi
25.	APR	16	17 REG	18 REG	19 REG	20	21	22	17th to 19th April 2023 Registration for Even Semester

MSE Portions and weightages:

MSE	Units to be covered	Maximum Marks	Weightage
1	1 and 2	30	40%
2	3 and 4	30	40%
3	5	30	20%

Note: Saturday allocated to carry out activities to carry Activity Points.
MSE – Mid Semester Examination
LA – Learning Activity
LWD – Last Working Day
AOR- Announcement of Results
H-Holiday
DO-Subject Drop out
REG-Registration
SEE-Semester End Examination
CIE – Continuous Internal Evaluation
WD-Subject Withdraw

Controller of Examinations

Principal

NITTE MEENAKSHI INSTITUTE OF TECHNOLOGY

Department of Aeronautical Engineering

Time Table and Subject Allotment for the Odd semesters Sept AY 2022-23 (w.e.f 28/11/2022)

3rd Semester - A

Day / Period	08:45 AM - 09:45 AM	09:45 AM - 10:45 AM	10:55 AM - 11:55 AM	11:55 AM - 12:55 PM	12:55 PM- 01:30 PM	01:30 PM - 02:30 PM	02:30 PM - 03:30 PM	03:30 PM - 04:30 PM
Monday	BAS	ATD	M-III	BAS(T)	Lunch Break	IAE(T)	FM	TT
Tuesday	PE	ATD	IAE	M-III		TT	ATD(T)	BAS
Wednesday	IAE	M-III	ATD	FM		BASL- A1/CAAD –A2		
Thursday	PE	SK	BAS	FM(T)		BASL-A 2/CAAD –A1		
Friday	FM	BAS	IAE	M-III		ATD	PE(T)	Mentoring
Saturday	PE	BK	IAE	FM				

Sl. No	Sub Code	Subject Name		Room No.	Faculty	Mobil No.	Email
1	21MAT31	Engineering Mathematics –III	M-III		Dr. Chandrakala S B	9741556807	Chandrakala.sb@nmit.ac.in
2	21AE32	Introduction to Aircraft Engineering	IAE		Mr. Abhishek T K	8660441047	Abhishek.tk@nmit.ac.in
3	21AE33	Aerothermodynamics	ATD		Mr. Santosh Hosur	9035757535	Santosh.hosur@nmit.ac.in
4	21AE34	Fluid Mechanics	FM		Mr.Koushik Kumar	9003367525	@nmit.ac.in
5	21AE35	Basics of Aero structures + (Aero structures lab)	BAS		Dr. Rajadurai M	8883678026	Rajadurai.m@nmit.ac.in
			BASL- A1		Dr. Vinayaka N	9902385846	vinayaka.n@nmit.ac.in
			BASL- A2		Dr. Rajadurai M	8883678026	Rajadurai.m@nmit.ac.in
6	21AEE36X	**Program Elective-A**	PE		Mrs. Thara. L /Ms. Vishali	9686919584 8580875405	thara.l.ae@nmit.ac.in vishali.thakur@nmit.ac.in
7	21AEL37	Computer Aided Aircraft Drawing	CAAD-A2		Mrs. Thara. L	9686919584	thara.l.ae@nmit.ac.in
			CAAD-A1		Mrs. Sreelakshmi	8123946231	sree.lakshmil@nmit.ac.in
8	21KAN38A/21KAN38B	Samskrutika Kannada/ BalakeKannada	SK/BK		Dr. Gowramma .T	9902704467	gowramma.t@nmit.ac.in
9	21INT39	Internship-I	INT-I		Dr. Vinayaka N	9902385846	vinayaka.n@nmit.ac.in

Time Table coordinator

Prof & HoD

Principal

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Department of Aeronautical Engineering

Time Table and Subject Allotment for the Odd semesters Sept AY 2022-23 (w.e.f 28/11/2022)

3rd Semester-B

Day / Period	08:45 AM - 09:45 AM	09:45 AM - 10:45 AM	10:55 AM - 11:55 AM	11:55 AM - 12:55 PM	12:55 PM-01:30 PM	01:30 PM - 02:30 PM	02:30 PM - 03:30 PM	03:30 PM - 04:30 PM
Monday	ATD	IAE	BAS	M-III	Lunch Break	BASL- B1/CAAD –B2		
Tuesday	PE	SK	M-III	FM		BASL- B2/CAAD –B1		
Wednesday	FM	IAE	M-III	ATD		FM(T)	BCM	TT
Thursday	PE	FM	BAS	ATD		IAE	ATD(T)	BAS(T)
Friday	IAE	BK	M-III	BAS		FM	PE(T)	Mentoring
Saturday	PE	ATD	BAS	TT				

Sl. No	Sub Code	Subject Name		Room No.	Faculty	Mobil No.	Email
1	21MAT31	Engineering Mathematics –III	M-III		Dr. Chandrakala	9741556807	chandrakala.sb@nmit.ac.in
2	21AE32	Introduction to Aircraft Engineering	IAE		Mr. Siddalingappa P K	9632532692	siddalingappa.pk@nmit.ac.in
3	21AE33	Aerothermodynamics	ATD		Dr. Srikanth H V	8147719698	srikanth.hv@nmit.ac.in
4	21AE34	Fluid Mechanics	FM		Mrs. Sreelakshmi	8123946231	sree.lakshmil@nmit.ac.in
5	21AE35	Basics of Aero structures + (Aero structures lab)	BAS		Dr .Vinayaka N	9902385846	vinayaka.n@nmit.ac.in
			BASL- B1		Mr. Sridhar K	9965895279	sridhar.kanagaraj@ nmit.ac.in
			BASL- B2		Mr. Ram Vishal G	9676141747	ramvishal.g@nmit.ac.in
6	21AEE36X	**Program Elective-A**	PE		Mrs. Thara. L	9686919584	thara.l.ae@nmit.ac.in
					Ms. Vishali	8580875405	vishali.thakur@nmit.ac.in
7	21AEL37	Computer Aided Aircraft Drawing	CAAD-B2		Ms. Vishali	8580875405	vishali.thakur@nmit.ac.in
			CAAD-B1		Mr.Koushik Kumar	9003367525	@nmit.ac.in
8	21KAN38A/21KAN38B	Samskrutika Kannada/ BalakeKannada	SK/BK		Dr. Gowramma .T	9902704467	gowramma.t@nmit.ac.in
9	21MATD31	Bridge Course Mathematics - I	BCM		Mr. Pramod S	9036882924	pramod.s@nmit.ac.in
10	21INT39	Internship-I	INT-I		Dr. Vinayaka N	9902385846	vinayaka.n@nmit.ac.in

Time Table coordinator | Prof & HoD | Principal

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Department of Aeronautical Engineering

Time Table and Subject Allotment for the Odd semesters Sept AY 2022-23 (w.e.f 28/11/2022)

5th Semester - A

Day / Period	08:45 AM - 09:45 AM	09:45 AM - 10:45 AM	10:55 AM - 11:55 AM	11:55 AM - 12:55 PM	12:55 PM- 01:30 PM	01:30 PM - 02:30 PM	02:30 PM - 03:30 PM	03:30 PM - 04:30 PM
Monday	AP	APF	PE	AD-II	Lunch Break	PE	AS-II	AD-II(T)
Tuesday	AD-II	AP	PE	ASM		APF	CE	TT
Wednesday	PE	APF	Placement training			AD-II	PL-A1/ ADL-A2/ CML-A3	
Thursday	AS-II	AP	AD-II	ASM		AS-II	PL-A2/ ADL-A3/ CML-A1	
Friday	ASM	AP	AS-II	ASM		APF(T)	PL-A3/ ADL-A1/ CML-A2	
Saturday	AP(T)	Gate coaching						

Sl. No	Sub Code	Subject Name		Room No.	Faculty	Mobil No.	Email
1	18AE51	Aircraft Performance	APF	363	Mr Prashant Manvi	9739066998	prashant.manvi@nmit.ac.in
2	18AE52	Aerodynamics-II	AD-II	363	Mr Siddalingappa P K	9632532692	siddalingappa.pk@nmit.ac.in
3	18AE53	Aircraft Structures-II	AS-II	363	Mr Ram Vishal G	9676141747	ramvishal.g@nmit.ac.in
4	18AE54	Aircraft Propulsion	AP	363	Mrs Jhumki Nandy	7387138707	jhumki.nandy@nmit.ac.in
5	18AEH55	Aviation safety management and accident investigations	ASM	363	Mr. Santosh Hosur	9035757535	santosh.hosur@nmit.ac.in
6	18AEE563	Non Destructive Testing	PE	363	Capt.Somaiah	7411657195	Chodsumada.aiyanna@nmit.ac.in
	18AEE564	Industrial Aerodynamics		364	Mr.Koushik Kumar	9003367525	@nmit.ac.in
7	18AEL57	Propulsion Lab	PL-A1	369	Mr.Shivaji	8073265549	shivaji.lamani@nmit.ac.in
			PL-A2		Mr. Santosh H	9035757535	santosh.hosur@nmit.ac.in
			PL-A3		Mrs Jhumki Nandy	7387138707	jhumki.nandy@nmit.ac.in
8	18AEL58	Aerodynamics Lab	ADL-A1	Ground floor	Mr Siddalingappa P K	9632532692	siddalingappa.pk@nmit.ac.in
			ADL-A2		Ms.Vishali	8580875405	vishali.thakur@nmit.ac.in
			ADL-A3		Mr.Abhishek T K	8660441047	abhishek.tk@nmit.ac.in
9	18AEL59	Composite Material lab	CML-A1	2nd floor PGDM block	Mr.Koushik Kumar	9003367525	@nmit.ac.in
			CML-A2		Dr Vinayaka N	9902385846	vinayaka.n@nmit.ac.in
			CML-A3		Mr Ram Vishal G	9676141747	ramvishal.g@nmit.ac.in
10	18AEM510	Swayam/NPTEL/MOOC		363	Mrs Jhumki Nandy	7387138707	jhumki.nandy@nmit.ac.in
11	-	Communicative English	CM	366	Mr. Srinivas	8123919839	srinivas@nmit.ac.in

Time Table coordinator | Prof & HoD | Principal

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Department of Aeronautical Engineering

Time Table and Subject Allotment for the Odd semesters Sept AY 2022-23 (w.e.f 28/11/2022)

5th Semester - B

Day / Period	08:45 AM - 09:45 AM	09:45 AM - 10:45 AM	10:55 AM - 11:55 AM	11:55 AM - 12:55 PM	12:55 PM-01:30 PM	01:30 PM - 02:30 PM	02:30 PM - 03:30 PM	03:30 PM - 04:30 PM
Monday	AD-II	ASM	PE	AS-II		PE	AD-II(T)	AP
Tuesday	AS-II	APF	PE	AP		AD-II	CE	APF
Wednesday	PE	ASM	AS-II	AD-II	Lunch Break	APF	PL-A1/ ADL-A2/ CML-A3	
Thursday	Placement Training		AD-II	ASM(T)		AS-II	PL-A2/ ADL-A3/ CML-A1	
Friday	AP	AS-II(T)	ASM	AP		APF(T)	PL-A3/ ADL-A1/ CML-A2	
Saturday	AP (T)	Gate Coaching						

Sl. No	Sub Code	Subject Name		Room No.	Faculty	Mobil No.	Email
1	18AE51	Aircraft Performance	APF	364	Mr Prashant Manvi	9739066998	prashant.manvi@nmit.ac.in
2	18AE52	Aerodynamics-II	AD-II	364	Mrs. Sreelakshmi	8123946231	sree.lakshmil@nmit.ac.in
3	18AE53	Aircraft Structures-II	AS-II	364	Mr Sridhar K	9965895279	sridhar.kanagaraj@nmit.ac.in
4	18AE54	Aircraft Propulsion	AP	364	Mr.Shivaji	8073265549	shivaji.lamani@nmit.ac.in
5	18AEH55	Aviation safety management and accident investigations	ASM	364	Ms. Vishali	8580875405	Vishali.thakur@nmit.ac.in
	18AEE553	Non Destructive Testing	PE	363	Capt.Somaiah	7411657195	Chodsumada.aiyanna@ nmit.ac.in
	18AEE554	Industrial Aerodynamics	PE	364	Mr.Koushik Kumar	9003367525	@nmit.ac.in
7	18AEL57	Propulsion Lab	PL-A1	369	Mr.Shivaji	8073265549	shivaji.lamani@nmit.ac.in
			PL-A2		Mr. Santosh H	9035757535	santosh.hosur@nmit.ac.in
			PL-A3		Mrs Jhumki Nandy	7387138707	jhumki.nandy@nmit.ac.in
8	18AEL58	Aerodynamics Lab	ADL-A1	Ground floor	Mr Siddalingappa P K	9632532692	siddalingappa.pk@nmit.ac.in
			ADL-A2		Ms. Vishali	8580875405	vishali.thakur@nmit.ac.in
			ADL-A3		Mr.Abhishek T K	8660441047	abhishek.tk@nmit.ac.in
9	18AEL59	Composite Material lab	CML-A1	2nd floor PGDM block	Mr.Koushik Kumar	9003367525	@nmit.ac.in
			CML-A2		Dr Vinayaka N	9902385846	vinayaka.n@nmit.ac.in
			CML-A3		Mr Ram Vishal G	9676141747	ramvishal.g@nmit.ac.in
10	18AEM510	Swayam/NPTEL/MOOC	-	363	Mrs Jhumki Nandy	7387138707	jhumki.nandy@nmit.ac.in
11	-	Communicative English	CM	366	Mr. Srinivas	8123919839	srinivas@nmit.ac.in

Time Table coordinator

Prof & HoD

Principal

NITTE EDUCATION TRUST | NITTE MEENAKSHI INSTITUTE OF TECHNOLOGY

Department of Aeronautical Engineering

Time Table and Subject Allotment for the Odd semesters Sept AY 2022-23 (w.e.f 28/11/2022)

7th Semester

Day / Period	08:45 AM - 09:45 AM	09:45 AM - 10:45 AM	10:55 AM - 11:55 AM	11:55 AM - 12:55 PM	12:55 PM-01:30 PM	01:30 PM - 02:30 PM	02:30 PM - 03:30 PM	03:30 PM - 04:30 PM
Monday	VIB	CFD	PE	OE	Lunch Break	CMS	SML-A1/ ASL-A2	
Tuesday	CMS	EIPR	PE	OE		CFD	SML-A2/ ASL-A1	
Wednesday	PE	VIB	EIPR(T)	OE		CMS (T)	EIPR	CFD(T)
Thursday	EIPR	CFD	PE(T)	CMS		VIB	PP-II	
Friday	EIPR	CMS	VIB(T)	CFD		PE	PP-II	
Saturday	VIB	Gate coaching						

Sl. No	Sub Code	Subject Name		Room No	Faculty	Mobil No.	Email
1	18AE71	Vibration & Aeroelasticity	VIB	355	Dr Vinayaka N	9902385846	vinayaka.n@nmit.ac.in
2	18AE72	CFD in Aerospace Engineering	CFD		Mr.Abhishek T K	8660441047	abhishek.tk@nmit.ac.in
3	18AE73	Composite Materials & Structures	CMS		Mr.Shivaji	8073265549	shivaji.lamani@nmit.ac.in
4	18AEH74	Entrepreneurship Development & IPR	EIPR		Dr Srikanth H V	8147719698	srikanth.hv@nmit.ac.in
5	18AEE762	Fatigue and Fracture	PE	355	Mr Ram Vishal G	9676141747	ramvishal.g@nmit.ac.in
	18AEE759	Advances in Artificial intelligence and machine learning		366	Mrs.Thara L	9686919584	Thara.l.ae@nmit.ac.in
6	18AEO761	Mechanics of Flight	OE	355	Mrs Jhumki Nandy	7387138707	jhumki.nandy@nmit.ac.in
7	18AEL77	Simulation Laboratory	SML-A1	370	Mr Prashant Manvi	9739066998	prashant.manvi@nmit.ac.in
			SML-A2		Mrs. Thara	9686919584	Thara.l.ae@nmit.ac.in
8	18AEL78	Aircraft Systems Lab	ASL-A1	PGDM Block	Mr Sridhar K	9965895279	sridhar.kanagaraj@nmit.ac.in
			ASL-A2		Dr Rajdurai	8883678026	rajadurai.m@nmit.ac.in
9	18AEI/S/P79	Internship/Self-Study/Minor Project	ISM	355	Dr Vinayaka N	9902385846	vinayaka.n@nmit.ac.in
10	18AEP710	Project Phase-II	PP-II		Dr Rajdurai Mr.Abhishek T K	8883678026 8660441047	rajadurai.m@nmit.ac.in abhishek.tk@nmit.ac.in

Time Table coordinator | Prof & HoD | Principal

TIMETABLE

SECTION -A AIDS ROOM 101	1 8:45am- 9:40am	2 9:55am 10:50am	3 10:50am 11:45am	4 11:45am 12:40pm	12:40pm 1:30pm	5 1:30pm 2:25pm	6 2:25pm- 3:20pm	7 3:20pm 4:15pm
Monday	SFH	MATHS	ENG	CHEM		ESC-1	PYTHON(A2)/SKILL LAB(A1)	
Tuesday	CHEML LAB		PYTHON	MATHS		ESC-1	CIP	
Wednesday	CHEM	PYTHON	MATHS	SFH		ESC-1	CAED	
Thursday	MATHS	MATHS	PYTHON(A1)/SKILL LAB(A2)			ESC-1		
Friday	CAED		CHEM	ENG		MATHS		

I semester: Chemistry Cycle		CLASS TEACHER : Mrs Sadhana H Upadya	
Sl No	Course Code	Course Title	Section A AIDS ROOM NO 101
1	22MATS11	Mathematics- I	Dr Chandrakala S B
2	22CHES12	Chemistry	Mrs Sadhana Upadya H
3	22CED13	Computer Aided Engineering Drawing	Dr Chethan K S
4	22ESC141	Introduction to Civil Engineering	
	22ESC142	Introduction to Electrical Engineering	Open Elective to be given
	22ESC143	Introduction to Electronics Engineering	
	22ESC144	Introduction to Mechanical Engineering	
5	22PLC15b	Introduction to Python Programming	Dr P V R Murthy (AIDS)
6	22ENG16	Commutative English	Mrs Ann Theres Joy
7	22IC07	Indian Constitution	Dr Vandana Rai
8	22SFH18	Scientific Foundations for Health	Dr BhanuPrakash

Note: Python Lab---lab8 of CSE Departmen

FIRST YEAR COORDINATOR **DEAN ACADEMICS** **PRINCIPAL**

SECTION -B AIML ROOM 101	1 8:45am- 9:40am	2 9:55am 10:50am	3 10:50am 11:45am	4 11:45am 12:40pm	12:40pm 1:30pm	5 1:30pm 2:25pm	6 2:25pm- 3:20pm	7 3:20pm 4:15pm
Monday	CAED		CHEM	MATHS		ESC-1	ENG	MATHS
Tuesday	PYTHON	MATHS	CAED			ESC-1	PYTHON(B2)/SKILL LAB(B1)	
Wednesday	SFH	CIP	CHEM LAB			ESC-1		
Thursday	PYTHON(B1)/SKILL LAB(B2)		SFH	MATHS		ESC-1	CHEM	
Friday	CHEM	ENG	PYTHON	MATHS		MATHS		

I semester: Chemistry Cycle			**Class Teacher: Dr Sreekala C K**
Sl No	**Course Code**	**Course Title**	**Section B AIML ROOM NO 102**
1	22MATS11	Mathematics- I	Dr Sreekala C K
2	22CHES12	Chemistry	Mrs Sadhana
3	22CED13	Computer Aided Engineering Drawing	Dr Vijay Kumar S
4	22ESC141	Introduction to Civil Engineering	
	22ESC142	Introduction to Electrical Engineering	Open Elective to be given
	22ESC143	Introduction to Electronics Engineering	
	22ESC144	Introduction to Mechanical Engineering	
5	22PLC15b	Introduction to Python Programming	Dr Manoj I V(Mech Dept)
6	22ENG16	Commutative English	Mrs Ann Theres Joy
7	22IC07	Indian Constitution	Dr Vandana Rai
8	22SFH18	Scientific Foundations for Health	Dr BhanuPrakash

Note: Python Lab---Room 330 of ISE Department

FIRST YEAR COORDINATOR **DEAN ACADEMICS** **PRINCIPAL**

SECTION -C CSE ROOM 103	1 8:45am- 9:40am	2 9:55am 10:50am	3 10:50am 11:45am	4 11:45am 12:40pm	12:40pm 1:30pm	5 1:30pm 2:25pm	6 2:25pm- 3:20pm	7 3:20pm 4:15pm
Monday	MATHS	CHEM	PYTHON(C1)/SKILL LAB(C2)			ESC-1	MATHS	
Tuesday	CHEM	MATHS	CIP	PYTHON		ESC-1	CAED	
Wednesday	PYTHON(C2)/SKILL LAB(C1)		ENG	MATHS		ESC-1	PYTHON	
Thursday	SFH	ENG	CAED			ESC-1	MATHS	MATHS
Friday	CHEM LAB		CHEM	SFH				

I semester: Chemistry Cycle			**Class Teacher: Dr Sowmyashree A S**
Sl No	**Course Code**	**Course Title**	**Section C CSE ROOM NO 103**
1	22MATS11	Mathematics- I	Mrs Rashmi K R
2	22CHES12	Chemistry	Dr Sowmyashree
3	22CED13	Computer Aided Engineering Drawing	Dr Chethan D
4	22ESC141	Introduction to Civil Engineering	
	22ESC142	Introduction to Electrical Engineering	Open Elective to be given
	22ESC143	Introduction to Electronics Engineering	
	22ESC144	Introduction to Mechanical Engineering	
5	22PLC15b	Introduction to Python Programming	Mrs Shilpa(CSE)
6	22ENG16	Commutative English	Mrs Ann Theres Joy
7	22IC07	Indian Constitution	Dr Vandana Rai
8	22SFH18	Scientific Foundations for Health	Dr BhanuPrakash

Note: Python Lab---lab8 of CSE Department

FIRST YEAR COORDINATOR **DEAN ACADEMICS** **PRINCIPAL**

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SECTION -D CSE ROOM 104	1 8:45am-9:45am	2 9:45 am 10:45am	3 10:55am 11:55am	4 11:55am 12:55pm	12:55pm 1:30pm	5 1:30pm 2:25pm	6 2:25pm-3:20pm	7 3:20pm 4:15pm
Monday	CHEM	SFH	ENG	MATHS		ESC-1		
Tuesday	CAED		PYTHON	MATHS		ESC-1		
Wednesday	MATHS	MATHS	PYTHON	CHEM		ESC-1	CIP	ENG
Thursday	MATHS	CHEM	CHEM LAB			ESC-1	PYTHON(D2)/SKILL LAB(D1)	
Friday	PYTHON(D1)/SKILL LAB(D2)		SFH	MATHS		CAED		

I semester: Chemistry Cycle			**Class Teacher: Mr Pramod S**
Sl No	**Course Code**	**Course Title**	**Section D CSE ROOM NO 104**
1	22MATS11	Mathematics- I	Mr Pramod S
2	22CHES12	Chemistry	Dr Srilatha Rao
3	22CED13	Computer Aided Engineering Drawing	Dr Shailesh Rao
4	22ESC141	Introduction to Civil Engineering	
	22ESC142	Introduction to Electrical Engineering	Open Elective to be given
	22ESC143	Introduction to Electronics Engineering	
	22ESC144	Introduction to Mechanical Engineering	
5	22PLC15b	Introduction to Python Programming	Ms Sowmya P (CSE)
6	22ENG16	Commutative English	Mrs Ann Theres Joy
7	22IC07	Indian Constitution	Dr Vandana Rai
8	22SFH18	Scientific Foundations for Health	Dr BhanuPrakash

Note: Python Lab---lab8 of CSE Department

FIRST YEAR COORDINATOR **DEAN ACADEMICS** **PRINCIPAL**

SECTION -E CSE ROOM 105	1 8:45am-9:45am	2 9:45 am 10:45am	3 10:55am 11:55am	4 11:55am 12:55pm	12:55pm 1:30pm	5 1:30pm 2:25pm	6 2:25pm-3:20pm	7 3:20pm 4:15pm
Monday	ENG	CHEM	CHEM LAB			ESC-1		
Tuesday	CHEM	PYTHON	MATHS	ENG		ESC-1	MATHS	
Wednesday	CAED		PYTHON(E1)/SKILL LAB(E2)			ESC-1	MATHS	
Thursday	MATHS	CIP	PYTHON	SFH		ESC-1	CAED	
Friday	SFH	CHEM	MATHS	MATHS		PYTHON(E2)/SKILL LAB(E1)		

I semester: Chemistry Cycle			**Class Teacher: Mrs Sushma C T**
Sl No	**Course Code**	**Course Title**	**Section E CSE ROOM NO 105**
1	22MATS11	Mathematics- I	Mrs Sushma C T
2	22CHES12	Chemistry	Dr Srilatha Rao
3	22CED13	Computer Aided Engineering Drawing	Dr Avinash L
4	22ESC141	Introduction to Civil Engineering	Open Elective to be given
	22ESC142	Introduction to Electrical Engineering	
	22ESC143	Introduction to Electronics Engineering	
	22ESC144	Introduction to Mechanical Engineering	
5	22PLC15b	Introduction to Python Programming	Ms Sandya B R(CSE)
6	22ENG16	Commutative English	Mrs Ann Theres Joy
7	22IC07	Indian Constitution	Dr Vandana Rai
8	22SFH18	Scientific Foundations for Health	Dr BhanuPrakash

Note: Python Lab---lab8 of CSE Department

FIRST YEAR COORDINATOR **DEAN ACADEMICS** **PRINCIPAL**

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SECTION -F ISE ROOM-201	1 8:45am-9:45am	2 9:45 am 10:45am	3 10:55am 11:55am	4 11:55am 12:55pm	12:55pm 1:30pm	5 1:30pm 2:25pm	6 2:25pm-3:20pm	7 3:20pm 4:15pm
Monday	CHEM	ENG	CAED			ESC-1		
Tuesday	PYTHON(F1)/SKILL LAB(F2)		MATHS	CHEM		ESC-1		
Wednesday	CHEM LAB		SFH	PYTHON		ESC-1	MATHS	MATHS
Thursday	CAED		MATHS	CIP		ESC-1	ENG	
Friday	PYTHON	SFH	CHEM	MATHS		MATHS	PYTHON(F2)/SKILL LAB(F1)	

I semester: Chemistry Cycle			**Class Teacher : Mrs Sumashree.P**
Sl No	**Course Code**	**Course Title**	**Section F ISE ROOM NO 201**
1	22MATS11	Mathematics- I	Mrs Sumashree.P
2	22CHES12	Chemistry	Dr Aravind T
3	22CED13	Computer Aided Engineering Drawing	Mr Girish Prasad
4	22ESC141	Introduction to Civil Engineering	
	22ESC142	Introduction to Electrical Engineering	Open Elective to be given
	22ESC143	Introduction to Electronics Engineering	
	22ESC144	Introduction to Mechanical Engineering	
5	22PLC15b	Introduction to Python Programming	Mr. Mohan M(ISE)
6	22ENG16	Commutative English	Mrs Ann Theres Joy
7	22IC07	Indian Constitution	Dr Vandana Rai
8	22SFH18	Scientific Foundations for Health	Dr BhanuPrakash

Note: Python Lab---Room 330 of ISE Department

FIRST YEAR COORDINATOR **DEAN ACADEMICS** **PRINCIPAL**

SECTION -G ISE ROOM 202	1 8:45am- 9:45am	2 9:45 am 10:45am	3 10:55am 11:55am	4 11:55am 12:55pm	12:55pm 1:30pm	5 1:30pm 2:25pm	6 2:25pm- 3:20pm	7 3:20pm 4:15pm
Monday	CAED		MATHS	SFH		ESC-1		
Tuesday	CHEM	PYTHON	CAED			ESC-1	MATHS	MATHS
Wednesday	MATHS	SFH	CHEM	ENG		ESC-1	PYTHON(G1)/SKILL LAB(G2)	
Thursday	CHEM LAB		CHEM	MATHS		ESC-1	CIP	
Friday	ENG	PYTHON	PYTHON(G2)/SKILL LAB(G1)			MATHS		

I semester: Chemistry Cycle			**Class Teacher: Dr Kshama Shetty**
Sl No	**Course Code**	**Course Title**	**Section G ISE ROOM NO 202**
1	22MATS11	Mathematics- I	New Faculty (till then DM)
2	22CHES12	Chemistry	Dr Kshama Shetty
3	22CED13	Computer Aided Engineering Drawing	Mr Hemanth Kumar N
4	22ESC141	Introduction to Civil Engineering	
	22ESC142	Introduction to Electrical Engineering	Open Elective to be given
	22ESC143	Introduction to Electronics Engineering	
	22ESC144	Introduction to Mechanical Engineering	
5	22PLC15b	Introduction to Python Programming	Faculty from ISE
6	22ENG16	Commutative English	Mrs Ann Theres Joy
7	22IC07	Indian Constitution	Dr Vandana Rai (Coming only for 3 days)
8	22SFH18	Scientific Foundations for Health	Dr BhanuPrakash (coming only for 4 days between 11:00 am -3:30Pm

Note: Python Lab---Room 330 of ISE Department

SECTION -H ISE ROOM 203	1 8:45am- 9:45am	2 9:45 am 10:45am	3 10:55am 11:55am	4 11:55am 12:55pm	12:55pm 1:30pm	5 1:30pm 2:25pm	6 2:25pm- 3:20pm	7 3:20pm 4:15pm
Monday	PYTHON(H2)/SKILL LAB(H1)		SFH	PYTHON		ESC-1		
Tuesday	CHEM	MATHS	PYTHON(H1)/SKILL LAB(H2)			ESC-1		
Wednesday	MATHS	ENG	CAED			ESC-1		
Thursday	ENG	SFH	CHEM	MATHS		ESC-1	MATHS	CIP
Friday	PYTHON	CHEM	CHEM LAB			MATHS	CAED	

I semester: Chemistry Cycle			**Class Teacher: Dr Padmavathi R**
Sl No	**Course Code**	**Course Title**	**Section H ISE ROOM NO 203**
1	22MATS11	Mathematics- I	Dr Padmavathi R
2	22CHES12	Chemistry	Mrs Shwetha
3	22CED13	Computer Aided Engineering Drawing	Dr P V Badiger
4	22ESC141	Introduction to Civil Engineering	
	22ESC142	Introduction to Electrical Engineering	Open Elective to be given
	22ESC143	Introduction to Electronics Engineering	
	22ESC144	Introduction to Mechanical Engineering	
5	22PLC15b	Introduction to Python Programming	Ms. Tejaswini N P (ISE)
6	22ENG16	Commutative English	Mrs Ann Theres Joy
7	22IC07	Indian Constitution	Dr Vandana Rai
8	22SFH18	Scientific Foundations for Health	Dr BhanuPrakash

Note: Python Lab---Room 330 of ISE Department

FIRST YEAR COORDINATOR **DEAN ACADEMICS** **PRINCIPAL**

SECTION -I CIVIL ROOM 204	1 8:45am- 9:45am	2 9:45 am 10:45am	3 10:55am 11:55am	4 11:55am 12:55pm	12:55pm 1:30pm	5 1:30pm 2:25pm	6 2:25pm- 3:20pm	7 3:20pm 4:15pm
Monday	KANNADA	C-PROG	PHYSICS	EM		ETC-1	MATHS	
Tuesday	MATHS	PHYSICS	ENG	MATHS		ETC-1		
Wednesday	C-PROG	PHYSICS	MATHS	EM		ETC-1	PHY(I1)/CPROG LAB(I2)	
Thursday	PHYSICS	C-PROG	EM	EM		ETC-1	MATHS	
Friday	PHY(I2)/CPROG LAB(I1)		PHYSICS	ENG		MATHS	IDT LAB	

I semester: Physics Cycle			CLASS TEACHER: Mrs Jyothi Gupta
Sl No	**Course Code**	**Course Title**	**Section I (Civil) ROOM NO 204**
1	**22MATS11**	**Mathematics- I**	Mrs Swathi H R
2	**22CHES12**	**Physics**	Mrs Jyothi Gupta
3	**22CIV13**	**Engineering Mechanics**	Mrs Pratima (Civil)
4	**22ESC145**	**Introduction to C Programming**	Dr Nagaratna (CSE)
5	**22ETC15**	**Introduction to Drone Technology (Aero Dept)**	
		Introduction to Sustainable Engg (Civil dept)	
		Renewable Energy Sources (Mech Dept)	
		Introduction to Solar Energy (EEE dept)	
		Introduction to Smart Materials(Mech Dept)	
		Introction to Nano Materials(Mech Dept)	
		Introduction to Embedded System (ECE Dept)	
6	**22ENG16**	**Communicatative English**	Ms Priyanka Tresa Paul
7	**22KSK17/22KBK17**	**Kannada**	DrGowramma(BK) & Dr Pathaiah (SK)
8	**22IDT18**	**IDT**	**Mr Manjunath L (civil)**

NOTE: C-PROG LAB--- LAB7 OF CSE DEPARTMENT

FIRST YEAR COORDINATOR **DEAN ACADEMICS** **PRINCIPAL**

SECTION -J MECH ROOM 205	1 8:45am-9:45am	2 9:45 am 10:45am	3 10:55am 11:55am	4 11:55am 12:55pm	12:55pm 1:30pm	5 1:30pm 2:25pm	6 2:25pm-3:20pm	7 3:20pm 4:15pm
Monday	KANNADA	C-PROG	PHYSICS	MATHS		ETC-1	PHY(J1)/CPROG LAB(J2)	
Tuesday	C-PROG	ENG	PHYSICS	EME		ETC-1	MATHS	
Wednesday	PHYSICS		ENG	EME		ETC-1	MATHS	
Thursday	C-PROG	MATHS	PHYSICS	PHYSICS®		ETC-1	EME	
Friday	EME	MATHS	PHY(J2)/CPROG LAB(J1)			IDT LAB		

I semester: Physics Cycle		CLASS TEACHER: Mrs Swathi H R	
Sl No	**Course Code**	**Course Title**	**Section J (Mech & Aero) ROOM NO 205**
1	**22MATS11**	**Mathematics- I**	Mrs Swathi H R
2	**22CHES12**	**Physics**	Dr Sheik Abdul Sattar
	22EME13	**Elements of Mechanical Engineering**	Mr Girish Prasad (Mech)
4	**22ESC145**	**Introduction to C Programming**	Ms. Pushpanjali (CSE)
5	**22ETC15**	**Introduction to Drone Technology (Aero Dept)**	
		Introduction to Sustainable Engg(Civil dept)	
		Renewable Energy Sources (Mech Dept)	
		Introduction to Solar Energy (EEE dept)	
		Introduction to Smart Materials(Mech Dept)	
		Introction to Nano Materials(Mech Dept)	
		Introduction to Embedded System (ECE Dept)	
6	**22ENG16**	**Communicatative English**	Ms Priyanka Tresa Paul
7	**22KSK17/22KBK17**	**Kannada**	Dr Gowramma (BK) & Dr Pathaiah(SK)
8	**22IDT18**	**IDT LAB**	**Dr Harish Kumar L (MECH)**

NOTE: C-PROG LAB--- LAB7 OF CSE DEPARTMENT

FIRST YEAR COORDINATOR **DEAN ACADEMICS** **PRINCIPAL**

SECTION -K AERO ROOM 301	1 8:45am- 9:45am	2 9:45 am 10:45am	3 10:55am 11:55am	4 11:55am 12:55pm	12:55pm 1:30pm	5 1:30pm 2:25pm	6 2:25pm- 3:20pm	7 3:20pm 4:15pm
Monday	PHY(K1)/CPROG LAB(K2)		EME	PHYSICS		ETC-1	IDT LAB	
Tuesday	KANNADA	PHYSICS	MATHS	EME		ETC-1	PHYSICS®	MATHS
Wednesday	EME	PHYSICS	MATHS	C-PROG		ETC-1	MATHS	
Thursday	MATHS	EME	ENG	C-PROG		ETC-1		
Friday	PHYSICS	C-PROG	MATHS	ENG		PHY(K2)/CPROG LAB(K1)		

I semester: Physics Cycle CLASS TEACHER: Mrs Kavitha Kamath

Sl No	Course Code	Course Title	Section K (Aero) ROOM NO 301
1	22MATS11	Mathematics- I	Mrs Rashmi K R
2	22CHES12	Physics	Mrs Kavitha Kamath
	22EME13	Elements of Mechanical Engineering	Mr Raghavendra G (Mech)
4	22ESC145	Introduction to C Programming	Mrs Jagadevi Kalasetty(CSE)
5	22ETC15	Introduction to Drone Technology (Aero Dept)	
		Introduction to Sustainable Engg(Civil dept)	
		Renewable Energy Sources (Mech Dept)	
		Introduction to Solar Energy (EEE dept)	
		Introduction to Smart Materials(Mech Dept)	
		Introction to Nano Materials(Mech Dept)	
		Introduction to Embedded System (ECE Dept)	
6	22ENG16	Communicatative English	Ms Priyanka Tresa Paul
7	22KSK17/22KBK17	Kannada	DrGowramma (BK) & Dr Pathaiah(SK)
8	22IDT18	IDT	Dr Harish Kumar L (MECH)

NOTE: C-PROG LAB--- LAB7 OF CSE DEPARTMENT

FIRST YEAR COORDINATOR **DEAN ACADEMICS** **PRINCIPAL**

SECTION -L ECE ROOM 302	1 8:45am- 9:45am	2 9:45 am 10:45am	3 10:55am 11:55am	4 11:55am 12:55pm	12:55pm 1:30pm	5 1:30pm 2:25pm	6 2:25pm- 3:20pm	7 3:20pm 4:15pm
Monday	PHYSICS	ENG	MATHS	C-PROG		ETC-1		
Tuesday	ENG	PHYSICS	PHY(L2)/CPROG LAB(L1)			ETC-1	IDT LAB	
Wednesday	KANNADA	ELN	PHYSICS	C-PROG		ETC-1	MATHS	MATHS
Thursday	PHY(L1)/CPROG LAB(L2)		MATHS	ELN		ETC-1	PHYSICS®	MATHS
Friday	C-PROG	ELN	MATHS	PHYSICS		ELN		

I semester: Physics Cycle Class Teacher : Mrs Ranjitha

Sl No	Course Code	Course Title	Section L (ECE) ROOM NO302
1	22MATS11	Mathematics- I	Mr Pramod S
2	22CHES12	Physics	Mrs Ranjitha K
	22ELN 13	Basic Electronics	Mrs Ashitha(ECE)
4	22ESC145	Introduction to C Programming	Mrs Chaitra (ECE)
5	22ETC15	Introduction to Drone Technology (Aero Dept)	
		Introduction to Sustainable Engg(Civil dept)	
		Renewable Energy Sources(Mech Dept)	
		Introduction to Solar Energy (EEE dept)	
		Introduction to Smart Materials(Mech Dept)	
		Introction to Nano Materials(Mech Dept)	
		Introduction to Embedded System (ECE Dept)	
6	22ENG16	Communicatative English	Ms Priyanka Tresa Paul
7	22KSK17/22KBK17	Kannada	DrGowramma (BK) & Dr Pathaiah(SK)
8	22IDT18	IDT	Mr Manjunath H N (MECH)

NOTE: C-PROG LAB--- Room no 248 OF ISE DEPARTMENT

FIRST YEAR COORDINATOR **DEAN ACADEMICS** **PRINCIPAL**

SECTION M ECE ROOM 303	1 8:45am-9:45am	2 9:45 am 10:45am	3 10:55am 11:55am	4 11:55am 12:55pm	12:55pm 1:30pm	5 1:30pm 2:25pm	6 2:25pm-3:20pm	7 3:20pm 4:15pm
Monday	C-PROG	MATHS	IDT LAB			ETC-1	MATHS	
Tuesday	ELN	PHYSICS	C-PROG	ENG		ETC-1	PHYSICS®	
Wednesday	PHY(M2)/CPROG LAB(M1)		PHYSICS	MATHS		ETC-1	ELN	
Thursday	KANNADA	ELN	MATHS	PHYSICS		ETC-1	PHY(M1)/CPROG LAB(M2)	
Friday	MATHS	PHYSICS	ENG	C-PROG		ELN	MATHS	

I semester: Physics Cycle Class Teacher : Mr.ShivaPrasad

Sl No	Course Code	Course Title	Section M (ECE) ROOM NO 303
1	22MATS11	Mathematics- I	Mrs Sushma T C
2	22CHES12	Physics	Mr Shivaprasad
	22ELN 13	Basic Electronics	Mrs Naina Karkala(ECE)
4	22ESC145	Introduction to C Programming	Ms. Suganya (ECE)
5	22ETC15	Introduction to Drone Technology (Aero Dept)	
		Introduction to Sustainable Engg(Civil dept)	
		Renewable Energy Sources (Mech Dept)	
		Introduction to Solar Energy (EEE dept)	
		Introduction to Smart Materials(Mech Dept)	
		Intoction to Nano Materials (Mech Dept)	
		Introduction to Embedded System (ECE Dept)	
6	22ENG16	Communicatative English	Ms Priyanka Tresa Paul
7	22KSK17/22KBK17	Kannada	DrGowramma(BK) & Dr Pathaiah (SK)

NOTE: C-PROG LAB--- Room no 248 OF ISE DEPARTMENT

FIRST YEAR COORDINATOR **DEAN ACADEMICS** **PRINCIPAL**

SECTION -N EEE ROOM 304	1 8:45am- 9:45am	2 9:45 am 10:45am	3 10:55am 11:55am	4 11:55am 12:55pm	12:55pm 1:30pm	5 1:30pm 2:25pm	6 2:25pm- 3:20pm	7 3:20pm 4:15pm
Monday	C-PROG	PHYSICS	BEE	ENG		ETC-1	BK	SK
Tuesday	PHY(N1)/CPROG LAB(N2)		BEE	MATHS		ETC-1	ENG	PHYSICS
Wednesday	MATHS	MATHS	PHYSICS	BEE		ETC-1	IDT LAB	
Thursday	PHYSICS	C-PROG	PHY(N2)/CPROG LAB(N1)			ETC-1	MATHS	MATHS
Friday	PHYSICS	MATHS	BEE	C-PROG				

I semester: Physics Cycle Class Teacher: Mrs Jyothi G B

Sl No	Course Code	Course Title	Section N (EEE) ROOM NO 304
1	22MATS11	Mathematics- I	Mrs Sumashree.P
2	22CHES12	Physics	Mrs Jyothi G B
	22EEE13	Elements of Electrical Engineering	Dr Prasanth (EEE)
4	22ESC145	Introduction to C Programming	Dr Aruna (AIML)
5	22ETC15	Introduction to Drone Technology (Aero Dept)	
		Introduction to Sustainable Engg(Civil dept)	
		Renewable Energy Sources(Mech Dept)	
		Introduction to Solar Energy (EEE dept)	
		Introduction to Smart Materials(Mech Dept)	
		Introction to Nano Materials(Mech Dept)	
		Introduction to Embedded System (ECE Dept)	
6	22ENG16	Communicatative English	Ms Priyanka Tresa Paul
7	22KSK17/22KBK17	Kannada	DrGowramma(BK) & Dr Pathaiah (SK)
8	22IDT18	IDT	Dr Ramesh Babu N (MECH)

NOTE: C-PROG LAB--- Room no 248 OF ISE DEPARTMENT

FIRST YEAR COORDINATOR **DEAN ACADEMICS** **PRINCIPAL**

SECTION -P ECE ROOM 305	1 8:45am-9:45am	2 9:45 am 10:45am	3 10:55am 11:55am	4 11:55am 12:55pm	12:55pm 1:30pm	5 1:30pm 2:25pm	6 2:25pm-3:20pm	7 3:20pm 4:15pm
Monday	PHYSICS	MATHS	PHY(P1)/CPROG LAB(P2)			ETC-1	ELN	
Tuesday	C-PROG	ELN	MATHS	PHYSICS		ETC-1	PHY(P2)/CPROG LAB(P1)	
Wednesday	ENG	PHYSICS	C-PROG	ELN		ETC-1	MATHS	
Thursday	MATHS	ELN	PHYSICS	ENG		ETC-1		
Friday	KANNADA	C-PROG	IDT LAB			MATHS	PHYSICS®	

I semester: Physics Cycle Class Teacher: Mr Naveen Kumar & Mr Prashanth

Sl No	Course Code	Course Title	Section P (ECE) ROOM NO 305
1	22MATS11	Mathematics- I	Dr Kiran S
2	22CHES12	Physics	Mr. Naveen Kumar & Mr Prashanth
	22ELN 13	Basic Electronics	Mrs LathaKumari (ECE)
4	22ESC145	Introduction to C Programming	Mrs Padmashree (ECE)
5	22ETC15	Introduction to Drone Technology (Aero Dept)	
		Introduction to Sustainable Engg(Civil dept)	
		Renewable Energy Sources (Mech Dept)	
		Introduction to Solar Energy (EEE dept)	
		Introduction to Smart Materials(Mech Dept)	
		Introction to Nano Materials(Mech Dept)	
		Introduction to Embedded System (ECE Dept)	
6	22ENG16	Communicatative English	Ms Priyanka Tresa Paul
7	22KSK17/22KBK17	Kannada	DrGowramma(BK) & Dr Pathaiah
8	22IDT18	IDT	Dr Sunil (ECE)

NOTE: C-PROG LAB--- Room no 248 OF ISE DEPARTMENT

FIRST YEAR COORDINATOR **DEAN ACADEMICS** **PRINCIPAL**

SECTION -Q EEE ROOM 405	1 8:45am-9:45am	2 9:45 am 10:45am	3 10:55am 11:55am	4 11:55am 12:55pm	12:55pm 1:30pm	5 1:30pm 2:25pm	6 2:25pm-3:20pm	7 3:20pm 4:15pm
Monday	C-PROG	MATHS	BEE	PHYSICS		ETC-1	BK	SK
Tuesday	BEE	C-PROG	PHYSICS	ENG		ETC-1	ENG	MATHS
Wednesday	PHYSICS	C-PROG	PHY(Q1)/CPROG LAB(Q2)			ETC-1	MATHS	BEE
Thursday	ENG	IDT LAB		MATHS		ETC-1	PHYSICS®	
Friday	MATHS	BEE	PHYSICS			PHY(Q2)/CPROG LAB(Q1)		

I semester: Physics Cycle		Class Teacher:	
Sl No	**Course Code**	**Course Title**	**Section Q (EEE) ROOM NO 405**
1	**22MATS11**	**Mathematics- I**	Dr Indira R
2	**22CHES12**	**Physics**	Dr Hitha Shetty
	22EEE13	**Elements of Electrical Engineering**	Mrs Sridevi H R (EEE)
4	**22ESC145**	**Introduction to C Programming**	Ms. Shyamashree Das (AIDS) & Ms. B P Nayana(AIDS)
5	**22ETC15**	**Introduction to Drone Technology (Aero Dept)**	
		Introduction to Sustainable Engg(Civil dept)	
		Renewable Energy Sources (Mech Dept)	
		Introduction to Solar Energy (EEE dept)	
		Introduction to Smart Materials(Mech Dept)	
		Introction to Nano Materials(Mech Dept)	
		Introduction to Embedded System (ECE Dept)	
6	**22ENG16**	**Communicatative English**	Ms Priyanka Tresa Paul
7	**22KSK17/22KBK17**	**Kannada**	DrGowramma(BK) & Dr Pathaiah
8	**22IDT18**	**IDT**	**Dr Shiv Pratap Singh (MECH)**

NOTE: C-PROG LAB--- Room no 248 OF ISE DEPARTMENT

FIRST YEAR COORDINATOR **DEAN ACADEMICS** **PRINCIPAL**

SECTION-R AERO ROOM 404	1 8:45am-9:45am	2 9:45 am 10:45am	3 10:55am 11:55am	4 11:55am 12:55pm	12:55pm 1:30pm	5 1:30pm 2:25pm	6 2:25pm-3:20pm	7 3:20pm 4:15pm
Monday	PHYSICS	C-PROG	MATHS	EME		ETC-1	PHY(R1)/CPROG LAB(R2)	
Tuesday	KANNADA	MATHS	EME	PHYSICS		ETC-1		
Wednesday	C-PROG	PHYSICS	IDT LAB			ETC-1		
Thursday	MATHS	MATHS	PHYSICS	EME		ETC-1	ENG	PHYSICS®
Friday	MATHS	ENG	PHY(R2)/CPROG LAB(R1)			MATHS	EME	

I semester: Physics Cycle		Class Teacher:	
Sl No	**Course Code**	**Course Title**	**Section R (AERO) Room 404**
1	**22MATS11**	**Mathematics- I**	Dr Jagadeesha S
2	**22CHES12**	**Physics**	Dr Abdul Sattar
	22EME13	**Elements of Mechanical Engineering**	Dr Praveen B A (Mech)
4	**22ESC145**	**Introduction to C Programming**	
5	**22ETC15**	**Introduction to Drone Technology (Aero Dept)**	
		Introduction to Sustainable Engg(Civil dept)	
		Renewable Energy Sources(Mech Dept)	
		Introduction to Solar Energy (EEE dept)	
		Introduction to Smart Materials(Mech Dept)	
		Intrction to Nano Materials(Mech Dept)	
		Introduction to Embedded System (ECE Dept)	
6	**22ENG16**	**Communicatative English**	Ms Priyanka Tresa Paul
7	**22KSK17/22KBK17**	**Kannada**	DrGowramma(BK) & Dr Pathaiah
8	**22IDT18**	**IDT**	**Mrs Krupa R (MECH)**

NOTE: C-PROG LAB--- LAB7 OF CSE DEPARTMENT

FIRST YEAR COORDINATOR **DEAN ACADEMICS** **PRINCIPAL**

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Department of Artificial Intelligence and Machine Learning

REF NO: NMIT/AIML/TT 2022-23/3/v1 **W.e.f: 09/11/2022**

Time Table for the Academic Year 2022-23 (Odd Semester)

Class: 3rd Semester AIML **Class Teacher: Mr. V Sunil Kumar** **Room No: 402**

	I 8.45–9.45	II 9.45 - 10.45	10.45 10.55	III 10.55-11.55	IV 11.55 12.55	12.55-1.30	VI 1.30- 2.30	VI 2.30 3.30	VII 3.30 – 4.15
MON	21MAT31A	21AMG35		21AM33	21AM34		Internship/Placement Training		
TUE	21AM32	21AM34	**B**	21MAT31A	21AME372	**L**	Kannada	Bridge Maths (LE)	
WED	21AMG35	21AMG35	**R**	21AM32	21AM33	**U**	21AML38 (B1)		
THU	21AM33	21AME372	**E**	IOT-COE		**N**	21AML38 (B2)		
FRI	21MAT31A	21AMG35	**A**	21AM34	21AME372	**C**	Kannada	IOT-COE	
SAT	21AM34	21AM32	**K**	21MAT31A	21AM33	**H**			

Total Contact Hours: **Theory** – 24 hours **Lab**-4 hours **Total** – 28 hours

Theory:

Sl No	Subject Code	Subject Name	Faculty Name	PHONE NO
1	21MAT31A	INTEGRAL TRANSFORMS, LINEAR ALGEBRA AND NUMERICAL METHODS	Mr. Pramod S	9036882924
2	21AM32	INTRODUCTION TO ARTIFICIAL INTELLIGENCE	Mrs. Aruna T M	8296760239
3	21AM33	SOFTWARE ENGINEERING	Dr. Jyothi Neeli	9480041556
4	21AM34	STATISTICS FOR AI	Dr. Indira R	9900567039
5	21AMG35	DATA STRUCTURES INTEGRATED	Mr. V Sunil Kumar	9035151112
6	21AML38	INTRODUCTION TO ARTIFICIAL INTELLIGENCE LAB	Dr. Piyush Kumar Pareek/ Mrs. Madhura G K	7022574966/ 9535833005
PROGRAM ELECTIVE				
1	21AME372	INTRODUCTION TO DATA SCIENCE	Mr. V Sunil Kumar	9035151112

Coordinator for Time-Table
(Mrs. Madhura G K)

HOD, Dept. of AIML
(Dr. Piyush Kumar Pareek)

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DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

REF NO:NMIT/CSE/TT 2022-23/3/v2 **W.e.f: 19/12/2022**

Time Table for the Academic Year 2022-23 (Odd Semester)

Class: 3rd Semester CS-A **Class Teacher: Mrs. Ramya S** **Room No: 128**

	I 8.45–9.45	II 9.45 - 10.45	10.45 10.55	III 10.55-11.55	IV 11.55 12.50	12.50-1.30	V 1.30-2.30	VI 2.30 3.30	VII 3.30 – 4.15
MON	MIII	PE		L1: DS Lab-B2-SSJ/SBV L6:DS Lab-B1-RS/SSS L5:DS Lab-B3- SMP/NJS			JAVA	Kannada	
TUE	DADC	DS	B	MIII	Kannada	L	Kannada	Bridge Maths (LE)	
WED	DS	PE	R E	CO&MP	MIII	U N	JAVA	Internship/Placement Training	
THU	CO&MP	JAVA	A	IOT-COE		C	DADC	CO&MP	
FRI	PE	DADC	K	DS	MIII	H	IOT-COE		
SAT	JAVA	DS		CO&MP	DADC				

Total Contact Hours: **Theory** -23 hours **Lab-** 2 hours **Total** - 25 hours

Theory:

Sl No	Subject Code	Subject Name	Faculty Name	PHONE NO
1	21MAT31	ENGINEERING MATHEMATICS –III	Dr. Jagadeesha	9980971991
2	21CS32	DESIGN OF ANALOG AND DIGITAL CIRCUITS (DADC)	Ms. Ramya S (RS)	9880640887
3	21CS33	DATA STRUCTURES (DS)	Ms. Shruthi Shetty (SSJ)	8310091891
4	21CS34	COMPUTER ORGANIZATION AND MICROPROCESSORS (CO&MP)	Dr. Sreenivas N	9611494607
5	21CS35	OOPs WITH JAVA (JAVA)	Ms. Sowmya P(SMP)	9867133715
6	21CSL37	DATA STRUCTURES Lab USING C++	Ms. Shruthi Shetty(SSJ)/ Ms. Nirmala J S(NJS) /Ms. Ramya S(RS)/MS. Sharmila(SSS)/Ms. Sowmya P (SMP)/Dr. Shruthi B V(SBV)	8310091891
PROGRAM ELECTIVE:				
7	21CSE361	INTRODUCTION TO EMBEDDED SYSTEMS	Mr. Satish E G (SEG)	9739707000
8	21CSE362	INTRODUCTION TO IMAGE PROCESSING	Dr.Jyothi Neeli	9480041556
9	21CSE363	INTRODUCTION TO UNIX	Ms. Jayashree S (JS)	9341802445
10	21CSE364	INTRODUCTION TO SOFTWARE TECHNOLOGIES	Dr. Dileep Reddy (DRB)	9980417673

Coordinator for Time-Table
(Dr. P Ramesh Naidu)

HOD, Dept. of CSE
(Dr. Nalini N)

Nalini N
19/12/2022

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DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

REF NO:NMIT/CSE/TT 2022-23/3/v2 **W.e.f: 19/12/2022**

Time Table for the Academic Year 2022-23 (Odd Semester)

Class: 3rd Semester CS-B **Class Teacher: Dr. Nagaratna P** **Room No: 130**

	I 8.45–9.45	II 9.45 - 10.45	10.45-10.55	III 10.55-11.55	IV 11.55 12.50	12.50-1.30	V 1.30-2.30	VI 2.30 3.30	VII 3.30-4.15
MON	JAVA	PE		DS	MIII		CO&MP	Kannada	
TUE	DS	CO&MP	**B**	DADC	Kannada	**L**	Kannada	Bridge Maths (LE)	
WED	MIII	PE	**R**	JAVA	DADC	**U**	JAVA	Internship/Placement Training	
THU	DADC	MIII	**E A**	IOT-COE		**N C**	L1: DS Lab-B2-NP/RAM L5:DS Lab-B3- SSJ/SEG L6:DS Lab-B1-JS/ DS		
FRI	PE	MIII	**K**	DS	CO&MP	**H**	IOT-COE		
SAT	DADC	CO&MP		JAVA	DS				

Total Contact Hours: Theory: Theory -23 hours **Lab-** 2 hours **Total -** 25 hours

Sl No	Subject Code	Subject Name	Faculty Name	PHONE NO
1	21MAT31	ENGINEERING MATHEMATICS –III	MS. Rashmi K. R	9740292282
2	21CS32	DESIGN OF ANALOG AND DIGITAL CIRCUITS (DADC)	Ms. Ramya S	9880640887
3	21CS33	DATA STRUCTURES (DS)	Dr. Nagaratna P	8618011985
4	21CS34	COMPUTER ORGANIZATION AND MICROPROCESSORS (CO&MP)	Mr. Janardhan	9663429872
5	21CS35	OOP WITH JAVA (JAVA)	Ms. Shruthi Shetty	8310091891
6	21CSL37	DATA STRUCTURES Lab USING C++	Dr. Nagaratna P(NP)/Ms. Shruthi Shetty(SSJ)/Mr Satish(SEG)/Ms. Jayashree(JS)/ Ms. Deepthi Sheety(DS)/Dr. Ramesh(RAM)	8618011985
PROGRAM ELECTIVE				
7	21CSE361	INTRODUCTION TO EMBEDDED SYSTEMS	Mr. Satish E G (SEG)	9739707000
8	21CSE362	INTRODUCTION TO IMAGE PROCESSING	Dr.Jyothi Neeli	9480041556
9	21CSE363	INTRODUCTION TO UNIX	Ms. Jayashree S (JS)	9341802445
10	21CSE364	INTRODUCTION TO SOFTWARE TECHNOLOGIES	Dr. Dileep Reddy (DRB)	9980417673

Coordinator for Time-Table
(Dr. P Ramesh Naidu)

HOD, Dept. of CSE
(Dr. Nalini N)

Nalini N
19/12/2022

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DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

REF NO:NMIT/CSE/TT 2022-23/3/v2 **W.e.f: 19/12/2022**

Time Table for the Academic Year 2022-23 (Odd Semester)

Class: 3rd Semester CS-C **Class Teacher : Ms. Trisheela.** **Room No: 132**

	I 8.45–9.45	II 9.45 - 10.45	10.45 10.55	III 10.55-11.55	IV 11.55 12.50	12.50-1.30	V 1.30-2.30	VI 2.30 3.30	VII 3.30 – 4.15
MON	DS	PE		JAVA	MIII		CO&MP	Kannada	
TUE	DADC	DS	B	JAVA	Kannada	L	Kan nada	Bridge Maths (LE)	
WED	MIII	PE	R E	JAVA	CO&MP	U	MIII	Internship/Placement Training	
THU	CO&MP	DS	A	IOT-COE		N C	DADC	JAVA	Mentor Meeting
FRI	PE	DADC	K	L1: DS Lab-B2-TS/ SN L5:DS Lab-B3- RS/SMR L6:DS Lab-B1-SA/MBG		H	IOT-COE		
SAT	MIII	DS		DADC	CO&MP				

Total Contact Hours: **Theory** -23 hours **Lab-** 2 hours **Total** - 25 hours

Theory:

Sl No	Subject Code	Subject Name	Faculty Name	PHONE NO
1	21MAT31	ENGINEERING MATHEMATICS –III (MIII)	Dr. Jagadeesha	9980971991
2	21CS32	DESIGN OF ANALOG AND DIGITAL CIRCUITS (DADC)	Ms. Shobha	9845733151
3	21CS33	DATA STRUCTURES (DS)	Ms. Shilpa	9620683675
4	21CS34	COMPUTER ORGANIZATION AND MICROPROCESSORS (CO&MP)	Dr. Vasanth Kumar	9902269559
5	21CS35	OOP WITH JAVA (JAVA)	Dr. Vijaya Shetty S	9845450259
6	21CSL37	DATA STRUCTURES Lab USING C++	Ms. Shilpa A(SA)/Ms. Trisheela(TS)/Ms. Ramya S(RS)/ Ms. Sowmya M R(SMR)/ Dr. Srinivas N(SN)/Ms. Mamatha Bai(MBG)	9620683675
PROGRAM ELECTIVE				
7	21CSE361	INTRODUCTION TO EMBEDDED SYSTEMS	Mr. Satish E G (SEG)	9739707000
8	21CSE362	INTRODUCTION TO IMAGE PROCESSING	Dr.Jyothi Neeli	9480041556
9	21CSE363	INTRODUCTION TO UNIX	Ms. Jayashree S (JS)	9341802445
10	21CSE364	INTRODUCTION TO SOFTWARE TECHNOLOGIES	Dr. Dileep Reddy (DRB)	9980417673

Coordinator for Time-Table
(Dr. P Ramesh Naidu)

HOD, Dept. of CSE
(Dr. Nalini N)

Nalini N
19/12/2022

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DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

REF NO:NMIT/CSE/TT 2022-23/5/v2 **W.e.f: 19/09/2022**

Time Table for the Academic Year 2022-23 (Odd Semester)

Class: 5th Semester CS-A **Class Teacher:** Ms. Jayashree **Room No: 134**

	I 8.45– 9.45	II 9.45 - 10.45	10.45- 10.55	III 10.55- 11.55	IV 11.55 12.55	12.55- 1.30	V 1.30 2.30	VI 2.30 3.30	VII 3.30 – 4.15
MON	L1: CN Lab B2 -SSS L2:AI Lab B1-MGK L5:CN Lab B3-SP			DM	FLAT		AI&NN	Placement Training	
TUE	CN	SE	B	FLAT	PE	L	IoT-COE/Placement training		
WED	AI&NN	SE	R E	FLAT	PE	U N	IoT-COE/Placement training/ Cumulative English		
THU	L2: AI Lab B3-MGK L4:AI Lab B2- SSJ L1:CN Lab B1-SSS		A K	DM	PE	C H	SE	CN	
FRI	FLAT	AI&NN		DM	CN		Placement Training		
SAT	SE/ CC (PE)	CN		DM	AI&NN				

Total Contact Hours: **Theory -** 23 hours **Lab-** 4 hours **Total** - 27 hours

Theory:

Sl No	Subject Code	Subject Name	Faculty Name	PHONE NO
1	18CS51	COMPUTER NETWORKS (CN)	Ms. Sharmila Sequeira (SSS)	9964499983
2	18CS52	SOFTWARE ENGINEERING (SE)	Dr. Vasantha kumar G U(VGU)	9902269559
3	18CS54	DATA MINING (DM)	Ms. Jayashree (JS)	9341802445
4	18CS56	ARTIFICIAL INTELLIGENCE AND NEURAL NETWORKS (AI&NN)	Ms. Madhura G K(MGK)	9535833005
5	18CS57	FORMAL LANGUAGES AND AUTOMATA THEORY (FLAT)	Ms. Ushashree P (UP)	9912056225
6	18CSL58	ARTIFICIAL INTELLIGENCE WITH PYTHON LAB (AI Lab)	Ms. Madhura G K (MGK)/Ms. Shruthi Shetty(SSJ)	9535833005
7	18CSL59	COMPUTER NETWORKS LAB (CN Lab)	Ms. Sharmila Sequeira /Ms. Shobha P (SP)	9964499983
8	18CSE531	COMPUTER GRAPHICS	Ms. Nirmala J Saunshimath (NJS)	9880037599
9	18CSE532	INFORMATION SECURITY (PE)- Room No: 138	Dr. H. Saroja Devi (SH)	9845977020
10	18CSE533	INTERNET OF THINGS (PE)-Room No:135	Dr. Dileep Reddy Bolla	9980417673
11	18CSE539	INTRODUCTION TO CLOUD COMPUTING- Room No:132	Ms. Pushpanjali M K /Mr. Jayashankar (Adjunct Faculty)	9986951420/ 9880936066

Coordinator for Time-Table
(Dr. P Ramesh Naidu)

HOD, Dept. of CSE
(Dr. Nalini N)

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DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

REF NO:NMIT/CSE/TT 2022-23/5/v2 **W.e.f: 19/09/2022**

Time Table for the Academic Year 2022-23 (Odd Semester)

Class: 5th Semester CS-A **Class Teacher:** Ms. Jayashree **Room No: 134**

	I 8.45– 9.45	II 9.45 - 10.45	10.45- 10.55	III 10.55- 11.55	IV 11.55 12.55	12.55- 1.30	V 1.30 2.30	VI 2.30 3.30	VII 3.30 – 4.15
MON	L1: CN Lab B2 -SSS L2:AI Lab B1-MGK L5:CN Lab B3-SP			DM	SE		AI&NN	Placement Training	
TUE	CN	SE	**B**	FLAT	PE	**L**	IoT-COE/Placement training		
WED	AI&NN	SE	**R** **E**	FLAT	PE	**U** **N**	IoT-COE/Placement training/ Cumulative English		
THU	L2: AI Lab B3-MGK L4:AI Lab B2- SSJ L1:CN Lab B1-SSS		**A** **K**	FLAT	PE	**C** **H**	DM	CN	
FRI	FLAT	AI&NN		DM	CN		Placement Training		
SAT	SE/ CC (PE)	CN		DM	AI&NN				

Total Contact Hours: **Theory** - 23 hours **Lab**- 4 hours **Total** - 27 hours

Theory:

Sl No	Subject Code	Subject Name	Faculty Name	PHONE NO
1	18CS51	COMPUTER NETWORKS (CN)	Ms. Sharmila Sequeira (SSS)	9964499983
2	18CS52	SOFTWARE ENGINEERING (SE)	Dr. Vasantha kumar G U(VGU)	9902269559
3	18CS54	DATA MINING (DM)	Ms. Jayashree (JS)	9341802445
4	18CS56	ARTIFICIAL INTELLIGENCE AND NEURAL NETWORKS (AI&NN)	Ms. Madhura G K(MGK)	9535833005
5	18CS57	FORMAL LANGUAGES AND AUTOMATA THEORY (FLAT)	Ms. Ushashree P (UP)	9912056225
6	18CSL58	ARTIFICIAL INTELLIGENCE WITH PYTHON LAB (AI Lab)	Ms. Madhura G K (MGK)/Ms. Shruthi Shetty(SSJ)	9535833005
7	18CSL59	COMPUTER NETWORKS LAB (CN Lab)	Ms. Sharmila Sequeira /Ms. Shobha P (SP)	9964499983
8	18CSE531	COMPUTER GRAPHICS	Ms. Nirmala J Saunshimath (NJS)	9880037599
9	18CSE532	INFORMATION SECURITY (PE)- Room No: 138	Dr. H. Saroja Devi (SH)	9845977020
10	18CSE533	INTERNET OF THINGS (PE)-Room No:135	Dr. Dileep Reddy Bolla	9980417673
11	18CSE539	INTRODUCTION TO CLOUD COMPUTING- Room No:132	Ms. Pushpanjali M K /Mr. Jayashankar (Adjunct Faculty)	9986951420/ 9880936066

Coordinator for Time-Table
(Dr. P Ramesh Naidu)

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(Dr. Nalini N)

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DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

REF NO:NMIT/CSE/TT 2022-23/5/v2 **W.e.f: 19/09/2022**

Time Table for the Academic Year 2022-23 (Odd Semester)

Class: 5th Semester CS-B **Class Teacher:** Ms. Mamatha Bai B G **Room No: 135**

	I 8.45–9.45	II 9.45 10.45	10.45-10.55	III 10.55-11.55	IV 11.55 12.55	12.55-1.30	V 1.30-2.30	VI 2.30 3.30	VII 3.30 –4.15
MON	DM	CN		AI&NN	FLAT		L1:CN Lab B1- SMR L2:AI Lab B3-MBG L5:CN Lab B2-DS		
TUE	CN	DM	B R	AI&NN	PE	L U	IoT-COE/Mentor meeting		
WED	SE	CN	E	FLAT	PE	N	IoT-COE/ / Cumulative English		
THU	AI&NN	SE	A	DM	PE	C	FLAT	Placement training	
FRI	L4: AI Lab B2-MBG L2: AI Lab B1-SBV L1:CN Lab B3-SMR		K	SE	AI&NN	H	Career & Skill Enhancement Training		
SAT	FLAT/CC (PE)	CN		SE	DM				

Total Contact Hours: **Theory -** 23 hours **Lab**- 4 hours **Total** - 27 hours

Theory:

Sl No	Subject Code	Subject Name	Faculty Name	PHONE NO
1	18CS51	COMPUTER NETWORKS (CN)	Ms. Sowmya M R	9880338564
2	18CS52	SOFTWARE ENGINEERING (SE)	Ms. Mamatha Bai B G	9980580341
3	18CS54	DATA MINING (DM)	Ms. Deepthi Shetty	7975276424
4	18CS56	ARTIFICIAL INTELLIGENCE AND NEURAL NETWORKS (AI&NN)	Dr. Tapas Guha	9051945948
5	18CS57	FORMAL LANGUAGES AND AUTOMATA THEORY (FLAT)	Ms. Trisheela S	7411107765
6	18CSL58	ARTIFICIAL INTELLIGENCE WITH PYTHON LAB (AI Lab)	Ms. Mamatha Bai B G(MBG)/ Dr. Shruthi B V (NP)	9980580341
7	18CSL59	COMPUTER NETWORKS LAB (CN Lab)	Ms. Sowmya M R (SMR)/ Ms. Deepthi Shetty(DS)	9880338564/79752 76424
8	18CSE531	COMPUTER GRAPHICS (Lab 2)	Ms. Nirmala J Saunshimath	9880037599
9	18CSE532	INFORMATION SECURITY (PE)-Room No: 138	Dr. H. Saroja Devi	9845977020
10	18CSE533	INTERNET OF THINGS (PE)-Room No:135	Dr. Dileep Reddy Bolla	9980417673
11	18CSE539	INTRODUCTION TO CLOUD COMPUTING- Room No:132	Ms. Pushpanjali M K/Mr. Jayashankar (Adjunct Faculty)	9986951420/ 9880936066

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Coordinator for Time-Table
(Dr. P Ramesh Naidu)

HOD, Dept. of CSE 19/09/2022
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DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

REF NO:NMIT/CSE/TT 2022-23/5/v2 **W.e.f: 19/09/2022**

Time Table for the Academic Year 2022-23 (Odd Semester)

Class: 5th Semester CS-C **Class Teacher :** Mr. Janardhan D R. **Room No: 138**

	I 8.45–9.45	II 9.45 - 10.45	10.45-10.55	III 10.55-11.55	IV 11.55 12.55	12.55-1.30	V 1.30-2.30	VI 2.30 3.30	VII 3.30 – 4.15
MON	DM	SE	BREAK	CN	FLAT	LUNCH	Career & Skill Enhancement Training		
TUE	AI&NN	SE		FLAT	PE		IoT-COE/Placement training		
WED	L1:CN Lab B3-JDR L2: AI Lab B1-NJS L7:AI Lab B2-PMK			FLAT	PE		IoT-COE/ / Cumulative English		
THU	CN	SE		AI&NN	PE		DM	Mentor Meeting	
FRI	SE	CN		DM	AI&NN		L1:CN Lab B2 -JDR L2: AI Lab B3-NJS L5:CN LAB B1-DS		
SAT	FLAT	DM		AI&NN	CN				

Total Contact Hours: **Theory** - 23 hours **Lab**- 4 hours **Total** - 27 hours

Theory:

Sl No	Subject Code	Subject Name	Faculty Name	PHONE NO
1	18CS51	COMPUTER NETWORKS (CN)	Mr. Janardhan D R	9663429872
2	18CS52	SOFTWARE ENGINEERING (SE)	Ms. Nirmala J Saunshimath	9880037599
3	18CS54	DATA MINING (DM)	Ms. Sandhya B R	9035482824
4	18CS56	ARTIFICIAL INTELLIGENCE AND NEURAL NETWORKS (AI&NN)	Dr. Chaitra H V	8884121313
5	18CS57	FORMAL LANGUAGES AND AUTOMATA THEORY (FLAT)	Ms. Shobha	9845733151
6	18CSL58	ARTIFICIAL INTELLIGENCE WITH PYTHON LAB (AI Lab)	Ms. Nirmala(NJS)/ Ms. Pushpanjali M K	9880037599
7	18CSL59	COMPUTER NETWORKS LAB (CN Lab)	Mr. Janardhan D R(JDR)/ Ms. Deepthi Shetty(DS)	9663429872
8	18CSE531	COMPUTER GRAPHICS –(Lab 2)	Ms. Nirmala J Saunshimath	9880037599
9	18CSE532	INFORMATION SECURITY (PE)- Room No: 138	Dr. H. Saroja Devi	9845977020
10	18CSE533	INTERNET OF THINGS (PE)-Room No:135	Dr. Dileep Reddy Bolla	9980417673
	18CSE539	INTRODUCTION TO CLOUD COMPUTING- Room No:134	Ms. Pushpanjali M K/ Mr. Jayashankar (Adjunct Faculty)	9986951420/ 9880936066

Coordinator for Time-Table
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DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

REF NO:NMIT/CSE/TT 2022-23/3/v2 **W.e.f: 19/09/2022**

Time Table for the Academic Year 2022-23 (Odd Semester)

Class: 7th Semester CS-A Class Teacher: Ms. Ushashree P Room No: 307

Time / Day	I 8.45 AM– 9.45 AM	II 9.45 AM - 10.45 AM	10.45AM - 10.55AM	III 10.55AM - 11.55AM	IV 11.55AM 12.55PM	12.55PM- 1.30 PM	V 1.30PM - 2.30PM	VI 2.30 PM- 3.30 PM	VII 3.30 PM – 4.15 PM
MON	CD	HPC		CS	OE		L7: PD Lab(B1,B2))-JS L3: HPC Lab(B3)-UP		
TUE	EDM	CD		PE	OE		Carrier & Skill Enhancement Training		
WED	L3: HPC Lab(B1)- UP L4: HPC Lab (B2)-SN L10: PD lab(B3) -JNK		BREAK	CD	OE	LUNCH	Project work		
THU	HPC	PE		CS	EDM		Placement Training		
FRI	PE	CS		EDM	HPC		CD	CS	
SAT	EDM	HPC		Placement training/ Google Cloud (add-on course)					

Total Contact Hours: **Theory -** 2 2 hours **Lab-** 4 hours **Total** - 26 hours

Theory:

Sl. No.	Subject Code	Subject Name	Faculty Name	Phone No.
1	18CS71	HIGH PERFORMANCE COMPUTING (HPC)	Ms. Ushashree P (UP)	9912056225
2	18CS72	CYBER SECURITY(CS)	Mr. Satish E G (SEG)	9739707000
3	18CS73	COMPILER DESIGN (CD)	Ms. Uma R (UR)	9902053376
4	18CSH74	ENTREPRENEURSHIP DEVELOPMENT & IPR (EDM)	Dr. Sreenivasa N (SN)	9611494607
5	18CSL77	HIGH PERFORMANCE COMPUTING LAB	Ms. Ushashree P (UP)/ Dr. Sreenivasa N (SN)	9912056225
6	18CSL78	PRODUCT DEVELOPMENT LAB	Ms. Jagadevi K (JNK/ Ms. Jayashree	9620730503
7	18CSE751	INTRODUCTION TO MACHINE LEARNING (PE)- Room No: 307	Dr. Vani V (VV)	7708444711
8	18CSE754	GAME THEORY (PE)-Room No : 310	Dr. Nalini N (NN)	8722455452
9	18CSE757	BUILDING ENTERPRISE APPLICATIONS (PE)-Room No:312	Ms. Jagadevi K(JNK)	9620730503
10	18CSE75x	FULL STACK DEVELOPMENT	Dr. Ramesh Naidu (RAM)	9686595609
11	18CSO761	INTRODUCTION TO CYBER SECURITY	Ms. Deepthi Shetty (DS)	7975276424
12	18CSO762	INTRODUCTION TO SOFTWARE TESTING	Ms. Mamatha Bai B G (MBG)	9980580341
13	18CSO763	INTRODUCTION TO BUSINESS INTELLIGENCE AND APPLICATIONS	Ms. Sowmya M R (SMR)	9880338564
14		Google cloud (Add-on Course)	Mr. Jayashankar (Adjunct Faculty)	9880936066

Coordinator for Time-Table
(Dr. P Ramesh Naidu)

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REF NO:NMIT/CSE/TT 2022-23/3/v2 **W.e.f: 19/09/2022**

Time Table for the Academic Year 2022-23 (Odd Semester)

Class: 7th Semester CS-B **Class Teacher:** Dr. Shruthi B V **Room No: 310**

Time / Day	I 8.45 AM– 9.45 AM	II 9.45 AM - 10.45 AM	10.45AM 10.55AM	III 10.55AM- 11.55AM	IV 11.55AM 12.55PM	12.55PM 1.30 PM	V 1.30PM 2.30PM	VI 2.30 PM- 3.30 PM	VII 3.30 PM 4.15 PM
MON	CD	EDM		HPC	OE		Carrier & Skill Enhancement Training		
TUE	L3: HPC Lab (B1)- AN L4: HPC Lab (B2) -SEG L7: PD lab -SBV			PE	OE		CD	CS	
WED	EDM	CS	B	HPC	OE	L	Project Work		
THU	HPC	PE	R	CD	CS	U	Placement Training		
FRI	PE	CS	E A K	HPC	EDM	N C H	L7: PD Lab-(B1, B2)-RN L3: HPC Lab (B3)-AN		
SAT	CD	EDM		Placement Training / Google Cloud (add-on course)					

Total Contact Hours: **Theory** - 22 hours **Lab**- 4 hours **Total** - 26 hours

Theory:

Sl No	Subject Code	Subject Name	Faculty Name	PHONE NO
1	18CS71	HIGH PERFORMANCE COMPUTING(HPC)	Ms. Archana Naik (AN)	9886787342
2	18CS72	CYBER SECURITY(CS)	Ms. Sharmila Sequeira (SSS)	9964499983
3	18CS73	COMPILER DESIGN (CD)	Mr. Santhosh Kumar G(SKG)	9916261385
4	18CSH74	ENTREPRENEURSHIP DEVELOPMENT & IPR (EDM)	Dr. Shruthi B V (SBV)	9880273399
5	18CSL77	HIGH PERFORMANCE COMPUTING LAB	Ms. Archana Naik (AN) / Mr. Satish E G (SEG)	9886787342
6	18CSL78	PRODUCT DEVELOPMENT LAB	Dr. Ramesh Naidu (RN)/ Dr. Shruthi B V (SBV)	9686595609
7	18CSE751	INTRODUCTION TO MACHINE LEARNING (PE)- Room No: 307	Dr. Vani V (VV)	7708444711
8	18CSE754	GAME THEORY (PE)-Room No : 310	Dr. Nalini N (NN)	8722455452
9	18CSE757	BUILDING ENTERPRISE APPLICATIONS (PE)-Room No:312	Mrs. Jagadevi K (JNK)	9620730503
10	18CSE75x	FULL STACK DEVELOPMENT	Dr. Ramesh Naidu (RN)	9686595609
11	18CSO761	INTRODUCTION TO CYBER SECURITY	Ms. Deepthi Shetty (DS)	7975276424
12	18CSO762	INTRODUCTION TO SOFTWARE TESTING	Ms. Mamatha Bai B G (MBG)	9980580341
13	18CSO763	INTRODUCTION TO BUSINESS INTELLIGENCE AND APPLICATIONS	Ms. Sowmya M R (SMR)	9880338564
		Google cloud (Add-on Course)	Mr. Jayashankar (Adjunct Faculty)	9880936066

Coordinator for Time-Table
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REF NO:NMIT/CSE/TT 2022-23/3/v2 **W.e.f: 19/09/2022**

Time Table for the Academic Year 2022-23 (Odd Semester)

Class: 7th Semester CS-C **Class Teacher :** Ms. Uma R **Room No: 312**

Time / Day	I 8.45 AM– 9.45 AM	II 9.45 AM - 10.45 AM	10.45AM 10.55AM	III 10.55AM- 11.55AM	IV 11.55AM 12.55PM	12.55PM- 1.30 PM	V 1.30PM 2.30PM	VI 2.30 PM- 3.30 PM	VII 3.30 PM 4.15 PM
MON	L3 : HPC Lab(B1)- CHV L4 : HPC Lab (B2)-VGU L7 : PD lab(B3)-SEG		BREAK	CD	OE	LUNCH	EDM	CS	
TUE	HPC	EDM		PE	OE		L7: Product Dev Lab(B1,B2)-UR L3: HPC Lab(B3)-CHV		
WED	EDM	HPC		CS	OE		Career & Skill Enhancement Training		
THU	CS	PE		CD	HPC		Placement Training		
FRI	PE	CD		HPC	EDM		Project Work		
SAT	CS	CD		Placement training/ Google Cloud (add-on course)					

Total Contact Hours: **Theory** - 22 hours **Lab**- 4 hours **Total** - 26 hours

Theory:

Sl No	Subject Code	Subject Name	Faculty Name	PHONE NO
1	18CS71	HIGH PERFORMANCE COMPUTING(HPC)	Dr. Krishna Rao Venkatesh	9844057194
2	18CS72	CYBER SECURITY(CS)	Dr. Chaitra H V (CHV)	8884121313
3	18CS73	COMPILER DESIGN (CD)	Ms. Uma R (UR)	9902053376
4	18CSH74	ENTREPRENEURSHIP DEVELOPMENT & IPR (EDM)	Dr. Sujata Joshi (SJ)	9844756058
5	18CSL77	HIGH PERFORMANCE COMPUTING LAB	Dr. Chaithra H V(CHV)/Dr. Vasanth Kumar(VGU)	8884121313
6	18CSL78	PRODUCT DEVELOPMENT LAB	Ms.Uma R(UR)/Mr. Satish E G (SEG)	9902053376
7	18CSE751	INTRODUCTION TO MACHINE LEARNING (PE)- Room No: 307	Dr. Vani V (VV)	7708444711
8	18CSE754	GAME THEORY (PE)-Room No : 310	Dr. Nalini N (NN)	8722455452
9	18CSE757	BUILDING ENTERPRISE APPLICATIONS (PE)-Room No:312	Mrs. Jagadevi K (JNK)	9620730503
10	18CSE75x	FULL STACK DEVELOPMENT	Dr. Ramesh Naidu (RN)	9686595609
11	18CSO761	INTRODUCTION TO CYBER SECURITY	Ms. Deepthi Shetty (DS)	7975276424
12	18CSO762	INTRODUCTION TO SOFTWARE TESTING	Ms. Mamatha Bai B G (MBG)	9980580341
13	18CSO763	INTRODUCTION TO BUSINESS INTELLIGENCE AND APPLICATIONS	Ms. Sowmya M R (SMR)	9880338564
		Google cloud (Add-on Course)	Mr. Jayashankar (Adjunct Faculty)	9880936066

Coordinator for Time-Table
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Bangalore - 560 064

Department of Electronics and Communication Engineering

Date:14/11/2022

3rd SEM---A SECTION **Room No: 321** **Class Teacher: Dr.Manohar H T**

Day/ Time	8.45-9.40	09.40-10.35		10.55-11.50	11.50-12.45	12.45-1.30	1.30-2.25	2.25-3.15	3.15-4.10
	1	2		3	4		5	6	7
MON	**A1/A2** Electronic Circuits and Logic Design Lab A1:Lathakumari// A2: Ashitha		**B**	**AEC**	**ARM**	**L**	**CE**	**DSD**	**INM**
TUE	**INM**	**NS**	**R**	**ARM**	**AEC**	**U**	**AEC**	**SK**	**DSD**
WED	**DSD**	**BK**	**E**	**NS**	**AEC**	**N**	**ARM**	**ARM**	**CE**
THU	**NS**	**CE**	**A**	**A3/A1** Electronic Circuits and Logic Design Lab A3:Dr.Pavan//A1: **Ms.Ashitha**		**C**	**IOT**		
FRI	**CE**	**DSD**	**K**	**INM**	**INM**	**H**	**NS**	**A2/A3** Electronic Circuits and Logic Design Lab A2:Sthuthi//A3:Dr.Sapna	
SAT	**ACTIVITY POINT// IOT**								

Subject Code	Subjects	Short forms	A-Section	Contact Numbers
21MAT31	Integral Transforms And Numerical Methods	INM	Dr.Padmavathi R	9341308939
21EC32	Analog Electronic Circuits	AEC	Ms.Sthuthi A	9900001517
21EC33	ARM Microcontroller	ARM	Ms.Ayesha S	9844871449
21EC34	Digital System Design	DSD	Dr.Sapnakumari	9902807798
21EC35	Networks and Systems	NS	Shubhra Chakraborty	7019631157
21ECE36	Professional Elective - I	-		
21ECE361	Embedded Systems with C	CE	Ms.Suganya	8012941472
21ECE362	DSD using Verilog	CE	Dr.Naveen I G	9620901562
21ECE363	Basics of Python Programming	CE	Ms.Divya	9986384759
21ECE364	Computer Organization and Architecture	CE	Dr.Rajesh N	9448912098
21ECL36	Electronic Circuits and Logic Design Lab	A1:Lathakumari, A2:Ms.Sthuthi,A3:Dr.Pavan		
	Electronic Circuits and Logic Design Lab	A1: **Ms.Ashitha** A2:Ms.Ashitha ,A3:Dr.Sapna		
21INT36	Internship - I			
21KSK37	Samskrutika Kannada/Balake Kannada	SK BK	Dr.Gowramma	9902704467

HOD ECE

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P.O.Box 6429, Yelahanka, Bangalore 560 064

Department of Electronics and Communication Engineering

Date:14/11/2022

3rd SEM---B SECTION **Room No 322** **Class Teacher: Mr.Pradeepkumar**

Day/ Time	8.45-9.40	09.40-10.35		10.55-11.50	11.50-12.45	12.45-1.30	1.30-2.25	2.25-3.15	3.15-4.10
	1	2		3	4		5	6	7
MON	INM	AEC	B	B1/B2 Electronic Circuits and Logic Design Lab B1:Smitha//B2:Dr.Pavan		L	CE	ARM	NS
TUE	AEC	ARM	R	B3/B1 Electronic Circuits and Logic Design Lab **B3:Dr.Rajani //B1:Dr.Sapna**		U	NS	DSD	INM
WED	B2/B3 Electronic Circuits and Logic Design Lab B2:Lathakumari//B3:Dr.Manohar		E	BK	NS	N	ARM	DSD	CE
THU	AEC	CE	A	DSD	NS	C	IOT		
FRI	CE	ARM	K	SK	DSD	H	AEC	INM	INM
SAT	ACTIVITY POINT//IOT								

Subject Code	Subjects	Short forms	B-Section	Contact Numbers
21MAT31	Integral Transforms And Numerical Methods	INM	Ms.Sushma.T. C	7892258903
21EC32	Analog Electronic Circuits	AEC	Ms.Sthuthi A	9900001517
21EC33	ARM Microcontroller	ARM	Ms.Nitya	9741431792
21EC34	Digital System Design	DSD	Dr.Roopa K	9845150241
21EC35	Networks and Systems	NS	Ms.Smitha	9930530254
21ECE36	Professional Elective - I	-		
21ECE361	Embedded Systems with C	CE	Ms.Suganya	8012941472
21ECE362	DSD using Verilog	CE	Dr.Naveen I G	9620901562
21ECE363	Basics of Python Programming	CE	Ms.Divya	9986384759
21ECE364	Computer Organization and Architecture	CE	Dr.Rajesh N	9448912098
21ECL36	Electronic Circuits and Logic Design Lab	B1:Ms.Smitha B2:Ms.Lathakumari B3:Dr.Rajani		
	Electronic Circuits and Logic Design Lab	B1:Dr.Sapna B2: Dr.Pavan B3:Dr.Manohar		
21INT36	Internship - I			
21KSK37	Samskrutika Kannada/Balake Kannada	SK/BK	Dr.Gowramma	9902704467

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Date:14/11/2022

3rd SEM---C SECTION **Room No: 323** **Class Teacher: Dr.Rajani**

Day/ Time	8.45-9.40	09.40-10.35		10.55-11.50	11.50-12.45	12.45-1.30	1.30-2.25	2.25-3.15	3.15-4.10
	1	2		3	4		5	6	7
MON	AEC	NS	B	INM	SK	L	CE	AEC	ARM
TUE	C1/C2 Electronic Circuits and Logic Design Lab **C1:Ashitha//C2:Smitha**		R E A K	DSD	AEC	U	AEC	ARM	INM
WED	NS	INM		C2/C3 Electronic Circuits and Logic Design Lab C2:Ashitha//C3: Dr.Rajani		N	DSD	INM	CE
THU	NS	CE		DSD	ARM	C	IOT		
FRI	CE	DSD		C3/C1 Electronic Circuits and Logic Design Lab C3:Sthuthi//C1:Dr.Pavan		H	NS	ARM	BK
SAT			ACTIVITY POINT//IOT						

Subject Code	Subjects	Short forms	C-Section	Contact Numbers
21MAT31	Integral Transforms And Numerical Methods	INM	Dr.Padmavathi R	9341308939
21EC32	Analog Electronic Circuits	AEC	Dr.Harsha K	9686846781
21EC33	ARM Microcontroller	ARM	Ms.Nitya G	9741431792
21EC34	Digital System Design	DSD	Ms.Lathakumari	8105158441
21EC35	Networks and Systems	NS	Ms.Smitha Prabhu	9930530254
21ECE36	Professional Elective - I	-		
21ECE361	Embedded Systems with C	CE	Ms.Suganya	8012941472
21ECE362	DSD using Verilog	CE	Dr.Naveen I G	9620901562
21ECE363	Basics of Python Programming	CE	Ms.Divya	9986384759
21ECE364	Computer Organization and Architecture	CE	Dr.Rajesh N	9448912098
21ECL36	Electronic Circuits and Logic Design Lab	C1:Ms.Ashitha C2:Ms.Ashitha C3:Ms.Sthuti		
	Electronic Circuits and Logic Design Lab	C1:Dr.Pavan C2:Ms.Smitha C3:Dr.Rajani		
21INT36	Internship - I			
21KSK37	Samskrutika Kannada/Balake Kannada	SK//BK	Dr.Gowramma	9902704467

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NITTE MEENAKSHI INSTITUTE OF TECHNOLOGY
P.O.Box 6429, Yelahanka, Bangalore 560 064

Department of Electronics and Communication Engineering

Date:30/11/2022

5th SEM---A SECTION **Room No: 233** **Class Teacher: Dr. Naveen I G**

Day/ Time	8.45-9.40	09.40-10.35		10.55-11.50	11.50-12.45	12.45-1.30	1.30-2.25	2.25-3.20	3.20-4.15
	1	2		3	4		5	6	7
MON	A1/A2 COMM/DSP LAB		B	MW	VLSI	L	COMM	MW	VLSI
TUE	CS	VLSI	R	DS	COMM	U	MW	VLSI	
WED	Placement		E	CS	CE	N	CS	DS	MW
THU	COMM	DS	A	VLSI	MW	C	A2/A3 COMM/DSP LAB		DS// Dept Meeting
FRI	DS	CE	K	COMM	CS	H	CE	A3/A1 COMM/DSP LAB	
SAT	ACTIVITY POINT//DEPT MEETING								

Sl. No	Subject Code	Subjects	Name of the faculty	Contact Numbers
1.	18EC51	Control System	Dr. Manjula B M	9844480532
2.	18EC52	Communication system 1	Mr. Sathisha B M	9972502600
3.	18EC53	Fundamentals of VLSI Design	Dr. Shashidhara K S	8660718986
4.	18EC54	Data structure using C++	Dr. Rekha Phadke	9901733233
5.	18EC55	Microwave and Radiating Systems	Mr. Subhra Chakraborty	9916098540
6.	18ECE561	PE1:Digital Image Processing	Dr. Sunil S H	7676639308
7.	18ECE562	PE2:Artificial Neural Network	Dr. Viswanatha V	9741236462
8.	18ECE563	PE3:FPGA Architecture and Application	Dr. Sowmya Madhavan	9739308665
9.	18ECE566	PE4:Programming using Python	Ms. Prajna K B	9886052528
10.	18ECL58	Communication System Lab-I	A1:Dr. Sunil S H A2: Ms. Pramodhini A3: Dr. Sunil S H	
11.	18ECL57	Digital Signal Processing Lab	A1:Ms.Kushalatha A2: Mr. Pradeep kumar S A3: Ms. Prajna K B	

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5th SEM---B SECTION **Room No: 235** **Class Teacher: Ms. Sthuthi A**

Day/ Time	8.45-9.40	09.40-10.35		10.55-11.50	11.50-12.45	12.45-1.30	1.30-2.25	2.25-3.20	3.20-4.15
	1	2		3	4		5	6	7
MON	Placement		B	MW	DS	L	VLSI	MW	VLSI
TUE	B1/B2 COMM/DSP LAB		R	CS	VLSI	U	MW	ENG (2.20-3.30)	COMM
WED	COMM	DS	E	MW	CE	N	CS	B2/B3 COMM/DSP LAB	
THU	MW	CS	A	B3/B1 COMM/DSP LAB		C	VLSI	COMM	DS// Dept Meeting
FRI	VLSI	CE	K	DS	CS	H	CE	COMM	
SAT	ACTIVITY POINT//DEPT MEETING								

Sl. No	Subject Code	Subjects	Name of the faculty	Contact Numbers
1.	18EC51	Control System	Ms. Kushalatha M R	9945862708
2.	18EC52	Communication system 1	Dr. Vinaykumar R	7077109826
3.	18EC53	Fundamentals of VLSI Design	Mr. Pradeep Kumar S	9738544217
4.	18EC54	Data structure using C++	Ms. Prajna K B	98860 52528
5.	18EC55	Microwave and Radiating Systems	Dr. Thimmaraja Y G	9743244344
6.	18ECE561	PE1:Digital Image Processing	Dr. Sunil SH	7676639308
7.	18ECE562	PE2:Artificial Neural Network	Dr. Viswanatha V	9741236462
8.	18ECE563	PE3:FPGA Architecture and Application	Dr. Sowmya Madhavan	9739308665
9.	18ECE566	PE4:Programming using Python	Ms. Prajna K B	9886052528
10.	18ECL58	Communication System Lab-I	B1: Ms.Pramodhini R B2: Dr.Harsha B3: Dr.Sowmya	
11.	18ECL57	Digital Signal Processing Lab	B1:Ms.Kushalatha B2: Ms. Prajna K B B3: Mr. Pradeepkumar S	

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Department of Electronics and Communication Engineering

5th SEM---C SECTION Room No: 236 Class Teacher: Dr. Sapna Kumari C

Day/ Time	8.45-9.40	09.40-10.35		10.55-11.50	11.50-12.45	12.45-1.30	1.30-2.25	2.25-3.20	3.20-4.15
	1	2		3	4		5	6	7
MON	CS	DS	B	Placement		L	COMM	COMM	CS
TUE	COMM	MW	R	C2/C3 COMM/DSP LAB		U	VLSI	ENG (2.20-3.30)	DS
WED	C1/C2 COMM/DSP LAB		E	VLSI	CE	N	COMM	CS	MW
THU	VLSI	CS	A	COMM	MW	C	DS	MW	DS// Dept Meeting
FRI	DS	CE	K	C3/C1 COMM/DSP LAB		H	CE	VLSI	CS
SAT	ACTIVITY POINT//DEPT MEETING								

Sl. No	Subject Code	Subjects	Name of the faculty	Contact Numbers
1.	18EC51	Control System	Ms. Naina R K	97316 83072
2.	18EC52	Communication system 1	Ms. Chaithra K N	91643 02758
3.	18EC53	Fundamentals of VLSI Design	Dr. Naveen I G	96209 01562
4.	18EC54	Data structure using C++	Prof. Sitaram V Yaji	98452 62698
5.	18EC55	Microwave and Radiating Systems	Dr. Thimmaraja Y G	97432 44344
6.	18ECE561	PE1:Digital Image Processing	Dr. Sunil SH	76766 39308
7.	18ECE562	PE2:Artificial Neural Network	Dr. Viswanatha V	97412 36462
8.	18ECE563	PE3:FPGA Architecture and Application	Dr. Sowmya Madhavan	97393 08665
9.	18ECE566	PE4:Programming using Python	Ms. Prajna K B	98860 52528
10.	18ECL58	Communication System Lab-I	C1: Dr. Harsha K C2: Mr. Subhra C C3: Mr. Subhra C	
11.	18ECL57	Digital Signal Processing Lab	C1:Dr. Shashidhara K S C2: Ms. Chaithra K N C3: Ms. Chaithra K N	

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Department of Electronics and Communication Engineering

Sl. No	Subject Code	5th sem	A	B	C
1.	18EC51	Control System	Dr. Manjula B M	Ms. Kushalatha M R	Ms. Naina R K
2.	18EC52	Communication system 1	Mr. Sathisha B M	Dr. Vinaykumar R	Ms. Chaithra K N
3.	18EC53	Fundamentals of VLSI Design	Dr. Shashidhara K S	Mr. Pradeep Kumar S	Dr. Naveen I G
4.	18EC54	Data structure using C++	Dr. Rekha Phadke	Ms. Prajna K B	Prof. Sitaram V Yaji
5.	18EC55	Microwave and Radiating Systems	Mr. Subhra Chakraborty	Dr. Thimmaraja Y G	Dr. Thimmaraja Y G
6.	18ECE561	PE1:Digital Image Processing	Dr. Sunil SH		
7.	18ECE562	PE2:Artificial Neural Network	Dr. Viswanatha V		
8.	18ECE563	PE3:FPGA Architecture and Application	Dr. Sowmya Madhavan		
9.	18ECE566	PE4:Programming using Python	Ms. Prajna K B		
10.	18ECL58	Communication System Lab-I	A1:Dr.. Sunil S H A2: Ms. Pramodhini R A3: Dr. Sunil S H	B1: Ms.Pramodhini R B2: Dr.Sowmya B3: Dr.Harsha	C1: Dr. Harsha K C2: Mr. Subhra C C3: Mr. Subhra C
11.	18ECL57	Digital Signal Processing Lab	A1:Ms.Kushalatha A2: Mr. Pradeepkumar S A3: Ms. Prajna K B	B1:Ms.Kushalatha B2: Ms. Prajna K B B3: Mr. Pradeepkumar S	C1:Dr. Shashidhara K S C2: Ms. Chaithra K N C3: Ms. Chaithra K N

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Department of Electronics and Communication Engineering

Date: 15/09/2022

7th SEM---A SECTION Room No: 324 Class Teacher: Dr. Harsha Karamchandani

Day/Time	8.45-9.45	09.45-10.45		11-12.00	12.00-1.00	1.00-2.00	2.00-3.00	3.00-4.00
	1	2		3	4		5	6
MON	A1/A2 PE/DCN LAB		B	PE	OE	L	WC	Mentor/Mentee meeting
TUE	ARM	ENT	R	CE	OE	U	A3/A1 PE/DCN LAB	
WED	WC	ARM	E	ENT	OE	N	CE	PE
THU	PE	ENT	A	ARM	WC	C	ARM	Dept Meeting
FRI	PE	ENT	K	A2/A3 PE/DCN LAB		H	CE	WC
SAT	ACTIVITY POINT							

Sl. No	Subject Code	Subjects	Name of the faculty	Contact Numbers
1.	18EC71	Arm programming and Optimization	Ms.Divya	9986384759
2.	18EC72	Wireless Communication	Dr.Prasanna Paga	7204463893
3.	18EC73	Power Electronics	Dr.Manohar H T	9901499698
4.	18ECH74	Entrepreneurship, Project Management & IPR	Ms.Ayesha S	9844871449
5.	18ECE754	PE1:Optical Fiber Communication	Ms.Pramodini	9886262783
6.	18ECE752	PE2: IP Networking	Prof.Sitaram Yaji	9845262698
7.	18ECE755	PE3:Internet of Things	Dr.Shashidhara K S	8660718986
8.	18ECE756	PE4:Data Compression	Dr.Pavan	
9.	18ECE757	JAVA Programming - Coursera	Dr. Ramachandra A C	9448201096
10.	18ECL77	Power Electronics Lab	A1: Ms.Nitya A2 Ms.Nitya A3:Ms.Ayesha	B1: Ms.Ayesha B2:Dr.Prasanna B3: Dr.Prasanna
11.	18ECL78	Data Communication Network Lab	A1: Ms.Divya A2: Dr.Thimmaraju A3:Ms.Divya	B1: Mr.Vinaykumar B2: Dr.Thimmaraju B3:Dr.Sunil
12.	18ECO762	OE1: Avionics	Dr.Naveenkumar R	96209 01562
13.	18ECO764	OE3: Introduction to Data Analytics	Dr.Roopa K	9845150241
14.	18ECO765	OE2: Satellite Technology Principles and application	Dr.Parameshachari	98862 11981

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Department of Electronics and Communication Engineering

7th SEM---B SECTION   Room No; 325   Class Teacher: Ms. Prajna K B

Day/Time	8.45-9.45	09.45-10.45		11-12.00	12.00-1.00	1.00-2.00	2.00-3.00	3.00-4.00
	1	2		3	4		5	6
MON	PE	ARM	B	WC	OE	L	B1/B2 PE/DCN LAB	
TUE	B2/B3 PE/DCN LAB		R	CE	OE	U	ENT	Mentor/Mentee meeting
WED	WC	ENT	E	ARM	OE	N	CE	PE
THU	B3/B1 PE/DCN LAB		A	ENT	ARM	C	WC	Dept Meeting
FRI	PE	WC	K	ENT	ARM	H	CE	PE
SAT	ACTIVITY POINT							

Sl. No	Subject Code	Subjects	Name of the faculty	Contact Numbers
1.	18EC71	Arm programming and Optimization	Dr.Karunakar Rai	9844286965
2.	18EC72	Wireless Communication	Ms.Kushalatha M R	9945862708
3.	18EC73	Power Electronics	Dr. Rajani N	9740798868
4.	18ECH74	Entrepreneurship, Project Management & IPR	Mr.Pradeepkumar	9738544217
5.	18ECE754	PE1:Optical Fiber Communication	Ms.Pramodini	9886262783
6.	18ECE752	PE2: IP Networking	Prof.Sitaram Yaji	9845262698
7.	18ECE755	PE3:Internet of Things	Dr.Shashidhara K S	8660718986
8.	18ECE756	PE4:Data Compression	Dr.Pavan	
9.	18ECE757	JAVA Programming - Coursera	Dr. Ramachandra A C	9448201096
10.	18ECL77	Power Electronics Lab	B1: Ms.Ayesha B2:Dr.Prasanna B3: Dr.Prasanna	
11.	18ECL78	Data Communication Network Lab	B1: Mr.Vinaykumar B2: Dr.Thimmaraju B3:Dr.Sunil	
12.	18ECO762	OE1: Avionics	Dr.Naveenkumar R	96209 01562
13.	18ECO764	OE3: Introduction to Data Analytics	Dr.Roopa K	9845150241
14.	18ECO765	OE2: Satellite Technology Principles and application	Dr.Parameshachari	98862 11981

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P.O.Box 6429, Yelahanka, Bangalore 560 064

Department of Electronics and Communication Engineering

7th SEM---C SECTION Room No:326 Class Teacher: Ms. Pramodhini R

Day/Time	8.45-9.45	09.45-10.45		11-12.00	12.00-1.00	1.00-2.00	2.00-3.00	3.00-4.00
	1	2		3	4		5	6
MON	ENT	ARM	B	WC	OE	L	PE	Mentor/Mentee meeting
TUE	ARM	PE	R	CE	OE	U	ENT	WC
WED	C1/C2 PE/DCN LAB		E	WC	OE	N	CE	ARM
THU	ENT	PE	A	C3/C1 PE/DCN LAB		C	WC	Dept. Meeting
FRI	C2/C3 PE/DCN LAB		K	PE	ENT	H	CE	ARM
SAT	ACTIVITY POINT							

Sl. No	Subject Code	Subjects	Name of the faculty	Contact Numbers
15.	18EC71	Arm programming and Optimization	Dr.Vishwanath	9741236462
16.	18EC72	Wireless Communication	Dr.Prasanna Paga	7204463893
17.	18EC73	Power Electronics	Dr. Rajani N	9740798868
18.	18ECH74	Entrepreneurship, Project Management & IPR	Ms.Pramodini	9886262783
19.	18ECE754	PE1:Optical Fiber Communication	Ms.Pramodini	9886262783
20.	18ECE752	PE2: IP Networking	Prof.Sitaram Yaji	9845262698
21.	18ECE755	PE3:Internet of Things	Dr.Shashidhara K S	8660718986
22.	18ECE756	PE4:Data Compression	Dr.Pavan	
23.	18ECE757	JAVA Programming - Coursera	Dr. Ramachandra A C	9448201096
24.	18ECL77	Power Electronics Lab	C1: Ms. Naina C2: Ms.Naina C3: Dr. Manjula B M	
25.	18ECL78	Data Communication Network Lab	C1: Dr.Naveen C2: Dr.Sunil C3: Dr.Vinaykumar R	
26.	18ECO762	OE1: Avionics	Dr.Naveenkumar R	96209 01562
27.	18ECO764	OE3: Introduction to Data Analytics	Dr.Roopa K	9845150241
28.	18ECO765	OE2: Satellite Technology Principles and application	Dr.Parameshachari	98862 11981

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Department of Electronics and Communication Engineering

Sl. No.	Subject Code	Subject	A	B	C
1.	18EC71	Arm programming and Optimization	Ms.Divya	Dr.K Rai	Dr.Vishwanath
2.	18EC72	Wireless Communication	Dr.Prasanna Paga	Ms.Kushalatha M R	Dr.Prasanna Paga
3.	18EC73	Power Electronics	Dr.Manohar H T	Dr. Rajani N	Dr. Rajani N
4.	18ECH74	Entrepreneurship, Project Management & IPR	Ms.Ayesha S	Mr.Pradeepkumar	Ms.Pramodini
5.	18ECE754	PE1:Optical Fiber Communication	Ms.Pramodini		
6.	18ECE752	PE2: IP Networking	Prof.Sitaram Yaji		
7.	18ECE755	PE3:Internet of Things	Dr.Shashidhara K S		
8.	18ECE756	PE4:Data Compression	Dr.Prashantha H S		
9.	18ECE757	JAVA Programming - Coursera	Dr. Ramachandra A C		
10.	18ECL77	Power Electronics Lab	A1: Ms.Nitya A2 Ms.Nitya A3:Ms.Ayesha	B1: Ms.Ayesha B2:Dr.Prasanna B3: Dr.Prasanna	C1: Ms. Naina C2: Ms.Naina C3: Dr. Manjula B M
11.	18ECL78	Data Communication Network Lab	A1: Ms.Divya A2: Dr.Thimmaraju A3:Ms.Divya	B1: Mr.Vinaykumar B2: Dr.Thimmaraju B3:Dr.Sunil	C1: Dr.Naveen C2: Dr.Sunil C3: Dr.Vinaykumar R
12.	18ECO762	OE1: Avionics	Dr.Naveenkumar R		
13.	18ECO764	OE3: Introduction to Data Analytics	Dr.Roopa K		
14.	18ECO765	OE2: Satellite Technology Principles and application	Dr.Parameshachari		

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DATE:08/12/2022

Additional classes for 5th semester on Monday

Sec	8.45-9.40	09.40-10.35		10.55-11.50	11.50-12.45	12.45-1.30	1.30-2.25	2.25-3.20	3.20-4.15
	1	2		3	4		5	6	7
5A	AS PER TIMETABLE							MW	VLSI
5B								MW	VLSI
5C								COMM	CS

HOD ECE

Department of Electronics and Communication Engineering

DATE:15/12/2022

Additional classes for 5th semester on Thursday

Sec	8.45-9.40	09.40-10.35		10.55-11.50	11.50-12.45	12.45-1.30	1.30-2.25	2.25-3.20	3.20-4.15
	1	2		3	4		5	6	7
5A	AS PER TIMETABLE								DS
5B									DS
5C									DS

HOD ECE

SECTION -A AIDS ROOM 101	1 8:45am- 9:40am	2 9:55am 10:50am	3 10:50am 11:45am	4 11:45am 12:40pm	12:40pm 1:30pm	5 1:30pm 2:25pm	6 2:25pm- 3:20pm	7 3:20pm 4:15pm
Monday	SFH	MATHS	ENG	CHEM		ESC-1	PYTHON(A2)/SKILL LAB(A1)	
Tuesday	CHEML LAB		PYTHON	Mentoring		ESC-1	CIP	
Wednesday	CHEM	PYTHON	MATHS	SFH		ESC-1	CAED	
Thursday	MATHS	MATHS	PYTHON(A1)/SKILL LAB(A2)			ESC-1	Class Teacher Interaction	
Friday	CAED		CHEM	ENG		ESC-1	MATHS	MATHS®
Saturday	STUDENT ACTIVITY							

I semester: Chemistry Cycle			CLASS TEACHER : Mrs Sadhana H Upadhya
Sl No	**Course Code**	**Course Title**	**Section A AIDS(ROOM NO 101)**
1	22MATS11	Mathematics- I	Dr Chandrakala S B 9741556807
2	22CHES12	Chemistry	Mrs Sadhana Upadhya H 8147321566
3	22CED13	Computer Aided Engineering Drawing	Dr Chethan K S 9986048620
4	22ESC143	Introduction to Electronics Engineering	Dr Ramakrishna Reddy 9177950372
5	22PLC15b	Introduction to Python Programming	Dr P V R Murthy (AIDS) 9845568042
6	22ENG16	Commutative English	Mrs Ann Theres Joy 7907544248
7	22IC017	Indian Constitution	Dr Vandana Rai 9916897728
8	22SFH18	Scientific Foundations for Health	Dr BhanuPrakash 8050711197

Note: Python Lab---lab8 of CSE Department

FIRST YEAR COORDINATOR **DEAN ACADEMICS** **PRINCIPAL**

SECTION -B AIML ROOM 102	1 8:45am-9:40am	2 9:55am 10:50am	3 10:50am 11:45am	4 11:45am 12:40pm	12:40pm 1:30pm	5 1:30pm 2:25pm	6 2:25pm-3:20pm	7 3:20pm 4:15pm
Monday	ENG	CHEM	SFH	MATHS		ESC-1	CAED	
Tuesday	PYTHON	PYTHON	MATHS	CHEM		ESC-1	PYTHON(B2)/SKILL LAB(B1)	
Wednesday	SFH	CIP	CHEM LAB			ESC-1	MATHS	MATHS®
Thursday	PYTHON(B1)/SKILL LAB(B2)		MATHS			ESC-1	PYTHON	Mentoring
Friday	CHEM	ENG	CAED			ESC-1	MATHS	Class Teacher interaction
Saturday	STUDENT ACTIVITY							

I semester: Chemistry Cycle			Class Teacher: Dr Sreekala C K
Sl No	Course Code	Course Title	Section B AIML(ROOM NO 102)
1	22MATS11	Mathematics- I	Dr Sreekala C K 9880009307
2	22CHES12	Chemistry	Mrs Sadhana Upadhya 8147321566
3	22CED13	Computer Aided Engineering Drawing	Dr Vijay Kumar S 9663360566
4	22ESC144	Introduction to Mechanical Engineering	Mr Mahadev Prasad 9739444382
5	22PLC15b	Introduction to Python Programming	Dr Manoj I V(Mech Dept) 9986754795
6	22ENG16	Commutative English	Ms Akshara 8136883549
7	22IC017	Indian Constitution	Dr Vandana Rai 9916897728
8	22SFH18	Scientific Foundations for Health	Dr BhanuPrakash 8050711197

Note: Python Lab---Room 330 of ISE Department

FIRST YEAR COORDINATOR **DEAN ACADEMICS** **PRINCIPAL**

SECTION -C CSE ROOM 103	1 8:45am-9:40am	2 9:55am 10:50am	3 10:50am 11:45am	4 11:45am 12:40pm	12:40pm 1:30pm	5 1:30pm 2:25pm	6 2:25pm-3:20pm	7 3:20pm 4:15pm
Monday	MATHS	CHEM	PYTHON(C1)/SKILL LAB(C2)			ESC-1	MATHS	
Tuesday	CHEM	MATHS	CIP	PYTHON		ESC-1	CAED	
Wednesday	PYTHON(C2)/SKILL LAB(C1)		ENG	MATHS		ESC-1	PYTHON	
Thursday	SFH	ENG	CAED			ESC-1	MATHS	MATHS®
Friday	CHEM LAB		CHEM	SFH		ESC-1	Class Teacher interaction	
Saturday	STUDENT ACTIVITY							

I semester: Chemistry Cycle			Class Teacher: Dr Sowmyashree A S
Sl No	**Course Code**	**Course Title**	**Section C CSE(ROOM NO 103)**
1	22MATS11	Mathematics- I	Mrs Rashmi K R 9740292282
2	22CHES12	Chemistry	Dr Sowmyashree A S 9611948974
3	22CED13	Computer Aided Engineering Drawing	Dr Chethan D 9886045413
4	22ESC144	Introduction to Mechanical Engineering	Ms Preethi J 8660143703
5	22PLC15b	Introduction to Python Programming	Mrs Shilpa(CSE) 9620683675
6	22ENG16	Commutative English	Mrs Ann Theres Joy 7907544248
7	22IC017	Indian Constitution	Dr Vandana Rai 9916897728
8	22SFH18	Scientific Foundations for Health	Dr BhanuPrakash 8050711197

Note: Python Lab---lab8 of CSE Department

FIRST YEAR COORDINATOR **DEAN ACADEMICS** **PRINCIPAL**

SECTION -D CSE ROOM 104	1 8:45am-9:40am	2 9:55am 10:50am	3 10:50am 11:45am	4 11:45am 12:40pm	12:40pm 1:30pm	5 1:30pm 2:25pm	6 2:25pm-3:20pm	7 3:20pm 4:15pm
Monday	CHEM	SFH	ENG	MATHS	LUNCH BREAK	ESC-1	ESC-1	Class Teacher interaction
Tuesday	CAED		PYTHON	CHEM		ESC-1	MATHS	Mentoring
Wednesday	MATHS	MATHS	PYTHON	CHEM		ESC-1	CIP	ENG
Thursday	MATHS	MATHS®	CHEM LAB			ESC-1	PYTHON(D2)/SKILL LAB(D1)	
Friday	PYTHON(D1)/SKILL LAB(D2)		SFH	LUNCH BREAK	CAED			
Saturday	STUDENT ACTIVITY							

I semester: Chemistry Cycle			**Class Teacher: Mr Pramod S**
Sl No	**Course Code**	**Course Title**	**Section D CSE(ROOM NO 104)**
1	22MATS11	Mathematics- I	Mr Pramod S 9036882924
2	22CHES12	Chemistry	Dr Srilatha Rao 9900407008
3	22CED13	Computer Aided Engineering Drawing	Dr Shailesh Rao 9916928808
4	22ESC144	Introduction to Mechanical Engineering	Dr Praveen B A 7411119540
5	22PLC15b	Introduction to Python Programming	Ms Sowmya P (CSE) 9867133715
6	22ENG16	Commutative English	Ms Akshara 8136883549
7	22IC017	Indian Constitution	Dr Vandana Rai 9916897728
8	22SFH18	Scientific Foundations for Health	Dr BhanuPrakash 8050711197

Note: Python Lab---lab8 of CSE Department

FIRST YEAR COORDINATOR **DEAN ACADEMICS** **PRINCIPAL**

SECTION -E CSE ROOM 105	1 8:45am-9:40am	2 9:55am 10:50am	3 10:50am 11:45am	4 11:45am 12:40pm	12:40pm 1:30pm	5 1:30pm 2:25pm	6 2:25pm-3:20pm	7 3:20pm 4:15pm
Monday	ENG	CHEM	CHEM LAB			ESC-1	Class teacher Interaction	
Tuesday	CHEM	PYTHON	MATHS	ENG		ESC-1	ESC-1	MATHS®
Wednesday	CAED		PYTHON(E1)/SKILL LAB(E2)			ESC-1	MATHS	Mentoring
Thursday	MATHS	CIP	PYTHON	SFH		ESC-1	CAED	
Friday	SFH	CHEM	MATHS	MATHS		PYTHON(E2)/SKILL LAB(E1)		
Saturday	STUDENT ACTIVITY							

I semester: Chemistry Cycle			Class Teacher: Mrs Sushma C T
Sl No	Course Code	Course Title	Section E CSE(ROOM NO 105)
1	22MATS11	Mathematics- I	Mrs Sushma T C 7892258903
2	22CHES12	Chemistry	Dr Srilatha Rao 9900407008
3	22CED13	Computer Aided Engineering Drawing	Dr Avinash L 8957162147
4	22ESC144	Introduction to Mechanical Engineering	Mr Raghavendra G 9945467878 & Mr Girish Prasad 8553458626
5	22PLC15b	Introduction to Python Programming	Ms Sandya B R(CSE) 9035482824
6	22ENG16	Commutative English	Mrs Ann Theres Joy 7907544248
7	22IC017	Indian Constitution	Dr Vandana Rai 9916897728
8	22SFH18	Scientific Foundations for Health	Dr BhanuPrakash 8050711197

Note: Python Lab---lab8 of CSE Department

FIRST YEAR COORDINATOR **DEAN ACADEMICS** **PRINCIPAL**

NITTE EDUCATION TRUST | NITTE MEENAKSHI INSTITUTE OF TECHNOLOGY

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SECTION -F ISE ROOM-201	1 8:45am-9:40am	2 9:55am 10:50am	3 10:50am 11:45am	4 11:45am 12:40pm	12:40pm 1:30pm	5 1:30pm 2:25pm	6 2:25pm-3:20pm	7 3:20pm 4:15pm
Monday	CHEM	ENG	CAED			ESC-1	MATHS	Class teacher interaction
Tuesday	PYTHON(F1)/SKILL LAB(F2)		MATHS	CHEM		ESC-1	Mentoring	
Wednesday	CHEM LAB		SFH	PYTHON		ESC-1	MATHS	MATHS®
Thursday	CAED		MATHS	CIP		ESC-1	ENG	
Friday	PYTHON	SFH	CHEM	MATHS		ESC-1	PYTHON(F2)/SKILL LAB(F1)	
Saturday	STUDENT ACTIVITY							

I semester: Chemistry Cycle			Class Teacher : Mrs Sumashree.P
Sl No	Course Code	Course Title	Section F ISE (ROOM NO 201)
1	22MATS11	Mathematics- I	Mrs Sumashree.P 9845954860
2	22CHES12	Chemistry	Dr Aravind T 9986038391
3	22CED13	Computer Aided Engineering Drawing	Mr Girish Prasad 8553458626
4	22ESC143	Introduction to Electronics Engineering	Dr Pramod Bhat Nempu 9481145700
5	22PLC15b	Introduction to Python Programming	Mr. Mohan M(ISE) 9900401982
6	22ENG16	Commutative English	Mrs Ann Theres Joy 7907544248
7	22IC017	Indian Constitution	Dr Vandana Rai 9916897728
8	22SFH18	Scientific Foundations for Health	Dr BhanuPrakash 8050711197

Note: Python Lab---Room 330 of ISE Department

FIRST YEAR COORDINATOR **DEAN ACADEMICS** **PRINCIPAL**

SECTION -G ISE ROOM 202	1 8:45am-9:40am	2 9:55am 10:50am	3 10:50am 11:45am	4 11:45am 12:40pm	12:40pm 1:30pm	5 1:30pm 2:25pm	6 2:25pm-3:20pm	7 3:20pm 4:15pm
Monday	CAED		MATHS	SFH		ESC-1	Class Teacher interaction	
Tuesday	CHEM	PYTHON	CAED			ESC-1	MATHS	MATHS®
Wednesday	MATHS	SFH	CHEM	ENG		ESC-1	PYTHON(G1)/SKILL LAB(G2)	
Thursday	CHEM LAB		CHEM	MATHS		ESC-1	CIP	
Friday	ENG	PYTHON	PYTHON(G2)/SKILL LAB(G1)			ESC-1	MATHS	Mentoring
Saturday	STUDENT ACTIVITY							

I semester: Chemistry Cycle			Class Teacher: Dr Kshama Shetty
Sl No	Course Code	Course Title	Section G ISE(ROOM NO 202)
1	22MATS11	Mathematics- I	Dr. Dhananjayamurthy B V 9886002272
2	22CHES12	Chemistry	Dr Kshama Shetty 9901723368
3	22CED13	Computer Aided Engineering Drawing	Mr Hemanth Kumar N 9035870712
4	22ESC143	Introduction to Electronics Engineering	Dr Prashanth V 8088411207
5	22PLC15b	Introduction to Python Programming	Dr. Evangeline 9597887400
6	22ENG16	Commutative English	Mrs Ann Theres Joy 7907544248
7	22IC017	Indian Constitution	Dr Vandana Rai 9916897728
8	22SFH18	Scientific Foundations for Health	Dr BhanuPrakash 8050711197

Note: Python Lab---Room 330 of ISE Department

FIRST YEAR COORDINATOR **DEAN ACADEMICS** **PRINCIPAL**

SECTION -H ISE ROOM 203	1 8:45am-9:40am	2 9:55am 10:50am	3 10:50am 11:45am	4 11:45am 12:40pm	12:40pm 1:30pm	5 1:30pm 2:25pm	6 2:25pm-3:20pm	7 3:20pm 4:15pm
Monday	PYTHON(H2)/SKILL LAB(H1)		CHEM	PYTHON		ESC-1	Mentoring	
Tuesday	CHEM	MATHS	PYTHON(H1)/SKILL LAB(H2)			ESC-1	Class Teacher interaction	
Wednesday	MATHS	ENG	CAED			ESC-1	SFH	MATHS
Thursday	ENG	SFH	MATHS	ESC-1		ESC-1	MATHS®	CIP
Friday	PYTHON	CHEM	CHEM LAB			MATHS	CAED	
Saturday	STUDENT ACTIVITY							

I semester: Chemistry Cycle			Class Teacher: Dr Padmavathi R
Sl No	Course Code	Course Title	Section H ISE(ROOM NO 203)
1	22MATS11	Mathematics- I	Dr Padmavathi R 9341308939
2	22CHES12	Chemistry	Mrs Shwetha K 8861932717
3	22CED13	Computer Aided Engineering Drawing	Dr P V Badiger 9980556720
4	22ESC143	Introduction to Electronics Engineering	Mrs Sowmya Raman 9632240366
5	22PLC15b	Introduction to Python Programming	Ms. Tejaswini N P (ISE) 7829877378
6	22ENG16	Commutative English	Mrs Ann Theres Joy 7907544248
7	22IC017	Indian Constitution	Dr Vandana Rai 9916897728
8	22SFH18	Scientific Foundations for Health	Dr BhanuPrakash 8050711197

Note: Python Lab---Room 330 of ISE Department

FIRST YEAR COORDINATOR **DEAN ACADEMICS** **PRINCIPAL**

SECTION -I CIVIL ROOM 204	1 8:45am-9:40am	2 9:55am 10:50am	3 10:50am 11:45am	4 11:45am 12:40pm	12:40pm 1:30pm	5 1:30pm 2:25pm	6 2:25pm-3:20pm	7 3:20pm 4:15pm
Monday	KANNADA	C-PROG	PHYSICS	EM		ETC-1	MATHS	Mentoring
Tuesday	MATHS	PHYSICS	ENG	MATHS		ETC-1	Class Teacher interaction	
Wednesday	C-PROG	PHYSICS	MATHS	EM		ETC-1	PHY(I1)/CPROG LAB(I2)	
Thursday	PHYSICS	C-PROG	EM	EM		ETC-1	MATHS	MATHS®
Friday	PHY(I2)/CPROG LAB(I1)		PHYSICS	ENG		ETC-1	IDT LAB	
Saturday	STUDENT ACTIVITY							

I semester: Physics Cycle			CLASS TEACHER: Mrs Jyothi Gupta
Sl No	**Course Code**	**Course Title**	**Section I (Civil)(ROOM NO 204)**
1	**22MATC11**	**Mathematics- I**	**Mrs Swathi H R 9535195261**
2	**22PHYC12**	**Physics**	**Mrs Jyothi Gupta 9036377839**
3	**22CIV13**	**Engineering Mechanics**	**Mrs Pratima (Civil) 9739913814**
4	**22ESC145**	**Introduction to C Programming**	**Dr P Nagarathna (CSE) 8618011985**
5	**22ETC15D**	**Introduction to Sustainable Engineering (Civil dept)**	**Dr Chethan Kumar B 7829812469**
6	**22ENG16**	**Communicatative English**	**Ms Priyanka Tresa Paul 9746310265**
7	**22KSK17/22KBK17**	**Kannada**	**Dr.Gowramma(BK) 9902704467 Mr. Pathaiah (SK) 9663821975**
8	**22IDT18**	**IDT**	**Mr Manjunath L (civil) 9886857638**

NOTE: C-PROG LAB--- LAB7 OF CSE DEPARTMENT

NOTE: SK Class in Room 205 & BK Class in Room 204

FIRST YEAR COORDINATOR **DEAN ACADEMICS** **PRINCIPAL**

SECTION -J MECH ROOM 205	1 8:45am-9:40am	2 9:55am 10:50am	3 10:50am 11:45am	4 11:45am 12:40pm	12:40pm 1:30pm	5 1:30pm 2:25pm	6 2:25pm-3:20pm	7 3:20pm 4:15pm
Monday	KANNADA	C-PROG	PHYSICS	MATHS		MATHS	PHY(J1)/CPROG LAB(J2)	
Tuesday	C-PROG	ETC-1	PHYSICS	EME		ENG	ETC-1	Mentoring
Wednesday	PHYSICS	ETC-1	ENG	EME		MATHS	MATHS®	Class Teacher interaction
Thursday	C-PROG	MATHS	PHYSICS	PHYSICS®		EME	ETC-1	
Friday	EME	MATHS	PHY(J2)/CPROG LAB(J1)			IDT LAB		ETC-1
Saturday	STUDENT ACTIVITY							

I semester: Physics Cycle			CLASS TEACHER: Mrs Swathi H R
Sl No	Course Code	Course Title	Section J (Mech)(ROOM NO 205)
1	22MATM11	Mathematics- I	Mrs Swathi H R 9535195261
2	22PHYM12	Physics	Dr Sheik Abdul Sattar 8951531221
3	22EME13	Elements of Mechanical Engineering	Mr Girish Prasad (Mech) 8553458626
4	22ESC145	Introduction to C Programming	Ms. Pushpanjali (CSE) 9986951420
5	22ETC15f	Introduction to Drone Technology (Aero Dept)	Mr Mallappa 9482904701
6	22ENG16	Communicatative English	Ms Akshara 8136883549
7	22KSK17/22KBK17	Kannada	Dr.Gowramma(BK) 9902704467 Mr. Pathaiah (SK) 9663821975
8	22IDT18	IDT LAB	Dr Harish Kumar LMECH) 9845440119

NOTE: C-PROG LAB--- LAB7 OF CSE DEPARTMENT

NOTE: SK Class in Room 205 & BK Class in Room 204

FIRST YEAR COORDINATOR **DEAN ACADEMICS** **PRINCIPAL**

SECTION -K AERO ROOM 301	1 8:45am-9:40am	2 9:55am 10:50am	3 10:50am 11:45am	4 11:45am 12:40pm	12:40pm 1:30pm	5 1:30pm 2:25pm	6 2:25pm-3:20pm	7 3:20pm 4:15pm
Monday	PHY(K1)/CPROG LAB(K2)		EME	PHYSICS		ETC-1	IDT LAB	
Tuesday	KANNADA	PHYSICS	MATHS	EME		ETC-1	PHYSICS®	MATHS®
Wednesday	EME	PHYSICS	MATHS	C-PROG		ETC-1	MATHS	
Thursday	MATHS	EME	ENG	C-PROG		ETC-1	ETC-1	Class Teacher interaction
Friday	PHYSICS	C-PROG	MATHS	ENG		PHY(K2)/CPROG LAB(K1)		Mentoring
Saturday	STUDENT ACTIVITY							

I semester: Physics Cycle CLASS TEACHER: Mrs Kavitha Kamath

Sl No	Course Code	Course Title	Section K (Aero)(ROOM NO 301)
1	22MATM11	Mathematics- I	Mrs Rashmi K R 9740292282
2	22PHYM12	Physics	Mrs Kavitha Kamath 9986612287
3	22EME13	Elements of Mechanical Engineering	Mr Mahadev Prasad 9739444382
4	22ESC145	Introduction to C Programming	Mrs Jagadevi Kalasetty(CSE) 9620730503
5	22ETC15f	Introduction to Drone Technology (Aero Dept)	Dr Rajadurai 8883678026
6	22ENG16	Communicatative English	Ms Akshara 8136883549
7	22KSK17/22KBK17	Kannada	Dr. Gowramma(BK) 9902704467 Mr. Pathaiah (SK) 9663821975
8	22IDT18	IDT	Dr. Harish Kumar L (MECH) 9845440119

NOTE: C-PROG LAB--- LAB7 OF CSE DEPARTMENT

NOTE: SK Class in Room 301 & BK Class in Room 404

FIRST YEAR COORDINATOR **DEAN ACADEMICS** **PRINCIPAL**

SECTION -L ECE ROOM 302	1 8:45am-9:40am	2 9:55am 10:50am	3 10:50am 11:45am	4 11:45am 12:40pm	12:40pm 1:30pm	5 1:30pm 2:25pm	6 2:25pm-3:20pm	7 3:20pm 4:15pm
Monday	PHYSICS	ENG	MATHS	C-PROG		ETC-1	Mentoring	
Tuesday	ENG	PHYSICS	PHY(L2)/CPROG LAB(L1)			ETC-1	IDT LAB	
Wednesday	KANNADA	ELN	PHYSICS	C-PROG		ETC-1	MATHS	MATHS
Thursday	PHY(L1)/CPROG LAB(L2)		MATHS	ELN		ETC-1	PHYSICS®	MATHS®
Friday	C-PROG	ELN	MATHS	PHYSICS		ELN	Class Teacher interaction	
Saturday	STUDENT ACTIVITY							

I semester: Physics Cycle			Class Teacher : Mrs Ranjitha
Sl No	Course Code	Course Title	Section L (ECE) (ROOM NO 302)
1	22MATE11	Mathematics- I	Mr Pramod S 9036882924
2	22PHYE12	Physics	Mrs Ranjitha K 9742749378
3	22BEE13	Basic Electronics	Mrs Ashitha(ECE) 9481986185
4	22ESC145	Introduction to C Programming	Mrs Chaitra (ECE) 9164302758
5	22ETC15d	Introduction to Embedded System (ECE Dept)	Dr Manohar(L-01 to L-16)- Room 303 Mr Satish B M(L-16 to L-31)-Room 304 Dr Harsha K(L-32 to L-46)-Room 305 Dr Sapnakumari(L-47 to L-63)-Room 405
6	22ENG16	Communicatative English	Ms Priyanka Tresa Paul 9746310265
7	22KSK17/22KBK17	Kannada	Dr. Gowramma(BK) 9902704467 Mr. Pathaiah (SK) 9663821975)
8	22IDT18	IDT	Mr Manjunath H N (MECH) 7353877755

NOTE: C-PROG LAB--- Room no 248 OF ISE DEPARTMENT

NOTE: SK Class in Room 302 & BK Class in Room 403

FIRST YEAR COORDINATOR **DEAN ACADEMICS** **PRINCIPAL**

SECTION M ECE ROOM 303	1 8:45am-9:40am	2 9:55am 10:50am	3 10:50am 11:45am	4 11:45am 12:40pm	12:40pm 1:30pm	5 1:30pm 2:25pm	6 2:25pm-3:20pm	7 3:20pm 4:15pm
Monday	C-PROG	MATHS	IDT LAB			ETC-1	ELN	MATHS
Tuesday	ELN	PHYSICS	C-PROG	ENG		ETC-1	PHYSICS®	
Wednesday	PHY(M2)/CPROG LAB(M1)		PHYSICS	MATHS		ETC-1	Class Teacher interaction	MATHS®
Thursday	KANNADA	ELN	MATHS	PHYSICS		ETC-1	PHY(M1)/CPROG LAB(M2)	
Friday	MATHS	PHYSICS	ENG	C-PROG		ELN	Mentoring	
Saturday	STUDENT ACTIVITY							

I semester: Physics Cycle			Class Teacher : Mr.ShivaPrasad
Sl No	Course Code	Course Title	Section M (ECE)(ROOM NO 303)
1	22MATE11	Mathematics- I	Mrs Sushma T C 7892258903
2	22PHYE12	Physics	Mr Shivaprasad 9448354846
3	22BEE13	Basic Electronics	Mrs Naina Karkala(ECE) 9731683072
4	22ESC145	Introduction to C Programming	Ms. Suganya (ECE) 8012941472
5	22ETC15d	Introduction to Embedded System (ECE Dept)	Dr Manohar 9901499698
6	22ENG16	Communicatative English	Ms Akshara 8136883549
7	22KSK17/22KBK17	Kannada	Dr. Gowramma(BK) 9902704467 Mr. Pathaiah (SK) 9663821975
8	22IDT18	IDT	Dr Shiv Pratap Singh (MECH) 9538180485

NOTE: C-PROG LAB--- LAB7 OF CSE DEPARTMENT

NOTE: SK Class in Room 303 & BK Class in Room 403

FIRST YEAR COORDINATOR **DEAN ACADEMICS** **PRINCIPAL**

SECTION -N EEE ROOM 304	1 8:45am-9:40am	2 9:55am 10:50am	3 10:50am 11:45am	4 11:45am 12:40pm	12:40pm 1:30pm	5 1:30pm 2:25pm	6 2:25pm-3:20pm	7 3:20pm 4:15pm
Monday	C-PROG	PHYSICS	BEE	ENG		ETC-1	SK	BK
Tuesday	PHY(N1)/CPROG LAB(N2)		BEE	MATHS		ETC-1	ENG	PHYSICS
Wednesday	MATHS	MATHS	PHYSICS	BEE		ETC-1	IDT LAB	
Thursday	PHYSICS	C-PROG	PHY(N2)/CPROG LAB(N1)			ETC-1	MATHS	MATHS®
Friday	PHYSICS	MATHS	BEE	C-PROG		Class Teacher interaction		Mentoring
Saturday	STUDENT ACTIVITY							

I semester: Physics Cycle			Class Teacher: Mrs Jyothi G B
Sl No	Course Code	Course Title	Section N (EEE)(ROOM NO 304)
1	22MATE11	Mathematics- I	Mrs Sumashree.P 9845954860
2	22PHYE12	Physics	Mrs Jyothi G B 9972098212
3	22EEE13	Elements of Electrical Engineering	Dr Prasanth (EEE) 8088411207
4	22ESC145	Introduction to C Programming	Dr Aruna (AIML) 8296760239
5	22ETC15d	Introduction to Embedded System (ECE Dept)	Mr Satisha B M 9972502600
6	22ENG16	Communicatative English	Ms Priyanka Tresa Paul 9746310265
7	22KSK17/22KBK17	Kannada	Dr. Gowramma(BK) 9902704467 Mr. Pathaiah (SK) 9663821975
8	22IDT18	IDT	Dr Ramesh Babu N (MECH) 7411333604

NOTE: C-PROG LAB--- LAB7 OF CSE DEPARTMENT

NOTE: SK Class in Room 304 & BK Class in Room 405

FIRST YEAR COORDINATOR **DEAN ACADEMICS** **PRINCIPAL**

SECTION -P ECE ROOM 305	1 8:45am-9:40am	2 9:55am 10:50am	3 10:50am 11:45am	4 11:45am 12:40pm	12:40pm 1:30pm	5 1:30pm 2:25pm	6 2:25pm-3:20pm	7 3:20pm 4:15pm
Monday	PHYSICS	MATHS	PHY(P1)/CPROG LAB(P2)			ETC-1	ELN	MATHS®
Tuesday	C-PROG	ELN	MATHS	PHYSICS		ETC-1	PHY(P2)/CPROG LAB(P1)	
Wednesday	ENG	PHYSICS	C-PROG	ELN		ETC-1	MATHS	Mentoring
Thursday	MATHS	ELN	PHYSICS	ENG		ETC-1	Class Teacher interaction	
Friday	KANNADA	C-PROG	IDT LAB			PHYSICS®	MATHS	
Saturday	STUDENT ACTIVITY							

I semester: Physics Cycle			Class Teacher: Mr Naveen Kumar(P1) & Mr Prashanth(P2)
Sl No	Course Code	Course Title	Section P (ECE) (ROOM NO 305)
1	22MATE11	Mathematics- I	Dr Kiran S 7019191701
2	22PHYE12	Physics	Mr. Naveen Kumar 9642887325 & Mr Prashanth 8747826211
3	22BEE13	Basic Electronics	Mrs LathaKumari (ECE) 8105158441
4	22ESC145	Introduction to C Programming	Mrs Padmashree (ECE) 9449181853
5	22ETC15d	Introduction to Embedded System (ECE Dept)	Dr Harsha K 9686846781
6	22ENG16	Communicatative English	Ms Priyanka Tresa Paul 9746310265
7	22KSK17/22KBK17	Kannada	Dr.Gowramma(BK) 9902704467 Mr.Pathaiah (SK) 9663821975
8	22IDT18	IDT	Dr Sunil(ECE) 7676639308

NOTE: C-PROG LAB--- Room no 248 OF ISE DEPARTMENT

NOTE: SK Class in Room 305 & BK Class in Room 403

FIRST YEAR COORDINATOR **DEAN ACADEMICS** **PRINCIPAL**

SECTION -Q EEE ROOM 405	1 8:45am-9:40am	2 9:55am 10:50am	3 10:50am 11:45am	4 11:45am 12:40pm	12:40pm 1:30pm	5 1:30pm 2:25pm	6 2:25pm-3:20pm	7 3:20pm 4:15pm
Monday	C-PROG	MATHS	BEE	PHYSICS		ETC-1	SK	BK
Tuesday	BEE	C-PROG	PHYSICS	ENG		ETC-1	Mentoring	
Wednesday	PHYSICS	C-PROG	PHY(Q1)/CPROG LAB(Q2)			ETC-1	MATHS	MATHS®
Thursday	ENG	IDT LAB		MATHS		ETC-1	PHYSICS®	BEE
Friday	MATHS	BEE	PHYSICS	MATHS		PHY(Q2)/CPROG LAB(Q1)		Class Teacher Interaction
Saturday	STUDENT ACTIVITY							

I semester: Physics Cycle			Class Teacher: Ms Priyanka Tresa Paul
Sl No	Course Code	Course Title	Section Q(EEE) (Room No 405)
1	22MATE11	Mathematics- I	Dr Indira R 9900567039
2	22PHYE12	Physics	Dr Hitha Shetty 9845803552
3	22EEE13	Elements of Electrical Engineering	Mrs Sridevi H R(EEE) 9900103506
4	22ESC145	Introduction to C Programming	Ms. ShyamashreeDas(AIDS) 6909524753 Ms. B P Nayana(AIDS) 9538566116
5	22ETC15d	Introduction to Embedded System (ECE Dept)	Dr Sapna Kumari 9902807798
6	22ENG16	Communicatative English	Ms Priyanka Tresa Paul 9746310265
7	22KSK17/22KBK17	Kannada	Dr.Gowramma(BK) 9902704467 Mr. Pathaiah (SK) 9663821975
8	22IDT18	IDT	Dr Shiv Pratap Singh (MECH) 9538180485

NOTE: C-PROG LAB--- Room no 248 OF ISE DEPARTMENT

NOTE: SK Class in Room 304 & BK Class in Room 405

FIRST YEAR COORDINATOR **DEAN ACADEMICS** **PRINCIPAL**

SECTION-R AERO ROOM 404	1 8:45am-9:40am	2 9:55am 10:50am	3 10:50am 11:45am	4 11:45am 12:40pm	12:40pm 1:30pm	5 1:30pm 2:25pm	6 2:25pm-3:20pm	7 3:20pm 4:15pm
Monday	PHYSICS	C-PROG	ETC-1	EME		ETC-1	PHY(R1)/CPROG LAB(R2)	
Tuesday	KANNADA	MATHS	EME	PHYSICS		MATHS	Class Teacher interaction	
Wednesday	C-PROG	PHYSICS	IDT LAB			ETC-1	Mentoring	
Thursday	PHYSICS	MATHS	MATHS	EME		ETC-1	ENG	PHYSICS®
Friday	MATHS	ENG	PHY(R2)/CPROG LAB(R1)			ETC-1	EME	MATHS®
Saturday	STUDENT ACTIVITY							

I semester: Physics Cycle			Class Teacher: Dr Sheik Abdul Sattar
Sl No	Course Code	Course Title	Section R(AERO) Room No 404
1	22MATM11	Mathematics- I	Dr Jagadeesha S 9886610066
2	22PHYM12	Physics	Dr Sheik Abdul Sattar 8951531221
	22EME13	Elements of Mechanical Engineering	Ms. Preethi J 8660143703
4	22ESC145	Introduction to C Programming	Mr Nithin 7090296869
5	22ETC15f	Introduction to Drone Technology (Aero Dept)	Mr Mallappa 9482904701
6	22ENG16	Communicative English	Ms Priyanka Tresa Paul 9746310265
7	22KSK17/22KBK17	Kannada	DrGowramma(BK) 9902704467 Dr Pathaiah (SK) 9663821975
8	22IDT18	IDT	Mrs Krupa R(MECH) 9980595209

NOTE: C-PROG LAB--- Room no 248 OF ISE DEPARTMENT

NOTE: SK Class in Room 301 & BK Class in Room 404

FIRST YEAR COORDINATOR **DEAN ACADEMICS** **PRINCIPAL**

NITTE MEENAKSHI INSTITUTE OF TECHNOLOGY

(An Autonomous Institution Under Visvesvaraya Technological University, Belgaum),Yelahanka, Bengaluru

Department of Electrical and Electronics Engineering

Time Table UG 2022 (ODD)

7th A Semester **Room No: 356**

W.E.F 6/12/2022

Day/Time	1 (8:45-9:45)	2 (9:45-10:45)	10:45 - 11:00	3 (11:00-12:00)	4 (12:00-1:00)	4 1:00 to 1:45	5 (1:45-2:45)	6 (2:45-3:45)	7 (3:45-4:30)
Monday	ED&IPR	CTPS	**Break**	PE	OE	**LUNCH BREAK**	SGP	**Project work**	
Tuesday	CTPS	PE		ED&IPR	OE		**PSP B2 (MJN,SB)** **PSS B1 (SK,SG)**		
Wednesday	PE	SGP		ED&IPR	OE		**PSP B3 (MJN,SB)** **PSS B2 (SK,SG)**		
Thursday	SGP	PE		CTPS	CTPS		ED&IPR		
Friday	**PSP B1 (MJN,SB)** **PSS B3 (SK,SG)**			SGP	Mentoring		**Project work**		
Saturday	**Project Work**			**Project Work**					

Subject Code	Subject	Faculty
18 EE71	Computer Techniques in Power System (CTPS)	Dr. Shreeram Kulkarni
18 EE72	Switch Gear and Protection (SGP)	Dr Aruna
18 EEH73	Entrepreneurship Development Management & IPR (ED&IPR)	Ms Shruti Gatade
	Program Elective (PE)	
18EE741	Introduction to Micro and Smart Grid (M&SG)	Dr Vasudha Hegde
18EEE744A	Electric Vehicles (EV)	Dr Pramod Bhat/ Dr Pavana
18EE7CCE	Algorithms for Battery Management System (BMS)	Dr Pavana
	Open Elective	
18 EEO752	Programmable Logic Controllers (PLC)	Mr Nagaraj M J
18 EEO755	Quantum Computing (QC)	Dr N Samanvita
	Labs	
18 EEL76	Power System Simulation Laboratory	Dr. Shreeram Kulkarni(SK)/ Ms Shruti Gatade (SG)
18 EEL77	Power system Protection Laboratory	Mr Nagaraj M J(MJN) / Smitha B (SB)

NITTE MEENAKSHI INSTITUTE OF TECHNOLOGY
(An Autonomous Institution Under Visvesvaraya Technological University, Belgaum),Yelahanka, Bengaluru

KNOWLEDGE • CHARACTER • UNITY

Department of Electrical and Electronics Engineering

Time Table UG 2022 (ODD)
7th B Semester **Room No: 357**
W.E.F 6/12/2022

Day/Time	**1 (8:45-9:45)**	**2 (9:45-10:45)**	**10:45 - 11:00**	**3 (11:00-12:00)**	**4 (12:00-1:00)**	**4 1:00- 1:45**	**5 (1:45-2:45)**	**6 (2:45-3:45)**	**7 (3:45-4:30)**
Monday	**PSP B2 (VS,PB) PSS B1 (SHR,LI)**			PE	OE		CTPS	CTPS	
Tuesday	ED&IPR	PE		SGP	OE		**Project Work**		
Wednesday	PE	ED&IPR	**Break**	SGP	OE	**LUNCH BREAK**	**Project Work**		
Thursday	SGP	PE		ED&IPR	Mentoring		**PSP B3 (VS,PB) PSS B2 (SHR,LI)**		
Friday	ED&IPR	SGP		CTPS	CTPS		**PSP B1 (VS,PB) PSS B3 (SHR,LI)**		
Saturday	**Project Work**								

Subject Code	**Subject**	**Faculty**
18 EE71	Computer Techniques in Power System (CTPS)	Dr. Shreeram Kulkarni
18 EE72	Switch Gear and Protection (SGP)	Dr T C Balachandra
18 EEH73	Entrepreneurship Development Management & IPR (ED&IPR)	Ms Smitha B
	Program Elective	
18EE741	Introduction to Micro and Smart Grid	Dr Vasudha Hegde
18EEE744A	Electric Vehicles (EV)	Dr Pramod Bhat/ Dr Pavana
18EE7CCE	Algorithms for Battery Management System	Dr Pavana
	Open Elective	
18 EEO752	Programmable Logic Controllers	Mr Nagaraj M J
18 EEO755	Quantum Computing	Dr N Samanvita
	Labs	
18 EEL76	Power System Simulation Laboratory	Ms Sridevi H R(SHR)/ Ms Likitha (LI)
18 EEL77	Power system Protection Laboratory	Ms Veena S(VS)/ Dr Pramod Bhat(PB)

NITTE MEENAKSHI INSTITUTE OF TECHNOLOGY
(An Autonomous Institution Under Visvesvaraya Technological University, Belgaum),Yelahanka, Bengaluru

Department of Electrical and Electronics Engineering

Time Table UG 2022 (ODD)
3rd A Semester Room No: 360
w.e.f 6/12/2022

Day/Time	1 (8:45-9:45)	2 (9:45-10:45)	10:45-11:00	3 (11:00-12:00)	4 (12:00-1:00)	4 1:00-1:45	5 (1:45-2:45)	6 (2:45-3:45)	7 (3:45-4:30)
Monday	AE	MAT	**Break**	**Lab** **AEC(B1)-(SV,PV)** **DE(B2)-(SR,AR)**		**LUNCH BREAK**	ECA	PE	
Tuesday	**Lab** **AEC(B1)-(SV,PV)** **DE(B2)-(SR,AR)**			EVS	CIP				
Wednesday	ECA	EM		MAT	AE		DE		
Thursday	DE	PE	**Break**	ECA	EM		MAT	MENTORING	MENTORING
Friday	PE	AE		DE	EM		COE	COE	COE
Saturday	SMS	ECA (T)		MAT (T)					

Subject Code	**Subject**	**Faculty**
21MAT31	Basic Mathematics Course (MAT)	Dr Dhananjay Murthy
21 EE32	Electrical Circuit Analysis(ECA)	Ms Likhitha
21 EE33	Analog Electronics (AE)	Dr Pavana
21 EE34	Electrical Machines-I (EM)	Dr Rajkiran Balal
21 EE35	Digital Electronics (Integrated) (DE)	Ms Sowmya Raman
21EEE361 Program Elective (PE)	Object Oriented Programming using C++ (OOPS)	Ms Shruti Gatade
21EEE364 Program Elective (PE)	Fundamentals of AI (AI)	Dr Singaravelan
21EEL37	Analog Electronics lab	Dr Singaravelan (SV)/ Dr Pavana (PV)/ Ms Savitha
	Digital Electronics Lab (Integrated Lab)	Ms Sowmya Raman (SR)/ Dr Aruna (AR)
21KBK38	EVS	Akshatha Shetty
21KSK38	CIP	Dr Vandana Rai

SMS- Saturday Morning Show

NITTE MEENAKSHI INSTITUTE OF TECHNOLOGY

(An Autonomous Institution Under Visvesvaraya Technological University, Belgaum),Yelahanka, Bengaluru

Department of Electrical and Electronics Engineering

Time Table UG 2022 (ODD)
3rd B Semester Room No: 420
w.e.f 6/12/2022

Day/Time	1 (8:45-9:45)	2 (9:45-10:45)	10:45-11:00	3 (11:00-12:00)	4 (12:00-1:00)	4 1:00-1:45	5 (1:45-2:45)	6 (2:45-3:45)	7 (3:45-4:30)
Monday	ECA	DE	Break	AE	MAT	LUNCH BREAK	EM	PE	
Tuesday	AE	ECA		**Lab AEC (B1)(HB,RR) DE(B2)(SB,SS)**			EM	Bridge Maths	Bridge Maths
Wednesday	ECA	MAT		EVS	CIP		DE		
Thursday	DE	PE	Break	**Lab AEC (B1)(HB,RR) DE(B2)(SB,SS)**			COE	COE	COE
Friday	PE	MAT		AE	EM		DE	Mentoring	Mentoring
Saturday	SMS	MAT (T)		ECA (T)					

Subject Code	Subject	Faculty
21MAT31	Basic Mathematics Course (MAT)	Dr Dhananjay Murthy
21 EE32	Electrical Circuit Analysis(ECA)	Dr Ramakrishna Reddy
21 EE33	Analog Electronics (AE)	Dr Hussain Basha
21 EE34	Electrical Machines-I (EM)	Dr Pramod Bhat
21 EE35	Digital Electronics (Integrated) (DE)	Ms Smitha B
21EEE361 Program Elective (PE)	Object Oriented Programming using C++ (OOPS)	Ms Shruti Gatade
21EEE364 Program Elective (PE)	Fundamentals of AI (AI)	Dr Singaravelan
21EEL37	Analog Electronics lab	Dr Hussain Basha (HB)/Dr Ramakrishna Reddy (RR)/ Ms Chaitra Hebbar
	Digital Electronics Lab (Integrated Lab)	Ms Smitha B (SB)/ Ms Sujata S(SS)
21KBK38	EVS	Akshatha Shetty
21KSK38	CIP	Dr Vandana Rai

SMS- Saturday Morning Show

NITTE MEENAKSHI INSTITUTE OF TECHNOLOGY

(An Autonomous Institution Under Visvesvaraya Technological University, Belgaum),Yelahanka, Bengaluru

Department of Electrical and Electronics Engineering

Time Table UG 2022 (ODD)

5th Semester **Room No: 328**

W.E.F 06/12/2022

Day/Time	**1 (8:45-9:45)**	**2 (10:00-10:45)**	**10:45-11:00**	**3 (11:00-12:00)**	**4 (12:00-1:00)**	**4 1:00-1:45**	**5 (1:45-2:45)**	**6 (2:45-3:45)**	**7 (3:45-4:30)**
Monday	CS	EMD		AI	S&S		**Lab / COE** **CS LAB B1/ LIC LAB B3(SS and SHR)**		
Tuesday	CS	S&S		EMD	AI		LIC	LIC	
Wednesday	CS	LIC	**Break**	**Lab** **CS LAB B2/ LIC LAB B4 (SS and VS)**		LUNCH BREAK	S&S	English (Lateral Entry)	
Thursday	**Lab** **CS LAB B3/ LIC LAB B1(SS and PB)**			Placement Training			EMD	S&S	
Friday	CS	EMD		AI	Mentoring				
Saturday	CS	**CS**		**Lab** **CS LAB B4/LIC LAB B2(SS and SR)**					

Subject Code	**Subject Name**	**Faculty**
18 EE51	Control Systems (CS)	Mr Anand
18 EE52	Signals and Systems (S&S)	Ms Likhitha
18 EE53	Linear Integrated Circuits (LIC)	Dr Hussain Basha
18 EE54	Fundamentals of Artificial Intelligence (AI)	Dr Singaravelan
18 EE55	Electrical Machine Design (EMD)	Dr Rajkiran Ballal
Labs		
18EEL57	Control Systems Laboratory	Dr Aruna/ Mr Anand
18EEL58	Linear Integrated Circuits Laboratory	Ms Sujata S(SS)/ Ms Veena(VS)/ Ms Sridevi H R(SHR)/ Ms Sowmya Raman(SR)/ Dr Pramod Bhat(PB)

Control System Lab B1 to B4	Dr Aruna and Mr Anand S

NITTE MEENAKSHI INSTITUTE OF TECHNOLOGY
DEPARTMENT OF CIVIL ENGINEERING

TIMETABLE 2022-23 (ODD SEMESTER)
Revision: 01

Semester: III-A Sec, **Term: Nov-Feb - 2022-23**
Class Room: 280/188 **With effect from: 03/11/2022**

Time	8:45am - 9:45am	9:4am-9:55am	9:5am - 10:5am	10:5am - 11:5am	11:55am - 12:55pm	12:55pm - 1:30pm	1:30 pm - 2:30pm	2:30pm - 3:30pm	3:30pm - 4:30 pm
Mon	21MAT31/Dr.KS	Break	21CV32/GN	21CVI35/MH	21CV33/MHV	Lunch Break	PE	21CV34/NAV	21CV34/NAV
Tue	21CV34/NAV		21CVI35/MH	PE	21MAT31/Dr.KS		21CVL37/SKG-A2 : 21CVI35/MH-A3 : 21CVE362/ Dr. SG-A1		
Wed	21MAT31/Dr.KS		PE	21CV32/GN	21CVI35/MH		21KBK38/Dr.GT	Bridge Engg Mathematics -I	
Thu	21CV34/NAV		21CV32/GN	21MAT31/Dr.KS	21CV33/MHV		21CVL37/SKG-A1 : CVI35/MH-A2 : 21CVE362/ Dr. SG-A3		
Fri	PE		21CV33/MHV	21CV32/GN	21KSK38/ Dr.GT		Seminar/ Workshop/Technical activates/Site Visit		
Sat	21CV33/MHV		21CVL37/SKG-A3 : 21CVI35/MH-A1 : 21CVE362/ Dr. SG-A2						

Sl No	Subject Code	Subject	Faculty	Faculty Code
1	21MAT31C	Engineering Mathematics- III	Dr. Kiran S	Dr.KS
2	21CV32	Strength of Materials	Mr. Goutham Nair	GN
3	21CV33	Building Materials and Construction	Mrs. Moulya H.V	MHV
4	21CV34	Water Supply Engineering	Mr. Nitin A.V	NAV
5	21CVI35	Surveying, RS and GIS	Mr. Muralidhara H	MH
6	21CVE361	Disaster Management and Mitigation Engineering	Dr. Raghava G	Dr. RG
7	21CVE362	Engg Geology	Dr.Shalini G	Dr. SG
8	21CVL37	Building Planning and Drawing	Mrs. Shwetha K.G	SKG
9	DIP MATH	Bridge Engg Mathematics -I	Mr. Pramod	
10	21KSK38/21KBK38	Samskrutika Kannada/Balake Kannada	Dr. Gowramma T	Dr. GT
11	21INT39	Internship- I		

TIME TABLE CO-ORDINATOR PROF & HEAD PRINCIPAL

NITTE MEENAKSHI INSTITUTE OF TECHNOLOGY
DEPARTMENT OF CIVIL ENGINEERING

Semester: V-A Sec **Term:** Sep-Jan-2022-23
Class room: 373 **With effect from:** 19/09/2022

TIME TABLE-2022-23 Odd Semester

Time	8:45 am-9:45am	9:45am - 9:55m	9:55am – 10:55am	10:55am - 11:55am	11:55am -12:55pm	12:55pm 1:30 pm	1:30 pm -2:30pm	2:30pm -3:30pm	3:30pm -4;30 pm
Mon	18CV57/UGH-A2-18CVL58/NAV-A1				18CV55/Dr. SR	Lunch Break	Placement Training		
Tue	18CV53/Dr.BG	Break	18CV53/Dr.BG	18CV52/Dr. CK	18CV54/NVK		Software Training		
Wed	18CV51/MB		18CV54/NVK	18CV55/Dr. SR	18CV54/NVK		18CVL59/SR-A1-18CVL58/NAV-A2		
Thu	18CV53/Dr.BG		18CV53/Dr.BG	18CV51/MB	18CV55/Dr. SR		18CV52/Dr. CK	Communicative English	
Fri	18CV53/Dr.BG		18CV52/Dr. CK	18CV51/MB	18CV55/Dr.SR		18CV57/UGH-A1-18CVL59/SR-A2		
Sat	18CV52/CK		18CV52/CK	18CV54/NVK	18CV51/MB				

SL NO	Subject Code	Subject	Faculty	Faculty Code
1	18CV51	Water Supply Engineering	Ms. Mrinal B	MB
2	18CV52	Structural Analysis – II	Dr. Chetan Kumar B	Dr. CK
3	18CV53	Design of RCC Structures	Dr. Bharathi Ganesh	Dr. BG
4	18CV54	Highway Engineering	Mrs. Nanditha VK	NDV
5	18CV55	Geotechnical Engineering-I	Dr. Suma Raj	Dr. SR
6	18CVL57	Structural Analysis Lab	Mr. Umashankar Patil G.H	UGH
7	18CVl58	Concrete & Highway Materials Testing Lab	Mr. Nitin A.V	NAV
8	18CVL59	Geotechnical Engineering Lab	Dr. Suma Raj	Dr. SR

TIME TABLE CO-ORDINATOR PROF & HEAD PRINCIPAL

NITTE MEENAKSHI INSTITUTE OF TECHNOLOGY
DEPARTMENT OF CIVIL ENGINEERING

Semester: V- B Sec **Term:** Sep-Jan-2022-23
Class room: 375 **With effect from:** 19/09/2022

TIME TABLE-2022-23 Odd Semester

Time	8:45am-9:45am	9:45am - 9:55am	9:55am –10:55am	10:55am -11:55am	11:55am -12:55pm	12:55pm 1:30pm	1:30 pm-2:30pm	2:30pm-3:30pm	3:30pm-4:30pm
Mon	18CV54/PG	Break	18CV51/Dr. SR	18CV53/SP	18CV53/SP	Lunch Break	Placement Training		
Tue	18CV55/BP		18CV54/PG	18CV52/Dr. NV	18CV51/Dr SR		18CVL58/PG-B1-18CVL59/ BP-B2		
Wed	18CV57/ MCL-B1-18CVL58/PG-B2				18CV52/Dr. NV		Software Training		
Thu	18CV51/Dr. SR	Break	18CV55/BP	18CV52/Dr. NV	18CV55/BP		18CV53/SP	Communicative English	
Fri	18CV52/Dr. NV		18CV52/Dr. NV	18CV55/BP	18CV54/PG		18CV53/SP	18CV53/SP	18CV54/PG
Sat	18CV51/Dr. SR		18CVL59/ BP-B1-18CV57/ MCL-B2						

SL NO	Subject Code	Subject	Faculty	Faculty Code
1	18CV51	Water Supply Engineering	Dr. Suma Raj	Dr. SR
2	18CV52	Structural Analysis – II	Dr. Nagendra V	Dr. NV
3	18CV53	Design of RCC Structures	Mrs. Sushmitha P	SP
4	18CV54	Highway Engineering	Mrs. Prathima G	PG
5	18CV55	Geotechnical Engineering-I	Mrs Bharati Prasad	BP
6	18CVL57	Structural Analysis Lab	Mr. Mahesh Kumar C.L	MCL
7	18CVl58	Concrete & Highway Materials Testing Lab	Mrs. Prathima G	PG
8	18CVL59	Geotechnical Engineering Lab	Mrs. Bharati Prasad	BP

TIME TABLE CO-ORDINATOR PROF & HEAD PRINCIPAL

NITTE MEENAKSHI INSTITUTE OF TECHNOLOGY
DEPARTMENT OF CIVIL ENGINEERING

Semester: VII-A Sec **Term:** Sep-Jan-2022-23
Class room: 378 **With effect from:** 19/09/2022

TENTATIVE- TIME TABLE-2022-23 Odd Semester

Time	8:45 am-9:45am	9:45am - 9:55am	9:55am – 10:55am	10:55am -11:55am	11:55am -12:55pm	12:55pm 1:30 pm	1:30 pm -2:30pm	2:30pm -3:30pm	3:30pm -4;30 pm
Mon	P18CV76/BP	Break	18CV73/Dr. NV	PE	OE	Lunch Break	18CVL77/SP-A3		
Tue	18CVL77/SP-A1				OE		Project Work*		
Wed	18CV75/VSG	Break	18CV75/VSG	18CVH74/SKG	OE		18CV76/BP	PE	18CV73/Dr. NV
Thu	18CVL77/SP-A2				18CVH74/SKG		18CV73/Dr. NV	18CV76/BP	
Fri	18CV75/VSG	Break	18CV75/VSG	18CVH74/SKG	18CV76/BP		PE	18CV73/Dr. NV	18CVH74/SKG
Sat	Software Training/ Technical Training/ Project Work - Batch A1,A2 & A3								

- **Other students should work either in laboratory or analytical as per the lab slots allotted to them.**

SL NO	Subject Code	Subject	Faculty	Faculty Code
1	18CV73	Design & Drawing of Steel Structures	Dr. Nagendra V	Dr. NV
2	18CVH74	Entrepreneurship & IPR	Mrs. Shwetha K.G	SKG
3	18CV75	Quantity Surveying & Estimation	Mr. Vishwachetan S.G	VSG
4	18CV76	Irrigation Engineering & Hydraulic Structures	Mrs. Bharthi Prasad	BP
5	18CVE724	Matrix & Finite Method of Analysis	Mr. Mahesh Kumara C.L	MCL
6	18CVE727	Ground Improvement Technique	Mr. Vishvachetan S.G	VSG
7	18CVE722	Environmental Impact Assessment	Dr. Vidyavathi N	Dr. VN
8	18CVL77	Civil Engineering Software Lab	Mrs. Sushmitha P	SP
9	18CVO711	Building Services	Dr. Megha Kulkarni	Dr. MK
10	18CVO713	Environmental & Sustainability Engg	Ms. Mrinal B	MB

TIME TABLE CO-ORDINATOR PROF & HEAD PRINCIPAL

NITTE MEENAKSHI INSTITUTE OF TECHNOLOGY
DEPARTMENT OF CIVIL ENGINEERING
TIMETABLE 2022-23 (ODD SEMESTER)

Semester: VII A Sec, **Revision: 01** **Term: Nov-Feb - 2022-23**
Class Room: 379 **With effect from: 19/09/2022**

Time	8:45 am-9:45am	9:45am - 9:55am	9:55am – 10:55am	10:55am - 11:55am	11:55am - 12:55pm	12:55pm 1:30 pm	1:30 pm - 2:30pm	2:30pm - 3:30pm	3:30pm - 4;30 pm
Mon	18CVH74/MHV	Break	18CV76/Dr. MK	PE	OE	Lunch Break	18CVL77/MHV-B2		
Tue	18CV73/ML	Break	18CV73/ML	PE	OE		18CVL77/MHV-B1		
Wed	18CV75/MH	Break	18CV75/MH	18CVH74/MHV	OE		18CV76/Dr. MK		
Thu	18CV76/Dr. MK	Break	18CVH74/MHV	18CV73/ML	18CV73/ML		18CVL77/MHV-B3		
Fri	18CVH75/MH	Break	18CV75/MH	18CVH74/MHV	18CV76/Dr. MK		PE	Project Work	
Sat	Software Training/ Technical Training/ Project Work - Batch B1, B2 & B3								

SL NO	Subject Code	Subject	Faculty	Faculty Code
1	18CV73	Design & Drawing of Steel Structures	Mr. Manjunath L	ML
2	18CVH74	Entrepreneurship & IPR	Mrs. Moulya H.V	MHV
3	18CV75	Quantity Surveying & Estimation	Mr. Muralidhara H	MH
4	18CV76	Irrigation Engineering & Hydraulic Structures	Dr. Megha Kulkarni	Dr. MK
5	18CVE724	Matrix & Finite Method of Analysis	Mr. Mahesh Kumar C.L	MCL
6	18CVE727	Ground Improvement Technique	Mr. Vishwachetan S.G	VSG
7	18CVE722	Environmental Impact Assessment	Dr. Vidyavathi N	Dr. VN
8	18CVL77	Civil Engineering Software Lab	Mrs. Moulya H.V	MHV
9	18CVO711	Building Services	Dr. Megha Kulkarni	Dr. MK
10	18CVO713	Environmental & Sustainable Engg	Ms. Mrinal B	MB

TIME TABLE CO-ORDINATOR PROF & HEAD PRINCIPAL

PG
SYLLABUS

NITTE MEENAKSHI INSTITUTE OF TECHNOLOGY

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DEPARTMENT OF AERONAUTICAL ENGINEERING

KNOWLEDGE • CHARACTER • UNITY

SYLLABUS, SCHEME OF TEACHING AND EXAMINATION

M.Tech., in AEROSPACE ENGINEERING

2022-2024

VISION AND MISSION

INSTITUTION

VISION

To provide India and the World, Technical Manpower of Highest Academic Excellence by Shaping Our Youth through Holistic and Integrated Education of the Highest Quality.

MISSION

To develop Nitte Meenakshi Institute of Technology through Quality, Innovative and State-of-art educational initiatives into a center of academic excellence that will turn out youth with well- balanced personality & commitment to rich cultural heritage of India and who will successfully face the Scientific and Technological challenges in the fast-evolving Global scenario with a high degree of credibility, integrity and ethical standards.

DEPARTMENT

VISION

To see the students of this department, excel in research, design and innovation in the field of Aeronautical Engineering, thereby contributing to meet the evolving global needs and to be professional and well-balanced Aeronautical Engineers exhibiting moral and ethical values.

MISSION

The department of Aeronautical Engineering strives for excellence by applying and imparting knowledge in the field of Aeronautical Engineering through comprehensive educational program, industrial visits, interaction with experts from industry and similar co-curricular activities coupled with leadership qualities.

PROGRAM EDUCATIONAL OBJECTIVES (PEOS)

PEO 1: To develop strong foundation in students to understand and analyses advance research problems in Aerospace Engineering.

PEO 2: Nurture professional graduates to develop ability in analyzing real life problems of Space Technology.

PEO 3: To foster attitude towards continuous learning for developmental activities in research, academia and industry.

PEO 4: To improve professional skills for teamwork with ethical awareness and practice in achieving goal.

PROGRAM OUTCOMES OF M. Tech. AEROSPACE ENGINEERING

PO1- Acquire technical competence, comprehensive knowledge and understanding the methodologies and technologies of industrial / process automation, principles and practices of energy management.

PO2- Ability to apply the knowledge of mathematics, science, engineering and technology. Understand in detail, analyze, formulate and solve the issues pertaining to the application of automation technologies in a range of industrial settings.

PO3- Acquiring the ability to identify, investigate, understand and analyze complex problems pertaining to power management and automation in industries and identify effective solution strategies for implementation.

PO4- Inculcate the role of research in developing and maintaining knowledge of the state-of-the- art in various technologies and automation in industries. Acquire the skill to design, develop and modify systems in hardware and software platforms to meet desired needs within realistic constraints

PO5- Create, select and apply appropriate techniques, resources, modern engineering and IT tools to complex engineering activities in the field of automation, control and energy management.

PO6-Acquire the capacity to understand and summarize complex information pertaining to various fields of engineering in industries. Function effectively as an individual, and as a member or leader in a team.

PO7 -Acquire the skill to develop specifications, implement and critically assess projects and their outcomes. Demonstrate management, leadership and entrepreneurial skills, and apply these to one’s own work, as a member and a leader in a team to manage projects in multidisciplinary environments.

PO8-Ability to communicate effectively in both oral and written contexts in the form of technical papers, project reports, design documents and seminar presentations.

PO9- Recognize the need for, and acquire the ability to engage in self-improvement through continuous professional development and life-long learning to maintain an up-to-date knowledge of contemporary issues in various fields of engineering.

PO10- Apply and commit to professional ethics and responsibilities of engineering practice. Understand the importance of sustainability and cost effectiveness in design and development of engineering solutions for industries and their impacts in societal and environmental context. Demonstrate awareness of societal, safety, health, legal and cultural issues relevant to professional engineering practice.

PO11- Impart an eagerness to conduct investigation and research on chosen field of study and thus keep moving towards being adaptive, self-reliant and self-evaluative.

PROGRAM SPECIFIC OUTCOMES

PSO1. Professional skills: Able to utilize the knowledge of aerospace engineering in innovative, dynamic and challenging environment for design and development of new products

PSO2. Professional skills: Imparted through simulation language skills and general-purpose CAE packages to solve practical, design and analysis problems of components to complete the challenge of airworthiness for flight vehicles.

PSO3. Practical implementation and testing skills: Providing different types of in house and training and industry practice to fabricate and test and develop the products with more innovative technologies.

PSO4. Successful career and entrepreneurship: To prepare the students with broad aerospace knowledge to design and develop systems and subsystems of aerospace and allied systems and become technocrats.

DEPARTMENT OF AERONAUTICAL ENGINEERING

Course content, Scheme of Teaching and Examination

M.Tech. in Aerospace Engineering

SEMESTER – I

Sl. No	Course	Course Code	Course Title	Teaching Hours per Week			Examination				Credits
				Theory	Practical/Seminar	Tutorial/ Skill Development	Duration in hours	CIE Marks	SEE Marks	Total Marks	
				L	P	T/SDA					
1	BSC	22AEM11	Advanced Engineering Mathematics	03	00	00	03	50	50	100	3
2	IPCC	22MAS12	Aerodynamics	03	02	00	03	50	50	100	4
3	PCC	22MAS13	Aerospace Propulsion	03	00	02	03	50	50	100	4
4	PCC	22 MAS 14	Aerospace Materials	02	00	02	03	50	50	100	3
5	PCC	22 MAS 15	Flight Mechanics	02	00	02	03	50	50	100	3
6	MCC	22RMI16	Research Methodology and IPR	03	00	00	03	50	50	100	3
7	PCCL	22 MAS L17	Propulsion lab	01	02	00	03	50	50	100	2
8	AUD/AEC	22AUD18/ 22AEC18	BOS recommended ONLINE courses	Classes and evaluation procedures are as per the policy of the online course providers.							PP
TOTAL				**17**	**04**	**06**	**21**	**350**	**350**	**700**	**22**

SEMESTER – II

Sl. No	Course	Course Code	Course Title	Teaching Hours /Week			Examination				Credits
				Theory	Practical/ Seminar	Tutorial/ Skill Development Activities	Duration in hours	CIE Marks	SEE Marks	Total Marks	
				L	P	T/SDA					
1	PCC	22MAS21	Computational Methods in Aerospace	02	00	02	03	50	50	100	3
2	IPCC	22MAS22	Aerospace Structural Mechanics	03	02	00	03	50	50	100	4
3	PEC	22MAS23x	Professional elective 1	02	00	02	03	50	50	100	3
4	PEC	22MAS24x	Professional elective 2	02	00	02	03	50	50	100	3
5	MPS	22MAS25	Mini Project with Seminar	00	04	02	--	100	--	100	3
6	PCCL	22MASL26	Computational Lab	01	02	00	03	50	50	100	02
7	AUD/ AEC	22AUD27	Suggested ONLINE courses	Classes and evaluation procedures are as per the policy of the online course providers.							PP
TOTAL				**10**	**08**	**08**	**15**	**350**	**250**	**600**	**18**

Professional Elective 1		Professional Elective 2	
Course Code under 22MAS23X	**Course title**	**Course Code under 22MAS24X**	**Course title**
22MAS231	Experimental Aerodynamics	22MAS241	Hypersonic Aerodynamics
22MAS232	Advanced Light Weight Composite Materials and Structures	22MAS242	System Engineering and Analysis
22MAS233	Cryogenic Technology	22MAS243	Advanced Propulsion System
22MAS234	Rocketry and Space Mechanics	22MAS244	Orbital Mechanics and Space Flight
22MAS235	Avionics	22MAS245	Aerospace Instrumentation

SEMESTER – III

Sl. No	Course	Course Code	Course Title	Teaching Hours /Week			Examination				Credits
				Theory	Practical/ Mini–Project/ Internship	Tutorial/ Skill Development Activities	Duration in hours	CIE Marks	SEE Marks	Total Marks	
				L	P	SDA					
1	PCC	22MAS31	Finite Element Methods	03	00	02	03	50	50	100	4
2	PEC	22MAS32X	Professional elective 3	03	00	00	03	50	50	100	3
3	OEC	22MAS33X	Open elective Courses-1	03	00	00	03	50	50	100	3
4	PROJ	22MAS34	Project Work phase -1	00	06	00	--	100	--	100	3
5	SP	22MAS35	Societal Project	00	06	00	--	100	--	100	3
6	INT	22MASI36	Internship	(06 weeks Internship Completed during the intervening vacation of II and III semesters.)			03	50	50	100	6
TOTAL				**09**	**12**	**03**	**12**	**400**	**200**	**600**	**22**

Professional elective 3		Open elective -1	
Course Code under 22MAS32X	**Course title**	**Course Code under 22MAS33X**	**Course title**
22MAS321	Gas Dynamics	22MAS331	Introduction to Aerospace Engineering
22MAS322	Chemical Rocket Technology	22MAS332	Principles Of Aircraft Design
22MAS323	Missile Guidance and Control	22MAS333	Introduction to Aerospace Propulsion
22MAS324	Airport Planning and Operations	22MAS334	Unmanned Aerial Vehicle

22MAS325	Optimization Technique	22MAS335	Rockets and Missiles
22MAS326	Structural Dynamics and Aeroelasticity		

SEMESTER – IV

Sl. No	Course	Course Code	Course Title	Teaching Hours /Week		Examination				Credits
				Theory	Practical/Field work	Duration inhours	CIE Marks	SEE Marks Vivavoce	Total Marks	
				L	P					
1	Project	22MAS41	Project work phase-2	--	08	03	100	100	200	18
TOTAL				--	**08**	**03**	**100**	**100**	**200**	**18**

SEMESTER – I

ADVANCED ENGINEERING MATHEMATICS				
Course Code	**22MAE11**		**Credits**	**03**
Hours/Week (L-T-P)	**3-0-0**		**CIE Marks**	**50**
Total Hrs	**39**		**SEE Marks**	**50**
Exam Hrs	**03**		**Course Type**	**BSC**

COURSE OUTCOMES

Course outcomes: After completion of the course, students will be able to-

1. Apply the concepts of Fourier analysis, Integral transforms and Series solution techniques for problem solving
2. Apply the numerical techniques to solve complex problems
3. Apply the concept of Probability sampling and estimation for solving problems.
4. Use the concepts of Transforms, ODE, PDE, probability to model problems arising in defence and Aerospace.
5. Apply the concept of optimization and game theory.

TEACHING METHODOLOGY

- Blackboard teaching/PowerPoint presentation (if needed) /Flipped Classes for specified topics.
- Tutorial classes on topics covered.
- Unit tests on covered topics

COURSE CONTENTS

UNIT-1-(07 HOURS)

Numerical Methods for Differential equations: RK 4^{th} order methods for IVP, Simultaneous equations. Adam-Bashforth multi step methods. Explicit Schmidt, Dufort-Franknel methods, Crank Nicholson method for 1-D Diffusion and Convection equations Series solution, Frobenious method, Bessel Equation

UNIT-2-(08 HOURS)

Fourier Series expansion of periodic functions, Fitting Harmonics for given data, Fourier Complex, Sine and Cosine transforms
Laplace transform and Inverse Laplace transform for Standard functions. Solution of IVP

UNIT-3-(08 HOURS)

Solution of system of Equation-Gauss elimination, LU decomposition Eigen values and Eigen vectors- Power method, Jacobi, Rutishauser method Interpolation using Lagrangian and Newton's Formulae, Cubic spline.
Numerical integration using Simpson's $1/3^{rd}$ and $3/8^{th}$ Rule

UNIT-4-(08 HOURS)

Random variables- Discrete and continuous, Probability distribution, probability density function, mean, variance, Joint Distribution (Discrete and Continuous) Binomial, Poisson, Normal Distribution. Sampling Distribution, Confidence Interval for estimation of mean, Testing of Hypothesis for Large and small samples, ANOVA

UNIT-5-(08 HOURS)

Testing of Hypothesis for Large and small samples, ANOVA, Randomized Block Design Game theory, principle of dominance, Graphical method, Linear programming method, Applications to Defence and Aerospace

TEXT BOOKS

1. Applied statistics and Probability for Engg. Douglas C montgomery, George C Runger, Sixth edition, Wiley, 2016
2. Numerical Algorithms EV Krishna Murthy and SK Sen East west press 2007
3. Kreyszig: Advanced engineering mathematics, Publisher: Wiley, 10^{th} edition 2016

REFERENCE BOOKS

1. Probability and Stastistics MR Speigen, JJ schiller, R A Srinivasan and D Goswami. Sachaum's outline Mcgraw Hill 3^{rd} edition 2010.
2. Operation research VK Kapoor, S Chand & sons
3. Theory and Analysis of Experimental Designs B L Agarwal, CBS publisher 2010

COURSE ASSESSMENT METHOD

Continuous Internal Evaluation (CIE)														
Three internal assessments for **30** Marks each.														
Two Learning Activities for **10** Marks each.														
Semester End Examination (SEE)														
Semester end examination for 100 Marks														
Program Outcomes – Articulation matrix														
PO	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**PSO1**	**PSO2**
CO1	3								3	3				3
CO2	3	3	3						3	3				3
CO3	3	2	3						3	2				2
CO4	3	3	3						3	3				3
CO5	3	3	3						3	3				3

AERODYNAMICS				
Course Code	**22MAS12**		**Credits**	**4**
Hours/Week (L-T-P)	**3-0-2**		**CIE Marks**	**50**
Total Hrs	**50**		**SEE Marks**	**50**
Exam Hrs	**3**		**Course Type**	**IPCC**

COURSE OUTCOMES

Course outcomes: After completion of the course, students will be able to-

1. Analyze the airfoil characteristics.
2. Analyze the incompressible inviscid flows and their combinations.
3. Analyze the incompressible inviscid flow over airfoil and finite wing.
4. Analyze the subsonic linearized flow over airfoil and effect of compressibility.
5. Analyze the features of viscous flow and discuss the aerodynamic testing.

TEACHING METHODOLOGY

- Blackboard teaching/PowerPoint presentation (if needed) /Flipped Classes for specified topics
- Regular review of students by asking questions based on topics covered in the class

COURSE CONTENTS

UNIT-1 - (10 HOURS)

Governing equations: Euler and Lagrangian descriptions, Control volume approach to continuity and momentum equations, Path lines, Streamlines and Streak lines, Stream function, Velocity potential. Types of flow.

Airfoil Characteristics: Airfoil section geometry and wing plan form geometry, aerodynamic forces and moment and pressure coefficient. Centre of pressure, calculation of airfoil lift and drag from measured surface pressure distributions, typical airfoil aerodynamic characteristics at low speeds. High lift Devices.

UNIT-2 - (10 HOURS)

Two-Dimensional Inviscid Incompressible Flows: Bernoulli's equation and applications. Condition on velocity for incompressible flow. Laplace equation and boundary conditions. Two-dimensional source, sink and doublet flows and vortex flow and combinations of elementary flows.

Flow over Circular Cylinders: Non-lifting flow over a two-dimensional circular cylinder, Lifting flow over a two-dimensional circular cylinder, Kutta-Joukowski theorem and generation of lift, D'Alembert's paradox.

UNIT-3 - (10 HOURS)

Incompressible Flow over Airfoils: Kelvin's circulation theorem and the starting vortex, Kutta condition, Classical thin airfoil theory for symmetric and cambered airfoils.

Incompressible Flows over Finite Wings: Downwash, Induced drag, vortex filament, the Biot-Savart Law, Prandtl's lifting line theory and its limitations, Elliptic lift distribution. Simplified horse-shoe vortex model, formation flight, influence of downwash on tail plane, ground effects.

UNIT-4 - (08 HOURS)

Subsonic linearized flow over airfoils: Full velocity potential equation, linearized velocity potential equation and boundary condition, Prandtl-Glauert compressibility correction.

Effects of Compressibility: Basics of speed of sound, Mach waves, Normal shock waves, Oblique shock waves, Expansion fan, Prandtl – Meyer expansion, Critical Mach number; Drag- divergence Mach number, Sound Barrier, Transonic area rule. Swept wing.

UNIT-5 - (10 HOURS)

Viscous Flows: Derivation of Navier-Stokes equation for two-dimensional flows, boundary approximations, laminar boundary equations and boundary conditions, Blasius solution, qualitative features of boundary layer flow under pressure gradients, aspects of transition to turbulence, turbulent boundary layer properties over a flat plate at low speeds.

Introduction to Aerodynamic Testing: Principles of wind tunnel flow simulation, Classification and Major features of subsonic, supersonic and hypersonic wind tunnels. Flow visualization techniques. Measurement of pressure, velocity and Aerodynamic load measurements on a model.

TEXT BOOKS

1.

1. J.D. Anderson, Fundamentals of Aerodynamics, McGraw-Hill Education, 6th edition, 2017.
2. Rathakrishnan.E., Gas Dynamics, Prentice Hall of India, 7th edition, 2020.
3. Shapiro, AH, "Dynamics & Thermodynamics of Compressible Fluid Flow", Ronald Press, 1982.

REFERENCE BOOKS
1. Houghton, EL and Caruthers, NB,"Aerodynamics for Engineering Students", Butterworth- Heinemann series, 7th edition 2017. 2. Zucrow, M.J, and Anderson, J.D, "Elements of gas dynamics" McGraw-Hill Book Co., New York, 1989. 3. Rae, WH and Pope, A, "Low speed Wind Tunnel Testing", John Wiley Publications, 3rd edition, 1999.

AERODYNAMICS LABORATORY

List of Experiments

1. Calibration of a subsonic wind tunnel
2. Smoke flow visualization studies
   i. On a two-dimensional circular cylinder at low speeds.
   ii. On a two dimensional airfoil at different angles of incidence at low speeds.
3. Tuft flow visualization on a wing model at different angles of incidence at low speeds.
4. Surface pressure distributions and calculation of aerodynamic coefficients.
   i. On a two-dimensional circular cylinder at low speeds
   ii. On a two-dimensional symmetric airfoil at different angles of incidence.
   iii. On a two-dimensional cambered airfoil at different angles of incidence.
5. Measurement of a typical boundary layer velocity profile on the tunnel wall
6. Measurement of Aerodynamic Loads and Moment using three-component balance.
   i. Over a rectangular wing with symmetrical airfoil
   ii. Over a rectangular wing with cambered airfoil
7. Calculation of total drag using Pitot-static probe wake survey
   i. Of a two-dimensional circular cylinder at low speeds.
   ii. Of total drag of a two-dimensional airfoil at low speeds.
8. Measurement of Aerodynamic Loads and Moments using six-component balance.

ONLINE RESOURCES	Link
NPTEL	https://nptel.ac.in/courses/101/105/101105059/
NPTEL	https://nptel.ac.in/courses/101/103/101103003/
NPTEL	https://nptel.ac.in/courses/101/101/101101058/
MIT OCW	https://ocw.mit.edu/courses/aeronautics-and-astronautics/16-100-aerodynamics-fall-2005/lecture-notes/
TU Delft	https://online-learning.tudelft.nl/courses/introduction-aeronautical-engineering/

COURSE ASSESSMENT METHOD
Continuous Internal Evaluation (CIE)
Three internal assessments for 30 Marks each.
Two Learning Activities for 10 Marks each.
Semester End Examination (SEE)
Semester end examination for 100 Marks
Program Outcomes – Articulation matrix:

PO	1	2	3	4	5	6	7	8	9	10	11	12	PSO1	PSO2
CO1	3								3	3				3
CO2	3	3	3						3	3				3
CO3	3	2	3						3	2				2
CO4	3	3	3						3	3				3
CO5	3	3	3						3	3				3

AEROSPACE PROPULSION				
Course Code	**22MAS13**		**Credits**	**4**
Hours/Week (L-T-P)	**3-0-2**		**CIE Marks**	**50**
Total Hrs	**50**		**SEE Marks**	**50**
Exam Hrs	**3**		**Course Type**	**PCC**

COURSE OUTCOMES

Course outcomes: After completion of the course, students will be able to-

1. Apply the fundamentals of thermodynamics to compressible flows
2. Understand the working principle of air breathing propulsion systems.
3. Use cycle analysis and assess performance of air breathing engines
4. Analyze the performance parameters of various rocket propulsion systems.
5. Understand the concepts of advanced propulsion systems.

TEACHING METHODOLOGY

- Blackboard teaching/PowerPoint presentation (if needed) /Flipped Classes for specified topics.
- Tutorial classes on topics covered.
- Unit tests on covered topics

COURSE CONTENTS

UNIT -1- (10 HOURS)

Review of thermodynamics: Work and energy interactions, Representation of isothermal, isentropic, isobaric and isochoric processes on P-V and T-S diagrams, Classical thermodynamics, conservation equations for systems and control volumes, one dimensional flow of a compressible perfect gas – isentropic and non-isentropic flows. Propulsion system performance, the gas generator Brayton cycle, zero dimensional analysis of ideal ramjet, turbojet and turbofan cycles, non-ideality and isentropic efficiencies. Performance analysis of inlets and nozzles, gas turbine combustors, compressors and turbines and discussion of factors limiting performance.

UNIT -2- (10 HOURS)

Basics of Air breathing Propulsion: Introduction to various air breathing and non-air breathing engines. Principle of thrust generation, Brayton cycle, types of air-breathing propulsion systems, components of jet engine and their functions, diffuser design for subsonic and supersonic flights, preliminary aspects of axial flow compressor and turbines, types of combustors, convergent nozzle, CD Nozzle, flow through nozzles – optimal, under and over expanded nozzles.

UNIT -3- (10 HOURS)

Performance of Air breathing engines: Ideal cycle analysis, efficiencies of components and non-ideal cycle analysis, engine performance analysis – specific thrust, specific fuel consumption, propulsive, thermal and overall efficiencies. Efficiencies of air breathing and non-air breathing engines.

UNIT -4- (10 HOURS)

Rocket Propulsion: Classification based on energy system, nozzle and Thrust Equation; Specific Impulse, Thrust Coefficient, Characteristic Velocity and other Performance Parameters; liquid rocket engine, components and propellants, solid rocket propellants, performance parameters and motor design, hybrid rocket propulsion systems, selection of rocket propulsion systems, thrust vector control methods, rocket exhaust plumes, rocket testing.

UNIT -5- (10 HOURS)

Advanced Propulsion: Scramjet and pulse jet engines - principle of operation. Electric propulsion thrusters: classification, principle and application. nuclear propulsion system, concepts, design and application, Recent Micro Spacecraft Developments; Micro-propulsion Options; Primary Set of Micro-propulsion Requirements

TEXT BOOKS

1. Cohen, H, Saravanamuttoo, HIH., Rogers, GFC, Paul Straznicky and Andrew Nix, “Gas Turbine Theory”, Pearson Education Canada; 7th edition, 2017.
2. Gill,WP, Smith,HJ & Ziurys,JE, “Fundamentals of Internal Combustion Engines as applied to Reciprocating, Gas turbine & Jet Propulsion Power Plants”, Oxford & IBH Publishing Co., 1980.
3. Hill, PG. & Peterson, CR. “Mechanics & Thermodynamics of Propulsion” Pearson education, 2 nd edition, 2014.

REFERENCE BOOKS		
1. Oates, GC,"Aerothermodynamics of Aircraft Engine Components", AIAA Education Series, 2007. 2. Sutton,GP, "Rocket Propulsion Elements", John Wiley & Sons Inc., New York, 9th Edition, 2017. 3. J Seddon & E L Goldsmith. "Intake Aerodynamics", AIAA education series. 1999.		
Sl. No	**ONLINE RESOURCES**	**LINK**
1.	NPTEL	https://nptel.ac.in/courses/101106033
COURSE ASSESSMENT METHOD		
Continuous Internal Evaluation (CIE)		
Three internal assessments for 30 Marks each.		
Two Learning Activities for 10 Marks each.		
Semester End Examination (SEE)		
Semester end examination for 100 Marks		
Program Outcomes – Articulation matrix		

PO	1	2	3	4	5	6	7	8	9	10	11	12	PSO1	PSO2
CO1	3	1										2		1
CO2	2	2							2			1		1
CO3	1			1	1							2		1
CO4	2								2			1		
CO5	1	2		1					2			2		

AEROSPACE MATERIALS				
Course Code	**22MAS14**		**Credits**	**3**
Hours/Week (L-T-P)	**2-0-2**		**CIE Marks**	**50**
Total Hrs	**36**		**SEE Marks**	**50**
Exam Hrs	**3**		**Course Type**	**PCC**

COURSE OUTCOMES

Course outcomes: After completion of the course, students will be able to-

1. Designing aerospace structures
2. Material and particular choices according to designs
3. Explaining stress and load on different structures
4. Manufacturing aircraft and spacecraft, Safety philosophies and their effects on designs
5. Creating preliminary solutions for structural problems in designs

TEACHING METHODOLOGY

- Blackboard teaching/PowerPoint presentation (if needed) /Flipped Classes for specified topics.
- Tutorial classes on topics covered.
- Unit tests on covered topics

COURSE CONTENTS

UNIT -1- (07 HOURS)

Material physics, properties and Environment & durability: Stress-strain, Loading modes, Engineering terminology, Engineering terminology, Shear stress, Bi-axial loading, Stiffness and apparent stiffness, Isotropic and anisotropic sheet deformation, Toughness, Environment & durability, The effect of ambient temperature, The effect of humidity, Environmental aspects.

UNIT -2- (08 HOURS)

Material types and Manufacturing: Introduction, Metal alloys, Polymers, Ceramic materials, Composite materials, Composite materials, Manufacturing, Metals, Composites,
Thermoset versus thermoplastic

UNIT -3- (08 HOURS)

Aircraft & spacecraft structures and loads: Airframe, Structural concepts, Fuselage structures, Wing structures, Torsion box, Structural details, Typical launch vehicle structures, Externally loaded airframe, Load path, Loads and load paths in an airframe, Complex load cases, Load and load cases for spacecraft structures.

UNIT -4- (08 HOURS)

Translating loads to stresses and Consideration of strength & stiffness: Pressurization of a fuselage structure, Torsional loading of a fuselage structure, Bending of a wing structure, Structural performance, Geometrical aspects, Geometrical aspects, Geometrical aspects, Material selection criteria, Structural sizing for natural frequency Structural sizing for quasi-static loads.

UNIT -5- (08 HOURS)

Design & certification, Fatigue & durability and Structural joints: Safety, regulations and specifications, Requirements for aeronautical structures, Structural design philosophies, Design approach, Fatigue & durability, Stress and strain concentrations, Fatigue, Damage tolerance, Structural joints, mechanically fastened joints, mechanically fastening in composites, mechanically fastening in sandwich composites, Welded joints, Adhesive bonding.

TEXT BOOKS /REFERENCE BOOKS

1. Alderliesten, R., 2018. Introduction to Aerospace Structures and Materials. Delft University of Technology.
2. Megson, T.H.G., 2016. Aircraft structures for engineering students. Butterworth-Heinemann.
3. Sun, C.T., 2006. Mechanics of aircraft structures. John Wiley & Sons.
4. Donaldson, B.K., 2008. Analysis of aircraft structures: an introduction. Cambridge University Press.
5. Peery, D.J., 2011. Aircraft structures. Courier Corporation.
6. Narasaiah, G.L., 2011. Aircraft Structures. BS Publications.

Sl. No	ONLINE RESOURCES	LINK
1.	edX	https://www.edx.org/course/introduction-to-aerospace-structures-

<table>
<tr><td></td><td colspan="4"></td><td colspan="10">and-materials</td></tr>
<tr><td colspan="15">COURSE ASSESSMENT METHOD</td></tr>
<tr><td colspan="15">Continuous Internal Evaluation (CIE)</td></tr>
<tr><td colspan="15">Three internal assessments for 30 Marks each.</td></tr>
<tr><td colspan="15">Two Learning Activities for 10 Marks each.</td></tr>
<tr><td colspan="15">Semester End Examination (SEE)</td></tr>
<tr><td colspan="15">Semester end examination for 100 Marks</td></tr>
<tr><td colspan="15">Program Outcomes – Articulation matrix</td></tr>
<tr><th>PO</th><th>1</th><th>2</th><th>3</th><th>4</th><th>5</th><th>6</th><th>7</th><th>8</th><th>9</th><th>10</th><th>11</th><th>12</th><th>PSO1</th><th>PSO2</th></tr>
<tr><td>CO1</td><td>2</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td>3</td><td></td><td></td></tr>
<tr><td>CO2</td><td>2</td><td>2</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td>3</td><td></td><td></td></tr>
<tr><td>CO3</td><td>2</td><td>2</td><td></td><td></td><td>1</td><td>1</td><td></td><td></td><td></td><td></td><td></td><td>3</td><td></td><td></td></tr>
<tr><td>CO4</td><td>2</td><td>2</td><td></td><td>1</td><td>1</td><td>1</td><td></td><td></td><td></td><td></td><td></td><td>3</td><td>1</td><td></td></tr>
<tr><td>CO5</td><td>2</td><td>2</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td>2</td><td></td><td></td></tr>
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FLIGHT MECHANICS				
Course Code	**22MAS15**		**Credits**	**3**
Hours/Week (L-T-P)	**2-0-2**		**CIE Marks**	**50**
Total Hrs	**39**		**SEE Marks**	**50**
Exam Hrs	**3**		**Course Type**	**PCC**

COURSE OUTCOMES

Course outcomes: After completion of the course, students will be able to-

1. Understand the basics of aircraft performance
2. Understand about aircraft maneuvering performance
3. Understand the fundamentals of aircraft static stability
4. Understand the basic ideas of aircraft dynamic stability
5. Understand the basic ideas of space dynamics

TEACHING METHODOLOGY

- Blackboard teaching/PowerPoint presentation (if needed) /Flipped Classes for specified topics.
- Tutorial classes on topics covered.
- Unit tests on covered topics

COURSE CONTENTS

UNIT -1- (07 HOURS)

Introduction to Aircraft Performance: Definition And Subdivisions of Flight Dynamics, Forces and Moments Acting on Vehicles In Flight., Equations of Motion And Simplification for Performance Analysis., Earth's Atmosphere and International Standard Atmosphere, Drag Polar, Various Types of Drags, Methods of Estimating Drag Polar, Variation of Thrust, Power With Velocity and Altitudes for Air Breathing Engines, Performance of Airplane in Level Flight, Thrust Required and Thrust Available, Power Available and Power Required Curves. Maximum Speed in Level Flight, Conditions for Minimum Drag and Power Required

UNIT -2- (08 HOURS)

More on Aircraft Performance: Climbing and gliding flight (Maximum rate of climb), Service and Absolute Ceilings, Range and Endurance, Level Turn, the pull up and pull down maneuvers, Bank angle and load factor, limitations on Turn, V-n Diagram and Load Factor.

UNIT -3- (08 HOURS)

Static Stability: Introduction to Static Stability, Stability and Trim, Criteria for Longitudinal Static Stability, Static Longitudinal Control, Elevator effectiveness, Elevator angle to trim. Directional Static Stability, Directional Control, Control in Asymmetric Power, Rudder Lock.

UNIT -4- (08 HOURS)

Static Lateral Stability and Control: Introduction, definition of Roll stability. Estimation of dihedral effect, Effect of wing sweep, flaps, and power, Lateral control, Estimation of lateral control power, Aileron control forces, Balancing the aileron. Adverse yaw effects. Aileron reversal

UNIT -5- (08 HOURS)

Dynamic Stability: Introduction to Dynamic Stability, Forces and Moments, Longitudinal Dynamic Stability, Modes of Stability, Short Period and Phugoid Approximations, Brief Description of Lateral and Directional Dynamic Stability, Spiral Divergence, Dutch Roll, Auto Rotation and Spin.

TEXT BOOKS

1. Mc Cornick. W., “Aerodynamics, Aeronautics and Flight Mechanics”, John Wiley, NY, 1979.
2. Nelson, R.C. “Flight Stability and Automatic Control”, McGraw-Hill Book Co., 2004.
3. Perkins, C.D., and Hage, R.E., “Airplane Performance stability and Control”, John Wiley & Son:, Inc, NY, 1988.
4. Babister, A.W., “Aircraft Dynamic Stability and Response”, Pergamon Press, Oxford, 1980.

REFERENCE BOOKS

1. Dommasch, D.O., Sherby, S.S., and Connolly, T.F., “Aeroplane Aero dynamics”, Third Edition, Issac Pitman, London, 1981.
2. Etkin, B., “Dynamics of Flight Stability and Control”, Edn. 2, John Wiley, NY, 1982.
3. Mc Cornick B. W, “Aerodynamics, Aeronautics and Flight Mechanics”, John Wiley, NY, 1995.

Sl. No	ONLINE RESOURCES	LINK
1.	NPTEL	https://nptel.ac.in/courses/101106041
2.	NPTEL	https://nptel.ac.in/courses/101106043

COURSE ASSESSMENT METHOD

Continuous Internal Evaluation (CIE)

Three internal assessments for 30 Marks each.

Two Learning Activities for 10 Marks each.

Semester End Examination (SEE)

Semester end examination for 100 Marks

Program Outcomes – Articulation matrix

PO	1	2	3	4	5	6	7	8	9	10	11	12	PSO1	PSO2
CO1	3	1										2		1
CO2	2	2							2			1		1
CO3	1			1	1							2		1
CO4	2								2			1		
CO5	1	2		1					2			2		

RESEARCH METHODOLOGY AND IPR				
Course Code	**22RMI16**		**Credits**	**3**
Hours/Week (L-T-P)	**3-0-0**		**CIE Marks**	**50**
Total Hrs	**39**		**SEE Marks**	**50**
Exam Hrs	**3**		**Course Type**	**MCC**

COURSE OUTCOMES

Course outcomes: After completion of the course, students will be able to-

1. Understand research methodology and the technique of defining a research problem.
2. Understand the process and method of the literature review in research, carrying out a literature search and writing a review.
3. Collect and designing the sampling data for research work.
4. Verify the Test data and report writing research reports.
5. Understand the concepts of intellectual property rights.

TEACHING METHODOLOGY

- Blackboard teaching/PowerPoint presentation (if needed) /Flipped Classes for specified topics.
- Tutorial classes on topics covered.
- Unit tests on covered topics

COURSE CONTENTS

UNIT -1- (07 HOURS)

Research Methodology: Introduction, Meaning of Research, Objectives of Research, Motivation in Research, Types of Research, Research Approaches, Significance of Research, Research Methods versus Methodology, Research and Scientific Method, Importance of Knowing How Research is Done, Research Process, Criteria of Good Research, and Problems Encountered by Researchers in India. Defining the Research Problem: Research Problem, Selecting the Problem, Necessity of Defining the Problem, Technique Involved in Defining a Problem, An Illustration.

UNIT -2- (08 HOURS)

Reviewing the literature: Place of the literature review in research, bringing clarity and focus to your research problem, improving research methodology, broadening knowledge base in research area, enabling contextual findings, how to review the literature, searching the existing literature, reviewing the selected literature, developing a theoretical framework, developing a conceptual framework, writing about the literature reviewed. Research Design: Meaning of Research Design, need for Research Design, features of a Good Design, Important Concepts Relating to Research Design, Different Research Designs, Basic
Principles of Experimental Designs, Important Experimental Designs.

UNIT -3- (08 HOURS)

Design of Sampling: Introduction, Sample Design, Sampling and Non sampling Errors, Sample Survey versus Census Survey, Types of Sampling Designs. Measurement and Scaling: Qualitative and Quantitative Data, Classifications of Measurement Scales, Goodness of Measurement Scales, Sources of Error in Measurement Tools, Scaling, Scale Classification Bases, Scaling Technics, Multidimensional Scaling, Deciding the Scale. Data Collection: Experimental and Surveys, Collection of Primary Data, Collection of Secondary Data,
Selection of Appropriate Method for Data Collection, Case Study Method

UNIT -4- (08 HOURS)

Testing of Hypotheses: Hypothesis, Basic Concepts Concerning Testing of Hypotheses, Testing of Hypothesis, Test Statistics and Critical Region, Critical Value and Decision Rule, Procedure for Hypothesis Testing, Hypothesis Testing for Mean, Proportion, Variance, for Difference of Two Mean, for Difference of Two Proportions, for Difference of Two Variances, P-Value approach, Power of Test, Limitations of the Tests of Hypothesis. Chi-square Test: Test of Difference of more than Two Proportions, Test of Independence of Attributes, Test of Goodness of Fit, Cautions in Using Chi Square Tests.

Interpretation and Report Writing: Meaning of Interpretation, Technique of Interpretation, Precaution in Interpretation, Significance of Report Writing, Different Steps in Writing Report, Layout of the Research Report, Types of Reports, Oral Presentation, Mechanics of Writing a Research Report, Precautions for Writing Research Reports.

UNIT -5- (08 HOURS)
Intellectual Property: The Concept, Intellectual Property System in India, Development of TRIPS Complied Regime in India, Patents Act, 1970, Trade Mark Act, 1999,The Designs Act, 2000, The Geographical Indications of Goods (Registration and Protection) Act1999, Copyright Act,1957,The Protection of Plant Varieties and Farmers' Rights Act, 2001,The Semi-Conductor Integrated Circuits Layout Design Act, 2000, Trade Secrets, Utility Models, IPR and Biodiversity, The Convention on Biological Diversity (CBD) 1992, Competing Rationales for Protection of IPRs, Leading International Instruments Concerning IPR, World Intellectual Property Organisation (WIPO),WIPO and WTO, Paris Convention for the Protection of Industrial Property, National Treatment, Right of Priority, Common Rules, Patents, Marks, Industrial Designs, Trade Names, Indications of Source, Unfair Competition, Patent Cooperation Treaty (PCT), Advantages of PCT Filing, Berne Convention for the Protection of Literary and Artistic Works, Basic Principles, Duration of Protection, Trade Related Aspects of Intellectual Property Rights(TRIPS) Agreement, Covered under TRIPS Agreement, Features of the Agreement, Protection of Intellectual Property under TRIPS, Copyright and Related Rights, Trademarks, Geographical indications, Industrial Designs, Patents, Patentable Subject Matter, Rights Conferred, Exceptions, Term of protection, Conditions on Patent Applicants, Process Patents, Other Use without Authorization of the Right Holder, Layout Designs of Integrated Circuits, Protection of Undisclosed Information, Enforcement of Intellectual Property

TEXT BOOKS
1. Research methodology: Methods and Techniques, C.R. Kothari, Gaurav Garg, New Age International,4th Edition, 2018.
2. Research Methodology a step-by-step guide for beginners. (For the topic Reviewing the literature under module 2) , Ranjit Kumar, SAGE Publications Ltd.,3rd Edition, 2011
3. Ralph D Kimberlin: Flight Testing of Fixed wing Aircraft, AIAA Education Series, 2003
4. Study Material (For the topic Intellectual Property under module 5), Professional Programme Intellectual Property Rights, Law and Practice, The Institute of Company Secretaries of India, Statutory Body Under an Act of Parliament, September 2013.

REFERENCE BOOKS
1. An introduction to Research Methodology, Garg B.L et al ,RBSA Publishers 2002
2. Research Methodology, Sinha, S.C, Dhiman ,EssEss Publications2002
3. Research Methods: the concise knowledge base ,Trochim ,Atomic Dog Publishing ,2005
4. How to Write and Publish a Scientific Paper, Day R.A ,Cambridge University Press,1992
5. Conducting Research Literature Reviews: From the Internet to Paper ,Fink A Sage Publications,2009

Sl. No	ONLINE RESOURCES	LINK
1.	NPTEL	https://onlinecourses.nptel.ac.in/noc22_ge08/preview

COURSE ASSESSMENT METHOD
Continuous Internal Evaluation (CIE)
Three internal assessments for 30 Marks each.
Two Learning Activities for 10 Marks each.
Semester End Examination (SEE)
Semester end examination for 100 Marks
Program Outcomes – Articulation matrix

PO	1	2	3	4	5	6	7	8	9	10	11	12	PSO1	PSO2
CO1	2											2		
CO2	2											2		
CO3	1		1						1	1		3		
CO4									1			3		
CO5	2									1		2		

PROPULSION LAB				
Course Code	**22MASL17**		**Credits**	**2**
Hours/Week (L-T-P)	**1-2-0**		**CIE Marks**	**50**
Total Hrs	**30**		**SEE Marks**	**50**
Exam Hrs	**3**		**Course Type**	**PCCL**

COURSE OUTCOMES

Course outcomes: After completion of the course, students will be able to-

1. Analyse the flow over turbine and compressor cascades.
2. Analyse forced convective heat transfer over flat plate, developing theoretical and conceptual frameworks and writing a review.
3. Examine the nozzle flow and fuel injection characteristics
4. Predict the performance of a propeller and determine heat release by combustion of fuel Sketch the velocity profile of free jet at variable positions of pitot tube

TEACHING METHODOLOGY

- Blackboard teaching/PowerPoint presentation (if needed) /Flipped Classes for specified topics.
- Tutorial classes on topics covered.
- Unit tests on covered topics

EXPERIMENTS

1. Cascade testing of a model of turbine and compressor blade row and study of wake survey.
2. Estimation of propeller performance
3. Forced Convective heat transfer on a flat surface
4. Measurement of Burning Velocity of a Premixed Flame
5. Determination of heat of combustion of aviation fuels
6. Fuel - injection characteristics (spray cone geometry; spray speed etc. for various types of injectors)
7. Measurement of nozzle flow.
8. Study of free jet
9. Study of wall jet
10. Forced Convective heat transfer through non circular duct
11. Gas Turbine Parameters Calculation by Simulator.
12. Rocket Propulsion Performance Parameters by Simulator
13. Calorific Values of Different Fuels by Using Bomb Calorimeter.
14. Chemical Kinetic Study of the Fuels by Using Ansys Chemkin Pro

COURSE ASSESSMENT METHOD

Record: 30 marks
Internal Test: 15 marks
Viva-voce: 05 marks
Semester End Examination: 50 Marks
Scheme of Examination: Student will be asked to conduct any one experiment from Part A & B

Program Outcomes – Articulation matrix

PO	1	2	3	4	5	6	7	8	9	10	11	12	PSO1	PSO2
CO1	1	1							2		1			
CO2	2	1							2		1			
CO3	2	2									1			
CO4	1	2							2					
CO5	3	2							1					

BOS RECOMMENDED ONLINE COURSES				
Course Code	**22AUD18/22AEC18**		**Credits**	**PP**
Hours/Week (L-T-P)			**CIE Marks**	
Total Hrs			**SEE Marks**	
Exam Hrs			**Course Type**	**AUD/AEC**
COURSE ASSESSMENT METHOD				

1. Board of studies Recommended Online Courses
2. Classes and evaluation procedures are as per the policy of the online course providers.
3. A pass in AUD/AEC is mandatory for the award of the degree

SEMESTER – II

COMPUTATIONAL METHODS IN AEROSPACE				
Course Code	**22MAS21**		**Credits**	**3**
Hours/Week (L-T-P)	**2-0-2**		**CIE Marks**	**50**
Total Hrs	**39**		**SEE Marks**	**50**
Exam Hrs	**3**		**Course Type**	**PCC**

COURSE OUTCOMES

Course outcomes: After completion of the course, students will be able to-

1. To arrive at the numerical solutions to boundary layer equations.
2. To perform numerical grid generation and have knowledge about the mapping techniques.
3. To familiarise himself/herself with high performance computing for CFD applications.
4. To implement the explicit time dependent methods and their factorization schemes.
5. To do the stability analysis and linearization of the implicit methods.

TEACHING METHODOLOGY

- Blackboard teaching/PowerPoint presentation (if needed) /Flipped Classes for specified topics.
- Tutorial classes on topics covered.
- Unit tests on covered topics

COURSE CONTENTS

UNIT -1- (07 HOURS)

Introduction: CFD definition and application, Parallel and vector computer in CFD, Models of flows, Continuity, Momentum, and Energy Equations-Derivation in various forms, Physical boundary condition, Shock capturing and shock fitting.

UNIT -2- (08 HOURS)

Behaviors of Partial Differential Equations: Classification of partial differential equations and their nature, Discuss Hyperbolic, parabolic, and elliptic forms of equations, Finite difference approximation- Forward, backward, central, second order central difference. Explicit and Implicit approaches, Time marching and Space marching, Errors-Truncation error and Round off error.

UNIT -3- (08 HOURS)

Grid generation Techniques: Introduction- Definition, Classification of grids- Surface grid, Complex grid. Structured grid, Unstructured grid, Body fitted grid, Grid Quality, Various structured and unstructured grid generation Techniques, Multi block grid generation, Mesh free method, Adaptive grid.

UNIT -4- (08 HOURS)

CFD Techniques: The Lax-Wendroff technique, The Mac Cormack’s technique, The relaxation technique, Alternating Direction Implicit technique (ADI), Collocated grid, Staggered grid, Semi-Collocated grid, The Pressure correction technique, upwind scheme.

UNIT -5- (08 HOURS)

Transformation: Transformation of governing partial differential equations from physical domain to computational domain.

Introduction to finite volume method: Introduction to FVM, Spatial discretization- cell centered and cell vertex techniques (overlapping control volume, duel control volume), Boundary triangle and interior triangle, Flux vector splitting Scheme.

TEXT BOOKS

1. Bose. TK, “Numerical Fluid Dynamics”,Narosa Publishing House, 2001.
2. Chung. TJ, “Computational Fluid Dynamics”, Cambridge University Press, 2010.
3. Hirsch,AA, “Introduction to Computational Fluid Dynamics”, McGraw-Hill, 1989.

REFERENCE BOOKS

1. John D. Anderson, “Computational Fluid Dynamics”, McGraw Hill Education, 2017.
2. Sedat Biringen & Chuen-Yen Chow, “Introduction to Computational Fluid Dynamics by Example”, Wiley publishers, 2nd edition, 2011.
3. Wirz, HJ &Smeldern, JJ, “Numerical Methods in Fluid Dynamics”, McGraw-Hill & Co., 1978.

Sl. No	ONLINE RESOURCES	LINK

1.	www.kobo.com	https://www.kobo.com/us/en/ebook/computational-fluid-dynamics-principles-and-applications

COURSE ASSESSMENT METHOD														
Continuous Internal Evaluation (CIE)														
Three internal assessments for 30 Marks each.														
Two Learning Activities for 10 Marks each.														
Semester End Examination (SEE)														
Semester end examination for 100 Marks														
Program Outcomes – Articulation matrix														
PO	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**PSO1**	**PSO2**
CO1	**2**	**2**	**2**						**1**				**2**	**2**
CO2	**2**	**3**	**2**						**2**				**2**	**2**
CO3	**2**	**3**	**2**						**1**				**2**	**2**
CO4	**1**	**3**	**2**						**2**				**2**	**2**
CO5	**2**	**3**	**2**						**1**				**2**	**2**

<table>
<tr><th colspan="5">AEROSPACE STRUCTURAL MECHNAICS</th></tr>
<tr><td>Course Code</td><td>22MAS22</td><td></td><td>Credits</td><td>4</td></tr>
<tr><td>Hours/Week (L-T-P)</td><td>3-2-0</td><td></td><td>CIE Marks</td><td>50</td></tr>
<tr><td>Total Hrs</td><td>50</td><td></td><td>SEE Marks</td><td>50</td></tr>
<tr><td>Exam Hrs</td><td>03</td><td></td><td>Course Type</td><td>IPCC</td></tr>
<tr><th colspan="5">COURSE OUTCOMES</th></tr>
<tr><td colspan="5">Course outcomes: After completion of the course, students will be able to-</td></tr>
<tr><td colspan="5">1. Apply the concept of normal stress variation in unsymmetrical sections subject to bending moments
2. Find the shear flow variation in thin walled open sections with skin effective and ineffective in bending.
3. Evaluate the shear flow variation in single cell and multi-cell tubes subjected to shear and torque loads..
4. Analyse the behaviour of buckling of simply supported plates and also to know the effective width of sheet stringers combination..
5. Analyse and design structural members subject to compression</td></tr>
<tr><th colspan="5">TEACHING METHODOLOGY</th></tr>
<tr><td colspan="5">● Blackboard teaching/PowerPoint presentation (if needed) /Flipped Classes for specified topics.
● Tutorial classes on topics covered.
● Unit tests on covered topics</td></tr>
<tr><th colspan="5">COURSE CONTENTS</th></tr>
<tr><th colspan="5">UNIT-1-(10 HOURS)</th></tr>
<tr><td colspan="5">BENDING OF BEAMS
Elementary theory of pure bending – Stresses in beams of symmetrical and unsymmetrical sections – Box beams – Generalized theory of bending – Methods of bending stress determination – Principal axes method – Neutral axis method – ‘k’ method – Deflection of unsymmetrical beams – Stresses in Composite Beams – Idealization of cross-section – Wing spar sizing</td></tr>
<tr><th colspan="5">UNIT-2-(10 HOURS)</th></tr>
<tr><td colspan="5">SHEAR FLOW IN THIN-WALLED SECTION
General stress, strain and displacement relationships for open section thin-walled beams – Concept of shear flow – Shear flow in thin walled open sections – Determinations of the shear centre – Symmetrical and unsymmetrical cross-sections – Shear flow due to bending in open sections – Torsion of thin-walled open section members & determination of stresses – Design of thin-walled members</td></tr>
<tr><th colspan="5">UNIT-3-(10 HOURS)</th></tr>
<tr><td colspan="5">SHEAR FLOW IN CLOSED SECTIONS
Shear flow in thin-walled closed sections – Symmetrical and unsymmetrical sections – Flexural shear flow in two flange, three flange and multi-flange box beams – Determinations of the shear centre – Bredt-Batho theory – Torsional shear flow in multi-cell tubes – Shear flow due to combined bending and torsion – Stress analysis of aircraft components – Tapered wing spar – Introduction to shear lag</td></tr>
<tr><th colspan="5">UNIT-4-(10 HOURS)</th></tr>
<tr><td colspan="5">STABILITY PROBLEMS
Stability problems of thin walled structures – Buckling of sheets under compression, shear, and combined loads – Plate buckling coefficient – Inelastic buckling of plates – Sheet-stiffener panels – Effective width – Failure stress in plates and stiffened panels – Crippling stress estimation – Local Buckling – Wagner beam theory – Experimental determination of critical load for a flat plate – Principles of stiffener/web construction</td></tr>
<tr><th colspan="5">UNIT-5-(10 HOURS)</th></tr>
<tr><td colspan="5">ANALYSIS OF AIRCRAFT STRUCTURAL COMPONENTS
Aircraft Loads – Symmetric maneuver loads – Load factor determination – Inertia loads – Aerodynamic loads & Schrenk’s curve – The flight envelope – Shear force, bending moment and torque distribution along the span of the wing and fuselage – Structural parts of wing and fuselage and their functions – Analysis of rings and frames — Introduction to aero elasticity.</td></tr>
<tr><th colspan="5">TEXT BOOKS</th></tr>
<tr><td colspan="5">1. Bruce. K. Donaldson, “Analysis of Aircraft Structures: An Introduction”, Cambridge University Press, 2nd edition, 2012.</td></tr>
</table>

2. Bruhn. EF, “Analysis and Design of Flight Vehicle Structures”, Tristate Offset Co., 1980.
3. Megson, TMG, “Aircraft Structures for Engineering Students”, Elsevier, Aerospace Engineering, Series, 7th Edition, 2021.

REFERENCE BOOKS

1. Peery, DJ. And Azar, JJ, “Aircraft Structures”, 2nd Edition, McGraw-Hill, New York, 1993.
2. Rivello, R.M, “Theory and Analysis of Flight structures”, McGraw-Hill, N.Y., 1993.
3. Sun. CT, “Mechanics of Aircraft Structures”, Wiley publishers, 2nd edition, 2006.

Sl. No	ONLINE RESOURCES	LINK
1.	NPTEL	https://nptel.ac.in/courses/101105084
2.	NPTEL	https://onlinecourses.nptel.ac.in/noc22_ae19/preview

List of Experiments

1. Tensile and compression test of metallic specimens using Universal Testing Machine
2. Bending and torsion Test of metallic specimens
3. Deflection of beams with various conditions.
4. Shear failure of riveted joint and bolted joints
5. Column test – south well plot
6. Symmetrical and unsymmetrical bending of beams
7. Combined loading of beams
8. Wagner beam
9. Shear centre location of open section
10. Vibration analysis of cantilever beam

COURSE ASSESSMENT METHOD

Continuous Internal Evaluation (CIE)

Three internal assessments for **30** Marks each.

Two Learning Activities for **10** Marks each.

Semester End Examination (SEE)

Semester end examination for 100 Marks

Program Outcomes – Articulation matrix

PO	1	2	3	4	5	6	7	8	9	10	11	12	PSO1	PSO2
CO1	3	3	3	3	3		2							3
CO2	3	3	3	3	3	2								
CO3	3	3	3	3	3	2	2							3
CO4	3	3	3	3	3	2			2					3
CO5	3	3	3	3	3		2	2						

MINI PROJECT WITH SEMINAR				
Course Code	**22MAS25**		**Credits**	**3**
Hours/Week (L-T-P)	**0-4-2**		**CIE Marks**	**100**
Total Hrs	**36**		**SEE Marks**	**100**
Exam Hrs	**3**		**Course Type**	**MPS**

Seminar is to be given by the student after the completion of a mini project chosen by the student. Topics for the mini projects can be from the aeronautical engineering and allied fields. The mini project can be based on either numerical or analytical solution or design or fully experimental; or a combination of these tasks.

COURSE ASSESSMENT METHOD

1. Internal Examiner shall carry out the evaluation for 100 marks.
2. External Examiner shall carry out the evaluation for 100 marks.
3. The average of marks allotted by the internal and external examiner shall be the final marks of the project evaluation.
4. Viva-Voce examination of Project work shall be conducted jointly by Internal and External examiner for 100 marks.

Program Outcomes – Articulation matrix

PO	1	2	3	4	5	6	7	8	9	10	11	12	PSO1	PSO2
CO1	3	2						3	3			3	3	3
CO2	3	2						3	3			3	3	3
CO3	2	2						3	3			2	3	2
CO4	2	2						3	3			3	3	2
CO5	3	2						3	3			3	3	3

COMPUTATIONAL LAB				
Course Code	**22MASL26**		**Credits**	**02**
Hours/Week (L-T-P)	**1-2-0**		**CIE Marks**	**50**
Total Hrs	**30**		**SEE Marks**	**50**
Exam Hrs	**03**		**Course Type**	**PCCL**

COURSE OUTCOMES

Course outcomes: After completion of the course, students will be able to-

1. Model airfoils and perform meshing for symmetric and cambered airfoils Using advanced software tools.
2. Perform flow analysis using advanced software tools.
3. Carry out structural analysis for wing and fuselage of aircraft.
4. Analyse the stresses in rectangular plate with different geometry and Boundary conditions.

TEACHING METHODOLOGY

- Blackboard teaching/PowerPoint presentation (if needed) /Flipped Classes for specified topics.
- Tutorial classes on topics covered.
- Unit tests on covered topics

COURSE CONTENTS

1. Modeling of Symmetric Aerofoil Geometry, and Generation of Body Fitting Mesh.
2. Modeling of Cambered Aerofoil Geometry, And Generation of Body Fitting Mesh.
3. Modeling of 2-D Incompressible and Inviscid Flow over an Aerofoil.
4. Computations and Analysis for Velocity Vectors and Pressures Distributions.
5. Modeling of 2-D Incompressible and Viscous Flow over an Aerofoil.
6. Structural Modeling of Sandwich Beam of Rectangular Cross-Section and Analyses for Stresses.
7. Structural Modeling of a Three Dimensional Wing.
8. Structural Modeling and Stress Analysis of a Fuselage Bulk Head.
9. Structural Modeling and Stress Analysis of a Simply Supported Rectangular Plate Uniformly Compressed in one Direction.
10. Structural Modeling and Stress Analysis of a Simply Supported Rectangular Plate Uniformly Compressed in one Direction with a Cut-Out in Center.
11. Structural Modeling of Sandwich Beam of Rectangular Cross-Section and Analyses for Stresses.
12. Structural Modeling of a Three Dimensional Wing.

COURSE ASSESSMENT METHOD

Record: 30 marks
Internal Test: 15 marks
Viva-voce: 05 marks
Semester End Examination: 50 Marks
Scheme of Examination: Student will be asked to conduct any one experiment from Part A & B

Program Outcomes – Articulation matrix

PO	1	2	3	4	5	6	7	8	9	10	11	12	PSO1	PSO2
CO1	3				2	2					2		2	2
CO2	2	1			2	2					2		2	2
CO3	2	2			2	2					3		2	3
CO4	2	2			2	2					2		2	2
CO5	2	2			2	2					2		2	2

BOS RECOMMENDED ONLINE COURSES				
Course Code	**22AUD27**		**Credits**	**PP**
Hours/Week (L-T-P)			**CIE Marks**	
Total Hrs			**SEE Marks**	
Exam Hrs			**Course Type**	**AUD/AEC**

COURSE ASSESSMENT METHOD

1. Board of studies Recommended Online Courses
2. Classes and evaluation procedures are as per the policy of the online course providers.
3. A pass in AUD/AEC is mandatory for the award of the degree

PROFESSIONAL ELECTIVE I

EXPERIMENTAL AERODYNAMICS				
Course Code	**22MAS231**		**Credits**	**3**
Hours/Week (L-T-P)	**2-2-0**		**CIE Marks**	**50**
Total Hrs	**39**		**SEE Marks**	**50**
Exam Hrs	**3**		**Course Type**	**PEC**

COURSE OUTCOMES

Course outcomes: After completion of the course, students will be able to-

1. Describe the scaling effects.
2. Describe the wind tunnels layouts and design.
3. Describe the instrumentation for calibration of wind tunnel.
4. Analyze the measurement technique in wind tunnel.
5. Analyze flow using visualization techniques in the wind tunnel.

TEACHING METHODOLOGY

- Blackboard teaching/PowerPoint presentation (if needed) /Flipped Classes for specified topics.
- Tutorial classes on topics covered.
- Unit tests on covered topics

COURSE CONTENTS

UNIT-1-(08 HOURS)

Principles of Model Testing: Buckingham Theorem. Examples. Non-dimensional numbers. Scale effect. Geometric Kinematic and Dynamic similarities.

UNIT-2-(08 HOURS)

Wind Tunnels: Classification. Special features and problems of testing in subsonic, supersonic and hypersonic speed regions. Layouts. Sizing and design parameters. Losses in the wind tunnel circuit.

UNIT-3-(08 HOURS)

Calibration of Wind Tunnels: Calibration techniques for subsonic and supersonic wind tunnels. Test section speed. Horizontal buoyancy, Flow angularities. Turbulence measurements. Associated instrumentation.

UNIT-4-(08 HOURS)

Wind Tunnel Measurements: Wind Tunnel Balance. Force balance Co-ordinates. Force measurements. Internal and external balances. Three component and six component balances. Steady and Unsteady Pressure and velocity measurements. Principles of Hotwire Anemometer.

UNIT-5-(07 HOURS)

Flow Visualization: Surface flow visualization and Fluid flow visualization. Optical methods: Shadowgraphy, Schlieren Method, Interferometry, Laser Doppler anemometry. Trace methods: Smoke flow visualization, Tuft flow visualization, Visualization by dye. Surface flow visualization: Surface oil film visualization, Liquid crystals visualization. Special methods

TEXT BOOKS

1. Allan Pope and Kenneth L Goin, “High Speed Wind Tunnel Testing”, Krieger Publishing Company, 1978.
2. Jewel B. Barlow, Willian. H.Rae and Allan Pope,“Low-Speed Wind Tunnel Testing”, Wiley-Interscience, 3rd edition, 1999.

REFERENCE BOOKS

1. Rathakrishnan, E, “Instrumentation, Measurements, and Experiments in Fluids”, CRC Press –Taylor & Francis, 2020.
2. Robert B Northrop, “Introduction to Instrumentation and Measurements”, Second Edition, CRC Press, Taylor & Francis, 2017.

Sl. No	ONLINE RESOURCES	LINK
1.	NPTEL	https://onlinecourses.nptel.ac.in/noc22_ae09/preview

COURSE ASSESSMENT METHOD

Continuous Internal Evaluation (CIE)														
Three internal assessments for **30** Marks each.														
Two Learning Activities for **10** Marks each.														
Semester End Examination (SEE)														
Semester end examination for 100 Marks														
Program Outcomes – Articulation matrix														
PO	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**PSO1**	**PSO2**
CO1	**3**													**3**
CO2	**3**	**2**	**2**											**3**
CO3	**3**	**2**	**2**											**3**
CO4	**2**	**2**	**2**											**2**
CO5	**3**	**2**	**2**											**3**

ADVANCED LIGHT WEIGHT COMPOSITE MATERIALS AND STRUCTURES

Course Code	**22MAS232**		**Credits**	**3**
Hours/Week (L-T-P)	**2-2-0**		**CIE Marks**	**50**
Total Hrs	**39**		**SEE Marks**	**50**
Exam Hrs	**3**		**Course Type**	**PEC**

COURSE OUTCOMES

Course outcomes: After completion of the course, students will be able to-

1. Understand characteristics of composite materials for various applications.
2. Apply Hooke's law for orthotropic and anisotropic materials.
3. Carryout analysis of laminated composites
4. Develop composite materials
5. Apply failure theories and NDE for composite materials.

TEACHING METHODOLOGY

- Blackboard teaching/PowerPoint presentation (if needed) /Flipped Classes for specified topics.
- Tutorial classes on topics covered.
- Unit tests on covered topics

COURSE CONTENTS

UNIT-1-(08 HOURS)

Introduction: Classification and characteristics of composite materials - Types of fiber and resin materials, functions and their properties – Application of composite to aircraft structures-Micromechanics-Mechanics of materials, Elasticity approaches-Mass and volume fraction of fibers and resins-Effect of voids, Effect of temperature and moisture

UNIT-2-(07 HOURS)

Macro mechanics: Hooke's law for orthotropic and anisotropic materials-Lamina stress strain relations referred to natural axes and arbitrary axes.

UNIT-3-(08 HOURS)

Analysis of laminated composites: Governing equations for anisotropic and orthotropic plates- angle-ply and cross ply laminates- analysis for simpler cases of composite plates and beams – inter laminar stresses- netting analysis.

UNIT-4-(08 HOURS)

Manufacturing & fabrication processes: Manufacture of glass, boron and carbon fibers Manufacture of FRP components- Open mould and closed mould processes. Properties and functions of resins

UNIT-5-(08 HOURS)

Failure theory and NDE: Failure criteria- Flexural rigidity of Sandwich beams and plates – composite repair- Ultra Sonic Technique - AE technique, Analysis through FEM and Meshless technique.

TEXT BOOKS

1. Agarwal, BD and Broutman, LJ, "Analysis and Performance of Fibre Composites", John Wiley & Sons, 3rd edition, 2006.
2. Allen Baker, "Composite Materials for Aircraft Structures", AIAA Series, 2nd Edition, 2004.
3. Autar K Kaw, "Mechanics of Composite Materials", CRC Press, 2nd edition, 2005.

REFERENCE BOOKS

1. Calcote, LR, "The Analysis of laminated Composite Structures", Von – Nostrand Reinhold Company, New York, 1998.
2. Isaac M. Daniel &OriIshai ,"Mechanics of Composite Materials", OUP USA publishers, 2nd edition, 2005.
3. Lubing, "Handbook on Advanced Plastics and Fibre Glass", Von Nostran Reinhold Co., New York, 1989.

Sl. No	ONLINE RESOURCES	LINK
1.	NPTEL	https://nptel.ac.in/courses/101104010
2.	NPTEL	https://nptel.ac.in/courses/112104229
3.	MIT OCW	https://ocw.mit.edu/courses/3-11-mechanics-of-materials-fall-1999/pages/modules/

COURSE ASSESSMENT METHOD														
Continuous Internal Evaluation (CIE)														
Three internal assessments for **30** Marks each.														
Two Learning Activities for **10** Marks each.														
Semester End Examination (SEE)														
Semester end examination for 100 Marks														
Program Outcomes – Articulation matrix														
PO	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**PSO1**	**PSO2**
CO1	3	2	1						1			1	3	3
CO2	3	2	1									1	3	3
CO3	3	2	1									1	3	3
CO4	3	2	1						1			1	3	3
CO5	3	2	1						1			1	3	3

<table>
<tr><th colspan="5">CRYOGENIC TECHNOLOGY</th></tr>
<tr><td>Course Code</td><td>22MAS233</td><td></td><td>Credits</td><td>3</td></tr>
<tr><td>Hours/Week (L-T-P)</td><td>2-0-2</td><td></td><td>CIE Marks</td><td>50</td></tr>
<tr><td>Total Hrs</td><td>39</td><td></td><td>SEE Marks</td><td>50</td></tr>
<tr><td>Exam Hrs</td><td>3</td><td></td><td>Course Type</td><td>PEC</td></tr>
<tr><th colspan="5">COURSE OUTCOMES</th></tr>
<tr><td colspan="5">Course outcomes: After completion of the course, students will be able to-</td></tr>
<tr><td colspan="5">1. To acquire knowledge on the fundamental requirements that are peculiar to cryogenic rocket engines.
2. To determine the thermodynamic efficiency of cryogenic systems.
3. To carry out thermodynamic analysis for cryogenic plants.
4. To demonstrate the peculiar problems associated with cryopropellants.
5. To acquire knowledge on cryogenic propulsion systems</td></tr>
<tr><th colspan="5">TEACHING METHODOLOGY</th></tr>
<tr><td colspan="5">● Blackboard teaching/PowerPoint presentation (if needed) /Flipped Classes for specified topics.</td></tr>
<tr><td colspan="5">● Tutorial classes on topics covered.</td></tr>
<tr><td colspan="5">● Unit tests on covered topics</td></tr>
<tr><th colspan="5">COURSE CONTENTS</th></tr>
<tr><th colspan="5">UNIT -1- (07 HOURS)</th></tr>
<tr><td colspan="5">FUNDAMENTALS OF CRYOGENICS: Theory behind the production of low temperature - expansion engine - heat exchangers - Cascade process - Joule Thomson and magnetic effects - cryogenic liquids as cryogenic propellants for cryogenic rocket engines - properties of various cryogenic propellants – handling problems associated with cryogenic propellants.</td></tr>
<tr><th colspan="5">UNIT -2- (08 HOURS)</th></tr>
<tr><td colspan="5">CRYOGENIC SYSTEMS EFFICIENCY: Types of losses and efficiency of cycles - amount of cooling - the features of liquefaction process - cooling coefficient of performance - Thermodynamic efficiency - The energy balancing method.</td></tr>
<tr><th colspan="5">UNIT -3- (08 HOURS)</th></tr>
<tr><td colspan="5">THERMODYNAMIC CYCLES FOR CRYOGENIC PLANTS: Classification of cryogenic cycles - The structure of cycles Throttle expansion cycles - Expander cycles - Mixed throttle expansion and expander cycles - Thermodynamic analysis - Numerical problems.</td></tr>
<tr><th colspan="5">UNIT -4- (08 HOURS)</th></tr>
<tr><td colspan="5">PROBLEMS ASSOCIATED WITH CRYOPROPELLANTS: Storage problems of cryogenic propellants - zero gravity problems associated with cryopropellants - phenomenon of tank collapse - geysering effect - material strength considerations.</td></tr>
<tr><th colspan="5">UNIT -5- (08 HOURS)</th></tr>
<tr><td colspan="5">CRYOGENIC ROCKET ENGINES: Peculiar design difficulties associated with the design of feed system, injector and thrust chamber of cryogenic rocket engines - Relative performance of cryogenic engines when compared to non-cryo engines.</td></tr>
<tr><th colspan="5">TEXT BOOKS</th></tr>
<tr><td colspan="5">1. Barron.RF, “Cryogenic systems”, Oxford University, 1985.
2. Dieter K. Huzel& David H. Huang, “Modern Engineering for Design of Liquid-Propellant Rocket Engines", AIAA Series, 1992.
3. Haseldom.G, “Cryogenic Fundamentals”, Academic press, 2001.</td></tr>
<tr><th colspan="5">REFERENCE BOOKS</th></tr>
<tr><td colspan="5">1. Sarner.S.F, “Propellant Chemistry”, Reinhold Publishing Corporation New York, 1966.
2. Sutton, G.P. “Rocket Propulsion Elements”, John Wiley & Sons Inc., New York, 9th edition, 2016.</td></tr>
<tr><th>Sl. No</th><th>ONLINE RESOURCES</th><th colspan="3">LINK</th></tr>
<tr><td>1.</td><td>NPTEL</td><td colspan="3">https://nptel.ac.in/courses/112101004</td></tr>
<tr><td colspan="5">COURSE ASSESSMENT METHOD</td></tr>
<tr><td colspan="5">Continuous Internal Evaluation (CIE)</td></tr>
</table>

Three internal assessments for 30 Marks each.
Two Learning Activities for 10 Marks each.
Semester End Examination (SEE)
Semester end examination for 100 Marks
Program Outcomes – Articulation matrix

PO	1	2	3	4	5	6	7	8	9	10	11	12	PSO1	PSO2
CO1	3	1										2		1
CO2	2	2							2			1		1
CO3	1			1	1							2		1
CO4	2								2			1		
CO5	1	2		1					2			2		

ROCKETRY AND SPACE MECHANICS				
Course Code	**22MAS234**		**Credits**	**3**
Hours/Week (L-T-P)	**2-0-2**		**CIE Marks**	**50**
Total Hrs	**39**		**SEE Marks**	**50**
Exam Hrs	**03**		**Course Type**	**PEC**

COURSE OUTCOMES

Course outcomes: After completion of the course, students will be able to-

1. Understand solar system, Kepler's, Newton's law of motion, escape velocity, Geosynchronous, geostationary satellites
2. Understand principle of rocket and its stages, thrust equation, one and two dimensional rocket motions
3. Understand the loads, drag, performances at different altitudes, types of nozzles and launching problems
4. Understand materials used and special coatings and ablative materials
5. Understand Satellite injections, orbit transfer, orbit deviation due to injection error, general perturbation approach

TEACHING METHODOLOGY

- Blackboard teaching/PowerPoint presentation (if needed) /Flipped Classes for specified topics.
- Tutorial classes on topics covered.
- Unit tests on covered topics

COURSE CONTENTS

UNIT-1-(08 HOURS)

Description of solar system – Kepler's Laws of planetary motion – Newton's Law of Universal gravitation – Two body and Three-body problems – Jacobi's Integral, Librations points – Estimator of orbital and escape velocities – geosynchronous and geostationary satellites life time – satellite perturbations – Hohmann orbits – calculation of orbit parameters.

UNIT-2-(08 HOURS)

Principle of operation of rocket motor - thrust equation – one dimensional and two dimensional rocket motions in free space and homogeneous gravitational fields – Description of vertical, inclined and gravity turn trajectories determinations of range and altitude – simple approximations to burnout velocity – staging of rockets.

UNIT-3-(08 HOURS)

Description of various loads experienced by a rocket passing through atmosphere – drag estimation – wave drag, skin friction drag, and base pressure drag – Boat-tailing in missiles – performance at various altitudes – conical and bell shaped nozzles – adapted nozzles – rocket dispersion – launching problems.

UNIT-4-(07 HOURS)

Selections of materials for spacecraft and missiles – special requirements of materials to perform under adverse conditions – ablative materials.

UNIT-5-(08 HOURS)

General Aspects of satellite Injections – Satellite Orbit Transfer –Various Cases – Orbit Deviations Due to Injection Errors – Special and General Perturbations – Cowell's Method – Encke's Method – Method of vibrations of Orbital Elements – General Perturbations Approach.

TEXT BOOKS

1. Sutton, G.P. "Rocket Propulsion Elements", John Wiley & Sons Inc., New York, 9th edition, 2016.
2. Rocket Propulsion and Space flight dynamics", Cornelisse, Schoyer HFR and Wakker KF, Pitman, 1984

REFERENCE BOOKS

1. Vincent L. Pisacane, "Fundamentals of Space Systems", Oxford University Press, 2005.
2. Elements of Space Technology for aerospace Engineers", Meyer Rudolph X, Academic Press, 199

Sl. No	ONLINE RESOURCES	LINK
1.	MOOC	https://ecourses.ou.edu/cgi-bin/ebook.cgi?topic=me

COURSE ASSESSMENT METHOD

Continuous Internal Evaluation (CIE)

Three internal assessments for **30** Marks each.														
Two Learning Activities for **10** Marks each.														
Semester End Examination (SEE)														
Semester end examination for 100 Marks														
Program Outcomes – Articulation matrix														
PO	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**PSO1**	**PSO2**
CO1	**3**	**3**	**2**									**1**	**2**	**1**
CO2	**3**	**3**	**2**									**1**	**2**	**1**
CO3	**3**	**3**	**2**									**1**	**2**	**1**
CO4	**3**	**3**	**2**									**1**	**2**	**1**
CO5	**3**	**3**	**2**									**1**	**2**	**1**

AVIONICS				
Course Code	**22MAS235**		**Credits**	**3**
Hours/Week (L-T-P)	**2-2-0**		**CIE Marks**	**50**
Total Hrs	**39**		**SEE Marks**	**50**
Exam Hrs	**3**		**Course Type**	**PEC**

COURSE OUTCOMES

Course outcomes: After completion of the course, students will be able to-

1. Learn the fundamentals of avionics system used in civil and military aircraft.
2. Students will be able to illustrate the navigation system involved in avionics.
3. Students will be able to illustrate the Communication system involved in avionics.
4. Software Assessment and Validation for Civil and Military standards .
5. Learn to analyze the various electronic systems/subsystems involved in an aircraft.

TEACHING METHODOLOGY

- Blackboard teaching/PowerPoint presentation (if needed) /Flipped Classes for specified topics.
- Tutorial classes on topics covered.
- Unit tests on covered topics

COURSE CONTENTS

UNIT-1-(08 HOURS)

History and Evolution of Avionics, Significance of Avionics in modern Aviation, List of Avionics system on-board a modern aircraft. Block diagram of avionics architecture, Role of individual sub-system in avionics architecture

UNIT-2-(08 HOURS)

Surveillance Systems: Air traffic control, Primary radar, Secondary radar, Replies, Various system modes, error checking, Transponders of ATCCRB & Mode S, Collision avoidance, Lightning detection, Weather radar. Telemetry. Fiber Optic Comm., FMS, FBW, Autopilot, LRU, IMA & Mission Systems, Inertial Sensors

UNIT-3-(08 HOURS)

Airborne Communications Systems: VHF AM Communications, VHF Communications hardware, High frequency communications, ACARS, SELCAL, Digital Communications and Networking, VHF Digital communications, Data link Modes.

UNIT-4-(08 HOURS)

MIL-STD-1553B, ARINC-429, ARINC-629, AFDX, D0-178B and its Elements, Avionics system design,

UNIT-5-(08 HOURS)

Avionic Systems Integration: Data bus systems, integrated modular avionics, and commercial off-the shelf (COTS).

TEXT BOOKS

1. Collinson RPG, “Introduction to Avionics”, Chapmanand Hall, India,1996.
2. Albert Helfrick, Principles of Avionics, Avionics Communication Inc. 2002.
3. Siouris G. M., Aerospace Avionics systems: A Modern Synthesis, Academic Press, 1993.

REFERENCE BOOKS

1. Cary R. Spitzer, The Avionics Handbook, CRC Press, 2000.
2. Jim Curren, Trend in Advanced Avionics, IOWA State University, 1992
3. Middleton, D.H., Avionics Systems, Longman Scientific and Technical, Longman Group UK Ltd., England, 1989

Sl. No	ONLINE RESOURCES	LINK
1.	Udemy	www.udemy.com
2.	Coursera	www.coursera.org
3.	Aviation courses	www.aviationcourses.com

COURSE ASSESSMENT METHOD

Continuous Internal Evaluation (CIE)

Three internal assessments for **30** Marks each.

Two Learning Activities for **10** Marks each.
Semester End Examination (SEE)
Semester end examination for 100 Marks
Program Outcomes – Articulation matrix

PO	1	2	3	4	5	6	7	8	9	10	11	12	PSO1	PSO2
CO1	1					2	1		1			1		
CO2	1	2		2	1	2	1					1		1
CO3	1	2	2			2						1		1
CO4	1			2	1	2	1					1		
CO5	1				1	2	1				1	1		

PROFESSIONAL ELECTIVE II

HYPERSONIC AERODYNAMICS				
Course Code	**22MAS241**		**Credits**	**3**
Hours/Week (L-T-P)	**2-0-2**		**CIE Marks**	**50**
Total Hrs	**39**		**SEE Marks**	**50**
Exam Hrs	**3**		**Course Type**	**PEC**

COURSE OUTCOMES

Course outcomes: After completion of the course, students will be able to-

1. Be able to arrive at the solution for problems involving inviscid and viscous hypersonic flows.
2. Have thorough knowledge on high temperature effects in hypersonic aerodynamics.
3. Be able to arrive at various solution methods to overcome aerodynamic heating problem on hypersonic vehicles.
4. To gain ideas on the design issues associated with hypersonic vehicles.
5. Able to realize the importance and use of the relevant equations for viscous hypersonic flows.

TEACHING METHODOLOGY

- Blackboard teaching/PowerPoint presentation (if needed) /Flipped Classes for specified topics.
- Tutorial classes on topics covered.
- Unit tests on covered topics

COURSE CONTENTS

UNIT -1- (07 HOURS)

Introduction to hypersonic aerodynamics: Peculiarities of Hypersonic flows - Thin shock layers – entropy layers – low density and high density flows – hypersonic flight similarity parameters – shock wave and expansion wave relations of inviscid hypersonic flows – velocity vs altitude map for hypersonic vehicles.

UNIT -2- (08 HOURS)

Surface inclination methods for hypersonic inviscid flows: Local surface inclination methods – modified Newtonian Law – Newtonian theory – tangent wedge tangent cone and shock expansion methods – Calculation of surface flow properties – practical application of surface inclination methods – hypersonic independence principle.

UNIT -3- (08 HOURS)

Approximate methods for inviscid hypersonic flows: Assumptions in approximate methods hypersonic small disturbance equation and theory – Maslen''s theory– blast wave theory – hypersonic equivalence principle- entropy effects - rotational method of characteristics - hypersonic shock wave shapes and correlations.

UNIT -4- (08 HOURS)

Viscous hypersonic flow theory: Peculiarities of hypersonic boundary layers - boundary layer equations – hypersonic boundary layer theory and non-similar hypersonic boundary layers – hypersonic aerodynamic heating and entropy layers effects on aerodynamic heating – heat flux and skin friction estimation.

UNIT -5- (08 HOURS)

Viscous interactions and transition: Strong and weak viscous interactions – hypersonic shockwaves and boundary layer interactions – Parameters affecting hypersonic boundary layer transition - Estimation of hypersonic boundary layer transition- Role of similarity parameter for laminar viscous interactions in hypersonic viscous flow.

TEXT BOOKS

1. Anderson, JD, "Hypersonic and High Temperature Gas Dynamics", AIAA Education Series, 2nd edition, 2006.
2. Anderson, JD, "Modern compressible flow: with Historical Perspective", McGraw Hill Education, 3rd edition, 2017.

REFERENCE BOOKS

1. William H. Heiser and David T. Pratt, Hypersonic Air Breathing propulsion, AIAA Education Series, 1994.
2. John T. Bertin, Hypersonic Aerothermodynamics, AIAA Education Series, 1993.

Sl. No	ONLINE RESOURCES	LINK
1.	NPTEL	https://nptel.ac.in/courses/101103003

COURSE ASSESSMENT METHOD														
Continuous Internal Evaluation (CIE)														
Three internal assessments for 30 Marks each.														
Two Learning Activities for 10 Marks each.														
Semester End Examination (SEE)														
Semester end examination for 100 Marks														
Program Outcomes – Articulation matrix														
PO	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**PSO1**	**PSO2**
CO1	**3**	**1**										**2**		**1**
CO2	**2**	**2**							**2**			**1**		**1**
CO3	**1**			**1**	**1**							**2**		**1**
CO4	**2**								**2**			**1**		
CO5	**1**	**2**		**1**					**2**			**2**		

SYSTEM ENGINEERING AND ANALYSIS				
Course Code	**22MAS242**		**Credits**	**3**
Hours/Week (L-T-P)	**2-0-2**		**CIE Marks**	**50**
Total Hrs	**39**		**SEE Marks**	**50**
Exam Hrs	**3**		**Course Type**	**PEC**

COURSE OUTCOMES

Course outcomes: After completion of the course, students will be able to-

1. Understand the system design requirements, architecture, functional requirements.
2. Generate the system requirements documents as per the requirement analysis.
3. Understand the techniques of system design
4. Carry out the Supportability and producibility
5. Carry out the system reliability analysis.

TEACHING METHODOLOGY

- Blackboard teaching/PowerPoint presentation (if needed) /Flipped Classes for specified topics.
- Tutorial classes on topics covered.
- Unit tests on covered topics

COURSE CONTENTS

UNIT-1-(07 HOURS)

Fundamentals of systems engineering: Fundamentals of systems engineering and system architecting of weapon system, system engineering. standards 15288, requirements analysis, functional analysis and allocation, preliminary system architecture.

UNIT-2-(08 HOURS)

Systems design and analysis: systems analysis, system design, and the basics of test and evaluation, Introduction to combat systems, System development phases (Conceiving, Designing, Implementing, and Operating)

UNIT-3-(08 HOURS)

Techniques of system design: Techniques of system design and assessment for operational feasibility, including reliability, maintainability, usability (including human factors and human performance).

UNIT-4-(08 HOURS)

More on system analysis: Various ways of evaluating system performance, Supportability and producibility, System cost assessment and effectiveness estimation, certification methods, Case studies.

UNIT-5-(08 HOURS)

Reliability analysis and management (basic tools and methods of reliability for developing complex systems including electronic components, mechanical components, and software), redundancy, graceful degradation, fault tolerance, MTBF.

TEXT BOOKS

1. Buede D.M.2: The Engineering Design of Systems: Models and Methods, Publisher: John Wiley & Sons Inc.
2. Defense Acquisition University Press fort Belvoir, Virginia:" Systems engineering fundamentals"
3. Charles S. Wasson: System Analysis Design and Development, Publisher: Wiley Series in System Engineering and Management.
4. Clifton R H: Principles of Planned Maintenance, Publisher: McGraw Hill, New York.

REFERENCE BOOKS

1. Clifton R H: Principles of Planned Maintenance, Publisher: McGraw Hill, New York.
2. Srinath L S: Reliability Engineering, Publisher: Affiliated East-West Press Limited, New Delhi,2002.
3. Dhillon B S: Engineering Maintainability, Publisher: Prentice Hall of India.

COURSE ASSESSMENT METHOD

Continuous Internal Evaluation (CIE)

Three internal assessments for **30** Marks each.

Two Learning Activities for **10** Marks each.

Semester End Examination (SEE)														
Semester end examination for 100 Marks														
Program Outcomes – Articulation matrix														
PO	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**PSO1**	**PSO2**
CO1	3	1	2	-	-						-	3		
CO2	3	2	3					-	-		-	3		
CO3	3	3	2					-	-		-	3		
CO4	3	2	2					-	-		-	3		
CO5	3	2	1					-	-	-	-	3		

ADVANCED PROPULSION SYSTEM				
Course Code	**22MAS243**		**Credits**	**3**
Hours/Week (L-T-P)	**2-0-2**		**CIE Marks**	**50**
Total Hrs	**3**		**SEE Marks**	**50**
Exam Hrs	**3**		**Course Type**	**PEC**

COURSE OUTCOMES

Course outcomes: After completion of the course, students will be able to-

1. Familiarize students with the preliminary design and analysis of turbomachinery components found in conventional aircraft engines: compressors and turbines.
2. Evaluate various space missions, parameters to be considered for designing trajectories and rocket mission profiles
3. Relate the significance of test facilities and their associated parameters.
4. Acquire knowledge on orbit mechanics and satellite dynamics
5. Illustrate electric propulsion techniques, ion, and nuclear rocket and the performances of different advanced propulsion systems.

TEACHING METHODOLOGY

- Blackboard teaching/PowerPoint presentation (if needed) /Flipped Classes for specified topics.
- Tutorial classes on topics covered.
- Unit tests on covered topics

COURSE CONTENTS

UNIT-1- (07 HOURS)

Engine Design Parameters: Turbomachinery and combustor design, compressor-turbine matching and off-design engine performance. Introduction to advanced propulsion architectures including scramjets, pressure gain combustion, and electric/hybrid-electric.

UNIT-2- (08 HOURS)

Principles of rocket propulsion: History of rockets, Newton's third law, orbits and space flight, types of orbits, basic orbital equations, elliptical transfer orbits, launch trajectories, the velocity increment needed for launch, the thermal rocket engine, concepts of vertical takeoff and landing, SSTO and TSTO, launch assists.

UNIT-3- (08 HOURS)

Rocket Testing: Types of Tests; Test Facilities and Safeguards; Safety and Environmental Concerns; Monitoring and Control of Toxic Materials and Exhaust Gases; Instrumentation and Data Management; Reliability and Quality Control; Flight Testing.

UNIT-4- (08 HOURS)

Satellite Attitude Dynamics: Torque free Axi-symmetric rigid body-Attitude Control for Spining Spacecraft - Attitude Control for Non-spinning Spacecraft - The Yo-Yo Mechanism - Gravity - Gradient Satellite-Dual Spin Spacecraft- Attitude Determination.

UNIT-5- (08 HOURS)

Advanced propulsion techniques: Electric rocket propulsion, types of electric propulsion techniques, Ion propulsion, Nuclear rocket, comparison of performance of these propulsion systems with chemical rocket propulsion systems, future applications of electric propulsion systems, Solar sail.

TEXT BOOKS

1. Philip Hill and Carl Peterson, Mechanics and Thermodynamics of Propulsion, Addison Wesley, 2nd Edition,1992
2. S. Farokhi, Aircraft Propulsion, 2009
3. Turner, M.J.L, Rocket and Spacecraft Propulsion, MIT Press, 2nd Edition 1992
4. Spaceflight Dynamics, W.E. Wiesel, McGraw Hill, 1997

REFERENCE BOOKS

1. Mathur, M.L, "Gas Turbine, Jet and Rocket Propulsion, Standard Publishers and Distributors, Delhi, 1988.
2. Tajmar, M., Advanced Space Propulsion Systems, Springer, 2003
3. M. J. L, Rocket and Spacecraft Propulsion, Springer, 2000

4.	Ramamurthi, K, Rocket Propulsion, Trinity Press of Laxmi Publications Private Limited, 2nd Edition 2016

Sl. No	ONLINE RESOURCES	LINK
1.	NPTEL	http://nptel.iitm.ac.in

COURSE ASSESSMENT METHOD

Continuous Internal Evaluation (CIE)

Three internal assessments for **30** Marks each.

Two Learning Activities for **10** Marks each.

Semester End Examination (SEE)

Semester end examination for 100 Marks

Program Outcomes – Articulation matrix

PO	1	2	3	4	5	6	7	8	9	10	11	12	PSO1	PSO2
CO1	3	3		2										
CO2	3													
CO3	3													
CO4	3								3					
CO5	3													

ORBITAL MECHANICS AND SPACE FLIGHT				
Course Code	**22MAS244**		**Credits**	**3**
Hours/Week (L-T-P)	**2-0-0**		**CIE Marks**	**50**
Total Hrs	**39**		**SEE Marks**	**50**
Exam Hrs	**3**		**Course Type**	**PEC**

COURSE OUTCOMES

Course outcomes: After completion of the course, students will be able to-

1. To acquire knowledge on the peculiarities of space environment and its effect on spacecraft materials.
2. To estimate the time and position of an object in various orbits.
3. To acquire knowledge on the basic concepts of satellite injection and satellite perturbations.
4. To calculate orbital parameters and to perform conceptual trajectory designs for geocentric or interplanetary missions.
5. To estimate the time of flight and the position of impact point of ballistic missiles.

TEACHING METHODOLOGY

- Blackboard teaching/PowerPoint presentation (if needed) /Flipped Classes for specified topics.
- Tutorial classes on topics covered.
- Unit tests on covered topics

COURSE CONTENTS

UNIT -1- (07 HOURS)

Space Environment: Peculiarities of space environment and its description– effect of space environment on materials of spacecraft structure and astronauts- manned space missions – effect on satellite life time.

UNIT -2- (08 HOURS)

Characteristics of various orbits: Properties of elliptic, Parabolic and hyperbolic properties in terms of orbital elements – relations between position and time – Barker's theorem – Whittaker's theory – Sphere of influence.

UNIT -3- (08 HOURS)

Satellite injection and satellite perturbations: General aspects of satellite injection – satellite orbit transfer – various cases – orbit deviations due to injection errors – special and general perturbations – Cowell's method and Enake's method – method of variations of orbital elements – general perturbations approach.

UNIT -4- (08 HOURS)

Interplanetary trajectories: Two-dimensional interplanetary trajectories – fast interplanetary trajectories – three dimensional interplanetary trajectories – launch of interplanetary spacecraft – trajectory estimation about the target planet – concept of sphere of influence – Lambert's theorem.

UNIT -5- (08 HOURS)

Ballistic missile trajectories: Introduction to ballistic missile trajectories – boost phase – the ballistic phase – trajectory geometry – optimal flights – time of flight – re-entry phase – the position of impact point – influence coefficients.

TEXT BOOKS

1. Cornelisse, JW, Schoyer, HFR &Wakker, KF, "Rocket Propulsion and Space Dynamics", Pitman Publishing, 1979.
2. Howard D.Curtis, "Orbital Mechanics for Engineering Students", 3rd Edition, Butterworth- Heinemann, 2013.

REFERENCE BOOKS

1. Parker, ER, "Materials for Missiles and Spacecraft", Mc.Graw Hill Book Co. Inc., 1982.
2. Suresh. BN & Sivan. K, "Integrated Design for Space Transportation System", Springer India, 2015.
3. Sutton, G.P. "Rocket Propulsion Elements", John Wiley & Sons Inc., New York, 9th Edition, 2016.

Sl. No	ONLINE RESOURCES	LINK
1.	NPTEL	https://nptel.ac.in/courses/101105030
2.	NPTEL	https://nptel.ac.in/courses/101105083

COURSE ASSESSMENT METHOD

Continuous Internal Evaluation (CIE)

Three internal assessments for 30 Marks each.														
Two Learning Activities for 10 Marks each.														
Semester End Examination (SEE)														
Semester end examination for 100 Marks														
Program Outcomes – Articulation matrix														
PO	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**PSO1**	**PSO2**
CO1	**3**	**1**										**2**		**1**
CO2	**2**	**2**							**2**			**1**		**1**
CO3	**1**			**1**	**1**							**2**		**1**
CO4	**2**								**2**			**1**		
CO5	**1**	**2**		**1**					**2**			**2**		

AEROSPACE INSTRUMENTATION

Course Code	**22MAS245**		**Credits**	**3**
Hours/Week (L-T-P)	**2-0-2**		**CIE Marks**	**50**
Total Hrs	**39**		**SEE Marks**	**50**
Exam Hrs	**03**		**Course Type**	**PEC**

COURSE OUTCOMES

Course outcomes: After completion of the course, students will be able to-

1. Understand the controls and operation of an aircraft.
2. Understand the aircraft systems are maintained.
3. Understand the systems available in the aircraft engines.
4. Know the systems available in a missile.
5. Know the basics of systems available in a spacecraft.

TEACHING METHODOLOGY

- Blackboard teaching/PowerPoint presentation (if needed) /Flipped Classes for specified topics.
- Tutorial classes on topics covered.
- Unit tests on covered topics

COURSE CONTENTS

UNIT-1- (07 HOURS)

Flight control systems: Conventional Systems – Power assisted and fully powered flight controls – Power actuated systems – Engine control systems – Push pull rod system – flexible push full rod system – Components – Modern control systems – Digital fly by wire systems – Auto pilot system active control Technology – Communication and Navigation systems – Instrument landing systems.

UNIT-2-(08 HOURS)

Flight systems: Hydraulic systems, Components – Hydraulic system controllers – Modes of operation – Pneumatic systems – Working principles – Typical Air pressure system – Brake system – Typical Pneumatic power system, Components – Landing Gear systems – Classification – Shock absorbers – Retractive mechanism – Rocket Separation mechanism.

UNIT-3-(08 HOURS)

Engine systems: Fuel systems for Piston and jet engines – Components of multi engines – Lubricating systems for piston and jet engines – Starting and Ignition systems – Typical examples for piston and jet engines.

UNIT-4-(08 HOURS)

Guided missile systems: Introduction – Airframe – Propulsion System – Types of Control Systems – Gyroscope and its types – Roll and Lateral Control System – Fin Actuation Servos – Roll and Lateral Autopilot – Guidance System.

UNIT-5-(08 HOURS)

Spacecraft systems: Basics: Structure – Power – Thermal - Communications and Data Handling - Propulsion System-Attitude Stabilisation and Control.

TEXT BOOKS

1. David Harris, “Flight Instruments and Automatic Flight Control”, Blackwell, Sixth Ed., 2004.
2. “General Hand Books of Airframe and Powerplant Mechanics”, U.S. Dept. of Transportation, Federal Aviation Administration, The English Book Store, New Delhi, 1995.
3. McKinley, J.L. and Bent, R.D., “Aircraft Power Plants”, McGraw-Hill, 1993.

REFERENCE BOOKS

1. Treager, S., “Gas Turbine Technology”, McGraw-Hill, 1997.
2. Vincent L. Pisacane, “Fundamentals of Space Systems”, 2nd Ed., Oxford University Press, Inc., 2005.

Sl. No	ONLINE RESOURCES	LINK
1.	NPTEL	https://www.cavindia.com/are-nptel-instrumentation-in-videos-useful-for-gate-exam-preparation/

COURSE ASSESSMENT METHOD

Continuous Internal Evaluation (CIE)

Three internal assessments for **30** Marks each.

Two Learning Activities for **10** Marks each.														
Semester End Examination (SEE)														
Semester end examination for 100 Marks														
Program Outcomes – Articulation matrix														
PO	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**PSO1**	**PSO2**
CO1	**3**	**3**	**2**									**1**	**2**	**1**
CO2	**3**	**3**	**2**									**1**	**2**	**1**
CO3	**3**	**3**	**2**									**1**	**2**	**1**
CO4	**3**	**3**	**2**									**1**	**2**	**1**
CO5	**3**	**3**	**2**									**1**	**2**	**1**

SEMESTER – III

FINITE ELEMENT METHODS				
Course Code	**22MAS31**		**Credits**	**4**
Hours/Week (L-T-P)	**3-0-2**		**CIE Marks**	**50**
Total Hrs	**50**		**SEE Marks**	**50**
Exam Hrs	**3**		**Course Type**	**PCC**

COURSE OUTCOMES

Course outcomes: After completion of the course, students will be able to-

1. An ability to frame governing equations involving different type of finite elements.
2. Knowledge on the general finite element methodology for a variety of practical problems.
3. An ability to solve simple 1-D and 2-D problems using the finite element method.
4. Knowledge on how to apply numerical integration techniques effectively in finite elements solutions.
5. An ability to frame and solve heat transfer and fluid mechanics problems using the FE method.

TEACHING METHODOLOGY

- Blackboard teaching/PowerPoint presentation (if needed) /Flipped Classes for specified topics.
- Tutorial classes on topics covered.
- Unit tests on covered topics

COURSE CONTENTS

UNIT -1- (10 HOURS)

Introduction: Review of various approximate methods – Rayleigh-Ritz, Galerkin and Finite Difference Methods – Problem Formulation – Application to Structural Elements & Practical Problems – Derivation of Stiffness and Flexibility Matrices – Spring Systems – Role of Energy Principles – Basic Concepts of Finite Element Method – Interpolation, Nodes, Degrees of Freedom – Solution Schemes.

UNIT -2- (10 HOURS)

Discrete elements: Finite Element Structural Analysis Involving 1-D Bar and Beam Elements – Tapered Bar – Temperature Effects – Static Loading – Formulation of the Load Vector for 1-D Elements – Methods of Stiffness Matrix Formulation – Interpolation & Shape Functions – Boundary Conditions – Determination of Displacements & Reactions – Constitutive Relations – Determination of Nodal Loads & Stresses.

UNIT -3- (10 HOURS)

Continuum elements: Plane Stress & Plane strain Loading – CST Element – LST Element – Element Characteristics – Problem Formulation & Solution Using Finite Elements – Axisymmetric Bodies & Axisymmetric Loading – Consistent and Lumped Load Vectors – Use of Local, Area and Volume Co-ordinates – Isoparametric Formulation – Shape Functions – Role of Numerical Integration – Load Consideration – Complete FE Solution.

UNIT -4- (10 HOURS)

Vibration & buckling: Formulation of the Mass and Stiffness Element Matrices for Vibration Problems – Bar and Beam Elements – Derivation of the Governing Equation – Natural Frequencies and Modes – Damping Considerations –Harmonic Response – Response Calculation Using Numerical Integration – Buckling of Columns – Problem Formulation – Solution – Determination of Buckling Loads and Modes.

UNIT -5- (10 HOURS)

Heat transfer & fluid mechanics problems: One Dimensional Heat Transfer Analysis – Formulation of the Governing Equations in Finite Element Form – Equivalent Load Vector – Solution & Temperature Distribution – Finite Element Formulation & Solution for Sample Problems Involving Fluid Mechanics .

TEXT BOOKS

1. Bathe, KJ &Wilson,EL, Numerical Methods in Finite Elements Analysis, Prentice Hall of India Ltd., 1983.
2. Dhanaraj, R &K.PrabhakaranNair,K, Finite Element Method, Oxford university press, India, 2015.
3. Krishnamurthy,CS, Finite Elements Analysis, Tata McGraw – Hill, 1987.
4. Rao,SS Finite Element Method in Engineering, Butterworth, Heinemann Publishing, 3rd Edition, 1998.

REFERENCE BOOKS

1. Robert D. Cook, David S. Malkus, Michael E. Plesha and Robert J. Witt, Concepts and Applications of Finite Element Analysis, John Wiley & Sons, 4th Edition, 2002.
2. Segerlind,LJ, Applied Finite Element Analysis, , John Wiley and Sons Inc., New York, 2nd Edition,1984.
3. Tirupathi R. Chandrupatla& Ashok D. Belegundu, Introduction to Finite Elements in Engineering, Prentice Hall, 2002.

Sl. No	ONLINE RESOURCES	LINK
1.	NPTEL	https://nptel.ac.in/courses/112104116

COURSE ASSESSMENT METHOD

Continuous Internal Evaluation (CIE)

Three internal assessments for 30 Marks each.

Two Learning Activities for 10 Marks each.

Semester End Examination (SEE)

Semester end examination for 100 Marks

Program Outcomes – Articulation matrix

PO	1	2	3	4	5	6	7	8	9	10	11	12	PSO1	PSO2
CO1	3	1										2		1
CO2	2	2							2			1		1
CO3	1			1	1							2		1
CO4	2								2			1		
CO5	1	2		1					2			2		

PROJECT WORK PHASE -1				
Course Code	**22MAS34**		**Credits**	**3**
Hours/Week (L-T-P)	**0-6-0**		**CIE Marks**	**100**
Total Hrs	**-**		**SEE Marks**	**-**
Exam Hrs	**3**		**Course Type**	**PROJ**

COURSE OUTCOMES

The individual student must identify a project Advisor in the third semester. The student, in consultation with their Advisor, will form a Thesis Committee that includes head of the department and domain expert. The progress of the project is evaluated based on a minimum of three reviews. The review committee may be constituted by the Head of the Department. A project report is required at the end of the semester. The project work is evaluated based on oral presentation and the project report jointly by external and internal examiners constituted by the Head of the Department.

Program Outcomes – Articulation matrix

PO	1	2	3	4	5	6	7	8	9	10	11	12	PSO1	PSO2
CO1	3	2						3	3			3	3	3
CO2	3	2						3	3			3	3	3
CO3	2	2						3	3			2	3	2
CO4	2	2						3	3			3	3	2
CO5	3	2						3	3			3	3	3

SOCIETAL PROJECT				
Course Code	**22MAS35**		**Credits**	**3**
Hours/Week (L-T-P)	**0-6-0**		**CIE Marks**	**100**
Total Hrs	**-**		**SEE Marks**	**-**
Exam Hrs	**3**		**Course Type**	**SP**

Seminar is to be given by the student after the completion of a societal project chosen by the student. Topics for the projects can be from the aeronautical engineering and allied fields. The project can be based on either numerical or analytical solution or design or fully experimental; or a combination of these tasks.

COURSE ASSESSMENT METHOD

1. Internal Examiner shall carry out the evaluation for 100 marks.
2. External Examiner shall carry out the evaluation for 100 marks.
3. The average of marks allotted by the internal and external examiner shall be the final marks of the project evaluation.
4. Viva-Voce examination of Project work shall be conducted jointly by Internal and External examiner for 100 marks.

Program Outcomes – Articulation matrix

PO	1	2	3	4	5	6	7	8	9	10	11	12	PSO1	PSO2
CO1	3	2						3	3			3	3	3
CO2	3	2						3	3			3	3	3
CO3	2	2						3	3			2	3	2
CO4	2	2						3	3			3	3	2
CO5	3	2						3	3			3	3	3

INTERNSHIP				
Course Code	**22MASI36**		**Credits**	**6**
Hours/Week (L-T-P)	**6 Weeks**		**CIE Marks**	**50**
Total Hrs	**6 Weeks**		**SEE Marks**	**50**
Exam Hrs	**3**		**Course Type**	**INT**

COURSE OUTCOMES

1. Identify and define the problem for the project work
2. Apply the knowledge acquired to analyze and estimate the cost and time
3. Examine and use appropriate tools to solve the defined problem in a team
4. Develop an end product and prepare a technical report/paper

COURSE CONTENTS

A 6 weeks long internship course is to be carried out by the students. On completion of the internship, students shall prepare a report according to the guidelines and submit it to the concerned authority during their 3rd semester. The students should present their work and performance will be evaluated by the project committee and marks will be awarded.

Program Outcomes – Articulation matrix

PO	1	2	3	4	5	6	7	8	9	10	11	12	PSO1	PSO2
CO1	3	2						3	3			3	3	3
CO2	3	2						3	3			3	3	3
CO3	2	2						3	3			2	3	2
CO4	2	2						3	3			3	3	2
CO5	3	2						3	3			3	3	3

PROFESSIONAL ELECTIVE III

GAS DYNAMICS				
Course Code	**22MAS321**		**Credits**	**03**
Hours/Week (L-T-P)	**3-0-0**		**CIE Marks**	**50**
Total Hrs	**39**		**SEE Marks**	**50**
Exam Hrs	**03**		**Course Type**	**PEC**

COURSE OUTCOMES

Course outcomes: After completion of the course, students will be able to-

1. Be able to solve the steady one dimensional compressible fluid flow problems.
2. Be provided with the knowledge on thermodynamic state of the gas behind normal shock waves.
3. Be provided with the knowledge on thermodynamic state of the gas behind oblique shock waves and expansion waves.
4. Be provided with the adequate knowledge on compressible flow measurements.
5. Be provided with the basic knowledge on rarefied and high temperature gas dynamics.

TEACHING METHODOLOGY

- Blackboard teaching/PowerPoint presentation (if needed) /Flipped Classes for specified topics.
- Tutorial classes on topics covered.
- Unit tests on covered topics

COURSE CONTENTS

UNIT-1-(08 HOURS)

Steady one-dimensional flow: Thermodynamics of Fluid Flow – First Law of Thermodynamics - The Second Law of Thermodynamics - Thermal and Calorical Properties – Perfect Gas - Wave Propagation – Velocity of Sound - Subsonic and Supersonic Flows – Fundamental Equations - Discharge from a Reservoir – Stream tube Area-Velocity Relation - De Laval Nozzle – Supersonic Flow Generation – Diffusers - Dynamic Head Measurement in Compressible Flow - Pressure Coefficient.

UNIT-2-(10 HOURS)

Normal shock waves: Introduction – Equations of Motion for a Normal Shock Wave - The Normal Shock Relations for a Perfect Gas - Change of Stagnation or Total Pressure across the Shock- Hugoniot Equation - The Propagating Shock Wave - Reflected Shock Wave - Centered Expansion Wave - Shock Tube.

UNIT-3-(10 HOURS)

Oblique shock and expansion waves: Introduction – Oblique Shock Relations - Relation between θ and β- Shock Polar – Supersonic Flow over a Wedge - Weak Oblique Shocks – Supersonic Compression - Supersonic Expansion by Turning - The Prandtl-Meyer Expansion - Simple and Non-simple Regions.

UNIT-4-(10 HOURS)

Measurements in compressible flow: Introduction - Pressure Measurements – Temperature Measurements - Velocity and Direction - Density Problems - Compressible Flow Visualization - High-Speed Wind Tunnels - Instrumentation and Calibration of Wind Tunnels.

UNIT-5-(10 HOURS)

Introduction to rarefied and high temperature gas dynamics: Knudsen Number - Slip Flow Transition and Free Molecule Flow - Importance of High- Temperature Flows - Nature of High-Temperature Flows.

TEXT BOOKS

1. J.D. Anderson, Fundamentals of Aerodynamics, McGraw-Hill Education, 6th edition, 2017.
2. Rathakrishnan. E., Gas Dynamics, Prentice Hall of India, 7th edition, 2020.
3. Shapiro, AH, “Dynamics & Thermodynamics of Compressible Fluid Flow”, Ronald Press, 1982.

REFERENCE BOOKS

1. Houghton, EL and Caruthers, NB,“ Aerodynamics for Engineering Students”, Butterworth- Heinemann Series, 7th Edition 2017.
2. Zucrow, M.J, and Anderson, J.D, “Elements of gas dynamics” McGraw-Hill Book Co., New York, 1989.
3. Rae, WH and Pope, A, “Low speed Wind Tunnel Testing”, John Wiley Publications, 3rd edition, 1999.

Sl. No	ONLINE RESOURCES	LINK

1.	www.bookslock.org	https://www.bookslock.org/gas-dynamics-rathakrishnan/

COURSE ASSESSMENT METHOD

Continuous Internal Evaluation (CIE)

Three internal assessments for **30** Marks each.

Two Learning Activities for **10** Marks each.

Semester End Examination (SEE)

Semester end examination for 100 Marks

Program Outcomes – Articulation matrix

PO	1	2	3	4	5	6	7	8	9	10	11	12	PSO1	PSO2
CO1	3	3	2										2	3
CO2	3	2	2										2	2
CO3	3	2	2	1									2	2
CO4	3	2	2										2	2
CO5	3	2	2	1									2	3

CHEMICAL ROCKET TECHNOLOGY				
Course Code	**22MAS322**		**Credits**	**3**
Hours/Week (L-T-P)	**3-0-0**		**CIE Marks**	**50**
Total Hrs	**3**		**SEE Marks**	**50**
Exam Hrs	**3**		**Course Type**	**PEC**

COURSE OUTCOMES

Course outcomes: After completion of the course, students will be able to-

1. To identify the rocket propulsion system and its applications.
2. Analyze the performance of thrust chambers.
3. Describe and classify solid propellant rocket motors and its components.
4. Analyse propellants properties and associated physical and chemical processes.
5. Describe and classify liquid propellant rocket motors, its components and various associated systems.

TEACHING METHODOLOGY

- Blackboard teaching/PowerPoint presentation (if needed) /Flipped Classes for specified topics.
- Tutorial classes on topics covered.
- Unit tests on covered topics

COURSE CONTENTS

UNIT -1- (07 HOURS)

Rocket performance: Classification of Rockets - Propellants classification -Thrust equation, specific impulses, total impulse, characteristic velocity – Thrust coefficient – Efficiency: Real and ideal nozzle characteristic, Adiabatic flame temperature and its calculation, Criterion for Choice of propellants.

UNIT -2- (08 HOURS)

Solid rocket motors: Viscous subsystems of solid rocket motor and their function – Igniters - Type of igniters – Internal ballistics properties– Burning rate - Factor affecting burning rate - Equilibrium Chamber pressure– Propellant grain geometry design, Erosive burning – Pressure vs Time curve- thrust vs time curve – Special problems of solid rocket nozzle – Combustion mechanism of solid propellants – Solid rocket motor design.

UNIT -3- (08 HOURS)

Liquid rocket engines: Classification of liquid rocket engine — Injectors and its types - various of types of feeding system - performance and choice of feed system cycle – Propellants tank and propellant slosh - Gas requirement for propellant draining - Thrust chamber – Thrust chamber cooling – Cryogenic propellants – Problems peculiar to cryogenic engine -– Turbo pumps – Ignition system - Combustion of liquid rocket – Thrust chamber design.

UNIT -4- (08 HOURS)

Hybrid propulsion system: Standard and reverse hybrid rocket – Application – Limitation - Advance fuel – Combustion mechanism of hybrid rocket – Regression rate measurement – Methods for improving regression rate.

UNIT -5- (08 HOURS)

Rocket testing and combustion instabilities: Burning rate measurement techniques - Rocket testing – Static testing of rockets – Instrumentation and safety procedures – Ignition delay testing – Combustion instability - L* instability – different modes of combustion instability – Bulk and wave mode of combustion instability in solid and liquid rockets – Pogo instability.

TEXT BOOKS

1. Martin J. Chiaverini& Kenneth K. Kuo, "Fundamentals of Hybrid Rocket Combustion and Propulsion", Progress in Astronautics and Aeronautics (book218), 1st edition, 2007.
2. Ramamurthi,K, "Rocket Propulsion", Laxmi Publications Private Limited, 1st edition, 2016.

REFERENCE BOOKS

1. Sutton,GP "Rocket Propulsion Elements", John Wiley & Sons Inc., New York, 9th Edition, 2016.

Sl. No	ONLINE RESOURCES	LINK
1.	NPTEL	http://nptel.iitm.ac.in

COURSE ASSESSMENT METHOD

Continuous Internal Evaluation (CIE)

Three internal assessments for 30 Marks each.

Two Learning Activities for 10 Marks each.														
Semester End Examination (SEE)														
Semester end examination for 100 Marks														
Program Outcomes – Articulation matrix														
PO	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**PSO1**	**PSO2**
CO1	**3**	**1**										**2**		**1**
CO2	**2**	**2**							**2**			**1**		**1**
CO3	**1**			**1**	**1**							**2**		**1**
CO4	**2**								**2**			**1**		
CO5	**1**	**2**		**1**					**2**			**2**		

MISSILE GUIDANCE AND CONTROL				
Course Code	**22MAS323**		**Credits**	**3**
Hours/Week (L-T-P)	**3-0-0**		**CIE Marks**	**50**
Total Hrs	**39**		**SEE Marks**	**50**
Exam Hrs	**3**		**Course Type**	**PEC**

COURSE OUTCOMES

Course outcomes: After completion of the course, students will be able to-

1. Have through knowledge with the advanced concepts of missile guidance and control to the engineers.
2. Provide the necessary mathematical knowledge that is needed in understanding the physical processes.
3. Derive fundamental guidance equations and to compare guidance system performance.
4. Explain the importance of strategic missiles and tracking equation of motions.
5. Provide concepts on weapon delivery systems and also the factors influences weapon delivery system.

TEACHING METHODOLOGY

- Blackboard teaching/PowerPoint presentation (if needed) /Flipped Classes for specified topics.
- Tutorial classes on topics covered.
- Unit tests on covered topics

COURSE CONTENTS

UNIT -1- (07 HOURS)

Missile systems introduction: History of guided missile for defence applications- Classification of missiles– The Generalized Missile Equations of Motion- Coordinate Systems- Lagrange's Equations for Rotating Coordinate Systems-Rigid-Body Equations of Motion-missile system elements, missile ground systems.

UNIT -2- (08 HOURS)

Missile airframes, autopilots and control: Missile aerodynamics- Force Equations, Moment Equations, Phases of missile flight. Missile control configurations. Missile Mathematical Model. Autopilots — Definitions, Types of Autopilots, Example Applications. Open-loop autopilots. Inertial instruments and feedback. Autopilot response, stability, and agility- Pitch Autopilot Design, Pitch-Yaw-Roll Autopilot Design.

UNIT -3- (08 HOURS)

Missile guidance laws: Tactical Guidance Intercept Techniques, Derivation of the Fundamental Guidance Equations, explicit, Proportional Navigation, Augmented Proportional Navigation, beam riding, bank to turn missile guidance, Three-Dimensional Proportional Navigation, comparison of guidance system performance, Application of Optimal Control of Linear Feedback Systems.

UNIT -4- (08 HOURS)

Strategic missiles: Introduction, The Two-Body Problem, Lambert's Theorem, First-Order Motion of a Ballistic Missile-Correlated Velocity and Velocity- to-Be-Gained Concepts, Derivation of the Force Equation for Ballistic Missiles, Atmospheric Reentry, Ballistic Missile Intercept, Missile Tracking Equations of Motion, Introduction to Cruise Missiles , The Terrain-Contour Matching (TERCOM) Concept.

UNIT -5- (08 HOURS)

Weapon delivery systems: Weapon Delivery Requirements, Factors Influencing Weapon Delivery Accuracy, Unguided Weapons, The Bombing Problem, Guided Weapons, Integrated Flight Control in Weapon Delivery, Missile Launch Envelope, Mathematical Considerations Pertaining to the Accuracy of Weapon Delivery Computations

TEXT BOOKS

1. Blakelock, JH,"Automatic Control of Aircraft and Missiles", 2nd edition, John Wiley & Sons, 1991.
2. Fleeman, Eugene L, "Tactical Missile Design", 2nd edition, AIAA Education series, 2006.
3. Garnell, P, "Guided Weapon Control Systems", 2nd Edition, Pergamon Press, 1980.

REFERENCE BOOKS

1. Joseph Ben Asher and Isaac Yaesh, "Advances in Missile Guidance Theory" AIAA Education series, 1998.
2. Paul Zarchan, "Tactical and Strategic Missile Guidance", AIAA Education series,6th edition, 2013.
3. Siouris, GM,"Missile Guidance and control systems", Springer, 2004.

Sl. No	ONLINE RESOURCES	LINK

1.	NPTEL	https://archive.nptel.ac.in/courses/101/108/101108054/

COURSE ASSESSMENT METHOD

Continuous Internal Evaluation (CIE)

Three internal assessments for 30 Marks each.

Two Learning Activities for 10 Marks each.

Semester End Examination (SEE)

Semester end examination for 100 Marks

Program Outcomes – Articulation matrix

PO	1	2	3	4	5	6	7	8	9	10	11	12	PSO1	PSO2
CO1	3	1										2		1
CO2	2	2							2			1		1
CO3	1			1	1							2		1
CO4	2								2			1		
CO5	1	2		1					2			2		

AIRPORT PLANNING AND OPERATIONS				
Course Code	**22MAS324**		**Credits**	**3**
Hours/Week (L-T-P)	**3-0-0**		**CIE Marks**	**50**
Total Hrs	**39**		**SEE Marks**	**50**
Exam Hrs	**3**		**Course Type**	**PEC**

COURSE OUTCOMES

Course outcomes: After completion of the course, students will be able to-

1. Explain the typical operations of airports from a management perspective
2. Identify the economic, political and social role of airports
3. Discuss the airport operations management
4. Discuss the airport financial management
5. Explain and defining capacity, factors affecting capacity and delay

TEACHING METHODOLOGY

- Blackboard teaching/PowerPoint presentation (if needed) /Flipped Classes for specified topics.
- Tutorial classes on topics covered.
- Unit tests on covered topics

COURSE CONTENTS

UNIT -1- (07 HOURS)

Airports and Airport Systems: Introduction: Airport management on an international level; The national plan of integrated airport systems; The nation's airport system plan; The rules that govern airport management; Organizations that influence airport regulatory policies. A historical and legislative perspective: Introduction the formative period of aviation and airports, Airport growth: World War-II and the postwar period airport modernization: The early jet age

UNIT -2- (08 HOURS)

Components of the airport: The components of an airport, the airfield. Navigational aids (NAVAIDS) located on airfields; Air traffic control and surveillance facilities located on the airfield; Weather reporting facilities located on airfields; Security infrastructure on airfields. Airspace and air traffic control: Brief history of air traffic control; The basics of air traffic control; Current and future enhancements to air traffic control; Airport terminals and ground access: The historical development of airport terminals; Components of the airport terminal; Airport ground access.

UNIT -3- (08 HOURS)

Airport operations management: Introduction, pavement management, aircraft rescue and firefighting (ARFF); Snow and ice control, safety inspection programs. Bird and wildlife hazard management; Airport security: Security at commercial service airports, security at general aviation airports; the future of airport security.

UNIT -4- (08 HOURS)

Airport financial management: Airport financial accounting, revenue strategies at commercial airports, pricing of airport facilities and services, variation in the sources of operating revenues, rise in airport financial burdens, airport funding, grant programs, airport financing, private investment sale of the airport.

UNIT -5- (08 HOURS)

Airport capacity and delay Defining capacity, factors affecting capacity and delay, estimating capacity, analytical estimates of delay: The queuing diagram. The future of airport management: Introduction, restructuring of commercial air carriers, new large aircraft and small aircraft transportation systems.

TEXT BOOKS

1. Airport planning and Management, Alexander T Wells, Ed. D Seth Young McGraw-Hill Education 6th Edition, 2011

REFERENCE BOOKS

1. Airport Operations Norman J. Ashford, H. P. Martin Stanton, Clifton A. Moore, Pierre Coutu McGraw Hill 3rd Edition, 2013

Sl. No	ONLINE RESOURCES	LINK
1.	NPTEL	https://nptel.ac.in/courses/101101083/
2.	NPTEL	https://nptel.ac.in/noc/courses/noc18/SEM1/noc18-ae03

3.	NPTEL	https://nptel.ac.in/noc/courses/noc20/SEM1/noc20-ae03
4.	MIT OCW	https://ocw.mit.edu/courses/civil-and-environmental-engineering/1-206j-airline-schedule-planning-spring-2003
5.	TU Delft	https://ocw.mit.edu/courses/aeronautics-and-astronautics/16-75jairline-management-spring-2006

COURSE ASSESSMENT METHOD

Continuous Internal Evaluation (CIE)

Three internal assessments for 30 Marks each.

Two Learning Activities for 10 Marks each.

Semester End Examination (SEE)

Semester end examination for 100 Marks

Program Outcomes – Articulation matrix

PO	1	2	3	4	5	6	7	8	9	10	11	12	PSO1	PSO2
CO1	3	1										2		1
CO2	2	2							2			1		1
CO3	1			1	1							2		1
CO4	2								2			1		
CO5	1	2		1					2			2		

<table>
<tr><th colspan="5">OPTIMIZATION TECHNIQUE</th></tr>
<tr><td>Course Code</td><td>22MAS325</td><td></td><td>Credits</td><td>3</td></tr>
<tr><td>Hours/Week (L-T-P)</td><td>3-0-0</td><td></td><td>CIE Marks</td><td>50</td></tr>
<tr><td>Total Hrs</td><td>39</td><td></td><td>SEE Marks</td><td>50</td></tr>
<tr><td>Exam Hrs</td><td>03</td><td></td><td>Course Type</td><td>PEC</td></tr>
<tr><th colspan="5">COURSE OUTCOMES</th></tr>
<tr><td colspan="5">Course outcomes: After completion of the course, students will be able to-</td></tr>
<tr><td colspan="5">1. Understand how to translate a real-world problem, given in words, into a mathematical Formulation
2. Apply simplex algorithm for LPP.
3. Solve Transportation Models and Assignment Models, maximal flow problem, minimum spanning tree and shortest path problem
4. Handle issues in Decision making under various conditions
5. Acquire capability in applying and using of queuing models for day today problems</td></tr>
<tr><th colspan="5">TEACHING METHODOLOGY</th></tr>
<tr><td colspan="5">● Blackboard teaching/PowerPoint presentation (if needed) /Flipped Classes for specified topics.
● Tutorial classes on topics covered.
● Unit tests on covered topics</td></tr>
<tr><th colspan="5">COURSE CONTENTS</th></tr>
<tr><th colspan="5">UNIT-1-(08 HOURS)</th></tr>
<tr><td colspan="5">Introduction to Operations Research – assumptions of Linear Programming Problems - Formulations of linear programming problem – Graphical method. Solutions to LPP using simplex algorithm – Two phase method – Big M method</td></tr>
<tr><th colspan="5">UNIT-2-(07 HOURS)</th></tr>
<tr><td colspan="5">Revised simplex method - primal dual relationships – Dual simplex algorithm – Sensitivity analysis –changes in RHS value – changes in Coefficient of constraint – Adding new constraint – Adding new variable</td></tr>
<tr><th colspan="5">UNIT-3-(09 HOURS)</th></tr>
<tr><td colspan="5">Transportation problems: Northwest corner rule, Least cost method, Vogel's approximation method - stepping stone method - MODI method – Unbalanced transportation – Assignment problem – Hungarian algorithm – Travelling salesman problem – project management. Minimum spanning tree problem: prim's algorithm, Kruskal's algorithm - Shortest path problem: Dijkstra's algorithms, Floyds algorithm - maximal flow problem: Maximal-flow minimum-cut theorem - Maximal flow algorithm</td></tr>
<tr><th colspan="5">UNIT-4-(08 HOURS)</th></tr>
<tr><td colspan="5">Decision making under certainty – Decision making under risk – Decision making under uncertainty – Decision tree analysis –Introduction to MCDM; AHP. Game Theory – Two person zero sum games, pure and mixed strategies – Theory of dominance - Graphical Solution – Solving by LP</td></tr>
<tr><th colspan="5">UNIT-5-(07 HOURS)</th></tr>
<tr><td colspan="5">Queuing theory terminology – Single server, multi-server- limited and unlimited queue capacity-limited and unlimited population.</td></tr>
<tr><th colspan="5">TEXT BOOKS</th></tr>
<tr><td colspan="5">1. Hamdy A Taha, Operations Research – An Introduction, Pearson, 2017.
2. Panneerselvam. R, Operations Research, PHI, 2009</td></tr>
<tr><th colspan="5">REFERENCE BOOKS</th></tr>
<tr><td colspan="5">1. Philips, Ravindran and Solberg, Operations Research principles and practices, John Wiley, 2007.
2. Ronald L Rardin, Optimization in Operations Research, Pearson, 2018
3. Srinivasan. G, Operations Research Principles and Applications, PHI, 2017</td></tr>
</table>

Sl. No	ONLINE RESOURCES	LINK
1.	MOOC	https://nptel.ac.in/courses/111105039

COURSE ASSESSMENT METHOD

Continuous Internal Evaluation (CIE)

Three internal assessments for **30** Marks each.														
Two Learning Activities for **10** Marks each.														
Semester End Examination (SEE)														
Semester end examination for 100 Marks														
Program Outcomes – Articulation matrix														
PO	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**PSO1**	**PSO2**
CO1	**3**	**3**		**2**									**2**	**1**
CO2	**3**	**3**		**2**									**2**	**1**
CO3	**3**	**3**	**3**	**2**									**2**	**1**
CO4	**3**	**3**	**3**	**2**									**2**	**1**
CO5	**3**	**3**	**3**	**2**									**2**	**1**

STRUCTURAL DYNAMICS AND AEROELASTICITY				
Course Code	**22MAS326**		**Credits**	**3**
Hours/Week (L-T-P)	**3-0-0**		**CIE Marks**	**50**
Total Hrs	**39**		**SEE Marks**	**50**
Exam Hrs	**3**		**Course Type**	**PEC**

COURSE OUTCOMES

Course outcomes: After completion of the course, students will be able to-

1. Have knowledge of the role of aeroelasticity in aircraft design.
2. Interpret the use of semi-rigid body assumptions and numerical methods in airplane design.
3. Arrive at the solutions for steady state aeroelastic problem.
4. Be knowledge with the concept of flutter analysis of aircraft wings.
5. Have knowledge on practical examples of aeroelastic problems.

TEACHING METHODOLOGY

- Blackboard teaching/PowerPoint presentation (if needed) /Flipped Classes for specified topics.
- Tutorial classes on topics covered.
- Unit tests on covered topics

COURSE CONTENTS

UNIT -1- (07 HOURS)

Aeroelastic phenomena: Stability versus response problems – introduction to aeroelasticity and aeroelastic phenomena – Examples of aeroelastic phenomena – Galloping of transmission lines – Flow induced vibrations of tall slender structures – Instability of suspension bridges – Fluid structure interaction – The aero-elastic triangle of forces – Prevention of aeroelastic instabilities

UNIT -2- (08 HOURS)

Modelling of aeroelastic phenomena: Influence and stiffness co-efficients – illustration of aeroelastic phenomena using simplified aerodynamic and structural models – different subsonic and supersonic aerodynamic models for aeroelastic analysis – modelling techniques – aeroelastic models in state-space format Flexure – torsional oscillations of beams – Governing differential equation of motion and its solution

UNIT -3- (08 HOURS)

Static aeroelastic phenomena: Simple two dimensional idealisation – Strip theory – Exact solutions for simple rectangular wings – 'Semirigid' assumption and approximate solutions – Successive approximation method – Numerical approximations using matrix equations – Divergence of 2-D airfoil and Straight Wing – Aileron efficiency & reversal – Control Effectiveness – Wing deformations of swept wings

UNIT -4- (08 HOURS)

Flutter calculations: Flutter analysis – Two dimensional thin airfoils in steady incompressible flow –Quasi-steady aerodynamic derivatives – Galerkin method for critical flutter speed – Stability of disturbed motion – Solution of the flutter determinant – Methods of determining the critical flutter speeds – Flutter Calculation – U-g Method – P-k Method – Exact Treatment of Bending –Torsion Flutter of a Uniform Wing – Flutter Analysis by Assumed Mode Method

UNIT -5- (08 HOURS)

Prevention and control: Stiffness criteria – dynamic mass balancing – dimensional similarity – effect of elastic deformation on static longitudinal stability – introduction to aeroelastic control – aeroelastic aspects in the design of aircraft – Panel flutter and its control – Prevention of tail buffeting – Aeroelastic instabilities in helicopter and engine blades and prevention methods

TEXT BOOKS

1. Bisplinghoff.RL, Ashley,H and Halfmann,RL, "Aeroelasticity", 2nd Edition, Addison Wesley Publishing Co., Inc., 1996.
2. Blevins, RD," Flow Induced Vibrations", Krieger Pub Co., 2001.
3. Broadbent,EG, "Elementary Theory of Aeroelasticity", Bun Hill Publications Ltd., 1986.

REFERENCE BOOKS

1. Fung,YC, "An Introduction to the Theory of Aeroelasticity", John Wiley & Sons Inc., New York, 2008.

2. Scanlan, RH and R.Rosenbaum, “Introduction to the study of Aircraft Vibration and Flutter”, Macmillan Co., New York, 1981.

Sl. No	ONLINE RESOURCES	LINK
1.	NPTEL	https://nptel.ac.in/courses/101104005

COURSE ASSESSMENT METHOD

Continuous Internal Evaluation (CIE)

Three internal assessments for 30 Marks each.

Two Learning Activities for 10 Marks each.

Semester End Examination (SEE)

Semester end examination for 100 Marks

Program Outcomes – Articulation matrix

PO	1	2	3	4	5	6	7	8	9	10	11	12	PSO1	PSO2
CO1	3	1										2		1
CO2	2	2							2			1		1
CO3	1			1	1							2		1
CO4	2								2			1		
CO5	1	2		1					2			2		

OPEN ELECTIVE COURSES-I

INTRODUCTION TO AEROSPACE ENGINEERING				
Course Code	**22MAS331**		**Credits**	**3**
Hours/Week (L-T-P)	**3-0-0**		**CIE Marks**	**50**
Total Hrs	**39**		**SEE Marks**	**50**
Exam Hrs	**3**		**Course Type**	**OEC**

COURSE OUTCOMES

Course outcomes: After completion of the course, students will be able to-

1. Ability to understand the standard atmosphere.
2. Ability to understand aerodynamics, lift, drag.
3. Ability to understand the Aircraft performance, propulsion and structures.
4. Ability to understand the aircraft stability, and control.
5. Ability to understand the rocket and spacecraft trajectories and orbits.

TEACHING METHODOLOGY

- Blackboard teaching/PowerPoint presentation (if needed) /Flipped Classes for specified topics.
- Tutorial classes on topics covered.
- Unit tests on covered topics

COURSE CONTENTS

UNIT -1- (08 HOURS)

Standard atmosphere: History of aviation – standard atmosphere - pressure, temperature and density altitude.

UNIT -2- (YY HOURS)

Aerodynamics: Aerodynamic forces – Lift generation Viscosity and its implications - Shear stress in a velocity profile - Lagrangian and Eulerian flow field - Concept of a streamline - Aircraft terminology and geometry - Aircraft types - Lift and drag coefficients using NACA data.

UNIT -3- (YY HOURS)

Performance and propulsion: Viscous and pressure drag - flow separation - aerodynamic drag - thrust calculations - thrust/power available and thrust/power required.

UNIT -4- (YY HOURS)

Aircraft stability and structural theory: Degrees of freedom of aircraft motions - stable, unstable and neutral stability - concept of static stability - Hooke’s Law- brittle and ductile materials - moment of inertia - section modulus.

UNIT -5- (YY HOURS)

Space applications: History of space research - spacecraft trajectories and basic orbital manoeuvres - six orbital elements - Kepler’s laws of orbits - Newtons law of gravitation.

TEXT BOOKS

1. John D. Anderson, Introduction to Flight, 8th Ed., McGraw-Hill Education, New York, 2015.
2. Stephen. A. Brandt, "Introduction to Aeronautics: A design perspective" American Institute of Aeronautics & Astronautics,1997.

REFERENCE BOOKS

1. Kermode, A.C., “Mechanics of Flight”, Himalayan Book, 1997.

Sl. No	ONLINE RESOURCES	LINK
1.	NPTEL	https://archive.nptel.ac.in/courses/101/101/101101079/

COURSE ASSESSMENT METHOD

Continuous Internal Evaluation (CIE)

Three internal assessments for 30 Marks each.

Two Learning Activities for 10 Marks each.

Semester End Examination (SEE)

Semester end examination for 100 Marks

Program Outcomes – Articulation matrix

PO	1	2	3	4	5	6	7	8	9	10	11	12	PSO1	PSO2

CO1	**3**	**1**									**2**		**1**
CO2	**2**	**2**						**2**			**1**		**1**
CO3	**1**			**1**	**1**						**2**		**1**
CO4	**2**							**2**			**1**		
CO5	**1**	**2**		**1**				**2**			**2**		

PRINCIPLES OF AIRCRAFT DESIGN				
Course Code	**22MAS332**		**Credits**	**3**
Hours/Week (L-T-P)	**3-0-0**		**CIE Marks**	**50**
Total Hrs	**39**		**SEE Marks**	**50**
Exam Hrs	**3**		**Course Type**	**OEC**

COURSE OUTCOMES

Course outcomes: After completion of the course, students will be able to-

1. Conceptual designs of aerospace vehicles, components, missions, or systems that incorporate realistic constraints/applicable engineering standards.
2. Describes the terminology and definitions used in the design.
3. Explains the propulsion sizing estimates to meet specified operational and performance requirements
4. Illustrate the performance of a conceptual airplane and its propulsion system.
5. To calculate jet and propeller-driven airplane performance (takeoff/landing distance, range, endurance, climb, maneuver)

TEACHING METHODOLOGY

- Blackboard teaching/PowerPoint presentation (if needed) /Flipped Classes for specified topics.
- Tutorial classes on topics covered.
- Unit tests on covered topics

COURSE CONTENTS

UNIT-1-(8 HOURS)

Phases of the design process: Conceptual Design, Preliminary Design, and Detailed Design. Typical program organization and personnel responsibilities. Role of the aircraft designer - you are a key member of the design team. Major differences between manned and unmanned air vehicle design.

UNIT-2-(6 HOURS)

Basic aircraft terminology and conventions, Coordinate systems, forces and moments, and aerodynamic coefficients. Aircraft weight breakdown and definitions, Basic aircraft performance terminology (flight in the horizontal and vertical planes).

UNIT-3-(6 HOURS)

Aircraft sizing, Factors influencing aircraft configuration, size and weight. Weight breakdown, Historical weight data. Sizing with a “rubber” engine .The lift curve and parabolic drag polar.

UNIT-4-(8 HOURS)

Aircraft Performance and Fuel Fraction Estimates: Range, Endurance, Maneuvering Flight in the vertical and horizontal planes, Climbing Flight, Descent/Glide, Field Performance – Takeoff and Landing, Special performance requirements. Propulsion System Selection: Flight regimes, Refined performance estimating methods, Installation factors.

UNIT-5-(8 HOURS)

Configuration trade studies: Configuration type (tailless, canard, conventional), Wing location, Empennage configurations (cruciform, T, H, V, cathedral), Engine placement (single and multi-engine), Landing gear type and placement (tail dragger, tricycle, tandem), Airfoil selection, Packaging for storage/transport.

TEXT BOOKS

1. Daniel P. Raymer, Aircraft Design: A Conceptual Approach, AIAA Educational Series, USA, 4th Edition, 2006.
2. J. F. Marchman, L. R. Jenkinson, Aircraft Design Projects for Engineering students, AIAA Publishers, USA, 2003.
3. Ajoy Kumar Kunda, Aircraft Design, Cambridge University Press, UK, 2010.

REFERENCE BOOKS

1. E. Torenbeek, Synthesis of Subsonic Airplane Design, Delft University Press, New York, 1986.
2. E. H Bruhn, Analysis and Design of Flight Vehicles Structures, Jacobs Publishing House, USA, New Edition, 1973.
3. E. E Scheler, L.G Dunn, Airplane Structural Analysis and Design, John Wiley & Sons, USA, 1963.

4. D. Howe, Aircraft conceptual Design Synthesis, John Wiley and Sons Publishers, USA, 2005.		
Sl. No	**ONLINE RESOURCES**	**LINK**
1.	NPTL Course	https://nptel.ac.in/courses/101104069

COURSE ASSESSMENT METHOD

Continuous Internal Evaluation (CIE)

Three internal assessments for 30 Marks each.

Two Learning Activities for 10 Marks each.

Semester End Examination (SEE)

Semester end examination for 100 Marks

Program Outcomes – Articulation matrix

PO	1	2	3	4	5	6	7	8	9	10	11	12	PSO1	PSO2
CO1	3	1										2		1
CO2	2	2							2			1		1
CO3	1			1	1							2		1
CO4	2								2			1		
CO5	1	2		1					2			2		

INTRODUCTION TO AEROSPACE PROPULSION				
Course Code	**22MAS333**		**Credits**	**3**
Hours/Week (L-T-P)	**3-0-0**		**CIE Marks**	**50**
Total Hrs	**39**		**SEE Marks**	**50**
Exam Hrs	**3**		**Course Type**	**OEC**

COURSE OUTCOMES

Course outcomes: After completion of the course, students will be able to-

1. To carryout engine cycle analysis by considering component losses
2. To understand the basic design features of aircraft inlets and nozzles and their performance evaluation methods
3. To understand the basic aspects of combustion systems used in aircraft engines
4. To understand the working principle and performance of axial flow compressors.
5. To understand the working principle and performance of axial flow turbines and centrifugal compressors

TEACHING METHODOLOGY

- Blackboard teaching/PowerPoint presentation (if needed) /Flipped Classes for specified topics.
- Tutorial classes on topics covered.
- Unit tests on covered topics

COURSE CONTENTS

UNIT -1- (07 HOURS)

Introduction: Introduction to jet aircraft propulsion, Classifications of Aerospace Engines, Classification of Jet Engines, Classification of gas turbine engines, Performance Parameters of Jet Engines, Thrust Force, Factors Affecting Thrust, Engine Performance Parameters, Efficiencies, Takeoff Thrust, Specific Fuel Consumption, Aircraft Range, Specific Impulse, Cycle components and component performance, Real cycle analysis, Effect of losses on engine component performance, Real cycle analysis of turbojet, ramjet, turbofan, turboprop and turbo shaft engines, Role of afterburner on engine performance, Single and multispool arrangements

UNIT -2- (08 HOURS)

Diffusers and nozzles: Power Plant Installation. Intakes for transport and military aircrafts, Subsonic intakes, Flow patterns, Internal and external flow, Performance of intakes, Supersonic intakes, The starting problem, The shock boundary layer problem, External deceleration, The flow stability problem, Typical modes of inlet operation Working of nozzles, Nozzle types, Subsonic and supersonic nozzles, Convergent Nozzle, Convergent–Divergent Nozzle, Variable Geometry Nozzles, Afterburning Nozzles, Performance parameters for nozzles, Under and over expanded nozzles, Thrust Reversal, Noise

UNIT -3- (08 HOURS)

Aircraft Combustion Systems: Subsonic Combustion Chambers, Tubular (or Multiple) Combustion Chambers , Tubo Annular Combustion Chambers, Annular Combustion Chambers, Combustion Process, Chemistry of Combustion, Combustion Chamber Performance, Pressure Losses, Combustion Efficiency, Combustion Stability, Combustion Intensity, Development of a practical combustion system, Fuel Injectors, Simplex injectors, Stability limits, Flame Stabilization, Combustion Instability, Cooling, Material, Aircraft Fuels, Emissions and Pollutants, The Afterburner, Supersonic Combustion System.

UNIT -4- (08 HOURS)

Axial flow compressors: Classification of compressors and turbines, Comparison of Compressors and Turbines, Euler's Equation, Basic operation of an axial flow compressor, Elementary theory, Factors affecting pressure ratio, degree of reaction, Design steps of an axial flow compressor, Basic aspects of Blade design, Calculation of stage performance, compressibility effects, off-design performance, Compressor characteristics.

UNIT -5- (08 HOURS)

Axial Flow turbines and Centrifugal flow compressors: Axial Flow turbines: Elementary theory, Degree of reaction, Fifty percent reaction designs, Loss coefficients for the nozzle and rotor blades, vortex theory, Choice of blade profile, pitch and chord, stage performance, Turbine materials, Methods of blade cooling, Centrifugal flow compressors: Basic layout and operations, work done and pressure rise, losses and efficiency; Slip factor and power input factor, Flow in the diffuser, Accounting compressibility effects, Compressor characteristics

TEXT BOOKS

1. Saravanamuttoo H.I.H, Rogers G.F.C., and Cohen H., “Gas turbine theory”, Pearson education ltd., 2001
2. Hill P., and Peterson C., “Mechanics and thermodynamics of propulsion”, Pearson education ltd., 2010

REFERENCE BOOKS

1. Mattingly J. D., “Elements of gas dynamics propulsion”, Tata McGraw Hill education pvt. ltd., 2005.
2. Farokhi, S., 2014. Aircraft propulsion. John Wiley & Sons.

Sl. No	ONLINE RESOURCES	LINK
1.	NPTEL	(https://nptel.ac.in/courses/112/103/112103281/)
2.	NPTEL	(https://nptel.ac.in/courses/101/101/101101002/)

COURSE ASSESSMENT METHOD

Continuous Internal Evaluation (CIE)

Three internal assessments for 30 Marks each.

Two Learning Activities for 10 Marks each.

Semester End Examination (SEE)

Semester end examination for 100 Marks

Program Outcomes – Articulation matrix

PO	1	2	3	4	5	6	7	8	9	10	11	12	PSO1	PSO2
CO1	3	1										2		1
CO2	2	2							2			1		1
CO3	1			1	1							2		1
CO4	2								2			1		
CO5	1	2		1					2			2		

UNMANNED AERIAL VEHICLE				
Course Code	**22MAS334**		**Credits**	**3**
Hours/Week (L-T-P)	**3-0-0**		**CIE Marks**	**50**
Total Hrs	**39**		**SEE Marks**	**50**
Exam Hrs	**3**		**Course Type**	**OEC**

COURSE OUTCOMES

Course outcomes: After completion of the course, students will be able to-

1. To classify UAVs based on different parameters.
2. To demonstrate ability to design an efficient structure for an UAV of specific application.
3. To perform ground testing of UAVs.
4. To apply the knowledge gained on electronic intelligence and target designation for successful development of UAS.
5. To understand the basic concepts in the different types of navigation schemes for UAS.

TEACHING METHODOLOGY

- Blackboard teaching/PowerPoint presentation (if needed) /Flipped Classes for specified topics.
- Tutorial classes on topics covered.
- Unit tests on covered topics

COURSE CONTENTS

UNIT -1- (07 HOURS)

Introduction to uav: History of UAV –classification –basic terminology-models and prototypes –applications

UNIT -2- (08 HOURS)

Basics of airframe: Airframe –dynamics –modeling- structures –wing design- engines and its types-equipment, maintenance and management-control surfaces-specifications.

UNIT -3- (08 HOURS)

Development of uas system: System Development- Ground Testing-UAV component testing-Uav Sub-assembly and Sub- System Testing- Testing Complete UAV, Environmental testing – Testing Complete UAV-Control Station testing-Catapult Launch systems -System In flight Testing- Test sites-Test Crew training-Onsite preparation - System Certification.

UNIT -4- (08 HOURS)

Deployment of unmanned aerial system: Operational trails-network centric operations-Radar confusion-Missile Decoy-radio relay- Electronic Intelligence-Covert Reconnaissance and surveillance Target designation by laser, NBC contamination Monitoring-Long Range reconnaissance and strike- Aerial photography- Information services-communication relay- landmine detection and Destruction-other applications

UNIT -5- (08 HOURS)

Communication payloads and path planning: Payloads-Telemetry-tracking-Aerial photography, Frequency range – Commands- Control, FPV videos - Flight computer sensor-displays, RF modems, Simulation and ground testing, Trouble shooting, waypoints navigation and ground control software.

TEXT BOOKS

1. Armand J. Chaput, "Design of Unmanned Air Vehicle Systems", Lockheed Martin Aeronautics Company, 2001.
2. Kimon P. Valavanis, "Advances in Unmanned Aerial Vehicles: State of the Art and the Road to Autonomy", Springer, 2007.
3. Paul G Fahlstrom, Thomas J Gleason, "Introduction to UAV Systems", UAV Systems, Inc, 1998.

REFERENCE BOOKS

1. Reg Austin, "Unmanned Aircraft systems-UAVs Design, Development and Deployment", WILEY Publication, 2010.
2. Robert C. Nelson, "Flight Stability and Automatic Control", McGraw-Hill, Inc, 1998.
3. Swatton ,PJ, "Ground studies for pilots' flight planning", 6th edition, 2008.

Sl. No	ONLINE RESOURCES	LINK
1.	Udemy	www.udemy.com

2.	Coursera	www.coursera.org
3.	NPTEL	www.nptel.com

COURSE ASSESSMENT METHOD
Continuous Internal Evaluation (CIE)
Three internal assessments for 30 Marks each.
Two Learning Activities for 10 Marks each.
Semester End Examination (SEE)
Semester end examination for 100 Marks
Program Outcomes – Articulation matrix

PO	1	2	3	4	5	6	7	8	9	10	11	12	PSO1	PSO2
CO1	3	1										2		1
CO2	2	2							2			1		1
CO3	1			1	1							2		1
CO4	2								2			1		
CO5	1	2		1					2			2		

<table>
<tr><th colspan="5">ROCKETS AND MISSILES</th></tr>
<tr><td>Course Code</td><td>22MAS335</td><td></td><td>Credits</td><td>3</td></tr>
<tr><td>Hours/Week (L-T-P)</td><td>3-0-0</td><td></td><td>CIE Marks</td><td>50</td></tr>
<tr><td>Total Hrs</td><td>39</td><td></td><td>SEE Marks</td><td>50</td></tr>
<tr><td>Exam Hrs</td><td>03</td><td></td><td>Course Type</td><td>PEC</td></tr>
<tr><th colspan="5">COURSE OUTCOMES</th></tr>
<tr><td colspan="5">Course outcomes: After completion of the course, students will be able to-</td></tr>
<tr><td colspan="5">1. Design Consideration of liquid Rocket Combustion Chamber and Design Considerations of Igniter and types of igniters.
2. Describing Aerodynamic Forces and Moments. Lateral Damping Moment and Longitudinal Moment of a Rocket
3. Explain the One Dimensional and Two Dimensional rocket Motions in Free Space and Homogeneous Gravitational Fields.
4. Understand various methods of thrust determinations and thrust vector control. It will also describe the rockets Separation Techniques.
5. Understanding of selection criteria for materials and Special Requirements of Materials to Perform under Adverse Conditions.</td></tr>
<tr><th colspan="5">TEACHING METHODOLOGY</th></tr>
<tr><td colspan="5">● Blackboard teaching/PowerPoint presentation (if needed) /Flipped Classes for specified topics.
● Tutorial classes on topics covered.
● Unit tests on covered topics</td></tr>
<tr><th colspan="5">COURSE CONTENTS</th></tr>
<tr><th colspan="5">UNIT-1-(08 HOURS)</th></tr>
<tr><td colspan="5">Ignition System in rockets - types of Igniters - Igniter Design Considerations - Design Consideration of liquid Rocket Combustion Chamber, Injector Propellant Feed Lines, Valves, Propellant Tanks Outlet and Helium Pressurized and Turbine feed Systems - Propellant Slosh and Propellant Hammer - Elimination of Geysering Effect in Missiles - Combustion System of Solid Rockets.</td></tr>
<tr><th colspan="5">UNIT-2-(08 HOURS)</th></tr>
<tr><td colspan="5">Airframe Components of Rockets and Missiles - Forces Acting on a Missile While Passing Through Atmosphere - Classification of Missiles - methods of Describing Aerodynamic Forces and Moments- Lateral Aerodynamic Moment - Lateral Damping Moment and Longitudinal Moment of a Rocket - lift and Drag Forces - Drag Estimation - Body Upwash and Downwash in Missiles - Rocket Dispersion</td></tr>
<tr><th colspan="5">UNIT-3-(08 HOURS)</th></tr>
<tr><td colspan="5">One Dimensional and Two Dimensional rocket Motions in Free Space and Homogeneous Gravitational Fields - description of Vertical, Inclined and Gravity Turn Trajectories - Determination of range and Altitude Simple Approximations to Burnout Velocity.</td></tr>
<tr><th colspan="5">UNIT-4-(08 HOURS)</th></tr>
<tr><td colspan="5">Rocket Vector Control - Methods - Thrust determination - SITVC - Multistaging of rockets -Vehicle Optimization - Stage Separation Dynamics - Separation Techniques.</td></tr>
<tr><th colspan="5">UNIT-5-(07 HOURS)</th></tr>
<tr><td colspan="5">Selection of Materials - Special Requirements of Materials to Perform under Adverse Conditions.</td></tr>
<tr><th colspan="5">TEXT BOOKS</th></tr>
<tr><td colspan="5">1. G.P. Sutton, Rocket Propulsion Elements, John Wiley & Sons Inc., New York, 5th Edition, 1986.</td></tr>
<tr><th colspan="5">REFERENCE BOOKS</th></tr>
<tr><td colspan="5">2. J.W. Cornelisse, Rocket Propulsion and Space Dynamics, J.W. Freeman & Co., London, 1982.
3. Mathur, M., and Sharma, R.P, Gas Turbines and Jet and Rocket Propulsion, Standard Publishers, New Delhi, 1991.</td></tr>
</table>

Sl. No	ONLINE RESOURCES	LINK
1.	MOOC	http://nptel.ac.in/courses/112106073/

2.	e-book	https://www.nasa.gov/pdf/635963main_RocketsPeopleVolume2-ebook.pdf

COURSE ASSESSMENT METHOD

Continuous Internal Evaluation (CIE)

Three internal assessments for **30** Marks each.

Two Learning Activities for **10** Marks each.

Semester End Examination (SEE)

Semester end examination for 100 Marks

Program Outcomes – Articulation matrix

PO	1	2	3	4	5	6	7	8	9	10	11	12	PSO1	PSO2
CO1	3	3	2				1					1	2	1
CO2	3	3	2				1					1	2	1
CO3	3	3	2				1					1	2	1
CO4	3	3	2				1					1	2	1
CO5	3	3	2				1					1	2	1

SEMESTER – IV

PROJECT WORK PHASE-II				
Course Code	**22MAS41**		**Credits**	**18**
Hours/Week (L-T-P)	**0-8-0**		**CIE Marks**	**100**
Total Hrs	**50**		**SEE Marks**	**100**
Exam Hrs	**3**		**Course Type**	**Project**

COURSE OUTCOMES

1. Project work phase-II: 16-week duration during 4th semester. Evaluation shall be done by the committee constituted comprising of HoD as Chairman, Guide and Senior faculty of the department.
2. Project Evaluation: Evaluation shall be taken up at the end of 4th semester. Project work evaluation and Viva-Voce examination shall conducted
3. Project evaluation:
   a. Internal Examiner shall carry out the evaluation for 50 marks.
   b. External Examiner shall carry out the evaluation for 50 marks.
   c. The average of marks allotted by the internal and external examiner shall be the final marks of the project evaluation.
   d. Viva-Voce examination of Project work shall be conducted jointly by Internal and External examiner for 100 marks.

Program Outcomes – Articulation matrix

PO	1	2	3	4	5	6	7	8	9	10	11	12	PSO1	PSO2
CO1	3	2						3	3			3	3	3
CO2	3	2						3	3			3	3	3
CO3	2	2						3	3			2	3	2
CO4	2	2						3	3			3	3	2
CO5	3	2						3	3			3	3	3

NITTE EDUCATION TRUST | NITTE MEENAKSHI INSTITUTE OF TECHNOLOGY

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DEPARTMENT OF AERONAUTICAL ENGINEERING

KNOWLEDGE • CHARACTER • UNITY

SYLLABUS, SCHEME OF TEACHING AND EXAMINATION

M.Tech., in DEFENCE TECHNOLOGY

2022-2024

VISION AND MISSION

INSTITUTION

VISION

To provide India and the World, Technical Manpower of Highest Academic Excellence by Shaping Our Youth through Holistic and Integrated Education of the Highest Quality.

MISSION

To develop Nitte Meenakshi Institute of Technology through Quality, Innovative and State-of-art educational initiatives into a center of academic excellence that will turn out youth with well- balanced personality & commitment to rich cultural heritage of India and who will successfully face the Scientific and Technological challenges in the fast-evolving Global scenario with a high degree of credibility, integrity and ethical standards.

DEPARTMENT

VISION

To see the students of this department, excel in research, design and innovation in the field of Aeronautical Engineering, thereby contributing to meet the evolving global needs and to be professional and well-balanced Aeronautical Engineers exhibiting moral and ethical values.

MISSION

The department of Aeronautical Engineering strives for excellence by applying and imparting knowledge in the field of Aeronautical Engineering through comprehensive educational program, industrial visits, interaction with experts from industry and similar co-curricular activities coupled with leadership qualities.

PROGRAM EDUCATIONAL OBJECTIVES (PEOS)

PEO 1: To develop strong foundation in students to understand and analyses advance research problems in Defence Technology.

PEO 2: Nurture professional graduates to develop ability in analyzing real life problems of Space Technology.

PEO 3: To foster attitude towards continuous learning for developmental activities in research, academia and industry.

PEO 4: To improve professional skills for teamwork with ethical awareness and practice in achieving goal.

PROGRAM OUTCOMES OF M. Tech. DEFENCE TECHNOLOGY

PO1- Acquire technical competence, comprehensive knowledge and understanding the methodologies and technologies of industrial / process automation, principles and practices of energy management.

PO2- Ability to apply the knowledge of mathematics, science, engineering and technology. Understand in detail, analyze, formulate and solve the issues pertaining to the application of automation technologies in a range of industrial settings.

PO3- Acquiring the ability to identify, investigate, understand and analyze complex problems pertaining to power management and automation in industries and identify effective solution strategies for implementation.

PO4- Inculcate the role of research in developing and maintaining knowledge of the state-of-the- art in various technologies and automation in industries. Acquire the skill to design, develop and modify systems in hardware and software platforms to meet desired needs within realistic constraints

PO5- Create, select and apply appropriate techniques, resources, modern engineering and IT tools to complex engineering activities in the field of automation, control and energy management.

PO6-Acquire the capacity to understand and summarize complex information pertaining to various fields of engineering in industries. Function effectively as an individual, and as a member or leader in a team.

PO7 -Acquire the skill to develop specifications, implement and critically assess projects and their outcomes. Demonstrate management, leadership and entrepreneurial skills, and apply these to one’s own work, as a member and a leader in a team to manage projects in multidisciplinary environments.

PO8-Ability to communicate effectively in both oral and written contexts in the form of technical papers, project reports, design documents and seminar presentations.

PO9- Recognize the need for, and acquire the ability to engage in self-improvement through continuous professional development and life-long learning to maintain an up-to-date knowledge of contemporary issues in various fields of engineering.

PO10- Apply and commit to professional ethics and responsibilities of engineering practice. Understand the importance of sustainability and cost effectiveness in design and development of engineering solutions for industries and their impacts in societal and environmental context. Demonstrate awareness of societal, safety, health, legal and cultural issues relevant to professional engineering practice.

PO11- Impart an eagerness to conduct investigation and research on chosen field of study and thus keep moving towards being adaptive, self-reliant and self-evaluative.

PROGRAM SPECIFIC OUTCOMES

PSO1. Professional skills: Able to utilize the knowledge of Defence Technology in innovative, dynamic and challenging environment for design and development of new products

PSO2. Professional skills: Imparted through simulation language skills and general-purpose CAE packages to solve practical, design and analysis problems of components to complete the challenge of airworthiness for flight vehicles.

PSO3. Practical implementation and testing skills: Providing different types of in house and training and industry practice to fabricate and test and develop the products with more innovative technologies.

PSO4. Successful career and entrepreneurship: To prepare the students with broad aerospace knowledge to design and develop systems and subsystems of aerospace and allied systems and become technocrats.

DEPARTMENT OF AERONAUTICAL ENGINEERING

Scheme of Teaching and Examination and Syllabus

M.Tech. in DEFENCE TECHNOLOGY

SEMESTER – I

Sl. No	Course	Course Code	Course Title	Teaching Hours per Week			Examination				Credits
				Theory	Practical/Seminar	Tutorial/ Skill Development	Duration in hours	CIE Marks	SEE Marks	Total Marks	
				L	P	T/SDA					
1	BSC	22AEM11	Advanced Engineering Mathematics	03	00	00	03	50	50	100	3
2	IPCC	22DTX12	Systems and Warfare Platforms	03	02	00	03	50	50	100	4
3	PCC	22DTX13	Warfare Simulation and Strategies	03	00	02	03	50	50	100	4
4	PCC	22DTX14	Aerodynamics	02	00	02	03	50	50	100	3
5	PCC	22DTX15	Aerospace Propulsion	02	00	02	03	50	50	100	3
6	MCC	22RMI16	Research Methodology and IPR	03	00	00	03	50	50	100	3
7	PCCL	22DTXL17	Systems, Warfare Platforms, Warfare Simulation and Strategies Lab	01	02	00	03	50	50	100	2
8	AUD/AEC	22AUD18/ 22AEC18	BOS recommended ONLINE courses	Classes and evaluation procedures are as per the policy of the online course providers.							PP
TOTAL				**17**	**04**	**06**	**21**	**350**	**350**	**700**	**22**

M.Tech. in DEFENCE TECHNOLOGY (AEROSPACE TECHNOLOGY - SPECIALIZATION)
SEMESTER – II

Sl. No	Course	Course Code	Course Title	Teaching Hours /Week			Examination				Credits
				Theory	Practical/ Seminar	Tutorial/ Skill Development Activities	Duration in hours	CIE Marks	SEE Marks	Total Marks	
				L	P	T/SDA					
1	PCC	22DTA21	Aerospace System Configuration, Design and Simulation	02	00	02	03	50	50	100	3
2	IPCC	22DTA22	Guidance and control	03	02	00	03	50	50	100	4
3	PEC	22DTA23x	Professional elective 1	02	00	02	03	50	50	100	3
4	PEC	22DTA24x	Professional elective 2	02	00	02	03	50	50	100	3
5	MPS	22DTA25	Mini Project with Seminar	00	04	02	--	100	--	100	3
6	PCCL	22DTAL26	Aerospace System Configuration, Design and Simulation, and Guidance and control Lab	01	02	00	03	50	50	100	02
7	AUD/ AEC	22AUD27/22AEC27	BOS recommended ONLINE courses	Classes and evaluation procedures are as per the policy of the online course providers.							PP
TOTAL				**10**	**08**	**08**	**15**	**350**	**250**	**600**	**18**

Professional Elective 1		Professional Elective 2	
Course Code under 22DTX23X	**Course title**	**Course Code under 22DTX24X**	**Course title**
22DTA231	Communication Technology	22DTA241	Computational Methods in Aerospace
22DTA232	Advanced Light Weight Composite Materials and Structures	22DTA242	Hypersonic Aerodynamics
22DTA233	Advanced Thermal Engineering	22DTA243	Military Electronics System Engineering
22DTA234	Advanced Mechanical Engineering	22DTA244	Orbital Mechanics and Space Flight
22DTA235	Autonomy and Navigation Technology	22DTA245	Air independent propulsion & batteries

M.Tech. in DEFENCE TECHNOLOGY (AEROSPACE TECHNOLOGY - SPECIALIZATION)

SEMESTER – III

Sl. No	Course	Course Code	Course Title	Teaching Hours /Week			Examination				Credits
				Theory	Practical/ Mini–Project/ Internship	Tutorial/ Skill Development Activities	Duration in hours	CIE Marks	SEE Marks	Total Marks	
				L	P	SDA					
1	PCC	22DTA31	System Engineering and Analysis	03	00	02	03	50	50	100	4
2	PEC	22DTA32X	Professional elective 3	03	00	00	03	50	50	100	3
3	OEC	22DTA33X	Open elective Courses-1	03	00	00	03	50	50	100	3
4	PROJ	22DTA34	Project Work phase -1	00	06	00	--	100	--	100	3
5	SP	22DTA35	Societal Project	00	06	00	--	100	--	100	3
6	INT	22DTAI36	Internship	(06 weeks Internship Completed during the intervening vacation of II and III semesters.)			03	50	50	100	6
TOTAL				**09**	**12**	**03**	**12**	**400**	**200**	**600**	**22**

M.Tech. in DEFENCE TECHNOLOGY (AEROSPACE TECHNOLOGY - SPECIALIZATION)

Professional elective 3		**Open elective -1**	
Course Code under 22DTX32X	**Course title**	**Course Code under 22DTX33X**	**Course title**
22DTA321	Structural Dynamics and Aeroelasticity	22DTA331	Sensor Technology
22DTA322	Safety, Health & Hazard Management	22DTA332	Launch Vehicle Design and Analysis
22DTA323	Advanced Analytical Techniques	22DTA333	Data Acquisition, Tracking and Post Flight Analysis
22DTA324	Defence Electro Optics and Imaging Systems	22DTA334	Unmanned Aerial Vehicle
22DTA325	Fundamental of Telemetry, Telecommand and Transponder	22DTA335	Rockets and Missiles
22DTA326	Jamming and ECM/ECCM Technologies	22DTA336	Trajectories Modelling and Simulation
22DTA327	Software Defined Radios	22DTA337	Acquisition, Tracking and Pointing Technology
22DTA328	EMI/EMC in Military Systems	22DTA338	Advanced Digital Modulation Technologies and Standards
22DTA329	Test Methodologies for DEW Systems (Lasers & Microwave)	22DTA339	Modeling and Simulation of Laser Matter Interaction

M.Tech. in DEFENCE TECHNOLOGY (AEROSPACE TECHNOLOGY - SPECIALIZATION)

SEMESTER – IV

Sl. No	Course	Course Code	Course Title	Teaching Hours /Week		Examination				Credits
				Theory	Practical/Field work	Duration inhours	CIE Marks	SEE Marks Vivavoce	Total Marks	
				L	P					
1	Project	22DTA41	Project work phase-2	--	08	03	100	100	200	18
			TOTAL	**--**	**08**	**03**	**100**	**100**	**200**	**18**

M.Tech. in DEFENCE TECHNOLOGY (COMMUNICATION SYSTEMS AND SENSORS - SPECIALIZATION)

SEMESTER – II

Sl. No	Course	Course Code	Course Title	Teaching Hours /Week			Examination				Credits
				Theory	Practical/ Seminar	Tutorial/ Skill Development Activities	Duration in hours	CIE Marks	SEE Marks	Total Marks	
				L	P	T/SDA					
1	PCC	22DTC21	Digital and Satellite Communication and Navigation from Space	02	00	02	03	50	50	100	3
2	IPCC	22DTC22	Radar Technologies	03	02	00	03	50	50	100	4
3	PEC	22DTC23x	Professional elective 1	02	00	02	03	50	50	100	3
4	PEC	22DTC24x	Professional elective 2	02	00	02	03	50	50	100	3
5	MPS	22DTC25	Mini Project with Seminar	00	04	02	--	100	--	100	3
6	PCCL	22DTCL26	Digital Satellite Communication & Navigation from Space Lab	01	02	00	03	50	50	100	02
7	AUD/ AEC	22AUD27/22AEC27	BOS recommended ONLINE courses	Classes and evaluation procedures are as per the policy of the online course providers.							PP
TOTAL				**10**	**08**	**08**	**15**	**350**	**250**	**600**	**18**

M.Tech. in DEFENCE TECHNOLOGY (COMMUNICATION SYSTEMS AND SENSORS - SPECIALIZATION)

Professional Elective 1		**Professional Elective 2**	
Course Code under 22DTC23X	**Course title**	**Course Code under 22DTC24X**	**Course title**
22DTC231	EMI/EMC in Military systems	22DTC241	Software Defined Radio
22DTC232	Defence Electro Optics and Imaging Systems	22DTC242	Sensor Technologies
22DTC233	Jamming and ECM/ECCM technologies	22DTC243	Test Methodologies for DEW systems(Lasers and Microwave Systems
22DTC234	Communication Technology	22DTC244	Modelling and Simulation of Laser matter Interaction
22DTC235	Autonomy and Navigation Technology	22DTC245	Military Electronics System Engineering

M.Tech. in DEFENCE TECHNOLOGY (COMMUNICATION SYSTEMS AND SENSORS - SPECIALIZATION)

SEMESTER – III

Sl. No	Course	Course Code	Course Title	Teaching Hours /Week			Examination				Credits
				Theory	Practical/ Mini– Project/ Internship	Tutorial/ Skill Development Activities	Duration in hours	CIE Marks	SEE Marks	Total Marks	
				L	P	SDA					
1	PCC	22DTC31	Advanced Digital Modulation Technologies and Standards.	03	00	02	03	50	50	100	4
2	PEC	22DTC32X	Professional elective 3	03	00	00	03	50	50	100	3
3	OEC	22DTC33X	Open elective Courses-1	03	00	00	03	50	50	100	3
4	PROJ	22DTC34	Project Work phase -1	00	06	00	--	100	--	100	3
5	SP	22DTC35	Societal Project	00	06	00	--	100	--	100	3
6	INT	22DTCI36	Internship	(06 weeks Internship Completed during the intervening vacation of II and III semesters.)			03	50	50	100	6
TOTAL				**09**	**12**	**03**	**12**	**400**	**200**	**600**	**22**

M.Tech. in DEFENCE TECHNOLOGY (COMMUNICATION SYSTEMS AND SENSORS - SPECIALIZATION)

Professional elective 3		Open elective -1	
Course Code under 22DTXC2X	**Course title**	**Course Code under 22DTC33X**	**Course title**
22DTC321	Fundamental of Telemetry, Telecommand and Transponder	22DTC331	Sonar Systems Engineering
22DTC322	Safety, Health & Hazard Management	22DTC332	Air Independent propulsion & batteries
22DTC323	System Engineering & Analysis	22DTC333	Acquisition, Tracking & Pointing Technology
22DTC324	Tactical Battlefield Communication & Electronic Warfare	22DTC334	Naval Ocean Analysis and Prediction
22DTC325	Advanced Analytical Techniques	22DTC335	Unmanned Aerial Vehicle

M.Tech. in DEFENCE TECHNOLOGY (COMMUNICATION SYSTEMS AND SENSORS - SPECIALIZATION)
SEMESTER – IV

Sl. No	Course	Course Code	Course Title	Teaching Hours /Week		Examination				Credits
				Theory	Practical/Field work	Duration inhours	CIE Marks	SEE Marks Vivavoce	Total Marks	
				L	P					
1	Project	22DTC41	Project work phase-2	--	08	03	100	100	200	18
TOTAL				--	**08**	**03**	**100**	**100**	**200**	**18**

SEMESTER I

ADVANCED ENGINEERING MATHEMATICS				
Course Code	**22AEM11**		**Credits**	**03**
Hours/Week (L-T-P)	**3-0-0**		**CIE Marks**	**50**
Total Hrs	**39**		**SEE Marks**	**50**
Exam Hrs	**03**		**Course Type**	**BSC**

COURSE OUTCOMES

Course outcomes: After completion of the course, students will be able to-

1. Apply the concepts of Fourier analysis, Integral transforms and Series solution techniques for problem solving
2. Apply the numerical techniques to solve complex problems
3. Apply the concept of Probability sampling and estimation for solving problems.
4. Use the concepts of Transforms, ODE, PDE, probability to model problems arising in defence and Aerospace.
5. Apply the concept of optimization and game theory.

TEACHING METHODOLOGY

- Blackboard teaching/PowerPoint presentation (if needed) /Flipped Classes for specified topics.
- Tutorial classes on topics covered.
- Unit tests on covered topics

COURSE CONTENTS

UNIT-1-(10 HOURS)

Numerical Methods for Differential equations: RK 4th order methods for IVP, Simultaneous equations. Adam-Bashforth multi step methods. Explicit Schmidt, Dufort-Franknel methods, Crank Nicholson method for 1-D Diffusion and Convection equations Series solution, Frobenious method, Bessel Equation

UNIT-2-(10 HOURS)

Fourier Series expansion of periodic functions, Fitting Harmonics for given data, Fourier Complex, Sine and Cosine transforms Laplace transform and Inverse Laplace transform for Standard functions. Solution of IVP

UNIT-3-(10 HOURS)

Solution of system of Equation-Gauss elimination, LU decomposition Eigen values and Eigen vectors- Power method, Jacobi, Rutisha user method Interpolation using Lagrangian and Newton's Formulae, Cubic spline. Numerical integration using Simpson's 1/3rd and 3/8th Rule

UNIT-4-(10 HOURS)

Random variables- Discrete and continuous, Probability distribution, probability density function, mean, variance, Joint Distribution (Discrete and Continuous) Binomial, Poisson, Normal Distribution. Sampling Distribution, Confidence Interval for estimation of mean, Testing of Hypothesis for Large and small samples, ANOVA

UNIT-5-(10 HOURS)

Testing of Hypothesis for Large and small samples, ANOVA, Randomized Block Design Game theory, principle of dominance, Graphical method, Linear programming method, Applications to Defence and Aerospace

TEXT BOOKS

1. Applied statistics and Probability for Engg. Douglas C montgomery, George C Runger, Sixth edition, Wiley, 2016
2. Numerical Algorithms EV Krishna Murthy and SK Sen East west press 2007
3. Kreyszig: Advanced engineering mathematics, Publisher: Wiley, 10th edition 2016

REFERENCE BOOKS

1. Probability and Stastistics MR Speigen, JJ schiller, R A Srinivasan and D Goswami. Sachaum's outline Mcgraw Hill 3rd edition 2010.
2. Operation research VK Kapoor, S Chand & sons
3. Theory and Analysis of Experimental Designs B L Agarwal, CBS publisher 2010

COURSE ASSESSMENT METHOD

Continuous Internal Evaluation (CIE)

Three internal assessments for **30** Marks each.
Two Learning Activities for **10** Marks each.
Semester End Examination (SEE)
Semester end examination for 100 Marks
Program Outcomes – Articulation matrix

PO	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**PSO1**	**PSO2**
CO1	3								3	3				3
CO2	3	3	3						3	3				3
CO3	3	2	3						3	2				2
CO4	3	3	3						3	3				3
CO5	3	3	3						3	3				3

SYSTEMS AND WARFARE PLATFORMS

Course Code	**22DTX12**		**Credits**	**04**
Hours/Week (L-T-P)	**3-2-0**		**CIE Marks**	**50**
Total Hrs	**50**		**SEE Marks**	**50**
Exam Hrs	**03**		**Course Type**	**IPCC**

COURSE OUTCOMES

Course outcomes: At the end of the course the student will be able to:

1. Understand types of warfare platform used for Army, Air and Marine and their design fundamentals.
2. Understand the weapon systems like guns, ordnance, missiles projectiles, mines/ countermines, lasers, undersea weapons, air-launched weapons, anti-aircraft, anti-ship and anti-submarine
3. Understand the Mechanics of flight
4. Understand the Weapon systems
5. Understand the Self defence and Protection systems

TEACHING METHODOLOGY

- Blackboard teaching/PowerPoint presentation (if needed) /Flipped Classes for specified topics.
- Tutorial classes on topics covered.
- Unit tests on covered topics

COURSE CONTENTS

UNIT-1- (10 HOURS)

Types of platforms: land, sea and air; Lifecycle: concept, design, pre-production, production, operations, support, major aspects of different platforms, qualitative and quantitative treatment of major aspects

UNIT- 2 - (10 HOURS)

Ship design fundamentals: buoyancy, stability, ship resistance, survivability; damage control, NBCD, crew numbers, power requirements. Submarine design: buoyancy, stability, hull/tank design, air interdependence

UNIT-3-(10 HOURS)

Mechanics of flight: fixed and rotary wing, straight and level flight of aircraft, aircraft control and movement, aircraft control surfaces, aerodynamics, power requirements, range; speed, ceiling, survivability, payload.
Military vehicle fundamentals: tracked, wheeled, A, B and C vehicles

UNIT-4-(10 HOURS)

Weapon systems: guns, ordnance, missiles, rockets, bombs, sub- munitions, projectiles, mines/ countermines, lasers, undersea weapons, air-launched weapons, anti-aircraft, anti-personnel, anti-ship, anti-submarine

UNIT-5-(10 HOURS)

Self defence and Protection systems: Armour, smoke, chaff, decoys; Introduction to instrumentation, lab tests and flight trials, Other protection systems, unconventional and innovative concepts.

TEXT BOOKS

1. Nunney, Light And Heavy Vehicle Technology, Publisher Elsevier, Fourth Edition,2006.
2. Bonnick Allan et. Al, Practical approach to motor vehicle engineering and maintenance, Publisher: Yesdee.
3. Trelleborg, Automotive Vibration Control Technology, Fundamentals, Materials, Construction, Simulation, and Applications, Publisher:, Vogel Business Media GmbH & Co. KG, 1st edition, 2015.
4. Yacov Bar-Shlomo, An Introduction to Weapons Systems, Create Space Independent Publishing Platform.

REFERENCE BOOKS

1. Ian Nicholson, Heavy Vehicle Mechanics, Publisher: McGraw-Hill Education, Europe,2001.
2. Alastair D. McAulay, Military Laser Technology for Defense: Technology for Revolutionizing 21st Century Warfare, Publisher : Wiley-Interscience, 1st edition, 2011
3. Literature / books suggested by respective course Lecturers

COURSE ASSESSMENT METHOD

Continuous Internal Evaluation (CIE)

Three internal assessments for **30**Marks each.

Two Learning Activities for **10** Marks each.

Semester End Examination (SEE)														
Semester end examination for 100 Marks														
Program Outcomes – Articulation matrix														
PO	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**PSO1**	**PSO2**
CO1	3								3	3				3
CO2	3	3	3						3	3				3
CO3	3	2	3						3	2				2
CO4	3	3	3						3	3				3
CO5	3	3	3						3	3				3

WARFARE SIMULATIONS & STRATEGIES				
Course Code	**22DTX13**		**Credits**	**04**
Hours/Week (L-T-P)	**3-0-2**		**CIE Marks**	**50**
Total Hrs	**50**		**SEE Marks**	**50**
Exam Hrs	**03**		**Course Type**	**PCC**

COURSE OUTCOMES

Course outcomes: At the end of the course the student will be able to:

1. Understand the systems used in warfare scenario.
2. Understand the military capabilities during the warfare
3. Understand combat simulation & modelling
4. Understand the mathematical models in designing the simulations.
5. Understand the war gaming simulation & modelling and human factor representation.

TEACHING METHODOLOGY

- Blackboard teaching/PowerPoint presentation (if needed) /Flipped Classes for specified topics.
- Tutorial classes on topics covered.
- Unit tests on covered topics

COURSE CONTENTS

UNIT-1-(10 HOURS)

Introduction to Warfare systems: Tactical mission support system, mission planning: air, surface, naval vessels, subsurface, littoral, electronic, command and control, aviation support systems.

UNIT-2-(10 HOURS)

Military capabilities: air warfare, surface warfare, subsurface warfare, littoral warfare, surveillance and reconnaissance, interior and exterior communications, top side design, weapons, sensors, navigation.

UNIT-3-(10 HOURS)

Combat strategies: Introduction to the methods used in modeling combat and their application in support of defence decision making and training, Combat simulation: dog fighting, interception.

UNIT-4-(10 HOURS)

War simulation: Wargaming/interactive simulation, war strategies, Lanchester's equations, Mathematical models of combat, Relation to the salvo combat model, Lotka -Volterra equations, scoring systems.

UNIT-5-(10 HOURS)

Applications to real world: War gaming and combat modeling in practice, manual wargaming, Human factors representation in war gaming and combat modeling, Network and Non-network.

TEXT BOOKS

1. Defense Modeling, Simulation, and Analysis: Meeting the Challenge", Publisher: National Academies Press, October 22, 2006
2. David L, Adamy: Introduction to Electronic Warfare Modeling and Simulation, Publisher : Artech Print on Demand, October 31, 2002

REFERENCE BOOKS

1. An-dreas Tolk (Editor), Old Dominion University, Engineering Principles of Combat Modeling and Distributed Simulation, John Wiley & Sons.

COURSE ASSESSMENT METHOD

Continuous Internal Evaluation (CIE)

Three internal assessments for **30** Marks each.

Two Learning Activities for **10** Marks each.

Semester End Examination (SEE)

Semester end examination for 100 Marks

Program Outcomes – Articulation matrix

PO	1	2	3	4	5	6	7	8	9	10	11	12	PSO1	PSO2

CO1	3	3	2	-	-				2				-	3
CO2	3	3	2		-	-		-	2				-	3
CO3	3	3	2		-	-		-	2				-	3
CO4	3	3			-	-		-	2				-	3
CO5	3	3						-	2				-	3

AERODYNAMICS				
Course Code	**22DTX14**		**Credits**	**3**
Hours/Week (L-T-P)	**2-0-2**		**CIE Marks**	**50**
Total Hrs	**39**		**SEE Marks**	**50**
Exam Hrs	**3**		**Course Type**	**PCC**

COURSE OUTCOMES

Course outcomes: After completion of the course, students will be able to-

1. Analyze the airfoil characteristics.
2. Analyze the incompressible inviscid flows and their combinations.
3. Analyze the incompressible inviscid flow over airfoil and finite wing.
4. Analyze the subsonic linearized flow over airfoil and effect of compressibility.
5. Analyze the features of viscous flow and discuss the aerodynamic testing.

TEACHING METHODOLOGY

- Blackboard teaching/PowerPoint presentation (if needed) /Flipped Classes for specified topics
- Regular review of students by asking questions based on topics covered in the class

COURSE CONTENTS

UNIT-1 - (07 HOURS)

Governing equations: Euler and Lagrangian descriptions, Control volume approach to continuity and momentum equations, Path lines, Streamlines and Streak lines, Stream function, Velocity potential. Types of flow.

Airfoil Characteristics: Airfoil section geometry and wing plan form geometry, aerodynamic forces and moment and pressure coefficient. Centre of pressure, calculation of airfoil lift and drag from measured surface pressure distributions, typical airfoil aerodynamic characteristics at low speeds. High lift Devices.

UNIT-2 - (08 HOURS)

Two-Dimensional Inviscid Incompressible Flows: Bernoulli’s equation and applications. Condition on velocity for incompressible flow. Laplace equation and boundary conditions. Two-dimensional source, sink and doublet flows and vortex flow and combinations of elementary flows.

Flow over Circular Cylinders: Non-lifting flow over a two-dimensional circular cylinder, Lifting flow over a two-dimensional circular cylinder, Kutta-Joukowski theorem and generation of lift, D’Alembert’s paradox.

UNIT-3 - (08 HOURS)

Incompressible Flow over Airfoils: Kelvin’s circulation theorem and the starting vortex, Kutta condition, Classical thin airfoil theory for symmetric and cambered airfoils.

Incompressible Flows over Finite Wings: Downwash, Induced drag, vortex filament, the Biot-Savart Law, Prandtl’s lifting line theory and its limitations, Elliptic lift distribution. Simplified horse-shoe vortex model, formation flight, influence of downwash on tail plane, ground effects.

UNIT-4 - (08 HOURS)

Subsonic linearized flow over airfoils: Full velocity potential equation, linearized velocity potential equation and boundary condition, Prandtl-Glauert compressibility correction.

Effects of Compressibility: Basics of speed of sound, Mach waves, Normal shock waves, Oblique shock waves, Expansion fan, Prandtl – Meyer expansion, Critical Mach number; Drag- divergence Mach number, Sound Barrier, Transonic area rule. Swept wing.

UNIT-5 - (08 HOURS)

Viscous Flows: Derivation of Navier-Stokes equation for two-dimensional flows, boundary approximations, laminar boundary equations and boundary conditions, Blasius solution, qualitative features of boundary layer flow under pressure gradients, aspects of transition to turbulence, turbulent boundary layer properties over a flat plate at low speeds.

Introduction to Aerodynamic Testing: Principles of wind tunnel flow simulation, Classification and Major features of subsonic, supersonic and hypersonic wind tunnels. Flow visualization techniques. Measurement of pressure, velocity and Aerodynamic load measurements on a model.

TEXT BOOKS

1.
1. J.D. Anderson, Fundamentals of Aerodynamics, McGraw-Hill Education, 6th edition, 2017.
2. Rathakrishnan.E., Gas Dynamics, Prentice Hall of India, 7th edition, 2020.
3. Shapiro, AH, “Dynamics & Thermodynamics of Compressible Fluid Flow”, Ronald Press, 1982.

REFERENCE BOOKS
1. Houghton, EL and Caruthers, NB,"Aerodynamics for Engineering Students", Butterworth- Heinemann series, 7th edition 2017. 2. Zucrow, M.J, and Anderson, J.D, "Elements of gas dynamics" McGraw-Hill Book Co., New York, 1989. 3. Rae, WH and Pope, A, "Low speed Wind Tunnel Testing", John Wiley Publications, 3rd edition, 1999.
COURSE ASSESSMENT METHOD
Continuous Internal Evaluation (CIE)
Three internals tests (each 30 marks) are conducted, average of best two performances will be considered.
1. Minimum two Assignments/Model making - evaluated through rubrics for 10 marks. Average of two will be considered.
2. Tutorial classes and assessment are carried out/Surprise quiz tests are conducted and evaluated for 10 marks. Average of these two will be considered.
Semester End Examination (SEE)
1. Two Questions are to be set from each unit, carrying 20 Marks each.
2. Students have to answer 5 questions selecting one full question from each unit
Program Outcomes – Articulation matrix:

PO	1	2	3	4	5	6	7	8	9	10	11	12	PSO1	PSO2
CO1	3								3	3				3
CO2	3	3	3						3	3				3
CO3	3	2	3						3	2				2
CO4	3	3	3						3	3				3
CO5	3	3	3						3	3				3

AEROSPACE PROPULSION				
Course Code	**22DTX15**		**Credits**	**3**
Hours/Week (L-T-P)	**2-0-2**		**CIE Marks**	**50**
Total Hrs	**39**		**SEE Marks**	**50**
Exam Hrs	**3**		**Course Type**	**PCC**

COURSE OUTCOMES

Course outcomes: After completion of the course, students will be able to-

1. Apply the fundamentals of thermodynamics to compressible flows
2. Understand the working principle of air breathing propulsion systems.
3. Use cycle analysis and assess performance of air breathing engines
4. Analyze the performance parameters of various rocket propulsion systems.
5. Understand the concepts of advanced propulsion systems.

TEACHING METHODOLOGY

- Blackboard teaching/PowerPoint presentation (if needed) /Flipped Classes for specified topics.
- Tutorial classes on topics covered.
- Unit tests on covered topics

COURSE CONTENTS

UNIT -1- (07 HOURS)

Review of thermodynamics: Work and energy interactions, Representation of isothermal, isentropic, isobaric and isochoric processes on P-V and T-S diagrams, Classical thermodynamics, conservation equations for systems and control volumes, one dimensional flow of a compressible perfect gas – isentropic and non-isentropic flows. Propulsion system performance, the gas generator Brayton cycle, zero dimensional analysis of ideal ramjet, turbojet and turbofan cycles, non-ideality and isentropic efficiencies. Performance analysis of inlets and nozzles, gas turbine combustors, compressors and turbines and discussion of factors limiting performance.

UNIT -2- (08 HOURS)

Basics of Air breathing Propulsion: Introduction to various air breathing and non-air breathing engines. Principle of thrust generation, Brayton cycle, types of air-breathing propulsion systems, components of jet engine and their functions, diffuser design for subsonic and supersonic flights, preliminary aspects of axial flow compressor and turbines, types of combustors, convergent nozzle, CD Nozzle, flow through nozzles – optimal, under and over expanded nozzles.

UNIT -3- (08 HOURS)

Performance of Air breathing engines: Ideal cycle analysis, efficiencies of components and non-ideal cycle analysis, engine performance analysis – specific thrust, specific fuel consumption, propulsive, thermal and overall efficiencies. Efficiencies of air breathing and non-air breathing engines.

UNIT -4- (08 HOURS)

Rocket Propulsion: Classification based on energy system, nozzle and Thrust Equation; Specific Impulse, Thrust Coefficient, Characteristic Velocity and other Performance Parameters; liquid rocket engine, components and propellants, solid rocket propellants, performance parameters and motor design, hybrid rocket propulsion systems, selection of rocket propulsion systems, thrust vector control methods, rocket exhaust plumes, rocket testing.

UNIT -5- (08 HOURS)

Advanced Propulsion: Scramjet and pulse jet engines - principle of operation. Electric propulsion thrusters: classification, principle and application. nuclear propulsion system, concepts, design and application, Recent Micro Spacecraft Developments; Micro-propulsion Options; Primary Set of Micro-propulsion Requirements

TEXT BOOKS

1. Cohen, H, Saravanamuttoo, HIH., Rogers, GFC, Paul Straznicky and Andrew Nix, “Gas Turbine Theory”, Pearson Education Canada; 7th edition, 2017.
2. Gill,WP, Smith,HJ & Ziurys,JE, “Fundamentals of Internal Combustion Engines as applied to Reciprocating, Gas turbine & Jet Propulsion Power Plants”, Oxford & IBH Publishing Co., 1980.
3. Hill, PG. & Peterson, CR. “Mechanics & Thermodynamics of Propulsion” Pearson education, 2 nd edition, 2014.

REFERENCE BOOKS
1. Oates, GC,"Aerothermodynamics of Aircraft Engine Components", AIAA Education Series, 2007. 2. Sutton,GP, "Rocket Propulsion Elements", John Wiley & Sons Inc., New York, 9th Edition, 2017. 3. J Seddon & E L Goldsmith. "Intake Aerodynamics", AIAA education series. 1999.
COURSE ASSESSMENT METHOD
Continuous Internal Evaluation (CIE)
Three internal assessments for 30 Marks each.
Two Learning Activities for 10 Marks each.
Semester End Examination (SEE)
Semester end examination for 100 Marks
Program Outcomes – Articulation matrix

PO	1	2	3	4	5	6	7	8	9	10	11	12	PSO1	PSO2
CO1	3	1										2		1
CO2	2	2							2			1		1
CO3	1			1	1							2		1
CO4	2								2			1		
CO5	1	2		1					2			2		

RESEARCH METHODOLOGY AND IPR				
Course Code	**22RMI16**		**Credits**	**3**
Hours/Week (L-T-P)	**3-0-0**		**CIE Marks**	**50**
Total Hrs	**39**		**SEE Marks**	**50**
Exam Hrs	**3**		**Course Type**	**MCC**

COURSE OUTCOMES

Course outcomes: After completion of the course, students will be able to-

1. Understand research methodology and the technique of defining a research problem.
2. Understand the process and method of the literature review in research, carrying out a literature search and writing a review.
3. Collect and designing the sampling data for research work.
4. Verify the Test data and report writing research reports.
5. Understand the concepts of intellectual property rights.

TEACHING METHODOLOGY

- Blackboard teaching/PowerPoint presentation (if needed) /Flipped Classes for specified topics.
- Tutorial classes on topics covered.
- Unit tests on covered topics

COURSE CONTENTS

UNIT -1- (07 HOURS)

Research Methodology: Introduction, Meaning of Research, Objectives of Research, Motivation in Research, Types of Research, Research Approaches, Significance of Research, Research Methods versus Methodology, Research and Scientific Method, Importance of Knowing How Research is Done, Research Process, Criteria of Good Research, and Problems Encountered by Researchers in India. Defining the Research Problem: Research Problem, Selecting the Problem, Necessity of Defining the Problem, Technique Involved in Defining a Problem, An Illustration.

UNIT -2- (08 HOURS)

Reviewing the literature: Place of the literature review in research, bringing clarity and focus to your research problem, improving research methodology, broadening knowledge base in research area, enabling contextual findings, how to review the literature, searching the existing literature, reviewing the selected literature, developing a theoretical framework, developing a conceptual framework, writing about the literature reviewed. Research Design: Meaning of Research Design, need for Research Design, features of a Good Design, Important Concepts Relating to Research Design, Different Research Designs, Basic
Principles of Experimental Designs, Important Experimental Designs.

UNIT -3- (08 HOURS)

Design of Sampling: Introduction, Sample Design, Sampling and Non sampling Errors, Sample Survey versus Census Survey, Types of Sampling Designs. Measurement and Scaling: Qualitative and Quantitative Data, Classifications of Measurement Scales, Goodness of Measurement Scales, Sources of Error in Measurement Tools, Scaling, Scale Classification Bases, Scaling Technics, Multidimensional Scaling, Deciding the Scale. Data Collection: Experimental and Surveys, Collection of Primary Data, Collection of Secondary Data,
Selection of Appropriate Method for Data Collection, Case Study Method

UNIT -4- (08 HOURS)

Testing of Hypotheses: Hypothesis, Basic Concepts Concerning Testing of Hypotheses, Testing of Hypothesis, Test Statistics and Critical Region, Critical Value and Decision Rule, Procedure for Hypothesis Testing, Hypothesis Testing for Mean, Proportion, Variance, for Difference of Two Mean, for Difference of Two Proportions, for Difference of Two Variances, P-Value approach, Power of Test, Limitations of the Tests of Hypothesis. Chi-square Test: Test of Difference of more than Two Proportions, Test of Independence of Attributes, Test of Goodness of Fit, Cautions in Using Chi Square Tests.

Interpretation and Report Writing: Meaning of Interpretation, Technique of Interpretation, Precaution in Interpretation, Significance of Report Writing, Different Steps in Writing Report, Layout of the Research Report, Types of Reports, Oral Presentation, Mechanics of Writing a Research Report, Precautions for Writing Research Reports.

UNIT -5- (08 HOURS)

Intellectual Property: The Concept, Intellectual Property System in India, Development of TRIPS Complied Regime in India, Patents Act, 1970, Trade Mark Act, 1999,The Designs Act, 2000, The Geographical Indications of Goods (Registration and Protection) Act1999, Copyright Act,1957,The Protection of Plant Varieties and Farmers' Rights Act, 2001,The Semi-Conductor Integrated Circuits Layout Design Act, 2000, Trade Secrets, Utility Models, IPR and Biodiversity, The Convention on Biological Diversity (CBD) 1992, Competing Rationales for Protection of IPRs, Leading International Instruments Concerning IPR, World Intellectual Property Organisation (WIPO),WIPO and WTO, Paris Convention for the Protection of Industrial Property, National Treatment, Right of Priority, Common Rules, Patents, Marks, Industrial Designs, Trade Names, Indications of Source, Unfair Competition, Patent Cooperation Treaty (PCT), Advantages of PCT Filing, Berne Convention for the Protection of Literary and Artistic Works, Basic Principles, Duration of Protection, Trade Related Aspects of Intellectual Property Rights(TRIPS) Agreement, Covered under TRIPS Agreement, Features of the Agreement, Protection of Intellectual Property under TRIPS, Copyright and Related Rights, Trademarks, Geographical indications, Industrial Designs, Patents, Patentable Subject Matter, Rights Conferred, Exceptions, Term of protection, Conditions on Patent Applicants, Process Patents, Other Use without Authorization of the Right Holder, Layout Designs of Integrated Circuits, Protection of Undisclosed Information, Enforcement of Intellectual Property

TEXT BOOKS

1. Research methodology: Methods and Techniques, C.R. Kothari, Gaurav Garg, New Age International,4th Edition, 2018.
2. Research Methodology a step-by-step guide for beginners. (For the topic Reviewing the literature under module 2) , Ranjit Kumar, SAGE Publications Ltd.,3rd Edition, 2011
3. Ralph D Kimberlin: Flight Testing of Fixed wing Aircraft, AIAA Education Series, 2003
4. Study Material (For the topic Intellectual Property under module 5), Professional Programme Intellectual Property Rights, Law and Practice, The Institute of Company Secretaries of India, Statutory Body Under an Act of Parliament, September 2013.

REFERENCE BOOKS

1. An introduction to Research Methodology, Garg B.L et al ,RBSA Publishers 2002
2. Research Methodology, Sinha, S.C, Dhiman ,EssEss Publications2002
3. Research Methods: the concise knowledge base ,Trochim ,Atomic Dog Publishing ,2005
4. How to Write and Publish a Scientific Paper, Day R.A ,Cambridge University Press,1992
5. Conducting Research Literature Reviews: From the Internet to Paper ,Fink A Sage Publications,2009

COURSE ASSESSMENT METHOD

Continuous Internal Evaluation (CIE)

Three internal assessments for 30 Marks each.

Two Learning Activities for 10 Marks each.

Semester End Examination (SEE)

Semester end examination for 100 Marks

Program Outcomes – Articulation matrix

PO	1	2	3	4	5	6	7	8	9	10	11	12	PSO1	PSO2
CO1	2											2		
CO2	2											2		
CO3	1		1						1	1		3		
CO4									1			3		
CO5	2									1		2		

BOS RECOMMENDED ONLINE COURSES				
Course Code	**22AUD18/22AEC18**		**Credits**	**PP**
Hours/Week (L-T-P)			**CIE Marks**	
Total Hrs			**SEE Marks**	
Exam Hrs			**Course Type**	**AUD/AEC**

COURSE ASSESSMENT METHOD

1. Board of studies Recommended Online Courses
2. Classes and evaluation procedures are as per the policy of the online course providers.
3. A pass in AUD/AEC is mandatory for the award of the degree

SEMESTER II

AEROSPACE SYSTEM CONFIGURATION, DESIGN & SIMULATION				
Course Code	**22DTA21**		**Credits**	**03**
Hours/Week (L-T-P)	**2-0-2**		**CIE Marks**	**50**
Total Hrs	**39**		**SEE Marks**	**50**
Exam Hrs	**03**		**Course Type**	**CPP**

COURSE OUTCOMES

Course outcomes: After completion of the course, students will be able to-

1. Understand the concept of the missile system and its design requirements and process.
2. Understand the basic concepts of structural analysis.
3. Understand the methods for aero-elastic analysis, computational fluid analysis and advances in aero-dynamics.
4. Understand the basics of airplane performance.
5. Understand the concepts of stability and control and air to air, ground to air, air to ground weapon system, UAV mounted GW and UCAVs.

TEACHING METHODOLOGY

- Blackboard teaching/PowerPoint presentation (if needed) /Flipped Classes for specified topics.
- Tutorial classes on topics covered.
- Unit tests on covered topics

COURSE CONTENTS

UNIT-1-(07 HOURS)

Missiles and Systems: Introduction (aero-elastic phenomena and design requirements), Introduction to missiles & systems, basic aspects of missiles and systems, classification, conceptual and detailed design process.

UNIT-2-(08 HOURS)

Structural Analysis: A review of basic structures, Structural requirement, Structural and aerodynamic stiffness, Coupling between aerodynamics and structures, Static aero-elasticity: torsional divergence, Structural vibration and modal analysis.

UNIT-3-(08 HOURS)

Aero-elasticity And Advanced Aerodynamics: Aerodynamic loads on an oscillating lifting surface, Characteristics of flutter and important design parameters, Methods for aero-elastic analysis, Computational fluid dynamics, advances in aerodynamics (Hypersonic Flows and Aerodynamic Heating).

UNIT-4-(08 HOURS)

Aircraft Performance: Equations of motion, cruising, climb, descent, takeoff, landing, maneuver, flight path, expressions for range and endurance of propeller driven and jet driven aircrafts, v-n diagram and flight envelope

UNIT-5-(08 HOURS)

Stability and Control System's stability & control, aerodynamics control, Introduction to dynamic stability, first and second order responses, Equations of motion and modal characteristics.
Introduction to air to air, ground to air, air to ground weapon systems, UAV mounted GW and UCAVs

TEXT BOOKS

1. D. Raymer, Aircraft design a conceptual approach, Sixth Edition, September 30th 2018.
2. Michael V. Cook, Flight Dynamics Principles, Elsevier Science & Technology, Third Edition ,2013
3. Dewey H. Hodges, G. Alvin Pierce, Introduction to Structural Dynamics and Aero-elasticity, Cambridge University Press, June 2012

REFERENCE BOOKS

1. Roskam Aviation and Engineering, Airplane Aerodynamics and Performance, Chuan Tau Edward Lan, 1981.
2. Roy R. Craig Jr., Andrew J. Kurdila , Fundamentals of Structural Dynamics, 2nd edition (1st September 2006)

COURSE ASSESSMENT METHOD

Continuous Internal Evaluation (CIE)
Three internal assessments for **30** Marks each.
Two Learning Activities for10 Marks each.
Semester End Examination (SEE)
Semester end examination for 100 Marks
Program Outcomes – Articulation matrix

PO	1	2	3	4	5	6	7	8	9	10	11	12	PSO1	PSO2
CO1	3	3	2	2	-		2		2	2	-	3		
CO2	3	2	3	3	-	-	2	-	2	2	-	3		
CO3	3	3	2	3	-	-	2	-	2	1	-	3		
CO4	3	2	2	2	-	-	2	-	2	1	-	3		
CO5	3	3	3	2			2	-	2	2	-	3		

GUIDANCE AND CONTROL				
Course Code	**22TDA22**		**Credits**	**04**
Hours/Week (L-T-P)	**3-2-0**		**CIE Marks**	**50**
Total Hrs	**50**		**SEE Marks**	**50**
Exam Hrs	**03**		**Course Type**	**CPP**

COURSE OUTCOMES

Course outcomes: After completion of the course, students will be able to-

1. Understand the principles of satellite navigation, inertial navigation, radio positioning.
2. Understand various aspects of designing a navigation system
3. Develop mathematical model of missile dynamics
4. Understand methods of thrust vector control
5. Carry out simulation for aircraft/missile using mathematical tools like MATLAB

TEACHING METHODOLOGY

- Blackboard teaching/PowerPoint presentation (if needed) /Flipped Classes for specified topics.
- Tutorial classes on topics covered.
- Unit tests on covered topics

COURSE CONTENTS

UNIT-1-(10 HOURS)

Introduction: Introduction to Navigation, General principles of early conventional navigation systems. Geometric concepts of navigation. sensors used in navigation systems, Navigation Mathematics.

UNIT-2-(10 HOURS)

Global Navigation Satellite System: Fundamentals, Signals, and Satellites: Fundamentals of Satellite Navigation, Inertial Navigation, Advanced satellite Navigation, Principles of radio Positioning, Terrestrial radio Navigation, Short-Range Positioning, Satellite Navigation Processing

UNIT-3-(10 HOURS)

Instrumentation : Errors and Geometry, Dead Reckoning, Attitude, and Height Measurement, Feature matching, Integration of Inertial Navigation System / Global Navigation Satellite System.

UNIT-4-(10 HOURS)

Missile Control Methods: Elements of flight control system, Aerodynamic and Thrust Vector Control, Engine gimbal control and Secondary injection thrust vector control, Polar and Cartesian Control

UNIT-5-(10 HOURS)

Modeling, Design and Analysis: Mathematical Modeling of Missile Dynamics; Missile Actuators and Sensors. Roll and Roll Rate Stabilization. Design and Analysis of Lateral Autopilots, 6 degree of freedom trajectory simulation for aircraft / missile using MATLAB

TEXT BOOKS

1. Anthony Lawrence, Modern Inertial Technology Navigation, Guidance, and Control, Springer New York, 2012.
2. William Palm, MATLAB for Engineering Applications, McGraw-Hill Education, 4th edition (February 6, 2018).
3. Jay Farrell, The Global Positioning System & Inertial Navigation, McGraw-Hill Education, 16 December 1998

REFERENCE BOOKS

1. Grewal, M. S., Andrews, A. P., Bartone, C. G, Global Navigation Satellite Systems, Inertial Navigation, and Integration, John Wiley and Sons Inc, 2013.
2. Groves, P. D, Principles of GNSS, inertial and multisensor integrated navigation systems, Artech House.
3. Kalman, H Infinity, Optimal State Estimation.

COURSE ASSESSMENT METHOD

Continuous Internal Evaluation (CIE)

Three internal assessments for **30** Marks each.

Two Learning Activities for **10** Marks each.															
Semester End Examination (SEE)															
Semester end examination for 100 Marks															
Program Outcomes – Articulation matrix															
PO	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**PSO1**	**PSO2**	**BT**
CO1	3	3	-				2				-	3			2
CO2	3	2					3	-	-		-	3			3
CO3	3	2					2	-	-		-	3			3
CO4	3	2					2	-	-		-	3			3
CO5	3	2					3	-	-	-	-	3			3

MINI PROJECT WITH SEMINAR				
Course Code	**22DTA25**		**Credits**	**3**
Hours/Week (L-T-P)	**0-4-2**		**CIE Marks**	**100**
Total Hrs	**36**		**SEE Marks**	**100**
Exam Hrs	**3**		**Course Type**	**MPS**

Seminar is to be given by the student after the completion of a mini project chosen by the student. Topics for the mini projects can be from the aeronautical engineering and allied fields. The mini project can be based on either numerical or analytical solution or design or fully experimental; or a combination of these tasks.

COURSE ASSESSMENT METHOD

1. Internal Examiner shall carry out the evaluation for 100 marks.
2. External Examiner shall carry out the evaluation for 100 marks.
3. The average of marks allotted by the internal and external examiner shall be the final marks of the project evaluation.
4. Viva-Voce examination of Project work shall be conducted jointly by Internal and External examiner for 100 marks.

Program Outcomes – Articulation matrix

PO	1	2	3	4	5	6	7	8	9	10	11	12	PSO1	PSO2
CO1	3	2						3	3			3	3	3
CO2	3	2						3	3			3	3	3
CO3	2	2						3	3			2	3	2
CO4	2	2						3	3			3	3	2
CO5	3	2						3	3			3	3	3

AEROSPACE SYSTEM CONFIGURATION DESIGN & SIMULATION & GUIDANCE & CONTROL				
Course Code	**22DTAL26**		**Credits**	**2**
Hours/Week (L-T-P)	**1-2-0**		**CIE Marks**	**50**
Total Hrs	**30**		**SEE Marks**	**50**
Exam Hrs	**03**		**Course Type**	**PCCL**

COURSE OUTCOMES

Course outcomes: After completion of the course, students will be able to-

1. Flight dynamics and control
2. Autopilot structures
3. Various Guidance Algorithms
4. Navigation components

TEACHING METHODOLOGY

- Blackboard teaching/PowerPoint presentation (if needed) /Flipped Classes for specified topics.
- Tutorial classes on topics covered.
- Lap practical

COURSE CONTENTS

Basics of flight dynamics and control. Autopilot structures for aerospace vehicles (aircraft, missiles, launch vehicles). Equilibrium glide trajectories for atmospheric flight. Discussion of the various guidance algorithms used in aircraft/missiles/launch vehicles. Basics of Kalman filtering, sensor and data fusion. Selection and trade-off between various navigation components such as the IMU, GPS and other navigation components. Integration of the guidance, navigation and control components in aerospace vehicles.

COURSE ASSESSMENT METHOD

Record: 30 marks
Internal Test: 15 marks
Viva-voce: 05 marks
Semester End Examination: 50 Marks
Scheme of Examination: Student will be asked to conduct any one experiment from Part A & B

Program Outcomes – Articulation matrix

PO	1	2	3	4	5	6	7	8	9	10	11	12	PSO1	PSO2
CO1	3	3	2	2	-		2		2	2	-	3		
CO2	3	2	3	3	-	-	2	-	2	2	-	3		
CO3	3	3	2	3	-	-	2	-	2	1	-	3		
CO4	3	2	2	2	-	-	2	-	2	1	-	3		
CO5	3	3	3	2			2	-	2	2	-	3		

PROFESSIONAL ELECTIVE I

COMMUNICATION TECHNOLOGY				
Course Code	**22DTA231**		**Credits**	**03**
Hours/Week (L-T-P)	**3-0-0**		**CIE Marks**	**50**
Total Hrs	**39**		**SEE Marks**	**50**
Exam Hrs	**03**		**Course Type**	**PEC**

COURSE OUTCOMES

Course outcomes: After completion of the course, students will be able to-

1. Understand communication system design methodologies, communication system architecture, analogue & digital modulation techniques.
2. Computation of data rates, band width ,BER
3. To carry out the link budget analysis.
4. Analyze voice coding techniques
5. Study the performance of communication system architecture

TEACHING METHODOLOGY

- Blackboard teaching/PowerPoint presentation (if needed) /Flipped Classes for specified topics.
- Tutorial classes on topics covered.
- Unit tests on covered topics

COURSE CONTENTS

UNIT-1-(07 HOURS)

Introduction to Communication Systems, Digital Communication System, Communication Channels and Their Characteristics, Mathematical Models for Communication Channels, Design challenges, message sources, Channel effect, signal to noise ratio and capacity.

UNIT-2-(08 HOURS)

Digital data communication systems, digital signaling techniques, Link budget calculations telemetry and control and IO/IW implications, Antenna types –wire antennas, Horn Antennas, Reflector Antennas, phased array antennas

UNIT-3-(08 HOURS)

Data rates and bandwidth calculation in digital data communication systems: Pulse Code Modulation, ASK, FSK, Time Division Multiple Access, Frequency Division multiple Access, Direct Sequence spread spectrum, Frequency Hopping spread spectrum.

UNIT-4-(08 HOURS)

Probability of error and BER calculation, Modulation technologies (analogue & digital), Amplitude Modulation, Angle Modulation, ASK, FSK, BPSK, transmitter and receiver Block diagram, Expression for Bit Error Rate. Voice source coding, PCM, transmitter and receiver systems.

UNIT-5-(08 HOURS)

Communication system architectures, public switched Telephone network, First Generation wireless networks, Second Generation, Third Generation Wireless Network, Cellular packet switched Architecture, GSM system Architecture, terminal design and performance, associated information systems

TEXT BOOKS

1. Proakis and Salehi, Fundamentals of communication systems.
2. Simon Haykin and Michael Moher, Communication Systems, Wiley.
3. Theodore S Rappaport, Wireless Communication, Prentice Hall

REFERENCE BOOKS

1. B.P. Lathi and Zhi Ding, Modern digital and analog communication systems Oxford UniversityPress.

COURSE ASSESSMENT METHOD

Continuous Internal Evaluation (CIE)

Three internal assessments for 30 Marks each.

Two Learning Activities for **10** Marks each.

Semester End Examination (SEE)

Semester end examination for 100 Marks														
Program Outcomes – Articulation matrix														
PO	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**PSO1**	**PSO2**
CO1	2	2	3	1	-		-	-	-	-	-	2		
CO2	1	3	3	-	-	-	1	-	-	-	-	3		
CO3	2	3	1	-	-	-	2	-	-	-	-	3		
CO4	2	3	-	-	-	-	1	-	-	-	-	1		
CO5	1	2	-	-	3	1	1	-	-	-	-	2		

ADVANCED LIGHT WEIGHT COMPOSITE MATERIALS AND STRUCTURES				
Course Code	**22DTA232**		**Credits**	**3**
Hours/Week (L-T-P)	**3-0-0**		**CIE Marks**	**50**
Total Hrs	**39**		**SEE Marks**	**50**
Exam Hrs	**3**		**Course Type**	**PEC**

COURSE OUTCOMES

Course outcomes: After completion of the course, students will be able to-

1. Understand characteristics of composite materials for various applications.
2. Apply Hooke's law for orthotropic and anisotropic materials.
3. Carryout analysis of laminated composites
4. Develop composite materials
5. Apply failure theories and NDE for composite materials.

TEACHING METHODOLOGY

- Blackboard teaching/PowerPoint presentation (if needed) /Flipped Classes for specified topics.
- Tutorial classes on topics covered.
- Unit tests on covered topics

COURSE CONTENTS

UNIT-1-(07 HOURS)

Introduction: Classification and characteristics of composite materials - Types of fiber and resin materials, functions and their properties – Application of composite to aircraft structures-Micromechanics-Mechanics of materials, Elasticity approaches-Mass and volume fraction of fibers and resins-Effect of voids, Effect of temperature and moisture

UNIT-2-(08 HOURS)

Macro mechanics: Hooke's law for orthotropic and anisotropic materials-Lamina stress strain relations referred to natural axes and arbitrary axes.

UNIT-3-(08HOURS)

Analysis of laminated composites: Governing equations for anisotropic and orthotropic plates- angle-ply and cross ply laminates- analysis for simpler cases of composite plates and beams – inter laminar stresses- netting analysis.

UNIT-4-(08 HOURS)

Manufacturing & fabrication processes: Manufacture of glass, boron and carbon fibers Manufacture of FRP components- Open mould and closed mould processes. Properties and functions of resins

UNIT-5-(08 HOURS)

Failure theory and NDE: Failure criteria- Flexural rigidity of Sandwich beams and plates – composite repair- Ultra Sonic Technique - AE technique, Analysis through FEM and Meshless technique.

TEXT BOOKS

1. Agarwal, BD and Broutman, LJ, "Analysis and Performance of Fibre Composites", John Wiley & Sons, 3rd edition, 2006.
2. Allen Baker, "Composite Materials for Aircraft Structures", AIAA Series, 2nd Edition, 2004.
3. Autar K Kaw, "Mechanics of Composite Materials", CRC Press, 2nd edition, 2005.

REFERENCE BOOKS

1. Calcote, LR, "The Analysis of laminated Composite Structures", Von – Nostrand Reinhold Company, New York, 1998.
2. Isaac M. Daniel &OriIshai ,"Mechanics of Composite Materials", OUP USA publishers, 2nd edition, 2005.
3. Lubing, "Handbook on Advanced Plastics and Fibre Glass", Von Nostran Reinhold Co., New York, 1989.

COURSE ASSESSMENT METHOD

Continuous Internal Evaluation (CIE)

Three internal assessments for **30** Marks each.

Two Learning Activities for **10** Marks each.

Semester End Examination (SEE)

Semester end examination for 100 Marks														
Program Outcomes – Articulation matrix														
PO	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**PSO1**	**PSO2**
CO1	3	2	1						1			1	3	3
CO2	3	2	1									1	3	3
CO3	3	2	1									1	3	3
CO4	3	2	1						1			1	3	3
CO5	3	2	1						1			1	3	3

ADVANCED THERMAL ENGINEERING				
Course Code	**22DTA233**		**Credits**	**03**
Hours/Week (L-T-P)	**3-0-0**		**CIE Marks**	**50**
Total Hrs	**39**		**SEE Marks**	**50**
Exam Hrs	**03**		**Course Type**	**PEC**

COURSE OUTCOMES

Course outcomes: After completion of the course, students will be able to-

1. Understand thermal design and simulations for system design
2. Carry out CFD simulations
3. Understand the design of heat exchangers, refrigeration
4. Understand the concept of thermal management requirement & design
5. Understand thermal design for defence systems

TEACHING METHODOLOGY

- Blackboard teaching/PowerPoint presentation (if needed) /Flipped Classes for specified topics.
- Tutorial classes on topics covered.
- Unit tests on covered topics

COURSE CONTENTS

UNIT-1-(07 HOURS)

Basics Of Thermal Design: System thermal design & Analysis, Tools for thermal design and simulation, Heat transfer analysis (conduction, convection & radiation), analysis of elementary systems

UNIT-2-(08 HOURS)

Computational Techniques: Review of Computational fluid dynamics (CFD), CFD applied to refrigerator and heat exchanger design, Basics of finite element analysis, Thermal Finite Element Analysis

UNIT-3-(08 HOURS)

Some Thermal Devices: Heat Exchangers, Heat Exchanger Network Design, Refrigeration, Humidifiers, Air Washers and Cooling Towers, Numerical problems related to different thermal devices

UNIT-4-(08 HOURS)

Thermal Management: Basic aspects of thermal management, Thermal management design of defence systems (combat vehicles, missiles, aerial vehicles etc.), Illustrate examples of thermal management in defense systems

UNIT-5-(08 HOURS)

Defense Thermal Design: Basic requirements for a defense environment, Thermal testing, thermal operation, and integration of thermal design into the defence systems, Tested design examples

TEXT BOOKS

1. Incropera and Dewitt, Fundamentals of Heat and Mass Transfer, John Wiley.
2. W M Kays and M E Crawford, Convective Heat and Mass Transfer, McGraw-Hill publishing Company.
3. J Siegel and R Howell, Thermal Radiation Heat Transfer, Elsevier.
4. Manohar Prasad, Refrigeration and Air Conditioning, New Age International, 3rd Edition, 2015

REFERENCE BOOKS

1. John D Anderson, Computational Fluid Dynamics – The Basics with Applications, McGraw Hill, 1st Edition,2012.
2. P.L. Dhar, Thermal System Design and Simulation, 1st Edition.

COURSE ASSESSMENT METHOD

Continuous Internal Evaluation (CIE)

Three internal assessments for **30** Marks each.

Two Learning Activities for **10** Marks each.

Semester End Examination (SEE)

Semester end examination for 100 Marks

Program Outcomes – Articulation matrix

PO	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**PSO1**	**PSO2**

CO1	3	3	2	2	-		2		2	2	-	3		
CO2	3	3	3	2	-	-	3	-	2	2	-	3		
CO3	3	3	2	3	-	-	3	-	2	2	-	3		
CO4	3	3	2	2	-	-	3	-	2	2	-	3		
CO5	3	3	3	3			3	-	2	2	-	3		

ADVANCED MECHANICAL ENGINEERING				
Course Code	**22DTA234**		**Credits**	**03**
Hours/Week (L-T-P)	**3-0-0**		**CIE Marks**	**50**
Total Hrs	**39**		**SEE Marks**	**50**
Exam Hrs	**03**		**Course Type**	**PEC**

COURSE OUTCOMES

Course outcomes: After completion of the course, students will be able to-

1. Understand thermal design and simulations for system design
2. Carry out CFD simulations
3. Understand the design of heat exchangers, refrigeration
4. Understand the concept of thermal management requirement & design
5. Understand thermal design for defence systems

TEACHING METHODOLOGY

- Blackboard teaching/PowerPoint presentation (if needed) /Flipped Classes for specified topics.
- Tutorial classes on topics covered.
- Unit tests on covered topics

COURSE CONTENTS

UNIT-1-(07 HOURS)

Mechanical design & analysis: Introduction to tools for mechanical design & analysis - software's to generate precision 3D models of parts, components, and assemblies to aid in engineering, manufacturing, and design processes in product design, automotive, and aerospace applications.

UNIT-2-(08 HOURS)

Stress engineering – theory & simulation, mechanics of solids Concepts of simple and compound stresses and related strain in structural members, Bending stresses and shear stress in beams, Deflection of beams, Torsion of Shafts, Column and struts, Theory of Failures.

UNIT-3-(08 HOURS)

Finite element methods in structural dynamics and Structural integrity Shapes and frequencies, Natural modes and frequencies by energy methods, Natural mode shapes and frequencies derived from the integral equation, Natural mode shapes and frequencies derived from the differential equation, Solution of characteristic equations, Approximate methods - Rayleigh's method - Dunkerlay's method – Rayleigh-Ritz method, matrix iteration method

UNIT-4-(08 HOURS)

Fluid mechanics and Computational fluid dynamics Governing equations: Mass, momentum and energy conservation in integral form, differential form and using index notation. Difference between conservative and non-conservative forms. Classification and nature of PDEs, finite difference and finite volume techniques.

UNIT-5-(08 HOURS)

Component design, Applied materials and corrosion Recognize the design considerations for various mechanical metal forming processes and machine elements, shafts, springs, riveted joints, welded joints, helical gears, worm gears, sliding contact bearings, rolling contact bearings. Applications of engineering materials in structural, thermal, electronics and other industries.

TEXT BOOKS

1. H. Versteeg, An Introduction to Computational Fluid Dynamics: The Finite Volume Method.
2. John D. Ander Jr, "Computational Fluid Dynamics the Basics with Applications", McGraw Hill Education, 1 July 2017.
3. C. S. Jog, "Fluid Mechanics: Volume 2: Foundations and Applications of Mechanics, Cambridge University Press.
4. Robert C. Juvinall, Kurt M. Marshek, "Fundamentals of Machine Component Design", John Wiley & SonS.

REFERENCE BOOKS

1. Literature / books suggested by respective course Lecturers

COURSE ASSESSMENT METHOD

Continuous Internal Evaluation (CIE)
Three internal assessments for **30** Marks each.
Two Learning Activities for **10** Marks each.
Semester End Examination (SEE)
Semester end examination for 100 Marks

Program Outcomes – Articulation matrix

PO	1	2	3	4	5	6	7	8	9	10	11	12	PSO1	PSO2
CO1	2	2	3	1	-						-	2		
CO2	1	3	3	-	-	-	1	-	-		-	3		
CO3	2	3	1	-	-	-	2	-	-		-	3		
CO4	2	3	-	-	-	-	1	-	-		-	1		
CO5	1	2	-	-	3	1	1	-	-	-	-	2		

AUTONOMY AND NAVIGATION TECHNOLOGY				
Course Code	**22DTA235**		**Credits**	**03**
Hours/Week (L-T-P)	**3-0-0**		**CIE Marks**	**50**
Total Hrs	**39**		**SEE Marks**	**50**
Exam Hrs	**03**		**Course Type**	**PEC**

COURSE OUTCOMES

Course outcomes: At the end of the course the student will be able to:-

1. Describe the basic principle of operation of a global navigation satellite system
2. Understand the navigation systems and derive the navigation equations
3. Carry out path planning the UGV /UAV
4. Solve the equations for calculating a position estimate from a given satellite constellation.
5. Understand the working of GPS, GNSS and SLAM.

TEACHING METHODOLOGY

- Blackboard teaching/PowerPoint presentation (if needed) /Flipped Classes for specified topics.
- Tutorial classes on topics covered.
- Unit tests on covered topics

COURSE CONTENTS

UNIT-1-(07 HOURS)

Introduction: Introduction to the concepts of navigation and guidance systems, General principles of early conventional navigation systems. Guidance approaches: conventional guidance such as PN (Proportional Navigation).

UNIT-2-(08 HOURS)

Fundamentals of navigation: Geodetic fundamentals of navigation, positioning, reference- and coordinate systems and computational methods for navigation and positioning on the surface of the earth. Direction cosine matrix, Euler angles, Transformation of angular velocities, Quaternion representation in coordinate transformation. Comparison of transformation methods.

UNIT-3-(08 HOURS)

Geometric guidance: Geometric guidance, path planning and following, and optimal guidance; path planning for UGV/UAV guidance systems. Navigation approaches: navigation systems, Understanding the Global Positioning System (GPS)

UNIT-4-(08 HOURS)

Satellite Navigation : GNSS (Global Navigation Satellite System) - Applications in Tracking / Mapping Devices, Industrial Machinery, Sea vessels, Air Navigation, and Automobiles, terrain based navigation.

UNIT-5-(08 HOURS)

Simultaneous Localization and Mapping : Introduction to SLAM (Simultaneous Localization and Mapping); essential algorithms for SLAM, models for Cooperative guidance and collision avoidance system.

TEXT BOOKS

1. Bhatta, B., Glonass, Galileo, Compass, and Others, Global Navigation Satellite Systems Insights Into GPS, BS Publications, New Delhi, 2010.
2. Grewal, M. S., Weill, L. R., Andrews, A. P, Global Positioning Systems, Inertial Navigation, and Integration, John Wiley & Sons, New York, 2006.
3. Verlag Wien. Hofmann- Wellenhof, B., Lichtenegger, H., Wasle, E, Global Navigation Satellite Systems, Springer, 2008.

REFERENCE BOOKS

1. Hofmann-Wellenhof, B., Lichtenegger, H., Verlag Wien, Collins, J, Global Positioning System Theory and Practice, 2001.
2. Literature / books suggested by respective course Lecturers.

COURSE ASSESSMENT METHOD

Continuous Internal Evaluation (CIE)
Three internal assessments for **30** Marks each.
Two Learning Activities for **10** Marks each.
Semester End Examination (SEE)
Semester end examination for 100 Marks
Program Outcomes – Articulation matrix

PO	1	2	3	4	5	6	7	8	9	10	11	12	PSO1	PSO2
CO1	3	3	-	-	-		2				-	3		
CO2	3	2					3	-	-		-	3		
CO3	3	2					2	-	-		-	3		
CO4	3	3					3	-	-		-	3		
CO5	3	3					2	-	-	-	-	3		

PROFESSIONAL ELECTIVE II

COMPUTATIONAL METHODS IN AEROSPACE				
Course Code	**22DTA241**		**Credits**	**3**
Hours/Week (L-T-P)	**3-0-0**		**CIE Marks**	**50**
Total Hrs	**39**		**SEE Marks**	**50**
Exam Hrs	**3**		**Course Type**	**PEC**

COURSE OUTCOMES

Course outcomes: After completion of the course, students will be able to-

1. To arrive at the numerical solutions to boundary layer equations.
2. To perform numerical grid generation and have knowledge about the mapping techniques.
3. To familiarise himself/herself with high performance computing for CFD applications.
4. To implement the explicit time dependent methods and their factorization schemes.
5. To do the stability analysis and linearization of the implicit methods.

TEACHING METHODOLOGY

- Blackboard teaching/PowerPoint presentation (if needed) /Flipped Classes for specified topics.
- Tutorial classes on topics covered.
- Unit tests on covered topics

COURSE CONTENTS

UNIT -1- (07 HOURS)

Introduction: CFD definition and application, Parallel and vector computer in CFD, Models of flows, Continuity, Momentum, and Energy Equations-Derivation in various forms, Physical boundary condition, Shock capturing and shock fitting.

UNIT -2- (08 HOURS)

Behaviors of Partial Differential Equations: Classification of partial differential equations and their nature, Discuss Hyperbolic, parabolic, and elliptic forms of equations, Finite difference approximation- Forward, backward, central, second order central difference. Explicit and Implicit approaches, Time marching and Space marching, Errors- Truncation error and Round off error.

UNIT -3- (08 HOURS)

Grid generation Techniques: Introduction- Definition, Classification of grids- Surface grid, Complex grid. Structured grid, Unstructured grid, Body fitted grid, Grid Quality, Various structured and unstructured grid generation Techniques, Multi block grid generation, Mesh free method, Adaptive grid.

UNIT -4- (08 HOURS)

CFD Techniques: The Lax-Wendroff technique, The Mac Cormack's technique, The relaxation technique, Alternating Direction Implicit technique (ADI), Collocated grid, Staggered grid, Semi-Collocated grid, The Pressure correction technique, upwind scheme.

UNIT -5- (08 HOURS)

Transformation: Transformation of governing partial differential equations from physical domain to computational domain.

Introduction to finite volume method: Introduction to FVM, Spatial discretization- cell centered and cell vertex techniques (overlapping control volume, duel control volume), Boundary triangle and interior triangle, Flux vector splitting Scheme.

TEXT BOOKS

1. Bose. TK, "Numerical Fluid Dynamics",Narosa Publishing House, 2001.
2. Chung. TJ, "Computational Fluid Dynamics", Cambridge University Press, 2010.
3. Hirsch,AA, "Introduction to Computational Fluid Dynamics", McGraw-Hill, 1989.

REFERENCE BOOKS

1. John D. Anderson, "Computational Fluid Dynamics", McGraw Hill Education, 2017.
2. Sedat Biringen & Chuen-Yen Chow, "Introduction to Computational Fluid Dynamics by Example", Wiley publishers, 2nd edition, 2011.
3. Wirz, HJ &Smeldern, JJ, "Numerical Methods in Fluid Dynamics", McGraw-Hill & Co., 1978.

COURSE ASSESSMENT METHOD
Continuous Internal Evaluation (CIE)
Three internal assessments for 30 Marks each.
Two Learning Activities for 10 Marks each.
Semester End Examination (SEE)
Semester end examination for 100 Marks
Program Outcomes – Articulation matrix

PO	1	2	3	4	5	6	7	8	9	10	11	12	PSO1	PSO2
CO1	2	2	2						1				2	2
CO2	2	3	2						2				2	2
CO3	2	3	2						1				2	2
CO4	1	3	2						2				2	2
CO5	2	3	2						1				2	2

HYPERSONIC AERODYNAMICS				
Course Code	**22DTA242**		**Credits**	**3**
Hours/Week (L-T-P)	**3-0-0**		**CIE Marks**	**50**
Total Hrs	**39**		**SEE Marks**	**50**
Exam Hrs	**3**		**Course Type**	**PEC**

COURSE OUTCOMES

Course outcomes: After completion of the course, students will be able to-

1. Be able to arrive at the solution for problems involving inviscid and viscous hypersonic flows.
2. Have thorough knowledge on high temperature effects in hypersonic aerodynamics.
3. Be able to arrive at various solution methods to overcome aerodynamic heating problem on hypersonic vehicles.
4. To gain ideas on the design issues associated with hypersonic vehicles.
5. Able to realize the importance and use of the relevant equations for viscous hypersonic flows.

TEACHING METHODOLOGY

- Blackboard teaching/PowerPoint presentation (if needed) /Flipped Classes for specified topics.
- Tutorial classes on topics covered.
- Unit tests on covered topics

COURSE CONTENTS

UNIT -1- (07 HOURS)

Introduction to hypersonic aerodynamics: Peculiarities of Hypersonic flows - Thin shock layers – entropy layers – low density and high density flows – hypersonic flight similarity parameters – shock wave and expansion wave relations of inviscid hypersonic flows – velocity vs altitude map for hypersonic vehicles.

UNIT -2- (08 HOURS)

Surface inclination methods for hypersonic inviscid flows: Local surface inclination methods – modified Newtonian Law – Newtonian theory – tangent wedge tangent cone and shock expansion methods – Calculation of surface flow properties – practical application of surface inclination methods – hypersonic independence principle.

UNIT -3- (08 HOURS)

Approximate methods for inviscid hypersonic flows: Assumptions in approximate methods hypersonic small disturbance equation and theory – Maslen’’s theory– blast wave theory – hypersonic equivalence principle- entropy effects - rotational method of characteristics - hypersonic shock wave shapes and correlations.

UNIT -4- (08 HOURS)

Viscous hypersonic flow theory: Peculiarities of hypersonic boundary layers - boundary layer equations – hypersonic boundary layer theory and non-similar hypersonic boundary layers – hypersonic aerodynamic heating and entropy layers effects on aerodynamic heating – heat flux and skin friction estimation.

UNIT -5- (08 HOURS)

Viscous interactions and transition: Strong and weak viscous interactions – hypersonic shockwaves and boundary layer interactions – Parameters affecting hypersonic boundary layer transition - Estimation of hypersonic boundary layer transition- Role of similarity parameter for laminar viscous interactions in hypersonic viscous flow.

TEXT BOOKS

1. Anderson, JD, “Hypersonic and High Temperature Gas Dynamics”, AIAA Education Series, 2nd edition, 2006.
2. Anderson, JD, “Modern compressible flow: with Historical Perspective”, McGraw Hill Education, 3rd edition, 2017.

REFERENCE BOOKS

1. William H. Heiser and David T. Pratt, Hypersonic Air Breathing propulsion, AIAA Education Series, 1994.
2. John T. Bertin, Hypersonic Aerothermodynamics, AIAA Education Series, 1993.

COURSE ASSESSMENT METHOD

Continuous Internal Evaluation (CIE)

Three internal assessments for 30 Marks each.

Two Learning Activities for 10 Marks each.

Semester End Examination (SEE)														
Semester end examination for 100 Marks														
Program Outcomes – Articulation matrix														
PO	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**PSO1**	**PSO2**
CO1	**3**	**1**										**2**		**1**
CO2	**2**	**2**							**2**			**1**		**1**
CO3	**1**			**1**	**1**							**2**		**1**
CO4	**2**								**2**			**1**		
CO5	**1**	**2**		**1**					**2**			**2**		

MILITARY ELECTRONICS SYSTEM ENGINEERING				
Course Code	**22DTA243**		**Credits**	**03**
Hours/Week (L-T-P)	**3-0-0**		**CIE Marks**	**50**
Total Hrs	**39**		**SEE Marks**	**50**
Exam Hrs	**03**		**Course Type**	**PEC**

COURSE OUTCOMES

Course outcomes: After completion of the course, students will be able to-

1. Understand the military electronics systems
2. Generate system design requirements as per mission needs &operational requirements
3. To create digital simulation models
4. Understand the limitations of the COTS available electronics systems
5. Evaluate the radiation effects on the performance of electronics systems

TEACHING METHODOLOGY

- Blackboard teaching/PowerPoint presentation (if needed) /Flipped Classes for specified topics.
- Tutorial classes on topics covered.
- Unit tests on covered topics

COURSE CONTENTS

UNIT-1-(07 HOURS)

Fundamentals of electronics: Introduction to electronics engineering concepts, additional requirements for a defense environment, methods for the design and integration of complex defense systems.

UNIT-2-(08 HOURS)

Case studies: Familiarity with the systems engineering process through case studies of representative defense systems, simple to detailed design examples, defense related case studies.

UNIT-3-(08 HOURS)

Methods: Introduction to methods used for determination of system requirements from mission needs and operational requirements, principles used in different methods, advantages and disadvantages of each method.

UNIT-4-(08 HOURS)

Digital simulation models and ICs: Digital simulation models, including those currently used in defence for determining engineering and performance trade-offs. Limitations of commercial-off-the-shelf (COTS) integrated circuits, thermal failure, electrostatic breakdown, noise in solid state devices, packaging reliability issues.

UNIT-5-(08 HOURS)

Effect of ambient environment: The defense environment, Systematic way to account different aspects, Radiation effects due to space and nuclear environments, and the limited availability of military integrated circuit suppliers.

TEXT BOOKS

1. Neri Filippo, Introduction to Electronic Defense Systems, Artech House Publishers.
2. US Department of Defence, Military Handbook of Electronic Reliability design, US Department of Defence.
3. Ray Tricker, Electronics Standards and Quality Assurance, Elsevier.

REFERENCE BOOKS

1. Anil K. Maini, Handbook of Defence Electronics and Optronics: Fundamentals, Technologies and Systems, John Wiley & Sons Ltd.
2. M.G. Hartley, Digital Simulation Methods, P.Peregrinus Ltd.
3. Alper Demir, Analysis and Simulation of Noise in Nonlinear Electronic Circuits and Systems, Springer.

COURSE ASSESSMENT METHOD

Continuous Internal Evaluation (CIE)

Three internal assessments for **30** Marks each.

Two Learning Activities for **10** Marks each.

Semester End Examination (SEE)

Semester end examination for 100 Marks														
Program Outcomes – Articulation matrix														
PO	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**PSO1**	**PSO2**
CO1	3	2	1	-	-				1	1	-	-		
CO2	3	2	3					-	2	2	-			
CO3	3	3	3					-	3	2	-			
CO4	3	3	2					-	2	2	-			
CO5	3	2	3					-	3	-	-			

ORBITAL MECHANICS AND SPACE FLIGHT				
Course Code	**22DTA244**		**Credits**	**3**
Hours/Week (L-T-P)	**3-0-0**		**CIE Marks**	**50**
Total Hrs	**39**		**SEE Marks**	**50**
Exam Hrs	**3**		**Course Type**	**PEC**

COURSE OUTCOMES

Course outcomes: After completion of the course, students will be able to-

1. To acquire knowledge on the peculiarities of space environment and its effect on spacecraft materials.
2. To estimate the time and position of an object in various orbits.
3. To acquire knowledge on the basic concepts of satellite injection and satellite perturbations.
4. To calculate orbital parameters and to perform conceptual trajectory designs for geocentric or interplanetary missions.
5. To estimate the time of flight and the position of impact point of ballistic missiles.

TEACHING METHODOLOGY

- Blackboard teaching/PowerPoint presentation (if needed) /Flipped Classes for specified topics.
- Tutorial classes on topics covered.
- Unit tests on covered topics

COURSE CONTENTS

UNIT -1- (07 HOURS)

Space Environment: Peculiarities of space environment and its description– effect of space environment on materials of spacecraft structure and astronauts- manned space missions – effect on satellite life time.

UNIT -2- (08 HOURS)

Characteristics of various orbits: Properties of elliptic, Parabolic and hyperbolic properties in terms of orbital elements – relations between position and time – Barker's theorem – Whittaker's theory – Sphere of influence.

UNIT -3- (08 HOURS)

Satellite injection and satellite perturbations: General aspects of satellite injection – satellite orbit transfer – various cases – orbit deviations due to injection errors – special and general perturbations – Cowell's method and Enake's method – method of variations of orbital elements – general perturbations approach.

UNIT -4- (08 HOURS)

Interplanetary trajectories: Two-dimensional interplanetary trajectories – fast interplanetary trajectories – three dimensional interplanetary trajectories – launch of interplanetary spacecraft – trajectory estimation about the target planet – concept of sphere of influence – Lambert's theorem.

UNIT -5- (08 HOURS)

Ballistic missile trajectories: Introduction to ballistic missile trajectories – boost phase – the ballistic phase – trajectory geometry – optimal flights – time of flight – re-entry phase – the position of impact point – influence coefficients.

TEXT BOOKS

1. Cornelisse, JW, Schoyer, HFR &Wakker, KF, "Rocket Propulsion and Space Dynamics", Pitman Publishing, 1979.
2. Howard D.Curtis, "Orbital Mechanics for Engineering Students", 3rd Edition, Butterworth- Heinemann, 2013.

REFERENCE BOOKS

1. Parker, ER, "Materials for Missiles and Spacecraft", Mc.Graw Hill Book Co. Inc., 1982.
2. Suresh. BN & Sivan. K, "Integrated Design for Space Transportation System", Springer India, 2015.
3. Sutton, G.P. "Rocket Propulsion Elements", John Wiley & Sons Inc., New York, 9th Edition, 2016.

COURSE ASSESSMENT METHOD

Continuous Internal Evaluation (CIE)

Three internal assessments for 30 Marks each.

Two Learning Activities for 10 Marks each.

Semester End Examination (SEE)

Semester end examination for 100 Marks														
Program Outcomes – Articulation matrix														
PO	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**PSO1**	**PSO2**
CO1	**3**	**1**										**2**		**1**
CO2	**2**	**2**							**2**			**1**		**1**
CO3	**1**			**1**	**1**							**2**		**1**
CO4	**2**								**2**			**1**		
CO5	**1**	**2**		**1**					**2**			**2**		

AIR INDEPENDENT PROPULTION AND BATTERIES				
Course Code	**22DTA245**		**Credits**	**03**
Hours/Week (L-T-P)	**3-0-0**		**CIE Marks**	**50**
Total Hrs	**39**		**SEE Marks**	**50**
Exam Hrs	**03**		**Course Type**	**PEC**

COURSE OUTCOMES

Course outcomes: After completion of the course, students will be able to-

1. Understand hybrid concepts
2. Understand hybrid vehicle control and analysis
3. Understand electric vehicle control and analysis
4. Understand electric propulsion components
5. Understand advanced storage devices

TEACHING METHODOLOGY

- Blackboard teaching/PowerPoint presentation (if needed) /Flipped Classes for specified topics.
- Tutorial classes on topics covered.
- Unit tests on covered topics

COURSE CONTENTS

UNIT-1-(07 HOURS)

Hybrid Concepts: Introduction to Hybrid Electric Vehicles, basic requirements, advantages and disadvantages, Impact of modern drive-trains on energy supplies, performance evaluation methods

UNIT-2-(08 HOURS)

Hybrid Vehicle Control And Analysis: Hybrid Electric Drive-trains: hybrid traction, various hybrid drive-train topologies, power flow control, fuel efficiency analysis, differences from the conventional types.

UNIT-3-(08 HOURS)

Electric Vehicle Control And Analysis: Electric Drive-trains: electric traction, electric drive-train topologies, power flow control in electric drive-train topologies, fuel efficiency analysis

UNIT-4-(08 HOURS)

Electric Propulsion Components: Electric Propulsion unit: electric components used in hybrid and electric vehicles, Configuration and control of DC Motor drives, Induction Motor drives, Permanent Magnet Motor drives, Switch Reluctance Motor drives, drive system efficiency

UNIT-5-(08 HOURS)

Advanced Storage Devices: Battery based energy storage and its analysis, Fuel Cell based energy storage and its analysis, Super Capacitor based energy storage and its analysis, Flywheel based energy storage and its analysis, Hybridization of different energy storage devices

TEXT BOOKS

1. Chris Mi, M. AbulMasrur, Hybrid Electric Vehicles: Principles and Applications with Practical Perspectives, Wiley
2. Literature / books suggested by respective course Lecturers

REFERENCE BOOKS

1. YiminGao, Ali Emadi, Modern Electric, Hybrid Electric, and Fuel Cell Vehicles, Standards media.
2. Fundamentals, Theory, and Design, Second Edition

COURSE ASSESSMENT METHOD

Continuous Internal Evaluation (CIE)

Three internal assessments for **30** Marks each.

Two Learning Activities for **10** Marks each.

Semester End Examination (SEE)

Semester end examination for 100 Marks

Program Outcomes – Articulation matrix

PO	1	2	3	4	5	6	7	8	9	10	11	12	PSO1	PSO2

CO1	3	3			-				2	2	-	3		
CO2	3	2			-	-	-	-	2	2	-	3		
CO3	3	2			-	-	-	-	2	2	-	3		
CO4	3	2	-	-	-	-	-	-	2	2	-	3		
CO5	3	3	-	-	-	-	-	-	2	2	-	3		

SEMESTER III

SYSTEM ENGINEERING AND ANALYSIS

Course Code	**22DTA31**		**Credits**	**04**
Hours/Week (L-T-P)	**3-0-2**		**CIE Marks**	**50**
Total Hrs	**50**		**SEE Marks**	**50**
Exam Hrs	**03**		**Course Type**	**PCC**

COURSE OUTCOMES

Course outcomes: After completion of the course, students will be able to-

1. Understand the system design requirements, architecture, functional requirements.
2. Generate the system requirements documents as per the requirement analysis.
3. Understand the techniques of system design
4. Carry out the Supportability and producibility
5. Carry out the system reliability analysis.

TEACHING METHODOLOGY

- Blackboard teaching/PowerPoint presentation (if needed) /Flipped Classes for specified topics.
- Tutorial classes on topics covered.
- Unit tests on covered topics

COURSE CONTENTS

UNIT-1-(10 HOURS)

Fundamentals of systems engineering: Fundamentals of systems engineering and system architecting of weapon system, system engineering. standards 15288, requirements analysis, functional analysis and allocation, preliminary system architecture.

UNIT-2-(10 HOURS)

Systems design and analysis: systems analysis, system design, and the basics of test and evaluation, Introduction to combat systems, System development phases (Conceiving, Designing, Implementing, and Operating)

UNIT-3-(10 HOURS)

Techniques of system design: Techniques of system design and assessment for operational feasibility, including reliability, maintainability, usability (including human factors and human performance).

UNIT-4-(10 HOURS)

More on system analysis: Various ways of evaluating system performance, Supportability and producibility, System cost assessment and effectiveness estimation, certification methods, Case studies.

UNIT-5-(10 HOURS)

Reliability analysis and management (basic tools and methods of reliability for developing complex systems including electronic components, mechanical components, and software), redundancy, graceful degradation, fault tolerance, MTBF.

TEXT BOOKS

1. Buede D.M.2: The Engineering Design of Systems: Models and Methods, Publisher: John Wiley & Sons Inc.
2. Defense Acquisition University Press fort Belvoir, Virginia:" Systems engineering fundamentals"
3. Charles S. Wasson: System Analysis Design and Development, Publisher: Wiley Series in System Engineering and Management.
4. Clifton R H: Principles of Planned Maintenance, Publisher: McGraw Hill, New York.

REFERENCE BOOKS

1. Clifton R H: Principles of Planned Maintenance, Publisher: McGraw Hill, New York.
2. Srinath L S: Reliability Engineering, Publisher: Affiliated East-West Press Limited, New Delhi,2002.
3. Dhillon B S: Engineering Maintainability, Publisher: Prentice Hall of India.

COURSE ASSESSMENT METHOD

Continuous Internal Evaluation (CIE)

Three internal assessments for **30** Marks each.

Two Learning Activities for **10** Marks each.
Semester End Examination (SEE)
Semester end examination for 100 Marks
Program Outcomes – Articulation matrix

PO	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**PSO1**	**PSO2**
CO1	3	1	2	-	-						-	3		
CO2	3	2	3					-	-		-	3		
CO3	3	3	2					-	-		-	3		
CO4	3	2	2					-	-		-	3		
CO5	3	2	1					-	-	-	-	3		

PROJECT WORK PHASE -I				
Course Code	**22DTA34**		**Credits**	**3**
Hours/Week (L-T-P)	**0-6-0**		**CIE Marks**	**100**
Total Hrs	**39**		**SEE Marks**	**-**
Exam Hrs	**3**		**Course Type**	**PROJ**

COURSE OUTCOMES

The individual student must identify a project Advisor in the third semester. The student, in consultation with their Advisor, will form a Thesis Committee that includes head of the department and domain expert. The progress of the project is evaluated based on a minimum of three reviews. The review committee may be constituted by the Head of the Department. A project report is required at the end of the semester. The project work is evaluated based on oral presentation and the project report jointly by external and internal examiners constituted by the Head of the Department.

Program Outcomes – Articulation matrix

PO	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**PSO1**	**PSO2**
CO1	3	2						3	3			3	3	3
CO2	3	2						3	3			3	3	3
CO3	2	2						3	3			2	3	2
CO4	2	2						3	3			3	3	2
CO5	3	2						3	3			3	3	3

SOCIETAL PROJECT				
Course Code	**22DTA35**		**Credits**	**3**
Hours/Week (L-T-P)	**0-6-0**		**CIE Marks**	**100**
Total Hrs	**-**		**SEE Marks**	**-**
Exam Hrs	**3**		**Course Type**	**SP**

Seminar is to be given by the student after the completion of a societal project chosen by the student. Topics for the projects can be from the aeronautical engineering and allied fields. The project can be based on either numerical or analytical solution or design or fully experimental; or a combination of these tasks.

COURSE ASSESSMENT METHOD

1. Internal Examiner shall carry out the evaluation for 100 marks.
2. External Examiner shall carry out the evaluation for 100 marks.
3. The average of marks allotted by the internal and external examiner shall be the final marks of the project evaluation.
4. Viva-Voce examination of Project work shall be conducted jointly by Internal and External examiner for 100 marks.

Program Outcomes – Articulation matrix

PO	1	2	3	4	5	6	7	8	9	10	11	12	PSO1	PSO2
CO1	3	2						3	3			3	3	3
CO2	3	2						3	3			3	3	3
CO3	2	2						3	3			2	3	2
CO4	2	2						3	3			3	3	2
CO5	3	2						3	3			3	3	3

INTERNSHIP				
Course Code	**22DTAI36**		**Credits**	**6**
Hours/Week (L-T-P)	**6 Weeks**		**CIE Marks**	**50**
Total Hrs	**6 Weeks**		**SEE Marks**	**50**
Exam Hrs	**3**		**Course Type**	**INT**

COURSE OUTCOMES
1. Identify and define the problem for the project work
2. Apply the knowledge acquired to analyze and estimate the cost and time
3. Examine and use appropriate tools to solve the defined problem in a team
4. Develop an end product and prepare a technical report/paper

COURSE CONTENTS

A 6 weeks long internship course is to be carried out by the students. On completion of the internship, students shall prepare a report according to the guidelines and submit it to the concerned authority during their 3^{rd} semester. The students should present their work and performance will be evaluated by the project committee and marks will be awarded.

Program Outcomes – Articulation matrix

PO	1	2	3	4	5	6	7	8	9	10	11	12	PSO1	PSO2
CO1	3	2						3	3			3	3	3
CO2	3	2						3	3			3	3	3
CO3	2	2						3	3			2	3	2
CO4	2	2						3	3			3	3	2
CO5	3	2						3	3			3	3	3

PROFESSIONAL ELECTIVE III

STRUCTURAL DYNAMICS AND AEROELASTICITY				
Course Code	**22DTA321**		**Credits**	**3**
Hours/Week (L-T-P)	**3-0-0**		**CIE Marks**	**50**
Total Hrs	**39**		**SEE Marks**	**50**
Exam Hrs	**3**		**Course Type**	**PEC**

COURSE OUTCOMES

Course outcomes: After completion of the course, students will be able to-

1. Have knowledge of the role of aeroelasticity in aircraft design.
2. Interpret the use of semi-rigid body assumptions and numerical methods in airplane design.
3. Arrive at the solutions for steady state aeroelastic problem.
4. Be knowledge with the concept of flutter analysis of aircraft wings.
5. Have knowledge on practical examples of aeroelastic problems.

TEACHING METHODOLOGY

- Blackboard teaching/PowerPoint presentation (if needed) /Flipped Classes for specified topics.
- Tutorial classes on topics covered.
- Unit tests on covered topics

COURSE CONTENTS

UNIT -1- (07 HOURS)

Aeroelastic phenomena: Stability versus response problems – introduction to aeroelasticity and aeroelastic phenomena – Examples of aeroelastic phenomena – Galloping of transmission lines – Flow induced vibrations of tall slender structures – Instability of suspension bridges – Fluid structure interaction – The aero-elastic triangle of forces – Prevention of aeroelastic instabilities

UNIT -2- (08 HOURS)

Modelling of aeroelastic phenomena: Influence and stiffness co-efficients – illustration of aeroelastic phenomena using simplified aerodynamic and structural models – different subsonic and supersonic aerodynamic models for aeroelastic analysis – modelling techniques – aeroelastic models in state-space format Flexure – torsional oscillations of beams – Governing differential equation of motion and its solution

UNIT -3- (08 HOURS)

Static aeroelastic phenomena: Simple two dimensional idealisation – Strip theory – Exact solutions for simple rectangular wings – ‘Semirigid’ assumption and approximate solutions – Successive approximation method – Numerical approximations using matrix equations – Divergence of 2-D airfoil and Straight Wing – Aileron efficiency & reversal – Control Effectiveness – Wing deformations of swept wings

UNIT -4- (08 HOURS)

Flutter calculations: Flutter analysis – Two dimensional thin airfoils in steady incompressible flow –Quasi-steady aerodynamic derivatives – Galerkin method for critical flutter speed – Stability of disturbed motion – Solution of the flutter determinant – Methods of determining the critical flutter speeds – Flutter Calculation – U-g Method – P-k Method – Exact Treatment of Bending –Torsion Flutter of a Uniform Wing – Flutter Analysis by Assumed Mode Method

UNIT -5- (08 HOURS)

Prevention and control: Stiffness criteria – dynamic mass balancing – dimensional similarity – effect of elastic deformation on static longitudinal stability – introduction to aeroelastic control – aeroelastic aspects in the design of aircraft – Panel flutter and its control – Prevention of tail buffeting – Aeroelastic instabilities in helicopter and engine blades and prevention methods

TEXT BOOKS

1. Bisplinghoff.RL, Ashley,H and Halfmann,RL, “Aeroelasticity”, 2nd Edition, Addison Wesley Publishing Co., Inc., 1996.
2. Blevins, RD,” Flow Induced Vibrations”, Krieger Pub Co., 2001.
3. Broadbent,EG, “Elementary Theory of Aeroelasticity”, Bun Hill Publications Ltd., 1986.

REFERENCE BOOKS

1. Fung,YC, “An Introduction to the Theory of Aeroelasticity”, John Wiley & Sons Inc., New York, 2008.
2. Scanlan, RH and R.Rosenbaum, “Introduction to the study of Aircraft Vibration and Flutter”, Macmillan Co., New York, 1981.

COURSE ASSESSMENT METHOD

Continuous Internal Evaluation (CIE)

Three internal assessments for 30 Marks each.

Two Learning Activities for 10 Marks each.

Semester End Examination (SEE)

Semester end examination for 100 Marks

Program Outcomes – Articulation matrix

PO	1	2	3	4	5	6	7	8	9	10	11	12	PSO1	PSO2
CO1	3	1										2		1
CO2	2	2							2			1		1
CO3	1			1	1							2		1
CO4	2								2			1		
CO5	1	2		1					2			2		

SAFETY, HEALTH AND HAZARD MANAGEMENT				
Course Code	**22DTA322**		**Credits**	**03**
Hours/Week (L-T-P)	**3-0-0**		**CIE Marks**	**50**
Total Hrs	**39**		**SEE Marks**	**50**
Exam Hrs	**03**		**Course Type**	**PEC**

COURSE OUTCOMES

Course outcomes: After completion of the course, students will be able to-

1. Understand chemical safety standards, fire safety.
2. Handle toxic liquids & gases, explosives.
3. Understand the hazard management.
4. Understand warfare safety.
5. Understand health & environment safety.

TEACHING METHODOLOGY

- Blackboard teaching/PowerPoint presentation (if needed) /Flipped Classes for specified topics.
- Tutorial classes on topics covered.
- Unit tests on covered topics

COURSE CONTENTS

UNIT-1-(07 HOURS)

Chemical Safety: Standards and regulations of chemical safety in Industries or Laboratories, Storage of hazardous chemicals, Compatibility and classification codes, Chemical risk analysis and Management.

UNIT-2-(08 HOURS)

Toxic and explosive handling: Fire triangle and Handling of Toxic materials, Industrial Gases and other gases, instructions for handling toxic materials, industrial standards, accident protocols, emergency measures.

UNIT-3-(08 HOURS)

Hazard Management: HAZOP and HAZAN techniques, Hazard in manufacture, Hazard prevention measures, Disposal of hazardous materials, segregation of solid, liquid and gaseous materials.

UNIT-4-(08 HOURS)

Warfare safety: Basic understanding of the warfare environment, Classifications of explosives based on hazards, Nuclear,biological and chemical warfare safety, various protocols, accident and emergency protocols at the warfare.

UNIT-5-(08 HOURS)

Health and environment safety: Need of awareness about human health and environment safety, assessment of human factors, Health & Environment safety, Nano materials safety (Toxicology study), radiation related safety protocols, case studies.

TEXT BOOKS

1. "Occupational Health and Safety Management A Practical Approach", by Charles D. Reese. Publisher: CRC Press.
2. "Occupational and Environmental Safety and Health", Arezes, P.M., Baptista, J.S., Barroso, M.P., Carneiro, P., Cordeiro, P., Costa, N., Melo, R.B., Abreu dos Santos Baptista, J.M., Perestrelo, G. (Eds.). Publisher: Springers, 2019
3. "Handbook of Occupational Safety and Health", by S. Z. Mansdorf. Publisher: Wiley.
4. "Institution of Chemical Engineers", by Trevor Kletz"Hazop and Hazan

REFERENCE BOOKS

1. "Handbook of Toxicology of Chemical Warfare Agents", by Ramesh C. Gupta 2nd Edition Elsevier, 2015
2. "Nanomaterials Safety Toxicity and Health Hazards", by Shyamasree Ghosh De Gruyter.
3. "Hazardous Chemicals Handbook", by Phillip Carson, Clive Mumford Butterworth-Heinemann.

COURSE ASSESSMENT METHOD

Continuous Internal Evaluation (CIE)

Three internal assessments for **30** Marks each.
Two Learning Activities for **10** Marks each.
Semester End Examination (SEE)
Semester end examination for 100 Marks
Program Outcomes – Articulation matrix

PO	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**PSO1**	**PSO2**
CO1	3	2	-	-	-	3	2		3		-	3		
CO2	3	2			-	3	3	-	2		-	3		
CO3	3	3			-	3	2	-	3		-	3		
CO4	3	2			-	3	2	-	3		-	3		
CO5	3	3				3	3	-	2	-	-	3		

ADVANCED ANALYTICAL TECHNIQUES / LAB TESTING				
Course Code	**22DTA323**		**Credits**	**03**
Hours/Week (L-T-P)	**3-0-0**		**CIE Marks**	**50**
Total Hrs	**39**		**SEE Marks**	**50**
Exam Hrs	**03**		**Course Type**	**PEC**

COURSE OUTCOMES

Course outcomes: After completion of the course, students will be able to-

1. Understand different characterization techniques.
2. Apply appropriate analytical technique for a particular material organic/inorganic/ nanomaterial/ polymer etc.
3. Understand the principle and working of chromatography.
4. Understand the principle and working of spectroscopy
5. Understand the principle and working of XRD and SEM.

TEACHING METHODOLOGY

- Blackboard teaching/PowerPoint presentation (if needed) /Flipped Classes for specified topics.
- Tutorial classes on topics covered.
- Unit tests on covered topics

COURSE CONTENTS

UNIT-1-(07 HOURS)

Instrumental Analysis: Qualitative analysis, predictive analytics, spatial data processing, text analytics, text search, streaming analytics, graph data processing, network analysis techniques and specialized analytical tools.

UNIT-2-(08 HOURS)

Various techniques in instrumental analysis: Genesis of instrumental analysis, hyphenated techniques, Polymeric Techniques, Rheology Techniques, Molecular weight determination; Thermal Techniques: Thermo Gravimetry (TG), Differential Thermal Analysis (DTA), and Differential Scanning Calorimetry (DSC).

UNIT-3-(08 HOURS)

Chromatographic Techniques: Gas Chromatography (GC), High Performance Liquid Chromatography (HPLC), Thin Layer Chromatography (TLC), Ion chromatography, column chromatography, planar chromatography.

UNIT-4-(08 HOURS)

Spectroscopy: Ultra Violet-Visible Spectroscopy UV-VIS, Infra-Red spectroscopy (IR), Nuclear Magnetic Resonance (NMR), Mass spectroscopy, Atomic Absorption Spectroscopy (AAS), Atomic Emission Spectroscopy (AES) Acoustic spectroscopy, Glow Discharge Spectroscopy (GDS).

UNIT-5-(08 HOURS)

X-Ray Diffraction (XRD) and Scanning Electron Microscope techniques(SEM), Inverse reconstruction using electron-material interactive models, Photometric 3D SEM reconstruction from a four-quadrant detector, Sensitivity studies.

TEXT BOOKS

1. C. N. Banwell., Fundamentals of molecular spectroscopy, McGraw Hill Education; Fourth edition (1 July 2017)
2. Donald L. Pavia, Gary M. Lampman, and George S. Kriz. Introduction to Spectroscopy Publisher: Cengage Learning, 2014.
3. James M. Miller, Chromatography: Concepts and Contrast, Publisher: Wiley.
4. Mark F. Vitha., Chromatography: Principles and Instrumentation, Publisher: Wiley. Wiley; 1st edition (22 August 2016)

REFERENCE BOOKS

1. B.D. Cullity Deceased, S.R. Stock, Elements of X-Ray Diffraction, Publisher: Pearson.
2. S. Amelinckx, Dirk van Dyck, J. van Landuyt, Gustaaf van Tendeloo, Electron Microscopy: Principles and Fundamentals,. Publisher: Wiley.
3. Dan Campbell, Richard A. Pethrick, Jim R. White, Polymer Characterization: Physical Techniques, 2nd Edition. Publisher CRC Press.

COURSE ASSESSMENT METHOD														
Continuous Internal Evaluation (CIE)														
Three internal assessments for **30** Marks each.														
Two Learning Activities for **10** Marks each.														
Semester End Examination (SEE)														
Semester end examination for 100 Marks														
Program Outcomes – Articulation matrix														
PO	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**PSO1**	**PSO2**
CO1	3	2	2		-				2	2	-	3		
CO2	3	2	2		-	-	-	-	2	2	-	3		
CO3	3	3	3		-	-	-	-	2	2	-	3		
CO4	3	2	2	-	-	-	-	-	2	2	-	3		
CO5	3	2	2	-	-	-	-	-	2	2	-	3		

DEFENCE ELECTRO-OPTICS AND IMAGING SYSTEMS				
Course Code	**22DTA324**		**Credits**	**03**
Hours/Week (L-T-P)	**3-0-0**		**CIE Marks**	**50**
Total Hrs	**39**		**SEE Marks**	**50**
Exam Hrs	**03**		**Course Type**	**PEC**

COURSE OUTCOMES

Course outcomes: After completion of the course, students will be able to-

1. Understand the technology and principles underpinning electro-optic devices and systems
2. Understand Camera systems
3. Understand Image processing
4. Understand EO sensors and Laser DEW
5. Understand Electro-optic protection measures

TEACHING METHODOLOGY

- Blackboard teaching/PowerPoint presentation (if needed) /Flipped Classes for specified topics.
- Tutorial classes on topics covered.
- Unit tests on covered topics

COURSE CONTENTS

UNIT-1-(07 HOURS)

Optical sighting systems: Principles of radiometry, The human eye, insight into the optical, Visible band optical sighting systems, qualitative and quantitative aspects, detailed investigation.

UNIT-2-(08 HOURS)

Camera systems: Camera systems, basic components and their functions, Image intensifiers, Missile seekers, tracking principles, Electro-optic countermeasures, various counter measure techniques.

UNIT-3-(08 HOURS)

Image processing: Thermal imagers, II cameras, Hyper-spectral imaging, Digital image processing, different methodologies, challenges associated, tools for processing different categories of images.

UNIT-4-(08 HOURS)

EO sensors and Laser DEW: Basics of EO sensors, principles and techniques, EO sensors for lasers, Laser DEW, Challenges associated, counter measures, Other techniques, sizing and other aspects

UNIT-5-(08 HOURS)

Electro-optic protection measures: Introduction, basic aspects of electro optic techniques,

TEXT BOOKS

1. William WolfgangArrasmith., Systems engineering analysis of electro-optical and Infrared system, CRC Press; 1st edition (20 March 2015)
2. Author Ronald G.Driggers Ronald G.Driggers.Introduction to Infrared and Electro-Optical Systems, Artech Print on Demand (January 1, 1998)
3. Author(s): Anil K.Maini, Handbook of Defence Electronics and Optronics: Fundamentals, Technologies and Systems, Wiley; 1st edition (4 May 2018)

REFERENCE BOOKS

1. Building Electro-Optical Systems: Making It all Work, Author Philip C. D. Hobbs
2. “Electro-Optical Instrumentation: Sensing and Measuring with Lasers”, by Author Silvano Donati.
3. “Electro-optical systems design, Analysis and testing”, by Author Michael C. Dudzik.

COURSE ASSESSMENT METHOD

Continuous Internal Evaluation (CIE)

Three internal assessments for **30** Marks each.

Two Learning Activities for **10** Marks each.

Semester End Examination (SEE)

Semester end examination for 100 Marks

Program Outcomes – Articulation matrix														
PO	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**PSO1**	**PSO2**
CO1	3	3	2	-	-		2				-	3		
CO2	3	3	2	3	-	-	3	-	-		-	3		
CO3	3	2	2	3	-	-	2	-	-		-	3		
CO4	3	2	2	3	-	-	2	-	-		-	3		
CO5	3	3	2	3			1	-	-	-	-	3		

FUNDAMENTAL OF TELEMETRY, TELECOMMAND AND TRANSPONDER				
Course Code	**22DTA325**		**Credits**	**03**
Hours/Week (L-T-P)	**3-0-0**		**CIE Marks**	**50**
Total Hrs	**39**		**SEE Marks**	**50**
Exam Hrs	**03**		**Course Type**	**PEC**

COURSE OUTCOMES

Course outcomes: After completion of the course, students will be able to-

1. Satellite communication and related technologies.
2. Overall control of satellites through collection, processing, and transmission of data.
3. Determination of the satellite's exact location through the reception, processing, and transmitting of ranging signals.
4. Understanding the basics of signal processing.
5. Proper control of satellite through the reception, processing, and implementation of commands transmitted from the ground.

TEACHING METHODOLOGY

- Blackboard teaching/PowerPoint presentation (if needed) /Flipped Classes for specified topics.
- Tutorial classes on topics covered.
- Unit tests on covered topics

COURSE CONTENTS

UNIT-1-(07 HOURS)

Introduction: Fundamental of satellite communication, Mathematical Models for Communication Channels, Digital Communication System, Communication Channels and Their Characteristics, different modulation and multiplexing schemes.

UNIT-2-(08 HOURS)

Telemetry process: Satellite Telemetry, Tracking and Tele-command, Multiple Access Techniques Telemetry, Data Transmission, Methods of Modulation, Time Division and Frequency Division Multiplexing, FDMA, TDMA, CDMA and DAMA, Coding Schemes.

UNIT-3-(08 HOURS)

Communications and Telemetry: Satellite Packet Communications, Tracking and Telemetry. Doppler and Electro-Optical methods of tracking, Airborne Missile, Surface to air missile, missile tracking.

UNIT-4-(08 HOURS)

Signal Processing: Processing of Signal, Analog, continuous time, discrete time, non-linear, statistical signal processing, Data Acquisition and Reduction, Audio signal processing, Array processing, Feature extraction and image understanding.

UNIT-5-(08 HOURS)

Satellite communication: Introduction to satellite communication, low earth orbit, satellite constellation, medium earth orbit, Geostationary orbit, Molniya orbit, Frequency allocation for satellite systems: Radio Navigation satellite service, Meteorological satellite services, transponders.

TEXT BOOKS

1. "Spacecraft TT&C and Information Transmission Theory and Technologies", by, Jiaxing Liu. Publisher: Springer,2014
2. "Introduction to PCM Telemetering Systems", by Stephen Horan. Publisher: CRC Press
3. "Satellite Communications Systems: Systems, Techniques and Technology", by Gerard Maral, Michel Bousquet, Zhili Sun. Publisher: Wiley,2020

REFERENCE BOOKS

1. "Satellite Communications", by Timothy Pratt, Jeremy E. Allnutt, 3rd Edition Publisher: Wiley.
2. "Principles of Modern Communication Systems", by Samuel O. Agbo , Matthew
3. N. O. Sadiku 2017

COURSE ASSESSMENT METHOD

Continuous Internal Evaluation (CIE)

Three internal assessments for **30** Marks each.
Two Learning Activities for **10** Marks each.
Semester End Examination (SEE)
Semester end examination for 100 Marks
Program Outcomes – Articulation matrix

PO	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**PSO1**	**PSO2**
CO1	3	2	2		-				2	3	-	3		
CO2	3	2	3		-	-	-	-	3	2	-	3		
CO3	3	3	2		-	-	-	-	2	3	-	3		
CO4	3	2	1		-	-	-	-	2	2	-	3		
CO5	3	2	2	-	-	-	-	-	3	2	-	3		

JAMMING AND ELECTRONIC COUNTER MEASURE / ELECTRONIC COUNTER-COUNTERMEASURE				
Course Code	**22DTA326**		**Credits**	**03**
Hours/Week (L-T-P)	**3-0-0**		**CIE Marks**	**50**
Total Hrs	**39**		**SEE Marks**	**50**
Exam Hrs	**03**		**Course Type**	**PEC**

COURSE OUTCOMES

Course outcomes: After completion of the course, students will be able to-

1. Understand the concept of electronic attacks.
2. Understand the principles of electronic jamming technology.
3. Understand the practical applications of current and evolving electronic jamming technology.
4. Understand the different types of electronic counter measures.
5. Understand the different types of electronics counter – counter measures.

TEACHING METHODOLOGY

- Blackboard teaching/PowerPoint presentation (if needed) /Flipped Classes for specified topics.
- Tutorial classes on topics covered.
- Unit tests on covered topics

COURSE CONTENTS

UNIT-1-(07 HOURS)

Principles of Electronic Attack (EA): Identifying and managing security risks, Implementing security controls to reduce security risks, Detecting and understanding cyber security events, Jamming-to-Signal Ratio, Jamming Types Burn-Through, Cover Jamming, Range Deceptive Jamming, Inverse Gain Jamming.

UNIT-2-(08 HOURS)

Radar Jamming and deception: Repeater Jamming Equations, Noise Jamming - noise jamming are spot, sweep, and barrage. Noise Jamming versus Deception, Repeater versus Transponder, Side lobe Jamming versus Main Lobe Jamming.

UNIT-3-(08 HOURS)

Electronic counter measure Techniques : Stand-Off Jamming, Escort Jamming, Self-Protection Jamming, Electronic counter measure techniques, On-Board Electronic counter measure Systems, Off-Board Electronic counter measure Systems.

UNIT-4-(08 HOURS)

Advanced counter measure Techniques: Infrared Countermeasures (IRCM), Off-Board Electronic counter measure Systems, Communications Countermeasures (COM-ECM), Electro-Optic Counter Measure (EOCM) Systems.

UNIT-5-(08 HOURS)

Electronic counter- counter measure Techniques: Airborne Tactical Jamming System, Shipboard Self-Defense System, EA/Susceptibility against Weapon Systems. Search Radar Counter- Countermeasures, Tracking Radar. Counter- Countermeasures, Infrared Counter-Countermeasures, Communications Counter-Countermeasures.

TEXT BOOKS

1. "Electronic Countermeasure and Electronic Counter-Countermeasure", by Bahman Zohuri.
2. "Fundamentals of Electronic Warfare 2001", by S.A. Vakin , L.N. Shustov, R.H. Dunwell.
3. "Communications, Radar and Electronic Warfare by Adrian Graham 2010

REFERENCE BOOKS

1. "Electronic Warfare & Radar Systems Engineering Handbook" 2013, Naval Air Warfare Center Weapons Division.
2. "EW 101: A First Course in Electronic Warfare (Artech House Radar Library)", 1st Edition

COURSE ASSESSMENT METHOD

Continuous Internal Evaluation (CIE)

Three internal assessments for **30** Marks each.														
Two Learning Activities for **10** Marks each.														
Semester End Examination (SEE)														
Semester end examination for 100 Marks														
Program Outcomes – Articulation matrix														
PO	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**PSO1**	**PSO2**
CO1	3	3	2		-				2	2	-	3		
CO2	3	2	3		-	-	-	-	2	2	-	3		
CO3	3	2	2		-	-	-	-	2	2	-	3		
CO4	3	2	2	-	-	-	-	-	3	2	-	3		
CO5	3	2	2	-	-	-	-	-	2	2	-	3		

SOFTWARE DEFINED RADIOS				
Course Code	**21DTA247**		**Credits**	**03**
Hours/Week (L-T-P)	**3-0-0**		**CIE Marks**	**50**
Total Hrs	**39**		**SEE Marks**	**50**
Exam Hrs	**03**		**Course Type**	**PEC**

COURSE OUTCOMES

Course outcomes: After completion of the course, students will be able to-

1. Understand the concept, application of SDRs.
2. Understanding of analog RF components as front end block in implementation of SDR.
3. Gain knowledge of digital hardware architectures and its development techniques.
4. Gain knowledge of software development for embedded wireless systems.
5. Learn design aspects of software defined radio.

TEACHING METHODOLOGY

- Blackboard teaching/PowerPoint presentation (if needed) /Flipped Classes for specified topics.
- Tutorial classes on topics covered.
- Unit tests on covered topics

COURSE CONTENTS

UNIT-1-(07 HOURS)

Introduction: SDR introduction, major standards, SDR architecture, SDR enablers, advantage / disadvantages, Applications. SDR Hardware, super-heterodyne architecture, homodyne architecture, advantages & disadvantages, Software for SDR, Processing architecture for SDR.

UNIT-2-(08 HOURS)

Digital modulation: Waveform platform bifurcation, red – black separation, digital modulation- advanced linear and non-linear bandwidth efficient modulations. Bandwidth and power efficiency, peak to average power, error vector magnitude and error probability.

UNIT-3-(08 HOURS)

Radio frequency: RF channels, receiver channel equalization, multiple access techniques Frequency, time and code division techniques as well as carrier sensing, Wireless sensor networks and beam steering in azimuth and elevation, receiver analogue signal processing, receiver digital signal processing.

UNIT-4-(08 HOURS)

Source and channel coding: Source and channel coding, sampling, entropy, data compression, voice coding, block and convolution coding, turbo coding, space-time coding and trellis coding.

UNIT-5-(08 HOURS)

Aspects of Software radio design: Case studies associated with the design of software radio, Introduction and a Historical perspective of software defined radio. Applications of software-defined radios.

TEXT BOOKS

1. Jeffrey H.Reed, Software Radio, (A modern approach to radio engineering), Prentice Hall (20 May 2002)
2. John J. Rouphael, RF and Digital Signal Processing for Software Defined Radio,Newnes; Illustrated edition (19 November 2008)

REFERENCE BOOKS

1. B.G.Goldberg., Digital Techniques in Frequency Synthesis, Publisher: McGraw Hill..
2. N.J.Fliege, Multi rate Signal Processing. Publisher: John Wiley and sons

COURSE ASSESSMENT METHOD

Continuous Internal Evaluation (CIE)

Three internal assessments for **30** Marks each.

Two Learning Activities for **10** Marks each.

Semester End Examination (SEE)

Semester end examination for 100 Marks

Program Outcomes – Articulation matrix														
PO	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**PSO1**	**PSO2**	**BT**
CO1	3	2	2		-				2	3	-	3			3
CO2	3	2	2		-	-	-	-	2	2	-	3			3
CO3	3	2	2		-	-	-	-	2	3	-	3			3
CO4	3	2	2	-	-	-	-	-	2	2	-	3			3
CO5	3	2	2		-	-	-	-	2	2	-	3			3

ELECTROMAGNETIC INTERFERENCE / ELECTROMAGNETIC COMPATIBILITY IN MILITARY				
Course Code	**21DTA328**		**Credits**	**03**
Hours/Week (L-T-P)	**3-0-0**		**CIE Marks**	**50**
Total Hrs	**39**		**SEE Marks**	**50**
Exam Hrs	**03**		**Course Type**	**PEC**

COURSE OUTCOMES

Course outcomes: After completion of the course, students will be able to-

1. Understand the concept of EMI / EMC protection of equipment.
2. Identify and prevent the common EMI/EMC problems in military systems.
3. Understand the Design impact (by requirement) of military EMC specifications.
4. Understand EMI/EMC troubleshooting tips and techniques.
5. Learn generate EMI/EMC requirements document.

TEACHING METHODOLOGY

- Blackboard teaching/PowerPoint presentation (if needed) /Flipped Classes for specified topics.
- Tutorial classes on topics covered.
- Unit tests on covered topics

COURSE CONTENTS

UNIT-1-(07 HOURS)

Basic Concepts: Definition of Electromagnetic interference (EMI) / Electromagnetic compatibility (EMC) and Electromagnetic pulse, Classification of EMI/EMC, Sources of EMI, EMI coupling modes, ESD Phenomena and effects, Transient phenomena and suppression.

UNIT-2-(08 HOURS)

EMC requirements : EMC requirements for electronic systems, Non-ideal Behaviors of Components; EMI Measurements: Basic principles of EMI measurements, EMI measuring instruments;

UNIT-3-(08 HOURS)

EMI Control Methods : EMI Control Methods for Conducted and radiated emissions and susceptibility, Crosstalk and shielding, Grounding, Bonding, Filtering, EMI gasket, Isolation transformer, Opto-isolator; Faraday cage, isolation of shelters.

UNIT-4-(08 HOURS)

EMC Standard and Regulations: National and Intentional standardizing organizations, Frequency assignment, Spectrum conversation; EMC Design and Interconnection Techniques: Cable routing and connection, Component selection and mounting, PCB design (Trace routing, Impedance control, decoupling, Zoning and grounding).

UNIT-5-(07 HOURS)

EMC analysis and detection techniques: Using tools for electromagnetic signal integrity analysis, studying eye diagrams or eye patterns for communication system and analyzing signals using eye diagram.

TEXT BOOKS

1. Bruce R. Archambeault, Omar M. Ramahi, etal. , EMI/EMC Computational Modeling Handbook: The Springer International Series in Engineering and Computer Science), 31 August 2001

REFERENCE BOOKS

1. Chetan Kathalay A practical approach to electromagnetic compatibility, EMC Publications; 2nd edition (1 February 2019)

COURSE ASSESSMENT METHOD

Continuous Internal Evaluation (CIE)

Three internal assessments for **30** Marks each.

Two Learning Activities for **10 Marks** each.

Semester End Examination (SEE)

Semester end examination for 100 Marks

Program Outcomes – Articulation matrix

PO	1	2	3	4	5	6	7	8	9	10	11	12	PSO1	PSO2

CO1	3	2	-	-	-		2				-	2		
CO2	3	3					3	-	-		-	2		
CO3	3	2					2	-	-		-	2		
CO4	3	2					3	-	-		-	2		
CO5	3	3					3	-	-	-	-	2		

TEST METHODOLOGIES FOR DEW SYSTEMS (LASERS & MICROWAVE)

Course Code	**21DTA329**		**Credits**	**03**
Hours/Week (L-T-P)	**3-0-0**		**CIE Marks**	**50**
Total Hrs	**39**		**SEE Marks**	**50**
Exam Hrs	**03**		**Course Type**	**PEC**

COURSE OUTCOMES

Course outcomes: After completion of the course, students will be able to-

1. Understand the characterization and testing requirements of DEW systems.
2. Carry out the indoors & outdoors system performance testing.
3. Understand the safety issues, safety standards, handling high power sources.
4. Analyze and study the S parameters and impedance measurement, power measurement and phase noise measurement of microwave systems.
5. Analyze and study the system characterization techniques, HPM safety tools and safety standards.

TEACHING METHODOLOGY

- Blackboard teaching/PowerPoint presentation (if needed) /Flipped Classes for specified topics.
- Tutorial classes on topics covered.
- Unit tests on covered topics

COURSE CONTENTS

UNIT-1-(08 HOURS)

Testing requirements of DEW system, types of testing, laser effect testing on target, system output testing.

UNIT-2-(08 HOURS)

System performance testing, System outdoor test & measurement instruments.

UNIT-3-(08 HOURS)

Laser testing issues, Laser safety, Laser safety standards, laser safety tools.

UNIT-4-(08 HOURS)

Microwave system testing Impedance measurement, S-Parameters and the Smith Chart.

UNIT-5-(08 HOURS)

Power Measurement, Noise Figure and Phase Noise measurement, Frequency measurements (Spectrum Analysis), Gain Compression and Intermodulation, Network Analysis,
Microwave subsystem / system characterization techniques. HPM safety tools, safety standards.

TEXT BOOKS

1. Ananjan Basu., An Introduction to Microwave Measurements, CRC Press; 1st edition (24 December 2014)

REFERENCE BOOKS

1. Literature / books suggested by respective course Lecturers.

COURSE ASSESSMENT METHOD

Continuous Internal Evaluation (CIE)

Three internal assessments for 30 Marks each.

Two Learning Activities for **10** Marks each.

Semester End Examination (SEE)

Semester end examination for 100 Marks

Program Outcomes – Articulation matrix

PO	1	2	3	4	5	6	7	8	9	10	11	12	PSO1	PSO2
CO1	3	3			-		2			2	-	3		
CO2	3	2			-	-	1	-	-	2	-	3		
CO3	3	2			-	-	2	-	-	2	-	3		
CO4	3	3			-	-	1	-	-	2	-	3		
CO5	3	2					1	-	-	-2	-	3		

OPEN ELECTIVE COURSES-I

SENSOR TECHNOLOGY				
Course Code	**22DTA331**		**Credits**	**03**
Hours/Week (L-T-P)	**3-0-0**		**CIE Marks**	**50**
Total Hrs	**39**		**SEE Marks**	**50**
Exam Hrs	**03**		**Course Type**	**OEC**

COURSE OUTCOMES

Course outcomes: After completion of the course, students will be able to-

1. Understand the basic principles of sensor systems required for satellites and tactical aircraft.
2. Understand the atmospheric propagation and its impact on the performance of sensors.
3. Analyze the Phased array and pulsed compressed radars.
4. Troubleshoot, repair/replace a faulty sensor.
5. Analyze Optical and infrared imaging detector systems.

TEACHING METHODOLOGY

- Blackboard teaching/PowerPoint presentation (if needed) /Flipped Classes for specified topics.
- Tutorial classes on topics covered.
- Unit tests on covered topics

COURSE CONTENTS

UNIT-1-(07 HOURS)

Introduction : Physical principles underlying the sensor systems needed for satellites and tactical aircraft, as well as limitations imposed by the atmosphere and operating environment on the system and their communication links.

UNIT-2-(08 HOURS)

Radars: Phased array and pulsed compressed radars, imaging synthetic aperture and inverse synthetic aperture radars, Pulse Compression for Phased Array Weather Radars.

UNIT-3-(08 HOURS)

Signals and detectors: Atmospheric propagation of signal. Noise resources and thermal radiation, Principles of semiconductor devices. Optical and infrared imaging detector systems.

UNIT-4-(08 HOURS)

Signal and noise : Detector resolution limitations and bandwidth requirements, Relationship between signals and noise.

UNIT-5-(08 HOURS)

Sensor functions: The characteristics of critical sensor functions - including detection, estimation, imaging, and tracking.

TEXT BOOKS

1. J. W. Gardner. , Micro sensors, Principles and Applications, Publisher :Wiley
2. Jacob Fraden, Handbook of Modern Sensors, by. Publisher :Springer

REFERENCE BOOKS

1. S. M. Sze., Semiconductor Sensors, Publisher: Wiley
2. Literature / books suggested by respective course Lecturers

COURSE ASSESSMENT METHOD

Continuous Internal Evaluation (CIE)

Three internal assessments for **30** Marks each.

Two Learning Activities for **10** Marks each.

Semester End Examination (SEE)

Semester end examination for 100 Marks

Program Outcomes – Articulation matrix

PO	1	2	3	4	5	6	7	8	9	10	11	12	PSO1	PSO2
CO1	3	3			-				2	2	-	3		
CO2	3	2			-	-	-	-	2	2	-	3		

CO3	3	2			-	-	-	-	2	2	-	3		
CO4	3	2	-	-	-	-	-	-	2	2	-	3		
CO5	3	2	-	-	-	-	-	-	2	2	-	3		

LAUNCH VEHICAL DESING AND ANALYSIS				
Course Code	**22DTA332**		**Credits**	**03**
Hours/Week (L-T-P)	**3-0-0**		**CIE Marks**	**50**
Total Hrs	**39**		**SEE Marks**	**50**
Exam Hrs	**03**		**Course Type**	**OEC**

COURSE OUTCOMES

Course outcomes: After completion of the course, students will be able to-

1. Understand the launch vehicle requirements, its functioning.
2. Performance analysis of propulsion systems.
3. Design and analysis of launch vehicles.
4. Understand the propellant requirement for launch vehicles.
5. Analysis of rocket engines for structural integrity.

TEACHING METHODOLOGY

- Blackboard teaching/PowerPoint presentation (if needed) /Flipped Classes for specified topics.
- Tutorial classes on topics covered.
- Unit tests on covered topics

COURSE CONTENTS

UNIT-1-(07 HOURS)

Introduction: Introduction to propulsion systems for launch vehicles, beginning with mission energy requirements and an overview of current and proposed launch propulsion devices and its limitations.

UNIT-2-(08 HOURS)

Rocket Fundamentals Performance analysis, parameters, operating characteristics and propellant selection criteria for air breathing and solid, liquid and cryogenic rocket engines, staging of rockets. Tsiolkov sky rocket equation.

UNIT-3-(08 HOURS)

Design Concepts and Techniques Advanced cycles and concepts are presented. Design of components and subsystems like aerodynamics, propulsion, payload, structural and control systems. stage separation techniques

UNIT-4-(08 HOURS)

Dynamic Analysis: elements of structural dynamics and aero-elasticity, structural dynamics analysis of rocket engines for structural integrity, Nonlinear analysis in Finite element methods, Launch dynamic analysis. Tracking and controlling errors.

UNIT-5-(08 HOURS)

Finite element modelling: Idealization, Discretization, Meshing, Analysis and Post Processing of the data. Structural dynamic analysis of components - Turbomachinery and nozzles. Frequency response of systems.

TEXT BOOKS

1. Don Edberg, Willie Costa. Design of Rockets and Space Launch Vehicles, Publisher: American Institute of Aeronautics & Ast. (August 21,2020).
2. Dieter K Huzel, David H Huang., Modern Engineering for Design of Liquid Propellant Rocket Engines (Progress in Astronautics and Aeronautics), Publisher : AIAA (American Institute of Aeronautics & Astronautics); Revised, Subsequent edition.

REFERENCE BOOKS

1. Michael D. Griffin and James R. French, Space Vehicle Design, Second Edition,. Publisher The American Institute of Aeronautics and Astronautics, Inc.
2. Michael D. Griffin and James R. French, Space Vehicle Design, Second Edition, . Publisher The American Institute of Aeronautics and Astronautics, Inc.
3. Nickolay Mykola Zosimovych, Commercial Launch Vehicle Design, . Publisher: Lap Lambert Academic Publishing.

COURSE ASSESSMENT METHOD

Continuous Internal Evaluation (CIE)

Three internal assessments for **30** Marks each.
Two Learning Activities for **10** Marks each.
Semester End Examination (SEE)
Semester end examination for 100 Marks
Program Outcomes – Articulation matrix

PO	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**PSO1**	**PSO2**
CO1	3	3			-				2	2	-	3		
CO2	3	2	2		-	-	-	-	2	2	-	3		
CO3	3	2	2		-	-	-	-	2	2	-	3		
CO4	3	2	-	-	-	-	-	-	2	2	-	3		
CO5	3	3	-	-	-	-	-	-	2	2	-	3		

DATA ACQUISITION, TRACKING & POST FLIGHT ANALYSIS				
Course Code	**22DTA333**		**Credits**	**03**
Hours/Week (L-T-P)	**3-0-0**		**CIE Marks**	**50**
Total Hrs	**39**		**SEE Marks**	**50**
Exam Hrs	**03**		**Course Type**	**OEC**

COURSE OUTCOMES

Course outcomes: After completion of the course, students will be able to-

1. Understand the interfaces used in data acquisition and standalone instruments to real-world signals.
2. Understand the Sensors and transducers, Data acquisition hardware and data acquisition software.
3. Analyze Static and Dynamic Characteristics of instruments.
4. Understand the uses of active and passive types in measurement of acceleration and other parameters.
5. Carry out post flight analysis.

TEACHING METHODOLOGY

- Blackboard teaching/PowerPoint presentation (if needed) /Flipped Classes for specified topics.
- Tutorial classes on topics covered.
- Unit tests on covered topics

COURSE CONTENTS

UNIT-1-(07 HOURS)

Importance of Flight Trials: in Missile Development, Facilities, Safety, Requirements The goal of production flight trials is to ensure individual aircraft are manufactured properly and is in a condition for safe operations. It is the final stage of the production process and is a prerequisite to each aircraft being issued a Certificate of Airworthiness and released to the customer.

UNIT-2-(08 HOURS)

Methods of Measurement, Introduction to Measuring Instruments: Functional elements of an instrument Variables may be classified in many ways, but generally, most experts prefer two classifications: by characteristic and by type of measurement signal. Variables classified by characteristic include thermal, radiation, force, rate, quantity, time, geometric, physical properties, chemical composition, and electrical. Those classified by measurement signal include motion, force, electrical, and time-modulated. Measurement signals for variables often are hard to differentiate from the measuring system. Four factors require close consideration for measurement signals and systems: the types of transducers available for converting variables to measurement signals, transmission characteristics, data acquisition system input matching, and transducers available to convert from one type of measurement signal to another measurement signal.

UNIT-3-(08 HOURS)

Static and Dynamic Characteristics: Zero, First and Second order of Instruments and their response The characteristics of the one group may well influence the characteristics of the other. In order to access overall instrument performance, however, the two groups of characteristics are normally studied separately and then a semi-quantitative superposition is carried out.

UNIT-4-(08 HOURS)

Sensors and Transducers: Passive and Active types, their uses in measurement of acceleration, angle, vibration, pressure, flow and temperature, strain etc., Data acquisition systems measure, store, display, and analyze information collected from a variety of devices. Most measurements require a transducer or a sensor, a device that converts a measurable physical quantity into an electrical signal.

UNIT-5-(08 HOURS)

Methods: for post flight data analysis. Calibration of Instruments Air data are vital to successfully complete an aircraft's mission and are derived from the air surrounding the aircraft. References 1–4 supply pertinent information regarding air data measurement and calibration. These air data encompass indicated and true airspeed, pressure altitude, ambient air temperature, angles of attack and sideslip, Mach number, and rate of climb. Typically, pitot and static pressures are sensed and converted (by mechanical means in the instruments themselves) into indications on the altimeter, vertical speed indicator, airspeed indicator, and Machmeter. Similarly, measured local flow angles establish angles of attack and sideslip, and the outside air temperature is measured and indicated in the cockpit.

(Instruments that can perform the conversion, such as airspeed indicators, altimeters, and Machmeters, do not correct for errors in the input values.) These measured parameters are commonly input to the airdata computer, which, using appropriate algorithms and correction factors (or calibrations, as discussed later), can provide other parameters, such as true airspeed, required by the aircraft's avionics or flight control system.
TEXT BOOKS
1. Tsourdos, B.A.White, Advances in Missile Guidance, Control, and Estimation: 47 (Automation and Control Engineering), Wiley;23 November 2010. 2. Alessandro Brunelli., Calibration Handbook of Measuring Instruments 1st Edition, Publisher : International Society of Automation
REFERENCE BOOKS
1. Ian Sinclair, Sensors And Transducers Paperback, Publisher :Elsevier, January 2013. 2. Patranabis D, Sensors and Transducers, Publisher : Prentice Hall India Learning Private Limited
COURSE ASSESSMENT METHOD
Continuous Internal Evaluation (CIE)
Three internal assessments for 30 Marks each.
Two Learning Activities for **10** Marks each.
Semester End Examination (SEE)
Semester end examination for 100 Marks
Program Outcomes – Articulation matrix

PO	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**PSO1**	**PSO2**	**BT**
CO1	2	2	-	-	-						-	3			2
CO2	2	2	2	2	-	-	2	-	-		-	3			3
CO3	1	1	2	2	-	-	2	-	-		-	3			3
CO4	1	1	1	1	-	-	1	-	-		-	3			3
CO5	2	2	2	2	2	2	2	-	-	-	-	3			3

UNMANNED AERIAL VEHICLE				
Course Code	**22DTA334**		**Credits**	**3**
Hours/Week (L-T-P)	**3-0-0**		**CIE Marks**	**50**
Total Hrs	**39**		**SEE Marks**	**50**
Exam Hrs	**3**		**Course Type**	**OEC**

COURSE OUTCOMES

Course outcomes: After completion of the course, students will be able to-

1. To classify UAVs based on different parameters.
2. To demonstrate ability to design an efficient structure for an UAV of specific application.
3. To perform ground testing of UAVs.
4. To apply the knowledge gained on electronic intelligence and target designation for successful development of UAS.
5. To understand the basic concepts in the different types of navigation schemes for UAS.

TEACHING METHODOLOGY

- Blackboard teaching/PowerPoint presentation (if needed) /Flipped Classes for specified topics.
- Tutorial classes on topics covered.
- Unit tests on covered topics

COURSE CONTENTS

UNIT -1- (07 HOURS)

Introduction to uav: History of UAV –classification –basic terminology-models and prototypes –applications

UNIT -2- (08 HOURS)

Basics of airframe: Airframe –dynamics –modeling- structures –wing design- engines and its types-equipment, maintenance and management-control surfaces-specifications.

UNIT -3- (08 HOURS)

Development of uas system: System Development- Ground Testing-UAV component testing-Uav Sub-assembly and Sub- System Testing- Testing Complete UAV, Environmental testing – Testing Complete UAV-Control Station testing-Catapult Launch systems -System In flight Testing- Test sites-Test Crew training-Onsite preparation - System Certification.

UNIT -4- (08 HOURS)

Deployment of unmanned aerial system: Operational trails-network centric operations-Radar confusion-Missile Decoy-radio relay- Electronic Intelligence-Covert Reconnaissance and surveillance Target designation by laser, NBC contamination Monitoring-Long Range reconnaissance and strike- Aerial photography- Information services-communication relay- landmine detection and Destruction-other applications

UNIT -5- (08 HOURS)

Communication payloads and path planning: Payloads-Telemetry-tracking-Aerial photography, Frequency range – Commands- Control, FPV videos - Flight computer sensor-displays, RF modems, Simulation and ground testing, Trouble shooting, waypoints navigation and ground control software.

TEXT BOOKS

1. Armand J. Chaput, "Design of Unmanned Air Vehicle Systems", Lockheed Martin Aeronautics Company, 2001.
2. Kimon P. Valavanis, "Advances in Unmanned Aerial Vehicles: State of the Art and the Road to Autonomy", Springer, 2007.
3. Paul G Fahlstrom, Thomas J Gleason, "Introduction to UAV Systems", UAV Systems, Inc, 1998.

REFERENCE BOOKS

1. Reg Austin, "Unmanned Aircraft systems-UAVs Design, Development and Deployment", WILEY Publication, 2010.
2. Robert C. Nelson, "Flight Stability and Automatic Control", McGraw-Hill, Inc, 1998.
3. Swatton ,PJ, "Ground studies for pilots' flight planning", 6th edition, 2008.

COURSE ASSESSMENT METHOD

Continuous Internal Evaluation (CIE)
Three internal assessments for 30 Marks each.
Two Learning Activities for 10 Marks each.
Semester End Examination (SEE)
Semester end examination for 100 Marks
Program Outcomes – Articulation matrix

PO	1	2	3	4	5	6	7	8	9	10	11	12	PSO1	PSO2
CO1	3	1										2		1
CO2	2	2							2			1		1
CO3	1			1	1							2		1
CO4	2								2			1		
CO5	1	2		1					2			2		

ROCKETS AND MISSILES				
Course Code	**22DTA335**		**Credits**	**3**
Hours/Week (L-T-P)	**3-0-0**		**CIE Marks**	**50**
Total Hrs	**39**		**SEE Marks**	**50**
Exam Hrs	**03**		**Course Type**	**PEC**

COURSE OUTCOMES

Course outcomes: After completion of the course, students will be able to-

1. Design Consideration of liquid Rocket Combustion Chamber and Design Considerations of Igniter and types of igniters.
2. Describing Aerodynamic Forces and Moments. Lateral Damping Moment and Longitudinal Moment of a Rocket
3. Explain the One Dimensional and Two Dimensional rocket Motions in Free Space and Homogeneous Gravitational Fields.
4. Understand various methods of thrust determinations and thrust vector control. It will also describe the rockets Separation Techniques.
5. Understanding of selection criteria for materials and Special Requirements of Materials to Perform under Adverse Conditions.

TEACHING METHODOLOGY

- Blackboard teaching/PowerPoint presentation (if needed) /Flipped Classes for specified topics.
- Tutorial classes on topics covered.
- Unit tests on covered topics

COURSE CONTENTS

UNIT-1-(07 HOURS)

Ignition System in rockets - types of Igniters - Igniter Design Considerations - Design Consideration of liquid Rocket Combustion Chamber, Injector Propellant Feed Lines, Valves, Propellant Tanks Outlet and Helium Pressurized and Turbine feed Systems - Propellant Slosh and Propellant Hammer - Elimination of Geysering Effect in Missiles - Combustion System of Solid Rockets.

UNIT-2-(08 HOURS)

Airframe Components of Rockets and Missiles - Forces Acting on a Missile While Passing Through Atmosphere - Classification of Missiles - methods of Describing Aerodynamic Forces and Moments- Lateral Aerodynamic Moment - Lateral Damping Moment and Longitudinal Moment of a Rocket - lift and Drag Forces - Drag Estimation - Body Upwash and Downwash in Missiles - Rocket Dispersion

UNIT-3-(08 HOURS)

One Dimensional and Two Dimensional rocket Motions in Free Space and Homogeneous Gravitational Fields - description of Vertical, Inclined and Gravity Turn Trajectories - Determination of range and Altitude Simple Approximations to Burnout Velocity.

UNIT-4-(08 HOURS)

Rocket Vector Control - Methods - Thrust determination - SITVC - Multistaging of rockets -Vehicle Optimization - Stage Separation Dynamics - Separation Techniques.

UNIT-5-(07 HOURS)

Selection of Materials - Special Requirements of Materials to Perform under Adverse Conditions.

TEXT BOOKS

1. G.P. Sutton, Rocket Propulsion Elements, John Wiley & Sons Inc., New York, 5th Edition, 1986.

REFERENCE BOOKS

1. J.W. Cornelisse, Rocket Propulsion and Space Dynamics, J.W. Freeman & Co., London, 1982.
2. Mathur, M., and Sharma, R.P, Gas Turbines and Jet and Rocket Propulsion, Standard Publishers, New Delhi, 1991.

COURSE ASSESSMENT METHOD

Continuous Internal Evaluation (CIE)

Three internal assessments for **30** Marks each.														
Two Learning Activities for **10** Marks each.														
Semester End Examination (SEE)														
Semester end examination for 100 Marks														
Program Outcomes – Articulation matrix														
PO	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**PSO1**	**PSO2**
CO1	**3**	**3**	**2**				**1**					**1**	**2**	**1**
CO2	**3**	**3**	**2**				**1**					**1**	**2**	**1**
CO3	**3**	**3**	**2**				**1**					**1**	**2**	**1**
CO4	**3**	**3**	**2**				**1**					**1**	**2**	**1**
CO5	**3**	**3**	**2**				**1**					**1**	**2**	**1**

TRAJECTORIES MODELLING & SIMULATION

Course Code	**22DTA336**		**Credits**	**03**
Hours/Week (L-T-P)	**3-0-0**		**CIE Marks**	**50**
Total Hrs	**39**		**SEE Marks**	**50**
Exam Hrs	**03**		**Course Type**	**OEC**

COURSE OUTCOMES

Course outcomes: After completion of the course, students will be able to-

1. Understand the flight trajectories design requirements.
2. Evaluate and predict the flight performance for different trajectories.
3. Understand the practical implications while trajectory design.
4. Carry out MATLAB based simulation for trajectory modelling

TEACHING METHODOLOGY

- Blackboard teaching/PowerPoint presentation (if needed) /Flipped Classes for specified topics.
- Tutorial classes on topics covered.
- Unit tests on covered topics

COURSE CONTENTS

UNIT-1-(07 HOURS)

Elements of trajectory design: Flight Dynamics, Flight envelope limitations. Aerodynamic sizing- equations of motion. Accuracy of simplified equations of motion, escape velocity and elements of orbital mechanics.

UNIT-2-(08 HOURS)

Trajectories and maneuvers: Role of rocket propulsion in orbital trajectories and maneuvers, Ideal velocity attainment from Rocket equation, Maximizing missile flight performance. Benefits of flight trajectory shaping.

UNIT-3-(08 HOURS)

Flight performance: Flight performance prediction of different phases of flight trajectory - boost phase, climb, cruise, coast, steady descent, ballistic, maneuvering, divert, and homing flight.

UNIT-4-(08 HOURS)

Trajectory planning and implementation : Practical implementation of integrated trajectory planning, Agility in maneuvering trajectories, Extensive MATLAB-based mini-projects on trajectory planning and design.

UNIT-5-(08 HOURS)

Multiplier theory and mathematical formulations: Multiplier theory and its use in solving practical Problems covered from a real-time computational viewpoint, No-fly zones and engineering requirements, Formulation as a mathematical mixture of state and decision-variable constraints.

TEXT BOOKS

1. Robert F. Stengel., Flight Dynamics, Publisher : Princeton University Press.

REFERENCE BOOKS

1. Literature / books suggested by respective course Lecturers.

COURSE ASSESSMENT METHOD

Continuous Internal Evaluation (CIE)

Three internal assessments for **30** Marks each.

Two Learning Activities for **10** Marks each.

Semester End Examination (SEE)

Semester end examination for 100 Marks

Program Outcomes – Articulation matrix

PO	1	2	3	4	5	6	7	8	9	10	11	12	PSO1	PSO2
CO1	3	3			-				2	2	-	3		
CO2	3	3			-	-	-	-	2	2	-	3		
CO3	3	3			-	-	-	-	2	2	-	3		
CO4	3	3			-	-	-	-	2	2	-	3		

CO5	3	3			-	-	-	-	2	2	-	3		

ACQUISITION, TRACKING & POINTING TECHNOLOGY				
Course Code	**22DTA337**		**Credits**	**03**
Hours/Week (L-T-P)	**3-0-0**		**CIE Marks**	**50**
Total Hrs	**39**		**SEE Marks**	**50**
Exam Hrs	**03**		**Course Type**	**OEC**

COURSE OUTCOMES

Course outcomes: After completion of the course, students will be able to-

1. Understand the concepts and basic systems requirements tracking systems.
2. Understand the system configurations and critical component characteristics required in the design of stabilized pointing and tracking systems, along with an introduction to some more advanced concepts.
3. Understand the control system and algorithm techniques and practices commonly utilized in the design of tracking systems.
4. Understand counter measures.
5. Understand about Doppler and Electro-Optical methods of tracking.

TEACHING METHODOLOGY

- Blackboard teaching/PowerPoint presentation (if needed) /Flipped Classes for specified topics.
- Tutorial classes on topics covered.
- Unit tests on covered topics

COURSE CONTENTS

UNIT-1-(07 HOURS)

Basics: Basic aspects of acquisition, fundamental concepts of tracking, pointing technology details, Military system requirements, Acquisition, tracking, and pointing (ATP) design for military systems.

UNIT-2-(08 HOURS)

Mathematical aspects: Review of mathematical techniques, Target tracking and related mathematics, SNR requirement, the Johnson criteria, probability of estimation, detection criteria, examples.

UNIT-3-(08 HOURS)

Algorithms: Need of algorithms, Tracking algorithms, track filters, multi target tracking, example problems, Algorithms for simple cases, methods to incorporate additional requirements to algorithms.

UNIT-4-(08 HOURS)

Counter measures: Various aspects of counter measures, need for counter measures, Electronic countermeasures against modern target tracking radars multiplatform-multi-sensor-multi target tracking.

UNIT-5-(08 HOURS)

Tracking methods: Different principles used in tracking methods, Doppler and Electro-Optical methods of tracking, other tracking methods, un conventional methods used and their advantages.

TEXT BOOKS

1. Steven L. Chodos B(Editor), William E. Thompson(Editor).Acquisition, Tracking, Pointing, and Laser Systems Technologies XXI (Proceedings of SPIE) 30 October 2007 ,
2. Hemani Kaushal, Vk Jain and Subrat Kar. ,Acquisition, Tracking, and Pointing, January 2017 In book: Free Space Optical Communication, Publisher: Springer India.

REFERENCE BOOKS

1. Literature / books suggested by respective course Lecturers

COURSE ASSESSMENT METHOD

Continuous Internal Evaluation (CIE)

Three internal assessments for **30** Marks each.

Two Learning Activities for **10** Marks each.

Semester End Examination (SEE)

Semester end examination for 100 Marks

Program Outcomes – Articulation matrix														
PO	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**PSO1**	**PSO2**
CO1	3	3			-				2	2	-	3		
CO2	3	2			-	-	-	-	2	2	-	3		
CO3	3	3			-	-	-	-	2	2	-	3		
CO4	3	2	-	-	-	-	-	-	2	2	-	3		
CO5	3	3	-	-	-	-	-	-	2	2	-	3		

ADVANCED DIGITAL MODULATION TECHNOLOGIES & STANDARDS				
Course Code	**21DTA338**		**Credits**	**03**
Hours/Week (L-T-P)	**3-0-0**		**CIE Marks**	**50**
Total Hrs	**39**		**SEE Marks**	**50**
Exam Hrs	**03**		**Course Type**	**OEC**

COURSE OUTCOMES

Course outcomes: After completion of the course, students will be able to-

1. Understand the design of digital communication systems.
2. Understand the transmitter, receiver communications system models, voice source coding– pulse code modulation, delta modulation and vocoders.
3. Understand the requirement of cellular communication.
4. Apply the different communication models to optimize
5. Apply the signal analysing techniques

TEACHING METHODOLOGY

- Blackboard teaching/PowerPoint presentation (if needed) /Flipped Classes for specified topics.
- Tutorial classes on topics covered.
- Unit tests on covered topics

COURSE CONTENTS

UNIT-1-(07 HOURS)

Introduction: Design of digital communication system, transmitter and receiver communications system model, Radar Block diagram, Radar frequencies, Link budget calculations telemetry.

UNIT-2-(08 HOURS)

Modulation and its standards: Voice source coding–pulse code modulation, delta modulation, vocoders Introduction to cellular communication – CDMA, OFDM, MIMO, Introduction to digital modulation standards.

UNIT-3-(08 HOURS)

Digital signal modulation: Digital modulation – Amplitude-shift, Frequency-shift, Phase-shift, differential phase-shift, Quadrature phase-shift, Quadrature phase-shift, and Minimum-shift keying, Quadrature amplitude modulation.

UNIT-4-(08 HOURS)

Communication models: Communications channel and their Characteristics – Multipath effects, fading and diversity, models of Egli and Murphy, Time Division Multiple Access, Frequency Hopping spread spectrum.

UNIT-5-(08 HOURS)

Signal analysis: Receivers – super heterodyne systems, balanced and unbalanced mixers, frequency synthesizers, Link budget analysis, Expression for Bit Error Rate, analysis of repeater and transponder.

TEXT BOOKS

1. Haykin, S. Communication Systems, Publisher: John Wiley &Sons.
2. Lathi, B.P. and Ding, Z, Modern Digital and Analog Communication Systems, Publisher: Oxford University Press

REFERENCE BOOKS

1. H. Vincent Poor, Lang Tong, Signal Processing for Wireless Communication Systems, Publisher: Springers
2. Sklar, B., and Ray, Digital Communication: Fundamentals and Applications, P.K. Dorling Kindersley

COURSE ASSESSMENT METHOD

Continuous Internal Evaluation (CIE)

Three internal assessments for **30** Marks each.

Two Learning Activities for **10** Marks each.

Semester End Examination (SEE)

Semester end examination for 100 Marks

Program Outcomes – Articulation matrix

PO	1	2	3	4	5	6	7	8	9	10	11	12	PSO1	PSO2
CO1	3	2			-				2	2	-	3		

CO2	3	2			-	-	-	-	2	2	-	3		
CO3	3	2			-	-	-	-	2	2	-	3		
CO4	3	2	-	-	-	-	-	-	2	2	-	3		
CO5	3	2	-	-	-	-	-	-	2	2	-	3		

MODELING & SIMULATION OF LASER MATTER INTERACTION

Course Code	**21DTA339**		**Credits**	**03**
Hours/Week (L-T-P)	**3-0-0**		**CIE Marks**	**50**
Total Hrs	**39**		**SEE Marks**	**50**
Exam Hrs	**03**		**Course Type**	**OEC**

COURSE OUTCOMES

Course outcomes: After completion of the course, students will be able to-

1. Understand the fundamentals of laser matter interaction.
2. Develop physics-based model for evaluation of effect of laser on metals and composites.
3. Understand about damage characterization.
4. Understand the laser parameter measurement techniques.
5. Analyze the performance of high-power laser systems.

TEACHING METHODOLOGY

- Blackboard teaching/PowerPoint presentation (if needed) /Flipped Classes for specified topics.
- Tutorial classes on topics covered.
- Unit tests on covered topics

COURSE CONTENTS

UNIT-1-(07 HOURS)

Introduction: Laser beam characteristics, different types and classes of lasers, applications of lasers, laser matter interaction, Laser lethality modeling & simulation with metal targets & composite materials.

UNIT-2-(08 HOURS)

Laser matter interaction: Basic ideas, Physics based models for vulnerability assessment, Effect of laser on metals & composite materials, methods of evaluation, effect of material properties.

UNIT-3-(08 HOURS)

Damage characterization: Terminologies used, Measurement and Characterization of Damage Thresholds, charts used, Mechanisms of Damage, Exposure Limits and Their Interpretation.

UNIT-4-(08 HOURS)

Measurement techniques: Terminologies used, Laser parameters, analysis Tools for the Estimation of Hazards, laser parameters, Laser parameters measurement techniques, examples.

UNIT-5-(08 HOURS)

Laser system performance: Tools to analyze and predict Laser System performance under different conditions like land, sea air, etc. Introduction of full scale end to end modeling of laser system performance.

TEXT BOOKS

1. Mulser, Peter, Bauer, Dieter. High Power Laser-Matter Interaction, Publisher: Springer.

REFERENCE BOOKS

1. Literature / books suggested by respective course Lecturers

COURSE ASSESSMENT METHOD

Continuous Internal Evaluation (CIE)

Three internal assessments for **30** Marks each.

Two Learning Activities for **10** Marks each.

Semester End Examination (SEE)

Semester end examination for 100 Marks

Program Outcomes – Articulation matrix

PO	1	2	3	4	5	6	7	8	9	10	11	12	PSO1	PSO2
CO1	3	3			-				2	3	-	3		
CO2	3	2			-	-	-	-	2	2	-	3		
CO3	3	3			-	-	-	-	2	2	-	3		

CO4	3	3			-	-	-	-	2	2	-	3		
CO5	3	2			-	-	-	-	2	2	-	3		

SEMESTER IV

PROJECT WORK PHASE-II				
Course Code	**22DTA41**		**Credits**	**18**
Hours/Week (L-T-P)	**0-8-0**		**CIE Marks**	**100**
Total Hrs	**50**		**SEE Marks**	**100**
Exam Hrs	**3**		**Course Type**	**Project**

COURSE OUTCOMES

1. Project work phase-II: 16-week duration during 4th semester. Evaluation shall be done by the committee constituted comprising of HoD as Chairman, Guide and Senior faculty of the department.
2. Project Evaluation: Evaluation shall be taken up at the end of 4th semester. Project work evaluation and Viva-Voce examination shall conducted
3. Project evaluation:
    a. Internal Examiner shall carry out the evaluation for 50 marks.
    b. External Examiner shall carry out the evaluation for 50 marks.
    c. The average of marks allotted by the internal and external examiner shall be the final marks of the project evaluation.
    d. Viva-Voce examination of Project work shall be conducted jointly by Internal and External examiner for 100 marks.

Program Outcomes – Articulation matrix

PO	1	2	3	4	5	6	7	8	9	10	11	12	PSO1	PSO2
CO1	3	2						3	3			3	3	3
CO2	3	2						3	3			3	3	3
CO3	2	2						3	3			2	3	2
CO4	2	2						3	3			3	3	2
CO5	3	2						3	3			3	3	3

M.Tech. in DEFENCE TECHNOLOGY
(COMMUNICATION SYSTEMS AND SENSORS - SPECIALIZATION)
SEMESTER – II

DIGITAL & SATELLITE COMMUNICATION AND NAVIGATION FROM SPACE				
Course Code	**22DTC21**		**Credits**	**03**
Hours/Week (L-T-P)	**2-0-2**		**CIE Marks**	**50**
Total Hrs	**50**		**SEE Marks**	**50**
Exam Hrs	**03**		**Course Type**	**PCC**

COURSE OUTCOMES

Course outcomes: After completion of the course, students will be able to-

1. Understand the Communication Techniques.
2. Evaluate the Performance of Communication Systems.
3. Design the Analogue and Digital Communication Systems.
4. Understand and Analyze the Signal Transmission Effects.
5. Understand the Different types of Navigation Techniques.

TEACHING METHODOLOGY

- Blackboard teaching/PowerPoint presentation (if needed) /Flipped Classes for specified topics.
- Tutorial classes on topics covered.
- Unit tests on covered topics

COURSE CONTENTS

UNIT-1 (8 HRS)

Introduction: Elements of a communications system and their relationship to system performance. Digital Communication System , Communication Channels and their Characteristics, Mathematical Models for Communication Channels, Design challenges, message sources, Channel effect, signal to noise ratio and capacity.

UNIT -2 (8 HRS)

Digital Data Communication Systems, digital signaling techniques, Link budget calculations telemetry and control and IO/IW implications, Antenna types –wire antennas, Horn Antennas, Reflector Antennas, phased array antennas. Free space optical communication, Fiber optics communication, Wireless/cellular communications.

UNIT -3 (8 HRS)

More on Fundamentals : Fundamental concepts such as current/voltage relationships, time and frequency domains, power spectral density, random signals, Communications system components and functions, analog and digital communications systems.

UNIT -4 (8 HRS)

Modulation Transmission and Reception: baseband and passband digital modulation; system noise, transmission lines, waveguides and antennas, FEC techniques for mitigating channel errors.

UNIT -5 (7 HRS)

Propagation effects on signal transmission; end-to-end path calculations for wire/coax, and RF systems including terrestrial ground links and satellite communications, Spread spectrum, concept of frequency hopping. Navigation techniques from space regarding functioning of GPS, GLONASS, IRNSS & Galileo.

TEXT BOOKS

1. T. Pratt, C. W. Bostian, J. E.Allnut, Satellite communication, Publisher: John Willey and sons.
2. G. Maral, M. Bousquet, Z. Sun. Satellite Communications Systems: systems, techniques and technology, Publisher:John Willy and sons

REFERENCE BOOKS

1. B. Sklar, Digital Communications: Fundamentals and Applications, Prentice-Hall, Inc.
2. E. Kaplan and C. Hegarty, Understanding of GPS/GNSS: Principles and Applications, Publisher: Artech House Publishers.
3. Literature / books suggested by respective course Lecturers

COURSE ASSESSMENT METHOD

Continuous Internal Evaluation (CIE)

Three internal assessments for **30** Marks each.

Two Learning Activities for **10** Marks each.

Semester End Examination (SEE)

Semester end examination for 100 Marks

Program Outcomes – Articulation matrix

PO	1	2	3	4	5	6	7	8	9	10	11	12	PSO1	PSO2
CO1	3	3	2	-	-						-			3
CO2	3	3	2	1	-	-		-	-		-			3
CO3	3	3	2	2	-	-		-	-		-			2
CO4	3	3	2	1	-	-		-	-		-			3
CO5	3	3	2	1				-	-	-	-			3

RADAR TECHNOLOGIES				
Course Code	**22DTC22**		**Credits**	**04**
Hours/Week (L-T-P)	**3-2-0**		**CIE Marks**	**50**
Total Hrs	**50**		**SEE Marks**	**50**
Exam Hrs	**03**		**Course Type**	**IPCC**

COURSE OUTCOMES

Course outcomes: After completion of the course, students will be able to-

1. Understand the design of radar systems, solve range equations.
2. Apply appropriate mathematical and computer models relevant to radar systems to calculate system performance, and assess the limitations of particular cases
3. Analyze the major components of a modern radar system
4. Learn basic radar clutter and radar antenna
5. Understand radar tracking applications

TEACHING METHODOLOGY

- Blackboard teaching/PowerPoint presentation (if needed) /Flipped Classes for specified topics.
- Tutorial classes on topics covered.
- Unit tests on covered topics

COURSE CONTENTS

UNIT-1 (10 HRS)

Introduction to Radar and Radar Equation: Basic Radar, Simple form of radar equation, Radar Block diagram, Radar frequencies, radar cross section of targets, Radar cross section fluctuations, Transmitter power.

UNIT -2 (10 HRS)

Tracking RADARS: Tracking with radar, Monopulse tracking, Conical Scan and sequential lobing. Limitations to tracking accuracy, Low angle tracking, tracking in range, Other tracking radar topics.

UNIT -3 (10 HRS)

RADAR Clutter and RADAR Antenna: Introduction to Radar Clutter, Surface clutter radar equation, Land clutter, Sea Clutter, Functions of Radar antenna, Antenna Parameters, Antenna radiation pattern and aperture illumination, reflector antenna, Radiators for phased arrays.

UNIT -4 (10 HRS)

Tracking Radar Applications of Monopulse: Surface -Based Monopulse Tracking RADARS, airborne monopulse tracking radars, monopulse homing seekers.

UNIT -5 (10 HRS)

Non tracking Radar Applications of Monopulse: Monopulse 3-d surveillance radar, Monopulse secondary surveillance radar, other radar applications.

TEXT BOOKS

1. M.I. Skolnik., Introduction to Radar Systems, Publisher: Tata Mcgraw hill edition, 2001.
2. B.R. Mahafza, Radar Systems Analysis and Design using MATLAB, Publisher CRC Press, 2013.
3. S.M.Sherman and D.K. Barton.Monopulse Principles and Techniques, Publisher : Artech house, 2011

REFERENCE BOOKS

1. M.A. Richards., Fundamentals of Radar Signal Processing, Publisher Tata Mcgraw hill.
2. H.M. Jolt., Ground Penetrating Radar: Theory and Applications, Publisher: Elsevier.
3. K. K Sharma. Radar, Sonar and Navigation Engineering, Publisher: S K Kataria& Sons. M.A. Richards., Fundamentals of Radar Signal Processing, Publisher Tata Mcgraw hill.

COURSE ASSESSMENT METHOD

Continuous Internal Evaluation (CIE)

Three internal assessments for **30** Marks each.

Two Learning Activities for **10** Marks each.

Semester End Examination (SEE)

Semester end examination for 100 Marks

Program Outcomes – Articulation matrix														
PO	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**PSO1**	**PSO2**
CO1	2	3	3	1	-						-	-		2
CO2	1	3	4	2	-	-		-	-		-			2
CO3	1	3	2	2	-	-		-	-		-			3
CO4	2	3	2	2	-	-		-	-		-			3
CO5	1	3	4	2				-	-	-	-			2

MINI PROJECT WITH SEMINAR				
Course Code	**22DTC25**		**Credits**	**3**
Hours/Week (L-T-P)	**0-4-2**		**CIE Marks**	**100**
Total Hrs	**36**		**SEE Marks**	**100**
Exam Hrs	**3**		**Course Type**	**MPS**

Seminar is to be given by the student after the completion of a mini project chosen by the student. Topics for the mini projects can be from the aeronautical engineering and allied fields. The mini project can be based on either numerical or analytical solution or design or fully experimental; or a combination of these tasks.

COURSE ASSESSMENT METHOD

1. Internal Examiner shall carry out the evaluation for 100 marks.
2. External Examiner shall carry out the evaluation for 100 marks.
3. The average of marks allotted by the internal and external examiner shall be the final marks of the project evaluation.
4. Viva-Voce examination of Project work shall be conducted jointly by Internal and External examiner for 100 marks.

Program Outcomes – Articulation matrix

PO	1	2	3	4	5	6	7	8	9	10	11	12	PSO1	PSO2
CO1	3	2						3	3			3	3	3
CO2	3	2						3	3			3	3	3
CO3	2	2						3	3			2	3	2
CO4	2	2						3	3			3	3	2
CO5	3	2						3	3			3	3	3

BOS RECOMMENDED ONLINE COURSES				
Course Code	**22AUD27/22AEC27**		**Credits**	**PP**
Hours/Week (L-T-P)			**CIE Marks**	
Total Hrs			**SEE Marks**	
Exam Hrs			**Course Type**	**AUD/AEC**
COURSE ASSESSMENT METHOD				

1. Board of studies Recommended Online Courses
2. Classes and evaluation procedures are as per the policy of the online course providers.
3. A pass in AUD/AEC is mandatory for the award of the degree

PROFESSIONAL ELECTIVE I

ELECTROMAGNETIC INTERFERENCE / ELECTROMAGNETIC COMPATIBILITY IN MILITARY				
Course Code	**22DTC231**		**Credits**	**03**
Hours/Week (L-T-P)	**2-0-2**		**CIE Marks**	**50**
Total Hrs	**39**		**SEE Marks**	**50**
Exam Hrs	**03**		**Course Type**	**PEC**

COURSE OUTCOMES

Course outcomes: After completion of the course, students will be able to-

1. Understand the concept of EMI / EMC protection of equipment.
2. Identify and prevent the common EMI/EMC problems in military systems.
3. Understand the Design impact (by requirement) of military EMC specifications.
4. Understand EMI/EMC troubleshooting tips and techniques.
5. Learn generate EMI/EMC requirements document.

TEACHING METHODOLOGY

- Blackboard teaching/PowerPoint presentation (if needed) /Flipped Classes for specified topics.
- Tutorial classes on topics covered.
- Unit tests on covered topics

COURSE CONTENTS

UNIT-1-(07 HOURS)

Basic Concepts: Definition of Electromagnetic interference (EMI) / Electromagnetic compatibility (EMC) and Electromagnetic pulse, Classification of EMI/EMC, Sources of EMI, EMI coupling modes, ESD Phenomena and effects, Transient phenomena and suppression.

UNIT-2-(08 HOURS)

EMC requirements : EMC requirements for electronic systems, Non-ideal Behaviors of Components; EMI Measurements: Basic principles of EMI measurements, EMI measuring instruments;

UNIT-3-(08 HOURS)

EMI Control Methods : EMI Control Methods for Conducted and radiated emissions and susceptibility, Crosstalk and shielding, Grounding, Bonding, Filtering, EMI gasket, Isolation transformer, Opto-isolator; Faraday cage, isolation of shelters.

UNIT-4-(08 HOURS)

EMC Standard and Regulations: National and Intentional standardizing organizations, Frequency assignment, Spectrum conversation; EMC Design and Interconnection Techniques: Cable routing and connection, Component selection and mounting, PCB design (Trace routing, Impedance control, decoupling, Zoning and grounding).

UNIT-5-(07 HOURS)

EMC analysis and detection techniques: Using tools for electromagnetic signal integrity analysis, studying eye diagrams or eye patterns for communication system and analyzing signals using eye diagram.

TEXT BOOKS

1. Bruce R. Archambeault, Omar M. Ramahi, etal. , EMI/EMC Computational Modeling Handbook: The Springer International Series in Engineering and Computer Science), 31 August 2001

REFERENCE BOOKS

1. Chetan Kathalay A practical approach to electromagnetic compatibility, EMC Publications; 2nd edition (1 February 2019)

COURSE ASSESSMENT METHOD

Continuous Internal Evaluation (CIE)

Three internal assessments for **30** Marks each.

Two Learning Activities for **10 Marks** each.

Semester End Examination (SEE)

Semester end examination for 100 Marks

Program Outcomes – Articulation matrix

PO	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**PSO1**	**PSO2**
CO1	3	2	-	-	-		2				-	2		
CO2	3	3					3	-	-		-	2		
CO3	3	2					2	-	-		-	2		
CO4	3	2					3	-	-		-	2		
CO5	3	3					3	-	-	-	-	2		

DEFENCE ELECTRO-OPTICS AND IMAGING SYSTEMS				
Course Code	**22DTC232**		**Credits**	**03**
Hours/Week (L-T-P)	**2-0-2**		**CIE Marks**	**50**
Total Hrs	**39**		**SEE Marks**	**50**
Exam Hrs	**03**		**Course Type**	**PEC**

COURSE OUTCOMES

Course outcomes: After completion of the course, students will be able to-

1. Understand the technology and principles underpinning electro-optic devices and systems
2. Understand Camera systems
3. Understand Image processing
4. Understand EO sensors and Laser DEW
5. Understand Electro-optic protection measures

TEACHING METHODOLOGY

- Blackboard teaching/PowerPoint presentation (if needed) /Flipped Classes for specified topics.
- Tutorial classes on topics covered.
- Unit tests on covered topics

COURSE CONTENTS

UNIT-1-(07 HOURS)

Optical sighting systems: Principles of radiometry, The human eye, insight into the optical, Visible band optical sighting systems, qualitative and quantitative aspects, detailed investigation.

UNIT-2-(08 HOURS)

Camera systems: Camera systems, basic components and their functions, Image intensifiers, Missile seekers, tracking principles, Electro-optic countermeasures, various counter measure techniques.

UNIT-3-(08 HOURS)

Image processing: Thermal imagers, II cameras, Hyper-spectral imaging, Digital image processing, different methodologies, challenges associated, tools for processing different categories of images.

UNIT-4-(08 HOURS)

EO sensors and Laser DEW: Basics of EO sensors, principles and techniques, EO sensors for lasers, Laser DEW, Challenges associated, counter measures, Other techniques, sizing and other aspects

UNIT-5-(08 HOURS)

Electro-optic protection measures: Introduction, basic aspects of electro optic techniques,

TEXT BOOKS

1. William WolfgangArrasmith., Systems engineering analysis of electro-optical and Infrared system, CRC Press; 1st edition (20 March 2015)
2. Author Ronald G.Driggers Ronald G.Driggers.Introduction to Infrared and Electro-Optical Systems, Artech Print on Demand (January 1, 1998)
3. Author(s): Anil K.Maini, Handbook of Defence Electronics and Optronics: Fundamentals, Technologies and Systems, Wiley; 1st edition (4 May 2018)

REFERENCE BOOKS

1. Building Electro-Optical Systems: Making It all Work, Author Philip C. D. Hobbs
2. “Electro-Optical Instrumentation: Sensing and Measuring with Lasers”, by Author Silvano Donati.
3. “Electro-optical systems design, Analysis and testing”, by Author Michael C. Dudzik.

COURSE ASSESSMENT METHOD

Continuous Internal Evaluation (CIE)

Three internal assessments for **30** Marks each.

Two Learning Activities for **10** Marks each.

Semester End Examination (SEE)

Semester end examination for 100 Marks

Program Outcomes – Articulation matrix														
PO	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**PSO1**	**PSO2**
CO1	3	3	2	-	-		2				-	3		
CO2	3	3	2	3	-	-	3	-	-		-	3		
CO3	3	2	2	3	-	-	2	-	-		-	3		
CO4	3	2	2	3	-	-	2	-	-		-	3		
CO5	3	3	2	3			1	-	-	-	-	3		

JAMMING AND ELECTRONIC COUNTER MEASURE / ELECTRONIC COUNTER-COUNTERMEASURE				
Course Code	**22DTC233**		**Credits**	**03**
Hours/Week (L-T-P)	**2-0-2**		**CIE Marks**	**50**
Total Hrs	**39**		**SEE Marks**	**50**
Exam Hrs	**03**		**Course Type**	**PEC**

COURSE OUTCOMES

Course outcomes: After completion of the course, students will be able to-

1. Understand the concept of electronic attacks.
2. Understand the principles of electronic jamming technology.
3. Understand the practical applications of current and evolving electronic jamming technology.
4. Understand the different types of electronic counter measures.
5. Understand the different types of electronics counter – counter measures.

TEACHING METHODOLOGY

- Blackboard teaching/PowerPoint presentation (if needed) /Flipped Classes for specified topics.
- Tutorial classes on topics covered.
- Unit tests on covered topics

COURSE CONTENTS

UNIT-1-(08 HOURS)

Principles of Electronic Attack (EA): Identifying and managing security risks, Implementing security controls to reduce security risks, Detecting and understanding cyber security events, Jamming-to-Signal Ratio, Jamming Types Burn-Through, Cover Jamming, Range Deceptive Jamming, Inverse Gain Jamming.

UNIT-2-(08 HOURS)

Radar Jamming and deception: Repeater Jamming Equations, Noise Jamming - noise jamming are spot, sweep, and barrage. Noise Jamming versus Deception, Repeater versus Transponder, Side lobe Jamming versus Main Lobe Jamming.

UNIT-3-(08 HOURS)

Electronic counter measure Techniques : Stand-Off Jamming, Escort Jamming, Self-Protection Jamming, Electronic counter measure techniques, On-Board Electronic counter measure Systems, Off-Board Electronic counter measure Systems.

UNIT-4-(08 HOURS)

Advanced counter measure Techniques: Infrared Countermeasures (IRCM), Off-Board Electronic counter measure Systems, Communications Countermeasures (COM-ECM), Electro-Optic Counter Measure (EOCM) Systems.

UNIT-5-(07 HOURS)

Electronic counter- counter measure Techniques: Airborne Tactical Jamming System, Shipboard Self-Defense System, EA/Susceptibility against Weapon Systems. Search Radar Counter- Countermeasures, Tracking Radar. Counter- Countermeasures, Infrared Counter-Countermeasures, Communications Counter-Countermeasures.

TEXT BOOKS

1. “Electronic Countermeasure and Electronic Counter-Countermeasure”, by Bahman Zohuri.
2. “Fundamentals of Electronic Warfare 2001”, by S.A. Vakin , L.N. Shustov, R.H. Dunwell.
3. “Communications, Radar and Electronic Warfare by Adrian Graham 2010

REFERENCE BOOKS

1. “Electronic Warfare & Radar Systems Engineering Handbook” 2013, Naval Air Warfare Center Weapons Division.
2. “EW 101: A First Course in Electronic Warfare (Artech House Radar Library)”, 1st Edition

COURSE ASSESSMENT METHOD

Continuous Internal Evaluation (CIE)

Three internal assessments for **30** Marks each.

Two Learning Activities for **10** Marks each.														
Semester End Examination (SEE)														
Semester end examination for 100 Marks														
Program Outcomes – Articulation matrix														
PO	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**PSO1**	**PSO2**
CO1	3	3	2		-				2	2	-	3		
CO2	3	2	3		-	-	-	-	2	2	-	3		
CO3	3	2	2		-	-	-	-	2	2	-	3		
CO4	3	2	2	-	-	-	-	-	3	2	-	3		
CO5	3	2	2	-	-	-	-	-	2	2	-	3		

COMMUNICATION TECHNOLOGY				
Course Code	**22DTC234**		**Credits**	**03**
Hours/Week (L-T-P)	**2-0-2**		**CIE Marks**	**50**
Total Hrs	**39**		**SEE Marks**	**50**
Exam Hrs	**03**		**Course Type**	**PEC**

COURSE OUTCOMES

Course outcomes: After completion of the course, students will be able to-

1. Understand communication system design methodologies, communication system architecture, analogue & digital modulation techniques.
2. Computation of data rates, band width ,BER
3. To carry out the link budget analysis.
4. Analyze voice coding techniques
5. Study the performance of communication system architecture

TEACHING METHODOLOGY

- Blackboard teaching/PowerPoint presentation (if needed) /Flipped Classes for specified topics.
- Tutorial classes on topics covered.
- Unit tests on covered topics

COURSE CONTENTS

UNIT-1-(08 HOURS)

Introduction to Communication Systems, Digital Communication System, Communication Channels and Their Characteristics, Mathematical Models for Communication Channels, Design challenges, message sources, Channel effect, signal to noise ratio and capacity.

UNIT-2-(08 HOURS)

Digital data communication systems, digital signaling techniques, Link budget calculations telemetry and control and IO/IW implications, Antenna types –wire antennas, Horn Antennas, Reflector Antennas, phased array antennas

UNIT-3-(08 HOURS)

Data rates and bandwidth calculation in digital data communication systems: Pulse Code Modulation, ASK, FSK, Time Division Multiple Access, Frequency Division multiple Access, Direct Sequence spread spectrum, Frequency Hopping spread spectrum.

UNIT-4-(08 HOURS)

Probability of error and BER calculation, Modulation technologies (analogue & digital), Amplitude Modulation, Angle Modulation, ASK, FSK, BPSK, transmitter and receiver Block diagram, Expression for Bit Error Rate. Voice source coding, PCM, transmitter and receiver systems.

UNIT-5-(07 HOURS)

Communication system architectures, public switched Telephone network, First Generation wireless networks, Second Generation, Third Generation Wireless Network, Cellular packet switched Architecture, GSM system Architecture, terminal design and performance, associated information systems

TEXT BOOKS

1. Proakis and Salehi, Fundamentals of communication systems.
2. Simon Haykin and Michael Moher, Communication Systems, Wiley.
3. Theodore S Rappaport, Wireless Communication, Prentice Hall

REFERENCE BOOKS

1. B.P. Lathi and Zhi Ding, Modern digital and analog communication systems Oxford UniversityPress.

COURSE ASSESSMENT METHOD

Continuous Internal Evaluation (CIE)

Three internal assessments for 30 Marks each.

Two Learning Activities for **10** Marks each.

Semester End Examination (SEE)

Semester end examination for 100 Marks

Program Outcomes – Articulation matrix														
PO	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**PSO1**	**PSO2**
CO1	2	2	3	1	-		-	-	-	-	-	2		
CO2	1	3	3	-	-	-	1	-	-	-	-	3		
CO3	2	3	1	-	-	-	2	-	-	-	-	3		
CO4	2	3	-	-	-	-	1	-	-	-	-	1		
CO5	1	2	-	-	3	1	1	-	-	-	-	2		

AUTONOMY AND NAVIGATION TECHNOLOGY				
Course Code	**22DTC235**		**Credits**	**03**
Hours/Week (L-T-P)	**2-0-2**		**CIE Marks**	**50**
Total Hrs	**39**		**SEE Marks**	**50**
Exam Hrs	**03**		**Course Type**	**PEC**

COURSE OUTCOMES

Course outcomes: At the end of the course the student will be able to:-

1. Describe the basic principle of operation of a global navigation satellite system
2. Understand the navigation systems and derive the navigation equations
3. Carry out path planning the UGV /UAV
4. Solve the equations for calculating a position estimate from a given satellite constellation.
5. Understand the working of GPS, GNSS and SLAM.

TEACHING METHODOLOGY

- Blackboard teaching/PowerPoint presentation (if needed) /Flipped Classes for specified topics.
- Tutorial classes on topics covered.
- Unit tests on covered topics

COURSE CONTENTS

UNIT-1-(07 HOURS)

Introduction: Introduction to the concepts of navigation and guidance systems, General principles of early conventional navigation systems. Guidance approaches: conventional guidance such as PN (Proportional Navigation).

UNIT-2-(08 HOURS)

Fundamentals of navigation: Geodetic fundamentals of navigation, positioning, reference- and coordinate systems and computational methods for navigation and positioning on the surface of the earth. Direction cosine matrix, Euler angles, Transformation of angular velocities, Quaternion representation in coordinate transformation. Comparison of transformation methods.

UNIT-3-(08 HOURS)

Geometric guidance: Geometric guidance, path planning and following, and optimal guidance; path planning for UGV/UAV guidance systems. Navigation approaches: navigation systems, Understanding the Global Positioning System (GPS)

UNIT-4-(08 HOURS)

Satellite Navigation : GNSS (Global Navigation Satellite System) - Applications in Tracking / Mapping Devices, Industrial Machinery, Sea vessels, Air Navigation, and Automobiles, terrain based navigation.

UNIT-5-(08 HOURS)

Simultaneous Localization and Mapping : Introduction to SLAM (Simultaneous Localization and Mapping); essential algorithms for SLAM, models for Cooperative guidance and collision avoidance system.

TEXT BOOKS

1. Bhatta, B., Glonass, Galileo, Compass, and Others, Global Navigation Satellite Systems Insights Into GPS, BS Publications, New Delhi, 2010.
2. Grewal, M. S., Weill, L. R., Andrews, A. P, Global Positioning Systems, Inertial Navigation, and Integration, John Wiley & Sons, New York, 2006.
3. Verlag Wien. Hofmann- Wellenhof, B., Lichtenegger, H., Wasle, E, Global Navigation Satellite Systems, Springer, 2008.

REFERENCE BOOKS

1. Hofmann-Wellenhof, B., Lichtenegger, H., Verlag Wien, Collins, J, Global Positioning System Theory and Practice, 2001.
2. Literature / books suggested by respective course Lecturers.

COURSE ASSESSMENT METHOD

Continuous Internal Evaluation (CIE)

Three internal assessments for **30** Marks each.
Two Learning Activities for **10** Marks each.
Semester End Examination (SEE)
Semester end examination for 100 Marks
Program Outcomes – Articulation matrix

PO	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**PSO1**	**PSO2**
CO1	3	3	-	-	-		2				-	3		
CO2	3	2					3	-	-		-	3		
CO3	3	2					2	-	-		-	3		
CO4	3	3					3	-	-		-	3		
CO5	3	3					2	-	-	-	-	3		

PROFESSIONAL ELECTIVE II

SOFTWARE DEFINED RADIOS				
Course Code	**22DTC241**		**Credits**	**03**
Hours/Week (L-T-P)	**2-0-2**		**CIE Marks**	**50**
Total Hrs	**39**		**SEE Marks**	**50**
Exam Hrs	**03**		**Course Type**	**PEC**

COURSE OUTCOMES

Course outcomes: After completion of the course, students will be able to-

1. Understand the concept, application of SDRs.
2. Understanding of analog RF components as front end block in implementation of SDR.
3. Gain knowledge of digital hardware architectures and its development techniques.
4. Gain knowledge of software development for embedded wireless systems.
5. Learn design aspects of software defined radio.

TEACHING METHODOLOGY

- Blackboard teaching/PowerPoint presentation (if needed) /Flipped Classes for specified topics.
- Tutorial classes on topics covered.
- Unit tests on covered topics

COURSE CONTENTS

UNIT-1-(08 HOURS)

Introduction: SDR introduction, major standards, SDR architecture, SDR enablers, advantage / disadvantages, Applications. SDR Hardware, super-heterodyne architecture, homodyne architecture, advantages & disadvantages, Software for SDR, Processing architecture for SDR.

UNIT-2-(08 HOURS)

Digital modulation: Waveform platform bifurcation, red – black separation, digital modulation- advanced linear and non-linear bandwidth efficient modulations. Bandwidth and power efficiency, peak to average power, error vector magnitude and error probability.

UNIT-3-(08 HOURS)

Radio frequency: RF channels, receiver channel equalization, multiple access techniques Frequency, time and code division techniques as well as carrier sensing, Wireless sensor networks and beam steering in azimuth and elevation, receiver analogue signal processing, receiver digital signal processing.

UNIT-4-(08 HOURS)

Source and channel coding: Source and channel coding, sampling, entropy, data compression, voice coding, block and convolution coding, turbo coding, space-time coding and trellis coding.

UNIT-5-(07 HOURS)

Aspects of Software radio design: Case studies associated with the design of software radio, Introduction and a Historical perspective of software defined radio. Applications of software-defined radios.

TEXT BOOKS

1. Jeffrey H.Reed, Software Radio, (A modern approach to radio engineering), Prentice Hall (20 May 2002)
2. John J. Rouphael, RF and Digital Signal Processing for Software Defined Radio,Newnes; Illustrated edition (19 November 2008)

REFERENCE BOOKS

1. B.G.Goldberg., Digital Techniques in Frequency Synthesis, Publisher: McGraw Hill..
2. N.J.Fliege, Multi rate Signal Processing. Publisher: John Wiley and sons

COURSE ASSESSMENT METHOD

Continuous Internal Evaluation (CIE)

Three internal assessments for **30** Marks each.

Two Learning Activities for **10** Marks each.

Semester End Examination (SEE)

Semester end examination for 100 Marks															
Program Outcomes – Articulation matrix															
PO	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**PSO1**	**PSO2**	**BT**
CO1	3	2	2		-				2	3	-	3			3
CO2	3	2	2		-	-	-	-	2	2	-	3			3
CO3	3	2	2		-	-	-	-	2	3	-	3			3
CO4	3	2	2	-	-	-	-	-	2	2	-	3			3
CO5	3	2	2		-	-	-	-	2	2	-	3			3

SENSOR TECHNOLOGY				
Course Code	**22DTC242**		**Credits**	**03**
Hours/Week (L-T-P)	**2-0-2**		**CIE Marks**	**50**
Total Hrs	**39**		**SEE Marks**	**50**
Exam Hrs	**03**		**Course Type**	**PEC**

COURSE OUTCOMES

Course outcomes: After completion of the course, students will be able to-

1. Understand the basic principles of sensor systems required for satellites and tactical aircraft.
2. Understand the atmospheric propagation and its impact on the performance of sensors.
3. Analyze the Phased array and pulsed compressed radars.
4. Troubleshoot, repair/replace a faulty sensor.
5. Analyze Optical and infrared imaging detector systems.

TEACHING METHODOLOGY

- Blackboard teaching/PowerPoint presentation (if needed) /Flipped Classes for specified topics.
- Tutorial classes on topics covered.
- Unit tests on covered topics

COURSE CONTENTS

UNIT-1-(07 HOURS)

Introduction : Physical principles underlying the sensor systems needed for satellites and tactical aircraft, as well as limitations imposed by the atmosphere and operating environment on the system and their communication links.

UNIT-2-(08 HOURS)

Radars: Phased array and pulsed compressed radars, imaging synthetic aperture and inverse synthetic aperture radars, Pulse Compression for Phased Array Weather Radars.

UNIT-3-(08 HOURS)

Signals and detectors: Atmospheric propagation of signal. Noise resources and thermal radiation, Principles of semiconductor devices. Optical and infrared imaging detector systems.

UNIT-4-(08 HOURS)

Signal and noise : Detector resolution limitations and bandwidth requirements, Relationship between signals and noise.

UNIT-5-(08 HOURS)

Sensor functions: The characteristics of critical sensor functions - including detection, estimation, imaging, and tracking.

TEXT BOOKS

1. J. W. Gardner. , Micro sensors, Principles and Applications, Publisher :Wiley
2. Jacob Fraden, Handbook of Modern Sensors, by. Publisher :Springer

REFERENCE BOOKS

1. S. M. Sze., Semiconductor Sensors, Publisher: Wiley
2. Literature / books suggested by respective course Lecturers

COURSE ASSESSMENT METHOD

Continuous Internal Evaluation (CIE)

Three internal assessments for **30** Marks each.

Two Learning Activities for **10** Marks each.

Semester End Examination (SEE)

Semester end examination for 100 Marks

Program Outcomes – Articulation matrix

PO	1	2	3	4	5	6	7	8	9	10	11	12	PSO1	PSO2
CO1	3	3			-				2	2	-	3		
CO2	3	2			-	-	-	-	2	2	-	3		

CO3	3	2			-	-	-	-	2	2	-	3		
CO4	3	2	-	-	-	-	-	-	2	2	-	3		
CO5	3	2	-	-	-	-	-	-	2	2	-	3		

TEST METHODOLOGIES FOR DEW SYSTEMS (LASERS & MICROWAVE)				
Course Code	**22DTC243**		**Credits**	**03**
Hours/Week (L-T-P)	**2-0-2**		**CIE Marks**	**50**
Total Hrs	**39**		**SEE Marks**	**50**
Exam Hrs	**03**		**Course Type**	**PEC**

COURSE OUTCOMES

Course outcomes: After completion of the course, students will be able to-

1.
2. Understand the characterization and testing requirements of DEW systems.
3. Carry out the indoors & outdoors system performance testing.
4. Understand the safety issues, safety standards, handling high power sources.
5. Analyze and study the S parameters and impedance measurement, power measurement and phase noise measurement of microwave systems.
6. Analyze and study the system characterization techniques, HPM safety tools and safety standards.

TEACHING METHODOLOGY

- Blackboard teaching/PowerPoint presentation (if needed) /Flipped Classes for specified topics.
- Tutorial classes on topics covered.
- Unit tests on covered topics

COURSE CONTENTS

UNIT-1-(08 HOURS)

Testing requirements of DEW system, types of testing, laser effect testing on target, system output testing.

UNIT-2-(08 HOURS)

System performance testing, System outdoor test & measurement instruments.

UNIT-3-(08 HOURS)

Laser testing issues, Laser safety, Laser safety standards, laser safety tools.

UNIT-4-(08 HOURS)

Microwave system testing Impedance measurement, S-Parameters and the Smith Chart.

UNIT-5-(07 HOURS)

Power Measurement, Noise Figure and Phase Noise measurement, Frequency measurements (Spectrum Analysis), Gain Compression and Intermodulation, Network Analysis,
Microwave subsystem / system characterization techniques. HPM safety tools, safety standards.

TEXT BOOKS

2. Ananjan Basu., An Introduction to Microwave Measurements, CRC Press; 1st edition (24 December 2014)

REFERENCE BOOKS

2. Literature / books suggested by respective course Lecturers.

COURSE ASSESSMENT METHOD

Continuous Internal Evaluation (CIE)

Three internal assessments for 30 Marks each.

Two Learning Activities for **10** Marks each.

Semester End Examination (SEE)

Semester end examination for 100 Marks

Program Outcomes – Articulation matrix

PO	1	2	3	4	5	6	7	8	9	10	11	12	PSO1	PSO2
CO1	3	3			-		2			2	-	3		
CO2	3	2			-	-	1	-	-	2	-	3		
CO3	3	2			-	-	2	-	-	2	-	3		
CO4	3	3			-	-	1	-	-	2	-	3		

CO5	3	2					1	-	-	-2	-	3		

MODELING & SIMULATION OF LASER MATTER INTERACTION				
Course Code	22DTC244		**Credits**	**03**
Hours/Week (L-T-P)	**2-0-2**		**CIE Marks**	**50**
Total Hrs	**39**		**SEE Marks**	**50**
Exam Hrs	**03**		**Course Type**	**PEC**

COURSE OUTCOMES

Course outcomes: After completion of the course, students will be able to-

1. Understand the fundamentals of laser matter interaction.
2. Develop physics-based model for evaluation of effect of laser on metals and composites.
3. Understand about damage characterization
4. Understand the laser parameter measurement techniques.
5. Analyze the performance of high-power laser systems

TEACHING METHODOLOGY

- Blackboard teaching/PowerPoint presentation (if needed) /Flipped Classes for specified topics.
- Tutorial classes on topics covered.
- Unit tests on covered topics

COURSE CONTENTS

UNIT-1-(08 HOURS)

Introduction: Laser beam characteristics, different types and classes of lasers, applications of lasers, laser matter interaction, Laser lethality modelling & simulation with metal targets & composite materials.

UNIT-2-(08 HOURS)

Laser matter interaction: Basic ideas, Physics based models for vulnerability assessment, Effect of laser on metals & composite materials, methods of evaluation, effect of material properties.

UNIT-3-(08 HOURS)

Damage characterization: Terminologies used, Measurement and Characterization of Damage Thresholds, charts used, Mechanisms of Damage, Exposure Limits and Their Interpretation.

UNIT-4-(07 HOURS)

Measurement techniques: Terminologies used, Laser parameters, analysis Tools for the Estimation of Hazards, laser parameters, Laser parameters measurement techniques, examples.

UNIT-5-(08 HOURS)

Laser system performance: Tools to analyze and predict Laser System performance under different conditions like land, sea air, etc. Introduction of full scale end to end modelling of laser system performance.

TEXT BOOKS

1.Mulser, Peter, Bauer, Dieter. High Power Laser-Matter Interaction, Publisher: Springer.

REFERENCE BOOKS

1. Literature / books suggested by respective course Lecturers.

COURSE ASSESSMENT METHOD

Continuous Internal Evaluation (CIE)

Three internal assessments for **30** Marks each.

Two Learning Activities for **10** Marks each.

Semester End Examination (SEE)

Semester end examination for 100 Marks

Program Outcomes – Articulation matrix

PO	1	2	3	4	5	6	7	8	9	10	11	12	PSO1	PSO2
CO1	3	3			-				2	3	-	3		**1**
CO2	3	2			-	-	-	-	2	2	-	3		**3**
CO3	3	3			-	-	-	-	2	2	-	3		**2**
CO4	3	3			-	-	-	-	2	2	-	3		**3**

CO5	3	2			-	-	-	-	2	2	-	3		**2**

MILITARY ELECTRONICS SYSTEM ENGINEERING				
Course Code	22DTC245		**Credits**	**03**
Hours/Week (L-T-P)	**2-0-2**		**CIE Marks**	**50**
Total Hrs	**39**		**SEE Marks**	**50**
Exam Hrs	**03**		**Course Type**	**PEC**

COURSE OUTCOMES

Course outcomes: After completion of the course, students will be able to-

1. Understand the military electronic systems.
2. Generate system design requirements as per mission needs &operational requirements.
3. To create digital simulation models.
4. Understand the limitations of the COTS available electronics systems
5. Evaluate the radiation effects on the performance of electronics systems

TEACHING METHODOLOGY

- Blackboard teaching/PowerPoint presentation (if needed) /Flipped Classes for specified topics.
- Tutorial classes on topics covered.
- Unit tests on covered topics

COURSE CONTENTS

UNIT-1-(08 HOURS)

Fundamentals of electronics: Introduction to electronics engineering concepts, additional requirements for a defence environment, methods for the design and integration of complex defence systems.

UNIT-2-(08 HOURS)

Case studies: Familiarity with the systems engineering process through case studies of representative defence systems, simple to detailed design examples, defence related case studies.

UNIT-3-(08 HOURS)

Methods: Introduction to methods used for determination of system requirements from mission needs and operational requirements, principles used in different methods, advantages and disadvantages of each method.

UNIT-4-(07 HOURS)

Digital simulation models and ICs: Digital simulation models, including those currently used in defence for determining engineering and performance trade-offs. Limitations of commercial-off-the-shelf (COTS) integrated circuits, thermal failure, electrostatic breakdown, noise in solid state devices, packaging reliability issues.

UNIT-5-(08 HOURS)

Effect of ambient environment: The defence environment, Systematic way to account different aspects, Radiation effects due to space and nuclear environments, and the limited availability of military integrated circuit suppliers.

TEXT BOOKS

1. Neri Filippo: Introduction to Electronic Defence Systems, Publisher: Artech House Publishers
2. US Department of Defence: Military Handbook of Electronic Reliability design.
3. Ray Tricker:Defence Electronics Standards and Quality Assurance,Pub-lisher :Elsevier

REFERENCE BOOKS

2. Anil K. Maini: Handbook of Defence Electronics and Optronics: Fundamentals, Technologies and Systems, Publisher: John Wiley & SonsLtd
3. M.G. Hartley: Digital Simulation Methods, Publisher: P. PeregrinusLtd.
4. Alper Demir: Analysis and Simulation of Noise in Nonlinear Electronic Circuits and Systems, Publisher: Springer.

COURSE ASSESSMENT METHOD

Continuous Internal Evaluation (CIE)

Three internal assessments for **30** Marks each.

Two Learning Activities for **10** Marks each.

Semester End Examination (SEE)

Semester end examination for 100 Marks

Program Outcomes – Articulation matrix

PO	1	2	3	4	5	6	7	8	9	10	11	12	PSO1	PSO2
CO1	3	3	2	-	-				1	1	-	-		**2**
CO2	2	2	2					-	2	2	-			**3**
CO3	2	3	3					-	3	2	-			**2**
CO4	3	2	2					-	2	2	-			**1**
CO5	1	2	3					-	3	-	-			**2**

SEMESTER III

ADVANCED DIGITAL MODULATION TECHNOLOGIES & STANDARDS				
Course Code	**22DTC31**		**Credits**	**04**
Hours/Week (L-T-P)	**3-0-2**		**CIE Marks**	**50**
Total Hrs	**50**		**SEE Marks**	**50**
Exam Hrs	**03**		**Course Type**	**OEC**

COURSE OUTCOMES

Course outcomes: After completion of the course, students will be able to-

7. Understand the design of digital communication systems.
8. Understand the transmitter, receiver communications system models, voice source coding– pulse code modulation, delta modulation and vocoders.
9. Understand the requirement of cellular communication.
10. Apply the different communication models to optimize
11. Apply the signal analysing techniques

TEACHING METHODOLOGY

- Blackboard teaching/PowerPoint presentation (if needed) /Flipped Classes for specified topics.
- Tutorial classes on topics covered.
- Unit tests on covered topics

COURSE CONTENTS

UNIT-1-(10 HOURS)

Introduction: Design of digital communication system, transmitter and receiver communications system model, Radar Block diagram, Radar frequencies, Link budget calculations telemetry.

UNIT-2-(10 HOURS)

Modulation and its standards: Voice source coding–pulse code modulation, delta modulation, vocoders Introduction to cellular communication – CDMA, OFDM, MIMO, Introduction to digital modulation standards.

UNIT-3-(10 HOURS)

Digital signal modulation: Digital modulation – Amplitude-shift, Frequency-shift, Phase-shift, differential phase-shift, Quadrature phase-shift, Quadrature phase-shift, and Minimum-shift keying, Quadrature amplitude modulation.

UNIT-4-(10 HOURS)

Communication models: Communications channel and their Characteristics – Multipath effects, fading and diversity, models of Egli and Murphy, Time Division Multiple Access, Frequency Hopping spread spectrum.

UNIT-5-(10 HOURS)

Signal analysis: Receivers – super heterodyne systems, balanced and unbalanced mixers, frequency synthesizers, Link budget analysis, Expression for Bit Error Rate, analysis of repeater and transponder.

TEXT BOOKS

3. Haykin, S. Communication Systems, Publisher: John Wiley &Sons.
4. Lathi, B.P. and Ding, Z, Modern Digital and Analog Communication Systems, Publisher: Oxford University Press

REFERENCE BOOKS

3. H. Vincent Poor, Lang Tong, Signal Processing for Wireless Communication Systems, Publisher: Springers
4. Sklar, B., and Ray, Digital Communication: Fundamentals and Applications, P.K. Dorling Kindersley

COURSE ASSESSMENT METHOD

Continuous Internal Evaluation (CIE)

Three internal assessments for **30** Marks each.

Two Learning Activities for **10** Marks each.

Semester End Examination (SEE)

Semester end examination for 100 Marks

Program Outcomes – Articulation matrix

PO	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**PSO1**	**PSO2**

CO1	3	2			-				2	2	-	3		
CO2	3	2			-	-	-	-	2	2	-	3		
CO3	3	2			-	-	-	-	2	2	-	3		
CO4	3	2	-	-	-	-	-	-	2	2	-	3		
CO5	3	2	-	-	-	-	-	-	2	2	-	3		

PROJECT WORK PHASE -I				
Course Code	**22DTC34**		**Credits**	**3**
Hours/Week (L-T-P)	**0-6-0**		**CIE Marks**	**100**
Total Hrs	**39**		**SEE Marks**	**-**
Exam Hrs	**3**		**Course Type**	**PROJ**

COURSE OUTCOMES

The individual student must identify a project Advisor in the third semester. The student, in consultation with their Advisor, will form a Thesis Committee that includes head of the department and domain expert. The progress of the project is evaluated based on a minimum of three reviews. The review committee may be constituted by the Head of the Department. A project report is required at the end of the semester. The project work is evaluated based on oral presentation and the project report jointly by external and internal examiners constituted by the Head of the Department.

Program Outcomes – Articulation matrix

PO	1	2	3	4	5	6	7	8	9	10	11	12	PSO1	PSO2
CO1	3	2						3	3			3	3	3
CO2	3	2						3	3			3	3	3
CO3	2	2						3	3			2	3	2
CO4	2	2						3	3			3	3	2
CO5	3	2						3	3			3	3	3

SOCIETAL PROJECT				
Course Code	**22DTC35**		**Credits**	**3**
Hours/Week (L-T-P)	**0-6-0**		**CIE Marks**	**100**
Total Hrs	**-**		**SEE Marks**	**-**
Exam Hrs	**3**		**Course Type**	**SP**

Seminar is to be given by the student after the completion of a societal project chosen by the student. Topics for the projects can be from the aeronautical engineering and allied fields. The project can be based on either numerical or analytical solution or design or fully experimental; or a combination of these tasks.

COURSE ASSESSMENT METHOD

1. Internal Examiner shall carry out the evaluation for 100 marks.
2. External Examiner shall carry out the evaluation for 100 marks.
3. The average of marks allotted by the internal and external examiner shall be the final marks of the project evaluation.
4. Viva-Voce examination of Project work shall be conducted jointly by Internal and External examiner for 100 marks.

Program Outcomes – Articulation matrix

PO	1	2	3	4	5	6	7	8	9	10	11	12	PSO1	PSO2
CO1	3	2						3	3			3	3	3
CO2	3	2						3	3			3	3	3
CO3	2	2						3	3			2	3	2
CO4	2	2						3	3			3	3	2
CO5	3	2						3	3			3	3	3

INTERNSHIP				
Course Code	**22DTCI36**		**Credits**	**6**
Hours/Week (L-T-P)	**6 Weeks**		**CIE Marks**	**50**
Total Hrs	**6 Weeks**		**SEE Marks**	**50**
Exam Hrs	**3**		**Course Type**	**INT**

COURSE OUTCOMES

1. Identify and define the problem for the project work
2. Apply the knowledge acquired to analyze and estimate the cost and time
3. Examine and use appropriate tools to solve the defined problem in a team
4. Develop an end product and prepare a technical report/paper

COURSE CONTENTS

A 6 weeks long internship course is to be carried out by the students. On completion of the internship, students shall prepare a report according to the guidelines and submit it to the concerned authority during their 3rd semester. The students should present their work and performance will be evaluated by the project committee and marks will be awarded.

Program Outcomes – Articulation matrix

PO	1	2	3	4	5	6	7	8	9	10	11	12	PSO1	PSO2
CO1	3	2						3	3			3	3	3
CO2	3	2						3	3			3	3	3
CO3	2	2						3	3			2	3	2
CO4	2	2						3	3			3	3	2
CO5	3	2						3	3			3	3	3

PROFESSIONAL ELECTIVE III

FUNDAMENTAL OF TELEMETRY, TELECOMMAND AND TRANSPONDER				
Course Code	**22DTC321**		**Credits**	**03**
Hours/Week (L-T-P)	**3-0-0**		**CIE Marks**	**50**
Total Hrs	**39**		**SEE Marks**	**50**
Exam Hrs	**03**		**Course Type**	**PEC**

COURSE OUTCOMES

Course outcomes: After completion of the course, students will be able to-

12. Satellite communication and related technologies.
13. Overall control of satellites through collection, processing, and transmission of data.
14. Determination of the satellite's exact location through the reception, processing, and transmitting of ranging signals.
15. Understanding the basics of signal processing.
16. Proper control of satellite through the reception, processing, and implementation of commands transmitted from the ground.

TEACHING METHODOLOGY

- Blackboard teaching/PowerPoint presentation (if needed) /Flipped Classes for specified topics.
- Tutorial classes on topics covered.
- Unit tests on covered topics

COURSE CONTENTS

UNIT-1-(08 HOURS)

Introduction: Fundamental of satellite communication, Mathematical Models for Communication Channels, Digital Communication System, Communication Channels and Their Characteristics, different modulation and multiplexing schemes.

UNIT-2-(08 HOURS)

Telemetry process: Satellite Telemetry, Tracking and Tele-command, Multiple Access Techniques Telemetry, Data Transmission, Methods of Modulation, Time Division and Frequency Division Multiplexing, FDMA, TDMA, CDMA and DAMA, Coding Schemes.

UNIT-3-(08 HOURS)

Communications and Telemetry: Satellite Packet Communications, Tracking and Telemetry. Doppler and Electro-Optical methods of tracking, Airborne Missile, Surface to air missile, missile tracking.

UNIT-4-(08 HOURS)

Signal Processing: Processing of Signal, Analog, continuous time, discrete time, non-linear, statistical signal processing, Data Acquisition and Reduction, Audio signal processing, Array processing, Feature extraction and image understanding.

UNIT-5-(08 HOURS)

Satellite communication: Introduction to satellite communication, low earth orbit, satellite constellation, medium earth orbit, Geostationary orbit, Molniya orbit, Frequency allocation for satellite systems: Radio Navigation satellite service, Meteorological satellite services, transponders.

TEXT BOOKS

4. "Spacecraft TT&C and Information Transmission Theory and Technologies", by, Jiaxing Liu. Publisher: Springer,2014
5. "Introduction to PCM Telemetering Systems", by Stephen Horan. Publisher: CRC Press
6. "Satellite Communications Systems: Systems, Techniques and Technology", by Gerard Maral, Michel Bousquet, Zhili Sun. Publisher: Wiley,2020

REFERENCE BOOKS

4. "Satellite Communications", by Timothy Pratt, Jeremy E. Allnutt, 3rd Edition Publisher: Wiley.
5. "Principles of Modern Communication Systems", by Samuel O. Agbo , Matthew
6. N. O. Sadiku 2017

COURSE ASSESSMENT METHOD

Continuous Internal Evaluation (CIE)
Three internal assessments for **30** Marks each.
Two Learning Activities for **10** Marks each.
Semester End Examination (SEE)
Semester end examination for 100 Marks
Program Outcomes – Articulation matrix

PO	1	2	3	4	5	6	7	8	9	10	11	12	PSO1	PSO2
CO1	3	2	2		-				2	3	-	3		
CO2	3	2	3		-	-	-	-	3	2	-	3		
CO3	3	3	2		-	-	-	-	2	3	-	3		
CO4	3	2	1		-	-	-	-	2	2	-	3		
CO5	3	2	2	-	-	-	-	-	3	2	-	3		

SAFETY, HEALTH AND HAZARD MANAGEMENT				
Course Code	**22DTC322**		**Credits**	**03**
Hours/Week (L-T-P)	**3-0-0**		**CIE Marks**	**50**
Total Hrs	**39**		**SEE Marks**	**50**
Exam Hrs	**03**		**Course Type**	**PEC**

COURSE OUTCOMES

Course outcomes: After completion of the course, students will be able to-

17. Understand chemical safety standards, fire safety.
18. Handle toxic liquids & gases, explosives.
19. Understand the hazard management.
20. Understand warfare safety.
21. Understand health & environment safety.

TEACHING METHODOLOGY

- Blackboard teaching/PowerPoint presentation (if needed) /Flipped Classes for specified topics.
- Tutorial classes on topics covered.
- Unit tests on covered topics

COURSE CONTENTS

UNIT-1-(08 HOURS)

Chemical Safety: Standards and regulations of chemical safety in Industries or Laboratories, Storage of hazardous chemicals, Compatibility and classification codes, Chemical risk analysis and Management.

UNIT-2-(08 HOURS)

Toxic and explosive handling: Fire triangle and Handling of Toxic materials, Industrial Gases and other gases, instructions for handling toxic materials, industrial standards, accident protocols, emergency measures.

UNIT-3-(08 HOURS)

Hazard Management: HAZOP and HAZAN techniques, Hazard in manufacture, Hazard prevention measures, Disposal of hazardous materials, segregation of solid, liquid and gaseous materials.

UNIT-4-(08 HOURS)

Warfare safety: Basic understanding of the warfare environment, Classifications of explosives based on hazards, Nuclear,biological and chemical warfare safety, various protocols, accident and emergency protocols at the warfare.

UNIT-5-(08 HOURS)

Health and environment safety: Need of awareness about human health and environment safety, assessment of human factors, Health & Environment safety, Nano materials safety (Toxicology study), radiation related safety protocols, case studies.

TEXT BOOKS

5. “Occupational Health and Safety Management A Practical Approach”, by Charles D. Reese. Publisher: CRC Press.
6. “Occupational and Environmental Safety and Health”, Arezes, P.M., Baptista, J.S., Barroso, M.P., Carneiro, P., Cordeiro, P., Costa, N., Melo, R.B., Abreu dos Santos Baptista, J.M., Perestrelo, G. (Eds.). Publisher: Springers, 2019
7. “Handbook of Occupational Safety and Health”, by S. Z. Mansdorf. Publisher: Wiley.
8. “Institution of Chemical Engineers”, by Trevor Kletz“Hazop and Hazan

REFERENCE BOOKS

4. “Handbook of Toxicology of Chemical Warfare Agents”, by Ramesh C. Gupta 2nd Edition Elsevier, 2015
5. “Nanomaterials Safety Toxicity and Health Hazards”, by Shyamasree Ghosh De Gruyter.
6. “Hazardous Chemicals Handbook”, by Phillip Carson, Clive Mumford Butterworth-Heinemann.

COURSE ASSESSMENT METHOD

Continuous Internal Evaluation (CIE)

Three internal assessments for **30** Marks each.
Two Learning Activities for **10** Marks each.
Semester End Examination (SEE)
Semester end examination for 100 Marks
Program Outcomes – Articulation matrix

PO	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**PSO1**	**PSO2**
CO1	3	2	-	-	-	3	2		3		-	3		
CO2	3	2			-	3	3	-	2		-	3		
CO3	3	3			-	3	2	-	3		-	3		
CO4	3	2			-	3	2	-	3		-	3		
CO5	3	3				3	3	-	2	-	-	3		

SYSTEM ENGINEERING AND ANALYSIS				
Course Code	**22DTC323**		**Credits**	**03**
Hours/Week (L-T-P)	**3-0-0**		**CIE Marks**	**50**
Total Hrs	**39**		**SEE Marks**	**50**
Exam Hrs	**03**		**Course Type**	**PEC**

COURSE OUTCOMES

Course outcomes: After completion of the course, students will be able to-

22. Understand the system design requirements, architecture, functional requirements.
23. Generate the system requirements documents as per the requirement analysis.
24. Understand the techniques of system design
25. Carry out the Supportability and producibility
26. Carry out the system reliability analysis.

TEACHING METHODOLOGY

- Blackboard teaching/PowerPoint presentation (if needed) /Flipped Classes for specified topics.
- Tutorial classes on topics covered.
- Unit tests on covered topics

COURSE CONTENTS

UNIT-1-(08 HOURS)

Fundamentals of systems engineering: Fundamentals of systems engineering and system architecting of weapon system, system engineering. standards 15288, requirements analysis, functional analysis and allocation, preliminary system architecture.

UNIT-2-(08 HOURS)

Systems design and analysis: systems analysis, system design, and the basics of test and evaluation, Introduction to combat systems, System development phases (Conceiving, Designing, Implementing, and Operating)

UNIT-3-(08 HOURS)

Techniques of system design: Techniques of system design and assessment for operational feasibility, including reliability, maintainability, usability (including human factors and human performance).

UNIT-4-(08 HOURS)

More on system analysis: Various ways of evaluating system performance, Supportability and producibility, System cost assessment and effectiveness estimation, certification methods, Case studies.

UNIT-5-(07 HOURS)

Reliability analysis and management (basic tools and methods of reliability for developing complex systems including electronic components, mechanical components, and software), redundancy, graceful degradation, fault tolerance, MTBF.

TEXT BOOKS

5. Buede D.M.2: The Engineering Design of Systems: Models and Methods, Publisher: John Wiley & Sons Inc.
6. Defense Acquisition University Press fort Belvoir, Virginia:" Systems engineering fundamentals"
7. Charles S. Wasson: System Analysis Design and Development, Publisher: Wiley Series in System Engineering and Management.
8. Clifton R H: Principles of Planned Maintenance, Publisher: McGraw Hill, New York.

REFERENCE BOOKS

4. Clifton R H: Principles of Planned Maintenance, Publisher: McGraw Hill, New York.
5. Srinath L S: Reliability Engineering, Publisher: Affiliated East-West Press Limited, New Delhi,2002.
6. Dhillon B S: Engineering Maintainability, Publisher: Prentice Hall of India.

COURSE ASSESSMENT METHOD

Continuous Internal Evaluation (CIE)

Three internal assessments for **30** Marks each.

Two Learning Activities for **10** Marks each.

Semester End Examination (SEE)

Semester end examination for 100 Marks

Program Outcomes – Articulation matrix														
PO	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**PSO1**	**PSO2**
CO1	3	1	2	-	-						-	3		
CO2	3	2	3					-	-		-	3		
CO3	3	3	2					-	-		-	3		
CO4	3	2	2					-	-		-	3		
CO5	3	2	1					-	-	-	-	3		

TACTICAL BATTLEFIELD COMMUNICATION & ELECTRONIC

Course Code	22DTC324		**Credits**	**03**
Hours/Week (L-T-P)	**2-0-2**		**CIE Marks**	**50**
Total Hrs	**39**		**SEE Marks**	**50**
Exam Hrs	**03**		**Course Type**	**PEC**

COURSE OUTCOMES

Course outcomes: After completion of the course, students will be able to-

1. Understand the nature of tactical battlefield communication
2. Calculate communication link performance
3. Calculate the requirements for interception of tactical communication
4. Calculate the requirements for emitter location, intercept and jamming of tactical comm. signals including weapon control link, UAV links, Cell phone links.
5. Use various tools to perform electronic warfare calculations

TEACHING METHODOLOGY

- Blackboard teaching/PowerPoint presentation (if needed) /Flipped Classes for specified topics.
- Tutorial classes on topics covered.
- Unit tests on covered topics

COURSE CONTENTS

UNIT-1-(08 HOURS)

Radiometry and Power Calculation : Signature generation, atmospheric effects. Radar ES operational use, radar/ Electronic support detection battle, quiet radar, jamming techniques & strategies, jamming of Synthetic aperture radar systems.

UNIT-2-(08 HOURS)

Introduction to Radar Waveform : Interception, Technology and operational characteristics of electronic warfare, Signal processing statics & analysis, statistics & noise, analogue & digital signal processing.

UNIT-3-(08 HOURS)

Decision Theory- Hypothesis testing, probabilities of false alarm and detection, Bayesian network and systems, differences between error probability and bit error rate, receiver operating.

UNIT-4-(07 HOURS)

Network Issues: UAV Payload/link Issues, cell phone issues, Intercept links, Frequency hopping and other LPI threats; Special techniques for jamming LPI signals

UNIT-5-(08 HOURS)

ECM / ECCM : Introduction to electronic counter measures and electronic counter-counter measures. Various aspects of counter measures, need for countermeasures, Electronic countermeasures against modern target tracking radars multiplatform-multisensor-multitarget tracking

TEXT BOOKS

1. T. Pratt, C. W. Bostian, J. E.Allnut, Satellite communication, Publisher: John Willey and sons
2. G. Maral, M. Bousquet, Z. Sun. Satellite Communications Systems: systems, techniques and technology, Publisher:John Willy and sons

REFERENCE BOOKS

4. B. Sklar ,Digital Communications: Fundamentals and Applications, . Prentice-Hall, Inc.
5. E. Kaplan and C. Hegarty, Understanding of GPS/GNSS: Principles and Applications,. Publisher: Artech House Publishers.
6. Literature / books suggested by respective course Lecturers

COURSE ASSESSMENT METHOD

Continuous Internal Evaluation (CIE)

Three internal assessments for **30** Marks each.

Two Learning Activities for **10** Marks each.
Semester End Examination (SEE)
Semester end examination for 100 Marks
Program Outcomes – Articulation matrix

PO	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**PSO1**	**PSO2**
CO1	3	2	2	-	-						-	-		**2**
CO2	2	2	3	2	-	-		-	-		-			**3**
CO3	2	3	2	1	-	-		-	-		-			**3**
CO4	1	2	1	2	-	-		-	-		-			**2**
CO5	3	2	2	3				-	-	-	-			**1**

ADVANCED ANALYTICAL TECHNIQUES				
Course Code	**22DTC325**		**Credits**	**03**
Hours/Week (L-T-P)	**2-0-2**		**CIE Marks**	**50**
Total Hrs	**39**		**SEE Marks**	**50**
Exam Hrs	**03**		**Course Type**	**PEC**

COURSE OUTCOMES

Course outcomes: After completion of the course, students will be able to-

1. Understand different characterization techniques.
2. Apply appropriate analytical technique for a particular material organic/ inorganic/ nanomaterial/ polymer etc.
3. Understand the principle and working of chromatography.
4. Understand the principle and working of spectroscopy.
5. Understand the principle and working of XRD and SEM.

TEACHING METHODOLOGY

- Blackboard teaching/PowerPoint presentation (if needed) /Flipped Classes for specified topics.
- Tutorial classes on topics covered.
- Unit tests on covered topics

COURSE CONTENTS

UNIT-1-(08 HOURS)

Instrumental Analysis: Qualitative analysis, predictive analytics, spatial data processing, text analytics, text search, streaming analytics, graph data processing, network analysis techniques and specialized analytical tools

UNIT-2-(08 HOURS)

Various techniques in instrumental analysis: Genesis of instrumental analysis, hyphenated techniques**,** Polymeric Techniques, Rheology Techniques, Molecular weight determination; Thermal Techniques: Thermo Gravimetry (TG), Differential Thermal Analysis (DTA), and Differential Scanning Calorimetry (DSC)

UNIT-3-(08 HOURS)

Chromatographic Techniques: Gas Chromatography (GC), High Performance Liquid Chromatography (HPLC), Thin Layer Chromatography (TLC), Ion chromatography, column chromatography, planar chromatography.

UNIT-4-(07 HOURS)

Spectroscopy: Ultra Violet-Visible Spectroscopy UV-VIS, Infra-Red spectroscopy (IR), Nuclear Magnetic Resonance (NMR), Mass spectroscopy, Atomic Absorption Spectroscopy (AAS), Atomic Emission Spectroscopy (AES) Acoustic spectroscopy, Glow Discharge Spectroscopy (GDS).

UNIT-5-(08 HOURS)

X-Ray Diffraction (XRD) and Scanning Electron Microscope techniques(SEM), Inverse reconstruction using electron-material interactive models, Photometric 3D SEM reconstruction from a four-quadrant detector, Sensitivity studies.

TEXT BOOKS

1. C. N. Banwell., Fundamentals of molecular spectroscopy, McGraw Hill Education; Fourth edition (1 July 2017)
2. Donald L. Pavia, Gary M. Lampman, and George S. Kriz.Introduction to Spectroscopy Publisher: Cengage Learning, 2014.
3. James M. Miller, Chromatography: Concepts and Contrast,. Publisher : Wiley.
4. Mark F. Vitha., Chromatography: Principles and Instrumentation, Publisher: Wiley. Wiley; 1st edition (22 August 2016)

REFERENCE BOOKS

1. B.D. Cullity Deceased, S.R. Stock, Elements of X-Ray Diffraction, Publisher : Pearson.
2. S. Amelinckx, Dirk van Dyck, J. van Landuyt, Gustaaf van Tendeloo, Electron Microscopy: Principles and Fundamentals, . Publisher : Wiley.
3. Dan Campbell, Richard A. Pethrick, Jim R. White, Polymer Characterization: Physical Techniques, 2nd Edition. Publisher CRC Press.

COURSE ASSESSMENT METHOD

Continuous Internal Evaluation (CIE)

Three internal assessments for **30** Marks each.

Two Learning Activities for **10** Marks each.

Semester End Examination (SEE)

Semester end examination for 100 Marks

Program Outcomes – Articulation matrix

PO	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**PSO1**	**PSO2**
CO1	3	1	2		-				2	2	-	3		**3**
CO2	2	2	2		-	-	-	-	2	2	-	3		**2**
CO3	1	3	3		-	-	-	-	2	2	-	3		**1**
CO4	2	2	2	-	-	-	-	-	2	2	-	3		**2**
CO5	3	2	2	-	-	-	-	-	2	2	-	3		**1**

OPEN ELECTIVE I

SONAR SYSTEM ENGINEERING				
Course Code	**22DTC331**		**Credits**	**03**
Hours/Week (L-T-P)	**3-0-0**		**CIE Marks**	**50**
Total Hrs	**39**		**SEE Marks**	**50**
Exam Hrs	**03**		**Course Type**	**OEC**

COURSE OUTCOMES

Course outcomes: After completion of the course, students will be able to-

1. Know the basic building blocks of a SONAR based system.
2. Have an in-depth knowledge on different types of signals that are used.
3. Know about the ambiguity function and its significance in radar signal processing.
4. Know the physics behind sound propagation in water and principle of operation of sonar.
5. Apply the knowledge acquired in this course in real time applications.

TEACHING METHODOLOGY

- Blackboard teaching/PowerPoint presentation (if needed) /Flipped Classes for specified topics.
- Tutorial classes on topics covered.
- Unit tests on covered topics

COURSE CONTENTS

UNIT-1 (8 HRS)

Introduction: Mathematical development and discussion of fundamental principles that pertain to the design and operation of passive and active sonar systems critical to naval operation. Sound propagation, target characteristics, counter measures.

UNIT -2 (8 HRS)

Theories of Sonar systems: Topics from complex aperture theory, array theory. Signal processing, Audio signal processing, Array processing, Feature extraction and image understanding, Data Transmission, Methods of Modulation.8 HRS

UNIT -3 (8 HRS)

Introduction to undersea warfare: Conventional and unconventional Seabed warfare, non-kinetic approaches such as law fare, unmanned underwater vehicles. **Engineering acoustics:** Underwater acoustics, ultrasonic, vibrations and dynamics.8 HRS

UNIT -4 (8 HRS)

Statistical techniques: Multiple Sinusoids Model, two-dimensional sinusoids model, Principles of optimal signal processing techniques for detecting signals in noise, maximum likelihood, Bayes risk.

UNIT -5 (7 HRS)

Probabilities and errors: Neyman-Pearson: errors of the second kind, power function and inductive behaviour, rate of missed detections, minimizing the rate of false alarms, min-max criteria and calculations of their associated error probabilities (ROC curves)

TEXT BOOKS

1. K. K. Sharma, Fundamentals of Radar, Sonar and Navigation Engineering, S K Kataria and Sons; Reprint 2013 edition (1 January 2013)
2. William L. Melvin. Principles of Modern Radar: Advanced techniques, SciTech Publishing Inc; Illustrated edition (16 October 2012)
3. Lawrence J. Ziomek, An Introduction to Sonar Systems Engineering, CRC Press; 1st edition (12 December 2019)

REFERENCE BOOKS

1. D. Waite., Sonar for practicing engineers, Wiley; 3rd edition (27 March 2002)
2. Richard P. Hodges., Underwater Acoustics: Analysis, Design and Performance of Sonar, Wiley; 1st edition (28 June 2011)
3. Literature / books suggested by respective course Lecturers

COURSE ASSESSMENT METHOD

Continuous Internal Evaluation (CIE)														
Three internal assessments for **30** Marks each.														
Two Learning Activities for **10** Marks each.														
Semester End Examination (SEE)														
Semester end examination for 100 Marks														
Program Outcomes – Articulation matrix														
PO	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**PSO1**	**PSO2**
CO1	3	2			-				2	2	-	3		1
CO2	3	3			-	-	-	-	2	2	-	3		2
CO3	3	2			-	-	-	-	2	2	-	3		3
CO4	3	2	-	-	-	-	-	-	2	2	-	3		2
CO5	3	3	-	-	-	-	-	-	2	2	-	3		2

AIR INDEPENDENT PROPULTION AND BATTERIES				
Course Code	**22DTC332**		**Credits**	**03**
Hours/Week (L-T-P)	**3-0-0**		**CIE Marks**	**50**
Total Hrs	**39**		**SEE Marks**	**50**
Exam Hrs	**03**		**Course Type**	**OEC**

COURSE OUTCOMES

Course outcomes: After completion of the course, students will be able to-

27. Understand hybrid concepts
28. Understand hybrid vehicle control and analysis
29. Understand electric vehicle control and analysis
30. Understand electric propulsion components
31. Understand advanced storage devices

TEACHING METHODOLOGY

- Blackboard teaching/PowerPoint presentation (if needed) /Flipped Classes for specified topics.
- Tutorial classes on topics covered.
- Unit tests on covered topics

COURSE CONTENTS

UNIT-1-(08 HOURS)

Hybrid Concepts: Introduction to Hybrid Electric Vehicles, basic requirements, advantages and disadvantages, Impact of modern drive-trains on energy supplies, performance evaluation methods

UNIT-2-(08 HOURS)

Hybrid Vehicle Control And Analysis: Hybrid Electric Drive-trains: hybrid traction, various hybrid drive-train topologies, power flow control, fuel efficiency analysis, differences from the conventional types.

UNIT-3-(08 HOURS)

Electric Vehicle Control And Analysis: Electric Drive-trains: electric traction, electric drive-train topologies, power flow control in electric drive-train topologies, fuel efficiency analysis

UNIT-4-(08 HOURS)

Electric Propulsion Components: Electric Propulsion unit: electric components used in hybrid and electric vehicles, Configuration and control of DC Motor drives, Induction Motor drives, Permanent Magnet Motor drives, Switch Reluctance Motor drives, drive system efficiency

UNIT-5-(08 HOURS)

Advanced Storage Devices: Battery based energy storage and its analysis, Fuel Cell based energy storage and its analysis, Super Capacitor based energy storage and its analysis, Flywheel based energy storage and its analysis, Hybridization of different energy storage devices

TEXT BOOKS

3. Chris Mi, M. AbulMasrur, Hybrid Electric Vehicles: Principles and Applications with Practical Perspectives, Wiley
4. Literature / books suggested by respective course Lecturers

REFERENCE BOOKS

3. YiminGao, Ali Emadi, Modern Electric, Hybrid Electric, and Fuel Cell Vehicles, Standards media.
4. Fundamentals, Theory, and Design, Second Edition

COURSE ASSESSMENT METHOD

Continuous Internal Evaluation (CIE)

Three internal assessments for **30** Marks each.

Two Learning Activities for **10** Marks each.

Semester End Examination (SEE)

Semester end examination for 100 Marks

Program Outcomes – Articulation matrix

PO	1	2	3	4	5	6	7	8	9	10	11	12	PSO1	PSO2
CO1	3	3			-				2	2	-	3		
CO2	3	2			-	-	-	-	2	2	-	3		
CO3	3	2			-	-	-	-	2	2	-	3		
CO4	3	2	-	-	-	-	-	-	2	2	-	3		
CO5	3	3	-	-	-	-	-	-	2	2	-	3		

ACQUISITION, TRACKING & POINTING TECHNOLOGY				
Course Code	**22DTC333**		**Credits**	**03**
Hours/Week (L-T-P)	**3-0-0**		**CIE Marks**	**50**
Total Hrs	**39**		**SEE Marks**	**50**
Exam Hrs	**03**		**Course Type**	**OEC**

COURSE OUTCOMES

Course outcomes: After completion of the course, students will be able to-

32. Understand the concepts and basic systems requirements tracking systems.
33. Understand the system configurations and critical component characteristics required in the design of stabilized pointing and tracking systems, along with an introduction to some more advanced concepts.
34. Understand the control system and algorithm techniques and practices commonly utilized in the design of tracking systems.
35. Understand counter measures.
36. Understand about Doppler and Electro-Optical methods of tracking.

TEACHING METHODOLOGY

- Blackboard teaching/PowerPoint presentation (if needed) /Flipped Classes for specified topics.
- Tutorial classes on topics covered.
- Unit tests on covered topics

COURSE CONTENTS

UNIT-1-(08 HOURS)

Basics: Basic aspects of acquisition, fundamental concepts of tracking, pointing technology details, Military system requirements, Acquisition, tracking, and pointing (ATP) design for military systems.

UNIT-2-(08 HOURS)

Mathematical aspects: Review of mathematical techniques, Target tracking and related mathematics, SNR requirement, the Johnson criteria, probability of estimation, detection criteria, examples.

UNIT-3-(08 HOURS)

Algorithms: Need of algorithms, Tracking algorithms, track filters, multi target tracking, example problems, Algorithms for simple cases, methods to incorporate additional requirements to algorithms.

UNIT-4-(08 HOURS)

Counter measures: Various aspects of counter measures, need for counter measures, Electronic countermeasures against modern target tracking radars multiplatform-multi-sensor-multi target tracking.

UNIT-5-(08 HOURS)

Tracking methods: Different principles used in tracking methods, Doppler and Electro-Optical methods of tracking, other tracking methods, un conventional methods used and their advantages.

TEXT BOOKS

3. Steven L. Chodos B(Editor), William E. Thompson(Editor).Acquisition, Tracking, Pointing, and Laser Systems Technologies XXI (Proceedings of SPIE) 30 October 2007 ,
4. Hemani Kaushal, Vk Jain and Subrat Kar. ,Acquisition, Tracking, and Pointing, January 2017 In book: Free Space Optical Communication, Publisher: Springer India.

REFERENCE BOOKS

2. Literature / books suggested by respective course Lecturers

COURSE ASSESSMENT METHOD

Continuous Internal Evaluation (CIE)

Three internal assessments for **30** Marks each.

Two Learning Activities for **10** Marks each.

Semester End Examination (SEE)

Semester end examination for 100 Marks

Program Outcomes – Articulation matrix

PO	1	2	3	4	5	6	7	8	9	10	11	12	PSO1	PSO2
CO1	3	3			-				2	2	-	3		
CO2	3	2			-	-	-	-	2	2	-	3		
CO3	3	3			-	-	-	-	2	2	-	3		
CO4	3	2	-	-	-	-	-	-	2	2	-	3		
CO5	3	3	-	-	-	-	-	-	2	2	-	3		

NAVAL OCEAN ANALYSIS AND PREDICTION				
Course Code	22DTC334		**Credits**	**03**
Hours/Week (L-T-P)	**3-0-0**		**CIE Marks**	**50**
Total Hrs	**39**		**SEE Marks**	**50**
Exam Hrs	**03**		**Course Type**	**OEC**

COURSE OUTCOMES

Course outcomes: After completion of the course, students will be able to-

1. Understand and develop the Navy Ocean modeling and prediction program.
2. Understand the need to evaluate ocean models and prediction systems for operational and tactical applications.
3. Understand and predict environmental conditions in the coastal ocean.

TEACHING METHODOLOGY

- Blackboard teaching/PowerPoint presentation (if needed) /Flipped Classes for specified topics.
- Tutorial classes on topics covered.
- Unit tests on covered topics

COURSE CONTENTS

UNIT-1-(08 HOURS)

Introduction: Advanced knowledge of the Indian Navy ocean analysis, territory analysis, ocean currents, wind currents, effect of climatic changes on the oceans, prediction systems: NRL stennis, NOAA/NCEP

UNIT-2-(08 HOURS)

Modelling and data systems: Naval Ocean Modeling Program (NOMP), Ocean model evolution, Description of the Modelling and Prediction Capabilities, Shipboard model, acoustic model, Naval ocean data systems. anthropogenic climate drivers.

UNIT-3-(08 HOURS)

Assimilation of atmosphere: Atmospheric forcing systems, anthropogenic climate drivers, radiative forcing, data assimilation systems, cost function, 3D- Var, 4D-Var, Bayesian estimate, Analysis of data, numerical forecast model.

UNIT-4-(07 HOURS)

Interpolation and prediction: Collection of thermal currents data, Optimal Thermal Interpolation System (OTIS), Model assessments and verification, Ocean monitoring based on observing systems, Thermal Ocean Prediction Systems (TOPS).

UNIT-5-(08 HOURS)

Advanced concepts of atmosphere: Fundamental concepts in turbulence. The atmospheric planetary boundary layer, including surface layer, and bulk formula for estimating air-sea fluxes. The global ocean circulation prediction system, Shallow Water Analysis and Forecast System (SWAFS), Knowledge of ocean eddies.

TEXT BOOKS

1. Indian Navy: Ocean of opportunities (Defence Series Books), PRANAV ZOPE
2. Elements of Ocean Engineering. Author Robert E. Randall The Society of Naval Architects and Marine Engineers; Second edition (1 September 2010)

REFERENCE BOOKS

5. Ocean Modelling for Beginners - Using Open-Source Software. Author JochenKaempf.

COURSE ASSESSMENT METHOD

Continuous Internal Evaluation (CIE)

Three internal assessments for **30** Marks each.

Two Learning Activities for **10** Marks each.

Semester End Examination (SEE)

Semester end examination for 100 Marks

Program Outcomes – Articulation matrix														
PO	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**PSO1**	**PSO2**
CO1	3	3	2		-				2	2	-	3		**1**
CO2	2	1	2		-	-	-	-	2	2	-	3		**2**
CO3	2	3	1		-	-	-	-	2	2	-	3		**2**
CO4	1	1	2	-	-	-	-	-	2	2	-	3		**2**
CO5	3	2	1	-	-	-	-	-	2	2	-	3		**1**

UNMANNED AERIAL VEHICLE				
Course Code	**22DTC335**		**Credits**	**3**
Hours/Week (L-T-P)	**3-0-0**		**CIE Marks**	**50**
Total Hrs	**39**		**SEE Marks**	**50**
Exam Hrs	**3**		**Course Type**	**OEC**

COURSE OUTCOMES

Course outcomes: After completion of the course, students will be able to-

6. To classify UAVs based on different parameters.
7. To demonstrate ability to design an efficient structure for an UAV of specific application.
8. To perform ground testing of UAVs.
9. To apply the knowledge gained on electronic intelligence and target designation for successful development of UAS.
10. To understand the basic concepts in the different types of navigation schemes for UAS.

TEACHING METHODOLOGY

- Blackboard teaching/PowerPoint presentation (if needed) /Flipped Classes for specified topics.
- Tutorial classes on topics covered.
- Unit tests on covered topics

COURSE CONTENTS

UNIT -1- (07 HOURS)

Introduction to uav: History of UAV –classification –basic terminology-models and prototypes –applications

UNIT -2- (08 HOURS)

Basics of airframe: Airframe –dynamics –modeling- structures –wing design- engines and its types-equipment, maintenance and management-control surfaces-specifications.

UNIT -3- (08 HOURS)

Development of uas system: System Development- Ground Testing-UAV component testing-Uav Sub-assembly and Sub- System Testing- Testing Complete UAV, Environmental testing – Testing Complete UAV-Control Station testing-Catapult Launch systems -System In flight Testing- Test sites-Test Crew training-Onsite preparation - System Certification.

UNIT -4- (08 HOURS)

Deployment of unmanned aerial system: Operational trails-network centric operations-Radar confusion-Missile Decoy-radio relay- Electronic Intelligence-Covert Reconnaissance and surveillance Target designation by laser, NBC contamination Monitoring-Long Range reconnaissance and strike- Aerial photography- Information services-communication relay- landmine detection and Destruction-other applications

UNIT -5- (08 HOURS)

Communication payloads and path planning: Payloads-Telemetry-tracking-Aerial photography, Frequency range – Commands- Control, FPV videos - Flight computer sensor-displays, RF modems, Simulation and ground testing, Trouble shooting, waypoints navigation and ground control software.

TEXT BOOKS

4. Armand J. Chaput, “Design of Unmanned Air Vehicle Systems”, Lockheed Martin Aeronautics Company, 2001.
5. Kimon P. Valavanis, “Advances in Unmanned Aerial Vehicles: State of the Art and the Road to Autonomy”, Springer, 2007.
6. Paul G Fahlstrom, Thomas J Gleason, “Introduction to UAV Systems”, UAV Systems, Inc, 1998.

REFERENCE BOOKS

4. Reg Austin, “Unmanned Aircraft systems-UAVs Design, Development and Deployment”, WILEY Publication, 2010.
5. Robert C. Nelson, “Flight Stability and Automatic Control”, McGraw-Hill, Inc, 1998.
6. Swatton ,PJ, “Ground studies for pilots’ flight planning”, 6th edition, 2008.

COURSE ASSESSMENT METHOD

Continuous Internal Evaluation (CIE)														
Three internal assessments for 30 Marks each.														
Two Learning Activities for 10 Marks each.														
Semester End Examination (SEE)														
Semester end examination for 100 Marks														
Program Outcomes – Articulation matrix														
PO	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**PSO1**	**PSO2**
CO1	**3**	**1**										**2**		**1**
CO2	**2**	**2**							**2**			**1**		**1**
CO3	**1**			**1**	**1**							**2**		**1**
CO4	**2**								**2**			**1**		
CO5	**1**	**2**		**1**					**2**			**2**		

SEMESTER IV

PROJECT WORK PHASE-II				
Course Code	**22DTC41**		**Credits**	**18**
Hours/Week (L-T-P)	**0-8-0**		**CIE Marks**	**100**
Total Hrs	**50**		**SEE Marks**	**100**
Exam Hrs	**3**		**Course Type**	**Project**

COURSE OUTCOMES

1. Project work phase-II: 16-week duration during 4^{th} semester. Evaluation shall be done by the committee constituted comprising of HoD as Chairman, Guide and Senior faculty of the department.
2. Project Evaluation: Evaluation shall be taken up at the end of 4^{th} semester. Project work evaluation and Viva-Voce examination shall conducted
3. Project evaluation:
    a. Internal Examiner shall carry out the evaluation for 50 marks.
    b. External Examiner shall carry out the evaluation for 50 marks.
    c. The average of marks allotted by the internal and external examiner shall be the final marks of the project evaluation.
    d. Viva-Voce examination of Project work shall be conducted jointly by Internal and External examiner for 100 marks.

Program Outcomes – Articulation matrix

PO	1	2	3	4	5	6	7	8	9	10	11	12	PSO1	PSO2
CO1	3	2						3	3			3	3	3
CO2	3	2						3	3			3	3	3
CO3	2	2						3	3			2	3	2
CO4	2	2						3	3			3	3	2
CO5	3	2						3	3			3	3	3

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Department of Information Science & Engineering

Nitte Meenakshi Institute of Technology

P.B.No.6429, Yelahanka, Bangalore 560064

NITTE MEENAKSHI INSTITUE OF TECHNOLOGY

(A Unit of Nitte Education Trust (R), Mangalore)

An Autonomous Institution

Department of Information Science and Engineering

Curriculum Handbook for M.Tech – Data Science

NITTE EDUCATION TRUST | NITTE MEENAKSHI INSTITUTE OF TECHNOLOGY

Vision

To build a strong research and teaching environment in the field of Information Technology to meet the ever evolving global needs and to equip students with the latest knowledge, skills and practical orientation to face challenges in IT profession.

Mission

1. To offer comprehensive educational programs in the field of Information Technology producing highly accomplished graduates.
2. To inculcate among the students, the culture of research and innovation.
3. To encourage students to participate in co-curricular and extra-curricular activities leading to enhancement of their social and professional skills.

Programme Education Objectives (PEOs)

PEO-1. Graduate will have successful professional career in data science and allied fields with in-depth knowledge and practical/interpersonal skills.

PEO-2. Graduate undertakes research work or pursues higher studies by acquiring in depth knowledge in data engineering and allied fields.

Programme Outcomes (POs)

PO-1	An ability to independently carry out research /investigation and development work to solve practical problems
PO-2	An ability to write and present a substantial technical report/document
PO-3	Students should be able to demonstrate a degree of mastery over the area as per thespecialization of the program. The mastery should be at a level higher than therequirements in the appropriate bachelor program
PO-4	Conceptualize and solve data engineering problems using Mathematical, Statistical and Machine Learning concepts to arrive at feasible and optimal solutions for societal benefits.
PO-5	Use data analytics tool and technologies to analyze business models and solve real world problems.
PO-6	Inculcate professional ethics, intellectual integrity, understanding problems of others and contribution to the development of the society.

Process of Defining Vision and Mission of the Department

Developing strong vision and mission statements will help stakeholders of the college to attain their respective goals.

The process of defining vision and mission statements for department was started with formation of Program Assessment Committee with Head of the Department, being the chair person for the entire process.

Committee comprises of

- All faculty members.
- Distinguished students of 1nd &2nd years.

Functionality

- Formulate few Vision & Mission Statements
- Refine selected Vision and Mission statement according to the suggestions of Departmental Advisory Committee

Department Advisory Committee comprising of

- Distinguished academicians
- Experts from industry
- Alumni
- Dean- Academic
- Senior faculty members
- Distinguished students from final year

Department Advisory Committee Functionalities

- Formulate few Vision & Mission Statements by program assessment committee.
- Presented in the advisory committee for suggestions.
- Refine selected Vision and Mission according to the suggestions of advisory committee.
- Finalize the Vision & Mission statements in consultation with departmental advisory committee.

Process used for establishing the PEOs

Program Coordinator, PAC and DAC are involved in establishing the PEOs.

The process of establishing PEOs are as follows:

- PAC will refer the guidelines of NBA while establishing PEOs.
- PAC will formulate few PEOs which are in line with departmental mission statement.
- PAC will discuss about the attainment levels in terms of percentage.
- PAC will refer NASCOM and Government reports for further refinement of PEOs
- Formulated PEOs are Presented to DAC
- DAC will go through the PEO Statements, approve/suggest modifications.
- PAC will refine the selected PEOs according to the suggestions given by the DAC.
- Finalized PEOs with their target attainment level are presented to IQAC
- PAC will publish finalized PEO statements.

Establish consistency of the PEOs with the Mission of the department.

Mission **PEO**	**Comprehensive Educational Programs**	**Research and Innovation**	**Co-curricular and Extra-curricular Activities**
PEO1	**X**		**X**
PEO2	**X**	**X**	**X**

Our Mission statement can be disseminated into three parts. They are Comprehensive Educational Programs, Research/Innovation and Co-curricular activities.

PEO 1 is about professional career which can be accomplished through comprehensive education programs.

PEO 2 is about higher studies and research, which can be accomplished through comprehensive education and research& innovation.

NITTE EDUCATION TRUST | NITTE MEENAKSHI INSTITUTE OF TECHNOLOGY

Department of Information Science and Engineering
M. Tech Data Science
SEMESTER I

Bridge Course: (Two weeks from the commencement of the semester)

1. Probability Theory
2. Calculus
3. Data Mining
4. Python Programming
5. Essential Computer Science concepts

Sl. no.	Subject Code	Subject Name	Teaching Hours/Week			Credits
			L	T	P/S	
1	20DS11	Introduction to Data Management	4	0	0	4
2	20DS12	Statistics for Data Science	4	0	0	4
3	20DS13	Machine Learning- I	4	0	0	4
4	20DS14	Neural Networks	3	0	0	3
5	20DSE15X	Programme Elective- A	4	0	0	4
6	20DSL16	Data Analytics Lab	0	0	4	2
7	20DS17	Linear Algebra and Optimization	4	0	0	4
					Total	25

Program Elective- A

	Subject Code	Subject
Elective - A	20DSE151	IoT Analytics
	20DSE152	Time Series Analysis and Forecasting
	20DSE153	Computer Vision

Department of Information Science and Engineering
M. Tech Data Science

SEMESTER II

Sl. No.	Subject Code	Subject Name	Teaching Hours/Week			Credits
			L	T	P/S	
1	20DS21	Scalable Computing	3	0	0	3
2	20DS22	Deep Learning	4	0	0	4
3	20DS23	Exploratory Data Analysis	3	0	2	4
3	20DS24	Machine Learning- II	3	0	2	4
4	20DS25	Data Security & Privacy	4	0	0	4
5	20DSE26X	Programme Elective- B	4	0	0	4
7	20DS27	Research Methodology & IPR	2	0	0	2
					Total	25

	Subject Code	Subject
Elective-B	20DSE251	Big Data Analytics
	20DSE252	Business Analytics
	20DSE253	Social Network Analysis
	20DSE254	Natural Language & Text Mining

SEMESTER: III

Sl. No.	Subject Code	Subject Name	Teaching Hours/Week			Credits
			L	T	P/S	
1	20DS31	Self-study-MOOC	0	0	6	3
2	20DSI32	Internship*	0	0	20	10
3	20DSP33	Project Phase 1	0	0	10	5
***To be Completed during summer vacation after Ist Year for a period of 8 to 12 Weeks.**					Total	18

SEMESTER: IV

Sl. No.	Subject Code	Subject Name	Teaching Hours/Week			Credits
			L	T	P/S	
1	20DSP41	Project Phase 2	0	0	40	20
					Total	20

SEMESTER I

Semester: I Year: 2020-2021

Department: Information Science and Engineering	**Course Type:** Core
Course Title: Introduction to Data Management	**Course Code:20DS11**
L-T-P:4-0-0	**Credits:** 04
Total Contact Hours:52 hrs	**Duration of SEE:** 3 hrs
SEE Marks: 50	**CIE Marks:** 50

Pre-requisites:

- Database Management Systems
- Good programming skills

Course Outcomes:

Students will be able to

CO's	Course Learning Outcomes	BL
CO1	Describe the need for managing/storing data and identify the value and relative importance of data management.	**L2**
CO2	Describe fundamentals of Data Management techniques suitable for Enterprise Applications.	**L2**
CO3	Apply Data Management Solution for Internet Applications.	**L3**
CO4	Describe various data analysis techniques in the internet Context.	**L2**

Teaching Methodology:

- Blackboard teaching and PPT
- Programming Assignment

Assessment Methods

- Open Book Test for 10 Marks.
- Assignment evaluation for 10 Marks on basis of Rubrics
- Three internals, 30 Marks each will be conducted and the Average of best of two will be taken.
- Final examination, of 100 Marks will be conducted and will be evaluated for 50 Marks.

Course Outcome to Programme Outcome Mapping

	PO1	PO2	PO3	PO4	PO5	PO6
CO1	1		3		1	
CO2	1		2		3	
CO3	2		2	1	2	2
CO4	1		2		2	
20DS11	1		2	1	2	2

COURSE CONTENT

Unit – I	10 Hrs
Introduction to Data Science and Class Logistics/Overview, Statistical Inference and Exploratory Data Analysis, Principles of Data Management, SQL for Data Science: SQL Basics, SQL Joins and aggregates, Grouping and query evaluation, SQL Sub-queries, Key Principles of RDBMS	
Unit – II	**10 Hrs**
Data Models, Data Warehousing, OLAP, Data Storage and Indexing , Query Optimization and Cost Estimation, Datalog, E/R Diagrams and Constraints, Design Theory, BCNF	
Unit – III	**8 Hrs**
Data Management Solutions for Enterprise Applications: Introduction to Transactions, Transaction Implementations, Transaction Model, Database Concurrency Control Protocols, Transaction Failures and Recovery, Database Recovery Protocols.	
Unit – IV	**12 Hrs**
Parallel Databases: Introduction to NoSQL databases, comparison of Apache Cassandra, MongoDB, Apache Hive . Fundamentals of MongoDB: connecting to a MongoDB Cluster, using MongoDB Compass, MongoDB's document storage model and principles of flexible schema design, basic architecture of MongoDB clusters, CRUD operations. (Text Book-3- Chapter1, 2, 5))	
Unit – V	**12 Hrs**
Data Management Solution for Internet Applications: Google's Application Stack: Chubby Lock Service, BigTable Data Store, and Google File System; Yahoo's key-value store: PNUTS; Amazon's key-value store: Dynamo;	

Text Books:

1. Database Systems: the Complete Handbook, by Hector Garcia-Molina, Jennifer Widom, and Jeffrey Ullman. Second edition.
2. Fundamentals of database systems by Elsmasri and Navathe
3. Seven NoSQL Databases in a Week: Get up and running with the fundamentals, By Xun (Brian) Wu, Sudarshan Kadambi, Devram Kandhare, Aaron Ploetz, Packt Publishers

Reference Books/resources:

1. Database management systems by Raghu Ramakrishnan and Johannes Gehrke.
2. Foundations of database systems by Abiteboul, Hull and Vianu
3. “Transactional Information Systems” by Gerhard WEIKUM and Gottfried VOSSEN, publisher Morgan Kaufmann.
4. Programming Hive: Data Warehouse and Query Language for Hadoop By Edward Capriolo, Dean Wampler, Jason Rutherglen, O’Reilly
5. https://ai.google/research/pubs/pub27897
6. Fay Chang, Jeffrey Dean, Sanjay Ghemawat, Wilson C. Hsieh, Deborah A. Wallach Mike Burrows, Tushar Chandra, Andrew Fikes, Robert E. Gruber, Bigtable: A Distributed Storage System for Structured Data, Google, Inc. OSDI 2006
7. Brian F. Cooper et al., “ PNUTS: Yahoo!'s hosted data serving platform”, Journal Proceedings of the VLDB Endowment VLDB Endowment Hompage archive Volume 1 Issue 2, August 2008 Pages 1277-1288
8. Giuseppe DeCandia et al. , “Dynamo: Amazon’s Highly Available Key-value Store”, Proceeding SOSP '07 Proceedings of twenty-first ACM SIGOPS symposium on Operating systems principles,Pages 205-220 Stevenson, Washington, USA — October 14 - 17, 2007

Semester: I Year: 2020-2021

Department: Information Science and Engineering	**Course Type:** Core
Course Title: Statistics for Data Science	**Course Code:20DS12**
L-T-P: 4-0-0	**Credits:** 04
Total Contact Hours:52 hrs	**Duration of SEE:** 3 hrs
SEE Marks: 50	**CIE Marks:** 50

Pre-requisites:

- Good understanding of engineering mathematics (especially Algebra and Arithmetic).
- Inferring conclusions from two dimensional graphs.

Course Outcomes:

Students will be able to:

Cos	Course Outcome Description	Blooms Level
CO1	Describe the basic and intermediate concepts of probability, statistics, and distributions.	**L2**
CO2	Apply the applications of discrete probability distributions.	**L3**
CO3	Analyze the inference about population statistic based on the parameters of sample population.	**L3**
CO4	Analyse hypothesis to accept/reject alternative hypothesis based on statistical evidence available.	**L3**
CO5	Apply ANOVA and distribution-free procedures on population of any size	**L3**

Teaching Methodology:

- Black Board Teaching / Power Point Presentation.
- Seminar

Assessment Methods:

- Rubrics to evaluate Seminar
- Three internals, 30 Marks each will be conducted and the Average of best of two will be taken.
- Final examination of 100 Marks will be conducted and will be evaluated for 50 Marks.

Course Outcome to Programme Outcome Mapping

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**
CO1	1		2	2		
CO2	2			2		1
CO3	2		2	3		
CO4	3		3	3		2
CO5	2		3	3		2
20DS12	2		2	3		2

COURSE CONTENT

UNIT – I **Probability theory**	**10 hours**
Why Study Statistics?, Modern Statistics, Statistics and Engineering, two Basic Concepts—Population and Sample, A Case Study: Visually Inspecting Data to Improve Product Quality, Pareto Diagrams and Dot Diagrams, Frequency Distributions, Graphs of Frequency Distributions, Stem-and-Leaf Displays, Descriptive Measures, Quartiles and Percentiles, calculation of X bar and S, Problems with aggregating data, Sample Spaces and Events, Counting, Probability, The Axioms of Probability, Some Elementary Theorems, Conditional Probability, Bayes' Theorem.	
UNIT – II **Distributions/ Bootstrap**	**10 hours**
Random Variables, The Binomial Distribution, The Hypergeometric Distribution, The Mean and the Variance of a Probability Distribution, Chebyshev's Theorem, The Poisson Distribution and Rare Events, Poisson Processes, The Geometric and Negative, Binomial Distribution, The Multinomial Distribution, Simulation, Bootstrap: Introduction and the idea, Theoretical Support, Primary applications of bootstrap, Some real data Example (Text 1 and Text 3)	
UNIT – III **Probability Densities and Sampling Distributions**	**12 hours**
Continuous Random Variables, The Normal Distribution, The Normal Approximation to the Binomial Distribution, Other Probability Densities, The Uniform Distribution, The Log-Normal Distribution, The Gamma Distribution, The Beta Distribution, The Weibull Distribution, Continuous Random Variables, The Normal Approximation to the Binomial Distribution (Text 1)	
UNIT – IV **Inferences concerning mean and variance**	**10 hours**
Statistical Approaches to Making, Generalizations, Point Estimation, Interval Estimation, Maximum Likelihood Estimation, Tests of Hypotheses, Null Hypotheses and Tests of Hypotheses, Hypotheses Concerning One Mean, The Relation between Tests and Confidence Intervals, Power, Sample Size, and Operating Characteristic Curve, The Estimation of Variances, Hypotheses Concerning One Variance, Hypotheses Concerning Two Variances. (Text 1)	
UNIT – V **Analysis of Variance/ Distribution free procedures**	**10 hours**
Single-Factor ANOVA, Multiple Comparisons in ANOVA, More on Single-Factor ANOVA, Introduction Two-Factor ANOVA with Kij=1, Two-Factor ANOVA with Kij>1, Three-Factor ANOVA. Distribution free procedures: Wilcoxon single rank test, distribution-free confidence intervals, distribution-free ANOVA (Text 2)	

Text books:

1. Miller & freund's Probability and statistics for engineers, ninth edition, Richard a. Johnson, Pearson.
2. Devore. J.L., "Probability and Statistics for Engineering and the Sciences", Cengage Learning, New Delhi, 8th Edition, 2012.
3. Singh, K., & Xie, M. (2008). Bootstrap: a statistical method. Unpublished manuscript, Rutgers University, USA.
   Retrieved from http://www. stat. rutgers. edu/home/mxie/RCPapers/bootstrap. pdf.

Reference books:

1. Walpole. R.E., Myers. R.H., Myers. S.L. and Ye. K., "Probability and Statistics for Engineers and Scientists", Pearson Education, Asia, 8th Edition, 2007.
2. Ross, S.M., "Introduction to Probability and Statistics for Engineers and Scientists", 3rd Edition, Elsevier, 2004.
3. Spiegel. M.R., Schiller. J. and Srinivasan. R.A., "Schaum's Outline of Theory and Problems of Probability and Statistics", Tata McGraw Hill Edition, 2004.
4. Griffiths, Dawn. Head first statistics. " O'Reilly Media, Inc.", 2008.

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Semester: I Year: 2020-2021

Department: Information Science and Engineering	**Course Type:** Core
Course Title: Machine Learning-I	**Course Code:20DS13**
L-T-P:4-0-0	**Credits:** 04
Total Contact Hours:52 hrs	**Duration of SEE:** 3 hrs
SEE Marks: 50	**CIE Marks:** 50

Prerequisite:

Basics of probability, Engineering Mathematics

Course Outcomes:

Students will be able to

CO's	**Course Learning Outcomes**	**BL**
CO1	Explain concept learning and Feature engineering.	**L2**
CO2	Preprocess the input data to make it suitable for machine learning algorithms to consume.	**L3**
CO3	Construct a decision tree classifier to classify unknown instances.	**L3**
CO4	Apply conditional probability and Bayes theorem to analyze dependent events.	**L3**
CO5	Apply regression analysis to analyze/draw inferences from time series data	**L3**

Teaching Methodology:

- Black board teaching and Power Point presentations
- Programming Assignment
- Open Book Test

Assessment Methods:

- Open Book Test for 10 Marks.
- Assignment (10M), evaluated on the basis of Rubrics.
- Three internals, 30Marks each will be conducted and the Average of best of two will be taken.
- Final examination, of100 Marks will be conducted and will be evaluatedfor50Marks.

Course Outcome to Programme Outcome Mapping

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**
CO1	2		2	1		
CO2	2		2	1		
CO3	2		2	1		
CO4	2		2	1		
CO5	2		2	1		
20DS13	2		2	1		

Course Content

Unit – I	08 Hrs
Concept Learning: Learning problems, Designing a learning system, perspectives and issues in Machine Learning. Concept Learning Task, Concept Learning as search. (TextBook-1) **Feature Engineering for Machine Learning:** Machine Learning Pipeline, Binarization, Quantization/Binning, Log Transformation, Feature Scaling/Normalization, Interaction features, and feature selection	
Unit – II	**10 Hrs**
Text Data: Flattening, Filtering and chunking: Bag-of-X: Turning Natural Text into Flat Vectors, Filtering for cleaner features, Atoms of Meaning: From words to n-Grams to Phrases. (TextBook3) **Categorical variables:** Encoding categorical variables, dealing with large categorical variables: feature hashing, Bin counting **Dimensionality reduction:** Intuition, Derivation, PCA in Action, Whitening and ZCA, Considerations and limitations of PCA, Singular value decomposition, PCA as special case for SVD (TextBook3, Notes)	
Unit – III	**12 Hrs**
Decision Tree Learning: Decision Trees- Basic algorithm (ID3), Hypothesis search and Inductive bias, Entropy and Gain calculations, Issues in Decision Tree Learning – Overfitting, Solutions to overfitting, Dealing with continuous values, Improving performance: Bagging and Boosting, Adaboost - combining weak learners, Adaboost - simple problems. Random Forests: Methods for Growing the Trees, Choose m attributes randomly, compute their information gains, and choose the attribute with the largest gain to split, Generalization Error of Random Forests, Random Forest Regression	
Unit – IV	**12 Hrs**
Bayesian Learning: Bayes theorem – An Example; Bayes theorem and concept learning: Brute-Force Bayes Concept Learning, MAP Learning and Consistent Learners , Maximum Likelihood Estimation, Bayes optimal classifier, Naive Bayes classifier and Bayesian Belief Network- Conditional Independence, Representation, Inference, Learning Bayesian Belief Networks	
Unit – V	**10 Hrs**
Regression Analysis: Linear Regression, Multiple Linear Regression, Logistic Regression, Hypothesis space and logistic regression, Bias-Variance trade-offs in Regression, Case study-Boston Housing dataset	

Text Books:

1. Tom M. Mitchell, "Machine Learning", McGraw-Hill Education (INDIAN EDITION), 2013.
2. Introduction to Data Mining-Pang-NingTan, Michael Steinbach,Vipin Kumar, Pearson Education, 2007.
3. Amanda Casari, Alice Zheng, "Feature Engineering for Machine Learning", O'Reilly, 2018.

Additional Reference Book:

1. Gareth James, Daniela Witten, Trevor Hastie and Robert Tibshirani, "An Introduction to Statistical Learning: with Applications in R", Springer, 2016.
2. Trevor Hastie, Robert Tibshirani and Jerome Friedman, "The Elements of Statistical Learning: Data Mining, Inference, and Prediction", Springer, 2016
3. Andreas Muller, "Introduction to Machine Learning with Python: A Guide for Data Scientists", Shroff/O'Reilly; First edition (2016)
4. Introduction to Data Mining-Pang-NingTan, Michael Steinbach,Vipin Kumar, Pearson Education, 2007.

Online Materials:

1. https://nptel.ac.in/courses/106106139/
2. Andrew NG's online Course

Programming Assignments: (Sample)

1) Implement the CANDIDATE – ELIMINATION algorithm. Show how it is used to learn from training examples and hypothesize new instances in Version Space.
2) Implement the FIND–S algorithm. Show how it can be used to classify new instances of target concepts. Run the experiments to deduce instances and hypothesis consistently.
3) Implement the ID3 algorithm for learning Boolean–valued functions for classifying the training examples by searching through the space of a Decision Tree.
4) Design and implement the Back-propagation algorithm by applying it to a learning task involving an application like FACE RECOGNITION.
5) Design and implement Naïve Bayes Algorithm for learning and classifying TEXT DOCUMENTS.

Semester: I Year: 2020-2021

Department: Information Science and Engineering	**Course Type:** Core
Course Title: Neural Networks	**Course Code:20DS14**
L-T-P:3-0-0	**Credits:** 03
Total Contact Hours:39 hrs	**Duration of SEE:** 3 hrs
SEE Marks: 50	**CIE Marks:** 50

Pre-requisites:

- Data mining

Course Outcomes:

Students will be able to

CO's	**Course Learning Outcomes**	**BL**
CO1	Understand the biological structure of brain and neuron	**L2**
CO2	Understand the learning process and analyse the working of single layer perceptron mode	**L2**
CO3	Explore and Analyse the functioning of Single layer perceptron with single category and multi category models.	**L3**
CO4	Understand Multilayer feed-forward network, the back propagation algorithm and explore hyper-parameters for analysing performance of NN	**L3**

Teaching Methodology:

- Blackboard teaching and PPT
- Executable Codes/ Live Demonstration
- Programming Assignment

Assessment Methods

- Online certification from Course-era/Edx, etc. for 10 marks
- Programming assignments evaluated using rubrics for 10 marks
- Three internals, 30 Marks each will be conducted and the Average of best of two will be taken.
- Final examination, of 100 Marks will be conducted and will be evaluated for 50 Marks.

Course Outcome to Programme Outcome Mapping

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**
CO1	1					
CO2	3		2	3	1	
CO3	3		3	2	1	
CO4	3		3	3		
20DS14	2		2	2	1	

COURSE CONTENT

Unit – I	08 Hrs
Artificial Neural Systems: Preliminaries, Neural Computation: Some Examples and Applications,Classifiers, Approximators, and Autonomous Drivers, Simple Memory and Restoration of Patterns, Optimizing , NetworksClustering and Feature Detecting Networks **Fundamental Concepts and Models of Artificial:** Neural Systems, Biological Neurons and Their Artificial Models, Biological Neuron, McCulloch-Pitts Neuron Model, Neuron Modeling for Artificial Neural Systems, Models of Artificial Neural Networks, Feedforward Network, Feedback Network	
Unit – II	**08 Hrs**
Fundamental Concepts and Models of Artificial: Neural Processing, Learning and Adaptation, Learning as Approximation or Equilibria Encoding, Supervised and Unsupervised Learning, Neural Network Learning Rules, Hebbian Learning Rule, Perceptron Learning Rule, Delta Learning Rule, Widrow-Hoff Learning Rule, Correlation Learning Rule, Winner-Take-All Learning Rule, Outstar Learning Rule **Single-Layer Perceptron Classifiers:** Classification Model, Features, and Decision Regions, Discriminant Functions	
Unit – III	**08 Hrs**
Linear Machine and Minimum Distance Classification, Nonparametric Training Concept, Training and Classification Using the Discrete Perceptron, Algorithm and Example, Single-Layer Continuous Perceptron Networks for Linearly Separable Classifications, Multicategory Single-Layer Perceptron Networks	
Unit – IV	**08 Hrs**
Multilayer Feedforward Networks: Linearly Nonseparable Pattern Classification, Delta Learning Rule for Multiperceptron Layer, Generalized Delta Learning Rule, Feedforward Recall and Error Back-Propagation Training, Feedforward Recall, Error Back-Propagation Training, Example of Error Back-Propagation Training, Training Errors, Multilayer Feedforward Networks as Universal Approximators	
Unit – V	**07 Hrs**
Learning Factors: Initial Weights, Cumulative Weight Adjustment versus, Incremental Updating, Steepness of the Activation Function, Learning Constant, Momentum Method, Network Architectures Versus Data Representation, Necessary Number of Hidden Neurons, Classifying and Expert Layered Networks, Character Recognition Application, Expert Systems Applications, Learning Time Sequences, Functional Link Networks	

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Semester: I Year: 2020-2021

Department: Information Science and Engineering	**Course Type:** Elective
Course Title: IoT Analytics	**Course Code:20DSE151**
L-T-P: 4-0-0	**Credits:** 04
Total Contact Hours:52 hrs	**Duration of SEE:** 3 hrs
SEE Marks: 50	**CIE Marks:** 50

Pre-requisites:

- Machine Learning Fundamentals
- Programming in Linux (Basics)

Course Outcomes:

Students will be able to

CO's	**Course Learning Outcomes**	**BL**
CO1	Examine the fundamentals of IoT Networking	**L1**
CO2	Illustrate how to interface IoT devices with Cloud Infrastructure	**L2**
CO3	Describe types of data produced by IoT devices and its visualization tools	**L2**
CO4	Apply Machine learning algorithms on IoT data	**L3**
CO5	Understand the Economics of IoT Analysis	**L1**

Teaching Methodology:

- Blackboard teaching and PPT
- Programming Assignment

Assessment Methods

- Open Book test for 10 Marks
- Assignment evaluation for 10 Marks.
- Three internals, 30 Marks each will be conducted and the Average of best of two will be taken.
- Final examination, of 100 Marks will be conducted and will be evaluated for 50 Marks.

Course Outcome to Programme Outcome Mapping

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**
CO1	1	1	2	3	3	1
CO2	1	1	2	3	3	1
CO3	1	1	2	3	3	1
CO4	1	1	2	3	3	1
CO5	1	1	2	3	3	1
20DSE151	1	1	2	3	3	1

COURSE CONTENT

Unit – I	10 Hrs
Defining IoT Analytics and Challenges, The situation, Defining IoT analytics, IoT analytics challenges, Business value concerns, IoT Devices and Networking Protocols, IoT devices, The wild world of IoT devices, Sensor types, Networking basics, IoT networking connectivity protocols, Connectivity protocols (when the available power is limited- Bluetooth Low Energy, 6LoWPAN, ZigBee, NFC, Sigfox), Connectivity protocols (when power is not a problem- Wi-Fi	
Unit – II	**14 Hrs**
IoT networking data messaging protocols, Message Queue Telemetry Transport (MQTT), Hyper-Text Transport Protocol (HTTP), Constrained Application Protocol (CoAP), Data Distribution Service (DDS), Hands-on on CoAP, MQTT, and HTTP, Websocket, Building elastic analytics, Elastic analytics concepts, Designing for scale, Cloud security and analytics, The AWS overview, AWS key concepts, AWS key core services, AWS key services for IoT analytics, The AWS CloudFormation overview, The AWS Virtual Private Cloud (VPC) setup walk-through, Creating a key pair for the NAT and bastion instances, Creating an S3 bucket to store data, Creating a VPC for IoT Analytics, How to terminate and clean up the environment, Collecting All That Data - Strategies and Techniques, Designing data processing for analytics	
Unit – III	**11 Hrs**
Microsoft Azure overview, Azure Data Lake Store, Azure Analysis Services, HDInsight, The ThingWorx overview, ThingWorx Core, ThingWorx Connection Services, ThingWorx Edge, ThingWorx concepts, Hadoop, Amazon S3, Apache Spark for data processing, Lambda Architectures, Handling change, Exploring and visualizing data	
Unit – IV	**7 Hrs**
The Tableau overview, Techniques to understand data quality, Basic time series analysis, Get to know categories in the data, Solving industry-specific analysis problems, Decorating Your Data - Adding External Datasets to Innovate, Adding internal datasets, Adding external datasets, External datasets - geography, External datasets - demographic, External datasets - economic, Communicating with Others - Visualization and Dashboarding, Common mistakes when designing visuals, The Hierarchy of Questions method, Designing visual analysis for IoT data, Creating a dashboard with Tableau, Creating and visualizing alerts, Applying Geospatial Analytics to IoT Data, Why do you need geospatial analytics for IoT?, The basics of geospatial analysis, Vector-based methods, Raster-based methods, Storing geospatial data, Processing geospatial data, Forecasting, Edge computing, Fogg Computing	
Unit – V	**10 Hrs**
Security for IoT , Common challenges in OT security, formal risk analysis structures: OTAVE and FAIR, Hands on - Open source IoT Platforms: - Zetta, Kaa, Node-RED, Thinger	

Text Books:

1. Analytics for the Internet of Things (IoT), Andrew Minteer, 2017, Packt Publishing, ISBN: 9781787120730
2. https://www.zettajs.org/
3. https://nodered.org/users/go-iot/
4. https://www.kaaproject.org/
5. https://thinger.io/
6. https://www.cisco.com/c/dam/en_us/solutions/trends/iot/docs/computing-overview.pdf
7. https://www.cisco.com/c/dam/en_us/solutions/trends/iot/docs/computing-solutions.pdf
8. https://www.cisco.com/c/en_in/solutions/computing/what-is-edge-computing.html
9. https://www.ibm.com/downloads/cas/0WOR6ORJ
10. https://learn.adafruit.com/alltheiot-protocols/coap
11. https://xiaozhon.github.io/course_tutorials/Coap_tutorial_RPi.pdf
12. https://raspberry-valley.azurewebsites.net/CoAP-Getting-Started/

Semester: I Year: 2020-2021

Department: Information Science and Engineering	**Course Type:** Elective
Course Title: Time Series Analysis and Forecasting	**Course Code:20DSE152**
L-T-P: 4-0-0	**Credits:** 04
Total Contact Hours:52 hrs	**Duration of SEE:** 3 hrs
SEE Marks: 50	**CIE Marks:** 50

Pre-requisites:

- Probability and Statistics for data Science.
- Good programming skills

Course Outcomes:

Students will be able to

CO's	**Course Learning Outcomes**	**BL**
CO1	Describe the fundamental advantage and necessity of forecasting in various situations.	**L2**
CO2	Identify how to choose an appropriate forecasting method in a particular environment.	**L2**
CO3	Apply various forecasting methods, which include obtaining the relevant data and carrying out the necessary computation using suitable statistical software.	**L3**
CO4	Improve forecast with better statistical models based on statistical analysis	**L4**

Teaching Methodology:

- Blackboard teaching and PPT
- Programming Assignment

Assessment Methods

- Open Book Test for 10 Marks.
- Assignment evaluation for 10 Marks on basis of Rubrics
- Three internals, 30 Marks each will be conducted and the Average of best of two will be taken.
- Final examination, of 100 Marks will be conducted and will be evaluated for 50 Marks.

Course Outcome to Programme Outcome Mapping

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**
CO1	1		2	2		
CO2	2		2	3	1	1
CO3	3	1	3	3	2	2
CO4	3		3	3		
20DSE152	2	1	2	3	1	1

COURSE CONTENT

Unit – I	10 Hrs
An Introduction to Forecasting: Forecasting and Data. Forecasting Methods. Errors in Forecasting. Choosing a Forecasting Technique. An Overview of Quantitative Forecasting Techniques. **REGRESSION ANALYSIS:** The Simple Linear Regression Model. The Least Squares Point Estimates. Point Estimates and Point Predictions. Model Assumptions and the Standard Error. Testing the Significance of the Slope and y Intercept. Confidence and Prediction Intervals. Simple Coefficients of Determination and Correlation. An F Test for the Model.	
Unit – II	**10 Hrs**
Multiple Linear Regressions: The Linear Regression Model. The Least Squares Estimates, and Point Estimation and Prediction. The Mean Square Error and the Standard Error. Model Utility: R2, Adjusted R2, and the Overall F Test. **Model Building and Residual Analysis:** Model Building and the Effects of Multicollinearity. Residual Analysis in Simple Regression. Residual Analysis in Multiple Regressions. Diagnostics for Detecting Outlying and Influential Observations.	
Unit – III	**12 Hrs**
Time Series Regression: Modelling Trend by Using Polynomial Functions. Detecting Autocorrelation. Types of Seasonal Variation. Modelling Seasonal Variation by Using Dummy Variables and Trigonometric Functions. Growth Curves. Handling First-Order Autocorrelation. **Decomposition Methods:** Multiplicative Decomposition. Additive Decomposition. The X-12-ARIMA Seasonal Adjustment Method. **Exponential Smoothing:** Simple Exponential Smoothing. Tracking Signals. Holt's Trend Corrected Exponential Smoothing. Holt-Winters Methods. Damped Trends and Other Exponential	
Unit – IV	**10 Hrs**
Non-seasonal Box-Jenkins Modelling and Their Tentative Identification: Stationary and Nonstationary Time Series. The Sample Autocorrelation and Partial Autocorrelation Functions: The SAC and SPAC. An Introduction to Non-seasonal Modelling and Forecasting. Tentative Identification of Non-seasonal Box-Jenkins Models. **Estimation, Diagnostic Checking, and Forecasting for Non-seasonal Box-Jenkins Models:** Estimation. Diagnostic Checking. Forecasting. A Case Study. Box-Jenkins Implementation of Exponential Smoothing.	
Unit – V	**10 Hrs**
Box-Jenkins Seasonal Modelling: Transforming a Seasonal Time Series into a Stationary Time Series. Examples of Seasonal Modelling and Forecasting. Box-Jenkins Error Term Models in Time Series Regression. **Advanced Box-Jenkins Modelling:** The General Seasonal Model and Guidelines for Tentative Identification. Intervention Models. A Procedure for Building a Transfer Function Model **Causality in time series:** Granger causality. Hypothesis testing on rational expectations. Hypothesis testing on market efficiency.	

Text Books:

1. Bruce L. Bowerman, Richard O'Connell, Anne Koehler, "Forecasting, Time Series, and Regression, 4th Edition", Cengage Unlimited Publishers
2. Enders W. Applied Econometric Time Series. John Wiley & Sons, Inc., 1995

Additional Reference Material

1. Mills, T.C. The Econometric Modelling of Financial Time Series. Cambridge University Press, 1999
2. Andrew C. Harvey. Time Series Models. Harvester wheatsheaf, 1993
3. P. J. Brockwell, R. A. Davis, Introduction to Time Series and Forecasting. Springer, 1996
4. Cryer, Jonathan D.; Chan, Kung-sik, "Time series analysis : with applications in R", ed.: New York: Springer, cop. 2008

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Semester: I Year: 2020-2021

Department: Information Science and Engineering	**Course Type:** Elective
Course Title: Computer Vision	**Course Code:20DSE153**
L-T-P: 4-0-0	**Credits:** 04
Total Contact Hours:52 hrs	**Duration of SEE:** 3 hrs
SEE Marks: 50	**CIE Marks:** 50

Pre-requisites:

- Linear Algebra
- Basic Python programming

Course Outcomes:
Students will be able to:

Cos	Course Learning Outcomes	BL
CO1	Identify image processing techniques to solve real world applications	**L2**
CO2	Apply deep learning methods on images to solve high complexity problems	**L3**
CO3	Develop a technique for image feature extraction	**L3**
CO4	Design techniques for image analysis and classification	**L3**

Teaching Methodology:

- Black Board Teaching / Power Point Presentation
- Mini-projects using the concepts of deep learning

Assessment Methods:

- Three internals, 30 Marks each will be conducted and the Average of best of two will be taken.
- Rubrics for Min-Project for 20 marks.
- Final examination of 100 Marks will be conducted and will be evaluated for 50 Marks.

Course Outcome to Programme Outcome Mapping:

Cos	PO1	PO2	PO3	PO4	PO5	PO6
CO1	**2**		**2**	**1**	**1**	
CO2	**2**		**3**	**3**	**1**	
CO3	**3**		**3**	**2**		
CO4	**2**	**2**	**3**	**3**		
20DSE153	**2**	**2**	**3**	**2**	**1**	

COURSE CONTENT

UNIT – I	10hrs
Introduction to Computer Vision: Image Formation and Radiometry, Geometric Transformation, Geometric Camera Models, Image Reconstruction from a Series of Projections	
UNIT – II	11 hrs
Image Processing Concepts: Fundamentals of Image Processing, Image Transforms, Image Filtering, Colour Image Processing, Mathematical Morphology, Image Segmentation	
UNIT – III	10 hrs
Image Descriptors and Features: Texture Descriptors, Colour Feature, Edge Detection, Object Boundary and Shape Representations, Interest or Corner Point Detectors, Histogram of Oriented Gradients (HOG), Scale Invariant Feature Transform (SIFT), Speeded up Robust Features (SURF), Saliency	
UNIT – IV	11 hrs
Recognition: Fundamental Pattern Recognition Concepts: Introduction to Pattern Recognition, Linear Regression, Basic Concepts of Decision Functions, Elementary Statistical Decision Theory, Gaussian Classifier, Parameter Estimation, Clustering for Knowledge Representation, Dimension Reduction, Template Matching, Artificial Neural Network (ANN) for Pattern Classification, Convolutional Neural Networks (CNNs), Autoencoder	
UNIT – V	10 hrs
Applications of Computer Vision: Machine Learning Algorithms and their Applications in Medical Image Segmentation, Motion Estimation and Object Tracking, Face and Facial Expression Recognition, Gesture Recognition, Image Fusion, Programming Examples	

Text books:

1. **Computer Vision and Image Processing, Fundamentals and Applications, By Manas Kamal Bhuyan**
2. **Computer Vision: Algorithms and Applications, Richard Szeliski**
3. **Handbook of Image and video processing by A L Bovik**

Reference book:

1. **Image processing and computer vision by Milan Sonka**
2. **Digital image processing by Chanda and Dutta Majumdar**

Semester: I Year: 2020-2021

Department: Information Science and Engineering	**Course Type:** Core
Course Title: Data Analytics Lab	**Course Code:20DSL16**
L-T-P:0-0-4	**Credits:** 02
Total Contact Hours:26hrs	**Duration of SEE:** 3 hrs
SEE Marks: 50	**CIE Marks:** 50

Pre-requisites:

- Basic Python Programming,
- Machine learning
- Fundamentals of Probability and Statistics

Course Outcomes:

Students will be able to

CO's	Course Learning Outcomes	BL
CO1	Describe the commands and set up the programming environment of Python, Numpy and Pandas	**L2**
CO2	Apply machine learning concepts to analyze real world problems using Data Analysis.	**L3**
CO3	Apply probability and statistical techniques to solve problems of moderate complexity.	**L3**
CO4	Analyze large data sets to derive interesting inferences.	**L4**

Teaching Methodology:

- Blackboard teaching and PPT
- Executables
- Programming Assignment

Assessment Methods

- Program Evaluation on the basis of Rubrics.
- Two internals, 20 Marks each will be conducted and the Average of best of two will be taken.
- Final examination, of 50 Marks will be conducted and will be evaluated for 50 Marks.

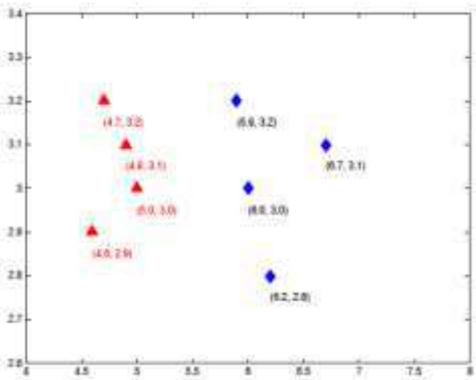
Course Outcome to Programme Outcome Mapping

	PO1	PO2	PO3	PO4	PO5	PO6
CO1	2		2	1	1	2
CO2	3	2	2	3	1	2
CO3	3	2	2	3	1	2
CO4	3	1	3	2	3	2
20DSL16	3	2	2	3	1	2

COURSE CONTENT

Program No.	Domain	Assignment
1	Basic Python	The number of birds banded at a series of sampling sites has been counted by your field crew and entered into the following list. The first item in each sublist is an alphanumeric code for the site and the second value is the number of birds banded. Cut and paste the list into your assignment and then answer the following questions by printing them to the screen. **data = [['A1', 28], ['A2', 32], ['A3', 1], ['A4', 0], ['A5', 10], ['A6', 22], ['A7', 30], ['A8', 19], ['B1', 145], ['B2', 27], ['B3', 36], ['B4', 25], ['B5', 9], ['B6', 38], ['B7', 21], ['B8', 12], ['C1', 122], ['C2', 87], ['C3', 36], ['C4', 3], ['D1', 0], ['D2', 5], ['D3', 55], ['D4', 62], ['D5', 98], ['D6', 32]]** 1. How many sites are there? 2. How many birds were counted at the 7th site? 3. How many birds were counted at the last site? 4. What is the total number of birds counted across all sites? 5. What is the average number of birds seen on a site? 6. What is the total number of birds counted on sites with codes beginning with C?
2.	Basic Python	Dr. Granger is interested in studying the relationship between the length of house-elves' ears and aspects of their DNA. She has obtained DNA samples and ear measurements from a small group of house-elves to conduct a preliminary analysis. You are supposed to conduct the analysis for her. She has placed the file on the web for you to download. Write a Python script that: 1. Imports the data into a data structure of your choice 2. Loops over the rows in the dataset 3. For each row in the dataset checks to see if the ear length is large (>10 cm) or small (<=10 cm) and determines the GC-content of the DNA sequence (i.e., the percentage of bases that are either G or C) 4. Stores this information in a table where the first column has the ID for the individual, the second column contains the string 'large' or the string 'small' depending on the size of the individuals ears, and the third column contains the GC content of the DNA sequence. 5. Prints the average GC-content for both large-eared elves and small-eared elves to the screen. 6. Exports the table of individual level GC values to a CSV (comma delimited text) file titled grangers_analysis.csv.
3.	Basic Exploratory Data Analysis	Measurements of electric power consumption in one household with a one-minute sampling rate over a period of almost 4 years. Different electrical quantities and some sub-metering values are available. Dataset: Individual household electric power consumption Data SetElectric power consumption https://github.com/mGalarnyk/datasciencecoursera/blob/master/4_Exploratory_Data_Analysis/project1/README.md Perform the following: 1. Load the data 2. Subset the data from the dates 2007-02-01 and 2007-02-02. 3. Create a histogram 4. Create a Time series 5. Create a plot for sub metering 6. Create multiple plot

4.	**Decision Tree**	Binary Decision Trees: One very interesting application area of machine learning is in making medical diagnoses. **Objective: To train and test a binary decision using zoo data available at** UCI Zoo Data Set **DataSet:** UCI Zoo Data Set. Information about the algorithm is available at https://www.python-course.eu/Decision_Trees.php
5	Linear Regression with One variable	**Objective: Implement linear regression with one variable to predict profits for a food truck.** Data Set: https://searchcode.com/codesearch/view/5404318/# Suppose you are the CEO of a restaurant franchise and are considering different cities for opening a new outlet. The chain already has trucks in various cities and you have data for profits and populations from the cities.You would like to use this data to help you select which city to expand to next.The file ex1data1.txt contains the dataset for our linear regression problem. The first column is the population of a city and the second column isthe profitt of a food truck in that city. A negative value for profitt indicates aloss.
6	**linear regression with multiple variables**	**Objective: Implement linear regression with multiple variables to predict the prices of houses.** Data Set: https://searchcode.com/codesearch/view/6577026/ Suppose you are selling your house and you want to know what a good market price would be. One way to do this is to first collect information on recent houses sold and make a model of housing prices. Thefile ex1data2.txt contains a training set of housing prices in Port-land, Oregon. The first column is the size of the house (in square feet), the second column is the number of bedrooms, and the third column is the price of the house.
7	**Logistic Regression**	**Objective: Build a logistic regression model to predict whether a student gets admitted into a university.** Dataset: http://en.pudn.com/Download/item/id/2546378.html Suppose that you are the administrator of a university department and you want to determine each applicant's chance of admission based on their results on two exams. You have historical data from previous applicants that you can use as a training set for logistic regression. For each training example, you have the applicant's scores on two exams and the admissions decision. Your task is to build a classification model that estimates an applicant's probability of admission based the scores from those two exams. Implement the following: 1. **Visualize the data.** 2. **Implement Sigmoid function** 3. Implement the cost function and gradient for logistic regression 4. Evaluate Logistic Regression 5. Predict the results
8	**Support Vector Machine**	**Objective:** To model a classifier for predicting whether a patient is suffering from any heart disease or not. **Data Set:**https://archive.ics.uci.edu/ml/datasets/heart+Disease Hint: https://dataaspirant.com/2017/01/19/support-vector-machine-classifier-implementation-r-caret-package/
9	**K Means**	Given the matrix X whose rows represent different data points, you are asked to perform a k-means clustering on this dataset using the Euclidean distance as the distance function. Here k is chosen as 3. The Euclidean distance d between a vector x

		and a vector y both in Rp is defined as d = pPp i=1(xi − yi) 2. All data in X were plotted in Figure 1. The centres of 3 clusters were initialized as μ1 = (6.2, 3.2) (red), μ2 = (6.6, 3.7) (green), μ3 = (6.5, 3.0) (blue). 1. What's the centre of the first cluster (red) after one iteration? (Answer in the format of [x1, x2], round your results to three decimal places, same as problems 2 and 3) 2. What's the centre of the second cluster (green) after two iteration? 3. What's the centre of the third cluster (blue) when the clustering converges? 4. How many iterations are required for the clusters to converge?
<u>10</u>	Hierarchical Clustering Multivariate Analysis	In Figure, there are two clusters A (red) and B (blue), each has four members and plotted in Figure . The coordinates of each member are labeled in the figure. Compute the distance between two clusters using Euclidean distance. 1. What is the distance between the two farthest members? (complete link) (round to four decimal places here, and next 2 problems); 2. What is the distance between the two closest members? (single link) 3. What is the average distance between all pairs? 4. Among all three distances above, which one is robust to noise? Answer either "complete", "single", or "average".  Figure 3: Scatter plot samples in two clusters

Semester: I Year: 2020-2021

Department: Information Science and Engineering	**Course Type:** Core
Course Title: Linear Algebra and Optimization	**Course Code: 20DS17**
L-T-P: 4-0-0	**Credits:** 04
Total Contact Hours:52 hrs	**Duration of SEE:** 3 hrs
SEE Marks: 50	**CIE Marks:** 50

Pre-requisites:

- Knowledge of Mathematics, Fundamentals of Matrix and statistics.

Course Outcomes:

Students will be able to

CO's	Course Learning Outcomes	BL
CO1	Understanding of basic Linear algebra concepts with respect to Machine Learning tasks	**L2**
CO2	Understand and explore concepts of Vector spaces, linear transformations and Matrix operations	**L3**
CO3	Analyse diagonalizability of Matrices and explore concepts of triangulations	**L3**
CO4	Understand and analyse different optimization techniques	**L2**

Teaching Methodology:

- Black Board Teaching / Power Point Presentation
- Assignment
- Case- study

Assessment Methods:

- Rubrics to evaluate Case Study
- Solution and Scheme of assignment evaluation
- Three mid-session examinations for 30 Marks each, and average of best of two is taken.
- Semester end examination of 100 Marks, calculated for 50 Marks.

Course Outcome to Programme Outcome Mapping

	PO1	PO2	PO3	PO4	PO5	PO6
CO1	1		2	3	1	
CO2	2		2	3	2	
CO3	3		3	3	2	
CO4	3		3	3	3	
20DS17	2		2	3	2	

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COURSE CONTENT

UNIT – I:	10 Hrs
Linear Algebra and Optimization: An Introduction, Scalars, Vectors, and Matrices, Basic Operations with Scalars and Vectors, Basic Operations with Vectors and Matrices,Special Classes of Matrices,Matrix Powers, Polynomials, and the Inverse ,The Matrix Inversion Lemma: Inverting the Sum of Matrices, Matrix Multiplication as a Decomposable Operator, Matrix Multiplication as Decomposable Row and Column Operators, Matrix Multiplication as Decomposable Geometric Operators, Basic Problems in Machine Learning, Matrix Factorization, Clustering, Classification and Regression Modeling,Outlier Detection , Optimization for Machine Learning, The Taylor Expansion for Function Simplification , Example of Optimization in Machine Learning , Optimization in Computational Graphs	
UNIT – II:	**10** Hrs
Linear Transformations and Linear Systems: What Is a Linear Transform? The Geometry of Matrix Multiplication Vector Spaces and Their Geometry, Coordinates in a Basis System, Coordinate Transformations Between Basis Sets , Span of a Set of Vectors , Machine Learning Example: Discrete Wavelet Transform, Relationships Among Subspaces of a Vector Space, The Linear Algebra of Matrix Rows and Columns, The Row Echelon Form of a Matrix, LU Decomposition, Application: Finding a Basis Set, Application: Matrix Inversion, Application: Solving a System of Linear Equation, Generating Orthogonal Basis Sets, Gram-Schmidt Orthogonalization and QR Decomposition	
UNIT – III:	**12** Hrs
Eigenvectors and Diagonalizable Matrices, Introduction, Determinants, Diagonalizable Transformations and Eigenvectors, Complex Eigenvalues, Left Eigenvectors and Right Eigenvectors, Existence and Uniqueness of Diagonalization , Existence and Uniqueness of Triangulation, Similar Matrix Families Sharing Eigenvalues, Diagonalizable Matrix Families Sharing Eigenvectors , Symmetric Matrices, Positive Semidefinite Matrices, Cholesky Factorization: Symmetric LU Decomposition, Machine Learning and Optimization Applications, Fast Matrix Operations in Machine Learning, Examples of Diagonalizable Matrices in Machine Learning, Symmetric Matrices in Quadratic Optimization, Diagonalization Application: Variable Separation for Optimization . Singular Value Decomposition- SVD of a square matrix.	
UNIT – IV:	10 Hrs
Optimization Basics: A Machine Learning View, Introduction, The Basics of Optimization, Univariate Optimization , Why We Need Gradient Descent, Convergence of Gradient Descent, The Divergence Problem, Bivariate Optimization , Multivariate Optimization, Convex Objective Functions, The Minutiae of Gradient Descent , Checking Gradient Correctness with Finite Differences, Learning Rate Decay and Bold Driver, Line Search, Binary Search Properties of Optimization in Machine Learning, Typical Objective Functions and Additive Separability, Stochastic Gradient Descent, How Optimization in Machine Learning Is Different, Tuning Hyperparameters, The Importance of Feature Preprocessing	
UNIT – V: Symmetric matrices and quadratic forms	10 Hrs
Computing Derivatives with Respect to Vectors - Matrix Calculus Notation, Useful Matrix Calculus Identities , Application: Unconstrained Quadratic Programming , Application: Derivative of Squared Norm, The Chain Rule of Calculus for Vectored Derivatives, Useful Examples of Vectored Derivatives, Linear Regression: Optimization with Numerical Targets, Tikhonov Regularization, Pseudoinverse and Connections to Regularization, Stochastic Gradient Descent, The Use of Bias, Heuristic Initialization, Optimization Models for Binary Targets, Least-Squares Classification: Regression on Binary Targets, Why Least-Squares Classification Loss Needs Repair	

Text Book:

1. "Linear Algebra and Optimization for Machine Learning A Textbook" Aggarwal, Charu, Springer International Publishing Print ISBN: 978-3-030-40343-0

Reference books:

1) Basics of Linear Algebra for Machine Learning, Jason Brownlee, Online free download Book.
2) Introductory Linear Algebra, an applied first course, Bernard Kolman and David R.Hill, Pearson, Eigth Edition, 2009.
3) Linear Algebra, Seymour Lipschutz and Marc Lipson, Schaum's Outline Series, McGraw Hill, Third Edition, 2005.
4) Matrix and Linear Algebra, K.B.Datta, PHI, 2003.

SEMESTER II

Semester: II Year: 2020-2021

Department: Information Science and Engineering	**Course Type:** Core
Course Title: Scalable Computing	**Course Code:20DS21**
L-T-P:3-0-0	**Credits:** 03
Total Contact Hours:39 hrs	**Duration of SEE:** 3 hrs
SEE Marks: 50	**CIE Marks:** 50

Pre-requisites:
- Software systems, programming, data structures and algorithms.
- Good programming skills (preferably in Java) Operating Systems,
- Distributed Computing Systems,
- Introduction to Cloud Computing,
- Design and Analysis of Algorithms.

Course Outcomes:
Students will be able to

CO's	Course Learning Outcomes	BL
CO1	Illustrate the requirements and challenges when designing, building and managing distributed systems.	**L2**
CO2	Describe the basic concepts of Kubernets, creating and running containers	**L2**
CO3	Analyze different scalable distributed system designs.	**L4**
CO4	Analyze use cases for managing distributed file system	**L4**
CO5	Implement the scalable distributed databases and its analysis.	**L3**

Teaching Methodology:
- Blackboard teaching and PPT
- Assignment

Assessment Methods
- Open Book Test for 10 Marks.
- Assignment evaluation for 10 Marks.
- Three internals, 30 Marks each will be conducted and the Average of best of two will be taken.
- Final examination, of 100 Marks will be conducted and will be evaluated for 50 Marks.

Course Outcome to Programme Outcome Mapping

	PO1	PO2	PO3	PO4	PO5	PO6
CO1	1		2		1	1
CO2	2		2	1	2	2
CO3	2		2		2	1
CO4	3		3	1	2	2
CO5	3	2	3	1	2	2
20DS21	2	2	2	1	2	2

COURSE CONTENT

Unit – I	09 Hrs
Virtual Machines and Virtualization of Clusters and Data Centres.: Implementation Levels of Virtualization, Levels of Virtualization Implementation, Design Requirements and Providers, Virtualization Support at the OS Level, Middleware Support for Virtualization, Virtualization Structures/Tools and Mechanisms, Hypervisor and Xen Architecture ,Binary Translation with Full Virtualization, Para-Virtualization with Compiler Support, Virtualization of CPU, Memory, and I/O Devices, Hardware Support for Virtualization, CPU Virtualization, Memory Virtualization, I/O Virtualization, Virtualization in Multi-Core Processors, Virtual Clusters and Resource Management, Physical versus Virtual Clusters, Live VM Migration Steps and Performance Effects, Migration of Memory, Files, and Network Resources, Dynamic Deployment of Virtual Clusters.	
Unit – II	**09 Hrs**
Introduction: Velocity, The Value of Immutability Declarative Configuration, Self-Healing Systems, Scaling Your Service and Your Teams, Decoupling, Easy Scaling for Applications and Clusters, Scaling Development Teams with Micro services, Separation of Concerns for Consistency and Scaling, Abstracting Your Infrastructure, Efficiency. **Creating and Running Containers:** Container Images, The Docker Image Format, Building Application Images with Docker, Docker files, Optimizing Image Sizes, Image Security, Multistage Image Builds, Storing Images in a Remote Registry, The Docker Container Runtime, Running Containers with Docker, Exploring the kuard Application	
Unit – III	**07 Hrs**
Cloud Platform Architecture over Virtualized Data Centres. Cloud Computing and Service Models, Public, Private, and Hybrid Clouds, Cloud Ecosystem and Enabling Technologies, Infrastructure-as-a-Service (IaaS), Platform-as-a-Service (PaaS) and Software-as-a-Service (SaaS). Public Cloud Platforms: GAE, AWS, and Azure. **Data Science in cloud**: AWS machine learning, Azure Machine Learning, IBM BlueMix	
Unit – IV	**07 Hrs**
MapReduce and the New Software Stack: Distributed File Systems, MapReduce, Algorithms Using MapReduce, Extensions to MapReduce, The Communication Cost Model, Complexity Theory for MapReduce	
Unit – V	**08 Hrs**
Analysing Big Data: The Challenges of Data Science, Introducing Apache Spark. Introduction to Data Analysis with Scala and Spark :Scala for Data Scientists, The Spark Programming Model, Record Linkage, Getting Started: The Spark Shell and Spark Context, Bringing Data from the Cluster to the Client, Shipping Code from the Client to the Cluster, Structuring Data with Tuples and Case Classes, Aggregations, Creating Histograms, Summary Statistics for Continuous Variables, Creating Reusable Code for Computing Summary Statistics, Simple Variable Selection and Scoring	

Text Books:

1. Kai Hwang, G. C. Fox, J.J. Dongarra “Distributed & Cloud Computing”, Morgan Kauffman Publishers
2. Kubernetes Up & Running -Dive into the Future of Infrastructure by Brendan Burns, Joe Beda, and Kelsey Hightower, Second Edition, Published by O’Reilly Media, August 2019
3. Mining of Massive Datasets. 2nd edition. - Jure Leskovec, AnandRajaraman, Jeff Ullman. Cambridge University Press. http://www.mmds.org/
4. By Sandy Ryza, Uri Laserson, Josh Wills, Sean Owen Advanced Analytics with Spark”” 2nd Edition, Publisher: O'Reilly Media, ISBN: 9781491972946

References:

1. https://docs.docker.com/get-started/overview/
2. https://data-flair.training/blogs/machine-learning-tutorial/
3. https://learning.oreilly.com/videos/azure-machine-learning/10000SRESR57/10000SRESR57-M000301
4. https://docs.dominodatalab.com/en/4.1/
5. https://docs.dominodatalab.com/en/4.1/ecosystem.html
6. https://www.dominodatalab.com/product/

Semester: II　　　　　　　　　　　　　　　　Year: 2020-2021

Department: Information Science and Engineering	**Course Type:** Core
Course Title: Deep Learning	**Course Code:20DS22**
L-T-P:4-0-0	**Credits:** 04
Total Contact Hours:52 hrs	**Duration of SEE:** 3 hrs
SEE Marks: 50	**CIE Marks:** 50

Pre-requisites:

- Machine learning-I, Data mining, Neural Networks

Course Outcomes:

Students will be able to

CO's	**Course Learning Outcomes**	**BL**
CO1	Understand the basic concepts of artificial neural networks	**L2**
CO2	Analyze deep neural network architectures for Autoencoders.	**L4**
CO3	Analyze the problems with shallow architectures and build Restricted Boltzmann machine	**L3**
CO4	Understand and Build architectures for Recurrent Neural Networks and CNN	**L3**
CO5	Understand and build framework for Reinforcement Learning	**L3**

Teaching Methodology:

- Blackboard teaching and PPT
- Executable Codes/ Live Demonstration
- Programming Assignment

Assessment Methods

- Online certification from Course-era/Edx, etc. for 10 marks
- Programming assignments evaluated using rubrics for 10 marks
- Three internals, 30 Marks each will be conducted and the Average of best of two will be taken.
- Final examination, of 100 Marks will be conducted and will be evaluated for 50 Marks.

Course Outcome to Programme Outcome Mapping

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**
CO1	2		3	1	1	
CO2	2		2	2	2	
CO3	2		3	2	2	
CO4	3		2	3	2	
CO5	3			2		
20DS22	2		2	1	2	

COURSE CONTENT

Unit – I	10 Hrs
An Introduction to Neural Networks: Introduction, Humans Versus Computers: Stretching the Limits of Artificial Intelligence, The Basic Architecture of Neural Networks, Single Computational Layer: The Perceptron, What Objective Function Is the Perceptron Optimizing? Relationship with Support Vector Machines, Choice of Activation and Loss Functions, Choice and Number of Output Nodes, Multilayer Neural Networks	
Unit – II	**10 Hrs**
Machine Learning with Shallow Neural Networks: Introduction, Neural Architectures for Binary Classification Models, Revisiting the Perceptron, Least-Squares Regression, Widrow-Hoff Learning, Logistic Regression, Neural Architectures for Multiclass Models, Multinomial Logistic Regression (Softmax Classifier), Matrix Factorization with Autoencoders, Autoencoder: Basic Principles, Autoencoder with a Single Hidden Layer, Sharing Weights in Encoder and Decoder	
Unit – III	**12 Hrs**
Training Deep Neural Networks: Introduction, Backpropagation: The Gory Details, Backpropagation with the Computational Graph Abstraction, Setup and Initialization Issues, Tuning Hyperparameters, Feature Preprocessing, Initialization, The Vanishing and Exploding Gradient Problems, The Boltzmann Machine, How a Boltzmann Machine Generates Data, Restricted Boltzmann Machines, Training the RBM, Contrastive Divergence Algorithm	
Unit – IV	**10 Hrs**
Recurrent Neural Networks: The Architecture of Recurrent Neural Networks, Language Modeling Example of RNN, Backpropagation Through Time, Multilayer Recurrent Networks, Long Short-Term Memory (LSTM) **Convolutional Neural Networks:** The Basic Structure of a Convolutional Network, Padding, Strides, The ReLU Layer, Pooling, Fully Connected Layers, The Interleaving Between Layers, Backpropagating Through Convolutions	
Unit – V	**10 Hrs**
Deep Reinforcement Learning: The Basic Framework of Reinforcement Learning, Challenges of Reinforcement Learning, Simple Reinforcement Learning for Tic-Tac-Toe	

Text Books:

1. Neural Networks and Deep Learning, Charu C. Aggarwal

Reference Books:

1. Learning & Soft Computing, Vojislav Kecman, 1st Edition, 2004, Pearson Education, ISBN:0-262-11255-8
2. Neural Networks Design, M T Hagan, H B Demoth, M Beale, 2002, Thomson Learning, ISBN-10: 0-9717321-1-6/ ISBN-13: 978-0-9717321-1-7

Online Materials

1. Deep learning courses by coursera: https://www.coursera.org/courses?query=deep%20learning
2. https://www.classcentral.com/course/coursera-neural-networks-and-deep-learning-9058
3. https://www.classcentral.com/course/coursera-introduction-to-deep-learning-9606
4. https://www.deeplearningbook.org/

Semester: II Year: 2020-2021

Department: Information Science and Engineering	**Course Type:** Core
Course Title: Exploratory Data Analysis	**Course Code:20DS23**
L-T-P:3-0-2	**Credits:** 04
Total Contact Hours:39 hrs	**Duration of SEE:** 3 hrs
SEE Marks: 50	**CIE Marks:** 50

Pre-requisites:

- Graduate Mathematics.
- Basic understanding of Probability Statistics and Linear Algebra.
- Ability to comprehend and understand relational, and unstructured datasets.

Course Outcomes:
Students will be able to:

Cos	Course Outcome Description	BL
CO1	Describe the philosophy of exploratory data analysis	**L2**
CO2	Visualize discrete and continuous data distributions using Pandas	**L3**
CO3	Describe visualizing, and estimating the relation between variables.	**L2**
CO4	Apply linear and nonlinear models in Matplotlib.	**L3**
CO5	Describe the visualization and analysis of data using Scikit-learn.	**L2**

Teaching Methodology:

- Black Board Teaching
- Power Point Presentation.
- Seminar

Assessment Methods:

- Rubrics to evaluate Seminar
- Three internals, 30 Marks each will be conducted and the Average of best of two will be taken.
- Final examination of 100 Marks will be conducted and will be evaluated for 50 Marks.

Course Outcome to Programme Outcome Mapping

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**
CO1	1		1	2		
CO2	2		2	3		1
CO3	1		1	2		
CO4	2		2	3		1
CO5	2	2	2	1		2
20DS14	2	2	2	2		1

COURSE CONTENT

UNIT – I **Introduction to Exploratory data analysis and IPython**	**8hrs**
IPython: Beyond Normal Python, IPython Magic Commands, Input and Output History, IPython and Shell Commands, Errors and Debugging, Understanding Data Types in Python, Aggregations: Min, Max, and Everything in Between, Computation on Arrays: Broadcasting, Comparisons, Masks, and Boolean Logic, Fancy Indexing, Sorting Arrays, Structured Data: NumPy's Structured Arrays	
UNIT – II **Introduction to Pandas and Data Manipulations**	**8hrs**
Introducing Pandas Objects, Data Indexing and Selection, Operating on Data in Pandas, Combining Datasets: Merge and Join, Aggregation and Grouping, Pivot Tables, Vectorized String Operations, Working with Time Series, Dates and Times in Python, Pandas Time Series: Indexing by Time, Pandas Time Series Data Structures	
UNIT – III **Visualization with Matplotlib**	**8hrs**
General Matplotlib Tips, Two Interfaces for the Price of One, Simple Line Plots, Simple Scatter Plots, Visualizing Errors, Density and Contour Plots, Histograms, Binnings, and Density, Customizing Plot Legends, Customizing Colorbars, Multiple Subplots, Three-Dimensional Plotting in Matplotlib, Visualization with Seaborn	
UNIT – IV **Visualizations using Scikit-Learn for Machine Learning**	**8hrs**
Introducing Scikit-Learn, Hyper parameters and Model Validation, Feature Engineering, In Depth: Naive Bayes Classification, Bayesian Classification, Gaussian Naive Bayes, When to Use Naive Bayes, In Depth: Linear Regression, Simple Linear Regression, Basis Function Regression, Regularization, In Depth: Principal Component Analysis, PCA as Noise Filtering, Example: Eigenfaces	
UNIT – V **Visualizations using Scikit-Learn for Machine Learning II**	**7hrs**
In Depth: k-Means Clustering, k-Means Algorithm: Expectation–Maximization, In Depth: Gaussian Mixture Models, Motivating GMM: Weaknesses of k-Means, Generalizing E–M: Gaussian Mixture Models, GMM as Density Estimation, In-Depth: Decision Trees and Random Forests, Motivating Random Forests: Decision Trees, Ensembles of Estimators: Random Forests	

Text books:

1. Python Data Science Handbook: Essential Tools for Working with Data, by Jake VanderPlas

Reference books:

1. Making sense of Data: A practical Guide to Exploratory Data Analysis and Data Mining, by Glenn J. Myatt.
2. Making Sense of Data II: A Practical Guide to Data Visualization, Advanced Data Mining Methods, and Applications, Glenn J. Myatt, and Wayne P. Johnson. Print ISBN:9780470222805 |Online ISBN:9780470417409 |DOI:10.1002/9780470417409.

Semester: II   Year: 2020-2021

Department: Information Science and Engineering	**Course Type:** Core
Course Title: Machine Learning- II	**Course Code:20DS24**
L-T-P:3-0-2	**Credits:** 04
Total Contact Hours:39 hrs	**Duration of SEE:** 3 hrs
SEE Marks: 50	**CIE Marks:** 50

Prerequisite:

- Machine learning-I, , Engineering Mathematics, Algorithms

Course Outcomes:

Students will be able to

CO's	Course Learning Outcomes	BL
CO1	Understand the fundamentals of instance space learning.	**L2**
CO2	Use the different ensemble methods on the given dataset	**L3**
CO3	Describe analytical learning	**L2**
CO4	Apply the Support Vector Machine algorithm on the given dataset	**L3**
CO5	Comprehend the Markov Birth-death process	**L2**
CO6	Apply the concepts of unsupervised learning on the given dataset	**L3**

Teaching Methodology:

- Black board teaching / Power Point presentations
- Executable Codes/ Live Demonstration
- Programming Assignment

Assessment Methods:

- Online certification from NPTEL/course-era for 10 marks
- Programming assignments evaluated using rubrics for 10 marks
- Three internals, 30Marks each will be conducted and the Average of best of two will be taken.
- Final examination, of100 Marks will be conducted and will be evaluatedfor50Marks.

Course Outcome to Programme Outcome Mapping:

PO	PO1	PO2	PO3	PO4	PO5	PO6
CO1	3					
CO2	3			2	1	
CO3	3					
CO4	3			2	1	
CO5	3					
CO6	3			2	1	
20DS24	3			2	1	

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COURSE CONTENT

Unit – I	07 Hrs
Instance space learning: K- Nearest Neighbour Learning Choosing K, Error Analysis of KNN, comparing KNN error with Bayesian error, – Locally Weighted Regression – Radial Basis Functions – Case Based Reasoning – Sequential Covering Algorithms. (Textbook1)	
Unit – II	**08 Hrs**
Learning Rule Sets – Learning First Order Rules – Learning Sets of First Order Rules – Induction as Inverted Deduction – Inverting Resolution (Textbook1) **Ensemble Methods:** Rationale for ensemble method, methods for constructing an Ensemble classifier, Bias-Variance decomposition, Bagging, Boosting, Random forests, Empirical comparison among Ensemble methods. (TextBook3)	
Unit – III	**08 Hrs**
Analytical learning: Introduction, Learning with Perfect domain theories, Remarks on Explanation based learning; Explanation based learning of search control knowledge (Textbook 1) **Support Vector machine:** Introduction (Textbook-4), Maximum Margin Hyperplane, Linear SVM: Separable Case, Soft Margins, Linear SVM: Non-Separable Case, Nonlinear SVM, Characteristics of SVM , Kernel SVM, (Textbook 3)	
Unit – IV	**08 Hrs**
Markov Birth-death process, Hidden Markov models – discrete Markov processes, Hidden Markov models – 3 basic problems, Learning the state sequence, Markov chains, Learning the parameters, Baum-Welch Algorithm, Monte Carlo Simulation, Markov Chain Monte Carlo	
Unit – V	**08 Hrs**
Un-supervised Learning: Hierarchical vs non-hierarchical clustering, Agglomerative and divisive clustering, Expectation Maximization, Gaussian Mixtures, EM Clustering, K-means clustering, Simple problems, Bisecting k-means, issues with k-means. K Means as special case of Expectation Maximization	

Text Books:

1. Tom M. Mitchell, “Machine Learning”, McGraw-Hill Education, ISBN: 978-1-25-909695-2, 2013.
2. Pang-Ning Tan, Michael Steinbach, Vipin Kumar, “Introduction to Data Mining” Pearson, 4th edition, ISBN: 978-81-717-1472-0, 2009.
3. Corrina cortes, Valdimir Vapnik, “Support Vector Networks” Kluwer Academic Publishers, 1995.

Reference Books:

1. Hands-On Machine Learning with Scikit-Learn and Tensor Flow: Concepts, Tools, and Techniques to Build Intelligent Systems
2. Text: Introduction to Machine Learning – Ethem Alpaydin

Online Materials:

1. Machine Learning by Stanford University-Coursera
2. Machine Learning with TensorFlow on Google Cloud Platform Specialization-Coursera
3. Become a Machine Learning Engineer – Udacity.

Semester: II Year: 2020-2021

Department: Information Science and Engineering	**Course Type:** Elective
Course Title: Data Security and Privacy	**Course Code:20DS25**
L-T-P: 4-0-0	**Credits:** 04
Total Contact Hours:52 hrs	**Duration of SEE:** 3 hrs
SEE Marks: 50	**CIE Marks:** 50

Pre-requisites:

- Knowledge of databases and how they are managed.
- Fundamentals of algorithm design techniques.

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Course Outcomes:

Students will be able to

CO's	**Course Learning Outcomes**	**BL**
CO1	Analyze the vulnerabilities in any computing system and hence be able to design a security solution	**L4**
CO2	Identify the security issues in the data network and resolve it.	**L2**
CO3	Evaluate security mechanisms using rigorous approaches.	**L4**
CO4	Understand the privacy and anonymization	**L2**

Teaching Methodology:

- Black Board Teaching / Power Point Presentation

Assessment Methods:

- Seminar on data security for 10 marks
- Assignment based on data security and access control problems for 10 marks
- Three internals, 30 Marks each will be conducted and the Average of best of two will be taken.
- Final examination of 100 Marks will be conducted and will be evaluated for 50 Marks.

Course Outcome to Programme Outcome Mapping

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**
CO1	2		2	1		
CO2	2		2	1	1	
CO3	3	2	3	2		
CO4	2	2	2			2
20DS25	2	2	2	1	1	1

COURSE CONTENT

UNIT – I : DATA SECURITY FUNDAMENTALS	**10** hrs
Computer Security Concepts,IntrusionDetection,Firewalls: Characteristics,Types.Classical Encryption Techniques Symmetric Cipher Model, Cryptography, Cryptanalysis and Brute-Force Attack,Substitution Techniques, Caesar Cipher, Monoalphabetic Cipher, Polyalphabetic Cipher, One Time Pad.Block Ciphers and the data encryption standard: Traditional block Cipher structure, stream Ciphers and block Ciphers, Motivation for the Feistel Cipher structure, the Feistel Cipher.	
UNIT – II: Public-Key Cryptography	10 hrs
Principles of Public-key Cryptosystems, Public-Key Cryptosystems, Applications for Public-Key Cryptosystems, Requirements for Public-Key Cryptosystems.Public-Key Cryptanalysis. The RSA Algorithm, Description of the Algorithm,Computational Aspects, the Security of RSA. Other Public-Key Cryptosystems:Diffe-Hellman Key Exchange, The Algorithm, Key exchange protocols, Man-in-the-Middle Attack, Simple secret key distribution, Secretkey distribution with confidentiality and authentication, A hybrid scheme.Public keys certificates, X.509certificates. Public key infrastructure, PKIXManagement Functions, PKIX Management Protocols.	
UNIT – III : Authentication and Authorization	10 hrs
Authentication Vs Authorization, Authentication Methods –Password authentication, Public Key Cryptography, Biometric authentication, Out of band, Authentication Protocols – SSL, Password Authentication Protocol (PAP), Kerberos, Email authentication,- PGP, Database authentication, Message authentication; secure hash functions and Authorization Approaches to hmac; publickey cryptography principles; public-key cryptography algorithms, digitalsignatures, key management. Kerberos, x.509 directory authentication service. Authorization Definition, Multilayer authorization,	
UNIT – IV: DATA PRIVACY AND ANONYMIZATION	12 hrs
Understanding Privacy: Social Aspects of Privacy, Legal Aspects of Privacy and Privacy Regulations Effect of Database and Data Mining technologies on privacy challenges raised by new emerging technologies such RFID, biometrics, etc., Privacy Models **Introduction to Anonymization**, Anonymization models: K-anonymity, l-diversity, t-closeness, differential privacy, Database as a service	
UNIT – V : DATA PRIVACY FOR DATA SCIENCE	10 hrs
Using technology for preserving privacy. Statistical Database security, Inference Control, Inference Control with Semantic Web, Homomorphic Encryption, Secure Multi-party computation and Cryptography Privacy-preserving Data mining Hippocratic databases, Hippocratic databases privacy preservation. **Emerging Applications:** Social Network Privacy, Location Privacy, Query Log Privacy, Biomedical Privacy	

Text books:

1. Cryptography and Network Security Principles and Practice William Stallings, 6th edition, Pearson Education
2. The Algorithmic Foundations of DifferentialPrivacy, Cynthia Dwork and Aaron Roth. DOI: 10.1561/0400000042.

Reference books:

1. https://s3.amazonaws.com/assets.datacamp.com/production/course_6412/slides/chapter1.pdf
2. Privacy-Preserving Data Mining- Models and Algorithms, Charu C Aggarwal, Yu Philips, S., Springer
3. Principles of Information Security, Information SecurityProfessional - Michael E. Whitman and Herbert J. Mattord,4th Edition, Thompson.

Semester: II Year: 2020-2021

Department: Information Science and Engineering	**Course Type:** Elective
Course Title: Big Data Analytics	**Course Code:20DSE261**
L-T-P: 4-0-0	**Credits:** 04
Total Contact Hours:52 hrs	**Duration of SEE:** 3 hrs
SEE Marks: 50	**CIE Marks:** 50

Prerequisite:

- Database Management Systems

Course Outcomes:

Students will be able to

CO's	Course Learning Outcomes	BL
CO1	Describe Big Data and its importance with its applications	**L2**
CO2	Differentiate various big data technologies like Hadoop MapReduce, Pig, Hive, Hbase and No-SQL.	**L4**
CO3	Apply tools and techniques to analyze Big Data.	**L3**
CO4	Design a solution for a given problem using suitable Big Data Techniques	**L4**

Teaching Methodology:

- Black board teaching/ Power Point presentations
- Executable Codes/ Live Demonstration
- Programming Assignment

Assessment Methods:

- Online certification for 10 marks
- Programming assignments evaluated using rubrics for 10 marks
- Three internals, 30Marks each will be conducted and the Average of best of two will be taken.
- Final examination, of100 Marks will be conducted and will be evaluatedfor50Marks.

Course Outcome to Programme Outcome Mapping

	PO1	PO2	PO3	PO4	PO5	PO6
CO1	3			3	2	
CO2	3			2	3	1
CO3	3			2	3	1
CO4	3			2	3	1
20DSE261	3			2	3	1

COURSE CONTENT

Unit – I	10 Hrs
Types of Digital data: Classification of Digital data: Structured Data, Semi Structured Data, Unstructured Data; Introduction to Big Data : Characteristics of Data, Evolution of Big Data, Definition of Big Data, Challenges of Big Data, What is Big Data?, Why Big Data? Traditional Business Intelligence versus Big Data, A Typical Data Warehouse Environment, A Typical Hadoop Environment, Coexistence of Big Data and Data Warehouse.	
Unit – II	**12Hrs**
Hadoop: Features, Advantages of Hadoop, Versions of Hadoop, Hadoop ecosystem, Hadoop distributions, Hadoop Vs SQL. Introduction to Hadoop: Why Hadoop? RDBMS Vs Hadoop, Distributed computing challenges, History of Hadoop, Hadoop overview, use case of Hadoop, HDFS, Processing data with Hadoop, Managing resources and applications with Hadoop YARN.	
Unit – III	**10 Hrs**
Introduction to Map Reduce Programming: Introduction, Mapper, Reducer, Combiner, Partitioner, Searching, sorting, compression Big Data Analytics: Big Data Analytics. Classification of Analytics, Greatest challenges on Big Data, Big Data Analytics importance, Data Science, Terminologies in Big Data.	
Unit – IV	**10 Hrs**
Introduction to HIVE: Introduction, HIVE architecture, HIVE data types, HIVE file formats, HIVE query language, RCFile implementation, SerDe, User Defined Functions (UDF) Introduction to PIG: Anatomy of PIG, PIG on Hadoop, PIG philosophy, overview of PIG, Data types in PIG, Running and execution modes of PIG, HDFS commands, Relational operators, Eval function, Complex Data types.	
Unit – V	**10 Hrs**
Spark Overview: Spark versus MapReduce. Advantages of Spark, Spark Ecosystem. Spark Core: Installing Spark in standalone mode, Spark shell, Spark Context, RDD's: Actions and Transformations, Lineage Graphs, Lazy evaluation, Persistence, Immutability, Fault Tolerance. Pair RDD's: Transformations and Actions, Partitioning.	

Text Books:

1) Seema Acharya, SubhasiniChellappan, "Big Data and Analytics", Wiley Publications, 2015.
2) Spark: The Definitive Guide 2018, by Matei Zaharia and Bill Chamber

Reference Book

1. Chris Eaton,Dirkderooset al., "Understanding Big data", McGraw Hill, 2012.

2. Boris lublinsky, Kevin T. Smith, Alexey Yakubovich, "Professional Hadoop Solutions", Wiley, ISBN: 9788126551071, 2015.

3. Tom White, "HADOOP: The definitive Guide", O Reilly 2012.

4. Norman Matloff, "The Art of R Programming: A Tour of Statistical Software Design", No Starch Press, USA, 2011.

5. http://www.bigdatauniversity.com/

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Semester: II

Year: 2020-2021

Department: Information Science and Engineering	**Course Type:** Elective
Course Title: Business Analytics	**Course Code:20DSE262**
L-T-P: 4-0-0	**Credits:** 04
Total Contact Hours:52 hrs	**Duration of SEE:** 3 hrs
SEE Marks: 50	**CIE Marks:** 50

Course Outcomes:

Students will be able to

CO's	Course Learning Outcomes	BL
CO1	Describing the significance of global platform for data retrieval/process among different business cultures of the world.	**L2**
CO2	Develop domain knowledge of various technology and its application to facilitates managerial decision /MIS	**L2**
CO3	Enable communication for data driven decision making	**L3**
CO4	Implement cross functional collaboration to enhance efficiency and productivity.	**L3**

Teaching Methodology:

- ICT enabled Classroom teaching
- Case study
- Practical / live assignment
- Interactive class room discussions

Assessment Methods

- Group Discussion for 10 Marks.
- Assignment evaluation for 10 Marks.
- Three internals, 30 Marks each will be conducted and the Average of best of two will be taken.
- Final examination, of 100 Marks will be conducted and will be evaluated for 50 Marks.

Course Outcome to Programme Outcome Mapping

	PO1	PO2	PO3	PO4	PO5	PO6
CO1	1		2		2	1
CO2	2	2	1		2	2
CO3	3		2		3	1
CO4	3	2	3	1	2	1
20DSE262	3	2	2	1	2	1

COURSE CONTENT

Unit – I	12 Hrs
Introduction to Business Analytics: Why Analytics, Business Analytics: the Science of data driven decision making, Descriptive Analysis, Predictive Analytics, Prescriptive Analytics, Big Data Analytics, Web and Social media Analytics, Machine Learning Algorithms, Framework for data driven decision making, Analytics Capability Building, Roadmap, Challenges, Types (Descriptive, Predictive and Prescriptive), Business Intelligence versus Business Analytics, Transaction Processing v/s Analytic Processing, OLTP v/s OLAP, OLAP Operations, Data models for OLTP	
Unit – II	**10Hrs**
Descriptive Analytics: Introduction, Data Types and Scales, Types of Data Measurement Scale, Population and Sample, Types of Data Measurement Scale **Data Warehouse:** Definition, characteristics, framework Data lake Business Reporting, Visual Analytics: Definition, concepts, Different types of charts and graphs, Emergence of data visualization and visual analytics	
Unit – III	**10 Hrs**
Data Mining: Concepts and applications, Data mining process Text & Web Analytics, Text analytics and text mining overview, Text mining applications, Web mining overview, Sentiment analysis overview, Supply Chain and Operations Analytics, Customer Analytics, Project Management, Decision Analysis, Process Analytics, Market Intelligence	
Unit – IV	**12 Hrs**
Social Network Analysis: Overview of SNA, history and resources, Mathematical foundations, matrices and graph theory, Whole versus personal networks, one-mode versus two-mode network data, Collecting network data, Informant accuracy, Network visualizations, Cohesive subgroups, bottom-up and top-down approaches, Block models, Egocentric SNA, design and applications	
Unit – V	**8 Hrs**
Business Performance Management: Business performance management cycle, KPI, Dashboard Analytics in Business Support Functions, Sales & Marketing Analytics, HR Analytics, Financial Analytics, Production and operations analytics, Analytics in Industries: Telecom, Retail, Healthcare, Financial Services	

Text Books:

1. U. Dinesh Kumar, "Business Analytics – The Science of Data Driven Decision Making", Wiley 2017.
2. Ramesh Sharda, DursunDelen, Efraim Turban, "Business Intelligence: A Managerial Perspective on Analytics", Pearson, 3e.
3. Wasserman, S., & Faust, K. (1994). Social Network Analysis: Methods and Applications. A classic, essential textbook on SNA.

Reference Books:

1. Jesper Thorlund &Gert H.N. Laursen, " Business Analytics for Managers: Taking Business Intelligence Beyond", Wiley
2. Sahil Raj, "Business Analytics", Cengage
3. James R. Evans, "Business Analytics", Pearson
4. https://www.bebr.ufl.edu/sites/default/files/ANG5420_Syllabus.pdf

List of Journals / Periodicals / Magazines / Newspapers / Web resources (Case Study):

- International Journal of Business Analytics
- International Journal of Business Analytics and intelligence
- International Journal on Consumer and Business Analytics
- Analytics India – Magazine

Semester: II Year: 2020-2021

Department: Information Science and Engineering	**Course Type:** Elective
Course Title: Social Network Analysis	**Course Code:20DSE263**
L-T-P: 4-0-0	**Credits:** 04
Total Contact Hours:52 hrs	**Duration of SEE:** 3 hrs
SEE Marks: 50	**CIE Marks:** 50

Prerequisite:
- Fundamental of Network, Data Mining, Graph theory
- Advanced Algorithms

Course Outcomes:
Students will be able to

CO's	Course Learning Outcomes	BL
CO1	Understand the basics of Social Network Models and analysis.	**L2**
CO2	Analysesocial network models for community detection.	**L4**
CO3	Implement link prediction and event detection	**L3**
CO4	Analyse social influence and contributing factors.	**L4**

Teaching Methodology:
- Black board teaching
- Power Point presentations

Assessment Methods:
- Rubrics for evaluation of case study 20 Marks
- Three internals, 30Marks each will be conducted and the Average of best of two will be taken.
- Final examination, of100 Marks will be conducted and will be evaluatedfor50Marks.

Course Outcome to Programme Outcome Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6
CO1	2		2		2	
CO2	2				1	
CO3	3		2	1	2	
CO4	3		2		3	
20DSE263	2		2	1	2	

COURSE CONTENT

Unit – I	10 Hrs
Social Networks : An Introduction; **Types of Networks:** General Random Networks, Small World Networks, Scale-Free Networks; Examples of Information Networks; Network Centrality Measures; Strong and Weak ties; Homophily **Walks:** Random walk-based proximity measures, Other graph-based proximity measures. Clustering with random-walk based measures	
Unit – II	**12 Hrs**
Community Detection Algorithms for Community Detection: The Kernighan-Lin algorithm, Agglomerative/Divisive algorithms, Spectral Algorithms, Multi-level Graph partitioning, Markov Clustering; Community Discovery in Directed Networks , Community Discovery in Dynamic Networks, Community Discovery in Heterogeneous Networks, Evolution of Community.	
Unit – III	**12 Hrs**
Link Prediction: Feature based Link Prediction, Bayesian Probabilistic Models, Probabilistic Relational Models, Linear Algebraic Methods: Network Evolution based Probabilistic Model, Hierarchical Probabilistic Model, Relational Bayesian Network. Relational Markov Network.	
Unit – IV	**10 Hrs**
Event Detection: Classification of Text Streams, Event Detection and Tracking: Bag of Words, Temporal, location, ontology based algorithms. Evolution Analysis in Text Streams, Sentiment analysis.	
Unit – V	**8 Hrs**
Social Influence Analysis: Influence measures, Social Similarity - Measuring Influence, Influencing actions and interactions. Influence maximization.	

Text Books:

1. David Easley, Jon Kleinberg: Networks, Crowds and Markets: Reasoning about a highly connected world, Cambridge Univ Press 2010
2. S.Wasserman, K.Faust: Social Network Analysis: Methods and Applications, Cambridge Univ Press, 1994

Semester: II Year: 2020-2021

Department: Information Science and Engineering	**Course Type:** Elective
Course Title: Natural Language & Text Mining	**Course Code:** 20DSE264
L-T-P:4-0-0	**Credits:** 04
Total Contact Hours:52 hrs	**Duration of SEE:** 3 hrs
SEE Marks: 50	**CIE Marks:** 50

Prerequisites:

- Fundamental of Language Processing.

Course outcomes:

Students will be able to:

CO's	Course Learning Outcomes	BL
CO1	Describe the basics of Natural Language Processing.	**L2**
CO2	Analyze syntactic and semantic parsing techniques.	**L2**
CO3	Implement a rule-based system to tackle morphology/syntax of a Language	**L3**
CO4	Describe the various issues of Natural Language of Processing.	**L2**

Teaching Methodology:

- Blackboard teaching
- PowerPoint presentations

Assessment Methods:

- Three internals, 30 Marks each will be conducted and the Average of best of two will be taken.
- Rubrics for evaluation of case study 20 Marks
- Final examination, of 100 Marks will be conducted and will be evaluated for 50 Marks.

Course Outcome to Programme Outcome Mapping:

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6
CO1	3	2				
CO2	3	2		1		
CO3	3	2	2	1	2	
CO4	3	3		2		2
20DSE264	3	2	2	2	2	2

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COURSE CONTENT

Unit – I	12 Hrs
Classical Approaches to Natural Language Processing: context, **Classical Toolkit** Text Preprocessing Lexical Analysis, Syntactic Parsing, Semantic Analysis , Natural Language Generation **Text Preprocessing :**Introduction Challenges of Text Preprocessing , Character-Set Dependence , Language Dependence , Corpus Dependence , Application Dependence ,Tokenization ,Tokenization in Space-Delimited Languages , Tokenization in Un segmented Languages , Sentence Segmentation ,Sentence Boundary Punctuation , The Importance of Context , Traditional Rule-Based Approaches. **Lexical Analysis**: Introduction ,Finite State Morphonology ,Closing Remarks on Finite State Morphonology , Finite State Morphology , Disjunctive Affixes, Inflectional Classes, and Exceptionality , Further Remarks on Finite State Lexical Analysis , “Difficult” Morphology and Lexical Analysis ,Isomorphism Problems , Contiguity Problems , Paradigm-Based Lexical Analysis, Paradigmatic Relations and Generalization..	
Unit – II	**12 Hrs**
Syntactic Parsing: Introduction ,Background ,Context-Free Grammars , Example Grammar , Syntax Trees , Other Grammar Formalisms , Basic Concepts in Parsing , Parsing as Deduction ,Deduction Systems , The CKY Algorithm , Chart Parsing , Bottom-Up Left-Corner Parsing , Top-Down Earley-Style Parsing , Example Session.**Semantic Analysis** : Basic Concepts and Issues in Natural Language Semantics ,Theories and Approaches to Semantic Representation , Logical Approaches , Discourse Representation Theory , Pustejovsky’s Generative Lexicon , Natural Semantic Meta language , Object-Oriented Semantics , Relational Issues in Lexical Semantics , Sense Relations and Ontologies , Roles , Fine-Grained Lexical-Semantic Analysis: Three Case Studies , Emotional Meanings: “Sadness” and “Worry” in English, Ethno geographical Categories: “Rivers” and “Creeks” , Functional Macro-Categories . Prospectus and “Hard Problems”	
Unit – III	**08 Hrs**
Natural Language Generation: Introduction ,Generation Compared to Comprehension, The Components of a Generator, Components and Levels of Representation , Approaches to Text Planning ,The Function of the Speaker , Desiderata for Text Planning , Pushing vs. Pulling , Planning by Progressive Refinement of the Speaker’s Message , Planning Using Rhetorical Operators , Text Schemas , The Linguistic Component, Surface Realization Components , Relationship to Linguistic Theory , Chunk Size , Assembling vs. Navigating , Systemic Grammars , Functional Unification Grammars The Cutting Edge Story Generation , Personality-Sensitive Generation Conclusions.	
Unit – IV	**10 Hrs**
Corpus Creation: Introduction, Corpus Size, Balance, Representativeness, and Sampling Data Capture and Copyright Corpus Markup and Annotation Multilingual Corpora Multimodal Corpora. **Part-of-Speech Tagging Tunga:** Introduction, Parts of Speech , Part-of-Speech Problem , The General Framework, Part-of-Speech Tagging Approaches , Rule-Based Approaches , Markov Model Approaches , Maximum Entropy Approaches ,Other Statistical and Machine Learning Approaches , Methods and Relevant Work , Combining Taggers	
Unit – V	**10 Hrs**
Information Retrieval: Introduction, Indexing, Indexing Dimensions • Indexing Process, IR Models Classical Boolean Model , Vector-Space Models , Probabilistic Models , Query Expansion and Relevance Feedback , Advanced Models , Evaluation and Failure Analysis , Evaluation Campaigns , Evaluation Measures , Failure Analysis , Natural Language Processing and Information Retrieval, Morphology , Orthographic Variation and Spelling Errors , Syntax , Semantics , Related Applications **Text Analytics:** text analytics systems, Named entity recognition Disambiguation, Document clustering: identification of sets of similar text documents, Term frequency-inverse document frequency- TFIDF, Analysis and Evaluation of Current Graph-Based Text Mining Researches, Coreference: Relationship, Case study on Biomedical text mining,	

Text Books:

1. Nitin Indurkhya, Fred J Damerau “Handbook of Natural Language Processing”, Chapman & Hall/CRC Publications, 2nd Editions 2010.

Reference Books:

1. Tanveer Sidiqui, U.S Tiwary, “ Natural Language Processing & Information Retrieval”, Oxford University Press, 2008.
2. Anne Kao & Stephen R Poteel, “ Natural Language & Text Mining”, Springer- Verlag , 2007

Nitte Meenakshi Institute of Technology

(An Autonomous Institution under Visvesvaraya Technological University, Belagavi)

YELAHANKA, BENGALURU – 560064

Department of Electrical and Electronics Engineering

Curriculum
For
Post Graduate Engineering
M.Tech in Renewable Energy

(2021-2022)

VISION, MISSION, OBJECTIVE & OUTCOMES

Vision

To build a strong research and teaching environment in the field of electrical engineering to meet the ever evolving global needs and to equip students with the latest knowledge, skills and practical orientation to face challenges in electrical professions.

Mission

1. To offer comprehensive educational programs in the field of electrical engineering producing highly accomplished graduates.

2. To inculcate among the students, the culture of research and innovation.

3. To encourage students to participate in co-curricular and extra-curricular activities leading to enhancement of their social and professional skills.

Programme Education Objectives (PEOs)

1. Graduate will have a sufficient depth of understanding in renewable energy in electrical engineering and the skills, confidence, professionalism, and experience necessary for successful careers in renewable energy and related fields.

2 .Graduate will work with the latest technological topics, to find opportunities to engage in advanced studies, to conduct research, and develop skills for professionally communicating their work**.**

Programme Specific Outcomes (PSO)

1.PSO 1: Aptitude to handle complex problems in the area of Renewable Energy relevant to industry and society by applying latest technologies.

2. PSO2: Ability to optimize non-conventional energy sources for the holistic benefit of society and carryout research combined with innovation.

Programme Outcomes (POs)

PO-1	Students will have the ability to acquire and apply knowledge of renewable energy and electrical engineering to evaluate, analyse and synthesize existing and new complex electrical problems.
PO-2	Problem analysis: Identify ,formulate, review research literature and analyze complex problems
PO-3	Students will have the ability to apply independent judgment for critical appraisal skills – planning, organizing, problem solving and decision making which helps in conducting research in a wider theoretical, practical and policy context.
PO-4	Students will have the ability to Conceptualize and solve renewable energy based problems, evaluate a feasible and optimal solution for those problems by assessing the impact of global, social and cultural changes on electrical field.
PO-5	Students will have the ability to recognize the research problem; apply appropriate research methodologies, techniques and tools, design, conduct experiments, critical reviewing, documenting and reporting in the development of scientific or technological knowledge in one or more domains of renewable energy in electrical engineering
PO-6	Students will have the ability to use current technology, skills and modern tools for renewable energy practices
PO-7	Students will have the ability to possess knowledge and understanding of group dynamics, recognize opportunities for collaboration/ multidisciplinary work and relating energy issues with other disciplines to improve the outcomes.
PO-8	Students will have the ability to demonstrate knowledge and understanding of several method of renewable energy for projects. To manage projects efficiently after considering the economical and financial issues
PO-9	Students will have the ability to effectively communicate with the engineering community and with the society at large and capable of presenting reports and design documentation by adhering to appropriate standards.
PO-10	Students will have the ability to engage in lifelong learning independently, with the high level of enthusiasm and commitment to improve knowledge and competence continuously.
PO-11	Students will have the ability to acquire professional and intellectual integrity, code of conduct, ethics and professional practices and responsible to contribute to the community for sustainable development of the society.
PO-12	Students will have the ability to observe and examine the outcomes of one's actions periodically and make corrective measures subsequently, and learn from mistakes without depending on external feedback

About the Department

The department of Electrical and Electronics Engineering was started in the year 2001 with a sanctioned intake of 60 students. The department has been accredited in 2009, 2014 and 2018. The main areas of learning in this program pertain to principles and analysis of equipment and systems used in the generation, transmission, distribution and utilization of electrical energy. Other areas of learning pertain to electronic devices and circuits used in the measurement, instrumentation, control and protection of electrical equipment and conversion systems. Students also learn concepts related to computers and applications for computer based systems used in the design, analysis and operation of power system. The faculty members always strive to impart knowledge in the best possible manner to the students. Quality and standard of teaching is always a priority for the faculty members.

The department offers a UG (B.E) program in Electrical & Electronics Engineering and a PG (M.Tech) program in Renewable Energy. The department is recognized as a research center by VTU and offers M.Sc (by research) and Ph.D programs.

The laboratories in the department are well equipped for the experiments and for research work. The department has also received Rs. 10 Lacs from AICTE, New Delhi, under 'MODROBS' scheme for upgrading the Power Electronics Laboratory, Power system protection Laboratory lab and Advanced Electrical Machines Laboratory. The department regularly organizes industrial visits. Experts from industries and institutes enhance the students' knowledge through technical lectures on contemporary subjects in the field of Electrical and Electronics Engineering.

Objectives of the Programme

Energy is vital for improving the quality of human life of every nation. The growing scarcity of conventional fuels and their adverse ecological and environmental impacts have raised global interest in harnessing various renewable energy sources. Renewable Energy Technologies are emerging as the source of sustainable energy, which will be very important for future energy supply strategies of the entire world. Availability of adequate manpower and appropriate resources is crucial for success in this endeavor. Providing renewable energy education at all the required levels in an efficient and effective manner is a challenging task.

There are very few institutes in India and First in Karnataka that offer a structured programme to cover the diverse range of issues to meet this demand. The program at NMIT is intended to fill the gap and provide the much needed human resource capacity in renewable energy technology and management. The program is designed to train students not only in renewable energy technology and implementation but also in equally important synergetic areas of energy infrastructure, energy economics, and energy conversion technologies. The program will lead to a specialization in renewable energy.

Bearing this in mind, NMIT offers M.Tech. course in Renewable Energy.

This M.Tech. Program provides an opportunity to specialize in the field of renewable energy. The course covers wide range of topics in renewable energy, energy efficiency and renewable energy technology, energy demand and energy economics.

The programme consists of core and elective courses taught during the first, second semester, during third & fourth semester, the student is required to take up an Internship and major project either in an industrial establishment or a research/ consultancy organization dealing with renewable energy, as an independent study under the supervision of a faculty member at NMIT and a working professional of that organization.

Credit Distribution

Sl No	Semester	Credits
1	I	24
2	II	24
3	III	20
4	IV	20
Total		**88**

Sl No	Category	Credits
1	BS-Basic Science	4
2	PC-Program Core	34
3	PE-Program Elective	12
4	PL-Program Laboratory	6
5	SS-Self Study -Internship	5
6	MP-Mini Project	2
7	Self-Study(SS)-MOOC	3
8	PR-Project Review(Phase 1 and 2)	22

NITTE MEENAKSHI INSTITUTE OF TECHNOLOGY, BANGALORE
SCHEME OF TEACHING AND EXAMINATION FOR
DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING
SCHEME FOR M.TECH IN RENEWABLE ENERGY (2019-2021)

SEMESTER: I

Sl No	Course Code	Course Name	Course Type	Teaching Dept.	Teaching Hours/week				Examination			Credits
					L#	T#	P#	S#	CIE*	SEE**	Total	
1.	19ERE 11	Advanced Mathematics	PC	BS	4	-	-	-	50	50	100	4
2.	19ERE12	Energy Sources And Conversion Technologies	PC	EE	4	-	-	-	50	50	100	4
3.	19ERE13	Materials For Energy Applications	PC	EE	4	-	-	-	50	50	100	4
4.	19ERE14	Solar Energy Technology	PC	EE	4	-	-	-	50	50	100	4
5.	19ERE15X	Power Systems for Renewable Energy /Thermal Systems for Renewable Energy	PC	EE	4	-	-	-	50	50	100	4
6.	19EREL16	Energy Lab 1	PL	EE	-	-	4	-	50	50	100	2
7.	19EREMP17	Mini Project	MP	EE	-	-	4	-	50	50	100	2
								Total	350	350	700	24

Note- 1)19ERE151-Power Systems for Renewable Energy
2)19ERE152-Thermal Systems for Renewable Energy

SEMESTER: II

Sl No	Course Code	Course Name	Course Type	Teaching Dept.	Teaching Hours/week				Examination			Credits
					L#	T#	P#	S#	CIE*	SEE**	Total	
1	19ERE21	Instrumentation and Control of Energy Systems	PC	EE	4	-	-	-	50	50	100	4
2	19ERE22	Wind Energy Technology	PC	EE	4	-	-	-	50	50	100	4
3	19ERE23A	Machine Learning in Renewable Energy	PC	EE	4	-	-	-	50	50	100	4
4	19EREE24x	Program Elective – A	PE	EE	3	-	-	-	50	50	100	3
5	19EREE25x	Program Elective – B	PE	EE	3	-	-	-	50	50	100	3
6	19EREL26	Simulation Laboratory	PL	EE	-	-	4	-	50	50	100	2
7	19ERES27	Research Methodology & IPR	PC	EE	2	-	-	-	50	50	100	2
8	19EREL28	Energy Lab 2	PL	EE	-	-	4	-	50	50	100	2
								Total	400	400	800	24

NITTE MEENAKSHI INSTITUTE OF TECHNOLOGY, BANGALORE
SCHEME OF TEACHING AND EXAMINATION FOR
DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING
SCHEME FOR M.TECH IN RENEWABLE ENERGY (2019-2021)

SEMESTER: III

Sl No	Course Code	Course Name	Course Type	Teaching Dept.	Teaching Hours/week				Examination			Credits
					L#	T#	P#	S#	CIE*	SEE**	Total	
1	19EREE31	SELF STUDY – MOOC	SS	EE	-	-	-	3	50	50	100	3
2	19ERE I32	INTERNSHIP	SP	EE	-	-	-	5	50	50	100	5
3	19ERE P33	PROJECT PHASE -1	PR	EE	-	-	6	9	50	50	100	12
								Total	150	150	300	20

SEMESTER: IV

Sl No	Course Code	Course Name	Course Type	Teaching Dept.	Teaching Hours/week				Examination			Credits
					L#	T#	P#	S#	CIE*	SEE**	Total	
1	19EREP41	PROJECT PHASE -2	PR	EE	-	-	20	10	200	200	400	20
								Total	200	200	400	20

L#-LECTURE, T#-TUTORIAL, P#-PRACTICAL, S-SELF STUDY
CIE*-CONTINOUOUS INTERNAL EVALUATION
SEE-SEMESTER END EXAMINATION**

NITTE MEENAKSHI INSTITUTE OF TECHNOLOGY, BANGALORE
SCHEME OF TEACHING AND EXAMINATION FOR
DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING
SCHEME FOR M.TECH IN RENEWABLE ENERGY (2019-2021)

Program Elective A			**Program Elective B**	
Sl No	Course Code	Course Name	Course Code	Course Name
1	19EREE241	Energy System and Modeling	19EREE251 A	Predictive Analytics in Energy Management
2	19EREE242	Computational Fluid Dynamics For Energy Systems	19EREE252	Design of Solar Energy System
3	19EREE243	Sensors For Renewable Energy	19EREE253	Micro and Smart grid
4	19EREE244	Large Scale Grid Integration of Renewable energy Sources	19EREE254	Energy Forecasting, Modeling and Project Management
5	19EREE245	Bio Energy Systems	19EREE255	Energy Storage Technologies
6	19EREE246	Computational Fluid Dynamics For Energy Systems	19EREE256	Waste Management and Energy Recovery
7	19EREE247	Energy Conservation in Electrical Systems	19EREE257	Recent Advances in Solar cell Design
8	19EREE248	Financial Management In Energy Sector	19EREE258	IOT Based Energy Management

Semester I

Department: Basic Science	**Course Type:** Core
Course Title: Advanced Mathematics	**Course Code:** 19ERE11
L-T-P:4-0-0	**Credits:**04
Total Contact Hours:52hrs	**Duration of SEE:**3hrs
SEE Marks:50	**CIE Marks:**50

Course Outcomes:

Students will be able to

1. Identify and analyse different situations where stochastic processes can be used.
2. Identify and analyse situations where Fourier transforms are used.
3. Use basic concepts of linear algebra to Engineering problems.
4. Use process of orthogonalisation and diagonalisation to different engineering problems.
5. Apply the concepts of optimization to engineering problems.

Teaching Methodology:

Lectures
Power Point Presentation
Case Study

Assessment Methods:

- Three internal tests for 30 Marks each – average of best two will be considered.
- Assignment based tests for 20 marks.
- Final Examination will be conducted for 100 Marks and evaluated for 50 Marks.

Course Outcomes and their mapping with POs and PSOs (1: SLIGHT; 2: MODERATE; 3: SUBSTANTIAL)

PO	1	2	3	4	5	6	7	8	9	10	11	12	PSO1	PSO2
CO1		3	2	2	3	1	1						1	
CO2		3	2	2	3	1	1						1	
CO3		3	3	2	3	1	1							2
CO4		3		2	1	1	1							2
CO5		3		2	1	1	1							2

UNIT-I

Stochastic process: Definition, classification, stationary and ergodic random process, auto-correlation, Cross correlation, Gauss random process, Poisson process. Definition and examples of Markov processes, states and transition probability, **Queuing theory**:- Pure birth and death models, Poisson queues, single and multiple server models, queuing decision models, M/M/1 and M/G/1 queues **12Hours**

UNIT-II

Fourier Transforms: Fourier complex transforms, sine and cosine transforms, inverse Fourier transforms, DFT, FFT. Engineering applications. **10Hours**

UNIT-III

Linear Algebra: Vector spaces, Linear combinations, spanning sets, subspaces, linear dependence and independence. Basis and dimension, linear transformation. Kernel and image. Singular and non-singular linear mapping, matrix representation of a linear operator, change of basis. **10Hours**

UNIT-IV

Inner product spaces, orthogonality, orthogonal sets and basis, Gram-Schmidt orthogonalisation process. Block matrices, eigen values and eigen vectors, diagonalisation. Characteristic and minimal polynomial. Nilpotent operators, Jordan canonical form, Quadratic and bilinear forms, Applications. **10Hours**

UNIT-V

Optimization: Linear programming- Basic concepts, Simplex and dual simplex method, revised simplex method, Big M- method Nonlinear programming Single variable problems, local and global optima, sequential search, three point interval search, Fibonacci search. **10Hours**

TEXT BOOKS:

1. "Linear Algebra and its applications", David. C.Lay, Pearson, 3rd edition, 2014.
2. "Probability and Random process with application to signal processing and communication. Scott L Miller and Donald G Childers, Elsevier, 2010.
3. "Operations research", Hamdy A Taha, Pearson education, 7th edition, 2006
4. "Advanced Engg. Mathematics", Erwin E Kreyszig,Wiley, 9th edition, 2011

Department: Electrical and Electronics Engineering	**Course Type:** Core
Course Title: Energy Sources and Conversion Technologies	**Course Code:**19ERE12
L-T-P:4-0-0	**Credits:**04
Total Contact Hours:52 hrs	**Duration of SEE:**3hrs
SEE Marks:50	**CIE Marks:**50

Course Outcomes:

Students will be able to

1. Understand and apply the knowledge on solar system.
2. Understand fundamentals of design calculations and analysis of wind energy systems.
3. Understand and apply the knowledge on Biomass system.
4. The students will be able to understand and apply the knowledge on Ocean & Geothermal Energy system.
5. The students will be able to understand and apply the knowledge on Geothermal Energy System.

Teaching Methodology:

Lectures
Power Point Presentation
Case Study

Assessment Methods:

- Three internal tests for 30 Marks each – average of best two will be considered.
- Assignment based tests/ subject seminars/ mini projects for 20 marks.
- Final Examination will be conducted for 100 Marks and evaluated for 50 Marks.

Course Outcomes and their mapping with POs and PSOs (1: SLIGHT; 2: MODERATE; 3: SUBSTANTIAL)

PO	1	2	3	4	5	6	7	8	9	10	11	12	PSO1	PSO2
CO1	3												2	
CO2	3	2	2		2									2
CO3	3	2												2
CO4	3													
CO5	3												2	2

UNIT-I

Solar Energy: Solar radiation: measurements and prediction. Solar Photovoltaic systems: Principle of photovoltaic conversion of solar energy, types of solar cells and fabrication. Solar thermal systems: collectors- flat plate collectors, concentrating collectors. Basic theory of flat plate collectors, solar heating of buildings, solar still, solar water heaters, solar driers; conversion of heat energy in to mechanical energy, solar thermal power generation systems. Applications: battery charger, domestic lighting, street lighting, water pumping, power generation schemes. **12Hours**

UNIT-II

Wind Energy: Atmospheric circulations, classification, factors influencing wind, wind shear, turbulence, wind speed monitoring, Betz limit, WECS: classification, characteristics, and applications. Principles of Aerodynamics of wind turbine blade, various aspects of wind turbine design, Wind Turbine Generators: Induction, Synchronous machine, constant V & F and variable V & F generations. Wind Farms. **Hybrid wind energy systems** - wind with diesel power, wind with conventional grid, wind with Photovoltaic system etc. **10Hours**

UNIT-III

Biomass Energy: Introduction, Photosynthesis process, Biomass fuels, Biomass conversion technologies, Urban waste to Energy Conversion, Biomass Gasification, Biomass to Ethanol Production, Bio-gas production from waste biomass, factors affecting biogas generation, types of biogas plants. Application of Biogas in domestic, industry and vehicles. **10Hours**

UNIT-IV

Ocean Energy: Ocean energy resources-ocean energy routes - Principles of ocean thermal energy conversion systems- ocean thermal power plants- Principles of ocean wave energy conversion and tidal energy conversion. **10Hours**

UNIT-V

Alternative Source of Energy: Geothermal energy: Origin and Distribution of Geothermal energy, types of geothermal energy sites, site selection, geothermal power plants; Analysis of Geothermal resources **10Hours**

TEXT BOOKS:

1. "Renewal Energy Resources", John Twideu and Tony Weir, BSP Publications, 2006.
2. "Renewable Energy Sources And Emerging Technologies", Kothari Et Al PHI,2012 edition.

REFERENCE BOOKS:

1. "Non-Conventional Energy Sources", B.H.Khan.Tata McGraw-Hill, 3rd edition.
2. "Renewable Energy",Sorenson B. ,Elsevier,3rd edition,2004.
3. "Advanced Renewable Energy Source",GopalNathTiwari, Rajeev Kumar Mishra,2011.
4. "Sustainable Energy Technologies: Options and Prospects", (Google eBook) Kemal Hanjalić, R. van de Krol, A. Lekić, Springer Science & Business Media, 2007.
5. "Biomass Regenerable Energy" edited by D.O. Hall and R.P. Overend, John Wiley & Sons, New York, NY, 1987 .
6. "Renewable Energy Sources and Conversion Technology" NK Bansal,TataMcGraw-Hill, 1990.

Department: Electrical and Electronics Engineering	**Course Type:** Core
Course Title: Materials for Energy Applications	**Course Code:**19ERE13
L-T-P:4-0-0	**Credits:**04
Total Contact Hours:52hrs	**Duration of SEE:**3hrs
SEE Marks:50	**CIE Marks:**50

Course Outcomes:

Students will be able to

1. Understand the properties, composition of materials used in hydro power generation.
2. Understand the properties, composition of materials used in thermal power generation.
3. Understand the working of different types of Batteries and Super capacitors for electrochemical energy storage.
4. Understand the synthesis and fabrication of different Materials for energy storage.
5. Understand the basics, types, characteristics and applications of fuel cells.

Teaching Methodology:

Lectures
Power Point Presentation
Case Study

Assessment Methods:

- Three internal tests for 30 Marks each – average of best two will be considered.
- Assignment based tests/ subject seminars/ mini projects for 20 marks.
- Final Examination will be conducted for 100 Marks and evaluated for 50 Marks.

Course Outcomes and their mapping with POs and PSOs (1: SLIGHT; 2: MODERATE; 3: SUBSTANTIAL)

PO	1	2	3	4	5	6	7	8	9	10	11	12	PSO1	PSO2
CO1	3						3						1	
CO2	3						3							2
CO3	3												1	
CO4	3													2
CO5	3													2

UNIT-I

Materials for hydro power generation: Introduction: India' vast potential of hydro power; problem of high silt content of Himalayan rivers and its associated erosion damage, and high velocity streaming water causing cavitation. Size and shape of particles, hardness of particles and its concentration in water. Chemical composition, microstructure, mechanical properties like hardness, ductility, tensile strength, work-hardening rate and toughness **10Hours**

UNIT-II

Materials for thermal power generation: Introduction to the constraints that are currently placed on power generation plant in terms of environmental impact and developing of high efficiency, low emission systems. Measures to improve the efficiency of a power plant- Increasing the temperature and the pressure of the steam entering the turbine. **10Hours**

Unit-III

Batteries and Super capacitors for electrochemical energy storage: Batteries – primary and secondary batteries, Lithium, Solid-state and molten solvent batteries; Lead acid batteries; Nickel Cadmium Batteries; Advanced Batteries, Super capacitors for energy storage. Role of carbon nanomaterials as electrodes in batteries and super capacitors. **11Hours**

Unit-IV

Materials for energy storage: Synthesis of nanomaterials, top-down and bottom-up approaches, mechanical milling, solgel method, chemical vapour deposition (CVD), Carbon Nano-Tubes (CNT), Carbon Nano-Fibres (CNF), graphene, preparation of graphene. Fabrication of CNTs and CNFs, CNTs and CNFs for hydrogen storage. **10Hours**

Unit-V

Fuel Cells and its applications: Fuel Cells, components of fuel cells, Types of fuel cells, Acid/alkaline fuel cells, polymer electrolyte fuel cell, phosphoric acid fuel cell, molten carbonate fuel cell, solid oxide fuel cell, Types of solid oxide fuel cells: High temperature, intermediate temperature Single chamber solid oxide fuel cells, Problems with fuel cells, applications of fuel cells, difference between batteries and fuel cells, principle of working of fuel cell, performance characteristics of fuel cells, efficiency of fuel cell, fuel cell stack, description of some commercially available fuel cell stacks, fuel cell cars and buses, overview on research activities. **11Hours**

REFERENCES

1. Dieter, G. E., "Mechanical Metallurgy", 3rd Ed., 1988,McGraw Hill,.
2. Reed-Hill, R.E. and Abbaschian, R., "Physical Metallurgy Principles", 1992, The PWS-KENT Series in Engg.
3. Hutchings, I.M. "Tribology - Friction and Wear of Engineering Materials", 1992, Edward Arnold Publications Ltd.
4. Linden D. and Reddy Thomas B., "Handbook of Batteries", 2001, McGraw Hill Publications
5. Larminie and A. Dicks, Fuel Cell Systems Explained, 2nd Edition, Wiley (2003)
6. Xianguo Li, Principles of Fuel Cells, Taylor and Francis (2005)
7. S. Srinivasan, Fuel Cells: From Fundamentals to Applications, Springer (2006)
8. O'Hayre, S. W. Cha, W. Colella and F. B. Prinz, Fuel Cell Fundamentals, Wiley (2005)
9. A. J. Bard and L. R. Faulkner, Electrochemical Methods: Fundamentals and Applications, 2nd Edition, Wiley, 2000
10. A. Faghri and Y. Zhang, Transport Phenomena in Multiphase Systems, Elsevier 2006

Department: Electrical and Electronics Engineering	**Course Type:** Core
Course Title: Solar Energy Technology	**Course Code:**19ERE14
L-T-P:4-0-0	**Credits:**04
Total Contact Hours:52hrs	**Duration of SEE:**3hrs
SEE Marks:50	**CIE Marks:**50

Course Outcomes:

Students will be able to

1. Understand the Advances in Renewable Energies and Power Technologies.
2. Understand the Solar Cells and Arrays: Principles, Analysis, and Design.
3. Understand the Performance of MPPT Techniques of Photovoltaic Systems Under Normal and Partial Shading Conditions.
4. Understand the Solar PV Power Plants Site Selection.
5. The students will be able to understand and apply the knowledge of Solar-Renewable Energy System Design, Energy Management, and Economics.

Teaching Methodology:

Lectures
Power Point Presentation
Case Study

Assessment Methods:

- Three internal tests for 30 Marks each – average of best two will be considered.
- Assignment based tests/ subject seminars/ mini projects for 20 marks.
- Final Examination will be conducted for 100 Marks and evaluated for 50 Marks.

Course Outcomes and their mapping with POs and PSOs (1: SLIGHT; 2: MODERATE; 3: SUBSTANTIAL)

PO	1	2	3	4	5	6	7	8	9	10	11	12	PSO1	PSO2
CO1	3												2	1
CO2	3	2	2		2									2
CO3	3	2												2
CO4	3													1
CO5	3												2	2

UNIT-I

Solar Cells and Arrays: Introduction: General Photovoltaic System, The Solar Radiation, and The Incident Solar Radiation "Insolation". Properties of Semiconductors for Solar Cells, The Dark pen Junction Diode, The Solar Cells, and The PV Arrays and Example modules. **10Hours**

UNIT-II

Design and Modelling of Solar Energy: F-Chart method and program, performance and design of liquid based solar heating systems, performance and design of air based solar heating systems, solar service water systems. Utilizability method, the Φ, f- chart method, storage tank losses correction, heat exchange correction. Un utilizability method.

Solar PV Power Plants Site Selection: Introduction to Solar Photovoltaic Land Suitability: Multi criteria Decision-Making Techniques for Photovoltaic Site Selection, Geographical Information System and Dealing With Uncertainties in Photovoltaic Site Selection. Criteria for Site Selection and Restriction Factors and Unsuitable Sites. **11Hours**

UNIT-III

Forecasting of Intermittent Solar Energy Resource: Introduction, Intermittent and Stochastic Renewable Energy Production in an Electrical Grid: The Production/Consumption Balance, Intermittence of Renewable Production and Impact on the Electrical Grid Management. Cost of Intermittence and Benefit of Forecasting and Forecasting Methods for Different Forecast Horizons. **10Hours**

UNIT-IV

MPPT Techniques: Performance of MPPT Techniques of Photovoltaic Systems Under Normal and Partial Shading Conditions. MPPT Techniques, PV System Under Non shading Conditions and Smart Maximum Power Point Tracker Under Partial Shading Conditions.	**11Hours**

UNIT-V

Hybrid PV/Batteries Bank/Diesel Generator Solar-Renewable Energy System Design, Energy Management, and Economics: Hybrid Renewable Energy System Modelling: Photovoltaic Cell Model, Lead-Acid Battery Model and Diesel Generator Model. Sizing of Hybrid Photovoltaic/Batteries Bank/Diesel Generator System, Energy Management and Economics of Hybrid Photovoltaic/Batteries Bank/Diesel Generator System.	**10Hours**

TEXT BOOKS:

1. "Advances in Renewable Energies and Power Technologies", TNQ Books and Journals, ImeneYahyaoui, 2018.
2. "Solar Power Generation: technology, new concept and policy", Technique\\Energy, P Jayarama Reddy, 2012.

REFERENCE BOOKS:

1. "Solar energy technology handbook. / Part B, Applications, systems design, and economics", Energy power and environment, Cheremisinoff, Paul N., Dickinson, William C, 2018.
2. "Renewable Energy Sources and Emerging Technologies", Kothari Et Al., PHI, 2012 edition.

Department: Electrical and Electronics Engineering	**Course Type:** Program Elective
Course Title: Power System Engineering	**Course Code:**19ERE151
L-T-P: 4-0-0	**Credits:**04
Total Contact Hours: 52 hrs	**Duration of SEE:**3hrs
SEE Marks:50	**CIE Marks:**50

Course Outcomes:

Students will be able to

1. Understand basic terminologies used in the study of power systems.
2. Understand the transmission line parameters and various phenomena associated with transmission lines.
3. Understand power system operation, protection and control.
4. Understand and analyse power distribution systems.
5. Understand control of voltage, frequency and reactive power exchange technologies.

Teaching Methodology:

Lectures
Power Point Presentation
Case Study

Assessment Methods:

- Three internal tests for 30 Marks each – average of best two will be considered.
- Assignment based tests/ subject seminars/ mini projects for 20 marks.
- Final Examination will be conducted for 100 Marks and evaluated for 50 Marks.

Course Outcomes and their mapping with POs and PSOs (1: SLIGHT; 2: MODERATE; 3: SUBSTANTIAL)

PO	1	2	3	4	5	6	7	8	9	10	11	12	PSO1	PSO2
CO1	3												1	
CO2	3	2	2		2									2
CO3	3	2											1	
CO4	3												1	
CO5	3													2

UNIT-I

Fundamentals of Electrical Power Systems Energy and Power, definitions of operational factors, Tariffs, Power system representation: One-line diagrams, Impedance and Reactance diagrams, Per-Unit Representation, Summary of Three – phase circuits relationships.

10Hours

UNIT-II

Transmission line parameters: Resistance, Inductance and Capacitance. Transmission line Representation: Short transmission line, Medium-length transmission line, Long transmission line. Surge impedance loading, Corona, ACSR conductors, Bundled conductors, Types of faults. Underground cables: Grading of Cables, Cable Capacitance, Cable Inductance, Dielectric loss and Heating, power flow studies: Power flow in a short transmission line, an iterative procedure and the power flow equations.

12Hours

UNIT-III

Power system operation and control- Economic distribution of load between generators, Effect of transmission line loss, Power system control. Power system protection: Components of a power system, circuit breakers, transducers and relays, relay types, protection of lines, transformers and generators.

10Hours

UNIT-IV

Power distribution systems-General aspects, DC distribution, AC distribution
Sub-station – Functions of substation, Classification of sub-stations, Indoor sub-stations, Outdoor sub-stations, Transformer Sub-stations, Symbols for circuit elements in sub-stations, Key diagram of 11kV/400V Indoor Sub-station. **10Hours**

UNIT-V

Control of reactive power, voltage and load frequency- Generation and absorption of reactive power, the effect of reactive power on voltage and voltage regulation, reactive power compensation in power system, methods of voltage control in the transmission system, the relation between voltage and reactive power, frequency and active power, control of load frequency. Static compensators. Introduction to Flexible AC transmission System (FACTS). **10Hours**

TEXT BOOKS:

1. "Electric Power Systems", Nasar A. S. and K.Umarao, TMH, Indian Adapted edition, 2006.
2. "Power System Engineering", R. K. Rajuput,Laxmi Publications, New Delhi, 4th edition.

REFERENCE BOOKS:

1. "Elements of Power system analysis", Stevenson W , McGraw Hill Higher Education, 4th edition, 1982.
2. "Power System Engineering", D P Kothari and I J Nagrath, TMH, 2nd edition.

Department: Electrical and Electronics Engineering	**Course Type:** Program Elective
Course Title: Thermal Systems for Renewable Energy	**Course Code:**19ERE152
L-T-P: 4-0-0	**Credits:**04
Total Contact Hours: 52 hrs	**Duration of SEE:**3hrs
SEE Marks:50	**CIE Marks:**50

Course Outcomes:

Students will be able to

1. Understand basic terminologies of thermal systems and heat transfer.
2. Identify the working of Heat transfer equipment.
3. Analyse the working of single phase and multiphase electronics cooling.

Teaching Methodology:

- Lectures, Power Point Presentation and Case Study

Assessment Methods:

- Three internal tests for 30 Marks each – average of best two will be considered.
- Assignment based tests/ subject seminars/ mini projects for 20 marks.
- Final Examination will be conducted for 100 Marks and evaluated for 50 Marks.

Course Outcomes and their mapping with POs and PSOs (1: SLIGHT; 2: MODERATE; 3: SUBSTANTIAL)

PO	1	2	3	4	5	6	7	8	9	10	11	12	PSO1	PSO2
CO1	3												1	
CO2	3	2	2		2								1	2
CO3	3	2												2

UNIT-I

Macroscopic Heat Conduction formulation- Numerical methods for conduction type phenomena-Design of thermal systems-Thermal transports in micro and nano scale systems. **11 Hours**

UNIT-II

Single phase convective heat transfer -Enhancement convective heart transfer -free convection – natural convection – visualization of convective heat transfer

11 Hours

UNIT-III

Radiative heat transfers -Near field thermal radiation – design of optical and radiative properties of surfaces- radiative properties of gases and particles - Radiative transfers in combustion systems- inverse problem in radiative transfer

10 Hours

UNIT-IV

Heat transfer equipment – single phase heat exchanger – two phase heat exchangers-compact heat exchangers- evaporative heat exchangers energy efficiency and advanced heat recovery technologies-heat exchangers fouling cleaning and maintenance. **10 Hours**

UNIT-V

Single phase and multiphase flow for electronic cooling -film and dropwise condensa pipes and thermosyphons – phase change materials – heat transfer in biology and systems **10 Hours**

TEXT BOOK:

1.Fancis A Kulachki editor-in-chief, Hand book of thermal science and engineering, spinger,2018

Department: Electrical and Electronics Engineering	**Course Type:** Laboratory
Course Title: Energy Laboratory-1	**Course Code:** 19EREL16
L-T-P:0-0-4	**Credits:**02
Total Contact Hours: 36	**Duration of SEE:**3hrs
SEE Marks:50	**CIE Marks:**50

Course Outcomes:

Students will be able to

1. I-V and P-V characteristics, Fill factor, Impact of tilt and shading and MPPT of PV panel.
2. Evaluate cut-in speed and cut-off speed, I-V characteristics of wind turbine, P, V and F measurement of output of wind generator.

Teaching Methodology:

Practical sessions

Assessment Methods:

- Observation – 20 Marks
- Record - 20 Marks
- Internal lab test - 10 Marks
- Semester end examination - 50 Marks

Course Outcomes and their mapping with POs and PSOs (1: SLIGHT; 2: MODERATE; 3: SUBSTANTIAL)

PO	1	2	3	4	5	6	7	8	9	10	11	12	PSO1	PSO2
CO1				3									2	
CO2				3										2

List of Experiments

1) I-V and P-V characteristics of Series and Parallel combination of PV modules and calculation of Fill factor.
2) Impact of tilt angle and shading of solar panel on PV power.
3) Perform the experiment of manually finding the MPP by varying the resistive load across the PV panel.
4) Perform the experiment of finding the MPP by varying the duty cycle of DC-DC converter.
5) Performance study of Wind Energy Systems.
6) Evaluation of cut-in speed and cut-off speed of Wind Energy Systems.
7) I-V characteristics of wind turbine at different wind speed of Wind Energy Systems.
8) P, V and F measurement of output of wind generator of Wind Energy Systems.
9) Demonstration of system with charge controller and inverter of Wind Energy Systems.

II Semester

Course Title: Instrumentation and control in Energy Systems	Course Code:19ERE21
L-T-P:4-0-0	**Credits:**04
Total Contact Hours:52 hrs.	**Duration of SEE:**3hrs
SEE Marks:50	**CIE Marks:**50

Course Outcomes:

Students will be able to

1. Understand the functional descriptions and performance characteristics of Transducers and their Industrial applications.
2. Be acquainted with the types and principle of operation of Mechanical transducers.
3. Comprehend the types and principle of operation of Electrical transducers (passive and active).
4. Be familiar with the Instruments for monitoring electrical parameters and developments in sensor technology.

Teaching Methodology:

Lectures
Power Point Presentation
Case Study

Assessment Methods:

- Three internal tests for 30 Marks each – average of best two will be considered.
- Assignment based tests/ subject seminars/ mini projects for 20 marks.
- Final Examination will be conducted for 100 Marks and evaluated for 50 Marks.

Course Outcomes and their mapping with POs and PSOs (1: SLIGHT; 2: MODERATE; 3: SUBSTANTIAL)

PO	1	2	3	4	5	6	7	8	9	10	11	12	PSO1	PSO2
CO1	1	1							1	1			1	
CO2	1	1				1	1		1	1				2
CO3	1	1				1	1		1	1			1	
CO4	1	1				1	1		1	1				2

UNIT-I

Generalized configuration, performance characteristics of instruments:
Generalized configurations and functional descriptions of measuring instruments. Measurement Errors for mechanical instruments. Transducer classification. Generalized performance characteristics of instruments, Static and dynamic characteristics of transducers.
Mechanical transducers: Temperature measurement- Introduction, Basics of temperature measurement, bimetallic element. Basics of force measurements-Helical spiral springs, cantilever beams.

11Hours

UNIT-II

Mechanical and Electrical transducers: Basics of pressure measurement-Manometers, Diaphragms, Membranes, Bourdon tube elements.
Basics of torque measurement: Torsion bar, Flat spiral spring, Basics of flow measurement- Rota meter floats system. **Passive electrical transducers:** Introduction, Resistive Transducers.

11Hours

UNIT-III

Passive electrical transducers: inductive and capacitive transducers. **Active electrical transducers:** Introduction, Thermoelectric, Piezoelectric, hall effect, electromechanical, photoelectric transducers.

10Hours

UNIT-IV

Active electrical transducers: Ionization, digital and electrochemical transducers. **Instruments for monitoring electrical parameters**: Moving Iron/coil, Energy measurement, power factor meter. Analog signal conditioning, Amplifiers, Instrumentation amplifier, A/D and D/A Converters, Data acquisition system. **10Hours**

UNIT-V

MICROPROCESSORS: Microprocessor based temperature control system – Introduction to microcontrollers – Process control system – Pneumatic control systems - Simple circuits. **10Hours**

TEXT BOOKS:

1. "Transducers and Instrumentation", D. V. S. Murthy, PHI, India.
2. George C .Barney, "Intelligent Instrumentation Microprocessor and Applications in Measurements and Control", Prentice Hall, New Delhi, 2008.
3. "A course in Mechanical Measurements and Instrumentation ",A.K. Sawhney. Puneet Sawney, Dhanpat Rai &Co 2002.

REFERENCE BOOKS:

1. "Measurement Systems-Application and Design", Doeblin E.O,TMH International edition, New York, 5th edition.
2. "Hand book of Modern Sensors: Physics, Design and applications ",Jacob Fraden, publication by Springer, 4th edition.
3. "Principle of measurement systems", John P. Bentley, Third edition, Wesley, Longman Ltd, UK.
4. "Industrial Instruments and Controls handbook", Gregory K. McMillan and Doughlas M. Considine, TMH.

Department: Electrical and Electronics Engineering	**Course Type:** Core
Course Title: Wind Energy Technology	**Course Code:**19EREE152
L-T-P:4-0-0	**Credits:**04
Total Contact Hours:52hrs	**Duration of SEE:**3hrs
SEE Marks:50	**CIE Marks:**50

Course Outcomes:

Students will be able to

1. Understand the Advances in Renewable Energies and Power Technologies.
2. Understand the Wind Energy: Principles, Analysis, and Design.
3. Understand the Performance of Doubly Fed Induction Generator in Wind Energy Conversion Systems.
4. Understand the Wind Farm Configuration.
5. The students will be able to understand Modelling and Characterization of a Wind Turbine Emulator.

Teaching Methodology:

Lectures
Power Point Presentation
Case Study

Assessment Methods:

- Three internal tests for 30 Marks each – average of best two will be considered.
- Assignment based tests/ subject seminars/ mini projects for 20 marks.
- Final Examination will be conducted for 100 Marks and evaluated for 50 Marks.

Course Outcomes and their mapping with POs and PSOs (1: SLIGHT; 2: MODERATE; 3: SUBSTANTIAL)

PO	1	2	3	4	5	6	7	8	9	10	11	12	PSO1	PSO2
CO1	3												1	2
CO2	3	2	2		2								2	2
CO3	3	2											2	2
CO4	3												2	2
CO5	3												2	2

UNIT-I

Electric Power from the Wind: Introduction, Basic concepts of Wind Energy Converters: Rotor with a Vertical Axis of rotation, Horizontal Axis Rotors, Wind Energy Concentrators and Terms and Expression. Physical Principle of wind energy conversion. **10Hours**

UNIT-II

Wind Energy FACTS Applications and Stabilization Schemes: Wind Farm Configuration, Issues of Integrating Wind Energy into the Grid: An Overview, Different FACTS Schemes and Applications, Wind Energy in Egypt and Simple example on Wind Turbine Modelling with characteristic results. **10Hours**

UNIT-III

Wind Power Variability and impacts on power systems: Understanding Variable Output Characteristics of Wind Power: Variability and Predictability, Wind Power: A Variable Output Source Embedded in a Variable Electricity System, Short-Term Variability, Long-Term Variability, Effects of Aggregation and Geographical Dispersion, Load Duration Curve and The Need for Interconnection. Variability Versus Predictability of Wind Power Production and Impacts of Wind Power on Power Systems. **11Hours**

UNIT-IV

Modelling and Characterization of a Wind Turbine Emulator: Modelling: Doubly Fed Induction Machine, The Static Model, The Dynamic Modelling and Model for Grid Disturbances. Control System: Vector Control, Control of Grid Side Converter and Control of Rotor Side Converter. Power Electronic Converters, Low-Voltage Ride-Through, Grid Code Requirements, Crowbar Protection, Types of Wind Turbines and Modelling of the Wind Turbine. **11Hours**

UNIT-V

Grid Infrastructure Upgrade for Large-Scale Integration: European Transmission and Distribution Networks, Network Planning for Wind Power: Benefits of and Options for Increasing Transmission Capacity, Grid Connection Requirements: Regulatory and Legal Background, Wind Power Plant Capabilities and Grid Codes and Essential Requirements for Wind Power Plants. **10Hours**

TEXT BOOKS:

1. "Wind Energy – The Facts A guide to the technology, economics and future of wind power", European Wind Energy Association (EWEA), 2009.
2. Wind Turbines: Fundamentals, Technologies, Application, Economics", Technique\\Energy, Erich Hau, 2014.

REFERENCE BOOKS:

1. "Advances in Renewable Energies and Power Technologies", TNQ Books and Journals, Imene Yahyaoui, 2018.

Department: Electrical and Electronics Engineering	**Course Type:** Core
Course Title: Machine Learning in Renewable Energy	**Course Code:**19ERE23
L-T-P:4-0-0	**Credits:**04
Total Contact Hours:52hrs	**Duration of SEE:**3hrs
SEE Marks:50	**CIE Marks:**50

Course Outcomes:

Students will be able to

1. Understand Supervised and Unsupervised Learning.
2. Understand the machine learning algorithms.
3. Understand Online and Distributed Learning
4. Understand the Forecasting Renewable Energy Generation using ML.

Teaching Methodology:

Lectures
Power Point Presentation
Case Study

Assessment Methods:

- Three internal tests for 30 Marks each – average of best two will be considered.
- Assignment based tests/ subject seminars/ mini projects for 20 marks.
- Final Examination will be conducted for 100 Marks and evaluated for 50 Marks.

Course Outcomes and their mapping with POs and PSOs (1: SLIGHT; 2: MODERATE; 3: SUBSTANTIAL)

PO	1	2	3	4	5	6	7	8	9	10	11	12	PSO1	PSO2
CO1	3												1	
CO2	3												1	
CO3	3												1	2
CO4	3												1	

UNIT-I

Supervised Learning (Regression/Classification) Basic methods: Distance-based methods, Nearest-Neighbours, Decision Trees, Naive Bayes, Linear models: Linear Regression, Logistic Regression, Generalized Linear Models Support Vector Machines, Nonlinearity and Kernel Methods Beyond Binary Classification: Multi-class/Structured Outputs, Ranking. **10Hours**

UNIT-II

Unsupervised Learning: Clustering: K-means/Kernel K-means, Dimensionality Reduction: PCA and kernel PCA, Matrix Factorization and Matrix Completion, Generative Models (mixture models and latent factor models) **10Hours**

UNIT-III

Evaluating Machine Learning algorithms and Model Selection, Introduction to Statistical Learning Theory, Ensemble Methods (Boosting, Bagging, and Random Forests), Sparse Modelling and Estimation, Modelling Sequence/Time-Series Data, Deep Learning and Feature Representation Learning. **10Hours**

UNIT-IV

Scalable Machine Learning (Online and Distributed Learning) A selection from some other advanced topics, e.g., Semi-supervised Learning, Active Learning, Reinforcement Learning, Inference in Graphical Models, Introduction to Bayesian Learning and Inference **11Hours**

UNIT-V

Forecasting Renewable Energy Generation- Wind Power Generation, Solar Energy Generation, Hydro Power Generation, Biogas Generation. **11Hours**

TEXT BOOKS/REFERENCE BOOKS:

1. Machine Learning: A Probabilistic Perspective, Kevin Murphy, MIT Press, 2012
2. The Elements of Statistical Learning, Trevor Hastie, Robert Tibshirani, Jerome Friedman, Springer 2009 (freely available online)
3. Pattern Recognition and Machine Learning, Christopher Bishop, Springer, 2007.

Department: Electrical and Electronics Engineering	**Course Type:** Program Elective-A
Course Title: Energy Systems Modelling and Analysis	**Course Code:**19EREE241
L-T-P: 3-0-0	**Credits:**03
Total Contact Hours:39hrs	**Duration of SEE:**3hrs
SEE Marks:50	**CIE Marks:**50

Course Outcomes:

Student will be able to :

1. Perform Simulation and Modelling of typical energy system
2. Analyse effect of constraints on the performance of energy systems
3. Perform Energy-Economic Analysis for typical applications

Teaching Methodology:

Lectures
Power Point Presentation
Case Study

Assessment Methods:

- Three internals, 30Marks each will be conducted and the Average of best of two will be taken, Assignment 10 marks and seminar 10 marks
- Final examination, of 100 Marks will be conducted and will be evaluated for 50Marks.

Course Outcomes and their mapping with POs and PSOs (1: SLIGHT; 2: MODERATE; 3: SUBSTANTIAL)

PO	1	2	3	4	5	6	7	8	9	10	11	12	PSO1	PSO2
CO1	3	3	3										1	2
CO2	3	3	3										1	2
CO3	3	3												2

UNIT-I

Primary energy analysis - energy balance for closed and control volume systems - applications of energy analysis for selected energy system design - modelling overview - levels and steps in model development - Examples of models – curve fitting and regression analysis. **8Hours**

UNIT-II

Modelling of energy systems – heat exchanger - solar collectors – distillation -rectification turbo machinery components - refrigeration systems - information flow diagram - solution of set of non-linear algebraic equations - successive substitution - Newton Raphson method- examples of energy systems simulation **8Hours**

UNIT-III

Objectives - constraints, problem formulation - unconstrained problems - necessary and sufficiency conditions. Constrained optimization - Lagrange multipliers, constrained variations, Linear Programming - Simplex tableau, pivoting, sensitivity analysis - New generation optimization techniques – Genetic algorithm and simulated annealing – examples. **8Hours**

UNIT-IV

Multiplier Analysis - Energy and Environmental Input / Output Analysis - Energy Aggregation – Econometric Energy Demand Modelling - Overview of Econometric Methods - Dynamic programming - Search Techniques - Univariate / Multivariate **8Hours**

UNIT-V

Case studies of optimization in Energy systems problems- Dealing with uncertainty- probabilistic techniques – Trade-offs between capital and energy using Pinch analysis. **7 Hours**

TEXT BOOKS:

1. Thermal Design and Optimization ,Bejan, A, Tsatsaronis, G and Moran, M., , John Wiley & Sons 1996
2. Design of Thermal Systems, Stoecker, W.F., McGraw Hill, 2011.

REFERENCE BOOKS

1. Design and Optimization of Thermal Systems, Yogesh Jaluria, CRC Press INC, 2008
2. Essentials of Thermal System Design and Optimization, C. Balaji, Aue Books, 2011

Department: Electrical and Electronics Engineering	**Course Type:** Program Elective-A
Course Title: Computational Fluid Dynamics for Energy Systems	**Course Code:**19EREE242
L-T-P:3-0-0	**Credits:**03
Total Contact Hours:52 hrs	**Duration of SEE:**3hrs
SEE Marks:50	**CIE Marks:**50

Course Outcomes:

Students will be able to

1. Understand the method of modelling the flow and heat transfer phenomenon.
2. Develop finite difference and finite volume discretized forms of the CFD equations.
3. Understand the various numerical schemes to solve convection and diffusion equations
4. Understand the method of modelling the flow and heat transfer phenomenon.
5. Develop finite difference and finite volume discretized forms of the CFD equations.

Teaching Methodology:

Lectures
Power Point Presentation
Case Study

Assessment Methods:

- Three internal tests for 30 Marks each – average of best two will be considered.
- Assignment based tests/ subject seminars/ mini projects for 20 marks.
- Final Examination will be conducted for 100 Marks and evaluated for 50 Marks.

Course Outcomes and their mapping with POs and PSOs (1: SLIGHT; 2: MODERATE; 3: SUBSTANTIAL)

PO	1	2	3	4	5	6	7	8	9	10	11	12	PSO1	PSO2
CO1	3												1	
CO2	3	2	2		2								1	
CO3	3	2											1	
CO4	3												2	
CO5	3												1	

UNIT-I
INTRODUCTION

Numerical simulation – Advantages, Methods of classification of PDE's, Elliptic, parabolic and hyperbolic equations, Initial and boundary conditions, Discretisation Methods, Finite Difference Expressions from Taylor's series, Uniform and non-uniform Grids - Numerical Errors, Grid Independence Test.

12 HOURS

UNIT-II
CONSERVATION EQUATION:

Mass, Momentum and Energy Equation three dimensions, Eulerian and Lagrangian Approach, Equation of State, Navier's Strokes equation, Differential and Integral form of general transport equations. **Hybrid wind energy systems** - wind with diesel power, wind with conventional grid, wind with Photovoltaic system etc.

10 HOURS

UNIT-III
CONDUCTION HEAT TRANSFER: Steady one-dimensional conduction, Two and three dimensional steady state problems, Transient one-dimensional problem, Two-dimensional Transient Problems - Finite difference and Finite Volume approach

10 HOURS

UNIT-IV

INCOMPRESSIBLE FLUID FLOW: Stream Function – Vorticity methods, Finite volume methods for Convection and diffusion problem –Central difference scheme, Upwind scheme, Hybrid scheme – Assessment of each scheme -Solution algorithm for pressure – velocity – coupling in steady flows - SIMPLE Procedure of Patankar and Spalding, SIMPLER and PISO Algorithm.. **10 HOURS**

UNIT-V

TURBULENCE MODELS: Algebraic Models – One equation model, K – ϵ Models, Standard and High and Low Reynolds number models, Prediction of fluid flow and heat transfer using standard codes **10 HOURS**

REFERENCES:

1. "Computational Fluid Flow and Heat Transfer", Muralidhar, K., and Sundararajan, T., Narosa Publishing House, New Delhi, 1995.
2. "Computer Simulation of flow and heat transfer" ,Ghoshdasdidar, P.STata McGraw-Hill Publishing Company Ltd., 1998.
3. "Numerical heat transfer fluid flow", Subas, V.Patankar Hemisphere Publishing Corporation, 1980.
4. "Finite Element Programming of the Navier-Stokes Equation",Taylor, C and Hughes, J.B. Pineridge Press Limited, U.K., 1981.
5. "Computational fluid Mechanics and Heat Transfer" Anderson, D.A., Tannehill, J.I., and Pletcher, R.H., Hemisphere Publishing Corporation, New York, USA,1984.
6. "Computational Techniques for Fluid Dynamics 1" ,Fletcher, C.A.J Fundamental and General Techniques, Springer – Verlag, 1987.
7. "Computational Techniques for fluid Dynamics 2" ,Fletcher, C.A.J Specific Techniques for Different Flow Categories, Springer – Verlag, 1987.
8. "Numerical Fluid Dynamics" , Bose, T.X., Narosa Publishing House, 1997.

Department: Electrical and Electronics Engineering	**Course Type:** Program Elective-A
Course Title: Sensors for Renewable Energy	**Course Code:**19EREE243
L-T-P:3-0-0	**Credits:**03
Total Contact Hours:39hrs	**Duration of SEE:**3hrs
SEE Marks:50	**CIE Marks:**50

Course Outcomes:

Students will be able to

1. Understand about different sensor technologies.
2. Understand different types of Sensors and its classification
3. Understand the concept of MEMS and NEMS.
4. Understand types of sensor materials.

Teaching Methodology:

Lectures
Power Point Presentation
Case Study

Assessment Methods:

- Three internal tests for 30 Marks each – average of best two will be considered.
- Assignment based tests/ subject seminars/ mini projects for 20 marks.
- Final Examination will be conducted for 100 Marks and evaluated for 50 Marks.

Course Outcomes and their mapping with POs and PSOs (1: SLIGHT; 2: MODERATE; 3: SUBSTANTIAL)

PO	1	2	3	4	5	6	7	8	9	10	11	12	PSO1	PSO2
CO1	3												1	2
CO2	3													2
CO3	3													2
CO4	3												1	2

UNIT-I **8Hours**

Introduction to sensor technologies-sensor characteristics-Physical principles of sensing – Optical components of sensors –Interface Electronic Circuits -sensor performance parameters-contemporary technologies for preparation of sensors-sensor data acquisition and Evaluation.

UNIT-II **8Hours**

Occupancy and Motion detectors-Displacement Position and Level sensors-Velocity and acceleration sensing -Surface Temperature sensor, Energy sensor Variable Load Sensor - Anemometer.

UNIT-III **8Hours**

Hydrogen sensor and its classification- Oxygen sensing technologies- Sensors for gaseous trace components - Humidity sensing technologies - Sensors for temperature, Pressure, Gas Flow and fire detection.

UNIT-IV **7Hours**

MEMS – NEMS – Nano robotics Based Sensors- TDS Meter- Radiation sensors-chemical sensors-Acoustic Sensors-Light detectors

UNIT-V

Sensor Materials and Technology - Sensor deployment- Regulations, codes and standards-
Sensor testing calibration and validation. **8Hours**

Text Books

1. "Sensors for Safety and Process Control in Hydrogen Technologies", Thomas Hübert, Lois Boon-Brett, Paperback.
2. "Hand Book of Modern Sensors", Jacob Fraden, Springer Third Edition,2004

Department: Electrical and Electronics Engineering	**Course Type:** Program Elective-B
Course Title: Large Scale Grid Integration of Renewable Energy Sources	**Course Code:** 18ERE244
L-T-P: 3-0-0	**Credits:**03
Total Contact Hours:39 hrs	**Duration of SEE:**3hrs
SEEMarks:50	**CIEMarks:**50

Course Outcomes:

Students will be able to understand

1. Status, trends in international requirement for large integration of renewable energy sources.
2. Wind forecasting methods and wind power integration-solutions and measures.
3. Grid integration of large-scale PV plants and issues, needs, conditions and enabling technologies.
4. DC distribution systems and micro grids, demand prediction.

   Distributed micro-storage system with high penetration of PV generation

Teaching Methodology:

Lectures
Power Point Presentation
Case Study

Assessment Methods:

- Three internal tests for 30 Marks each – average of best two will be considered.
- Assignment based tests/ subject seminars/ mini projects for 20 marks.
- Final Examination will be conducted for 100 Marks and evaluated for 50 Marks.

Course Outcomes and their mapping with POs and PSOs (1: SLIGHT; 2: MODERATE; 3: SUBSTANTIAL)

PO	1	2	3	4	5	6	7	8	9	10	11	12	PSO1	PSO2
CO1	3												2	1
CO2	3												2	
CO3	3												2	
CO4	3												2	1

UNIT-I

The power grid as part of a 100% renewable energy system:
Introduction, status and trends in the voluntary use of renewable energy, flexibility, role of the electricity transport, role of energy storage, Reliability in the complete renewable energy system- view of electricity consumer, view of electricity producer, view of system operator, The transition stage, renewable energy integration issues. **08 HOURS**

UNIT-II

International requirements for large integration of renewable energy sources: General overview, ancillary services in RES: Comparisons among different countries.- Active power reserves and frequency control, Reactive power control/ voltage control, RES under disturbances-fault ride through capability, renewable energy curtailment. Wind forecasting in grid and market operations, Uncertainty in wind energy production and effects of wind forecast uncertainty in the power system. Wind power forecasting systems. **08 HOURS**

UNIT-III

Grid Integration of large scale PV plants: Introduction, photoelectric observatory, Irradiance and power output fluctuations in large PV plants-at PV pant level **08 HOURS**

,smoothing power output fluctuations by using energy storage measurement and assessment of renewable generation, interconnection between renewable generation and electricity grid. Wide area network: data model with the IEC 61850 standard for smart grid.

UNIT-IV

DC distribution systems and microgrids: DC microgrid system overview, Operation and control of DC microgrids, application of DC microgrids to future smart grids, Distributed energy resources integration and demand response, Overview of modeling techniques for energy demand prediction, time of use-based bottom-up models.

08 HOURS

UNIT-V

Distributed micro-storage system with high penetration of PV generation

Overview of microgrid storage technologies-Conventional batteries, Flow batteries, super capacitors, superconducting magnetic energy storage, flywheels, comparison of characteristics of micro storage system technologies, Topologies of bidirectional electronic converter, control strategies for the ESMs of the storage devices.

07 HOURS

TEXT BOOKS:

1. "Large Scale Grid Integration of Renewable Energy Sources", Edited by Antonio Moreno-Munoz, The Institution of Engineering and Technology-IET energy engineering series 98, 2017.

REFERENCE BOOKS:

1. "Power Conversion and Control of Wind Energy Systems", Bin Wu, Yongqiang Lang, Navid Zargari, Samir Kouro, IEEE press series on power engineering, Wiley publication , 2011.
2. "Renewable Energy Grid Integration", Marco H. Balderas (ed.), Nova Science Publishers, New York, 2009.
3. "Impact of widespread photovoltaic generation on distribution systems", M. Thomson and D.G. Infield, IET Renew. Power Generation, Vol. 1, No.1, pp. 33–40,2007.

Department: Electrical and Electronics Engineering	**Course Type:** Program Elective-A
Course Title: Bio Energy Conversion Techniques	**Course Code:**19EREE245
L-T-P:3-0-0	**Credits:**03
Total Contact Hours:39hrs	**Duration of SEE:**3hrs
SEE Marks:50	**CIE Marks:**50

Course Outcomes:

Students will be able to

1. Understand the concept of biomass Technologies.
2. Understand the biomass: resources and potentials.
3. Understand the Performance of Doubly Fed Induction Generator in Wind Energy Conversion Systems.
4. Understand the Wind Farm Configuration.
5. The students will be able to understand Modelling and Characterization of a Wind Turbine Emulator.

Teaching Methodology:

Lectures
Power Point Presentation
Case Study

Assessment Methods:

- Three internal tests for 30 Marks each – average of best two will be considered.
- Assignment based tests/ subject seminars/ mini projects for 20 marks.
- Final Examination will be conducted for 100 Marks and evaluated for 50 Marks.

Course Outcomes and their mapping with POs and PSOs (1: SLIGHT; 2: MODERATE; 3: SUBSTANTIAL)

PO	1	2	3	4	5	6	7	8	9	10	11	12	PSO1	PSO2
CO1	3												1	3
CO2	3	2	2		2									3
CO3	3	2											1	3
CO4	3													3
CO5	3												1	3

UNIT-I

Executive Summary on Biomass: Introduction, Biomass Resources, Biomass Conversion Technologies, Bioenergy Markets, Interactions with other markets, Bioenergy and Policy Objectives.

08 HOURS

UNIT-II

Biomass Resources and Potentials: Overview of Biomass Feedstocks and Global Technical Potentials: Technical biomass potential, Key factors influencing technical biomass potential, Biomass potential taking into account several sustainability constraints, Regional and Short-term Biomass Utilization Scenarios, Environmental and Other Aspects of Energy Crop Production, Biomass Supply Chains and Logistics.

08 HOURS

UNIT-III

Bioenergy Routes and Conversion Technologies: Biomass – A Unique Renewable Resource, Characteristics of Bioenergy Routes, Biomass Pre-treatment and Upgrading Technologies, Biomass for Heat Applications, Biomass for Power and CHP Applications, Bio fuels for Transport Applications and Bio refineries.

08 HOURS

UNIT-IV

Biomass Trade and Bio Energy Markets: Bioenergy Markets and Opportunities, Trade in Biomass Energy Carriers, Bioenergy and Commodity Markets and Barriers to Deployment and Market Risks.

08 HOURS

UNIT-V

Bioenergy and Policy Objectives: The Role of Bioenergy in the Stationary and Transport Energy Systems, Bioenergy and Climate Change Mitigation, Bioenergy and Energy Security, Other Environmental and Socioeconomic Aspects and making policy for bioenergy deployment **07 HOURS**

TEXT BOOKS:

1. "Bioenergy – a Sustainable and Reliable Energy Source MAIN REPORT", IEA 2009 Bioenergy 2009.

REFERENCE BOOKS:

1. "Introduction to Biomass Energy Conversions", by Dr.Salim Mokraoui, King Saud University STE, Bio Mass Group.

2. "Biomass Conversion Technologies for Renewable Energy and Fuels: A Review Note", by Summit Sharma IOSR Journal of Mechanical and Civil Engineering (IOSR-JMCE).

Department: Electrical and Electronics Engineering	**Course Type:** Program Elective -A
Course Title: Power Electronics for Renewable Energy Systems	**Course Code:** 19EREE246
L-T-P: 3-0-0	**Credits:**03
Total Contact Hours:39hrs	**Duration of SEE:**3hrs
SEE Marks:50	**CIE Marks:**50

Course Outcomes:

Students will be able to

1. Understand the stand alone and grid connected renewable energy systems.
2. Understand the design of power converters for renewable energy applications.
3. Understand the various operating modes of wind electrical generators and solar energy systems.
4. Understand the maximum power point tracking algorithms

Teaching Methodology:

Lectures

Power Point Presentation

Case Study

Assessment Methods:

- Three internals, 30Markseachwill be conducted and the Average of best of two will be taken, Assignment 10 marks and seminar 10 marks
- Final examination, of 100 Marks will be conducted and will be evaluated for 50Marks.

Course Outcomes and their mapping with POs and PSOs (1: SLIGHT; 2: MODERATE; 3: SUBSTANTIAL)

PO	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**PSO1**	**PSO2**
CO1	3	3											1	
CO2	3	3	3										1	1
CO3	3	3	3										1	
CO4	3												1	1

UNIT-I

Environmental aspects of electric energy conversion: impacts of renewable energy generation on environment (cost-GHG Emission) - Qualitative study of different renewable energy resources ocean, Biomass, Hydrogen energy systems: operating principles and characteristics of: Solar PV, Fuel cells, wind electrical systems-control strategy, operating area. **08Hours**

UNIT-II

Electrical machines for renewable energy conversion **07Hours**

Review of reference theory fundamentals-principle of operation and analysis: IG, PMSG, SCIG and DFIG.

UNIT-III

Power Converters: Solar: Block diagram of solar photo voltaic system: line commutated converters (inversion-mode) - Boost and buck-boost converters- selection Of inverter, battery sizing, and array sizing. Wind: three phase AC voltage controllers- AC-DC-AC converters: uncontrolled rectifiers, PWM Inverters, Grid Interactive Inverters-matrix converters. **08Hours**

UNIT-IV

Stand-alone operation of fixed and variable speed wind energy conversion systems and solar system-Grid connection Issues -Grid integrated PMSG and SCIG Based WECS-Grid Integrated solar system. **08Hours**

UNIT-V

Hybrid renewable energy systems: Need for Hybrid Systems- Range and type of Hybrid systems- Case studies of Wind-PV- Maximum Power Point Tracking (MPPT). **08Hours**

TEXT BOOKS:

1. "Wind Electrical Systems", S.N.Bhadra, D. Kastha, & S. Banerjee Oxford University Press, 2009
2. "power electronics Hand book", Rashid .M. H Academic press, 2001.

REFERENCE BOOKS

1. "Non conventional energy sources", Rai. G.D, Khanna publishes, 1993.
2. " Solar energy utilization", Rai. G.DKhanna publishes, 1993.
3. "Wind energy system", Gray, L. Johnson, prentice hall linc, 1995.
4. Non-conventional Energy sources B.H.Khan Tata McGraw-hill Publishing Company, New Delhi.

Department: Electrical and Electronics Engineering	**Course Type:** Program Elective-A
Course Title: Energy Conservation in Electrical Systems	**Course Code:**19EREE247
L-T-P:3-0-0	**Credits:**03
Total Contact Hours:39hrs	**Duration of SEE:**3hrs
SEE Marks:50	**CIE Marks:**50

Course Outcomes:

Students will be able to

1. Study the concepts of power factor, load management
2. Understand the concept of Transformers & Motors
3. Understand the basics, types, characteristics and applications of fuel cells.
4. Study the Scope for energy conservation and its methods
5. Understand case studies for typical sectors

Teaching Methodology:

Lectures
Power Point Presentation
Case Study

Assessment Methods:

- Three internal tests for 30 Marks each – average of best two will be considered.
- Assignment based tests/ subject seminars/ mini projects for 20 marks.
- Final Examination will be conducted for 100 Marks and evaluated for 50 Marks.

Course Outcomes and their mapping with POs and PSOs (1: SLIGHT; 2: MODERATE; 3: SUBSTANTIAL)

PO	1	2	3	4	5	6	7	8	9	10	11	12	PSO1	PSO2
CO1	3						3						1	2
CO2	3						3							2
CO3	3												1	2
CO4	3												1	2
CO5	3													2

UNIT-I

Basics of Electrical Energy usage

Fuel to Power : Cascade Efficiency – Electricity Billing : Components & Costs – kVA – Need & Control – Determination of kVA demand & Consumption – Time of Day Tariff – Power Factor Basics – Penalty Concept for PF – PF Correction – Demand Side Management (a brief) **08Hours**

UNIT-II

Transformers & Motors

Transformer – Basics & Types – AVR & OLTC Concepts – Selection of Transformers – Performance Prediction - Energy Efficient Transformers - Motors: Specification & Selection – Efficiency / Load Curve – Load Estimation – Assessment of Motor Efficiency under operating conditions – Factors affecting performance – ill effects of Rewinding & Oversizing - Energy Efficient Motors – ENCON Scope. **08Hours**

UNIT-III

Fans / Pumps / Compressors

Basics – Selection – Performance Evaluation – Cause for inefficient operation – scope for energy conservation – methods (General & Latest) adopted for effecting ENCON – Economics of ENCON adoption in all the 3 utilities. **08Hours**

UNIT-IV

Illumination & Energy Efficiency Devices

Specification of Luminaries – Types – Efficacy – Selection & Application – ENCON Avenues &Economic Proposition - New Generation Luminaries (LED / Induction Lighting) -Soft Starters / Auto Star – Delta – Star Starters / APFC / Variable Speed & Frequency Drives –Time Sensors – Occupancy Sensors. **08Hours**

UNIT-V **07Hours**

Case Studies & CO_2 Mitigation

Case Study Evaluation for 3 / 4 Typical Sectors – PAT Scheme (an introduction) – CO2 Mitigation &Energy Conservation & Cost Factor.

TEXT BOOKS

1. Hamies, Energy Auditing and Conservation ; Methods Measurements, management and Case Study, Hemisphere, Washington, 1980
2. Energy Management, Trivedi, PR and Jolka KR, Commonwealth Publication, New Delhi, 1997
3. Handbook on Energy Efficiency, TERI, New Delhi, 2001

REFERENCE BOOKS

1. Peters et al. Sustainable Energy, beta – test – draft
2. Kraushaar and Ristenen, Energy and Problems of a Technical
3. Society, 1993
4. Guide book for National Certification Examination for Energy
5. Managers and Energy Auditors (Could be downloaded from
6. www.energymanagertraining.com)

Department: Electrical and Electronics Engineering	**Course Type:** Program Elective-B
Course Title: Predictive Analytics in Energy Management	**Course Code:** 19ERE251
L-T-P: 3-0-0	**Credits:** 03
Total Contact Hours: 39hrs	**Duration of SEE:** 3hrs
SEE Marks: 50	**CIE Marks:** 50

Course Outcomes:

Students will be able to

1. Understand predictive modeling process.
2. Understand Regression Modeling, Regression Trees and Rule Based Models.
3. Understand the concept of Non Linear Classification Models.
4. Analyze different case studies.

Teaching Methodology:

Lectures
Power Point Presentation
Case Study

Assessment Methods:

- Three internal tests for 30 Marks each – average of best two will be considered.
- Assignment based tests/ subject seminars/ mini projects for 20 marks.
- Final Examination will be conducted for 100 Marks and evaluated for 50 Marks.

Course Outcomes and their mapping with POs (1: SLIGHT; 2: MODERATE; 3: SUBSTANTIAL)

PO	1	2	3	4	5	6	7	8	9	10	11	12	PSO 1	PSO 2
CO1	3												1	2
CO2	3										2		1	2
CO3	3												1	2
CO4	3												1	2

UNIT-I

Introduction – A short Tour of predictive modeling process-Data Pre-processing – Over-fitting and model tuning. **08Hours**

UNIT-II

Regression Modeling – Measuring performance in Regression Models –Linear Regression and its cousins – Non Linear Regression Models. **08Hours**

UNIT-III

Regression Trees and Rule Based Models – Solubility Models – Case study in Energy Management – Classification Models – Measuring Performance in Classification Models **07Hours**

UNIT-IV

Discriminant Analysis and other Classification Models –Non Linear Classification Models-Classification Trees and Rule based Models –Grant Application Models. **08Hours**

UNIT-V

Remedies for severe class imbalance – Case Study: Job Scheduling –Measuring Predictor

Importance- Feature Selection – Factors affecting Model Performance

08Hours

TEXT BOOKS:

1. Applied Predictive Modeling, Max Kuhn, Kjell Johnson, Springer,2013
2. Modeling Techniques in Predictive Analytics, Thomas W Miller Pearson,2013

REFERENCES :

1. http://fueleconomy.gov
2. http://archive.ics.uci.edu/ml

Department: Electrical and Electronics Engineering	**Course Type:** Program Elective
Course Title: Design of Solar Energy Systems	**Course Code:**19EREE252
L-T-P:3-0-0	**Credits:**03
Total Contact Hours:39hrs	**Duration of SEE:**3hrs
SEE Marks:50	**CIE Marks:**50

Course Outcomes:

Students will be able to:

1. Understand the design concepts of solar systems.
2. Design and development of solar thermal systems.
3. Design of photovoltaic system and its components.
4. Analyze the performance of solar energy systems

Teaching Methodology:

Lectures
Power Point Presentation
Case Study

Assessment Methods:

- Three internal tests for 30 Marks each – average of best two will be considered.
- Assignment based tests/ subject seminars/ mini projects for 20 marks.
- Final Examination will be conducted for 100 Marks and evaluated for 50 Marks.

Course Outcomes and their mapping with POs and PSOs (1: SLIGHT; 2: MODERATE; 3: SUBSTANTIAL)

PO	1	2	3	4	5	6	7	8	9	10	11	12	PSO1	PSO2
CO1	3												2	2
CO2	3	2	2		2								2	2
CO3	3	2											2	2
CO4	3												2	2

UNIT-I

Design Concepts of Solar Systems

System conceptual design, design of major components, overall system, design of physical principles to the solar system based on application. The process includes idea generation, concepts election and estimation, design of major components, and overall system design, solar radiation data.

08 Hours

UNIT-II

Solar Heating and Cooling Systems

Design of solar thermal systems for water, space heating, cooling and power generation. f-Chart calculation method for sizing solar water and space heating systems. Design of non-focusing and focusing collectors.

08 Hours

UNIT-III

Solar Thermal Energy Storage

Design aspects of solar thermal energy storage systems. Selection criteria of storage materials for heating and cooling applications, selection of heat transfer fluid for heating and cooling applications. Design of LHTES for solar process heating and power generation applications.

08 Hours

UNIT-IV

Solar Photovoltaic System

Design of photovoltaic off-grid and grid- connected power systems. Design of system components - PV modules, batteries, charge controllers, inverters, auxiliaries. Performance analysis of a photovoltaic system. Using software codes for design of solar thermal and photovoltaic systems. **08 Hours**

UNIT-V

Performance Analysis

Performance analysis of various solar thermal systems, PV system and evaluation of solar thermal energy storage system, selection of components and materials, estimation of economics. Using software tools for design of solar thermal and photovoltaic systems, case studies. **07 Hours**

TEXT BOOKS:

1. "Solar Engineering of Thermal Process", Duffie .J.A and Beckman .W.A, Wiley,3rd ed., 2006.
2. "Fundamentals of Renewable Energy Processes", Da Rosa .A.V, 2nd ed., Academic Press, 2009.

REFERENCES:

1. "Solar Energy Engineering: Processes and Systems", Kalogirou .S.A, Academic Press, 2009.
2. "Solar Energy Fundamentals and Modeling Techniques", Sen .Z, Turkey, 2008.
3. "Large- Scale Solar Thermal Power Technologies", Vogel .W, Kalb .H, Wiley-VCH, 2010.
4. "Thermal Energy Storage",Dincer .I, Rosen .M, 2nd ed., Wiley, 2011.
5. "Designing with Solar Power", Prasad .D, &Snow .M, Earthscan, 2005.

Department: Electrical and Electronics Engineering	**Course Type:** Program Elective-B
Course Title: Micro and Smart Grid	**Course Code:**18ERE253
L-T-P: 3-0-0	**Credits:**03
Total Contact Hours:39hrs	**Duration of SEE:**3hrs
SEEMarks:50	**CIEMarks:**50

Course Outcomes:

The students are able to understand

1. The current power system scenario and the existing challenges in India.
2. The various communication protocols related power system and their characteristics
3. The basic concepts of smart grid and its architecture
4. Technical and economical constraints of smart grid mechanism
5. Transmission and distribution challenges in smart grid systems

Teaching Methodology:

Lectures

Power Point Presentation

Case Study

Assessment Methods:

- Three internal tests for 30 Marks each – average of best two will be considered.
- Assignment based tests/ subject seminars/ mini projects for 20 marks.
- Final Examination will be conducted for 100 Marks and evaluated for 50 Marks.

Course Outcomes and their mapping with POs and PSOs (1: SLIGHT; 2: MODERATE; 3: SUBSTANTIAL)

PO	1	2	3	4	5	6	7	8	9	10	11	12	PSO1	PSO2
CO1	3	2											1	
CO2	2	1											1	
CO3	3	1											1	
CO4	3	3											1	
CO5	3	3											1	2

UNIT-I

Introduction: Driving the move towards Smart Grids globally and in India Smart Grid. Overview of how Indian power market is organized operated and challenges being faced. Overview of how the Indian GENERATION, TRANSMISSION and DISTRIBUTION business is operated and controlled and some of the challenges being faced, software management of generation and optimize generator performance, Software to support integration of renewables, System planning & condition monitoring based maintenance, Forecasting & basic trading, Demand response, Performance management. **08Hours**

UNIT-II

Communications in Power Systems: Overview of power sector communications, Generic model of communication network needed for Smart-grid, Introduction to different communication technologies available in the market (Latest standards. Emphasis on importance of inoperability and standardization of communication protocols), Matrix of different technologies against the smart-grid communication needs in a given utility environment, AMI, AMR & MDA: How it works and how it will help to; reduce peaks manage networks more efficiently and contribute towards **08Hours**

smarter grids, Communication Standards IEC6150, Wide Area Situation Awareness (WASA), Network stability and Phasor Measurement Unit (PMU), 6Automation and Integration of Distributed Generation / Renewable Energy, Automation and Micro-grids.

UNIT-III

Smart Grid Technologies: Distribution Management Systems (DMS) and Meter Data Management (MDM) are improving energy efficiency and security of supply in Distribution Systems, Overview of Power Electronics in Electrical T&D Systems, Power Electronics in emerging Smart Grids, Transmission (DC Super Grids) , Distribution (PE facilitating the integration of, (Distributed Generation, Renewables, Microgrids, Virtual Power Plants (VPP), Storage, Fault Current Limitation, Power Electronics, Super Conducting and Magnetic types). **08Hours**

UNIT-IV

Developing technology and systems that will enable grids to work smarter in the future: Storage: Organic and Inorganic Salts & Synthetic Heat Storage, Developing technology and systems that will enable grids to work smarter in the future (Smart Meters, Recording consumption, Advanced payback options for load-management, Communication between the utility and customer's home (for home automation)), In-home controls, Demand Side Management (DSM).Power Trading & the India Energy Exchange : Encouraging Markets, Regulation enabling grids to work smarter in India, Project Financing: Financial Incentives to Enable Smart Grids in India, Smart Grid Economics: Making Smarter Grids Financially Viable, Planning for Smarter Grids. **08Hours**

UNIT-V

Transmission and Distribution challenges in Smart Grids: Challenges faced by the Transmission System Developing technology and systems that will enable smarter transmission of bulk energy (Metering, Trading mechanisms, AC – FACTS (Statcom) DC – HVDC, Fault Current Limiters), Challenges faced by the Distribution Networks:(**07Hours**

How to be more energy efficient, stable, reliable and environmentally friendly, Reducing losses, Integration of renewable Connecting/disconnecting micro-grids and virtual power plants, manage bi-directional energy flows), Developing technology and systems that will enable smarter distribution networks (DC – MVDC, Fault Current Limiters, Others (AC/DC TXs etc).

REFERENCES:

1. Join Gridwise & Smartgrids groups in LinkedIn http://www.linkedin.com/.

2. Sign up to Smart Grid News www.smartgridnews.com

3. US DoE Smart Grid Book http://www.oe.energy.gov/DocumentsandMedia/DOE_SG_Book_Single_Pages(1).pdf

4. Technology enabling the transformation of India's power distribution http://www.infosys.com/newsroom/features/power-sector-report.pdf

5. Gridwise Alliance website http://www.gridwise.org/

6. European Union Smart Grids Technology Platform http://www.smartgrids.eu/

JOURNALS AND MAGAZINES:

1. IEEE Transactions on Power Systems.

2. IEEE Transaction on Smart Grid

Department: Electrical and Electronics Engineering	**Course Type:** Program Elective-B
Course Title: Energy Forecasting, Modelling and Project Management	**Course Code:**19EREE254
L-T-P:3-0-0	**Credits:**03
Total Contact Hours:39hrs	**Duration of SEE:**3hrs
SEE Marks:50	**CIE Marks:**50

Course Outcomes:

Students will be able to

1. Understand the Role of energy in economic development and social transformation.
2. To develop forecasting models and optimization models for energy planning.
3. To equip the students in writing project proposals and making project cost estimation
4. To evaluate the limit cost of energy for various renewable energy systems.

Teaching Methodology:

Lectures
Power Point Presentation
Case Study

Assessment Methods:

- Three internal tests for 30 Marks each – average of best two will be considered.
- Assignment based tests/ subject seminars/ mini projects for 20 marks.
- Final Examination will be conducted for 100 Marks and evaluated for 50 Marks.

Course Outcomes and their mapping with POs and PSOs (1: SLIGHT; 2: MODERATE; 3: SUBSTANTIAL)

PO	1	2	3	4	5	6	7	8	9	10	11	12	PSO1	PSO2
CO1	3						1						1	2
CO2	3		2										1	1
CO3	3												1	1
CO4	3												1	1

UNIT-I **08Hours**

ENERGY SCENARIO: Role of energy in economic development and social transformation: Energy & GDP, GNP and its dynamics - Energy Sources and Overall Energy demand and Availability - Energy Consumption in various sectors and its changing pattern - Status of Nuclear and Renewable Energy: Present status and future promise.

UNIT-II **08Hours**

FORECASTING MODEL: Forecasting Techniques - Regression Analysis - Double Moving Average - Double Experimental smoothing - Triple Exponential Smoothing – ARIMA model - Validation techniques – Qualitative forecasting – Delphi technique - Concept of Neural Net Works.

UNIT-III **08Hours**

OPTIMIZATION MODEL: Principles of Optimization - Formulation of Objective Function - Constraints - Multi Objective Optimization – Mathematical Optimization Software – Development of Energy Optimization Model -Development of Scenarios – Sensitivity Analysis - Concept of Fuzzy Logic.

UNIT-IV **07Hours**

PROJECT MANAGEMENT: Project Preparation – Feasibility Study – Detailed Project Report - Project Appraisal – Social-cost benefit Analysis - Project Cost Estimation – Project Risk Analysis - Project Financing – Financial Evaluation.

UNIT-V **08Hours**

ENERGY POLICY: National & State Level Energy Issues - National & State Energy Policy - Energy Security – National solar mission - state solar energy policy - Framework of Central Electricity Authority (CEA), Central& States Electricity Regulatory Commissions (CERC & ERCs).

REFERENCE BOOKS

1. S. Makridakis, Forecasting Methods and applications. Wiley 1983
2. Yang X.S. Introduction to mathematical optimization: From linear programming to Metaheuristics, Cambridge, Int. Science Publishing, 2008
3. Austin H. Church, centrifugal pumps and blowers, John Wiley and sons, 1980.
4. Fred Luthans, Organisational Behaviour, McGraw Hill, lnc, USA, 1992.
5. Armstrong, J.Scott (ed.) Principles of forecasting: a hand book for researchers and practitioners, Norwell, Masschusetts: Kluwer Academic Publishers.2001
6. Dhandapani Alagiri, Energy Security in India Current Scenario, The ICFAI University Press,2006
7. Sukhvinder Kaur Multani, Energy Security in Asia Current Scenario, The ICFAI University Press, 2008

Department: Electrical and Electronics Engineering	**Course Type:** Program Elective -B
Course Title: Advanced Energy Storage Technologies	**Course Code:**19EREE255
L-T-P:3-0-0	**Credits:**03
Total Contact Hours:39hrs	**Duration of SEE:**3hrs
SEE Marks:50	**CIE Marks:**50

Course Outcomes:

Students will be able to

1. Understand the concept and use of Energy Storage Systems.
2. Understand the different types of Energy storage techniques.
3. Understand the Future of Energy Storage Systems.
4. Understand the Cost Models and Economic Analysis.
5. The students will be able to understand Modeling and control the Energy Storage Systems.

Teaching Methodology:

Lectures
Power Point Presentation
Case Study

Assessment Methods:

- Three internal tests for 30 Marks each – average of best two will be considered.
- Assignment based tests/ subject seminars/ mini projects for 20 marks.
- Final Examination will be conducted for 100 Marks and evaluated for 50 Marks.

Course Outcomes and their mapping with POs and PSOs (1: SLIGHT; 2: MODERATE; 3: SUBSTANTIAL)

PO	1	2	3	4	5	6	7	8	9	10	11	12	PSO1	PSO2
CO1	3													1
CO2	3	2	2		2									1
CO3	3	2												1
CO4	3													1
CO5	3													1

UNIT-I

The Use of Energy Storage: Trends in power system development: Demand side characteristics and Supply side characteristics, Energy storage as a structural unit of a power system: Energy and power balance in a storage unit and Mathematical and Economical model of storage and Storage applications. **08 Hours**

UNIT-II

Energy Storage Techniques: Thermal energy storage, Flywheel storage, Pumped hydro storage, Compressed air energy storage, Hydrogen and other synthetic fuels, Electrochemical energy storage, Capacitor bank storage, Superconducting magnetic energy storage, Energy storage in the power system itself, Considerations on the choice of a storage system. **08 Hours**

UNIT-III

The Future of Energy Storage Systems: Introduction: Nanotechnologies for energy related issues, Current state of the art: Batteries, Fuel cells, Micro engines and micro turbines, Super capacitors: Electric double layer capacitors, Electrochemical pseudo super capacitors, and Hybrid super capacitors. **08Hours**

UNIT-IV

Cost Models and Economic Analysis: Introduction, A Cost Model for Storage Technologies: The Capital Costs, Operating and Maintenance Costs, Replacement Costs, End-of-Life Costs, The Synthesis of a Cost Model. Mid- and Long-Term Applications of Energy Storage Installations in the Power System. **08 Hours**

UNIT-V

Modelling, Control, and Simulation: Introduction, Modelling of Storage Technologies: A General Approach Orientated to Simulation Objectives, The Modelling and Control of the Grid-Side Converter: Modelling, Control. The Modelling and Control of Storage-Side Converters and Storage Containers: Supercapacitors and DC–DC Converters, Secondary Batteries and DC–DC Converters and Flywheels and AC–DC Converters. **07 Hours**

TEXT BOOKS:

1. “Energy Storage System for Power Systems 2nd Edition”, The Institution of Engineering and Technology, A.G. Ter-Gazarian, 2011.
2. “Energy Storage – Technologies and Applications”, Published by InTech, Edited by Ahmed FaheemZobaa, 2013.
3. “Energy Storage in Power System”, Wiley, Francisco D´ıaz-Gonz´alez, 2016.

REFERENCE BOOKS:

1. “Energy Storage System for Power Systems 2nd Edition”, The Institution of Engineering and Technology, A.G. Ter-Gazarian, 2009.

Department: Electrical and Electronics Engineering	**Course Type:** Program Elective-B
Course Title: Waste Management and Energy Recovery	**Course Code:**19EREE256
L-T-P:3-0-0	**Credits:**03
Total Contact Hours:39hrs	**Duration of SEE:**3hrs
SEE Marks:50	**CIE Marks:**50

Course Outcomes:

Students will be able to

1. Understand the basics of waste management System
2. To familiarize students with recent energy generation techniques
3. Provide information on various methods of waste management.
4. make student realize on the importance of healthy environment

Teaching Methodology:

Lectures
Power Point Presentation
Case Study

Assessment Methods:

- Three internal tests for 30 Marks each – average of best two will be considered.
- Assignment based tests/ subject seminars/ mini projects for 20 marks.
- Final Examination will be conducted for 100 Marks and evaluated for 50 Marks.

Course Outcomes and their mapping with POs (1: SLIGHT; 2: MODERATE; 3: SUBSTANTIAL)

PO	1	2	3	4	5	6	7	8	9	10	11	12	PSO1	PSO2
CO1	3													2
CO2	3													2
CO3	3						2							2
CO4	3						2							2

UNIT-I **07Hours**

CHARACTERISTICS AND PERSPECTIVES: Sources – Types – Composition – Generation – Estimation Techniques – Characterization – Types of Collection System – Transfer Stations – Transfer Operations – Material Recycle / Recovery Facilities.

UNIT-II **08Hours**

UNIT OPERATIONS & TRANSFORMATION TECHNOLOGIES: Separation & Processing: Size Reduction – Separation through Density Variation, Magnetic / Electric Field: Densification - Physical, Chemical and Biological Properties and Transformation Technologies – Selection of Proper Mix of Technologies.

UNIT-III **08Hours**

WASTE DISPOSAL: Landfill Classification – Types – Siting Considerations – Landfill Gas (Generation, Extraction, Gas Usage Techniques) – Leachates Formation, Movement, Control Techniques Environmental Quality Monitoring – Layout, Closure & Post Closure Operation – Reclamation.

UNIT-IV **08Hours**

TRANSFORMATION TECHNOLOGIES AND VALUE ADDITION: Physical Transformation : Component Separation & Volume Reduction : Chemical Transformation –Combustion / Gasification / Pyrolysis : Energy Recovery - Biological Transformation – Aerobic Composting – Anaerobic Digestion

UNIT-V **08Hours**

HAZARDOUS WASTE MANAGEMENT & WASTE RECYCLING: Definition – Sources – Classification – Incineration Technology - Incineration vs Combustion Technology – RDF / Mass Firing – Material Recycling : Paper / Glass / Plastics etc., - Disposal of White Goods & E-Wastes

Text Books

1. Integrated Solid Waste Management, Tchobanoglous, Theisen and Vigil, 2d Ed. Mc Graw-Hill,New York, 1993.
2. Environmental Engineering, Howard S. Peavyetal, McGraw Hill International Edition, 1985

Reference Books

1. Hazardous Waste Management, LaGrega, M., et al., McGraw-Hill, c. 1200 pp., 2nd ed.,2001.
2. Hazardous Waste Chemistry, Stanley E. Manahan. Toxicology and Treatment, Lewis Publishers, Chelsea, Michigan, 1990
3. Energy from Waste – An Evaluation of Conversion Technologies, Parker, Colin and Roberts, Elsevier Applied Science, London, 1985.
4. Waste Disposal in Engineered Landfills, Manoj Datta, Narosa Publishing House, 1997

Department: Electrical and Electronics Engineering	**Course Type:** Program Elective
Course Title: Recent Advances in Solar cell design	**Course Code:**19EREE257
L-T-P:3-0-0	**Credits:**03
Total Contact Hours:52hrs	**Duration of SEE:**3hrs
SEE Marks:50	**CIE Marks:**50

Course Outcomes:

Students will be able to:

1. Understand the traditional silicon material cell structure.
2. Understand characteristics and Efficient Light-Trapping Structures of silicon cell.
3. Understand different types of nano cells solar cells and its working principle.
4. Understand different types of advancement in solar cells.

Teaching Methodology:

Lectures
Power Point Presentation
Case Study

Assessment Methods:

- Three internal tests for 30 Marks each – average of best two will be considered.
- Assignment based tests/ subject seminars/ mini projects for 20 marks.
- Final Examination will be conducted for 100 Marks and evaluated for 50 Marks.

Course Outcomes and their mapping with POs and PSOs (1: SLIGHT; 2: MODERATE; 3: SUBSTANTIAL)

PO	1	2	3	4	5	6	7	8	9	10	11	12	PSO1	PSO2
CO1	3												1	1
CO2	3	2	2		2								1	1
CO3	3	2											1	1
CO4	3												1	1

UNIT-I **08 Hours**

Traditional silicon material, cell structure and processes for silicon based solar cell, New developing silicon crystals and their challenges to the traditional silicon based solar cell processes, Immerging architectures of high efficiency silicon based solar cells and their realization processes. Effective light management in thin silicon wafers, Optoelectronic Characteristics of Passivated and Non-passivated Silicon Quantum Dot.

UNIT-II **08 Hours**

Absorption by Particulate Silicon Layer: Theoretical Treatment to Enhance Efficiency of Solar Cells Modeling and Simulation of New Generation of Thin-Film Silicon Solar Cells Using Efficient Light-Trapping Structures.

UNIT-III **08 Hours s**

Optical Anisotropy and Compositional Ratio of Conductive Polymer PEDOT: PSS and Their Effect on Photovoltaic Performance of Crystalline Silicon/Organic Heterojunction Solar Cells, Flexible, Stretchable, and Biodegradable Thin-Film Silicon Photovoltaics, Silicon Nano crystal-Based Organic/Inorganic Hybrid Solar Cells.

UNIT-IV **08 Hours**

Organic–Inorganic Hybrid Silicon Solar: Recent Advances in the Use of Silicon-

Based Photocathodes for Solar Fuel Production.

UNIT-V

Silicon Nanowire Solar Cells, Si Nanowire Solar Cells: Principles, Device Types, Future Aspects, and Challenges. **07 Hours**

REFERENCES:

1. ShadiaIkhmayies Editor, "*Advances in Silicon Solar Cells"*, Springer International Publishing AG 2018.https://doi.org/10.1007/978-3-319-69703-1.
2. R. Jha, "Solar Cell Technology and Applications" Taylors and Francis group,2009CRC press, 2009.
3. Jiahe Chen,"Recent Developments on Silicon Based Solar Cell Technologies and their Industrial Applications", Open access peer-reviewed chapter,2015.

Department: Electrical and Electronics Engineering	**Course Type:** Program Elective-B
Course Title: IOT Based Energy Management	**Course Code:**19EREE258
L-T-P:3-0-0	**Credits:**03
Total Contact Hours:39hrs	**Duration of SEE:**3hrs
SEE Marks:50	**CIE Marks:**50

Course Outcomes:

Students will be able to

1. Understand Energy Management Multidisciplinary challenges.
2. Understand different types of Energy Management Systems.
3. Understand the concept of smart appliances and Smart embedded appliances network.
4. Understand Power supplies for low power applications.

Teaching Methodology:

Lectures
Power Point Presentation
Case Study

Assessment Methods:

- Three internal tests for 30 Marks each – average of best two will be considered.
- Assignment based tests/ subject seminars/ mini projects for 20 marks.
- Final Examination will be conducted for 100 Marks and evaluated for 50 Marks.

Course Outcomes and their mapping with POs and PSOs (1: SLIGHT; 2: MODERATE; 3: SUBSTANTIAL)

PO	1	2	3	4	5	6	7	8	9	10	11	12	PSO1	PSO2
CO1	3										2		1	1
CO2	3										2			1
CO3	3												1	1
CO4	3													1

UNIT-I

Energy Management Multidisciplinary challenges- demand response management of dependable systems **08Hours**

UNIT-II

Intelligent small scale Decentralized Energy systems- online energy management systems IoT based on-line energy management systems. **08Hours**

UNIT-III

Model Based design of smart appliances – wireless standard for building automation and energy management. **08Hours**

UNIT-IV

Smart embedded appliances network –security considerations- embedded and Integrated Platforms for Energy Management **07Hours**

UNIT-V

Power supplies for low power applications – Design of energy management units for smart metering **08Hours**

TEXT BOOKS

1. Christoph Grimm, Peter Neumann, Embedded Systems for Smart Appliances and Energy Management, springer, 2013

Department: Electrical and Electronics Engineering	**Course Type:** Core
Course Title: Simulation Lab	**Course Code:**19EREL26
L-T-P:0-0-4	**Credits:02**
Total Contact Hours:36	**Duration of SEE:**3hrs
SEE Marks: 50	**CIE Marks:**50

Course Outcomes:

Students will be able to understand :

1. Load forecasting, yield optimization, predictive maintenance, demand management, energy theft and customer insights using AI techniques
2. Energy trading, virtual agents, suppliers selection, consumption insights using machine learning

Practical sessions

Assessment Methods:

1. 20 marks for observation, 20 marks for record and 10 marks for internal test.
2. 50 marks external examination.

Course Outcomes and their mapping with POs and PSOs (1: SLIGHT; 2: MODERATE; 3: SUBSTANTIAL)

PO	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**PSO1**	**PSO2**
CO1	3			3									1	
CO2	3			3									1	1

List of experiments

1. Load Forecasting : Use machine learning to forecast supply and demand in real time and optimize economic load despatch

2. Yield Optimization: Using AI optimize generation efficiency with real time adjustments across assets

3. Predictive Maintenance: Deep learning algorithms to automatically identify defects and predict failures without interrupting operations

4. Demand Management: machine learning algorithm implementation to help unlock demand-side flexibility which can be shifted during the evening peak without affecting end users.

5. Energy Theft: AI can be used to detect usage patterns, payment history, and other customer data that may signal irregular behaviour.

6. Customer Insights: Machine learning applications could allow utilities to craft electricity prices that maximize their margins while minimizing customer churn. AI could be used to create individual offers and services to help utilities retain their most profitable customers.

7. Energy Trading: In this era of the prosumer generating their own renewable energy and sending the excess back into the grid, platforms are emerging to allow peer-to-peer trading between producers and consumers. As supply and demand continuously fluctuates, AI can be used to more quickly match producers with consumers.

8. Virtual Agents: will revolutionize call centres, being able to respond to consumer queries and provide instant assistance. They will be able to automatically segment consumers based on service history and provide early warning of bad debts. The development of natural language technologies will eventually unlock the capacity to fully automate customer service.

9. Supplier Selection: Machine learning can help customers choose their energy retailer by learning about their preferences – such as energy generation type, how much they're willing to pay and their consumption patterns – and then scanning the market for the most suitable offers

10. Consumption Insights: Meter data can be analysed to extract the consumption profiles of a household's hungriest appliances and see how much each contributes to the energy bill. Universal disaggregation algorithm uses machine learning and a database of over 50 billion meter readings from smart meters to extend the appliance profiling to homes without smart meters.

Department: Electrical and Electronics Engineering	**Course Type: Core**
Course Title: Energy Laboratory-2	**Course Code:18EREL17**
L-T-P:0-0-4	**Credits:02**
Total Contact Hours: 36	**Duration of SEE:3hrs**
SEE Marks: 50	**CIE Marks:50**

Course Outcomes:

Students will be able to understand

1. The concept of virtual grid and comparison with actual grid in terms of voltage regulation and THD at PCC and Observation of current for linear & nonlinear loads and voltage waveform at PCC and Power factor improvement using capacitor bank and its impact on power quality at PCC
2. Synchronization of grid tied inverter, observation of current waveform and calculations for distortion, displacement and power factor of grid tied inverter, evaluation of the active, reactive power and net energy flow between grid tied inverter, artificial grid & load and understanding islanding protection for sudden failure of grid.
3. Evaluation of different parameters U_L, F_R and η in thermos phonic mode and forced mode for Solar thermal system.

Teaching Methodology:

Practical sessions

Assessment Methods:

3. 20 marks for observation, 20 marks for record and 10 marks for internal test.
4. 50 marks external examination.

Course Outcomes and their mapping with POs (1: SLIGHT; 2: MODERATE; 3: SUBSTANTIAL)

PO	1	2	3	4	5	6	7	8	9	10	11	12	PSO1	PSO2
CO1	3			3									1	
CO2	3			3									1	
CO3	3			3									2	1

List of experiments

1) Set-up for virtual grid and comparison with actual grid in terms of voltage regulation and THD at PCC
2) Observation of current for linear & nonlinear loads and voltage waveform at PCC
3) Power factor improvement using capacitor bank and its impact on power quality at PCC
4) Synchronization of grid tied inverter, observation of current waveform and calculations for distortion, displacement and power factor of grid tied inverter
5) Evaluation of the active, reactive power and net energy flow between grid tied inverter, artificial grid & load
6) Demonstration of islanding protection for sudden failure of grid.
7) Evaluation of different parameters (U_L, F_R and η) in thermos phonic mode of flow with fixed input parameters, different radiation level/ inlet water temperature/ wind speed/ tilt angle
8) Evaluation of different parameters (U_L, F_R and η) in forced mode of flow with fixed input parameters/ different flow rate.9) Evaluation of different parameters (U_L, F_R and η) in forced mode of flow at different radiation level/ inlet water temperature/ wind speed/ incident angle.

NITTE MEENAKSHI INSTITUTE OF TECHNOLOGY

(An Autonomous Institution)

Affiliated to Visvesvaraya Technological University, Belgaum.

Yelahanka, Bangalore - 560 064

DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

M.Tech in Computer Science & Engineering

SCHEME AND SYLLABUS

(21 SCHEME)

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Vision

To impart technical education of a very high quality to the post graduate students of Computer Science and Engineering which will empower them to be technically adept and agile, innovative, self-motivated, ethical and responsible global citizens who can contribute significantly to the industrial development, pursue higher education with focus on blue-sky and application oriented research, in order to improve the quality of life of all citizens in this ever changing world.

Mission

The M.Tech in Computer Science and Engineering strives to prepare students

- For a challenging professional career and nurture entrepreneurship by grooming their leadership skills and innovative ability, thereby enabling them to serve the engineering profession and society.
- To gain proficiency in specific domains by adopting conducive teaching–learning processes and providing them a highly challenging research environment.

PROGRAMME EDUCATIONAL OBJECTIVES (PEOs)

1. Excel in Professional career by acquiring knowledge in multi-disciplinary advanced algorithms, development methodologies and their applications to industrial research.
2. Graduates will pursue higher education and research in state-of-the-art technical areas of Computer Science & Engineering.
3. Graduates will adapt to technological advancements by engaging in lifelong learning with leadership qualities, professional ethics and soft skills.

PROGRAM SPECIFIC OUTCOMES (PSOs)

By the completion of M. Tech in Computer Science and Engineering program, the student will have the ability to

PSO1: Professional Skills

The ability to analyze, design, implement and conduct Advanced Research in the domain of Machine Learning, Big Data Analytics, Data Mining, Cloud Computing, Wireless Sensor Networking, Web Mining and Web Development, IOT, Android Application etc.

PSO2: Problem Solving Skills

Ability to apply the technologies learnt including additional Hands-on Training programs to solve the practical problems of Industry and take part in conducting Workshops and Hands-on
Training program.

PSO3: Ethics and Career Development

Ability to adopt professional skills, intellectual integrity, ethics of research and soft skills to nurture the quest for higher levels of knowledge.

PROGRAMME OUTCOMES (PO's)

1. Scholarship of Knowledge
Graduates will acquire in-depth knowledge of Computer Science & Engineering and able to discriminate, evaluate, analyse and synthesis the existing and new technology in the emerging areas considering wider and global perspective.

2. Critical Thinking
Graduates will be able to analyse the complex Computer Science & engineering problems critically, apply independent judgement for synthesis information to make intellectual and creative advances for conducting research in a wider theoretical, practical and policy context.

3. Problem Solving
Graduates will be able to conceptualize and solve Computer Science & Engineering problems, formulate alternate design solutions and arrive at feasible and optimal solutions considering public health, safety and societal factors.

4. Research Skill
Graduates will be able to apply appropriate research methodologies through literature survey, techniques and conduct experiments, analyse and interpret data to demonstrate higher order skills in a broader perspective to contribute for the development of technological knowledge in Computer Science Engineering Domain.

5. Usage of modern tools
Graduates will be able to understand the limitations of complex Computer Science & Engineering problems by applying appropriate techniques, resources and modern Software tools.

6. Collaborative and Multidisciplinary work
Graduates will be in a position to understand the advantages of group activities and contribute positively to collaborative-multidisciplinary research.

7. Project Management and Finance
Graduates will be able to manage the knowledge of Computer Science & Engineering effectively within given financial and time constraints, which leads to the larger multidisciplinary projects.

8. Communication

Graduates will be able to write effective reports and design documentation as per the required standards and communicate effectively with the Computer Science & Engineering community and society.

9. Life-long Learning

Graduates will recognize the technological advancement and upgrade their knowledge, skills and ability to engage in independent and life-long learning.

10. Ethical Practices and Social Responsibility

Graduates will have professional and intellectual integrity, ethics of research and scholarship by considering sustainable development of society.

11. Independent and Reflective Learning

Graduates will observe and examine critically the impact of one's actions and make corrective measures subsequently.

SEMESTER - I

Sl. No	Subject Code	Subject Name	Course Type	Teaching Dept.	Teaching Hours/week			Examination			Credits
					L#	T#	P#	CIE*	SEE*	Total	
1	21CSE101	Mathematical foundations of Computer Science	M	Mathematics	4	0	0	50	50	100	4
2	21CSE102	Machine Learning and Intelligent Data Analytics	PC	CSE	4	0	0	50	50	100	4
3	21CSE103	Hybrid Programming-CUDA, MPI, Open-MP	PC	CSE	3	0	0	50	50	100	3
4	21CSE104	Wireless and Mobile Networks	PC	CSE	3	0	0	50	50	100	3
5	21CSE105EX	Program Elective 1	PE	CSE	3	0	1	50	50	100	4
6	21CSE106EX	Program Elective 2	PE	CSE	3	0	1	50	50	100	4
7	21CSE107L	Applications of Machine Learning Laboratory	PL	CSE	0	0	4	50	50	100	1
8	21CSE108P	Mini Project	PP	CSE	0	0	4	50	50	100	1
TOTAL								**350**	**350**	**700**	**24**

Program Elective 1

Sl. No.	Subject Code	Subject Name
1	21CSE105E1	Reinforcement Learning
2	21CSE105E2	E-Commerce and Web Security
3	21CSE105E3	Advances in Computer Graphics
4	21CSE105E4	Advanced Operating Systems

Program Elective 2

Sl. No.	Subject Code	Subject Name
1	21CSE106E1	Natural Language Processing
2	21CSE106E2	Information Systems Security
3	21CSE106E3	Virtual and Augmented Reality
4	21CSE106E4	Advanced Databases Systems

SEMESTER - II

Sl. No	Subject Code	Subject Name	Course Type	Teaching Dept.	Teaching Hours/week			Examination			Credits
					L#	T#	P#	CIE*	SEE*	Total	
1	21CSE201	Block Chain Technology	PC	CSE	4	0	0	50	50	100	4
2	21CSE202	Image Processing and Computer Vision	PC	CSE	3	0	0	50	50	100	3
3	21CSE203	Big Data Analytics	PC	CSE	3	0	0	50	50	100	3
4	21CSE204	Advanced Data Structures and Algorithms	PC	CSE	4	0	0	50	50	100	4
5	21CSE205EX	Programme Elective 3	PE	CSE	3	0	1	50	50	100	4
6	21CSE206EX	Programme Elective 4	PE	CSE	3	0	1	50	50	100	4
7	21IC27	Research Methodology & IPR	PR	CSE	2	0	0	50	50	100	2
8	21CSE208P	Mini Project	PP	CSE	0	0	2	50	50	100	1
TOTAL								**350**	**350**	**700**	**25**

Program Elective 3

Sl. No.	Subject Code	Subject Name
1	21CSE205E1	Deep Learning
2	21CSE205E2	IOT Security
3	21CSE205E3	Animation / Video Games Design
4	21CSE205E4	Dynamic Programming and Randomized Algorithms

Program Elective 4

Sl. No.	Subject Code	Subject Name
1	21CSE206E1	Advances in Natural Language Processing
2	21CSE206E2	Cyber Forensics
3	21CSE206E3	Human Computer Interaction
4	21CSE206E4	Advanced Compiler Design

SEMESTER – III

Sl. No	Subject Code	Subject Name	Course Type	Teaching Dept.	Teaching Hours/week			Examination			Credits
					L#	T#	P#	CIE*	SEE*	Total	
1	21CSE301	NPTEL Course/ MOOC/ SWAYAM	PC		3	0	0	50	50	100	3
2	21CSE302I	Internship*	PI		0	0	24	50	50	100	12
3	21CSE303P	Project Phase 1	PP		0	0	8	50	50	100	4
TOTAL								**150**	**150**	**300**	**19**
***To be completed during Summer Vacation after 1st Year for a period of 8 to 12 Weeks.**											

SEMESTER - IV

Sl. No	Subject Code	Subject Name	Course Type	Teaching Dept.	Teaching Hours/week			Examination			Credits
					L#	T#	P#	CIE*	SEE*	Total	
1	21CSE401P	Project Phase 2 Thesis Assessmen t / Evaluation and Viva Voce	PP		0	0	40	100	100	200	20
TOTAL								**100**	**100**	**200**	**20**

* Continuous Internal Evaluation (CIE), ** Semester End Exam (SEE)
$ - Internal evaluation, # - External Examiner Evaluation

I SEMESTER

Department: *Computer Science and Engineering (PG)*
Course Type: *Programme Elective*
Course Title*: Mathematical foundations of Computer Science*
Course Code: *21CSE101*
L-T-P: *3-1-0*
Credits: *4*
Total Contact Hours: *50 Hours*
Duration of SEE: *3 Hours*
SEE Marks*: 50*
CIE Marks: *50*

COURSE DESCRIPTION

This is a foundation course which imparts basic knowledge of various topics requested in computer science field such as linear Algebra, Graph theory, Fuzzy logic, Probability and Fourier analysis.

PREREQUISITES

Integral calculus, Matrices, Set theory, Basic Probability theory

COURSE OBJECTIVES

To impart fundamental concepts and techniques related to Graph theory, Fuzzy logic, Linear algebra through problem solving and applications

COURSE CONTENTS

UNIT 1 **12 Hours**

Linear Algebra: Vector space and sub spaces, Linear dependence, Basis, dimension, change of basis Linear Transformations, Matrix representation, Eigen values and Eigen vectors, diagonalization, inner product, Orthogonality, Gram Schmidt process

Numerical Methods: Forward, backward and central differences, NEWTON'S forward and backward interpolation formula, Lagrange's interpolation, Newton's divided difference formula, cubic spline.

UNIT 2 **8 Hours**

Graph Theory: - Graphs, graph models, special types of graphs, graph isomorphism, connectivity, Euler and Hamilton paths, shortest path problems, planar graphs, trees, application of trees, spanning trees, minimum spanning tree.

UNIT 3 **10 Hours**

Linear Programming: Simplex, Big M and Dual Simplex methods,

Non-Linear Programming: Local and Global optima, Golden mean search and Fibonocci search

Fourier Transforms: Complex, Sine and Cosine transforms, Inverse transforms, DFT, FFT

UNIT 4	10 Hours

Fuzzy set theory: - Basic definitions, set operations, properties of Fuzzy sets, alternative fuzzy set operations, problems, Fuzzy relations, tolerance and equivalence relations, λ-cuts for fuzzy relations, fuzzy logic, decision making with fuzzy information

UNIT 5	10 Hours

Probability theory: Random variable, Probability distribution, Discrete and continuous, probability density function and cumulative density functions, binomial, Poisson, Normal, uniform, Gamma, Weibull distributions, Joint distribution, Expectation, variance, co-variance, Estimation, Testing of hypothesis, Test for goodness of fit using chi square test, Baye's rule, Random process, stationary process, autocorrelation and covariance.

TEXT BOOKS

1. Discrete mathematics and its applications with combinatorics and graph theory, by Kenneth H Rossen, 7th edition
2. Linear algebra by S Lipschutz and M Lipson, 3rd edition
3. Probability and Statistics for Science and Engg. , G Shanker Rao
4. Fuzzy Logic with engg. Applications, T J Ross, 3rd edition
5. Operation research, Hamdy Taha, 7th edition, Pearson education
6. Numerical Methods for Scientific and Engg. Computation, M K Jain, S R K Iyengar, R K Jain, 6th edition

TEACHING METHODOLOGY

- Black Board Teaching
- Tutorials
- Problem solving
- Power Point presentation

ASSESSMENT METHODS

1. Three internals – 30 marks each will be conducted and the average of best of two will be considered
2. Assignment – 10 marks, Quiz- 10 marks
3. Final Examination –Conducted for 100 and evaluated for 50 marks

Course Outcomes:

After completion of the course, the student will be able to:

CO	Description
CO1	Analyze the problems arising in computer science, model using Techniques of Linear algebra and graph theory
CO2	Obtain reasonable solutions using appropriate techniques of graph theory, linear algebra.
CO3	Interpret data using probability theory, and implement concept of estimation, testing and Fuzzy logic
CO4	Analyze and draw useful conclusions using concepts of probability Fuzzy logic.
CO5	Model problems arising in computer science and solve using Fourier trans forms and numerical techniques

Mapping of Course outcomes (COs) to Program outcomes (POs)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO 1	PSO 2	PSO 3
CO1	3	2	3											
CO2	3	2	3											
CO3	3	2	3											
CO4	3	2	3											
CO5	3	3	3											

I SEMESTER

Department: Computer Science and Engineering (PG)	***Course Type:*** *Programme Core*
Course Title*: Machine Learning and Intelligent Data Analytics*	***Course Code:*** *21CSE102*
L-T-P: *3-1-1*	***Credits:*** *4*
Total Contact Hours: *50 Hours*	***Duration of SEE:*** *3 Hours*
SEE Marks*: 50*	***CIE Marks:*** *50*

COURSE DESCRIPTION

This course focuses on the theory of learning machines and intelligent data analytics (IDA), which are important techniques underlying data mining and many AI applications. The topics include concepts of Machine Learning, types, supervised learning, ubiquitous learning machines such as support vector machines; unsupervised learning,Evolutionary learning, visualization techniques and IDA applications.

PREREQUISITES

Probability, Statistics, Data structures

COURSE OBJECTIVES

To introduce the basic concepts and techniques of Machine Learning and Intelligent Data Analysis.

- To be familiar with a set of well-known supervised,semi-supervised and unsupervised learning algorithms
- To develop the skills in using recent machine learning software for solving practical problems.
- To build the intelligent data analysis solutions

COURSE CONTENTS

UNIT 1 **10 Hours**

Introduction: Machine Learning, Types of Machine Learning, Machine Learning Process, Machine Learning Applications. Machine Learning Preliminaries, Basic Statistics, Neurons and Neural Networks.

UNIT 2 **10 Hours**

Intelligent Data Analysis (IDA): Introduction, Statistical concepts and methods, Bayesian methods, Support Vector Machines: Optimal Separation, Kernels, SVM Algorithm, Multiclass Classification, SVM Regression. Kernel PCA, CCA.

UNIT 3 **10 Hours**

Bayesian Learning: Introduction, Classification, Losses and Risks, Discriminant Functions, Utility Theory, Association Rules, Bayes Optimal Classifier, Naïve Bayes Classifier, Bayesian Belief

Networks. Nearest Neighbor Methods: K-nearest Neighbor Learning, Distance – Weighted Nearest Neighbor Algorithm, Examples. Decision Trees: Learning with Trees, Using Decision Trees, Univariate Trees, Classification Trees, Regression Trees, Pruning, Rule Extraction from Trees,

UNIT 4	10 Hours

Learning Rules from Data, Multivariate Trees, ID3, Examples.

Stochastic Search Methods: Introduction, Simulated Annealing, Stochastic, Adaptive Search by Evolution. Evolutionary Learning: The Genetic Algorithm, Genetic Operators, Using Genetic Algorithms, Genetic Programming, combining sampling with Evolutionary learning.

UNIT 5	10 Hours

Unsupervised Learning-Clustering: Introduction, Mixture Densities, K-means Clustering, Expectation-Maximization Algorithm, Mixtures of Latent Variable Models, Supervised Learning after Clustering, Hierarchical Clustering, Choosing the Number of Clusters. Visualization: Introduction, Classification of Visual Data Analysis Techniques, Data types to be visualized, Visualization Techniques, Interaction Techniques, Specific Visual Data Analysis Techniques. Intelligent Data Analysis Applications.

TEXT BOOKS

1. Stephan Marsland, Machine Learning, An algorithmic Perspective, CRC Press Second Edition, 2015.
2. Ethem Alpaydin, Introduction to Machine Learning, 2nd Ed., PHI Learning Pvt. Ltd., 2013.
3. Michael Berthold, David J.Hand, Intelligent Data Analysis, Springer,2007.

REFERENCE BOOKS

1. Tom M. Mitchell, Machine Learning, McGraw-Hill Education (INDIAN EDITION), 2013
2. T. Hastie, R. Tibshirani, J. H. Friedman, The Elements of Statistical Learning, Springer, First Edition, 2001.
3. K.Murphy, Machine Learning: A Probabilistic Perspective, MIT Press,2012.
4. Wes McKinney, Python for Data Analysis, O'Reilly Media, Inc., First Edition,2013.
5. Ian H. Witten,Eibe Frank, Mark A. Hall, Data Mining Practical Machine Learning Tools and Techniques, Morgan Kaufmann, Third Edition,2011.

TEACHING METHODOLOGY

- Black board teaching
- Lectures
- Power Point Presentation
- Problem based learning
- Demonstration

ASSESSMENT METHODS

- Total - 50 marks include
    a. Three internals for 30 Marks each will be conducted and the Average of best of two will be taken
    b. Surprise test / Tutorials tests to be conducted for each topic for 10 marks.
    c. Mini project / Case study based on practical application for 10 marks.
- Final SEE Examination of 100 Marks will be conducted and will be evaluated for 50 Marks

COURSE OUTCOMES

After completion of the course, the students will be able to:

CO	DESCRIPTION	Bloom's Level
CO1	Describe the concepts related to machine learning and intelligent data analytics	L2
CO2	Recognize the characteristics of machine learning techniques that are useful to solve real-world problems	L2
CO3	Implement and apply machine learning algorithms	L3
CO4	Examine a complete intelligent data analytics solution	L4
CO5	Select appropriate algorithms for solving a particular group of real-world problems	L5

Course Outcome to Programme Outcome Mapping

Mapping of Course outcomes (COs) to Program outcomes (POs)												
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	2									
CO2	3	2	2									2
CO3	2	2	2	2	2					3	2	2
CO4	3	2	2	2	2					2	2	2
CO5	3	2	2	2	2					2	2	2

3: Strong, 2: Medium, 1: Weak ** H: Highly related S: Supportive

I SEMESTER

Department: *Computer Science and Engineering (PG)*	***Course Type:*** *Programme Core*
Course Title*: Hybrid Programming-CUDA, MPI, Open-MP*	***Course Code:*** *21CSE103*
L-T-P: *3-1-1*	***Credits:*** *4*
Total Contact Hours: *52 Hours*	***Duration of SEE:*** *3 Hours*
SEE Marks*: 50*	***CIE Marks:*** *50*

COURSE DESCRIPTION

This course covers the theoretical principles of massively parallel approach to high- performance computing using multiprocessing systems and/or combination of GPU hardware. Knowledge on basics of Computer Organization

PREREQUISITES

COURSE OBJECTIVES

- Provide an overview of existing High-Performance Computing (HPC) software and hardware
- Present basic software design patterns for high performance parallel computing
- Introduce CUDA for parallel computing on the Graphics Processing Unit (GPU)

COURSE CONTENTS

UNIT 1 — 10 Hours

Introduction to High Performance Computers: Memory Hierarchy, CPU Design: Reduced Instruction Set Computers, Multiple Core Processors, Vector Processors.

Programming Shared Address Space Platforms: Thread Basics, the POSIX Thread API, Thread Creation and Termination, Thread Cancellation

UNIT 2 — 10 Hours

Shared-memory parallel programming with OpenMP: Introduction to OpenMP, Parallel execution, Data scoping , OpenMP work-sharing for loops , Reductions , Loop scheduling , Tasking , Efficient OpenMP programming :Profiling OpenMP programs , Performance pitfalls: Ameliorating the impact of OpenMP work sharing constructs , Serialization , False sharing.

UNIT 3 — 10 Hours

Programming using the Message-Passing Paradigm: Principles of Message-Passing Programming, The Building Blocks: Send and Receive Operations, MPI: The Message Passing Interface, Topologies and Embedding, Overlapping Communication with Computation, Collective Communication and Computation Operations.

UNIT 4	12 Hours

GPUs as Parallel Computers: Architecture of a Model GPU, Why More Speed or Parallelism? GPU Computing. Introduction to CUDA: Data Parallelism, CUDA Program Structure, A Vector Addition Kernel , Device Global Memory And Data Transfer, Kernel Functions and Threading.

UNIT 5	12 Hours

CUDA Threads: CUDA Thread Organization, Mapping Threads To Multidimensional Data, Synchronization and Transparent Scalability, Assigning Resources to Blocks, Thread Scheduling and Latency Tolerance

TEXT BOOKS

1. Ananth Grama,Anshul Gupta,Vipin kumar, George Karypis, Introduction to parallel computing, second edition, 2003, Pearson education publishers.
2. David B Reference Books: Wen-mei W. Hwu, "Programming Massively Parallel Processors on Approach", First edition, Elsevier and nvidia publishers 2010.
3. Georg Hager, Gerhard Wellein, Introduction to High Performance Computing for Scientists and Engineers, Taylor and Francis Group, LLC, CRC Press, 2011

REFERENCE BOOKS

- Thomas Rauber and Gudula Runger Parallel Programming for Multicore and cluster systems, Springer International Edition, 2009.
- Hennessey and Patterson Computer Architecture: A quantitative Approach, Morgan Kaufman Publishers, 2011.
- Michael J. Quin Parallel Programming in C with MPI and Open MP", McGraw Hill.
- Rubin H Landau, Oregon State University, http://science.oregonstate.edu/ rubin/.

TEACHING METHODS

- Black Board Teaching.
- Power point presentation (If needed).
- Tutorial Classes.

ASSESSMENT METHODS

Continuous internal Evaluation (CIE) for 50 Marks

- Surprise test / Tutorials tests to be conducted for each topic for 10 marks.
- Mini project / Case study based on practical application for 10 marks.
- Three mid semester examinations will be conducted each for 30 marks and the average of best of two will be taken.

Semester End Examination (SEE) for 50 Marks

Final examination, of 100 Marks will be conducted and will be evaluated for 50 marks.

COURSE OUTCOMES

After completion of the course, the students will be able to:

CO	DESCRIPTION	Bloom's Level
CO1	Explain the technologies and architectures used for parallel computing	L1
CO2	Design and develop parallel programs using Open-MP programming interface	L3
CO3	Elaborate the principles and architecture of message-passing programming paradigm for solving real world problems	L2
CO4	Provide an understanding of Graphical Processing Units and their architecture	L1
CO5	Analyze the features of GPUs, their functionalities and also Design parallel applications using CUDA-C	L3

Course Outcome to Programme Outcome Mapping

Mapping of Course outcomes (COs) to Program outcomes (POs)															
CO\PO	1	2	3	4	5	6	7	8	9	10	11	12	PSO1	**PSO2**	**PSO3**
CO1	3	2	1										1		
CO2	1	2	3												
CO3	3	1	1	2	3										
CO4	1	2	3	1	1								3	1	
CO5	3	3	3	1	3			1	1				3	1	

***3: Strong, 2: Medium, 1: Weak** ****3: Highly related 2: Supportive**

"A" Grade,

I SEMESTER

Department: *Computer Science and Engineering (PG)*	***Course Type:*** *Programme Core*
Course Title*: Wireless and Mobile Networks*	***Course Code:*** *21CSE104*
L-T-P: *3-1-1*	***Credits:*** *4*
Total Contact Hours: *52 Hours*	***Duration of SEE:*** *3 Hours*
SEE Marks*: 50*	***CIE Marks:*** *50*

COURSE DESCRIPTION

This course focuses on the introduction to Wirelss and Mobile Networks, Wireless Medium Access Control, Wireless Telecommunication Systems, Satellite Systems, Broadcast Systems and Mobile Networks

PREREQUISITES

Basics of Computer Networks

COURSE OBJECTIVES

- To introduce the basic concepts and techniques of Wireless and Mobile Networks
- To be familiar with a set of well-known wireless telecommunication Systems
- To be familiar with Satellite Syetsm and Broadcast systems
- To get the knowledge on Mobile Network Layers

COURSE CONTENTS

UNIT 1 — 10 Hours

Introduction to Wireless and Mobile Networks: Applications**,** A short history of wireless communication, a short history of wireless communication**,** some open research topics, a simplified reference model.

Wireless Transmission: Signals, Antennas, Signal Propagation, Multiplexing, Modulation, Spread Spectrum

UNIT 2 — 10 Hours

Wireless Medium Access Control: Common Problems, SDMA, FDMA, TDMA, CDMA

Wireless Telecommunications Systems: GSM, DECT, TETRA, UMTS, IMT-2000, LTE

UNIT 3 — 10 Hours

Satellite Systems: Introduction, Deficiencies of existing GEO/MEO/LEO Satellite Systems, Satellite Architectures, Satellite Routing, Satellite Channel Access, Satellite Handover, High Altitude Platforms, and Applications.

UNIT 4 **12 Hours**

Broadcast systems: Overview, Cyclical repetition of data**,** Digital audio broadcasting, Digital video broadcasting, Convergence of broadcasting and mobile communications

Wireless LAN: IEEE 802.11, Bluetooth, RFID, Security issues.

Mobile Network Layer I: Problems of IP in Wireless, Principles behind Mobile IP, Problems, Security issues, DHCP.

Mobile Network Layer II: Routing in Ad-hoc Networks, Wireless Sensor Networks

UNIT 5 **12 Hours**

Mobile Transport Layer: Effects of mobility and wireless transmissions on reliable transport protocols such as TCP.

Support for Mobility: File Systems, databases, WWW and Mobility, WAP, Application layer for mobile networks.

TEXT BOOKS

1. J. Schiller, Mobile Communications, 2nd edition, Addison Wesley.
2. Wireless Communications and Networks, William Stallings, 2nd edition, Prentice Hall.

TEACHING METHODS

- Black Board Teaching.
- Power point presentation (If needed).
- Tutorial Classes.

ASSESSMENT METHODS

Continuous internal Evaluation (CIE) for 50 Marks

- Surprise test / Tutorials tests to be conducted for each topic for 10 marks.
- Mini project / Case study based on practical application for 10 marks.
- Three mid semester examinations will be conducted each for 30 marks and the average of best of two will be taken.

Semester End Examination (SEE) for 50 Marks

Final examination, of 100 Marks will be conducted and will be evaluated for 50 marks.

COURSE OUTCOMES

After completion of the course, the students will be able to:

CO	DESCRIPTION	Bloom's Level
CO1	Describe the concepts related to Wireless and Mobile Networks and Wireless Transmission	L2
CO2	Recognize the problems of and usage of Wireless Medium Access Control	L2

CO3	Describe the Concepts of Satellite and Broadcast Systems	L2
CO4	Recognize the Problems of IP in Wireless and usage of Mobile IP and support for mobility	L2

Course Outcome to Programme Outcome Mapping

Mapping of Course outcomes (COs) to Program outcomes (POs)												
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	3	2	2									
CO2	3	2	2									
CO3	2	2	2									
CO4	3	2	2									
CO5	3	2	2									

3: Strong, 2: Medium, 1: Weak ** H: Highly related S: Supportive

I SEMESTER

Department: *Computer Science and Engineering (PG)*	***Course Type:*** *Programme Elective*
Course Title: *Reinforcement Learning*	***Course Code:*** *21CSE105E1*
L-T-P: *3-1-0*	***Credits:*** *4*
Total Contact Hours: *50 Hours*	***Duration of SEE:*** *3 Hours*
SEE Marks: *50*	***CIE Marks:*** *50*

COURSE DESCRIPTION

Reinforcement learning is an area of machine learning where an agent learns how to behave in an environment by performing actions and assessing the result.

PREREQUISITES

Basics of machine learning, deep learning and Python programming and mathematical models.

COURSE OBJECTIVES

- To learn the basics of reinforcement learning (RL) and methods & algorithms used in RL like Markov decision process, dynamic programming etc.
- To practice implementing reinforcement techniques using Python, for gaming and other application.
- To get knowledge of Monte Carlo method, Deep Q learning and advanced techniques for reinforcement learning.

COURSE CONTENTS

UNIT 1 **11 Hours**

Reinforcement Learning problem: Reinforcement learning (RL), examples, elements, Multi-arm Bandits : basics & theory, An n-Armed Bandit Problem, Action value methods, incremental implementation.

UNIT 2 **11 Hours**

Markov decision processes: The Agent–Environment Interface, Goals and Rewards, returns, The Markov property, Markov decision process, optimality & approximation, Dynamic programming basics.

UNIT 3 **10 Hours**

RL with Python: RL algorithm, RL applications, RL VS ML, RL environment &

platforms, RL applications, Getting started with OpenAI and TensorFlow

UNIT 4	09 Hours

Gaming with Monte Carlo methods: Monte Carlo methods, Monte Carlo prediction, Monte Carlo control. Examples and programs.

UNIT 5	09 Hours

Q Learning, Deep Q network (DQN), DQN Architecture, Gaming using DQN – Atari & Doom examples.
Recent advancements: Overview, Hierarchical reinforcement learning, inverse reinforcement learning.

TEXT BOOKS

- Richard S. Sutton and Andrew G. Barto, "Reinforcement learning: An introduction", Second
Edition, MIT Press, 2015/2019
- Sudharsan Ravichandiran, "Hands-On Reinforcement Learning with Python", Packt Publishing, 2018

References:

- https://github.com/sudharsan13296/Hands-On-Reinforcement-Learning-With-Python
- Li, Yuxi. "Deep reinforcement learning." arXiv preprint arXiv:1810.06339 , 2018.

TEACHING METHODOLOGY

- Black Board Teaching
- Tutorials
- Problem solving
- Power Point presentation

ASSESSMENT METHODS

1. Three internal assessment exams – 30 marks each will be conducted and the average of best of two will be considered
2. Course project – 10 marks, Seminar - 10 marks
3. Final Examination –Conducted for 100 and evaluated for 50 marks

Course Outcomes:

After completion of the course, the student will be able to:

CO	Description	BL
CO1	Explain basics of reinforcement learning and the techniques used.	L2
CO2	Illustrate Markov decision processes and dynamic programming methods used commonly for RL.	L2
CO3	Demonstrate the RL development skills with Python.	L2
CO4	Apply Montel Carlo methods for RL gaming applications.	L3
CO5	Analyse & implement Q learning methods deep queue network and recent advancements in RL.	L4

Mapping of Course outcomes (COs) to Program outcomes (POs)														
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO 1**	**PSO 2**	**PSO 3**
CO1	3		3	3					3				3	
CO2	3		3	3					3				3	
CO3	3		3		3				3				3	
CO4	3		3	3	3				3				3	
CO5	3		3	3	3				3				3	

I SEMESTER

Department: *Computer Science and Engineering (PG)*	***Course Type:*** *Programme Elective*
Course Title*: E-COMMERCE and Web Security*	***Course Code:*** 21CSE105E2
L-T-P: *3-1-0*	***Credits:*** *4*
Total Contact Hours: *39 Hours*	***Duration of SEE:*** *3 Hours*
SEE Marks*: 50*	***CIE Marks:*** *50*

COURSE DESCRIPTION & OBJECTIVES

This course provides an introduction to information systems for business and management. It is designed to familiarize students with organizational and managerial foundations of E-commerce and security issues that araises

PREREQUISITES

COURSE CONTENTS

UNIT 1

Electronic Commerce Environment and Opportunities:
Background, The Electronic Commerce Environment, Electronic Marketplace Technologies. Modes of Electronic Commerce: Electronic Data Interchange, Migration to Open EDI, Electronic Commerce with www/Internet, Commerce Net Advocacy, web Commerce Going Forward.

UNIT 2

Approaches to Safe Electronic Commerce:

Secure Transport Protocols, Secure Transactions, Secure Electronic Payment Protocol (SEPP), Secure Electronic Transaction (SET), Certificates for authentication Security on web Servers and Enterprise Networks. Electronic Cash and Electronic Payment Schemes: Internet Monetary Payment & Security Requirements. Payment and Purchase Order Process, On-line Electronic cash.

UNIT 3

Internet/Intranet Security Issues and Solutions:
The need for Computer Security, Specific Intruder Approaches, Security Strategies, Security Tools, Encryption, Enterprise Networking and Access to the Internet, Antivirus Programs, Security Teams.

UNIT 4

Master Card/Visa Secure Electronic Transaction:
Introduction, Business Requirements, Concepts, payment Processing. E-Mail and Secure E- mail Technologies for Electronic Commerce: Introduction, The Means of Distribution, A model for Message Handling, E-mail working, Multipurpose Internet Mail Extensions, Message Object

Security Services, Comparisons of Security Methods, MIME and Related Facilities for EDI over the Internet.

UNIT 5

Internet Resources for Commerce:
Introduction, Technologies for web Servers, Internet Tools Relevant to Commerce, Internet Applications for Commerce, Internet Charges, Internet Access and Architecture, Searching the Internet. Advertising on Internet: Issues and Technologies. Introduction, Advertising on the Web, Marketing creating web site, Electronic Publishing Issues, Approaches and Technologies: EP and web based EP.

Text Books:

1.Web Commerce Technology Handbook, by Daniel Minoli, Emma Minoli, McGraw-Hill
2.Frontiers of electronic commerce by Galgotia.

Reference Books:

1. E-Commerce fundamentals and applications Hendry Chan, Raymond Lee, Tharam Dillon, Ellizabeth Chang, John Wiley.

Course Outcomes:

After Completion of the subject student should able to

- Understand the basic concepts and technologies used in the field of E-commerce.
- Analyze the concepts of the different Approaches to Safe Electronic Commerce and security issues;
- Understand the processes of developing and implementing information systems with different internet and intranet security Strategies;
- Understanding and implementing the ethical, social, and security issues in E-commerce;
- Students are able to develop E-commerce website and deploy in web servers, with publishing and marketing.

Course Outcomes:

At the end of the course student will be able to

CO	Description
CO 1	Understand the basic concepts and technologies used in the field of E-commerce.
CO 2	Understand and analyse the concepts of the different Approaches to Safe Electronic Commerce and security issues.
CO 3	Understand the processes of developing and implementing information systems with different internet and intranet security Strategies;
CO 4	Understand the E-Mail and Secure E- mail Technologies for Electronic Commerce

CO 5	Understand and analyse the Internet Resources for Commerce.

Mapping of Course Outcomes (COs) to Program Outcomes (POs*)& PSO **															
Course Outcomes mapping to Program Outcomes													**PSOs**		
PO/CO	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**PSO1**	**PSO2**	**PSO3**
CO1	3	3	2										3	2	
CO2	3	2	2										3	2	
CO3	3	2	2										3	2	
CO4	3	2							2				3	2	2
CO5	3	2							3				3		3

3: Strong, 2: Medium,1:Weak** * 2: Highly related 3:Supportive**

I SEMESTER

Department: *Computer Science and Engineering (PG)*	***Course Type:*** *Programme Elective*
Course Title*: Advances in Computer Graphics*	***Course Code:*** *21CSE105E3*
L-T-P: *3-1-0*	***Credits:*** *4*
Total Contact Hours: *50 Hours*	***Duration of SEE:*** *3 Hours*
SEE Marks*: 50*	***CIE Marks:*** *50*

COURSE DESCRIPTION

PREREQUISITES

Fundamentals of Compute Graphics, c,c++,Java. Python

COURSE OBJECTIVES

COURSE CONTENTS

UNIT 1 — 10 Hours

Review of Two and Three -dimensional graphics

Review of two-dimensional graphics Transformations Windowing Clipping. Three Dimensions 3D geometry, primitives and transformations. Rotation about an arbitrary axis Parallel and perspective projection Viewing parameters 3D clipping and viewing transformation

UNIT 2 — 10 Hours

Curves and Fractals and Solid Modeling Representing:

Curves and Fractals: Polygon Meshes Parametric Cubic curves: B-spline, Bezier, Hermite. Parametric

Bicubic Surfaces Quadric surfaces Fractals: fractal lines and surfaces Applications

Solid Modeling Representing solids : Regularized Boolean Set Operations Primitive Instancing Sweep and Boundary Representations Spatial-partitioning Representations Constructive Solid Geometry User Interface for Solid Modeling

UNIT 3 — 10 Hours

Hidden Lines and Surfaces:

Algorithms for Visible-Line and Surface determination: zbuffer, List priority, Scan line, Area Subdivision, Ray Tracing

Hidden Lines and Surfaces and Image based Rendering

UNIT 4	09 Hours

Hidden Lines and Surfaces Algorithms for Visible-Line and Surface determination: zbuffer, List priority, Scan line, Area Subdivision, Ray Tracing Image based Rendering Introduction

UNIT 5	09 Hours

comparison with geometry
Animation Introduction morphing character animation and facial animation Graphics Hardware Special-purpose computer graphics processors and accelerators

TEXT BOOKS

1. Computer Graphics: principals and practice Foley, vanDam, Feiner Hughes Addision Wesley
2. Mathematical Elements of Graphics Roges Tata McGrow Hill
3. Computer Graphics Donald Hearn and M.Pauline Baker Prentice Hall
4. Procedural Elements-Computer Graphics, David Rogers, TMH
5. Principals of Computer graphics, Shalini Govil-pal, springer

TEACHING METHODOLOGY

- Black Board Teaching
- Tutorials
- Problem solving
- Power Point presentation

ASSESSMENT METHODS

1. Three internal assessment exams – 30 marks each will be conducted and the average of best of two will be considered
2. Assignment – 10 marks, Quiz- 10 marks
3. Final Examination –Conducted for 100 and evaluated for 50 marks

Course Outcomes:
After completion of the course, the student will be able to:

CO	Description	BL
CO1	Learn more about 2D, 3D and Curve applications	
CO2	Understand ,identify and apply graphics algorithms and functions	
CO3	Applying efficient graphics technique to solve engineering problems	
CO4	Understand image fundamentals and animations	
CO5	To Introduce various Graphics Applications in real world scenario.	

Mapping of Course outcomes (COs) to Program outcomes (POs)														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO 1	PSO 2	PSO 3
CO1	3	3												
CO2	3													
CO3	3	3	3	2	3						2	3	3	
CO4	3		3	2	3						2	3	3	
CO5	3	3	3	3	3						2	3	3	

I SEMESTER

Department: *Computer Science and Engineering (PG)*	***Course Type:*** *Programme Core*
Course Title*: Advanced Operating Systems*	***Course Code:*** *21CSE105E4*
L-T-P: *3-1-1*	***Credits:*** *4*
Total Contact Hours: *50 Hours*	***Duration of SEE:*** *3 Hours*
SEE Marks*: 50*	***CIE Marks:*** *50*

COURSE DESCRIPTION

This course focuses on the Operating system overview, Threads, SMP, and Microkernel, Multiprocessor and Real-Time Scheduling Virtual Memory, Multiprocessor and Real-Time Scheduling, Embedded Operating Systems and Kernel Organization.

PREREQUISITES

NA

COURSE OBJECTIVES

- Provides the overview of Operating Systems.
- Study of Threads, SMP, and Microkernel, Virtual Memory
- To work on Multiprocessor and Real-Time Scheduling
- Overview of Embedded Operating Systems and Kernel Organization

COURSE CONTENTS

UNIT 1 — 10 Hours

Operating System Overview, Process description & Control: Operating System Objectives and Functions, The Evolution of Operating Systems, Major Achievements, Developments Leading to Modern Operating Systems, Microsoft Windows Overview, Traditional UNIX Systems, Modern UNIX Systems, What is a Process? Process States, Process Description, Process Control, Execution of the Operating System, Security Issues.

UNIT 2 — 10 Hours

Threads, SMP, and Microkernel, Virtual Memory: Processes and Threads, Symmetric Multiprocessing (SMP), Micro Kernels, Windows Vista Thread and SMP Hours Management, Linux Process and Thread Management. Hardware and Control Structures, Operating System Software, UNIX Memory Management, Windows Vista Memory Management, Summary

UNIT 3	10 Hours

Multiprocessor and Real-Time Scheduling: Multiprocessor Scheduling, Real-Time Scheduling, Linux Scheduling, Windows Vista Hours Scheduling, Process Migration, Distributed Global States, Distributed Mutual Exclusion, Distributed Deadlock

UNIT 4	10 Hours

Embedded Operating Systems: Embedded Systems, Characteristics of Embedded Operating Systems, eCOS, TinyOS, Computer Security Concepts, Threats, Attacks, and Assets, Intruders, Malicious Software Overview, Viruses, Worms, and Bots, Rootkits.

UNIT 5	10 Hours

Kernel Organization: Using Kernel Services, Daemons, Starting the Kernel, Control in the Machine, Modules and Device Management, MODULE Organization, MODULE Installation and Removal, Process and Resource Management, Running Process Manager, Creating a new Task, IPC and Synchronization, The Scheduler, Memory Manager, The Virtual Address Space, The Page Fault Handler, File Management.

TEXT BOOKS

William Stallings: Operating Systems: Internals and Design Principles, 6th Edition, Prentice Hall, 2013.

1. Gary Nutt: Operating Systems, 3rd Edition, Pearson, 2014.

REFERENCE BOOKS

1. Silberschatz, Galvin, Gagne: Operating System Concepts, 8th Edition, Wiley, 2008.
2. Andrew S. Tanenbaum, Albert S. Woodhull: Operating Systems, Design and Implementation, 3rd Edition, Prentice Hall, 2006.
3. Pradeep K Sinha: Distribute Operating Systems, Concept and Design, PHI, 2007.

TEACHING METHODOLOGY

- Black board teaching
- Lectures
- Power Point Presentation

ASSESSMENT METHODS

Total - 50 marks include

a. Three internals for 30 Marks each will be conducted and the Average of best of two will be taken
b. Surprise Test – 10 Marks
c. Assignment – 10 Marks

- Final SEE Examination of 100 Marks will be conducted and will be evaluated for 50 Marks

COURSE OUTCOMES

After completion of the course, the students will be able to:

CO	DESCRIPTION
CO1	Analyze and demonstrate the Mutual exclusion, Deadlock detection and agreement protocols of Distributed operating system.
CO2	Describe the various resource management techniques for distributed systems.
CO3	Identify and analyze the different features of real time and mobile operating system.
CO4	Illustrate and modify existing open source kernels in terms of functionality or features used.

Course Outcome to Programme Outcome Mapping

Mapping of Course outcomes (COs) to Program outcomes (POs)														
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	PSO 1	PSO 2	PSO 3
CO 1	3	2	2									2	2	2
CO 2	3	2	2									2	2	2
CO 3	2	2	2	2	2						2	2	2	2
CO 4	3	2	2	2	2						2	2	2	2

I SEMESTER

Department: *Computer Science and Engineering (PG)*	***Course Type:*** *Programme Elective*
Course Title*: Natural Language Processing*	***Course Code:*** *21CSE106E1*
L-T-P: *3-1-1*	***Credits:*** *4*
Total Contact Hours: *52 Hours*	***Duration of SEE:*** *3 Hours*
SEE Marks*: 50*	***CIE Marks:*** *50*

COURSE DESCRIPTION

Regular Expressions, Automata, Similarity Computation, Computational Phonology, Text-to-Speech, Probabilistic Models of Pronunciation and Spelling, Speech Recognition, Parsing with Context-Free Grammars, Features, Unification, Lexical Semantics, Information Retrieval, Text Sequence Modeling and Deep Learning are introduced in this course contains.

PREREQUISITES

Data Structure, Theory of Computation and Compiler Design.

COURSE OBJECTIVES

Students will learn how to process written text from basic of fundamental knowledge starts with Finite automata, Regular expression and probabilistic model with n-grams. Recognizing Speech and parsing with grammar. This course also covers basis of semantic analysis and discourse analysis and drives it to machine translation. This NLP course will boost student knowledge to research level where they can conduct new level of research.

COURSE CONTENTS

UNIT 1 — 8 Hours

Introduction of NLP: Knowledge in Speech and Language processing, ambiguity, models and algorithms, language and understanding.

Regular Expressions, Automata, Similarity Computation: Regular Expressions, patterns, Formal Language, NFSA, Regular Language and FSAs, Text normalization, Minimum edit distance & similarity computation in text.

Morphology and Finite-State Transducers: Inflection, Derivational Morphology, Finite-State Morphological Parsing, The Lexicon and Morphotactics, Morphological Parsing with Finite State Transducers, Combining FST Lexicon and Rules, Lexicon-free FSTs: The Porter Stemmer, Human Morphological Processing.

UNIT 2	10 Hours

N-grams: Counting Words in Corpora, Simple (Unsmoothed) N-grams, Smoothing, Backoff, and Interpolation, N-grams for Spelling and Pronunciation, Entropy.

Matrix Factorization and Topic Modeling: Introduction, Singular Value Decomposition, Nonnegative Matrix Factorization, Probabilistic Latent Semantic Analysis, Latent Dirichlet Allocation.

UNIT 3	10 Hours

HMMs and Speech Recognition: Overview of Hidden Markov Models, The Viterbi Algorithm, Training HMMs: The forward backward algorithm, Maximum entropy models.

Automatic speech recognition: Speech recognition Architecture, Applying HMM to speech.

Word Classes and Part-of-Speech Tagging: Tag-sets for English, Part of Speech Tagging, Rule-based Part-of-speech Tagging, HMM Part-of-speech Tagging, Transformation-Based Tagging.

UNIT 4	12 Hours

Context-Free Grammars for English: Context-Free grammars, Sentence-Level Constructions, The Noun Phrase, Agreement, The Verb Phrase and Sub categorization, Auxiliaries, Coordination, Grammar Equivalence & Normal Form, Finite State & Context-Free Grammars, Dependency Grammars, Spoken Language Syntax, Grammars & Human Processing.

Parsing with Context-Free Grammars: Parsing as Search, A Basic Top-down Parser, The Earley Algorithm, Partial parsing methods.

Features & unification: Feature Structures, Unification of Feature Structures, Features Structures in the Grammar, Implementing Unification, Parsing with Unification Constraints, Types and Inheritance.

Statistical Parsing: Probabilistic Context-Free Grammars, Problems with PCFGs, Probabilistic Lexicalized CFGs, Human Parsing. The Chomsky Hierarchy.

UNIT 5	12 Hours

Representing Meaning and Semantic Analysis: Computational Desiderata for Representations, First Order logic, Representing events & states, Alternative Approaches to Meaning,

Computational Semantics: Syntax-Driven Semantic Analysis, Semantic attachments for a Fragment of English, Integrating Semantic Analysis into the Earley Parser, Idioms and Compositionality.

Lexical Semantics and Information Retrieval: Word senses, Relation between Senses, WordNet: A Database of Lexical Relations, **Word sense Disambiguation** (WSD), Supervised, minimally supervised & unsupervised WSD, **Information extraction**: Named Entity recognition, **Information Retrieval** overview. Machine translation – overview.

Computational Discourse: Text Coherence, Reference Resolution, Discourse Structure, Psycholinguistic Studies of Reference and Coherence.

TEXT BOOKS

1. Daniel Jurafsky and James H. Martin Speech and Language Processing (2nd Edition), Prentice Hall, 2nd edition,2008.
2. Machine Learning for Text by Charu C. Aggarwal, Springer, 2018 edition
3. Foundations of Statistical Natural Language Processing by Christopher D. Manning and Hinrich Schuetze, MITpress, 1999

REFERENCE BOOKS

1. Steven Bird, Ewan Klein and Edward Loper Natural Language Processing with Python, O'Reilly Media;1 edition,2009
2. Roland R. Hausser, Foundations of Computational Linguistics: Human Computer Communication in Natural Language, Paperback, MIT press,2011

TEACHING METHODS

- Black Board Teaching.
- Power point presentation (If needed).
- Tutorial Classes.

ASSESSMENT METHODS

Continuous internal Evaluation (CIE) for 50 Marks

- Surprise test / Tutorials tests to be conducted for each topic for 10 marks.
- Mini project / Case study - based on practical application for 10 marks.
- Three mid semester examinations will be conducted each for 30 marks and the average of best of two will be taken.

Semester End Examination (SEE) for 50 Marks

Final examination, of 100 Marks will be conducted and will be evaluated for 50 marks.

COURSE OUTCOMES

CO	Description	BL
1.	Explain Natural language & speech processing basics and the techniques involved.	2
2.	Develop general models for natural language processing (NLP).	4
3.	Apply HMM models & other techniques in speech & language processing.	3

4.	Implement various grammars and parsing techniques for language processing.	4
5.	Illustrate semantics and related analysis and also different applications of NLP.	2

Course Outcome to Programme outcome Mapping:

PO	1	2	3	4	5	6	7	8	9	10	11	PSO1	PSO2	PSO3
CO1	3	3	3									2	3	
CO2	3	3	3									2	3	
CO3	3	3	3	3							3	2	3	
CO4	3	3	3	3							2	2	3	
CO5	3	3	3	3					3		2	2	3	

I SEMESTER

Department: *Computer Science and Engineering (PG)*	***Course Type:*** *Programme Elective*
Course Title*: Information Systems Security*	***Course Code:*** *21CSE106E2*
L-T-P: *3-1-0*	***Credits:*** *4*
Total Contact Hours: *50 Hours*	***Duration of SEE:*** *3 Hours*
SEE Marks*: 50*	***CIE Marks:*** *50*

COURSE DESCRIPTION

This course covers the introduction to Information System Security. It highlights the need for security against threats and attacks in the network. The security models, cryptographic protocols, intrusion detection and prevention systems are also discussed in the course

PREREQUISITES

Internetworking with TCP/IP , Cryptography and Network Security

COURSE OBJECTIVES

1. The course will incorporate the foundational understanding of Information Security.
2. The course will incorporate the threats and network perimeter security design principles and provide abilities to review procedures for installation, troubleshooting and monitoring of network devices to maintain integrity, confidentiality and availability of data and devices

COURSE CONTENTS

UNIT 1 — 08 Hours

Introduction: Computer Security Concepts, The OSI Security Architecture, Security Attacks, Security Services, Security Mechanisms, Fundamental Security Design Principles, Attack Surfaces and Attack Trees, A Model for Network Security, **Standards**.

UNIT 2 — 10 Hours

Cryptography: Symmetric Encryption and Message Confidentiality: Symmetric Encryption Principles, Symmetric Block Encryption Algorithms, Random and Pseudorandom Numbers, Stream Ciphers and RC4, Cipher Block Modes of Operation. **Public-Key Cryptography and Message Authentication:** Approaches to Message Authentication, Secure Hash Functions, Message Authentication Codes, Public-Key Cryptography Principles, Public-Key Cryptography Algorithms, Digital Signatures.

UNIT 3 — 12 Hours

Network Security Applications: Key Distribution and User Authentication: Remote User Authentication Principles, Symmetric Key Distribution Using Symmetric Encryption, Kerberos, Key Distribution Using Asymmetric Encryption, X.509 Certificates, Public-Key Infrastructure, Federated Identity Management.

Wireless Network Security: Wireless Security, Mobile Device Security, IEEE 802.11 Wireless LAN Overview, IEEE 802.11i Wireless LAN Security. **Electronic Mail Security:** Internet Mail Architecture, E-mail Formats, E-mail Threats and Comprehensive E-mail Security, S/MIME, Pretty Good Privacy, DNSSEC, DNS-Based Authentication of Named Entities, Sender Policy Framework, DomainKeys Identified Mail, Domain-Based Message Authentication, Reporting, and Conformance.

UNIT 4	12 Hours

IP Security: IP Security Overview, IP Security Policy, Encapsulating Security Payload, Combining Security Associations, **Internet** Key Exchange, Cryptographic Suites.

System Security: Malicious Software: Types of Malicious Software (Malware), Advanced Persistent Threat, Propagation—Infected Content—Viruses, Propagation—Vulnerability Exploit—Worms, Propagation—Social Engineering—Spam E-mail, Trojans, Payload—System Corruption, Payload—Attack Agent—Zombie, Bots, Payload—Information Theft—Keyloggers, Phishing, Spyware, Payload—Stealthing—Backdoors, Rootkits, Counter measures, Distributed Denial of Service Attacks.

UNIT 5	08 Hours

Intruders: Intruders, Intrusion Detection, Password Management. **Firewalls:** The Need for Firewalls, Firewall Characteristics and Access Policy, Types of Firewalls, Firewall Basing, Firewall Location and Configurations.

TEXT BOOKS

1. W. Stallings, Network Security Essentials (6th Edition), Prentice Hall, 2018

REFERENCE BOOKS

1. Principles of Information Security, 6th edition, Michael E Whittman, Herbert J Mattord, CENGAGE Learning, 2018

TEACHING METHODOLOGY

- Black Board Teaching
- Tutorials
- Problem solving
- Power Point presentation

ASSESSMENT METHODS

1. Three internals – 30 marks each will be conducted and the average of best of two will be considered
2. Assignment – 10 marks, Seminar- 10 marks
3. Final Examination –Conducted for 100 and evaluated for 50 marks

Course Outcomes:

After completion of the course, the student will be able to:

CO	Description	BL
CO1	Explain the core concepts of Fundamental Security Design Principles.	L1
CO2	Apply fundamental concepts Cryptography to adopt right security measures and design real time scenarios using algorithms.	L3
CO3	Implement Network Security Applications using Key Distribution and User Authentication	L4
CO4	Design/develop/ implement the IP security solution for a given malicious software/application.	L4
CO5	Using the concept of intruders and firewall design/develop an application.	L3

Mapping of Course outcomes (Cos) to Program outcomes (Pos)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO 1	PSO 2	PSO 3
CO1	3											3		
CO2		3	3										3	
CO3			3										3	
CO4			3		2				3					3
CO5		3							3					3

I SEMESTER

Department: *Computer Science and Engineering (PG)*	***Course Type:*** *Programme Elective*
Course Title: Virtual and Augmented Reality	***Course Code****: 21CSE106E3*
L-T-P: *3-1-0*	***Credits:*** *4*
Total Contact Hours: *50 Hours*	***Duration of SEE:*** *3 Hours*
SEE Marks*: 50*	***CIE Marks:*** *50*

COURSE DESCRIPTION

This course provides the fundamental knowledge of computer vision, computer graphics and human-computer interaction techniques related to VR/AR, knowledge of geometric modeling and Virtual environment, Knowledge to relate and differentiate VR/AR technology, ability to use various types of Hardware and software in virtual Reality systems and the ability to implement Virtual/Augmented Reality applications.

PREREQUISITES

NA

COURSE OBJECTIVES

The objective of the course is to establish and cultivate a broad and comprehensive understanding of this rapidly evolving technology of VR and AR. Integrating AR/VR in development can provide improved experience for learning in sectors like education, Increased efficiency in Business, Unmatchable Virtual Experience, Increase In User Engagement, Boost In Brand Loyalty, Mobility, Better Advertising of products and many more.

COURSE CONTENTS

UNIT 1 — 10 Hours

Introduction to Virtual Reality:
Virtual Reality and Virtual Environment: Introduction, Computer graphics, Real time computer graphics, Flight Simulation, Virtual environment requirement, benefits of virtual reality, Historical development of VR, Scientific Landmark.

Computer Graphics And Geometric Modelling:
Introduction, The Virtual world space, positioning the virtual observer, the perspective projection, human vision, stereo perspective projection, Colour theory, Conversion From 2D to 3D, 3D space curves, 3D boundary representation, Simple 3D modelling, 3D clipping.

UNIT 2	10 Hours

Computer Graphics And Geometric Modelling Contd…

Illumination models, Reflection models, Shading algorithms. Geometrical Transformations: Introduction, Frames of reference, Modelling.

Virtual Environment:

Input: Tracker, Sensor, Digital Gloves, Movement Capture, Video-based Input, 3D Menus & 3D Scanner etc.

Output: Visual /Auditory / Haptic Devices.

Generic VR system: Introduction, Virtualenvironment, Computer environment, VR technology, Model of interaction, VR Systems.

UNIT 3	12 Hours

Virtual Environment Contd…

Animating the Virtual Environment: Introduction, The dynamics of numbers, Linear and Nonlinear interpolation, the animation of objects, linear and non-linear translation, shape & object in between, free from deformation, particle system.

Physical Simulation: Introduction, Objects falling in a gravitational field, Rotating wheels, Elastic collisions, projectiles, simple pendulum, springs, Flight dynamics of an aircraft.

Augmented Reality:

Taxonomy, technology and features of augmented reality, difference between AR and VR, Challenges with AR, AR systems and functionality, Augmented reality methods, visualization techniques for augmented reality, enhancing interactivity in AR environments, evaluating AR systems.

UNIT 4	10 Hours

Development Tools and Frameworks:

Human factors: Introduction, the eye, the ear, the somatic senses.

Hardware: Introduction, sensor hardware, Head-coupled displays, Acoustic hardware, Integrated VR systems.

Software: Introduction, Modelling virtual world, Physical simulation, VR toolkits, Introduction to VRML

UNIT 5	10 Hours

AR / VR Applications:

Introduction, Engineering, Entertainment, Science, Training.

TEXT BOOKS

1. Grigore C. Burdea, Philippe Coiffet , Virtual Reality Technology, Wiley 2016
2. Alan B. Craig, Understanding Augmented Reality, Concepts and Applications, Morgan Kaufmann, 2013.
3. Alan Craig, William Sherman and Jeffrey Will, Developing Virtual Reality Applications, Foundations of Effective Design, Morgan Kaufmann, 2009.
4. John Vince, "Virtual Reality Systems ", Pearson Education Asia, 2007.
5. Anand R., "Augmented and Virtual Reality", Khanna Publishing House, Delhi.

TEACHING METHODOLOGY

- Black Board Teaching
- Power Point presentation
- Course Project

ASSESSMENT METHODS

1. Three internals – 30 marks each will be conducted and the average of best of two will be considered
2. Course Project– 20 marks
3. Final Examination –Conducted for 100 and evaluated for 50 marks

Course Outcomes:

After completion of the course, the student will be able to:

CO	Description
CO1	Understand fundamental computer vision, computer graphics and human-computer interaction techniques related to VR/AR. (Understand)
CO2	Understand geometric modeling and Virtual environment.(Understand)
CO3	Relate and differentiate VR/AR Technology(Analyze)
CO4	To use various types of Hardware and software in virtual Reality systems (Apply)
CO5	To implement Virtual/Augmented Reality applications. (Apply)

Mapping of Course outcomes (COs) to Program outcomes (POs)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3											3		
CO2	3											3		
CO3	2	3										3		
CO4	2	2	3		1				1	1		3	2	
CO5	2	2	3		1				1	1		3	2	

I SEMESTER

Department: *Computer Science and Engineering (PG)*	***Course Type:*** *Programme Elective*
Course Title*: Advanced Database Management System*	***Course Code:*** *(21CSE106E4)*
L-T-P: *3-1-0*	***Credits:*** *4*
Total Contact Hours: *50 Hours*	***Duration of SEE:*** *3 Hours*
SEE Marks*: 50*	***CIE Marks:*** *50*

COURSE DESCRIPTION

This course imparts the concepts of advanced database management concepts which is the necessity in today's versatile and heterogeneous data processing applications. It includes the concepts of storage, indexing techniques, object oriented databases, parallel and distributed databases and emerging trends in data.

PREREQUISITES

- Students should have knowledge of database.
- Students should have knowledge of SQL queries

COURSE OBJECTIVES

- To understand and describe the need of storage and indexing, indexing methods and data storage formats.
- To describe object oriented databases, parallel and distributed databases.
- To understand emerging database technologies and applications.

COURSE CONTENTS

UNIT 1 — 10 Hours

Overview of Storage and Indexing, Disks and files: Data on external storage; File organizations and Indexing, Index data structures; Comparison of file organizations, Indexes and performance tuning.

Storing Data : Disks and Files: Memory hierarchy: RAID; Disk space management; Buffer manager: Files of records; Page formats and record format.

UNIT 2 — 10 Hours

Tree Structured Indexing: Intuition for tree indexes; Indexed sequential access method; B+ trees, Search, Insert, Delete, Duplicates, B+ trees in practice

Hash-Based Indexing: Static hashing; Extendible hashing, Linear hashing, Comparisons.

UNIT 3 **10 Hours**

Object Database Systems : Structured Data Types, Operations on Structured Data, Encapsulation and ADT, Inheritance, Overview of Object-Oriented Concepts – Objects, Encapsulation, Inheritance, Objects, OID and Reference Types, Database Design for ORDBMS, ORDBMS Implementation Challenges, OODBMS, Comparison of RDBMS, OODBMS, ORDBMS.

UNIT 4 **10 Hours**

Parallel and Distributed Databases: Architectures for parallel databases; Parallel query evaluation; Parallelizing individual operations; Parallel query optimizations; Introduction to distributed databases; Distributed DBMS architectures; Storing data in a Distributed DBMS; Distributed catalog management; Distributed Query processing; Updating distributed data; Distributed transactions; Distributed Concurrency control and Recovery.

UNIT 5 **8 Hours**

Enhanced Data Models for Advanced Applications: Active database concepts; Temporal, Spatial, and Multimedia

Emerging Database Technologies and Applications: Databases on WWW, Multimedia databases, Mobile databases, Geographic Information systems, Genome Data Management

TEXT BOOKS

1. Raghu Ramakrishnan and Johannes Gehrke; Database Management Systems.3rd Edition McGraw-Hill, 2003
2. Elmasri and Navathe: Fundamentals of Database Systems 5th Edition, Pearson Education, 2007

REFERENCE BOOKS:

1. Connolly and begg: Database Systems, 4th Edition Pearson Education 2002.

TEACHING METHODOLOGY

- Chalk and Talk
- Problem solving
- Power Point presentation

ASSESSMENT METHODS

Midterm Test (Avg. of 2 Tests)	30 Marks
Surprise Test	10 Marks
Lab based Assignment	10 Marks

Course Outcomes:

After completion of the course, the student will be able to:

CO	Description
CO1	Identify and compare various file organizations and indexes, Describe and analyze data storage in disks and files, Identify and Analyze the need of RAID and RAID levels
CO2	Design and Analyze tree indexes and Hash based indexes
CO3	Appraise the purpose of Object Database systems to support complex data types.
CO4	Quote the implication of Parallel and distributed databases for improved performance.
CO5	Recognize the various emerging database technologies and applications including mobile, www, spatial, genome databases

Mapping of Course outcomes (COs) to Program outcomes (POs)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO 1	PSO 2	PSO 3
CO1	3	2										3	2	
CO2	3	2	2									3	2	
CO3	3	2	2									3	2	1
CO4	3	2	2									3	2	1
CO5	3	2										3	2	1

I SEMESTER

Department: *Computer Science and Engineering (PG)*	***Course Type:*** *Programme Lab*
Course Title*: Applications of Machine Learning Laboratory*	***Course Code:*** *21CSE107L*
L-T-P: *0-0-4*	***Credits:*** *1*
Total Contact Hours: *50 Hours*	***Duration of SEE:*** *3 Hours*
SEE Marks*: 50*	***CIE Marks:*** *50*

COURSE DESCRIPTION

This course provides an in-depth knowledge of applying machine learning techniques to real-world problems in various domains using python/R programming languages and ML-HPC services available in different platforms

PREREQUISITES

Probability, Statistics, Data structures

COURSE OBJECTIVES

To implement various machine learning techniques.

To solve machine learning problems using recent machine learning software in high-performance computing environment.

To apply appropriate supervised, semi-supervised or unsupervised learning algorithms for solving practical problems.

LABORATORY EXERCISES

1. Exercises to solve the real-world problems using the following machine learning methods:
    a. Regression(Linear,Logistic)
    b. SVM
    c. Neural Networks (MLP, Gradient variants, different activation functions etc.,)
    d. Bayesian classifiers(Naïve, optimal and BBF)
    e. Decision Tree Classifiers (CART, ID3, C4.5 etc.,)
    f. KNN (simple, weighted)
    g. Perceptron
    h. Multi-Class Classification
    i. PCA & CCA
    j. Genetic Algorithms
    k. Clustering (K-Means, Hierarchical etc.,)
2. Implement Anomaly Detection & Recommendation Systems.
3. Implement GPU computing models to solve some of the problems chosen in 1.

REFERENCES

1. Wes McKinney, Python for Data Analysis, O'Reilly Media, Inc., First Edition,2013.
2. Max Kuhn, Kjell Johnson, Applied Predictive Modeling, Springer Science & Business Media New York 2013
3. Ian H. Witten, Eibe Frank, Mark A. Hall, Data Mining Practical Machine Learning Tools and Techniques, Morgan Kaufmann, Third Edition,2011.
4. John Mueller and Luca Massaron, "Machine Learning For Dummies", John Wiley & Sons, 2016.

WEB RESOURCES

1. https://www.kdnuggets.com/ **- Site on AI, Analytics, Big Data, Data Mining, Data Science, and ML**
2. https://www.kaggle.com/ **- ML & DS community**
3. http://archive.ics.uci.edu/ml/index.php **- ML Repository**
4. https://homepages.ecs.vuw.ac.nz/~marslast/MLbook.html **- Stephen Marshland homepage which contains python code for each chapter**
5. https://www.cs.waikato.ac.nz/ml/weka/courses.html – **Waikato University - Weka MOOC**
6. https://nptel.ac.in/courses/106/106/106106202/ **- NPTEL - Machine Learning**

ASSESSMENT METHODS

- Total - 50 marks include
  a. Exercises write up, execution, analysis and inference, viva and report writing for 30 marks
  b. 2 Lab Internal tests for 10 marks each will be conducted

- Final SEE Examination will be conducted for 100 Marks and evaluated for 50 marks

COURSE OUTCOMES

After completion of the course, the students will be able to:

CO	DESCRIPTION	Bloom's Level
CO1	Build various machine learning algorithms using python	L3
CO2	Solve real-world problems using recent machine learning software in high-performance computing environment	L3
CO3	Apply appropriate machine learning techniques to solve practical problems	L3
CO4	Analyse the performance of different machine learning algorithms used to solve the practical problems	L4
CO5	Evaluate the performance of different machine learning algorithms in solving chosen problems	L5

Course Outcome to Programme Outcome Mapping

Mapping of Course outcomes (COs) to Program outcomes (POs)												
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	3	2	2				3	3		2
CO2	3	3	3	2	2				3	3		2
CO3	3	3	3	2	2				3	3		2
CO4	3	3	3	3	3				3	2	2	2
CO5	3	3	3	3	3				3	2	2	2

3: Strong, 2: Medium, 1: Weak ** H: Highly related S: Supportive

II SEMESTER

Department: *Computer Science and Engineering (PG)*	***Course Type:*** *Programme Core*
Course Title*: Block Chain Technology*	***Course Code:*** *21CSE201*
L-T-P: *4-0-0*	***Credits:*** *4*
Total Contact Hours: *50 Hours*	***Duration of SEE:*** *3 Hours*
SEE Marks*: 50*	***CIE Marks:*** *50*

COURSE DESCRIPTION

This Course focuses on Blockchain Technologies, smart Contracts, Hyperledger and alternative blockchains, cryptography and cryptocurrency, how bitcoin achieves decentralization, mechanics of bitcoin, how to store and use bitcoin and bitcoin mining.

PREREQUISITES

Basics of Cryptography

COURSE OBJECTIVES

The Blockchain technology course helps students to explore the driving force behind the blockchain technologies and Bitcoin and other crypto currencies along with concepts like smart contracts, Hyperledger and alternative Blockchains and Bitcoin mining.

UNIT 1 — 10 Hours

Blockchain: Distributed Systems, The history of blockchain, Introduction to blockchain, Types of Blockchain, CAP Theorem and Blockchain, Benefits and limitations of blockchain. Decentralization, blockchain and full ecosystem decentralization, Smart Contract, Platforms for decentralization.

UNIT 2 — 10 Hours

Smart Contracts and Ethereum 101- History, definition, Ricardian contracts, Ethereum clients and releases, the Ethereum stack, Ethereum blockchain, elements of the Ethereum blockchain, precompiled contracts, Accounts, Block, Ether, Messages, Mining, Clients, and Wallets, The Ethereum network.

UNIT 3 — 10 Hours

Hyperledger and Alternative Blockchains-Projects, Hyperledger as a Protocol, Fabric, Hyperledger Fabric, sawtooth lake, Corda, Architecture, Components, Kadena, Platforms, blockApps, Eris. **Introduction to Cryptography and Cryptocurrencies-** Cryptographic hash Functions, Hash Pointers and data structures, Digital Signatures, Public Keys as Identities, Two Simple Cryptocurrencies.

UNIT 4	10 Hours

How Bit Coin achieves decentralization-Centralization versus decentralization, Distributed Consensus, Consensus without identity using a blockchain, Incentives and Proof of work. Putting it all together. **Mechanics of Bitcoin**-Bitcoin Transactions, Bitcoin scripts, Applications of Bitcoin scripts, Bitcoin Blocks, The bitcoin network.

UNIT 5	10 Hours

How to store and use Bitcoins-Simple Local Storage, Hot and Cold Storage, Splitting and sharing keys, Online Wallets and Exchanges, Payment services, Transaction fees, Currency exchange markets. Bitcoin Mining-The task of bitcoin miners, mining hardware, energy consumption and ecology, mining pools, mining incentives and strategies.

TEXT BOOKS

1. Imran Bashir-Mastering Blockchain, Packt Publishing Ltd, 2017. (Unit 1 to Unit 3 till Kadena, Platforms, blockApps, Eris)
2. Arvind Narayanan, Joseph Bonneau, Edward Felten, Andrew Miller, Steven Goldfeder-Bit Coin and Cryptocurrency Technologies-A Comprehensive Introduction, Princeton University Press, Princeton and Oxford, 2016. (Unit 3 from Introduction to Cryptography… till Unit 5)

REFERENCE BOOKS

1. Elad Elrom-The Blockchain Developer: A Practical Guide for Designing, Implementing, Publishing, Testing, and Securing Distributed Blockchain-based Projects 1st ed. Edition, Apress, ISBN-13: 978-1484248461
2. Chriss Danen-Introducing Ethereum and Solidity-Foundations of Cryptocurrency and Blockchain Programming for Begineers, Apress, 2017

TEACHING METHODS

- Blackboard Teaching
- Power point Presentation
- Case Study Discussion

ASSESSMENT METHODS

Continuous internal Evaluation (CIE) for 50 Marks

- MINI Project based on Block Chain Technology using current/Modern Tools – 20 Marks
- Three Mid Semester Examinations with weightages given CIE Evaluated for 30 Marks

Semester End Examination (SEE) for 50 Marks

Final Examination for 100 Marks will be conducted and will be evaluated for 50 marks

COURSE OUTCOMES

After completion of the course, the student will be able to:

CO	Description	Blooms' Level
CO1	Understand and Analyse **Types of Blockchain, CAP Theorem, Benefits, and limitations of blockchain. Decentralization, Smart Contract, Platforms for decentralization.**	BL2 and BL4
CO2	Understand and Analyse the **Smart Contracts and Ethereum.**	BL2 and BL4
CO3	Understand and Analyse Hyperledger **and Alternative Blockchains and Cryptography and Cryptocurrencies**	BL2 and BL4
CO4	Understand and Analyse **How Bit Coin achieves decentralization and Mechanics of Bitcoin**	BL2 and BL4
CO5	Understand and Analyse **How to store and use Bitcoins and mine the bitcoins**	BL2 and BL4

Mapping of Course outcomes (COs) to Program outcomes (POs)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO 1	PSO 2	PSO 3
CO1	3				3	2							3	
CO2	3				3	2							3	
CO3	3	3			3	2		2					3	2
CO4	3	3			3	2		2					3	2
CO5	3	3			3	2		2					3	2

II SEMESTER

Department: *Computer Science and Engineering (PG)*	***Course Type:*** *Programme Core*
Course Title: *Image Processing and Computer Vision*	***Course Code:*** *21CSE202*
L-T-P: *3-0-1*	***Credits:*** *3*
Total Contact Hours: *42 Hours*	***Duration of SEE:*** *3 Hours*
SEE Marks: *50*	***CIE Marks:*** *50*

COURSE DESCRIPTION

This course focuses on Introduction to image processing, Image Enhancement, Image Restoration, Image Segmentation and Morphological Image Processing, Object Representation, and description and Mid and High-Level Computer Vision Techniques.

PREREQUISITES

Calculus and probability

COURSE OBJECTIVES

To introduce the basic concepts in Digital Image Processing and understand the steps in fundamental digital image processing
To apply Image Enhancement and Image Restoration techniques
To become familiar with the techniques used in Image Segmention, morphological operations, object representation and description
To understand and apply computer vision techniques.

COURSE CONTENTS

UNIT 1 — 6 Hours

Introduction and Digital Image Fundamentals

Motivation & Perspective, Applications, Components of Image Processing System, Fundamentals Steps in Image Processing, Image Sampling and Quantization, Some basic relationships like Neighbours, Connectivity, Distance Measures between pixels

UNIT 2 — 10 Hours

Image Enhancement in the Spatial and Frequency Domain

Image Enhancement in the Spatial Domain: Image enhancement by point processing, Image enhancement by neighbourhood processing, Basic Grey Level Transformations, Histogram Processing, Enhancement Using Arithmetic and Logic operations, Zooming, Basics of Spatial Filters, Smoothening and Sharpening Spatial Filters, Combining Spatial

Enhancement Methods. Image Enhancement in the Frequency Domain: Introduction to Fourier Transform and the frequency Domain, Smoothing and Sharpening Frequency Domain Filters, Homomorphic Filtering

UNIT 3	10 Hours

Image Restoration and Morphological Image Processing

Image Restoration: Model of The Image Degradation / Restoration Process, Noise Models, Restoration in the presence of Noise Only Spatial Filtering, Periodic Noise Reduction by Frequency Domain Filtering, Linear Position Invariant Degradations, Estimation of Degradation Function, Inverse filtering, Wiener filtering, Constrained Least Square Filtering, Geometric Mean Filter, Geometric Transformations.

Morphological Image Processing: Introduction to Morphology, Dilation, Erosion, and Some basic Morphological Algorithm.

UNIT 4	8 Hours

Image Segmentation, Representation and Description

Segmentation: Fundamentals, Point, Line and Edge Detection, Thresholding,Region based Segmentation, Segmentation using morphological watersheds, The use of motion in segementation. Representation and Description: Boundary Descriptors, Regional Descriptors, Object Recognition: Chain Code, Structural Methods

UNIT 5	8 Hours

Mid-Level & High-Level Vision

Segmentation by Clustering, Grouping and Model Fitting:The Hough Transfrom ,Tracking: Simple Tracking strategies, Tracking using matching, Tracking Linear Dynamic Models with Kalman Filters. Detecting Objects in Images.

TEXT BOOKS

1. Rafael C. Gonzalez & Richard E. Woods, "Digital Image Processing", Pearson Education (3rd Edition).
2. David A. Forsyth, Jean Ponce , "Computer Vision: A Modern Approach", Prentice Hall
3. A.K. Jain, "Fundamental of Digital Image Processing", PHI.

REFERENCE BOOKS

1. B. Chanda, D Dutta Majumder, "Digital Image Processing and Analysis'', Prentice-Hall, India, 2002

TEACHING METHODS

- Black Board Teaching.

- Power point presentation (If needed).
- Tutorial Classes.

ASSESSMENT METHODS

Continuous internal Evaluation (CIE) for 50 Marks

- Surprise test / Tutorials tests to be conducted for each topic for 10 marks.
- Mini project / Case study based on practical application for 10 marks.
- Three mid semester examinations will be conducted each for 30 marks and the average of best of two will be taken.

Semester End Examination (SEE) for 50 Marks

Final examination, of 100 Marks will be conducted and will be evaluated for 50 marks.

COURSE OUTCOMES

After completion of the course, the student will be able to:

CO	Description
CO1	Understanding the fundamentals of image processing and computer vision. (Understand)
CO2	Able to understand and apply the image enhancement techniques.(Apply)
CO3	Able to understand the Image restoration techniques, representation & description, and object recognition (Understand)
CO4	Apply the image segmentation and morphological image processing on images. (Apply)
CO5	Apply computer vision techniques. (Apply)

Mapping of Course outcomes (COs) to Program outcomes (POs)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO 1	PSO 2	PSO 3
CO1	3													
CO2	3	2	3	2	2							3		
CO3	2	3	3									3		
CO4	2	2	3	2	2							3		
CO5	2	2	3	2	2							3		

II SEMESTER

Department: *Computer Science and Engineering (PG)*	***Course Type:*** *Programme Elective*
Course Title*: Big Data Analytics*	***Course Code:*** *21CSE203*
L-T-P: *3-0-1*	***Credits:*** *3*
Total Contact Hours: *52 Hours*	***Duration of SEE:*** *3 Hours*
SEE Marks*: 50*	***CIE Marks:*** *50*

COURSE DESCRIPTION

This course provides knowledge on definitions of big data and big data analytics, comparison of conventional data warehouse and big data environment, big data frame works like Hadoop and SPARK frame works, data storage mechanisms for big data.

PREREQUISITES

- Students should have the knowledge of Distributed Systems and Parallel Processing
- Students should have knowledge object oriented and functional programming.

COURSE OBJECTIVES

- Understand the data and categories of the data.
- Understand the data analytic techniques.
- Study the big data framework Hadoop and SPARK
- Analyze the difference between Hadoop and SPARK environments
- Study the NOSQL databases.

UNIT 1 — 10 Hours

Introduction to Big Data: Types of Digital Data, Characteristics of Big Data, Evolution of Big Data, Definition of Big Data, Challenges of Big Data, Significance of Big Data, Trends in Big data, Introduction to Big Data Analytics, Technologies for Big data.
Hadoop / HDFS Overview: Hadoop Overview: Hadoop Distributed File System (HDFS), HDFS Daemons, File Read, File Write, Replica Placement Strategy, HDFS commands. YARN and MapReduce. Execution of MR Applications using YARN and HDFS.
Spark Overview: Spark versus MapReduce. Advantages of Spark, Spark Ecosystem.

UNIT 2 — 10 Hours

Introduction to Scala: Scala Overview, Vals and Variables, basic types, operators, control structures, functions, functions as a parameter. Tuples, Basic collections – Lists, Arrays, Maps. Common methods for collections – map, reduce, Iterators, comprehensions. Classes and objects. Pattern matching.

UNIT 3 **10 Hours**

Spark Core: Installing Spark in standalone mode, Spark shell, Spark Context, RDD's: Actions and Transformations, Lineage Graphs, Lazy evaluation, Persistence, Immutability, Fault Tolerance, Performance (Pipelining, Shuffle). Pair RDD's: Transformations and Actions, Partitioning. Broadcasting. Page Ranking Algorithm. Using sbt to compile spark programs for cluster execution.

UNIT 4 **12 Hours**

Spark SQL: Rows, Data frames, Tables and SQL operations on Tables. Partitioning and Bucketing for performance. Interfacing with Hive. Refreshing Table metadata. Loading and Saving Data: Parquet Files.

Spark Streaming: Introduction to Stream Processing – Micro batching, structured streaming, Event time versus Processing time, Time windows, Out of order events, Sliding versus overlapping windows, Sources and Sinks. Transformation and Actions. Caching, Persistence, Check pointing.

UNIT 5 **10 Hours**

Spark MLlib (Machine Learning Library): ML data types in Spark, ML Algorithms in Spark: scaling, normalization, word2vec, statistical, classification and regression, clustering, collaborative filtering, dimensionality reduction, pipelines.

TEXT BOOKS

1. Seema Acharya and Subhashini C, Big Data and Analytics, Wiley India, 2015 (Chapter 1,2,3,5,9)
2. Cay S. Horstmann, Scala for the Impatient, 2nd Edition (chapters 1 to 6, 12 to 14).
3. Andy Konwinski, Holden Karau, Matei Zaharia, Patrick Wendell, Learning Spark Lightning-Fast Big Data Analysis, O'Reilly, 2015 (chapters 1 to 8).
4. Spark: The Definitive Guide2018, by Matei Zaharia and Bill Chamber

REFERENCE BOOKS

TEACHING METHODS

- Black Board Teaching.
- Power point presentation (If needed).
- Tutorial Classes.

ASSESSMENT METHODS

Continuous internal Evaluation (CIE) for 50 Marks

- Surprise test / Tutorials tests to be conducted for each topic for 10 marks.
- Mini project / Case study based on practical application for 10 marks.
- Three mid semester examinations will be conducted each for 30 marks and the average of best of two will be taken.

Semester End Examination (SEE) for 50 Marks

Final examination, of 100 Marks will be conducted and will be evaluated for 50 marks.

COURSE OUTCOMES

After completion of the course, the students will be able to:

CO	DESCRIPTION
CO1	Understand the big data , big data analytics, big data processing requirements (L1)
CO2	Compare the Hadoop and SPARK framework for big data(L2)
CO3	Illustrate the programming model in Scala using basic data types, functions, objects, classes(L3)
CO4	Apply the Knowledge of RDDs, Data frames, Structured Data frames, MLLib to develop SPARK applications (L3)
CO5	Analyze the big data framework used in industry(L4)

Course Outcome to Programme outcome Mapping:

Mapping of Course outcomes (COs) to Program outcomes (POs)														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	2	2	2								3		
CO2	2	2	2	2								2		
CO3	3	3	3	2	2							2		
CO4	3	2	2	2	2							2		
CO5	3	2	2	2	2							2		

II SEMESTER

Department: *Computer Science and Engineering (PG)*	***Course Type:*** *Programme Core*
Course Title: Advanced Data Structures and Algorithms	***Course Code:*** 21CSE204
L-T-P: *3-0-1*	***Credits:*** *4*
Total Contact Hours: *52 Hours*	***Duration of SEE:*** *3 Hours*
SEE Marks: *50*	***CIE Marks:*** *50*

UNIT 1 **8 Hours**

Introduction, Understanding Pointers, Accessing the Address of a Variable, Declaring Pointer Variables, Initialization of Pointer Variables, Accessing a Variable through the Pointer, Chain of Pointers, Pointer Expressions, Pointer Increments and Scale Factor, Pointers and Arrays, Pointers and Character Strings, Array of Pointers, Pointer as Function Arguments, Functions Returning Pointers, Pointers to Functions, Pointers and Structures

UNIT 2 **10 Hours**

Dictionaries, linear list representation, skip list representation, operations insertion, deletion and searching, hash table representation, hash functions, collision resolution-separate chaining, open addressing-linear probing, quadratic probing, double hashing, rehashing, extendible hashing, comparison of hashing and skip lists.

UNIT 3 **10 Hours**

Priority Queues – Definition, ADT, Realizing a Priority Queue using Heaps, Definition, insertion, Deletion, External Sorting- Model for external sorting, Multiway merge, Polyphase merge.

UNIT 4 **10 Hours**

Binary Search Trees, Definition, ADT, Implementation, Operations- Searching, Insertion and Deletion, AVL Trees, Definition, Height of an AVL Tree, Operations – Insertion, Deletion and Searching, Black and Splay Trees, B-Trees, B-Tree of order m, height of a B-Tree, Comparison of Search Trees

UNIT 5 **10 Hours**

Pattern matching and Tries: Pattern matching algorithms-Brute force, the Boyer –Moore algorithm, the Knuth-Morris-Pratt algorithm, Standard Tries, Compressed Tries, and Suffix tries.

TEXT BOOKS:

1. Data Structures using C, Aaron M. Tanenbaum, Yedidyah Langsam& Moshe J. Augenstein, Pearson Education/PHI, 2006.
2. Data structures, Algorithms and Applications in C++, S. Sahni, University Press (India) Pvt Ltd, 2nd edition, Universities Press Orient Longman Pvt. Ltd.

3. Data structures and Algorithms in C++, Michael T. Goodrich, R. Tamassia and .Mount, Wiley student edition, John Wiley and Sons.

Reference Books:

1. Data structures and Algorithm Analysis in C++, Mark Allen Weiss, Pearson Education. Ltd., Second Edition.
2. Data structures and algorithms in C++, 3rd Edition, Adam Drozdek, Thomson
3. Data structures using C and C++, Langsam, Augenstein and Tanenbaum, PHI.
4. Problem solving with C++, The OOP, Fourth edition, W.Savitch, Pearson education.

Course Outcomes

After completion of the course, the students will be able to:

CO	DESCRIPTION
CO1	Able to implement pointers in c / c++ programming
CO2	Able to utilize the concepts of dictionaries and hash functions for proper applications
CO3	Able to understand and implement different queuing and searching techniques and compare different searching techniques
CO4	Able to understand and implement different techniques of pattern matching for proper applications.

Teaching Methodology:

- Black board teaching
- Lectures
- Power Point Presentation

Assessment Methods:

- Total - 50 marks include

a. Three internals for 30 Marks each will be conducted and the Average of best of two will be taken

b. Surprise Test – 10 Marks

c. Assignment – 10 Marks

- Final examination, of 100 Marks will be conducted and will be evaluated for 50 Marks.

Course Outcome to Programme Outcome Mapping

Mapping of Course outcomes (COs) to Program outcomes (POs)														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	S	M												
CO2	S	M	S		S									
CO3	S	M	M	M										
CO4	S		M	M	M									

(*S: Strong M: Medium W: Weak)

II SEMESTER

Department: *Computer Science and Engineering (PG)*	***Course Type:*** *Programme Elective*
Course Title*: Deep Learning*	***Course Code****: 21CSE205E1*
L-T-P: *3-0-1*	***Credits:*** *4*
Total Contact Hours: *52 Hours*	***Duration of SEE:*** *3 Hours*
SEE Marks*: 50*	***CIE Marks:*** *50*

COURSE DESCRIPTION

This course focuses on revisiting the machine learning concepts, Deep Feedforward Networks, Regularization, and Optimization for Training Deep Models, Sequence Modelling, and Applications of Deep Learning

PREREQUISITES

NA

COURSE OBJECTIVES

UNIT 1 — 10 Hours

Machine Learning Basics: Learning Algorithms, Capacity, Overfitting and Underfitting, Hyperparameters and Validation Sets, Estimator, Bias and Variance, Maximum Likelihood Estimation, Bayesian Statistics, Supervised Learning Algorithms, Unsupervised Learning Algorithms, Stochastic Gradient Decent, building a Machine Learning Algorithm, Challenges Motivating Deep Learning

UNIT 2 — 10 Hours

Deep Feedforward Networks: Gradient-Based Learning, Hidden Units, Architecture Design, Back Propagation.

Regularization: Parameter Norm Penalties, Norm Penalties as Constrained Optimization, Regularization and Under-Constrained Problems, Dataset Augmentation, Noise Robustness, Semi-Supervised Learning, Multi-Task Learning, Early Stopping, Parameter Tying and Parameter Sharing, Sparse Representations, Bagging, Dropout.

UNIT 3 — 12 Hours

Optimization for Training Deep Models: How Learning Differs from Pure Optimization, Challenges in Neural Network Optimization, Basic Algorithms. Parameter Initialization Strategies, Algorithms with Adaptive Learning Rates. Convolutional Networks: The Convolution Operation, Motivation, Pooling, Convolution and Pooling as an Infinitely Strong Prior, Variants of the Basic Convolution Function, Structured Outputs, Data Types, Efficient Convolution Algorithms, Random or Unsupervised Features.

UNIT 4	10 Hours

Sequence Modelling: Recurrent and Recursive Nets: Unfolding Computational Graphs, Recurrent Neural Networks, Bidirectional RNNs, Encoder-Decoder Sequence-to-Sequence Architectures, Deep Recurrent Networks, Recursive Neural Networks. Long short-term

UNIT 5	10 Hours

memory

Practical Methodology: Performance Metrics, Default Baseline Models, Determining Whether to Gather More Data, Selecting Hyperparameters, Debugging Strategies, Example: Multi-Digit Number Recognition. Applications: Vision, NLP, Speech.

TEXT BOOKS

1. Lan Good fellow and Yoshua Bengio and Aaron Courville. Deep Learning. MIT Press https://www.deeplearn ingbook.org/, 2016

REFERENCE BOOKS

1. Raúl Rojas. Neural Networks: Asystematic Introduction. 1996
2. Chirstopher Bishop. Pattern Recognition and Machine Learning. 2007.

TEACHING METHODS

- Black Board Teaching.
- Power point presentation (If needed).
- Tutorial Classes.

ASSESSMENT METHODS

Continuous internal Evaluation (CIE) for 50 Marks

- Surprise test / Tutorials tests to be conducted for each topic for 10 marks.
- Mini project / Case study based on practical application for 10 marks.
- Three mid semester examinations will be conducted each for 30 marks and the average of best of two will be taken.

Semester End Examination (SEE) for 50 Marks

Final examination, of 100 Marks will be conducted and will be evaluated for 50 marks.

COURSE OUTCOMES

1. Explain the concepts of deep learning and Neural Networks
2. Demonstrate the architectural principles of Deep Learning Networks
3. Explore the training and use of deep Learning networks with tools & software's
4. Analyse the Modern Practices of Deep Learning and Neural networks
5. Create the deep learning system to solve real world problems

Course Outcome to Programme outcome Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	3												
CO2	3	3												
CO3	3	3	3		3				2			2	2	
CO4	2	2	3	2	2				2					
CO5	3	3	3	3	3				2			2	2	

II SEMESTER

Department: *Computer Science and Engineering (PG)*	***Course Type:*** *Programme Elective*
Course Title*: IoT Security*	***Course Code****: 21CSE205E2*
L-T-P: *3-0-1*	***Credits:*** *4*
Total Contact Hours: *52 Hours*	***Duration of SEE:*** *3 Hours*
SEE Marks*: 50*	***CIE Marks:*** *50*

COURSE DESCRIPTION

This course provides the overview of IOT security, Vulnerability Issues, Networking Function Security, and Secured Protocols for IOT.

PREREQUISITES

COURSE OBJECTIVES

UNIT 1 **10 Hours**

Fundamentals, Architecture of IoTs, IoT Security Requirements, IoT Privacy Preservation Issues, IoTReference Model- Introduction -Functional View,IoT Security Challenges-Hardware Security Risks - Hardcoded/Default Passwords -Resource Constrained Computations -Legacy Assets Connections - Devices Physical Security, Software Security Risks -Software Vulnerabilities -Data Interception - Identification of Endpoints -Tamper Detection, Lack of

UNIT 2 **10 Hours**

IOT- SECURITY &VULNERABILITY ISSUES

IoT Security Requirements -Data Confidentiality -Data Encryption -Data Authentication -Secured Access Control –IoT-Vulnerabilities – Secret-Key, Authentication/Authorization for Smart Devices - Constrained System Resources -Device Heterogeneity -Fixed Firmware. Attack Models - Attacks to Sensors in IoTs, Attacks to RFIDs in IoTs, Attacks to Network Functions in IoTs, Attacks to Back-end Systems, Security in Front-end Sensors and Equipment, Prevent Unauthorized Access to Sensor Data,M2M Security, RFID Security, Cyber-Physical Object Security, Hardware Security, Front-end System Privacy Protection IoT Attacks -Side-channel Attacks -Reconnaissance -Spoofing -Sniffing -Neighbour -Discovery -Rogue Devices-Man-in-Middle

UNIT 3	10 Hours

Networking Function Security-IoT Networking Protocols, Secure IoT Lower Layers, Secure IoT Higher Layers, Secure Communication Links in IoTs , Back-end Security -Secure Resource Management, Secure IoT Databases, Security Products-Existing Test bed on Security and Privacy of IoTs, Commercialized Products

UNIT 4	10 Hours

SECURED PROTOCOLS FOR IOT Infrastructure-IPv6 -LowPAN , Identification-Electronic Product Code -uCode, Transport-Bluetooth - LPWAN, Data -MQTT -CoAP, Multi-layer Frameworks-Alljoyn,-IoTivity

UNIT 5	10 Hours

SECURING INTERNET OF THINGS ENVIRONMENT IoT Hardware -Test Device Range-Latency and Capacity -Manufacturability Test -Secure from Physical Attacks, IoT Software -Trusted IoT Application Platforms, -Secure Firmware Updating -Network Enforced Policy -Secure Analytics Visibility and Control

TEXT BOOKS

1. Fei HU, "Security and Privacy in Internet of Things (IoTs): Models, Algorithms, andImplementations", CRC Press,2016
2. Russell, Brian and Drew Van Duren, "Practical Internet of Things Security", Packt Publishing, 2016.
3. Ollie Whitehouse, "Security of Things: An Implementers' Guide to Cyber-Security forInternet of Things Devices and Beyond", NCC Group, 2014

Learning Resources:

1. **https://www.postscapes.com/internet-of-things-protocols/**
2. **https://www.cse.wustl.edu/~jain/cse570-15/ftp/iot_prot/index.html**
3. **https://www.cisco.com/c/en/us/about/security-center/secure-iot-proposed-framework.html**
4. **https://www.iotforall.com/5-worst-iot-hacking-vulnerabilities/**

REFERENCE BOOKS

TEACHING METHODS

- Black Board Teaching.
- Power point presentation (If needed).
- Tutorial Classes.

ASSESSMENT METHODS

Continuous internal Evaluation (CIE) for 50 Marks

- Surprise test / Tutorials tests to be conducted for each topic for 10 marks.
- Mini project / Case study based on practical application for 10 marks.
- Three mid semester examinations will be conducted each for 30 marks and the average of best of two will be taken.

Semester End Examination (SEE) for 50 Marks

Final examination, of 100 Marks will be conducted and will be evaluated for 50 marks.

COURSE OUTCOMES

1. Explain the concepts of IOT Security (Understand)
2. Understanding Vulnerability issues and IoT Security (Understand)
3. Study of Networking Function Security. (Understanding)
4. Able to differentiate Secured Protocols for IoT (Analysis).

Course Outcome to Programme outcome Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	3										2		
CO2	3	3				2						2		
CO3	3	3	2	2	2	2						2		
CO4	3	3	2		2							2		

II SEMESTER

Department: *Computer Science and Engineering (PG)*	***Course Type:*** *Programme Elective*
Course Title*: Animation and Game development*	***Course Code:*** *21CSE205E3*
L-T-P: *3-1-1*	***Credits:*** *4*
Total Contact Hours: *52 Hours*	***Duration of SEE:*** *3 Hours*
SEE Marks*: 50*	***CIE Marks:*** *50*

COURSE DESCRIPTION

Introduction to the programming and development of computer games especially through the use of open-source computer game engine like Unity. Course will cover the major aspects of programming and creating games within a game engine, basic interaction between code and game assets, movement and manipulation of assets, object collision detection, triggers and timed events. Provide an introduction to Animation of assets and Haptic IO devices such as HUD, manipulators, vibrators. The course will also deal with ways of augmenting the playing experience using AI in game development.

COURSE OBJECTIVES

- To understand the basic physics that governs the reactions of the characters of the game.
- To build capability to develop scripts using C# to create assets, UI, graphics and AI game agents
- To develop expertise in using open-source game engines like Unity.
- To enhance the gaming experience by incorporating AI to the assets.
- To be able to build AR and VR based games using Unity's AR foundation.

COURSE CONTENTS

UNIT 1 — 6 Hours

Games Overview; History of Games,History and Generations of Video Games, Designing a Game from Scratch, Setting Up Unity

UNIT 2 — 6 Hours

Game Genre Overview: Game Genres I, Game Genres II,Genres III
Principles of Game Design I: Layers of Game Design, Empathy, Motivation, Feedback, Agency, Pacing

Principles of Game Design II: Immersion, Realism, Consistency, Freedom, Action, Strategy, Simulation, Working with Scenes and Game Objects, Grayboxing with Terrain and ProBuilder,

UNIT 3	10 Hours

Importing and Integrating Assets, Materials and Effects with URP and Shader Graph and Visual Effects with Particle Systems and Visual Effect Graph
Trade-Offs in Game Design, Indicators of Poor Game Design, Game Development Cycle. Lighting Using the Universal Render Pipeline, Full screen Effects with Post processing Sound and Music Integration, User Interface Design, Creating a UI with the UI Toolkit
Creating Animations with Animator, Cinemachine, and Timeline, Introduction to C# and Visual

UNIT 4	10 Hours

Scripting, Implementing Movement and Spawning Physics Collisions and Health System, Win and Lose Condition, Scripting the UI, Sounds, and Graphics

UNIT 5	10 Hours

Implementing Game AI for Building Enemies, Scene Performance Optimization, Building the Project, Finishing Touches, Augmented Reality in Unity, Legalities of Game Development, Ethical Issues in Video Games (Ethics, Culture, Violence in Games; Responsibilities; ESRB Ratings. Future of Video Games

TEXT BOOKS

1. Fundamentals of Game Development: Heather Maxwell Chandler, Rafael Chandler; Jones & Bartlett Learning; 2011.
2. Hands-on Unity 2021 Game development: Nicolas Alejandro Borromeo; Second Edition, Packt Publishing Ltd. 2021.

REFERENCE BOOKS

TEACHING METHODS

- Power point presentation.
- Tutorial Classes.
- Programming exercises

ASSESSMENT METHODS

Continuous internal Evaluation (CIE) for 50 Marks

- Surprise test / Tutorials tests to be conducted for each topic for 10 marks.

- Mini project on practical application for 10 marks.
- Three mid semester examinations will be conducted each for 30 marks and the average of best of two will be taken.

Semester End Examination (SEE) for 50 Marks

Final examination, of 100 Marks will be conducted and will be evaluated for 50 marks.

COURSE OUTCOMES

CO	Description	Bloom's level
CO1	Unleash the capabilities of C# and Visual scripting tools to create UIs, graphics and customize various aspects like physics, gameplay and user experience	L3
CO2	Explore Unity's latest tools, including Universal Render Pipeline, Shader Graph, UI Toolkit, Visual Scripting, and VFX graph, to enhance graphics.	L4
CO3	Create rich particle systems for your Unity games from scratch using VFX Graph and Shuriken	L4
CO4	Add animations to the games using the Animator, Cinemachine, and Timeline	L3
CO5	Implement game AI to control character behaviour	L3

COURSE OUTCOMES to Programme Outcome Mapping

Mapping of Course outcomes (COs) to Program outcomes (POs)														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	2	3		2				3			3	2	
CO2	3	2	3		2				3			3	2	
CO3	3	3	3		2				3		3	3	2	
CO4	3	3	3	2	3				3		3	3	3	
CO5	3	3	3	2	3				3		3	3	3	

II SEMESTER

Department: *Computer Science and Engineering (PG)*	***Course Type:*** *Programme Elective*
Course Title*: Dynamic Programming and Randomized Algorithms*	***Course Code:*** *21CSE205E4*
L-T-P: *3-1-1*	***Credits:*** *4*
Total Contact Hours: *52 Hours*	***Duration of SEE:*** *3 Hours*
SEE Marks*: 50*	***CIE Marks:*** *50*

COURSE DESCRIPTION

Randomization has been serving as a central idea in algorithm design in particular and theoretical computer science in general. Indeed, randomized algorithms are often tend to be simple and thus practically useful than their deterministic counter parts yet provides matching guarantees. This is the case, for example, for randomized quick sort algorithm, randomized minimum cut algorithm, etc. Other than algorithm design, randomization has also been used to come up with path breaking proof techniques, for example, probabilistic methods, probabilistically checkable proof, etc. in theoretical computer science. In this course, we will introduce these probabilistic techniques with state of the art applications to the students so that they can apply it in their research whenever needed

PREREQUISITES

Knowledge of Fundamentals of Design and Analysis of Algorithms; Fundamentals of Probability theory and Random Processes.

COURSE OBJECTIVES

- To understand the major categories of approaches to Random algorithmic design: Las Vegas and Monte Carlo.
- To get expertise on Basic probability theory including linearity of expectation, conditional expectations and law of total probability.
- To understand the technique of applying Markov bounds, Chebyshev bounds and similar bounds to problems and identify the suitability of these bounds to particular applications.
- To understand the applications of Markov Chains and Monte-Carlo methods
- To be able to determine the performance of classical randomized data structures.

COURSE CONTENTS

UNIT 1 **10 Hours**

Review of Basic Probability, Polynomial Identity Testing, Schwartz-Zippel, Reduction from

Perfect Bipartite Matching to PIT, Randomized Quick sort, Markov, Chebyshev, and Chernoff bounds, Lemma, Tossing coins, coupon collector problem, birthday paradox, Balls and bins, Two-point sampling.

UNIT 2	10 Hours

Introduction to Markov chain, randomized algorithm for 2SAT, stationary distribution, Irreducible and aperiodic Markov chain, fundamental theorem of Markov chain (statement only), coupling.

UNIT 3	10 Hours

Random walk, Metropolis Algorithm, Mixing time of Random Walk on Cycles, Proof of the fundamental Theorem of Markov chains, Finishing proof of the fundamental Theorem of Markov chains, hitting time, commute time, cover time, Monte Carlo Method, FPRAS for DNF Counting, FPRAS for Independent Set Counting using Monte Carlo Method

UNIT 4	8 Hours

Overview of Path Coupling, Introduction to Probabilistic Methods, Methods of expectation, alteration; Lovasz Local Lemma and its application, Method of Conditional Expectation for Derandomization, Introduction to Universal Hash Family, Perfect Hashing, Cuckoo Hashing, Bloom Filter, Count Min Sketch, Construction of Universal Hash Family

UNIT 5	8 Hours

Probabilistic Tree Embedding, Buy at Bulk Network Design, Martingale: Definition, Doob's Martingale, Stopping Time Theorem (without proof), Wald's equation, Azuma-Hoeffding Inequality, McDiarmid's Inequality, Applications.

TEXT BOOKS

1. Randomized Algorithms: Rajeev Motwani, Prabhakar Raghavan
2. Probability and Computing: Randomization and Probabilistic Techniques in Algorithms and Data Analysis by Eli Upfal and Michael Mitzenmacher

REFERENCE BOOKS

TEACHING METHODS

- Black Board Teaching (as necessary)
- Power point presentations.
- Tutorial Classes.

ASSESSMENT METHODS

Continuous internal Evaluation (CIE) for 50 Marks

- Surprise test / Tutorials tests to be conducted for each topic for 10 marks.
- Mini project / Programming exercises based on practical application for 10 marks.
- Three mid semester examinations will be conducted each for 30 marks and the average of best of two will be taken.

Semester End Examination (SEE) for 50 Marks

Final examination, of 100 Marks will be conducted and will be evaluated for 50 marks.

COURSE OUTCOMES

Course Outcome to Programme outcome Mapping:

CO	Description	Bloom's level
CO1	Comprehend the basics. Of Randomized Algorithms and Bounds	L2
CO2	Good Understanding of Markov Chains and its applications	L2
CO3	Be a able to apply Monte-Carlo techniques to applications	L4
CO4	Good working knowledge of Probablistic methods	L3
CO5	Good knowledge of inequalities and applications to real life problems	L2

COURSE OUTCOMES to Programme outcome Mapping

Mapping of Course outcomes (COs) to Program outcomes (POs)														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	2	3									3	1	
CO2	3	2	3									3	2	
CO3	3	2	3						3		3	3	2	
CO4	3	2	3	2	2				3		3	3	3	
CO5	3	3	3	2	3				3		3	3	3	

II SEMESTER

Department: *Computer Science and Engineering (PG)*	***Course Type:*** *Programme Elective*
Course Title: *Advances in Natural Language Processing*	***Course Code:*** *21CSE206E1*
L-T-P: *3-1-0*	***Credits:*** *4*
Total Contact Hours: *50 Hours*	***Duration of SEE:*** *3 Hours*
SEE Marks: *50*	***CIE Marks:*** *50*

COURSE DESCRIPTION

This course discusses techniques, algorithms, illustrations, applications, solutions and case studies in Natural language processing. Advanced techniques and research topics are also covered.

PREREQUISITES

Mathematical techniques, basics of algorithms.

COURSE OBJECTIVES

To provide knowledge on basics and algorithms used in natural language processing (NLP).
To enable learning of applications in Natural language processing.
To impart implementation experience using Python & NLTK.

COURSE CONTENTS

UNIT 1 **10 Hours**

Introduction: What is Natural Language Processing, Motivation, Words - Regular Expressions and Automata, Words and Transducers, N - grams - Part – of - Speech Tagging, Hidden Markov Models, Maximum Entropy Model.

UNIT 2 **10 Hours**

Syntax: Syntactic Parsing, Statistical Parsing, Features and Unification - Language and Complexity, Language Modeling

UNIT 3 **10 Hours**

. **Semantics and Pragmatics** : Semantics and Pragmatics: The Representation of Meaning, Computational Semantics,
Lexical Semantics: Computational Lexical Semantics, Computational Discourse.

UNIT 4 **10 Hours**

Applications: Applications, Information Extraction, Question Answering and Summarization, Dialog and Conversational Agents, Machine Translation .

UNIT 5 **10 Hours**

NLP Using Python: Language Processing and Python - Accessing Text Corpora and Lexical Resources - Processing Raw Text - Writing Structured Programs -Categorizing and Tagging Words -Learning to Classify Text - Extracting Information from Text – Case study.

TEXT BOOKS

1. Allen, James, Natural Language Understanding, Second Edition, Benjamin/Cumming, 1995.
2. Jurafsky, D. and J. H. Martin. Speech and language processing: An Introduction to Natural Language Processing, Computational Linguistics, and Speech Recognition, Second Edition, Prentice Hall, 2008.
3. Steven Bird, S., Klein, E., Loper, E, Natural Language Processing with Python-Analyzing Text with the Natural Language Toolkit, O'Reilly Media, 2010.

TEACHING METHODOLOGY

- Black Board Teaching
- Tutorials
- Problem solving
- Power Point presentation

ASSESSMENT METHODS

1. Three internals – 30 marks each will be conducted and the average of best of two will be considered
2. Seminar – 10 marks, Course project - 10 marks
3. Final Examination –Conducted for 100 and evaluated for 50 marks

Course Outcomes:

After completion of the course, the student will be able to:

CO	Description	Bloom's level
CO1	Comprehend the basics of NLP and illustrate the techniques used.	L2
CO2	Explain the syntactic parsing and language modeling methods.	L2
CO3	Analyse the semantics and the prgamatics used in NLP.	L4
CO4	Apply NLP techniques for various applications.	L3
CO5	Implement NLP techniques using Python.	L2

Mapping of Course outcomes (COs) to Program outcomes (POs)														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	2	3									3	1	
CO2	3	2	3									3	2	
CO3	3	2	3						3		3	3	2	
CO4	3	2	3	2	2				3		3	3	3	
CO5	3	3	3	2	3				3		3	3	3	

II SEMESTER

Department: *Computer Science and Engineering (PG)*	***Course Type:*** *Programme Elective*
Course Title*: Cyber Forensics*	***Course Code:*** *21CSE206E2*
L-T-P: *3-1-0*	***Credits:*** *4*
Total Contact Hours: *52 Hours*	***Duration of SEE:*** *3 Hours*
SEE Marks*: 50*	***CIE Marks:*** *50*

COURSE DESCRIPTION

This course aims to provide an understanding of the various security attacks and knowledge to recognize malicious activity that lead to vulnerabilities. It gives an outline of the techniques for developing a secure application. The use of security tools and techniques in real life scenarios related to cyber security consultancy and forensics. In addition to this, students will be able to improve their technical skill-sets and enhance their learning experiences through the use of various cyber tools.

PREREQUISITES

COURSE OBJECTIVES

- To implement security as a culture and show mistakes that make applications vulnerable to attacks.
- To understand various attacks like DoS, buffer overflow, web specific, database specific, web-spoofing attacks.
- To identify the nature of the threats to software and incorporate secure coding practices throughout the planning and development of the product.
- Able to properly handle application faults, implement secure authentication, authorization and data validation controls used to prevent common vulnerabilities

COURSE CONTENTS

UNIT 1: INTRODUCTION TO COMPUTER FORENSICS — 10 Hours

A brief about Cyber Forensics, Forensics investigation process, Forensic protocol for evidence acquisition, digital forensic standard and guidelines, Digital Evidence, Cyber Crime and types of cybercrime, notable data breaches, Case studies. Challenges in cybercrime. (Text Book:1, Chapter-1)

UNIT 2: EVIDENCE COLLECTION AND FORENSICS TOOLS — 12 Hours

Processing Crime and Incident Scenes - Working with Windows and DOS Systems. Current Computer Forensics Tools: Software/ Hardware Tools. (Text Book:2, Chapter - 5,6,7)

UNIT 3 : ANALYSIS AND VALIDATION

Validating Forensics Data - Data Hiding Techniques - Performing Remote Acquisition - Network Forensics - Email Investigations - Cell Phone and Mobile Devices Forensics. (Text Book:2, Chapter - 9, 11, 12,13)

UNIT 4: CYBER FORENSIC IMAGING

Overview of forensic imaging, preparing a stage drive, Imaging, Network Evidence and Analysis: Analyzing packet captures, Analyzing network log files, Analyzing system memory: memory evidence overview, memory Analysis Methodology, Network Connection Methodology, Tools. (Text Book:3, Chapter-5,6,7)

UNIT 5: CYBER FORENSIC TOOLS **10 Hours**

Brief Introduction to IoT (Device, Architecture), Security Awareness for IoT Devices, Sectrio Honeypot, Basic Analysis on Malware, Overview on Tools and Software used for Honeypot Research (VBox, Qemu, Remnux, Kali), Overview on VAPT, Overview on Cyber Threat Intelligence.

TEXT BOOKS

1. Niranjan Reddy, "An Incident-Based Approach toForensic Investigations Malware forensics". In: Practical Cyber Forensics. Apress, Berkeley, CA (2019). https://doi.org/10.1007/978-1-4842-4460-9_9.
2. Bill Nelson, Amelia Phillips, Christopher Steuart, " Guide to Computer Forensics and Investigations", Third Edition, 2010 Course Technology, Cengage Learning. ISBN-13: 978-1-435-49883-9, ISBN-10: 1-435-49883-6.
3. Gerard Johansen "Digital Forensics and IncidentResponse: Incident response techniques and procedures to respond to modern cyber threats, Packt Publishing Ltd, 29-Jan-2020.

REFERENCE BOOKS

1. John R.Vacca, Computer Forensics, Cengage Learning, 2005.
2. MarjieT.Britz, Computer Forensics and Cyber Crime: An Introduction, 3rd Edition, Prentice Hall, 2013.
3. Man Young Rhee, "Internet Security: Cryptographic Principles", "Algorithms and Protocols", Wiley Publications, 2003.
4. Bill Nelson, Amelia Phillips, Frank Enfinger, Christopher Steuart, ―Computer Forensics and Investigations‖, Cengage Learning, India Edition, 2016.

TEACHING METHODOLOGY

- Black Board Teaching
- Tutorials

- Problem solving
- Power Point presentation

ASSESSMENT METHODS

Midterm Test (Avg. of 2 Tests)	– 30 Marks
Mini project/Seminar on Cyber Forensics Topics	– 10 Marks
Cyber-Forensics-Tools-Usage-Demonstration	– 10 Marks
Total	= 50 Marks

Course Outcomes:

After completion of the course, the student will be able to:

CO	Description	Bloom's level
CO1	Understand how important security principles must be adhered to when securing the infrastructures	L2
CO2	Understand the importance of balancing security, operational effectiveness, and cost	L2
CO3	Analyze and to aptly secure the cyber perimeter of the infrastructures against cyber attacks	L4
CO4	Able to properly handle application faults, implement secure authentication, authorization and data validation controls used to prevent common vulnerabilities	L3
CO5	Perform cyber forensics analysis upon networks and network devices.	L2

Mapping of Course outcomes (COs) to Program outcomes (POs)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	2	3									3	1	
CO2	3	2	3									3	2	
CO3	3	2	3						3		3	3	2	
CO4	3	2	3	2	2				3		3	3	3	
CO5	3	3	3	2	3				3		3	3	3	

II SEMESTER

Department: *Computer Science and Engineering (PG)*	***Course Type:*** *Programme Elective*
Course Title*: Human Computer Interaction*	***Course Code:*** *21CSE206E3*
L-T-P: *3-0-1*	***Credits:*** *4*
Total Contact Hours: *52 Hours*	***Duration of SEE:*** *3 Hours*
SEE Marks*: 50*	***CIE Marks:*** *50*

COURSE DESCRIPTION

This course starts with an overview of Compiler design and aims at solving problems in designing compilers and advanced optimization.

PREREQUISITES

Knowledge of assembly level programming, Formal Languages and Automata Theory and principles of Compiler Design.

COURSE OBJECTIVES

- To comprehend basics of user interface and GUI.
- To apply techniques for designing the user interface.
- To understanding the Business Functions
- To understand the Device and Screen-Based Control
- To provide Effective Feedback Guidance and Assistance

COURSE CONTENTS

UNIT 1 **10 Hours**

The User Interface: Introduction, Importance of the User Interface, Importance and benefits of Good Design History of Human Computer Interface. Characteristics of Graphical and Web User Interface: Graphical User Interface, popularity of graphics, concepts of Direct Manipulation, Graphical System advantage and disadvantage, Characteristics of GUI. Web User Interface, popularity of web, Characteristics of Web Interface, Merging of Graphical Business systems& the Web, Principles of User Interface Design

UNIT 2 **10 Hours**

The User Interface Design Process: Obstacles and Pitfall in the development Process, Usability, The Design Team, Human Interaction with Computers, Important Human Characteristics in Design, Human Consideration in Design, Human Interaction Speeds, Performance versus Preference, Methods for Gaining and Understanding of Users.

UNIT 3	10 Hours

Understanding Business Functions: Business Definitions & Requirement analysis, Determining Business Functions, Design standards or Style Guides, System Training and Documentation, Principles of Good Screen Design: Human considerations in screen Design, interface design goals, test for a good design, screen meaning and purpose, Technological considerations in Interface Design System Menus and Navigation Schemes: Structure, Functions, Context, Formatting, Phrasing and Selecting, Navigating of Menus, Kinds of Graphical Menus Windows Interface: Windows characteristic, Components of Window, Windows Presentation Styles,

UNIT 4	10 Hours

Types of Windows, Window Management, Web systems.

Device and Screen-Based Control: Device based controls, Operable Controls, Text entry/read- Only Controls, Section Controls, Combining Entry/Selection Controls, Other Operable Controls and Presentation Controls, Selecting proper controls.

Effective Feedback Guidance and Assistance: Providing the Proper Feedback, Guidance and

UNIT 5	10 Hours

Assistance Effective Internationalization and Accessibility- International consideration, Accessibility, Create meaningful Graphics, Icons and Images, Colors-uses, possible problems with colors, choosing colors.

TEXT BOOKS

1. Andrew Monk. Fundamentals of Human Computer Interaction, 1st Edition.
2. Wilbert O. Galitz. The Essential Guide to User Interface Design, Wiley India Edition

REFERENCE BOOKS

1. Prece, Rogers, Sharps Interaction Design, Wiley India
2. Ben Shneidermann. Designing the user interfaces, Pearson Education Asia, 3 rd Edition
3. SorenLauesen. User Interface Design, Pearson Education
4. Alan Cooper, Robert Riemann, David Cronin. Essentials of Interaction Design. Wiley
5. Alan Dix, Janet Fincay, GreGoryd, Abowd, Russ. Human Computer Interaction. Pearson Education

TEACHING METHODS

- Black Board Teaching.

- Power point presentation (If needed).
- Tutorial Classes.

ASSESSMENT METHODS

Continuous internal Evaluation (CIE) for 50 Marks

- Surprise test / Tutorials tests to be conducted for each topic for 10 marks.
- Mini project / Case study based on practical application for 10 marks.
- Three mid semester examinations will be conducted each for 30 marks and the average of best of two will be taken.

Semester End Examination (SEE) for 50 Marks

Final examination, of 100 Marks will be conducted and will be evaluated for 50 marks.

COURSE OUTCOMES

1. Able to understand the User Interface, Web Interface and Principles of User Interface Design (Understand)
2. Apply Methods and techniques for design and construction of user interfaces (Apply)
3. Demonstrate basic knowledge on theories of psychology and on how the human being interacts with (computer) systems. (Demonstrate)
4. Give insight on how knowledge of the human capabilities can influence the way in which we construct technical systems.

Course Outcome to Programme outcome Mapping:

PO	1	2	3	4	5	6	7	8	9	10	11	12	PSO1	PSO 2	PSO3
CO1	3	2													
CO2	3	2			2								2		
CO3	3	2		2									2		
CO4	3	2		2											

II SEMESTER

Department: *Computer Science and Engineering (PG)*	***Course Type:*** *Programme Elective*
Course Title*: Advanced Compiler Design*	***Course Code:*** *21CSE206E4*
L-T-P: *3-1-1*	***Credits:*** *4*
Total Contact Hours: *52 Hours*	***Duration of SEE:*** *3 Hours*
SEE Marks*: 50*	***CIE Marks:*** *50*

COURSE DESCRIPTION

This course starts with an overview of Compiler design and aims at solving problems in designing compilers and advanced optimization.

PREREQUISITES

Knowledge of assembly level programming, Formal Languages and Automata Theory and principles of Compiler Design.

COURSE OBJECTIVES

- To comprehend basics of compilers and the optimizations
- To carry out control flow & data flow analysis of programs and conceptualize the dependency
- To learn optimization techniques using compilers
- To perform register allocation & instruction scheduling for improving program performance

COURSE CONTENTS

UNIT 1 — 10 Hours

Overview of optimizing compilers & applications
Review of Compiler Structure, Importance of code optimization, Structure of optimizing compilers, Optimizations in aggressive optimizing compilers, Applications of Compiler Technology, Informal Compiler algorithm notation (ICAN): Extended Backus Naur Notation, Introduction to ICAN. Producing code generators automatically: Introduction to automatic generation of code generators.

UNIT 2 — 10 Hours

Control flow Analysis: Methods of control flow analysis, different search methods & traversals, dominators & post dominators, loops & strongly connected components, reducibility, interval analysis, structural analysis.

UNIT 3 — 10 Hours

Data flow analysis of programs: Reaching definitions, basic concepts, lattices, flow functions, fixed points, taxonomy of dataflow problems & solution methods, iterative data flow analysis, control tree based data flow analysis, dealing with arrays, structures & pointers, construction of dataflow analyzers, Dependence relations, and basic block dependence DAGs.

UNIT 4	8 Hours

Introduction to optimizations: global optimizations, individual optimizations, Early optimizations: constant folding, scalar replacement, algebraic specification, value numbering, copy propagation, Redundancy elimination: common sub expression elimination, loop invariant code motion, partial redundancy elimination, code hoisting, Loop optimization: induction variable optimization, Procedure optimization: basic concept.

UNIT 5	8 Hours

Register Allocation & Instruction Scheduling

Register allocation & assignment, local methods, graph coloring, other approaches to register allocation, Code scheduling: instruction scheduling, speculative loads & boosting, speculative scheduling, trace scheduling; Basic block scheduling, global code scheduling.

TEXT BOOKS

2. Steve Muchnick, Advanced Compiler Design & Implementation, Morgan Kaufmann publishers, 1997.

3. Alfred V. Aho, Monica S. Lam, Ravi Sethi, Jeffrey D. Ullman, "Compilers : Principles, echniques and Tools", Second Edition, Pearson Education, 2007.

REFERENCE BOOKS

TEACHING METHODS

- Black Board Teaching.
- Power point presentation (If needed).
- Tutorial Classes.

ASSESSMENT METHODS

Continuous internal Evaluation (CIE) for 50 Marks

- Surprise test / Tutorials tests to be conducted for each topic for 10 marks.
- Mini project / Case study based on practical application for 10 marks.
- Three mid semester examinations will be conducted each for 30 marks and the average of best of two will be taken.

Semester End Examination (SEE) for 50 Marks

Final examination, of 100 Marks will be conducted and will be evaluated for 50 marks.

COURSE OUTCOMES

After successful completion of the course the student will be able to:

CO	Description	BL
CO1	Provide an overview compiler design , applications and the technology.	L1
CO2	Analyse the control flow in the given programs using the popular research methods used in compiler design.	L4
CO3	Perform data flow analysis and dependence analysis required for efficient compiler design.	L2
CO4	Illustrate various code optimization techniques.	L2
CO5	Design register allocation and apply instruction scheduling algorithms for optimizing resources.	L4

Course Outcome to Programme outcome Mapping:

PO	1	2	3	4	5	6	7	8	9	10	11	12	PSO1	PSO2	PSO3
CO1	3		3	3										3	
CO2	3		3	3										3	
CO3	3		3	3										3	
CO4	3		3	3										3	
CO5	3		3	3										3	

NITTE EDUCATION TRUST

NITTE MEENAKSHI INSTITUTE OF TECHNOLOGY
An Autonomous Institution Approved by UGC/AICTE/Govt. of Karnataka
Accredited by NBA (Tier-I) and NAAC 'A+' Grade
Affiliated to Visvesvaraya Technological University, Belagavi
Post Box No. 6429, Yelahanka, Bengaluru-560064, Karnataka, INDIA

KNOWLEDGE ▪ CHARACTER ▪ UNITY

DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

Laboratory facility for PG-Renewable Energy

1. Wind energy training system
2. Solar thermal training system
3. Solar PV training system
4. Grid tied Solar system.
5. PSCAD/EMTDC software
6. MATLAB software

DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

Laboratory facility for PG-VLSI AND EMBEDDED SYSTEMS

Major software packages available

Sl No	Dept.	Description of Item	Date of Purchase	Quantity	Actual Cost(INR)	Name and Address of Venders/Suppliers
1	ECE	CADENCE SOFTWARE	13/12/2019	20	1100000	ENTUPLE TECOLOGIES Pvt. Ltd. INDIANAGARA ,BANGALORE
2	ECE	MATLAB SOFTWARE	29/7/2022	1	1146693	COREL TECHNOLOGIES KORAMANGALA BANGALORE
3	ECE	HFSS SOFTWARE	30/3/2022	1	879100	ENTUPLE TECOLOGIES Pvt. Ltd. INDIANAGARA ,BANGALORE
4	ECE	XILINK VIVADO	27-03-2019	1	188210	COREL TECHNOLOGIES KORAMANGALA BANGALORE

Department of Computer Science and Engineering

Details of Computers

Name of Lab	No. of Computers	Computers Model and Details	Operating System
M.Tech CSE Lab (R.No :247)	**22**	**HP** Processor**:** Intel Core i3 Processor Speed **:** 3.3 GHz Hard disk**:** 500GB RAM**: 2&**4GB	Ubuntu 20.04
	01	**UPS:** Model **:** Hykon 5KVA Centralized UPS 10 Batteries	
	01	**Projector (NEC):**	
	02	**N/W Switches:**	

Nitte Meenakshi Institute of Technology
(AN AUTONOMOUS INSTITUTION AFFILIATED TO
VISVESVARAYA TECHNOLOGICAL UNIVERSITY, BELAGAVI)
(A Unit of Nitte Education Trust, Mangaluru)
PB No. 6429, Yelahanka, Bengaluru 560-064, Karnataka
Telephone: 080- 22167800, 22167860
Fax: 080 - 22167805

Department of Computer Science and Engineering

Details of Computers &Equipments

Name of Lab	**No. of Computers**	**Computers Model and Details**	**Operating System**
M.Tech CSE R&D Lab (R.No :250)	11	**HP** Processor: Core 2 duo Hard disk: 160GB RAM: 1GB	
	02	**Oddyssey** Processor: Core 2 duo Hard disk**:** 500GB RAM**:** 2GB	
	01	**HP** Processor**:** Core 2 Quad Hard disk**:** 750GB RAM**:** 2GB &2GB	
	02	**HP** Processor**:** Intel Core i3 Hard disk**:** 500GB RAM**:** 4GB	
	01	**Lenova Think Centre** Hard disk**:** 160GB RAM**:** 2GB	
	01	**UPS:** Model **:** APC10KVA Centralized UPS 32 Batteries	
	01	**Printer:** **HP LaserJet P1007**	
	02	**N/W Switches:**	
	03	**A/C**	

Total Systems :17

Laboratory and Workshop : **MBA computer lab**

Computing Facilities	No.of COMPUTERS: 32
Internet Bandwidth	1GBPS
Number and configuration of System	Annexure-05 No: 32 Configuration : i3 processor, 4GB RAM, Hard disk: 1 TB
Total number of system connected by LAN	No. of sytem: 32
Special purpose facilities available (Conduct of online Meetings/Webinars/Workshops, etc.)	Facilities 1 Smart board, 2 Web cam
Facilities for conduct of classes/courses in online mode (Theory & Practical)	Annexure-10 Smart board: 1, Web cam: 2

Gmail

AICTE NMIT <aicte@nmit.ac.in>

Laboratory facility for M.Tech Data Science - Annexure-5

Deepthi K <deepthi.k@nmit.ac.in> Sat, Dec 24, 2022 at 1:02 PM
To: AICTE NMIT <aicte@nmit.ac.in>
Cc: "Dr. Mohan S G" <mohan.sg@nmit.ac.in>

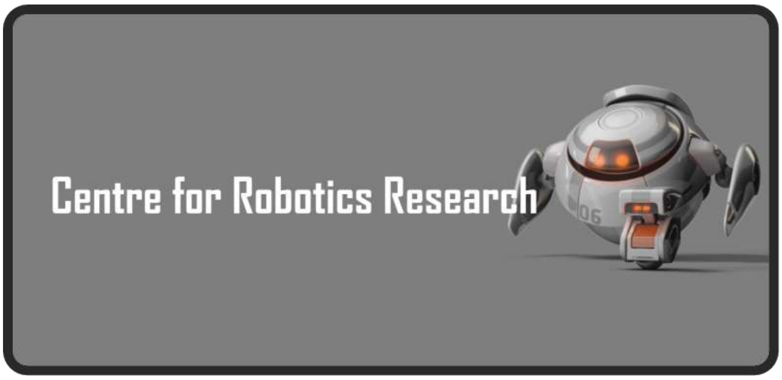
Dear Sir/Madam,
Laboratory facilities exclusive to the Post Graduate Course(M.Tech-Data Science)--
Annexure-5
1) Grid Lab at the Department of ISE for Data Analytics Laboratory course.
2) Ignis Lab with High End System to carry out the project work shared along with UG Programmme.

Regards,
Mrs. Deepthi. K,
Assistant Professor & PG Coordinator,
Department of ISE,
Nitte Meenakshi Institute of Technology,
Bengaluru-64.

NITTE EDUCATION TRUST | NITTE MEENAKSHI INSTITUTE OF TECHNOLOGY

CENTRE FOR ROBOTICS RESEARCH

Nitte Meenakshi Institute of Technology, Bengaluru-64



YouTube

Video to be Embedded on the First Screen: https://www.youtube.com/watch?v=sFgfVwgskr0&t=3s

OVERVIEW

Robotics is an emerging multi-disciplinary field with vast applications ranging from agriculture to outer space explorations. The Nitte Education Trust/Management has established Centre for Robotics Research (CRR) as one of its Centres of Excellence (CoE) to promote collaborative research and development in the field of Robotics & its allied disciplines. CRR has dedicated faculty members and students who are actively pursuing projects/research in the field of Robotics and its allied disciplines.

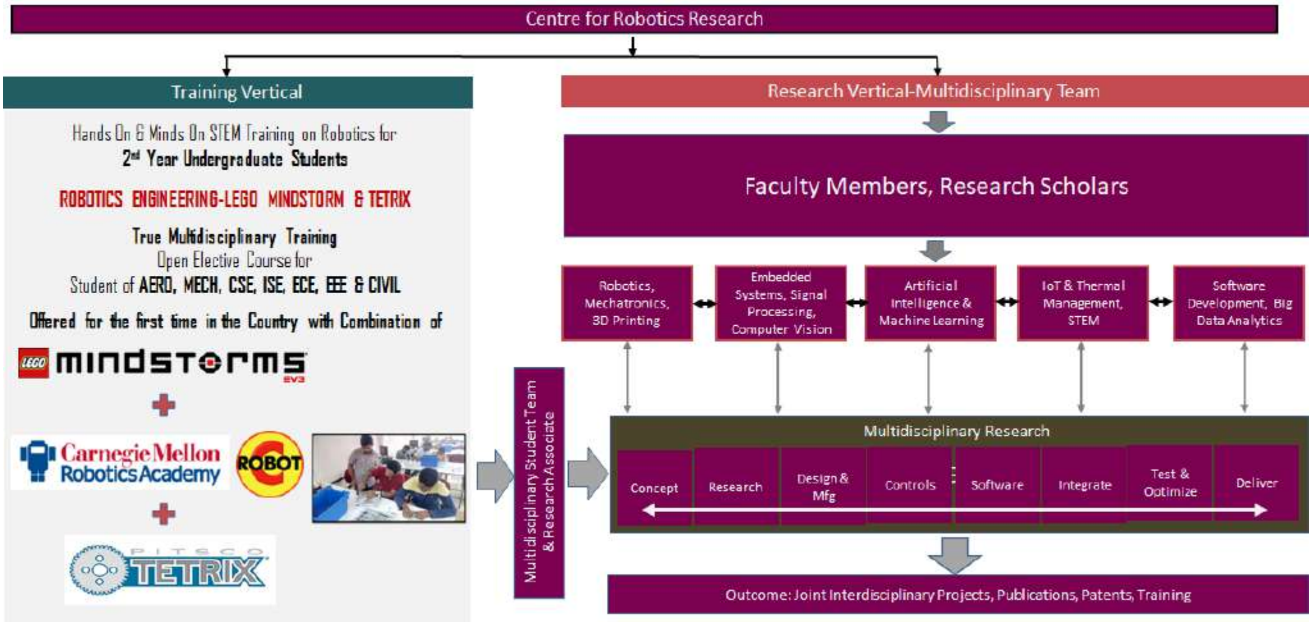
THRUST AREAS OF RESEARCH

a) Design & Development of Novel Robotic Systems
b) Unmanned Aerial & Ground Vehicles
c) Industrial Automation/Process Automation/Robot Process Automation (RPA)
d) Control Systems/ Localization, Path Planning &Autonomous Navigation Strategies
e) 3D Printing/Process Parameter Optimization
f) Artificial Intelligence/Machine Learning/DeepLearning
g) Computer Vision/Machine Vision Systems
h) Big Data Analytics
i) Social Robotics/Human Robot Interaction (HRI)
j) Real Time Control of Robots using EmbeddedSystems
k) Application of STEM/STEAM in Robotics Domain

HIGHLIGHTS

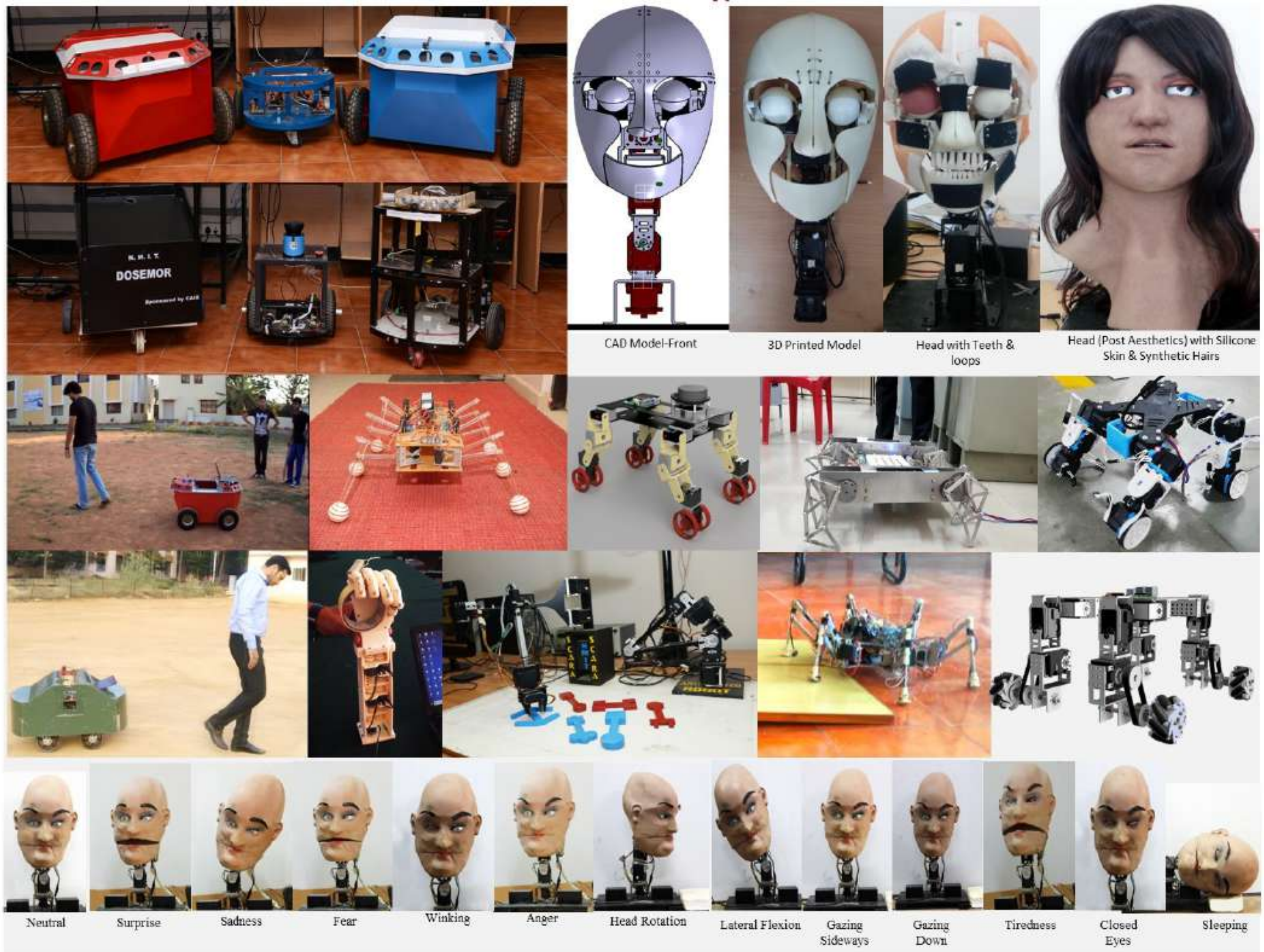
18	650+	50+	03	₹ 1.2+	03
No. of Robots Design & Developed	No. of Students trained on Robotics	No. of Publications in Robotics & Allied Areas	No. of Dedicated Labs Established	Successfully Executed Projects worth more than Rs 1.2 Crore	No. of Specialized Courses

OUR VERTICALS



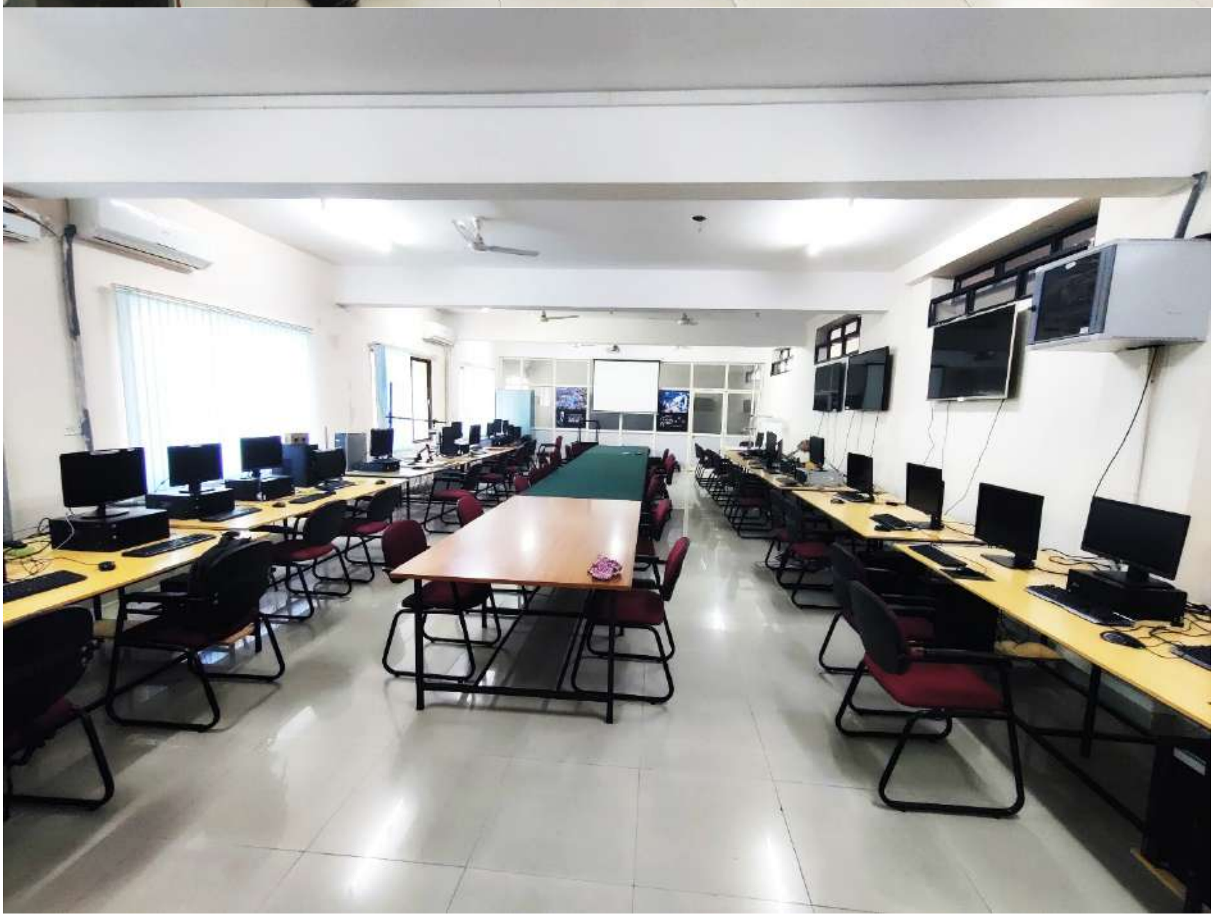
OUR MOTTO

PRODUCTS/TECHNOLOGIES DESIGN & DEVELOPED

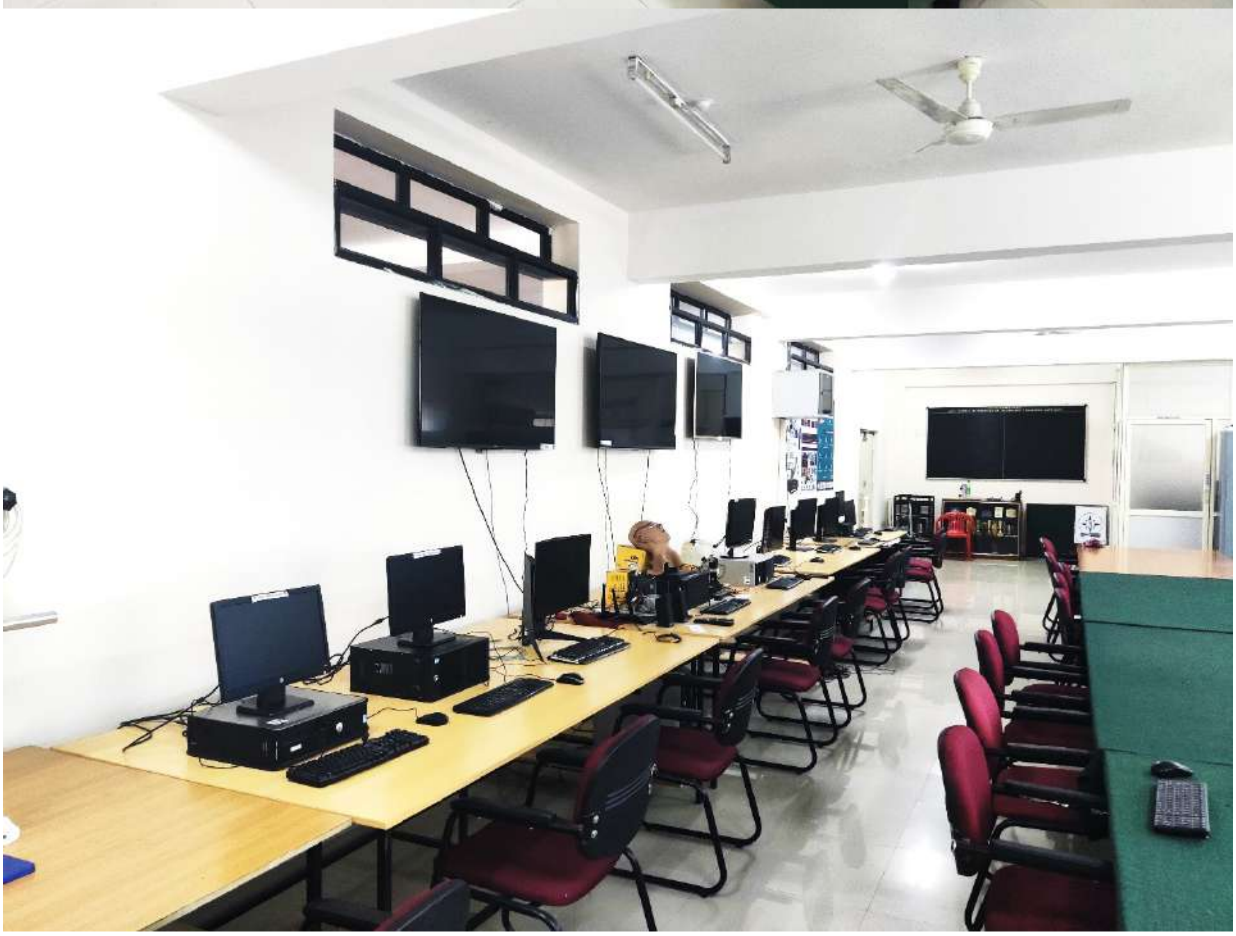


OUR FACILITIES

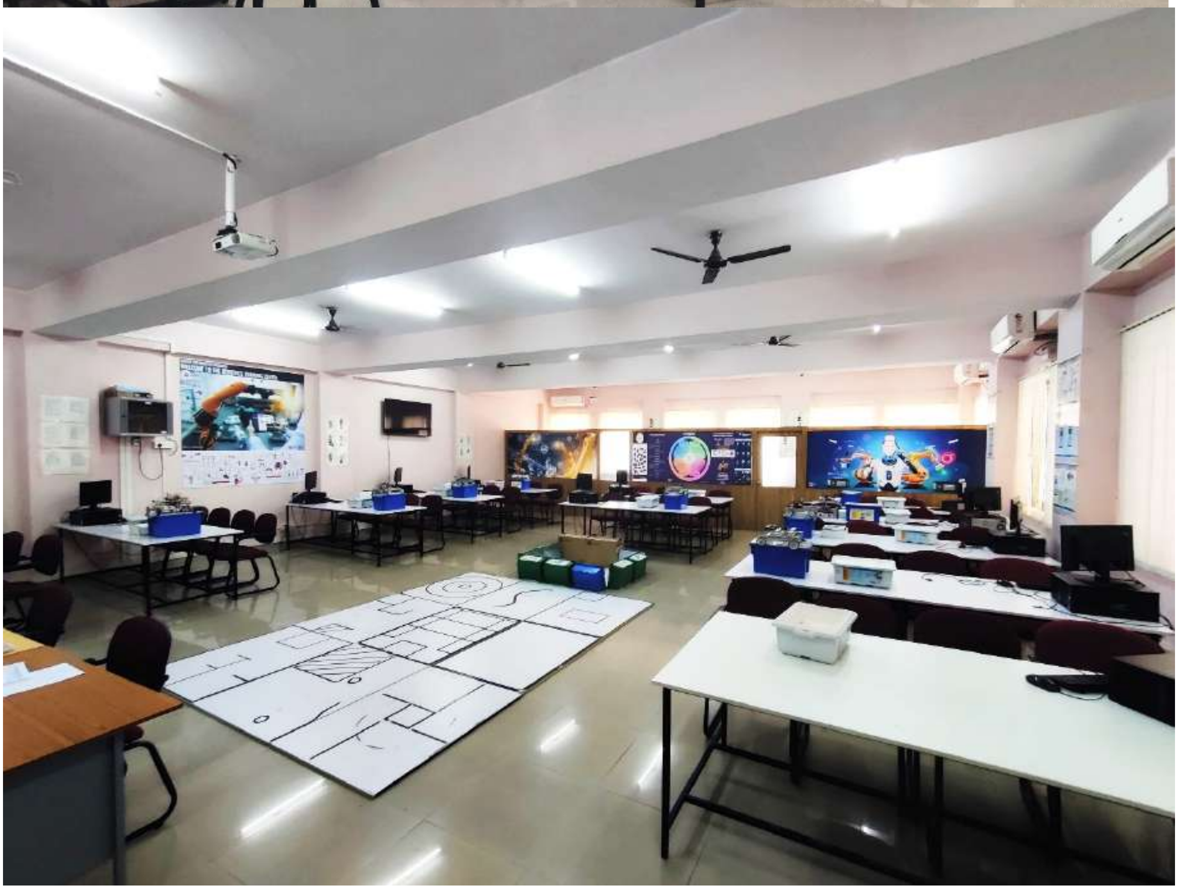
RESEARCH CENTRE:




IEEE
KSCST



TRAINING CENTRES:




THE FUTURE IS HERE....
AUTONOMOUS VEHICLES AND AI LABORATORY

Some of the equipment available at the Centre for Robotics Research (CRR) are as follows:

SINO		FACILITY	CAPABILITIES
1		High End Workstations • HP Z600 with Intel Xeon Processor • Lenovo v520 Tower • Dell Workstation	Workstations can be utilized for High Performance Computing, Design, Analysis, AI/ML Training etc
2	  	Robot Research Platforms Such as • Wheeled Mobile Robots • Firebird Research Platform • Legged Mobile Robots	• Mobile Robots can be used as a Research Platform to test your control system/theory program etc • External Control Boards & Sensors can be interfaced with these robots for autonomous navigation, data collection etc. • The robots are actuated by DC Servo Motors.
3		2nd and 3rd Generation Humanoid Robotic Head for Interactive Applications	• Humanoid Robotic Head comprises of 12 Degrees of Freedom. • Developers/Research can utilize this platform and develop interactive robotic applications.
4		U Print SE From Stratasys-FDM based Rapid Prototype Machine	• The FDM based Rapid Prototype machine is capable of printing industrial grade components with upto 0.254 mm resolution. • Dual Extruder: Separate Extruder for Build Material & Support Material • Max build volume is 203 x 203 x 152 mm. • Supported Material: ABS, Water soluble
5		Embedded Development Boards • NVIDIA Jetson TK1 Board CPU-GPU	These Development boards can be utilized for Application/Product Development and Demonstrations.

	 	• UDOO Board Quad Ultra • NVIDIA TEGRA Jetson TX2 • Raspberry Pi	
6		LIDAR Sensors	This Sensor can be used for various applications such as measuring distance to the obstacles, Mapping the environment etc.
7		Camera • Logitech HD Webcam	These cameras can be used for Image/Video Capturing and Analysis
8		Large Wide Screen Displays	These Display systems can be utilized to demonstrate the project work, presentations etc.
9	 	Prototype Development Kits • LEGO Mindstorms NXT • TETRIX MAX	These Hardware systems can be utilized for Prototype Development & Demonstrations

10		Self-driving Car-Prototype Kit	These Hardware systems can be utilized for Prototype Development & Demonstrations wrt self-driving, AI & ML and learning Python Programming.

TRAINING

The Centre also offers hands-on and minds-on training on Robotics & Allied Disciplines using state of the art STEM Kits. At present the Centre is offering three unique courses which are as follows:

SINO	COURSE TITLE	TYPE OF THE COURSE	SEM	COURSE OFFERED TO STUDENTS FROM	CURRICULUM SUPPORT
1	FUNDAMENTALS OF ROBOTICS ENGINEERING USING LEGO MINDSTORMS	ABILITY ENHANCEMENT COURSE	4	ISE, ECE, AE, AI & Data Science	Carneign Mellon Robotics Academy, USA
			5	CSE, ME, EEE, AI & ML	
2	AUTONOMOUS VEHICLES AND AI USING SELF DRIVING CARS	ABILITY ENHANCEMENT COURSE	4	CSE, ME, EEE, AI & Ml	Master.Ai From Auto Auto labs, Texas, USA
			5	ISE, ECE, AE, AI & Data Science	
3	ADVANCED ROBOTICS ENGINEERING USING TETRIX	OPEN ELECTIVE	5	ISE, ECE, AE, AI & Data Science	PITSCO Education, USA
		INTERNSHIP	6	CSE, ME, EEE, AI & ML	


ROBOTICS ENGINEERING

LETTER OF APPRECIATION

915 East Jefferson
Post Office Box 1708
Pittsburg, Kansas 66762
Telephone 800-828-5787
620-231-0000
Fax 620-231-1339

4/11/2022

Letter of Appreciation

To
Dr H C Nagaraj
Principal
Nitte Meenakshi Institute of Technology
Bengaluru-560064
Karnataka, INDIA

Respected Sir,

We at **Pitsco Education** sincerely appreciate the efforts of **Nitte Meenakshi Institute of Technology (NMIT)** for setting up a Centre for Robotics Research and being one of the earliest adopters of PITSCO Education products in Engineering Education in India. We have understood that you have formally Incorporated our TETRIX Products in your Robotics Engineering curriculum and have transformed your classroom with Future-ready STEM Learning.

For more than 45 years, Pitsco Education has supplied classrooms with innovative and engaging kits, equipment, and activities that put the power of STEM learning into students' hands and minds. Our classroom-proven concepts bring together student-centered, standards-based activities with hands-on projects that develop critical thinking and collaboration skills in exciting areas such as robotics, dragsters, aerospace, sustainable energy, structures, engineering, and physical science. Conveniently packaged with classroom management in mind and backed by our industry-leading customer service and technical support, everything we provide is teacher tested and teacher approved.

We appreciate your trust in our products and we wish you all the success in your future endeavours.

With Regards,

Melissa a Paterni

Melissa Paterni
President

Letter of Appreciation

To
Dr H C Nagaraj
Principal
Nitte Meenakshi Institute of Technology
Bengaluru-560064
Karnataka, INDIA

Respected Sir,

We at **Master AI, Inc.** are delighted to learn that **Nitte Meenakshi Institute of Technology (NMIT)** has formally Introduced a course on **Python and AI with Autonomous Cars** using our AUTOAUTO products. We believe our Learning Platform and Management System with Project Based Learning, using Virtual and Physical Autonomous Cars, will provide your students an opportunity to Master the Python Programming and Artificial Intelligence Skills needed for the 21st Century.

With more than 180 Hrs of course contents, which includes real world projects, your students will learn high-demand skills for their future jobs. Once again, we appreciate your trust in our products and we wish you all the success in your future endeavours.

With Regards,

Dr. Joyce Rigelo
Joyce Rigelo

ASSOCIATED ACADEMIC PROGRAMS

Master of Technology in Robotics and Artificial Intelligence
(Approved by AICTE, UGC, Govt of India, VTU, Govt of Karnataka)

Department of Mechanical Engineering in association with the Centre for Robotics Research, will be offering a NEW PG Program i.e. M.Tech in Robotics and Artificial Intelligence from the AY 2022-23 onwards. The PG program with above specialization is being offered for the first time in the state of Karnataka with an intake of 18 students. following are the salient features of the Programme:

- Industry Relevant Curriculum with Complete Hands-on & Project Based Learning.
- Industry Supported Laboratories
- Access to State-of-the-art Research Centres for Projects & Internships
- Job Opportunities in Core Mechanical & IT Multi-National Companies

SPONSORED RESEARCH PROJECTS

We have Successfully Completed/Carrying out Projects worth more than Rs 1 Crore till date from Various Funding Agencies Such as

ONGOING PROJECTS

SINO	PROJECT TITLE	SPONSORS	GRANT AMOUNT	STATUS
1	Establishment Of Centre for Robotics Research to Promote Multidisciplinary Research in Engineering Education	VGST, Govt of Karnataka	16.8 Lakhs (Part of Rs 60 Lakhs)	Ongoing
2	Design And Development of Advanced Multi Drive Mobile Robot	KSCST, Govt of Karnataka	Rs 1.5 Lakhs	Ongoing

SL NO	PROJECT TITLE	SPONSORS	GRANT AMOUNT	Status
1	Detection of Horizon in MAV Images	Aeronautical Development Establishment, DRDO, Min of Defence, Govt. of India	Rs. 9.9 Lakhs	Completed
2	Computer Vision Based Horizon Detection from MAV Video and Estimation of Attitude from Horizon Vision	Aeronautical Development Establishment (ADE), DRDO, Bangalore	Rs 9.60 Lakhs	Completed
3	Development of Video Processing Techniques for Removal of Image Perturbations	Aeronautical Development Establishment (ADE), DRDO, Bangalore	Rs 9.85 Lakhs	Completed
4	Industrial Robot Automation	Centre for Artificial Intelligence and Robotics (CAIR), DRDO, Bangalore	Rs. 9.50 Lakhs	Completed
5	Development of algorithms for fusion of multi sensor, multi spectral, multi focus imagery	VTU Research Fund, VTU, Belgaum	Rs 8.17 Lakhs	Completed
6	STUDSAT (STUDent SATellite) To design, develop and Fabricate India's First Pico Satellite	Consortium of Seven Colleges with NMIT as the Lead Institution, Vision Group of Science and Technology, Karnataka	Rs 55.00 Lakhs	Completed
7	Articulated 5 DOF Pick and Place Robot	IEEE- USA, Centre for Artificial Intelligence and Robotics (CAIR), DRDO, Bangalore	Rs 8.50 Lakhs	Completed
8	Segmentation and Classification of sky and non sky region using Texture and Neural Network Classifier	Innovative Entrepreneur Development Cell (IEDC), New Delhi	Rs 1.00 Lakhs	Completed
9	Door Sensing Mobile Robot	Centre for Artificial Intelligence and Robotics (CAIR), DRDO, Bangalore	Rs. 5.00 Lakhs	Completed
10	Design and Development of Robot Mechanisms, Vision and Control Algorithms	Department of Science and Technology, New Delhi	Rs 28.00 Lakhs	Completed
11	Development of a Real Time Human Tracking Capability on a Mobile Platform	Centre For Artificial Intelligence and Robotics (CAIR), DRDO, Bangalore	Rs. 9.90 Lakhs	Completed
12	Development of algorithms for Video Shot Detection and Video Summarization	Combat Vehicle Research and Development Establishment (CVRDE), DRDO, Chennai	Rs. 17.33 Lakhs	Completed

COMPLETED PROJECTS

RECOGNITIONS/AWARDS/PUBLICATIONS:

- Installed Pick & Place Robot in the Birla Science Centre, Hyderabad.

- Designed & Developed One of its Kind Humanoid Robotic Head in the Country

- More than 80 Publications in Peer Reviewed International /National Journals & Conferences

- Accolades won by Students at International Robotics Competition
- Best Project Award from KSCST, Govt of Karnataka

BEST PROJECT OF THE YEAR AWARD-2021

By KSCST, Govt of Karnataka

- Only Institute in the Country to Offer State of the art STEM Based Robotics Course in combination of TETRIX & LEGO at UG Level

Mr. BHADRESHJMUDAKAMATH, Mr. PRASANNA APPASAHEB MODI Mr. PRATHAP S & Mr. SANDEEP DESHPANDE students of NITTE MEENAKSHI INSTITUTE OF TECHNOLOGY, BENGALURU participated in the 45" Series of Student Project Programme (SPP) held during 12-13th August, 2022 at Visvesvaraya Technological University (VTU), Belagavi. Their project titled DESIGN AND DEVELOPMENT OF LAND ROVER ROBOT FOR MILITARY AND SPACE APPLICATIONS under the guidance of Mr. PRASHANTH N & Dr. J. SUDHEER REDDY, was selected for the Seminar/Exhibition. The SPP is supported by Department of Science and Technology, Government of Karnataka and Department of Science and Technology, Government of India.

PATENTS

SINO	TITLE	STATUS
1	Computer Vision Based Horizon Detection for an aerial vehicle on FPGA	Granted
2	Design and Development of Remote-Controlled Multipurpose Transplanter	Published

PUBLICATIONS

ROBOT DESIGN & ANALYSIS	
1.	Prashanth N, Vamsi Krishna T G, Keerthi Prakash G C, Sunil S, Sudheer Reddy J, "Influence of Gait, Gradient Terrain on the Performance of Six Legged Robot", 2022 IEEE 2nd Mysore Sub Section International Conference (MysuruCon), 16-17th October 2022 (Paper Accepted).
2.	Prashanth N, Karthik S, Rahul G R, Sandarsh T B, "Design and Optimization of Foot Locus Trajectory of Theo Jansen Mechanism",Advances in Structures, Systems and Materials, pp 237-248, 2020 Springer Publication: Link: https://link.springer.com/chapter/10.1007/978-981-15-3254-2_22
3.	Kishan Reddy Raghunath and N. Prashanth , "Influence of material density & model orientation on the mechanical strength & surface morphology of FDM based 3D printed specimens", AIP Conference Proceedings 2283, 020090 (2020) https://doi.org/10.1063/5.0026999
4.	Prashanth N, Manoj R M, Nikhil B, "Influence of Link Lengths & Input Angles on the Foot Locus Trajectory of Klann Mechanism", IOP Conf. Ser.: Mater. Sci. Eng.624 012014, 2020. (SCOPUS/WEB OF SCIENCE INDEXED)- H Index- 24, SJR-0.19. Link: https://iopscience.iop.org/article/10.1088/1757-899X/624/1/012014
5.	Sunil S, Sudip C Gupta, Mrityunjaya Sherikar, Prashanth N, Jharna Majumdar, "Design and Performance Analysis of All Terrain Mobile Robot", International Journal of Engineering Research in Electronics and Communication Engineering (IJERECE), Vol 4, Issue 11, November 2017 (ISSN (Online) 2394-6849). Thomson Reuters ID-q-6288-2016, Impact Factor-3.689. Link: http://ijerece.com/abstract.php?id=11651
6.	N Prashanth, R M Manoj, B Nikhil, "Influence of Link Lengths & Input Angles on the Foot Locus Trajectory of Klann Mechanism", 1st International Conference On Mechanical Power Transmission (ICMPT-2019), 11th – 13th July 2019, IIT Madras, INDIA
7.	Prashanth N, "Influence of Erodent Size, Impingement Angle and Fillers on Solid Particle Erosion Wear Behaviour of Carbon Fiber Reinforced Epoxy Composite" International Conference on Emerging Research in Civil, Aeronautical and Mechanical Engineering (ERCAM-2019), 25th – 26th July 2019, Bangalore, INDIA. AIP Publishing: https://aip.scitation.org/doi/abs/10.1063/1.5141593?journalCode=apc
8.	Kishan Reddy R, Akshay Bhat, Vamsi Krishna, Prashanth N, Jharna Majumdar, "Design and Development of Low-Cost Anthropomorphic Hand", NAFEMS Conference Engineering Modelling, Analysis, Simulation and 3D-Printing (NIRC-2018), Bangalore, July 2018.
9.	Prashanth N, Karthik Ravi M, Prashanth Kumar Reddy, Sunil Kumar H S, Jharna Majumdar, "Minimalist Mechanical Design & Characterization of an Android for Human Robot Interaction", IEEE -International Conference on Control, Automation and Robotics 2017 (ICCAR-2017), 22nd April 2017 to 24th April 2017, Nagoya, JAPAN. Link: https://ieeexplore.ieee.org/document/7942664
10.	Prashanth.N, Sunil S, Min Raj Nepali, Jharna Majumdar, "Application of FDM based Rapid Prototyping to Develop Humanoid Robotic Head for Human Robot Interaction", International NAFEMS Conference on Engineering Analysis, Modeling, Simulation and 3D-Printing (NAFEMS-3D) – 2016, Bangalore during 29-31 August 2016.
11.	Mr. Pavan Kumar AV ,Mr. Mohan G , Mr Brijesh N, Mr. Chethan V, Mr. Prashanth N, "IC Engine Powered Forward and Reverse Transmission for All Terrain Robot", International Conference on Computer Science and Mechanical Engineering (ICCSME), 22nd March 2015 Pune. IR-CSMEPUNE-22035-320.
IMAGE AND VIDEO PROCESSING	
12.	Dr. Jharna Majumdar, M Aniketh, B R Abhishek, Nikhil Hegde, Video Shot Detection in Transform Domain, IEEE Sponsored 2nd International Conference for Convergence in Technology (I2CT) 2017Paper presented in the Conference - Jan 6th& 7th 2017 and published in the IEEE Xplore 978-1-5090-4307-1/17/$31.00 ©2017 IEEE
13.	Dr. Jharna Majumdar, Aniketh M, Abhishek B R, Detection of Cut Transition of Video in Transform Domain Paper Presented in the Computing Conference 2018 10-12 July 2018 London, UK, and published in the Proceedings of the 2018 Computing Conference, Volume 1 (Intelligent Computing) DOI: 10.1007/978-3-030-01174-1_17
14.	Dr. Jharna Majumdar, Giridhar, Aniketh, Modelling Fade Transition in a Video using Texture Methods Paper accepted in the International Conference on Cybernetics, Cognition and Machine Learning Applications (ICCCMLA) - 2019
15.	M P Ashray, Madhan H M, Dhanush Adiga, Dr. Jharna Majumdar, Texture-Based Video Shot Detection and Summarization Methods, Paper accepted in the International Conference on Cybernetics, Cognition and Machine Learning Applications (ICCCMLA) - 2019
16.	Jharna Majumdar, Ashish Bhattarai, Saurabh Adhikari, Optical Flow-Initiated Particle Filter Framework for Human-Tracking and Body-Component Detection, International Conference on Computational Science and Engineering (ICCSE - 2016), Malaysia from 28th to 30th November 2016.
17.	Dr. Jharna Majumdar, Aniketh M, Giridhar N R, Optical Flow for Detection of Transitions in Video, Face and Facial Expression Paper Presented in the Computing Conference 2018 10-12 July 2018 London, UK , and published in the Proceedings of the 2018 Computing Conference, Volume 1 (Intelligent Computing) DOI: 10.1007/978-3-030-01174-1_38
18.	Aditya H, Gayatri T, Santosh T, Shilpa Ankalaki, Dr. Jharna Majumdar, Performance Analysis of Video Segmentation, 2017 International Conference on Advanced Computing and Communication Systems (ICACCS -2017), Jan. 06 – 07, 2017, Coimbatore, INDIA. DOI: 10.1109/ICACCS.2017.8014567 978-1-5090-45594/17/$31.00©2017IEEE
19.	Dr. Jharna Majumdar, Giridhar N R, Sudip Chandra Gupta, Human Tracking by a Mobile Robot in Low Illumination Environment, Paper presented in the Third International Conference on Circuits, Control, Communication and Computing – 2018 (I4C) at MSRIT, Bangalore on October 3 – 5, 2018, And published in the IEEE Xplore DOI: 10.1109/CIMCA.2018.8739668, ISBN: 978-1-5386-8487-0, ISSN: 2381-4128

20.	Adarsh C, Harshpreet Singh, Rahul V.C, Dr. Jharna Majumdar, Real-time Performance Analysis of Retinex International Conference on Advanced Informatics for Computing Research (ICAICR) – 2019, Shimla, July 15-16, 2019
21.	Dr. Jharna Majumdar, Dhanush M Adiga, Madhan HM, MP Ashray, Comparison of Video Shot Detection Methods Using Higher Order Local Descriptor, International Conference on Advanced Informatics for Computing Research (ICAICR) – 2019, Shimla, July 15-16, 2019
22.	Archana V, Dr. Jharna Majumdar, Video Shot Detection using Image Property, International Journal of Advanced Research (IJAR), ISSN: 2320-5407, Vol. 3, Issue 8, August 2015
23.	Kritika Gupta, Dr. Jharna Majumdar, Video Shot Detection using Distance Measure, International Journal of Innovative Research in Science, Engineering and Technology (IJIRSET), ISSN: 2319-8753, Vol. 4, Issue 8, August 2015,
24.	Priyanka A R, Dr. Jharna Majumdar, Video Shot Detection using Texture Feature, International Journal of Science and Research (IJSR), ISSN: 2319, Vol. 4 Issue 8, August 2015 Impact Factor (2013): 4.438
25.	Anup D Rao, Dr. Jharna Majumdar Kiran S, Multiple Target Tracking Applied with Memory-Based Particle Filter, International Journal of Innovative Research in Computer and Communication Engg. (IJIRCCE), ISSN: 2320-9801, Vol. 3, Issue 7, July 2015
26.	Kartheek G C R, Dr. Jharna Majumdar Kiran S, Multiple Human Tracking Based on Auxiliary Particle Filter International Journal of Innovative Research in Computer and Communication Engineering (IJIRCCE), ISSN: 2320-9801, Vol. 3, Issue 7, July 2015
27.	Giridhar N R, Aniketh M, Ashish Kumar Vishwakarma, Ganesh Prateek L, Dr. Jharna Majumdar, Detection of Human Face in a Meeting Using Audio Sensitive Camera, Paper presented in the 4th International Conference On Chip, Circuitry, Current, Coding Combustion & Composites, 16th November & 17th November, 2017, Anekal, Bengaluru and Paper Published in the International Journal of Engineering Research in Computer Science and Engineering (IJERCSE) Vol 4, Issue 11, November 2017
28.	A Peter Hudson, Giridhar N R, Hari Venkata Deepak S, Dr. Jharna Majumdar, Transition Based on Histogram Properties, International Journal of Engineering Research & Technology, ISSN: 2278-0181, Vol. 6 Issue 10, October 2017.
29.	B N Abhinava, Dr. Jharna Majumdar, Automatic Detection of Human in Video and Human Tracking International Journal of Engineering Research & Technology, ISSN: 2278-0181, Vol. 6 Issue 10, October 2017
30.	Jharna Majumdar, Sudip C Gupta, B Prassanna Prasath, Linear and Non-Linear Control Design of Skid Steer Mobile Robot on an Embedded Board, International Journal of Robotics and Automation (IJRA), Vol. 6, No. 2, June 2017, pp. 121~130, ISSN: 2089-4856, DOI: 10.11591/ijra.v6i2.pp121-130
31.	Karthik S, Dr. Jharna Majumdar, Real Time Video Segmentation in Cluttered Environment using Graph Cut Approach, International Journal of Innovative Research in Science, Engineering and Technology, ISSN (Online): 2319-8753 ISSN (Print): 2347-6710, Vol. 7, Issue 1, January 2018, DOI:10.15680/IJIRSET.2018.070102
MACHINE LEARNING & ANN, DNN, CNN	
32.	Jharna Majumdar, Shilpa Ankalaki, Comparison of Clustering Algorithms using Quality Metrics with Invariant Features Extracted from Plant Leaves, International Conference on Computational Science and Engineering (ICCSE - 2016), Malaysia from 28th to 30th November, 2016
33.	Shilpa Ankalaki, Sudip Chandra Gupta, B Prassanna Prasath, Dr. Jharna Majumdar, Design and implementation of Neural Network Based Non-Linear Control System (LQR) for Target Tracking Mobile Robots, Paper presented in the International Conference on Advances in Computing, Communications and Informatics (ICACCI) - 2018 on Sept 19 2018 at PESIT, Bangalore.
34.	Dr. Jharna Majumdar, Anand Mahato, Identification of Commonly used Medicinal Leaves using Machine Learning Techniques with SIFT Corner Detector as Features, Paper Published in the International Journal of Computer Sciences and Engineering, E-ISSN: 2347-2693, Volume-6, Issue-2, Pg. No.341-346
35.	Dr. Jharna Majumdar, Anand Mahato, Comparison of SIFT & SURF Corner Detector as Features and other Machine Learning Techniques for Identification of Commonly used Leaves, Paper Published in the International Research Journal of Engineering and Technology (IRJET), Volume: 05 Issue: 03 Mar-2018, e-ISSN: 2395-0056, p-ISSN: 2395-0072
36.	Jharna Majumdar, Manish Awale, Santhosh Kumar K L, Video Shot Detection Based on SIFT Features and Video Summarization Using Expectation-Maximization, Paper published in the IEEE Xplore, 978-1-5386-5314-2/18/$31.00 ©2018 IEEE
DATA ANALYTICS USING AGRICULTURE & HEALTHCARE	
37.	Dr. Jharna Majumdar, Shilpa Ankalaki, Neeti Chandra, Applying Data Mining Approach and Regression Model to Forecast Annual Yield of Major Crops in Different District of Karnataka, International Journal of Advanced Research in Computer and Communication Engineering (ICRITCSA-2016), Vol. 5, Special Issue 2, DOI 10.17148/IJARCCE, at M S Ramaiah Institute of Technology, Bangalore on October 21st and 22nd 2016.
38.	Tabassum S, Mamatha Bai B G, Dr. Jharna Majumdar, Analysis and Prediction of Chronic Kidney Disease using Data Mining Techniques, International Journal of Engineering Research in Computer Science and Engineering (IJERCSE) Vol 4, Issue 9, September 2017, ISSN (Online) 2394-2320
39.	Sneha N, Dr. Jharna Majumdar, Big Data Application in Agriculture to Maximize the Rice Yield Crop Production using Data Mining Techniques, International Journal of Innovative Research in Computer and Communication Engineering, ISSN(Online): 2320-9801, ISSN (Print): 2320-9798, Vol. 5, Issue 5, May 2017
40.	Jharna Majumdar, Sneha N, Shilpa Ankalaki, Analysis of Agriculture Data using Data Mining Techniques- Application of Big Data, Journal of Big Data, 2017, https://doi.org/10.1186/s40537-017-0077-4
41.	Mamatha Bai. B G, Meghana. V, Jharna Majumdar, Analysis of Wastewater Treatment Plant to Enhance the Eco-Friendly Environment Using Data Mining Techniques, Paper published in the International Journal of Engineering & Technology under IFERP 2018, Vol 7, No 3.29 (2018): Special Issue 29, http://dx.doi.org/10.14419/ijet.v7i3.29.21398
42.	Ms. Shilpa Ankalaki, Sarala Madolli, Jharna Majumdar, Applications of Clustering Algorithms for Analysis of Agriculture Data for Different Districts in Karnataka, Paper published in the International Journal of Engineering & Technology under IFERP 2018
43.	Dr. Jharna Majumdar, Sumant Udandakar, Mamatha Bai B G, Implementation of CURE Clustering Algorithm for Video Summarization and Healthcare Applications in Big Data , Paper Presented in the ERCICA 2018 and published in the proceedings of Emerging Research in Computing, Information, Communication and Applications (ERCICA 2018), Volume 2, ISBN: 978-981-13-6001-5, DOI: 10.1007/978-981-13-6001-5
44.	Mamatha Bai B G, Nalini B M, Jharna Majumdar, Analysis and Detection of Diabetes using Data Mining Techniques – A Big Data Application in Healthcare Paper Presented in the ERCICA 2018, Volume 1, ISSN 2194-5357 ISSN 2194-5365 (electronic), Advances in Intelligent Systems and Computing, ISBN 978-981-13-5952-1 ISBN 978-981-13-5953-8 (eBook), https://doi.org/10.1007/978-981-13-5953-

	8
45.	Mamatha Bai B G, Harshitha R, Jharna Majumdar, Diagnosis of Cardiotocography For Analysis and Prediction of Treatment During Pregnancy, Paper presented in the ICACCI - 2018 on Sept 19 2018 at PESIT, Bangalore. and published in IEEE Xplore, 978-1-5386-5314-2/18/$31.00 ©2018 IEEE
46. 47.	Dr. Jharna Majumdar, Ms. Mamatha Bai B G, Mrs. Shilpa Ankalaki, Data Mining Techniques and Its Applications in Agriculture and Healthcare Sectors for The Benefit of Mankind, Paper published in the Productivity: A Quarterly Journal of The National Productivity Council, ISSN: 0032-9924, e-ISSN: 0976-3902, 2019
48.	Jharna Majumdar, Shilpa Ankalaki, Sabari Prabaaker, Application of Fuzzy Expert System for Analysing Agriculture Data, Book Chapter, DOI: 10.4018/978-1-5225-9175-7.ch002, 2019
49.	Rashmi N S, Mamatha Bai B G, Dr. Jharna Majumdar, Dr. Ramachandra A.C, Data Mining Techniques in the Agricultural Sector , Paper submitted to IFERP 2019
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OUTREACH ACTIVITIES

FORMATION OF IEEE ROBOTICS AND AUTOMATION STUDENT CHAPTER

The Centre for Robotics Research has active IEEE Robotics and Automation Student Chapter with more than 150 student members from across all the engineering disciplines.

IEEE ROBOTICS AND AUTOMATION
Student Branch Chapter

IEEE Robotics & Automation Society

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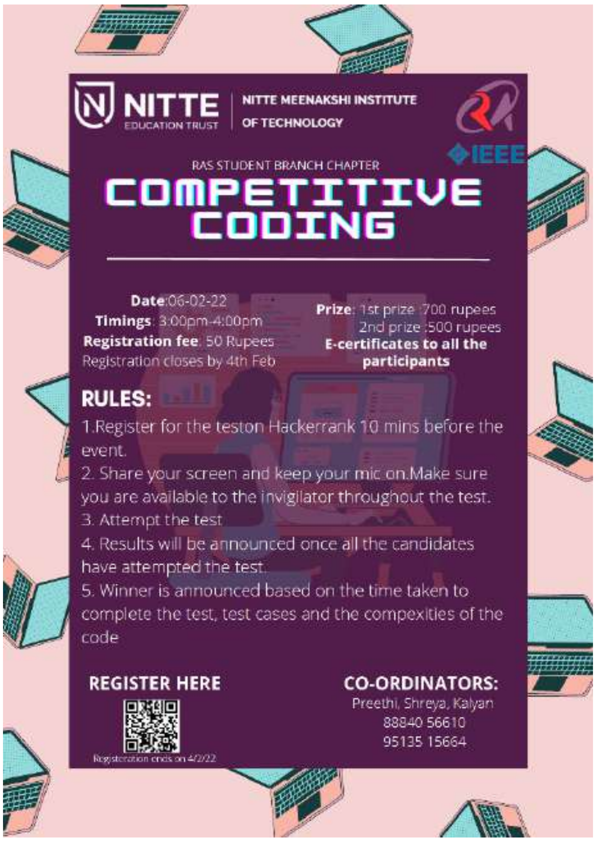
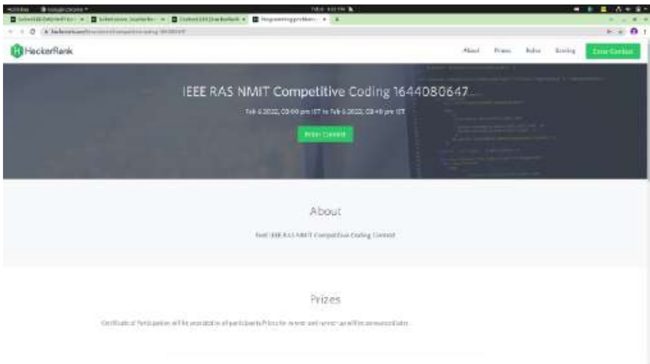
IEEE RAS ACTIVITIES

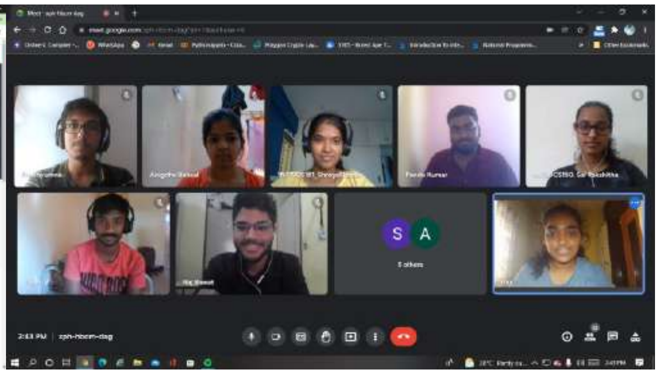
First Technical Event was held on 6-2-2022 as part of Inauguration of IEEE RAS

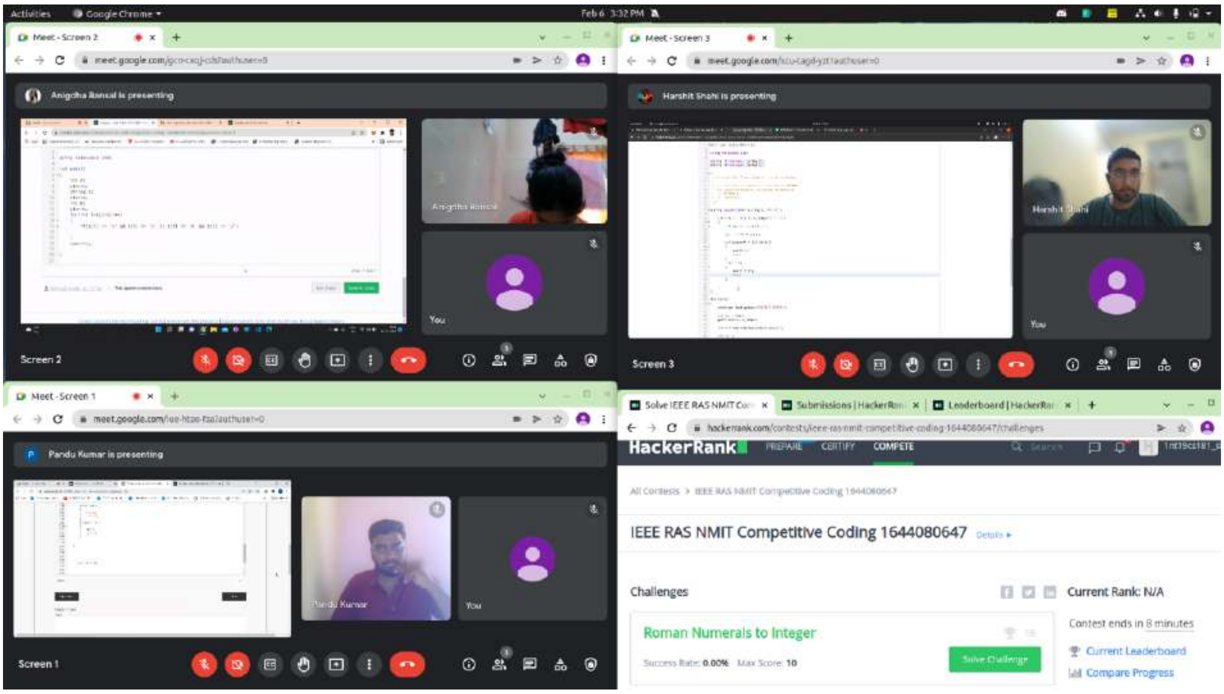


CHALLENGES:

1. Roman numerals to integer
2. Caesar Cipher
3. Extra Long Factorials



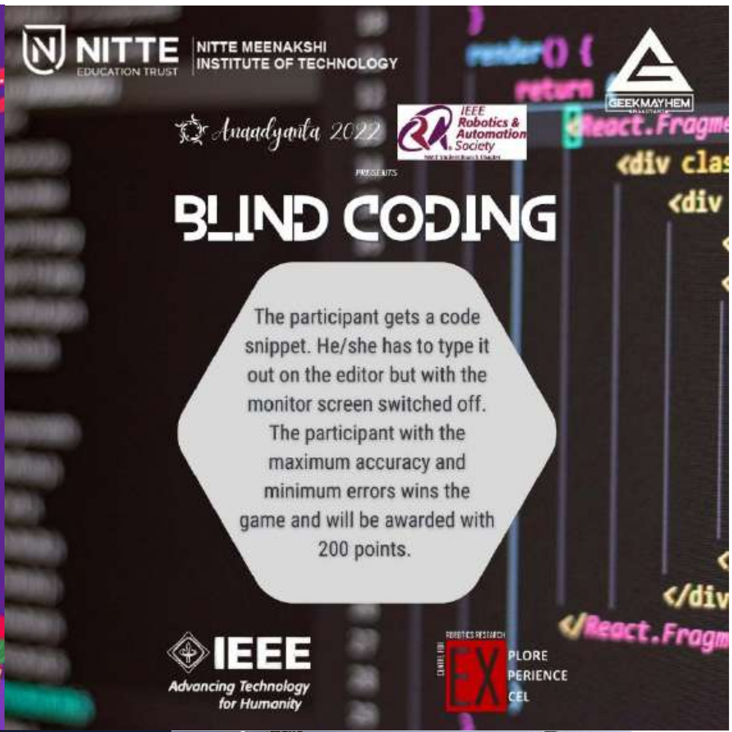




TECHNICAL EVENTS ON THE OCCASION OF ANAADYANTA-ANNUAL TECHNO CULTURAL AND MANAGEMENT FESTIVAL OF NMIT

The following events were organized by IEEE RAS


NITTE EDUCATION TRUST
NITTE MEENAKSHI INSTITUTE OF TECHNOLOGY
GEEKMAYHEM
Anaadyanta 2022
IEEE Robotics & Automation Society
PRESENTS
HEX-FACTA
RULES AND REGULATIONS:
Participants can register for all the 6 events by paying a registration amount of Rs. 200. If the participant is not interested to participate in all the events, he/she can register for a particular event by paying an amount of Rs. 50. The participant should take part in at least 4 different events to be considered for the winning criteria. He/she can participate in a maximum of 10 events.
DESCRIPTION:
The registered participants get a total of 10 coins. Each coin has a value of 100 points. So, in total a participant gets 1000 points on registering. The participant should pay 100 points to participate in an event. On winning that event he/she gets back 200 points. All the details regarding the points will be maintained in an excel sheet so as to avoid any malpractice. At the end of the day the participant with the highest number of points will be declared the winner. The participants with 2nd and 3rd highest points will be declared 1st runner up and 2nd runner up respectively
RULES:
Single event registration = 50
Complete registration = 200
Minimum no. of events = 4 different events
Max. = 10 any of your choice
12th MAY 2022
10AM TO 3PM
WINNER : Rs 6000
1st RUNNER-UP : Rs 4000
2nd RUNNER-UP : Rs 2000
SCAN TO REGISTER
IEEE Advancing Technology for Humanity
CONTACT US:
Greeshma - 9353317898
Preethi - 8884056610
EXPLORE EXPERIENCE EXCEL


NITTE EDUCATION TRUST
NITTE MEENAKSHI INSTITUTE OF TECHNOLOGY
GEEKMAYHEM
Anaadyanta 2022
IEEE Robotics & Automation Society
PRESENTS
BLIND CODING
The participant gets a code snippet. He/she has to type it out on the editor but with the monitor screen switched off. The participant with the maximum accuracy and minimum errors wins the game and will be awarded with 200 points.
IEEE Advancing Technology for Humanity
EXPLORE EXPERIENCE EXCEL


NITTE EDUCATION TRUST
NITTE MEENAKSHI INSTITUTE OF TECHNOLOGY
IEEE Robotics & Automation Society
SIMPLIFIED
DESCRIPTION :
The participant picks a random topic and gets 3 min to explain the topic in simple terms. The person who uses the least number of technical terms will be declared winner and would be awarded 200 points.
GEEKMAYHEM
EXPLORE EXPERIENCE EXCEL
IEEE


NITTE EDUCATION TRUST
NITTE MEENAKSHI INSTITUTE OF TECHNOLOGY
Anaadyanta 2022
IEEE Robotics & Automation Society
TECHNICAL PUZZLE
The participant gets 5 puzzles to be solved within 20 min. One who solves the maximum number of questions in the least time will be declared winner.
IEEE Advancing Technology for Humanity
EXPLORE EXPERIENCE EXCEL


NITTE
NITTE MEENAKSHI INSTITUTE OF TECHNOLOGY
PIN POINT
DESCRIPTION :
The participants will be given 3 darts. They have to aim it at the dartboard. The score will be decided accordingly and the person with the highest score will be given 200 points.
GAME ON
EXPLORE EXPERIENCE EXCEL
Anaadyanta 2022
Summer saga
IEEE

INDUSTRIAL VISIT TO IMTEX

IEEE RAS Students visited the IMTEX Exhibition on Forming, Digital Manufacturing, Industry 4.0 on 20th June 2022

Students and Research Scholar from Atria Institute of Technology Visited the Centre for Robotics Research on 10-06-2022 to understand the training & research activities of the Centre

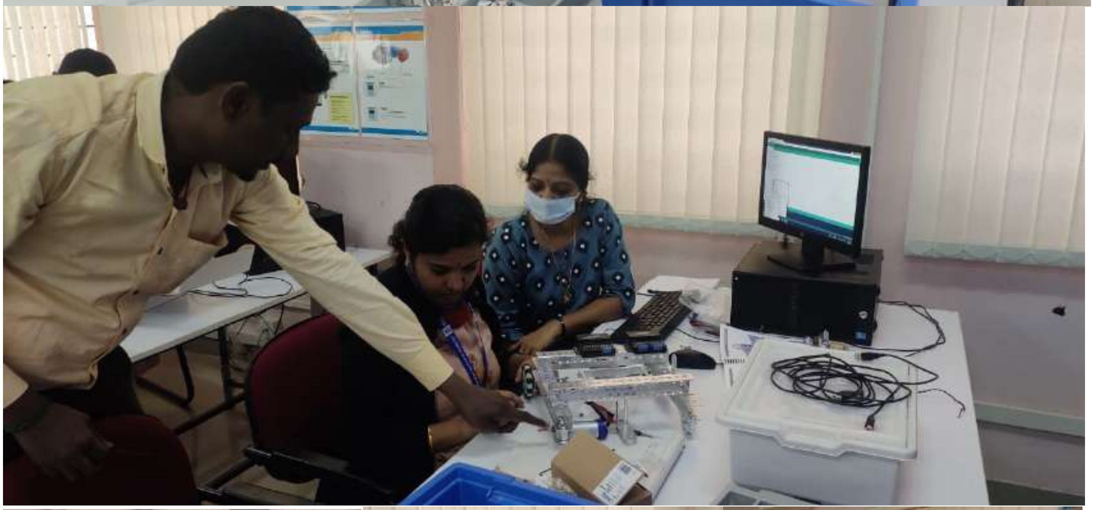
TRAIN THE TRAINER PROGRAM

Hands-on Train the Trainer Program was conducted by Centre for Robotics on 18th-20th July 2022. The training was imparted by industry personnel on the following topics

1. Advanced Robotics using Tetrix
2. Self-Driving Cars and AI

The following Faculty members were trained on the Course:

1. Mr Prashanth N, Asst Prof, Dept of Mech Engg
2. Ms Mamatha Bai B G, Asst Prof, Dept of CSE
3. Ms Sowmya P, Asst Prof, Dept of CSE
4. Dr Kiran MC, Asst Prof, Dept of Mech Engg
5. Mr Nithin U Althal, Asst Prof, Dept of Mech Engg
6. Dr P B Shetty, Prof, Dept of Mech Engg
7. Mrs Vani K S, Asst Prof, Dept of ISE
8. Mrs Sowmya Raman, Asst Prof, Dept of EEE
9. Mr Mahesh Kumar CL, Asst Prof, Dept of Civil
10. Mrs Shilpa Ankalaki, Asst Prof, Dept of CSE
11. Mrs Shwetha K G, Asst Prof, Dept of Civil
12. Mr Vasudeva Upadhya, Asst Prof, Dept of Mech Engg



For more Details, Kindly Contact

PRASHANTH N
Asst Professor
In-Charge, Centre for Robotics Research
Dept of Mechanical Engineering
Nitte Meenakshi Institute of Technology
Yelahanka, Bengaluru-64
Karnataka, INDIA.
Ph:+919964541327
Email: prashanth.n@nmit.ac.in
crr@nmit.ac.in

M.Tech Robotics and Artificial Intelligence

Laboratory Facilities

Facilities

Lecture Halls 1

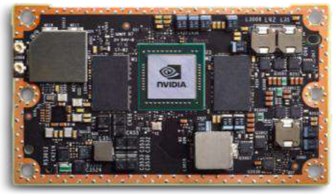
NITTE EDUCATION TRUST | NITTE MEENAKSHI INSTITUTE OF TECHNOLOGY

CENTRE FOR ROBOTICS RESEARCH

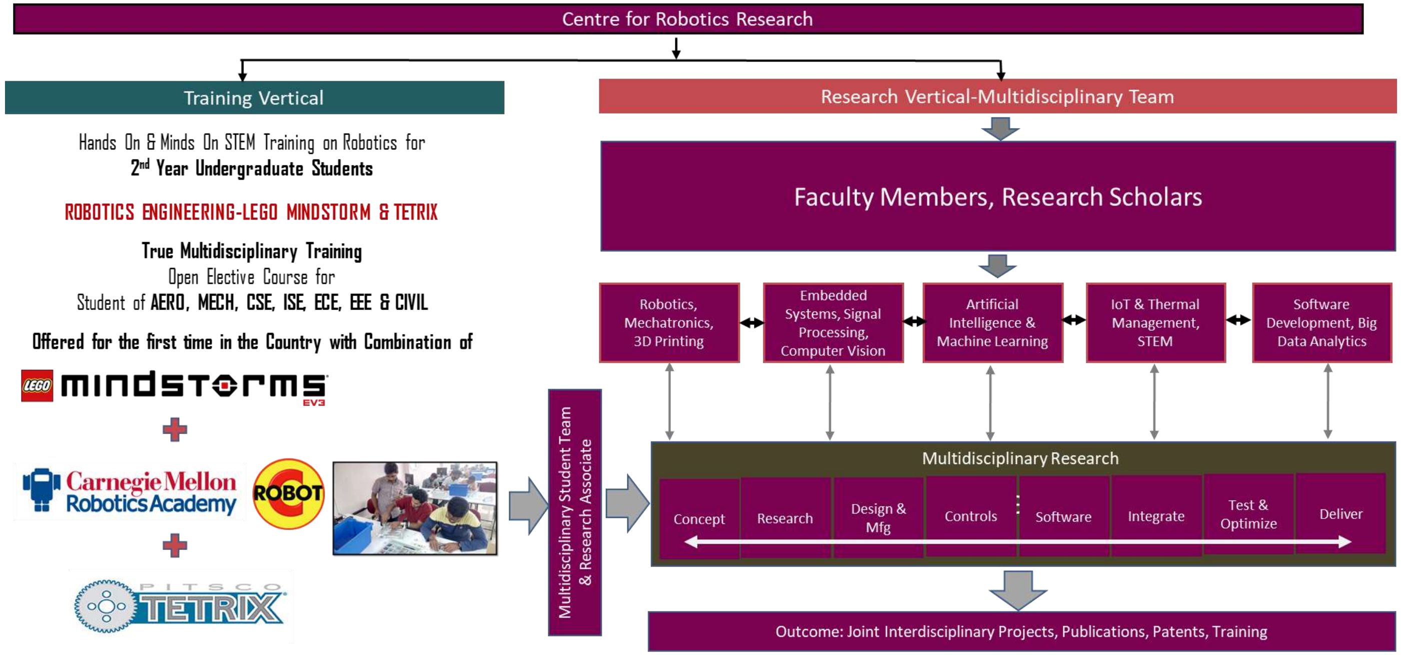
Centre for Robotics Research is one of the Centres of Excellence at NMIT. It Comprises Group of Researchers and Academicians working on Frontier Areas of Robotics & Allied Disciplines. Few Thrust Areas of Research at the Centre Include: Design & Development of Robots & Mechanisms, Embedded Systems/Control Engineering, Artificial Intelligence & Machine Learning, Mechatronics, Industrial Automation/Robot Process Automation (RPA), Signal Processing, Computer Vision/Machine Vision, Unmanned Ground/Aerial Vehicles/ Drones, Social Robotics/Human Robot Interaction, STEM/STEAM Education using Robotics Kit

3D Printers

HPZ600 Workstations



Embedded Boards & Sensors & Actuators



NITTE EDUCATION TRUST | NITTE MEENAKSHI INSTITUTE OF TECHNOLOGY

CENTRE FOR ROBOTICS RESEARCH

NITTE EDUCATION TRUST | NITTE MEENAKSHI INSTITUTE OF TECHNOLOGY

CENTRE FOR ROBOTICS RESEARCH

Indigenously Developed Robots

Facilities

Robot-Design, Analysis & Control Lab

First of its kind STEM course based on Robotics Engg Curriculum Developed by CMU, USA.

STEM Kits Available

- LEGO Mindstorms NXTs- With Sensors & Actuators
- Resource Kits
- TETRIX Max Pitsco Kit- With Prizm Controllers
- Extension Kits for Building Advanced Robots

Supported by

Facilities

NITTE EDUCATION TRUST | NITTE MEENAKSHI INSTITUTE OF TECHNOLOGY

Robot-Design, Analysis & Control Lab

Applied Mechatronics Lab

Some of the equipment available in the Lab are as follows:

- Basic Pneumatics Trainer Kit,
- Electro-Pneumatics Trainer Kit,
- FLUIDsim Simulation Software V5,
- PLC (Schneider Electric)
- Embedded Development Board, Raspberry Pi Model 4b/Arduino,
- Sensor Kits, Electronics & Accessories Kit.

Supported by

FESTO

Embedded Development Boards

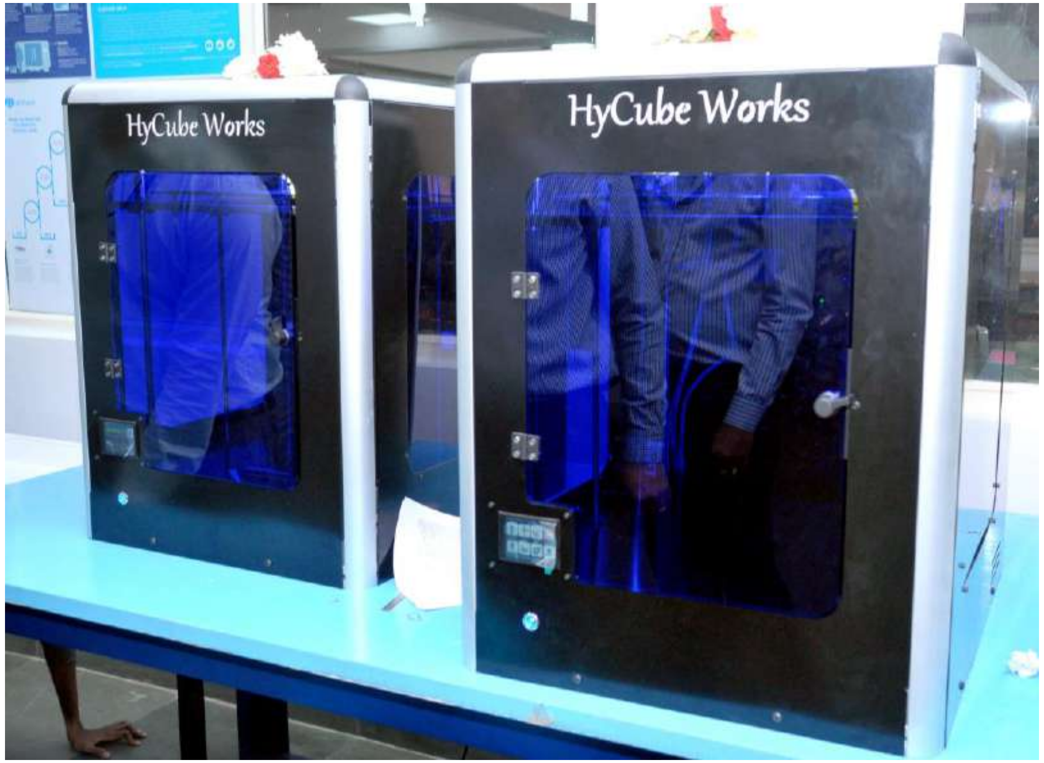
ARDUINO

RaspberryPi

Applied Mechatronics Lab

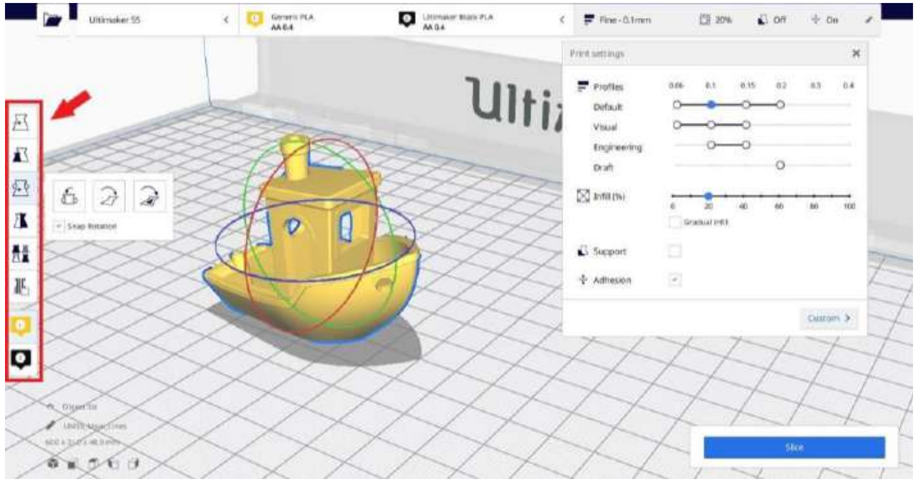
Facilities

Additive Manufacturing Lab



FDM Based 3D Printers

Materials Available: ABS, PLA, PETG, PEEK



CURA-Pre-processing Software

Supported by

stratasys

HyCube Works

Facilities

NITTE EDUCATION TRUST | NITTE MEENAKSHI INSTITUTE OF TECHNOLOGY

Applied Mechatronics Lab

Facilities

Autonomous Vehicles & AI Lab

Autonomous Vehicles & AI Laboratory

Supported by

NVIDIA

ROS

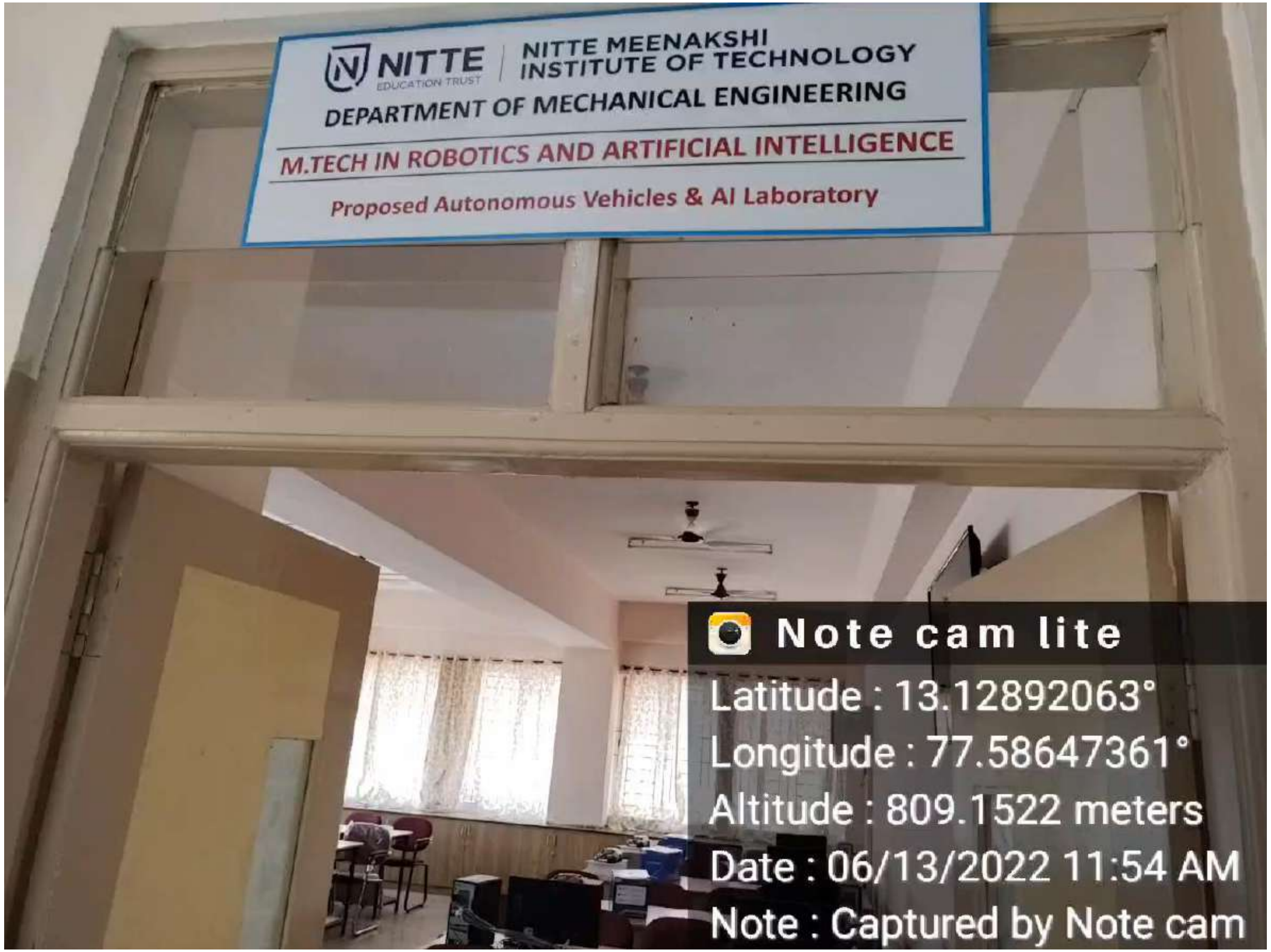
AUT8

The Lab is equipped with JET RACER PRO ROS AI KIT which meets the needs of scientific research algorithm verification in various fields such as Lidar mapping, autonomous navigation, autonomous driving, intelligent speech, target detection, face recognition, etc. It is not only compatible with software of the N-VIDIA JetRacer open-source project, but also is overall upgraded in hardware with better performance.

Facilities

NITTE EDUCATION TRUST | NITTE MEENAKSHI INSTITUTE OF TECHNOLOGY

Autonomous Vehicles & AI Lab



Facilities

Simulation Lab

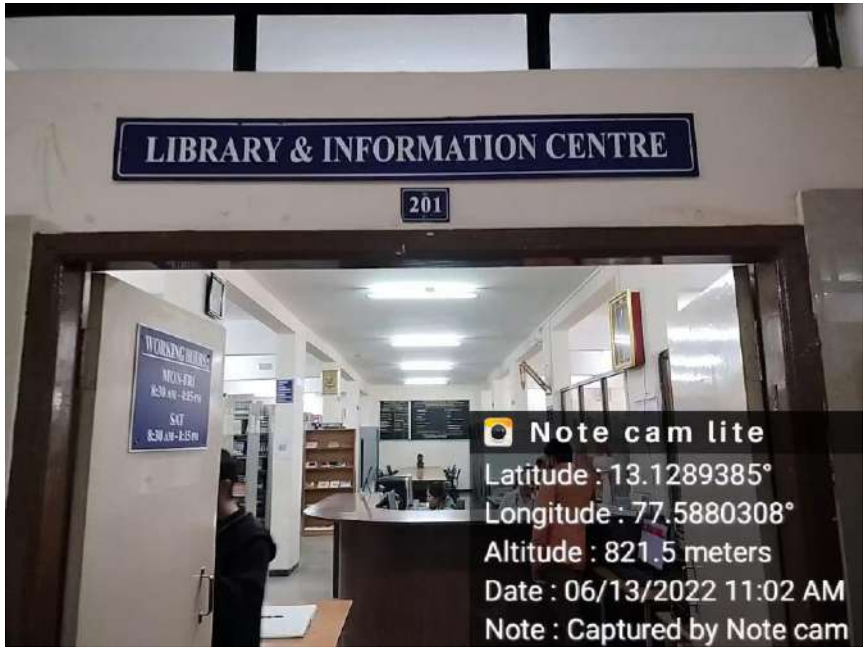
Facilities

CNC Lab

Facilities

NITTE EDUCATION TRUST | NITTE MEENAKSHI INSTITUTE OF TECHNOLOGY

Library



Department of Civil Engineering

[UG Civil Engineering program is NBA Accredited under Tier I up to 2023]

Infrastructure Facilities - PG Structural Engineering

Sl. No.	Course Code	Course Title	Infrastructure Facilitates
1	21SEL16	Structural Laboratory - I	Concrete Laboratory for Special Concretes-SCC Structural Laboratory with Loading frame Structural Dynamics – Shake Table Testing Facility
2	21SEL26	Structural Laboratory - II	Computer Laboratory with 24 Systems [PC] STAAD-Pro / ETABS Software

List of equipment Available in Structural Engineering Laboratory

Details of Structural Laboratory with Loading frame		
Sl. No.	**Particular**	**Specification**
	Loading Frame	
1	Loading Frame	2000 kN Capacity
2	Hydraulic Jack	2000 kN Capacity
3	Hydraulic Jack	1000 kN Capacity
4	Hydraulic jack for lateral Load application	200 kN Capacity
5	Data Acquisition System	8 Channel
6	Flexure Testing Machine	20 Ton Capacity
7	Load Cell	2000 kN
8	Load Cell	500kN
9	Shake table	40 kg Pay Load Capacity
	Shake Table Facility	
10	Data Acquisition system for Shake Table	5 Channel
11	Building Models – 6 No.s	
12	Vibration Absorption set up	
13	Vibration Isolation Setup	
14	Dynamic test set up Contineous beam	
15	Accelerometer – 5 No.s	
16	Kampana Software	
	Computer Laboratory	
17	Computers – 24 No.s	
18	STAAD-Pro Software	

RESEARCH PROJECT AND CONSULTANCY WORKS

MoUs with Industries for the benefit of students and faculty members 2021-2022

Sl No	Name of the institution/ industry/ corporate house	Dept	Month and Year of signing MoU	Duration	List the actual activities under each MOU year wise	Number of Students/Teachers participated under MoUs
1	Dhruva Space Private Limited	AE	February 2022	Mutual		
2	Institute of Defence Scientists & Technologysts (IDST)	AE	February 2022	Mutual		
3	Capgemini, Bangalore	AE	March 2022	2 YEARS	Aerospace Technical Publication	63 students, 3 Teachers
4	Creative Tools and Components PVT. LTD.	AE	January 2022	Mutual	Technical support for Funded Project	4
5	Planet Aerospace	AE	May 2022	Mutual	conducted Workshop	60

Sl No	Name of the institution/ industry/ corporate house	Dept	Month and Year of signing MoU	Duration	List the actual activities under each MOU year wise	Number of students/teachers participated under MoUs
1	Prakruthi Institute of Environmental studies	CV	Feb-20	3 years	Active	60
2	Glass Academy Foundation	CV	2017-2022	3 years	Active	20
3	Kalalingam Academy of Research and Education	CV	27.10.2018		Active	40
4	American Society of Civil Engineering	CV	14.9.2019		Active	60
5	Prayojana Construction Management Training Institute	CV	26.9.2019	3 years	Active	70
6	Qcrete Ready Mix (India) Pvt Ltd	CV	Feb-20	3 years	Active	60
7	Protect Infrastructure Systems Pvt Ltd.	CV	Feb-20	3 years	Active	50
8	National Highways Authority of India	CV	Oct-20	5 years	Active	30
9	Medini Bangalore	CV	Oct-20	4 years	Active	20
10	Nagarjuna College of Engineering	CV	Oct-20	3 years	Active	10

Sl No	Name of the institution/ industry/ corporate house	Month and Year of signing MoU	Dept	Duration	List the actual activities under each MOU year wise	Number of students/teachers participated under MoUs
1	Capgemini	November, 2021	CSE	2 years	Faculty Enablement Program-Training, Offering the Elective "Fullstack Development Tools and Technologies" - upcoming 7th Sem	9-Teachers as of now, Students yet to register
2	ICT-Honeywell	22 Oct 2021	CSE	3 years	Women empowerment program and faculty developmemt programs	109 students and 5 mentors
3	Capgemini	November-2021	CSE	2 years	5G Innovation Lab, Intrduced 5G mobile Communication course during ACY: 2021-2022 for 45 students from CSE, Trained faculty and students in 5G domain	05 Staff and 95 students (45 from CSE and 50 from ECE)

Sl No	Name of the institution/ industry/ corporate house	Month and Year of signing MoU	Dept	Duration	List the actual activities under each MOU year wise	Number of students/teachers participated under MoUs
1	Myquantum technology pvt ltd	July 2021	EEE	3	1. workshop on quantum computing 2. Ted talk 3. Guest lecture on Quantum Technology: Directions and Prospects 4. Industry training	40
2	Capgemini	29th November 2021	ECE		Offering Courses on 5G for CSE and ECE Dept.	110

Sl No	Name of the institution/ industry/ corporate house	Month and Year of signing MoU	Dept	Duration	List the actual activities under each MOU year wise	Number of students/teachers participated under MoUs
1	Unisys	2021	ISE		Campus Research Projects Student Innovation program Monthly Talks Faculty interaction Program Industry Tour Curriculum Design Partial	

					delivery of Curriculum Workshop Expert Lecture	
2	Bitgrit	2021	ISE		Curriculum design Student Training	
3	SRCISH	2021	ISE		Internship	
4	CodeParva Technologies	2021	ISE		Placement Internship Training	
5	Vodafone	2021	ISE		Student Training Bootcamp	
6	Dbali IT Solutions Pvt Ltd	2021	ISE	3 years	Interdisciplinary medical product development	4

Sl. No.	Name of the institution/ industry/ corporate house	Month and Year of signing MoU	Dept	Duration	List the actual activities under each MOU year wise	Number of students/teachers participated under MoUs
1	Capgemini Engineering	5th May 2022	Mech	2 years	1. Basics of Java training for students and faculty members 2. PLM training program for faculty members, delivered by the Capgemini team.	50 UG students and 3 faculty members
2	Toyota Kirloskar Motors Pvt Ltd	5th August 2021	Mech	2 years	four Traininig activites per year	43 UG students and 2 faculty Members
3	Tenneco	10 Jan 2020	Mech	3 years	1. Student Internships 2. Tech Talks	4 Students done internships and 2 technical talks delivered
4	Oerlickon Balzers	09 Jan 2020	Mech	3 years	1. Student Internships 2. Tech Talks	2 Students done internship and 1 technical talk delivered
5	Autoliv India Pvt Ltd	11th April 2022	Mech	3 Years	1. Early engagement program 2. Internship/ Final year project. 3. Placement	4 UG(Sixth Semester students), 4 UG (8th Semester students), 2 Faculties
6	MICROMATIC MACHINE TOOLS PRIVATE LTD	26/11/2021	Mech	3 Years	1. Student Internships 2. Tech Talks 3. Industry Visit	75 UG students and 3 faculty members

7	Rapid DMLS	10/07/2021	Mech	3 Years	1. Student Internships 2. Tech Talks 3. Industry Visit	Indusrty Visit by Faculty
8	Additive manufacturing society of India and EOS GmbH, Germany	25-11-2021	Mech	5 years	1. One training activities per semester, 2. Students internship, 3. Students Projects	50 students, 2 faculty members
9	Explorra Education Pvt. Ltd	30th April 2022	Mech	5 Years	Design thinking working training program for faculty members	30 faculty member
10	Ahana Systems and Solutions Pvt. Ltd.	May, 2022	MCA	5 years	2022: 1. Recruitment 2. Talk by Mr. Vivek Hegde on 'Opportunites for freshers in the IT Industry' 3. Talk on 'Robotic Process Automation' to faculty members by Mr. Narsimhan from Ahana Systems	120
11	Greenbots Software India Pvt. Ltd.	January, 2022	MCA	5 years	2021: 1. Offered jobs to students from the 2019-21 batch 2. Provided paid internships to students from the 2020-22 batch	100

12	Zibtek Pvt. Ltd.	November, 2021	MCA	2 years	2021: 2. Provided paid internships to students from the 2020-22 batch	50
13	Sutlej Soft LLP	December, 2020	MCA	2 years	2021: 1. Offered a job to a student from the 2019-21 batch 2. Offered a job to a student from the 2020-22 batch	80

Extension of Approval (EOA)

All India Council for Technical Education

(A Statutory body under Ministry of HRD, Govt. of India)

Nelson Mandela MargVasant Kunj, New Delhi-110067
PHONE: 23724151/52/53/54/55/56/57 FAX: 011-23724183 www.aicte-India.org

F.No. South-West/1-3326932818/2017/EOA   Date: 10-Apr-2017

To,

The Principal Secretary (Hr. & Tech Education)
Govt. of Karnataka, K. G.S., 6th Floor,
M.S. Building, R. N. 645,Dr. B. R. Ambedkar Road,
Bangalore-560001

Sub: Extension of approval for the academic year 2017-18

Ref: Application of the Institution for Extension of approval for the academic year 2017-18

Sir/Madam,

In terms of the provisions under the All India Council for Technical Education (Grant of Approvals for Technical Institutions) Regulations 2016 notified by the Council vide notification number F.No.AB/AICTE/REG/2016 dated 30/11/2016 and norms standards, procedures and conditions prescribed by the Council from time to time, I am directed to convey the approval to

Permanent Id	1-10233900	Application Id	1-3326932818
Name of the Institute	NITTE MEENAKSHI INSTITUTE OF TECHNOLOGY	Institute Address	GOLLAHALLI, GOVINDAPURA,P.B NO 6429 YELAHANKA, BANGALORE-560064, BANGALORE, BANGALORE RURAL, Karnataka, 560064
Name of the Society/Trust	NITTE EDUCATION TRUST	Society/Trust Address	NITTE EDUCATION TRUST, UNIVERSITY ENCLAVE, DERALAKATTE, MANGALORE-575018,MANGALORE,D KANNADA(DK),Karnataka,575018
Institute Type	Unaided - Private	Region	South-West

Opted for change from Women to Co-ed and Vice versa	No	Opted for change of name	No	Opted for change of site	No
Change from Women to Co-ed approved and Vice versa	Not Applicable	Change of name Approved	Not Applicable	Change of site Approved	Not Applicable
Opted for Conversion from degree to diploma	No	Opted for Conversion from diploma to degree	No	Conversion (degree to diploma or vice-a-versa) Approved	Not Applicable

To conduct following courses with the intake indicated below for the academic year 2017-18

Application Id: 1-3326932818			Course	Full/Part Time	Affiliating Body	Intake Approved for 2016-17	Intake Approved for 2017-18	NRI Approval status	PIO / FN / Gulf quota/ OCI/ Approval status	Foreign Collaborarion/Twining Program Approval status*
Program	Shift	Level								
ENGINEERIN G AND TECHNOLO	1st Shift	POS T GRA DUA	COMPUTER NETWORKING AND ENGINEERING	FULL TIME	Visvesvaraya Technologic al University, Belgaum	18	18	Yes	Yes	NA

GY		TE								
ENGINEERING AND TECHNOLOGY	1st Shift	POST GRADUATE	COMPUTER SCIENCE AND ENGINEERING	FULL TIME	Visvesvaraya Technological University, Belgaum	36	24	Yes	Yes	NA
ENGINEERING AND TECHNOLOGY	1st Shift	POST GRADUATE	DIGITAL COMMUNICATIONS AND NETWORKING	FULL TIME	Visvesvaraya Technological University, Belgaum	18	18	Yes	Yes	NA
ENGINEERING AND TECHNOLOGY	1st Shift	POST GRADUATE	MACHINE DESIGN	FULL TIME	Visvesvaraya Technological University, Belgaum	24	24	Yes	Yes	NA
ENGINEERING AND TECHNOLOGY	1st Shift	POST GRADUATE	RENEWABLE ENERGY	FULL TIME	Visvesvaraya Technological University, Belgaum	24	24	Yes	Yes	NA
ENGINEERING AND TECHNOLOGY	1st Shift	POST GRADUATE	STRUCTURAL ENGINEERING	FULL TIME	Visvesvaraya Technological University, Belgaum	24	24	Yes	Yes	NA
ENGINEERING AND TECHNOLOGY	1st Shift	POST GRADUATE	THERMAL POWER ENGINEERING	FULL TIME	Visvesvaraya Technological University, Belgaum	18	18	Yes	Yes	NA
ENGINEERING AND TECHNOLOGY	1st Shift	POST GRADUATE	VLSI DESIGN AND EMBEDDED SYSTEMS	FULL TIME	Visvesvaraya Technological University, Belgaum	18	18	Yes	Yes	NA
ENGINEERING AND TECHNOLOGY	1st Shift	UNDER GRADUATE	AERONAUTICAL ENGINEERING	FULL TIME	Visvesvaraya Technological University, Belgaum	60	60	Yes	Yes	NA
ENGINEERING AND TECHNOLOGY	1st Shift	UNDER GRADUATE	CIVIL ENGINEERING	FULL TIME	Visvesvaraya Technological University, Belgaum	120	120	Yes	Yes	NA
	1st	UND	COMPUTER	FULL	Visvesvaraya	180	180	Yes	Yes	NA

ENGINEERING AND TECHNOLOGY	Shift	UNDER GRADUATE	SCIENCE AND ENGINEERING	TIME	Technological University, Belgaum					
ENGINEERING AND TECHNOLOGY	1st Shift	UNDER GRADUATE	ELECTRICAL AND ELECTRONICS ENGINEERING	FULL TIME	Visvesvaraya Technological University, Belgaum	60	60	Yes	Yes	NA
ENGINEERING AND TECHNOLOGY	1st Shift	UNDER GRADUATE	ELECTRONICS AND COMMUNICATIONS ENGINEERING	FULL TIME	Visvesvaraya Technological University, Belgaum	180	180	Yes	Yes	NA
ENGINEERING AND TECHNOLOGY	1st Shift	UNDER GRADUATE	INFORMATION SCIENCE AND ENGINEERING	FULL TIME	Visvesvaraya Technological University, Belgaum	180	180	Yes	Yes	NA
ENGINEERING AND TECHNOLOGY	1st Shift	UNDER GRADUATE	MECHANICAL ENGINEERING	FULL TIME	Visvesvaraya Technological University, Belgaum	180	180	Yes	Yes	NA
ENGINEERING AND TECHNOLOGY	2nd Shift	DIPLOMA	CIVIL ENGINEERING	FULL TIME	None	60	60	Yes	Yes	NA
ENGINEERING AND TECHNOLOGY	2nd Shift	DIPLOMA	COMPUTER SCIENCE AND ENGINEERING	FULL TIME	Directorate of Technical Education	60	60	Yes	Yes	NA
ENGINEERING AND TECHNOLOGY	2nd Shift	DIPLOMA	ELECTRICAL AND ELECTRONICS ENGINEERING	FULL TIME	Directorate of Technical Education	60	60	Yes	Yes	NA
ENGINEERING AND TECHNOLOGY	2nd Shift	DIPLOMA	ELECTRONICS AND COMMUNICATIONS ENGINEERING	FULL TIME	None	60	60	Yes	Yes	NA
ENGINEERING AND TECHNOLOGY	2nd Shift	DIPLOMA	MECHANICAL ENGINEERING	FULL TIME	None	60	60	Yes	Yes	NA
	1st	POS	MASTERS IN	FULL	Visvesvaraya	120	120	Yes	Yes	NA

MANAGEMENT	Shift	T GRADUATE	BUSINESS ADMINISTRATION	TIME	Technological University, Belgaum					
MCA	1st Shift	POST GRADUATE	MASTERS IN COMPUTER APPLICATIONS	FULL TIME	Visvesvaraya Technological University, Belgaum	120	120	Yes	Yes	NA

The above mentioned approval is subject to the condition that
NITTE MEENAKSHI INSTITUTE OF TECHNOLOGY
shall follow and adhere to the Regulations, guidelines and directions issued by AICTE from time to time and the undertaking / affidavit given by the institution along with the application submitted by the institution on portal.

In case of any differences in content in this Computer generated Extension of Approval Letter, the content/information as approved by the Executive Council / General Council as available on the record of AICTE shall be final and binding.

Strict compliance of Anti-Ragging Regulation:- Approval is subject to strict compliance of provisions made in AICTE Regulation notified vide F. No. 37-3/Legal/AICTE/2009 dated July 1, 2009 for Prevention and Prohibition of Ragging in Technical Institutions. In case Institution fails to take adequate steps to Prevent Ragging or fails to act in accordance with AICTE Regulation or fails to punish perpetrators or incidents of Ragging, it will be liable to take any action as defined under clause 9(4) of the said Regulation.

Note: Validity of the course details may be verified at www.aicte-india.org

Prof. A.P Mittal
Member Secretary, AICTE

Copy to:

1. **The Regional Officer,**
   All India Council for Technical Education
   Health Centre Building
   Bangalore University Campus
   Bangalore - 560 009, Karnataka

2. **The Director Of Technical Education**,**
   Karnataka

3. **The Registrar**,**
   Visvesvaraya Technological University, Belgaum

4. **The Principal / Director,**
   NITTE MEENAKSHI INSTITUTE OF TECHNOLOGY
   GOLLAHALLI, GOVINDAPURA,P.B NO 6429
   YELAHANKA, BANGALORE-560064,
   BANGALORE,BANGALORE RURAL,
   Karnataka,560064

5. **The Secretary / Chairman,**
   NITTE EDUCATION TRUST
   NITTE EDUCATION TRUST, UNIVERSITY ENCLAVE, DERALAKATTE, MANGALORE-575018,
   MANGALORE,D KANNADA(DK),

Karnataka,575018

6. **Guard File(AICTE)**

Note: ** - Approval letter copy will not be communicated through post/email. However, provision is made in the portal for downloading Approval letter through Authorized login credentials allotted to concerned DTE/Registrar.

All India Council for Technical Education

(A Statutory body under Ministry of HRD, Govt. of India)

Nelson Mandela Marg,Vasant Kunj, New Delhi-110070 Website: www.aicte-india.org

APPROVAL PROCESS 2018-19

Extension of Approval (EoA)

F.No. South-West/1-3514634274/2018/EOA

Date: 10-Apr-2018

To,

The Principal Secretary (Hr. & Tech Education)
Govt. of Karnataka, K. G.S., 6th Floor,
M.S. Building, R. N. 645,Dr. B. R. Ambedkar Road,
Bangalore-560001

Sub: Extension of Approval for the Academic Year 2018-19

Ref: Application of the Institution for Extension of approval for the Academic Year 2018-19

Sir/Madam,

In terms of the provisions under the All India Council for Technical Education (Grant of Approvals for Technical Institutions) Regulations 2016 notified by the Council vide notification number F.No.AB/AICTE/REG/2016 dated 30/11/2016 and amended on December 5, 2017 and norms standards, procedures and conditions prescribed by the Council from time to time, I am directed to convey the approval to

Permanent Id	1-10233900	**Application Id**	1-3514634274
Name of the Institute	NITTE MEENAKSHI INSTITUTE OF TECHNOLOGY	**Name of the Society/Trust**	NITTE EDUCATION TRUST
Institute Address	GOLLAHALLI, GOVINDAPURA,P.B NO 6429 YELAHANKA, BANGALORE-560064, BANGALORE, BANGALORE RURAL, Karnataka, 560064	**Society/Trust Address**	NITTE EDUCATION TRUST, UNIVERSITY ENCLAVE, DERALAKATTE, MANGALORE-575018,MANGALORE,D KANNADA(DK),Karnataka,575018
Institute Type	Unaided - Private	**Region**	South-West

Opted for Change from Women to Co-Ed and vice versa	No	**Change from Women to Co-Ed and vice versa Approved or Not**	NA
Opted for Change of Name	No	**Change of Name Approved or Not**	NA
Opted for Change of Site	No	**Change of Site Approved or Not**	NA
Opted for Conversion from Degree to Diploma or vice versa	No	**Conversion for Degree to Diploma or vice versa Approved or Not**	NA
Opted for Organization Name Change	No	**Change of Organization Name Approved or Not**	NA

To conduct following Courses with the Intake indicated below for the Academic Year 2018-19

Program	Shift	Level	Course	FT/PT+	Affiliating Body (Univ/Body)	Intake Approved for 2018-19	NRI Approval Status	PIO / FN / Gulf quota/ OCI/ Approval Status	Foreign Collaboration /Twining Program Approval Status*
ENGINEERING AND TECHNOLOGY	1st	POST GRADUATE	RENEWABLE ENERGY	FT	Visvesvaraya Technological University, Belgaum	24	Yes	Yes	NA
ENGINEERING AND TECHNOLOGY	2nd	DIPLOMA	COMPUTER SCIENCE AND ENGINEERING	FT	Directorate of Technical Education	60	NA	NA	NA
ENGINEERING AND TECHNOLOGY	1st	UNDER GRADUATE	COMPUTER SCIENCE AND ENGINEERING	FT	Visvesvaraya Technological University, Belgaum	180	Yes	Yes	NA

ENGINEERING AND TECHNOLOGY	1st	UNDER GRADUATE	INFORMATION SCIENCE AND ENGINEERING	FT	Visvesvaraya Technological University, Belgaum	180	Yes	Yes	NA
ENGINEERING AND TECHNOLOGY	1st	UNDER GRADUATE	ELECTRICAL AND ELECTRONICS ENGINEERING	FT	Visvesvaraya Technological University, Belgaum	60	Yes	Yes	NA
ENGINEERING AND TECHNOLOGY	1st	UNDER GRADUATE	CIVIL ENGINEERING	FT	Visvesvaraya Technological University, Belgaum	120	Yes	Yes	NA
ENGINEERING AND TECHNOLOGY	1st	POST GRADUATE	COMPUTER SCIENCE AND ENGINEERING	FT	Visvesvaraya Technological University, Belgaum	24	Yes	Yes	NA
ENGINEERING AND TECHNOLOGY	1st	POST GRADUATE	VLSI DESIGN AND EMBEDDED SYSTEMS	FT	Visvesvaraya Technological University, Belgaum	18	Yes	Yes	NA
MCA	1st	POST GRADUATE	MASTERS IN COMPUTER APPLICATIONS	FT	Visvesvaraya Technological University, Belgaum	120	Yes	Yes	NA
ENGINEERING AND TECHNOLOGY	1st	UNDER GRADUATE	AERONAUTICAL ENGINEERING	FT	Visvesvaraya Technological University, Belgaum	60	Yes	Yes	NA
ENGINEERING AND TECHNOLOGY	1st	POST GRADUATE	THERMAL POWER ENGINEERING	FT	Visvesvaraya Technological University, Belgaum	18	Yes	Yes	NA
ENGINEERING AND TECHNOLOGY	1st	POST GRADUATE	DIGITAL COMMUNICATIONS AND NETWORKING	FT	Visvesvaraya Technological University, Belgaum	18	Yes	Yes	NA
ENGINEERING AND TECHNOLOGY	1st	POST GRADUATE	COMPUTER NETWORKING AND ENGINEERING	FT	Visvesvaraya Technological University, Belgaum	18	Yes	Yes	NA
ENGINEERING AND TECHNOLOGY	1st	UNDER GRADUATE	ELECTRONICS AND COMMUNICATIONS ENGINEERING	FT	Visvesvaraya Technological University, Belgaum	180	Yes	Yes	NA
ENGINEERING AND TECHNOLOGY	1st	UNDER GRADUATE	MECHANICAL ENGINEERING	FT	Visvesvaraya Technological University, Belgaum	180	Yes	Yes	NA
ENGINEERING AND TECHNOLOGY	2nd	DIPLOMA	MECHANICAL ENGINEERING	FT	Directorate of Technical Education	60	NA	NA	NA
ENGINEERING AND TECHNOLOGY	2nd	DIPLOMA	ELECTRONICS AND COMMUNICATIONS ENGINEERING	FT	Directorate of Technical Education	60	NA	NA	NA
ENGINEERING AND TECHNOLOGY	2nd	DIPLOMA	CIVIL ENGINEERING	FT	Directorate of Technical Education	60	NA	NA	NA
ENGINEERING AND TECHNOLOGY	1st	POST GRADUATE	STRUCTURAL ENGINEERING	FT	Visvesvaraya Technological University, Belgaum	24	Yes	Yes	NA
ENGINEERING AND TECHNOLOGY	1st	POST GRADUATE	MACHINE DESIGN	FT	Visvesvaraya Technological University, Belgaum	24	Yes	Yes	NA
MANAGEMENT	1st	POST GRADUATE	MASTERS IN BUSINESS ADMINISTRATION	FT	Visvesvaraya Technological University, Belgaum	120	Yes	Yes	NA
ENGINEERING AND TECHNOLOGY	2nd	DIPLOMA	ELECTRICAL AND ELECTRONICS ENGINEERING	FT	Directorate of Technical Education	60	NA	NA	NA

+FT –Full Time,PT-Part Time

In case of any differences in content in this Computer generated Extension of Approval Letter, the content/information as approved by the Executive Council / General Council as available on the record of AICTE shall be final and binding.

Strict compliance of Anti-Ragging Regulation: - Approval is subject to strict compliance of provisions made in AICTE Regulation notified vide F. No.

37-3/Legal/AICTE/2009 dated July 1, 2009 for Prevention and Prohibition of Ragging in Technical Institutions. In case Institution fails to take adequate steps to Prevent Ragging or fails to act in accordance with AICTE Regulation or fails to punish perpetrators or incidents of Ragging, it will be liable to take any action as defined under clause 9(4) of the said Regulation.

Prof. A.P Mittal
Member Secretary, AICTE

Copy to:

1. The Regional Officer,
   All India Council for Technical Education
   Health Centre Building
   Bangalore University Campus
   Bangalore - 560 009, Karnataka

2. The Director Of Technical Education**,
   Karnataka

3. The Registrar**,
   Visvesvaraya Technological University, Belgaum

4. The Principal / Director,
   NITTE MEENAKSHI INSTITUTE OF TECHNOLOGY
   GOLLAHALLI, GOVINDAPURA,P.B NO 6429
   YELAHANKA, BANGALORE-560064,
   BANGALORE,BANGALORE RURAL,
   Karnataka,560064

5. The Secretary / Chairman,
   NITTE EDUCATION TRUST
   NITTE EDUCATION TRUST, UNIVERSITY ENCLAVE, DERALAKATTE, MANGALORE-575018,
   MANGALORE,D KANNADA(DK),
   Karnataka,575018

6. Guard File(AICTE)

Note: Validity of the Course details may be verified at http://www.aicte-india.org/

****** Individual Approval letter copy will not be communicated through Post/Email. However, consolidated list of Approved Institutions(bulk) will be shared through official Email Address to the concerned Authorities mentioned above.

All India Council for Technical Education

(A Statutory body under Ministry of HRD, Govt. of India)

Nelson Mandela Marg,Vasant Kunj, New Delhi-110070 Website: www.aicte-india.org

APPROVAL PROCESS 2019-20

Extension of Approval (EoA) - Corrigendum

F.No. South-West/1-4266261550/2019/EOA/Corrigendum-1 Date:16-May-2019

To,

The Principal Secretary (Hr. & Tech Education)
Govt. of Karnataka, K. G.S., 6th Floor,
M.S. Building, R. N. 645,Dr. B. R. Ambedkar Road,
Bangalore-560001

Sub: Extension of Approval for the Academic Year 2019-20

Ref: Application of the Institution for Extension of approval for the Academic Year 2019-20

EOA Issued on	F.No. South-West/1-4266261550/2019/EOA	29-Apr-2019
Corrigendum 1	F.No. South-West/1-4266261550/2019/EOA/Corrigendum-1	16-May-2019

Sir/Madam,

In partial modification of the letter F.No. South-West/1-4266261550/2019/EOA and in terms of the provisions under the All India Council for Technical Education (Grant of Approvals for Technical Institutions) Regulations 2018 notified by the Council vide notification number F.No.AB/AICTE/REG/2018 dated 31/12/2018 along with norms standards, procedures and conditions prescribed by the Council from time to time, I am directed to convey the approval to

Permanent Id	1-10233900	**Application Id**	1-4266261550
Name of the Institute	Nitte Meenakshi Institute Of Technology	**Name of the Society/Trust**	NITTE EDUCATION TRUST
Institute Address	GOLLAHALLI, GOVINDAPURA,P.B NO 6429 YELAHANKA, BANGALORE-560064, BANGALORE, BANGALORE RURAL, Karnataka, 560064	**Society/Trust Address**	NITTE EDUCATION TRUST, UNIVERSITY ENCLAVE, DERALAKATTE, MANGALORE-575018,MANGALORE,D KANNADA(DK),Karnataka,575018
Institute Type	Unaided - Private	**Region**	South-West

Opted for Change from Women to Co-Ed and vice versa	No	**Change from Women to Co-Ed and vice versa Approved or Not**	NA
Opted for Change of Name	No	**Change of Name Approved or Not**	NA
Opted for Change of Site/Location	No	**Change of Site/Location Approved or Not**	NA
Opted for Conversion from Degree to Diploma or vice versa	No	**Conversion for Degree to Diploma or vice versa Approved or Not**	NA
Opted for Organization Name Change	No	**Change of Organization Name Approved or Not**	NA
Opted for Merger of Institution	No	**Merger of Institution Approved or Not**	NA
Opted for Introduction of New Program/Level	No	**Introduction of Program/Level Approved or Not**	NA

To conduct following Courses with the Intake indicated below for the Academic Year 2019-20

Program	Shift	Level	Course	FT/PT+	Affiliating Body (Univ/Body)	Intake Approved for 2019-20	NRI Approval Status	PIO / FN / Gulf quota/ OCI/ Approval Status

ENGINEERING AND TECHNOLOGY	1st	POST GRADUATE	RENEWABLE ENERGY	FT	Visvesvaraya Technological University, Belgaum	18	Yes	Yes
ENGINEERING AND TECHNOLOGY	2nd	DIPLOMA	COMPUTER SCIENCE AND ENGINEERING	FT	Directorate of Technical Education	60	NA	NA
ENGINEERING AND TECHNOLOGY	1st	UNDER GRADUATE	COMPUTER SCIENCE AND ENGINEERING	FT	Visvesvaraya Technological University, Belgaum	180	Yes	Yes
ENGINEERING AND TECHNOLOGY	1st	UNDER GRADUATE	INFORMATION SCIENCE AND ENGINEERING	FT	Visvesvaraya Technological University, Belgaum	180	Yes	Yes
ENGINEERING AND TECHNOLOGY	1st	UNDER GRADUATE	ELECTRICAL AND ELECTRONICS ENGINEERING	FT	Visvesvaraya Technological University, Belgaum	120	Yes	Yes
ENGINEERING AND TECHNOLOGY	1st	UNDER GRADUATE	CIVIL ENGINEERING	FT	Visvesvaraya Technological University, Belgaum	120	Yes	Yes
ENGINEERING AND TECHNOLOGY	1st	POST GRADUATE	COMPUTER SCIENCE AND ENGINEERING	FT	Visvesvaraya Technological University, Belgaum	18	Yes	Yes
ENGINEERING AND TECHNOLOGY	1st	POST GRADUATE	VLSI DESIGN AND EMBEDDED SYSTEMS	FT	Visvesvaraya Technological University, Belgaum	18	Yes	Yes
MCA	1st	POST GRADUATE	MASTERS IN COMPUTER APPLICATIONS	FT	Visvesvaraya Technological University, Belgaum	60	Yes	Yes
ENGINEERING AND TECHNOLOGY	1st	UNDER GRADUATE	AERONAUTICAL ENGINEERING	FT	Visvesvaraya Technological University, Belgaum	60	Yes	Yes
ENGINEERING AND TECHNOLOGY	1st	UNDER GRADUATE	ELECTRONICS AND COMMUNICATIONS ENGINEERING	FT	Visvesvaraya Technological University, Belgaum	180	Yes	Yes
ENGINEERING AND TECHNOLOGY	1st	UNDER GRADUATE	MECHANICAL ENGINEERING	FT	Visvesvaraya Technological University, Belgaum	180	Yes	Yes
ENGINEERING AND TECHNOLOGY	2nd	DIPLOMA	MECHANICAL ENGINEERING	FT	Directorate of Technical Education	60	NA	NA
ENGINEERING AND TECHNOLOGY	2nd	DIPLOMA	ELECTRONICS AND COMMUNICATIONS ENGINEERING	FT	Directorate of Technical Education	60	NA	NA
ENGINEERING AND TECHNOLOGY	2nd	DIPLOMA	CIVIL ENGINEERING	FT	Directorate of Technical Education	60	NA	NA
ENGINEERING AND	1st	POST GRADUA	STRUCTURAL	FT	Visvesvaraya Technological University, Belgaum	30	Yes	Yes

TECHNOLOGY		TE	ENGINEERING					
ENGINEERING AND TECHNOLOGY	1st	POST GRADUA TE	MACHINE DESIGN	FT	Visvesvaraya Technological University, Belgaum	18	Yes	Yes
MANAGEMENT	1st	POST GRADUA TE	MASTERS IN BUSINESS ADMINISTRATIO N	FT	Visvesvaraya Technological University, Belgaum	120	Yes	Yes
ENGINEERING AND TECHNOLOGY	2nd	DIPLOMA	ELECTRICAL AND ELECTRONICS ENGINEERING	FT	Directorate of Technical Education	60	NA	NA
ENGINEERING AND TECHNOLOGY	1st	POST GRADUA TE	DATA SCIENCE##	FT	Visvesvaraya Technological University, Belgaum	18	Yes	undefined
ENGINEERING AND TECHNOLOGY	1st	POST GRADUA TE	AEROSPACE ENGINEERING##	FT	Visvesvaraya Technological University, Belgaum	18	Yes	undefined

+FT –Full Time,PT-Part Time
Approved New Courses

Course(s) Applied for Closure by the Institute for the Academic Year 2019-20

Program	Shift	Level	Course	FT/PT+	Affiliating Body (Univ/Body)	Course Closure Status
ENGINEERING AND TECHNOLOGY	1st	POST GRADUATE	THERMAL POWER ENGINEERING	FT	Visvesvaraya Technologi cal University, Belgaum	Approved
ENGINEERING AND TECHNOLOGY	1st	POST GRADUATE	DIGITAL COMMUNICATIONS AND NETWORKING	FT	Visvesvaraya Technologi cal University, Belgaum	Approved
ENGINEERING AND TECHNOLOGY	1st	POST GRADUATE	COMPUTER NETWORKING AND ENGINEERING	FT	Visvesvaraya Technologi cal University, Belgaum	Approved

+FT-Full Time,PT-Part Time

***Corrigendum for-** 1. Change in Intake

In case of any differences in content in this Computer generated Extension of Approval Letter, the content/information as approved by the Executive Council / General Council as available on the record of AICTE shall be final and binding.

Strict compliance of Anti-Ragging Regulation: - Approval is subject to strict compliance of provisions made in AICTE Regulation notified vide F. No. 37-3/Legal/AICTE/2009 dated July 1, 2009 for Prevention and Prohibition of Ragging in Technical Institutions. In case Institution fails to take adequate steps to Prevent Ragging or fails to act in accordance with AICTE Regulation or fails to punish perpetrators or incidents of Ragging, it will be liable to take any action as defined under clause 9(4) of the said Regulation.

It is mandatory to comply all the essential requirements as given in APH 2019-20(appendix 6)

NOTE: If the State Government / UT / DTE / DME has a reservation policy for admission in Technical Education Institutes and the same is applicable to Private & Self-financing Technical Institutions, then the State Government / UT/ DTE / DME shall ensure that 10 % of Reservation for EWS would be operational from the Academic year 2019-20 without affecting the percentage reservations of SC/ST/OBC/General . However, this would not be applicable in the case of Minority Institutions referred to the clause (1) of Article 30 of Constitution of India.

Prof. A.P Mittal
Member Secretary, AICTE

Copy to:

1. **The Director Of Technical Education**, Karnataka**

2. **The Registrar**,**
   Visvesvaraya Technological University, Belgaum

3. **The Principal / Director,**
   Nitte Meenakshi Institute Of Technology
   Gollahalli, Govindapura,P.B No 6429
   Yelahanka, Bangalore-560064,
   Bangalore,Bangalore Rural,
   Karnataka,560064

4. **The Secretary / Chairman,**
   Nitte Education Trust
   Nitte Education Trust, University Enclave, Deralakatte, Mangalore-575018.
   Mangalore,D Kannada(Dk),
   Karnataka,575018

5. **The Regional Officer,**
   All India Council for Technical Education
   Health Centre Building
   Bangalore University Campus
   Bangalore - 560 009, Karnataka

6. **Guard File(AICTE)**

Note: Validity of the Course details may be verified at http://www.aicte-india.org/

****** Individual Approval letter copy will not be communicated through Post/Email. However, consolidated list of Approved Institutions(bulk) will be shared through official Email Address to the concerned Authorities mentioned above.

All India Council for Technical Education

(A Statutory body under Ministry of HRD, Govt. of India)

Nelson Mandela Marg,Vasant Kunj, New Delhi-110070 Website: www.aicte-india.org

APPROVAL PROCESS 2020-21

Extension of Approval (EoA)

F.No. South-West/1-7003765549/2020/EOA Date: 15-Jun-2020

To,

The Principal Secretary (Hr. & Tech Education)
Govt. of Karnataka, K. G.S., 6th Floor,
M.S. Building, R. N. 645,Dr. B. R. Ambedkar Road,
Bangalore-560001

Sub: Extension of Approval for the Academic Year 2020-21

Ref: Application of the Institution for Extension of Approval for the Academic Year 2020-21

Sir/Madam,

In terms of the provisions under the All India Council for Technical Education (Grant of Approvals for Technical Institutions) Regulations 2020 notified by the Council vide notification number F.No. AB/AICTE/REG/2020 dated 4th February 2020 and norms standards, procedures and conditions prescribed by the Council from time to time, I am directed to convey the approval to

Permanent Id	1-10233900	**Application Id**	1-7003765549
Name of the Institute	NITTE MEENAKSHI INSTITUTE OF TECHNOLOGY	**Name of the Society/Trust**	NITTE EDUCATION TRUST
Institute Address	GOLLAHALLI, GOVINDAPURA,P.B NO 6429 YELAHANKA, BANGALORE-560064, BANGALORE, BANGALORE RURAL, Karnataka, 560064	**Society/Trust Address**	NITTE EDUCATION TRUST, UNIVERSITY ENCLAVE, DERALAKATTE, MANGALORE-575018,MANGALORE,D KANNADA(DK),Karnataka,575018
Institute Type	Private-Self Financing	**Region**	South-West

To conduct following Courses with the Intake indicated below for the Academic Year 2020-21

Program	Level	Course	Affiliating Body (University /Body)	Intake Approved for 2019-20	Intake Approved for 2020-21	NRI Approval Status	PIO / FN / Gulf quota/ OCI/ Approval Status
ENGINEERING AND TECHNOLOGY	POST GRADUATE	RENEWABLE ENERGY	Visvesvaraya Technological University, Belgaum	18	18	Yes	Yes
ENGINEERING AND TECHNOLOGY	DIPLOMA	COMPUTER SCIENCE AND ENGINEERING	Directorate of Technical Education	60	60	NA	NA
ENGINEERING AND TECHNOLOGY	UNDER GRADUATE	COMPUTER SCIENCE AND ENGINEERING	Visvesvaraya Technological University, Belgaum	180	180	Yes	Yes

ENGINEERING AND TECHNOLOGY	UNDER GRADUATE	INFORMATION SCIENCE AND ENGINEERING	Visvesvaraya Tech nological University, Belgaum	180	180	Yes	Yes
ENGINEERING AND TECHNOLOGY	UNDER GRADUATE	ELECTRICAL AND ELECTRONICS ENGINEERING	Visvesvaraya Tech nological University, Belgaum	120	120	Yes	Yes
ENGINEERING AND TECHNOLOGY	UNDER GRADUATE	CIVIL ENGINEERING	Visvesvaraya Tech nological University, Belgaum	120	120	Yes	Yes
ENGINEERING AND TECHNOLOGY	POST GRADUATE	COMPUTER SCIENCE AND ENGINEERING	Visvesvaraya Tech nological University, Belgaum	18	18	Yes	Yes
ENGINEERING AND TECHNOLOGY	POST GRADUATE	VLSI DESIGN AND EMBEDDED SYSTEMS	Visvesvaraya Tech nological University, Belgaum	18	18	Yes	Yes
MCA	POST GRADUATE	MASTERS IN COMPUTER APPLICATIONS	Visvesvaraya Tech nological University, Belgaum	60	60	Yes	Yes
ENGINEERING AND TECHNOLOGY	UNDER GRADUATE	AERONAUTICAL ENGINEERING	Visvesvaraya Tech nological University, Belgaum	60	120	Yes	Yes
ENGINEERING AND TECHNOLOGY	UNDER GRADUATE	ELECTRONICS AND COMMUNICATIO NS ENGINEERING	Visvesvaraya Tech nological University, Belgaum	180	180	Yes	Yes
ENGINEERING AND TECHNOLOGY	UNDER GRADUATE	MECHANICAL ENGINEERING	Visvesvaraya Tech nological University, Belgaum	180	180	Yes	Yes
ENGINEERING AND TECHNOLOGY	DIPLOMA	MECHANICAL ENGINEERING	Directorate of Technical Education	60	60	NA	NA
ENGINEERING AND TECHNOLOGY	DIPLOMA	ELECTRONICS AND COMMUNICATIO NS ENGINEERING	Directorate of Technical Education	60	30	NA	NA
ENGINEERING AND TECHNOLOGY	DIPLOMA	CIVIL ENGINEERING	Directorate of Technical Education	60	60	NA	NA

ENGINEERING AND TECHNOLOGY	POST GRADUATE	STRUCTURAL ENGINEERING	Visvesvaraya Tech nological University, Belgaum	30	24	Yes	Yes
ENGINEERING AND TECHNOLOGY	POST GRADUATE	MACHINE DESIGN	Visvesvaraya Tech nological University, Belgaum	18	18	Yes	Yes
MANAGEMENT	POST GRADUATE	MBA	Visvesvaraya Tech nological University, Belgaum	120	120	NA	Yes
ENGINEERING AND TECHNOLOGY	DIPLOMA	ELECTRICAL AND ELECTRONICS ENGINEERING	Directorate of Technical Education	60	30	NA	NA
ENGINEERING AND TECHNOLOGY	POST GRADUATE	DATA SCIENCE	Visvesvaraya Tech nological University, Belgaum	18	18	Yes	NA
ENGINEERING AND TECHNOLOGY	POST GRADUATE	AEROSPACE ENGINEERING	Visvesvaraya Tech nological University, Belgaum	18	18	Yes	NA
ENGINEERING AND TECHNOLOGY	DIPLOMA	AERONAUTICAL ENGINEERING	Directorate of Technical Education	0	60##	Yes	No

Approved New Course(s)

It is mandatory to comply with all the essential requirements as given in APH 2020-21 (Appendix 6)

Important Instructions

1. The State Government/ UT/ Directorate of Technical Education/ Directorate of Medical Education shall ensure that 10% of reservation for Economically Weaker Section (EWS) as per the reservation policy for admission, operational from the Academic year 2020-21 is implemented without affecting the reservation percentages of SC/ ST/ OBC/ General. However, this would not be applicable in the case of Minority Institutions referred to the Clause (1) of Article 30 of Constitution of India. Such Institution shall be permitted to increase in annual permitted strength over a maximum period of two years beginning with the Academic Year 2020-21
2. The Institution offering courses earlier in the Regular Shift, First Shift, Second Shift/Part Time now amalgamated as total intake shall have to fulfil all facilities such as Infrastructure, Faculty and other requirements as per the norms specified in the Approval Process Handbook 2020-21 for the Total Approved Intake. Further, the Institutions Deemed to be Universities/ Institutions having Accreditation/ Autonomy status shall have to maintain the Faculty: Student ratio as specified in the Approval Process Handbook. All such Institutions/ Universities shall have to create the necessary Faculty, Infrastructure and other facilities WITHIN 2 YEARS to fulfil the norms based on the Affidavit submitted to AICTE.
3. In case of any differences in content in this Computer generated Extension of Approval Letter, the content/information as approved by

the Executive Council / General Council as available on the record of AICTE shall be final and binding.

4. Strict compliance of Anti-Ragging Regulation: - Approval is subject to strict compliance of provisions made in AICTE Regulation notified vide F. No. 373/Legal/AICTE/2009 dated July 1, 2009 for Prevention and Prohibition of Ragging in Technical Institutions. In case Institution fails to take adequate steps to Prevent Ragging or fails to act in accordance with AICTE Regulation or fails to punish perpetrators or incidents of Ragging, it will be liable to take any action as defined under clause 9(4) of the said Regulation.

Prof.Rajive Kumar
Member Secretary, AICTE

Copy to:

1. **The Director Of Technical Education**, Karnataka**

2. **The Registrar**,**
Visvesvaraya Technological University, Belgaum

3. **The Principal / Director,**
NITTE MEENAKSHI INSTITUTE OF TECHNOLOGY
Gollahalli, Govindapura,P.B No 6429
Yelahanka, Bangalore-560064,
Bangalore,Bangalore Rural,
Karnataka,560064

4. **The Secretary / Chairman,**
NITTE EDUCATION TRUST, UNIVERSITY ENCLAVE, DERALAKATTE, MANGALORE-575018
MANGALORE,D KANNADA(DK)
Karnataka,575018

5. **The Regional Officer,**
All India Council for Technical Education
Health Centre Building
Bangalore University Campus
Bangalore - 560 009, Karnataka

6. **Guard File(AICTE)**

Note: Validity of the Course details may be verified at http://www.aicte-india.org/

****** Individual Approval letter copy will not be communicated through Post/Email. However, consolidated list of Approved Institutions(bulk) will be shared through official Email Address to the concerned Authorities mentioned above.

All India Council for Technical Education

(A Statutory body under Ministry of Education, Govt. of India)

Nelson Mandela Marg,Vasant Kunj, New Delhi-110070 Website: www.aicte-india.org

APPROVAL PROCESS 2021-22

Extension of Approval (EoA)

F.No. South-West/1-9321368516/2021/EOA Date: 07-Jul-2021

To,

The Principal Secretary (Hr. & Tech Education)
Govt. of Karnataka, K. G.S., 6th Floor,
M.S. Building, R. N. 645,Dr. B. R. Ambedkar Road,
Bangalore-560001

Sub: Extension of Approval for the Academic Year 2021-22

Ref: Application of the Institution for Extension of Approval for the Academic Year 2021-22

Sir/Madam,

In terms of the provisions under the All India Council for Technical Education (Grant of Approvals for Technical Education) (1st Amendment) Regulations, 2021 notified on 24th February 2021 and other notifications as applicable and published from time to time, I am directed to convey the approval to

Permanent Id	1-10233900	**Application Id**	1-9321368516
Name of the Institution /University	NITTE MEENAKSHI INSTITUTE OF TECHNOLOGY	**Name of the Society/Trust**	NITTE EDUCATION TRUST
Institution /University Address	GOLLAHALLI, GOVINDAPURA,P.B NO 6429 YELAHANKA, BANGALORE-560064, BANGALORE, BANGALORE RURAL, Karnataka, 560064	**Society/Trust Address**	NITTE EDUCATION TRUST, UNIVERSITY ENCLAVE, DERALAKATTE, MANGALORE-575018,MANGALORE,D KANNADA(DK),Karnataka,575018
Institution /University Type	Private-Self Financing	**Region**	South-West

To conduct following Programs / Courses with the Intake indicated below for the Academic Year 2021-22

Program	Level	Course	Affiliating Body (University /Body)	Intake Approved for 2020-21	Intake Approved for 2021-22	NRI Approval Status	FN / Gulf quota/ OCI/ Approval Status
ENGINEERING AND TECHNOLOGY	POST GRADUATE	RENEWABLE ENERGY	Visvesvaraya Technological University, Belgaum	18	18	Yes	Yes
ENGINEERING AND TECHNOLOGY	DIPLOMA	COMPUTER SCIENCE AND ENGINEERING	Directorate of Technical Education	60	60	No	No
ENGINEERING AND TECHNOLOGY	UNDER GRADUATE	COMPUTER SCIENCE AND ENGINEERING	Visvesvaraya Technological University, Belgaum	180	180	Yes	Yes

ENGINEERING AND TECHNOLOGY	UNDER GRADUATE	INFORMATION SCIENCE AND ENGINEERING	Visvesvaraya Technological University, Belgaum	180	180	Yes	Yes
ENGINEERING AND TECHNOLOGY	UNDER GRADUATE	ELECTRICAL AND ELECTRONICS ENGINEERING	Visvesvaraya Technological University, Belgaum	120	120	Yes	Yes
ENGINEERING AND TECHNOLOGY	UNDER GRADUATE	CIVIL ENGINEERING	Visvesvaraya Technological University, Belgaum	120	120	Yes	Yes
ENGINEERING AND TECHNOLOGY	POST GRADUATE	COMPUTER SCIENCE AND ENGINEERING	Visvesvaraya Technological University, Belgaum	18	18	Yes	Yes
ENGINEERING AND TECHNOLOGY	POST GRADUATE	VLSI DESIGN AND EMBEDDED SYSTEMS	Visvesvaraya Technological University, Belgaum	18	18	Yes	Yes
MCA	POST GRADUATE	MASTERS IN COMPUTER APPLICATIONS	Visvesvaraya Technological University, Belgaum	60	120	Yes	Yes
ENGINEERING AND TECHNOLOGY	UNDER GRADUATE	AERONAUTICAL ENGINEERING	Visvesvaraya Technological University, Belgaum	120	120	Yes	Yes
ENGINEERING AND TECHNOLOGY	UNDER GRADUATE	ELECTRONICS AND COMMUNICATIONS ENGINEERING	Visvesvaraya Technological University, Belgaum	180	180	Yes	Yes
ENGINEERING AND TECHNOLOGY	UNDER GRADUATE	MECHANICAL ENGINEERING	Visvesvaraya Technological University, Belgaum	180	120	Yes	Yes
ENGINEERING AND TECHNOLOGY	DIPLOMA	MECHANICAL ENGINEERING	Directorate of Technical Education	60	60	No	No
ENGINEERING AND TECHNOLOGY	DIPLOMA	ELECTRONICS AND COMMUNICATIONS ENGINEERING	Directorate of Technical Education	30	30	No	No
ENGINEERING AND TECHNOLOGY	DIPLOMA	CIVIL ENGINEERING	Directorate of Technical Education	60	60	No	No

ENGINEERING AND TECHNOLOGY	POST GRADUATE	STRUCTURAL ENGINEERING	Visvesvaraya Technological University, Belgaum	24	24	Yes	Yes
ENGINEERING AND TECHNOLOGY	POST GRADUATE	MACHINE DESIGN	Visvesvaraya Technological University, Belgaum	18	18	Yes	Yes
MANAGEMENT	POST GRADUATE	MBA	Visvesvaraya Technological University, Belgaum	120	120	No	Yes
ENGINEERING AND TECHNOLOGY	DIPLOMA	ELECTRICAL AND ELECTRONICS ENGINEERING	Directorate of Technical Education	30	30	No	No
ENGINEERING AND TECHNOLOGY	POST GRADUATE	DATA SCIENCE	Visvesvaraya Technological University, Belgaum	18	18	Yes	No
ENGINEERING AND TECHNOLOGY	POST GRADUATE	AEROSPACE ENGINEERING	Visvesvaraya Technological University, Belgaum	18	18	Yes	No
ENGINEERING AND TECHNOLOGY	DIPLOMA	AERONAUTICAL ENGINEERING	Directorate of Technical Education	60	60	Yes	Yes
ENGINEERING AND TECHNOLOGY	UNDER GRADUATE	ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING	Visvesvaraya Technological University, Belgaum	0	60##	Yes	Yes
ENGINEERING AND TECHNOLOGY	UNDER GRADUATE	ARTIFICIAL INTELLIGENCE AND DATA SCIENCE	Visvesvaraya Technological University, Belgaum	0	60##	Yes	Yes
ENGINEERING AND TECHNOLOGY	POST GRADUATE	DEFENCE TECHNOLOGY	Visvesvaraya Technological University, Belgaum	0	18##	No	No

Approved New Course(s)

It is mandatory to comply with all the essential requirements as given in APH 2021-22 (Appendix 6)

Important Instructions

1. The State Government/ UT/ Directorate of Technical Education/ Directorate of Medical Education shall ensure that 10% of reservation for Economically Weaker Section (EWS) as per the reservation policy for admission, operational from the Academic year 2019-20 is implemented without affecting the reservation percentages of SC/ ST/ OBC/ General. However, this would not be applicable in the case of Minority Institutions referred to the Clause (1) of Article 30 of Constitution of India. Such Institution shall be permitted to increase in annual permitted strength over a maximum period of two years.

2. The Institution offering courses earlier in the Regular Shift, First Shift, Second Shift/Part Time now amalgamated as total intake shall have to fulfil all facilities such as Infrastructure, Faculty and other requirements as per the norms specified in the Approval Process Handbook 2021-22 for the Total Approved Intake. Further, the Institutions Deemed to be Universities/ Institutions having Accreditation/ Autonomy status shall have to maintain the Faculty: Student ratio as specified in the Approval Process Handbook.

3. Strict compliance of Anti-Ragging Regulation, Establishment of Committee for SC/ ST, Establishment of Internal Complaint Committee (ICC), Establishment of Online Grievance Redressal Mechanism, Barrier Free Built Environment for disabled and elderly persons, Fire and Safety Certificate should be maintained as per the provisions made in Approval Process Handbook and AICTE Regulation notified from time to time.

4. In case of any differences in content in this Computer generated Extension of Approval Letter, the content/information as approved by the Executive Council / General Council as available on the record of AICTE shall be final and binding.

Prof.Rajive Kumar
Member Secretary, AICTE

Copy ** to:

1. The Director of Technical Education, Karnataka**

2. The Registrar,**
Visvesvaraya Technological University, Belgaum

3. The Principal / Director,
NITTE MEENAKSHI INSTITUTE OF TECHNOLOGY
Gollahalli, Govindapura,P.B No 6429
Yelahanka, Bangalore-560064,
Bangalore,Bangalore Rural,
Karnataka,560064

4. The Secretary / Chairman,
NITTE EDUCATION TRUST, UNIVERSITY ENCLAVE, DERALAKATTE, MANGALORE-575018
MANGALORE,D KANNADA(DK)
Karnataka,575018

5. The Regional Officer,
All India Council for Technical Education
Health Centre Building
Bangalore University Campus
Bangalore - 560 009, Karnataka

6. Guard File(AICTE)

Note: Validity of the Course details may be verified at http://www.aicte-india.org/ .

** Individual Approval letter copy will not be communicated through Post/Email. However, consolidated list of Approved Institutions(bulk) will be shared through official Email Address to the concerned Authorities mentioned above.

This is a computer generated Statement. No signature Required

All India Council for Technical Education

(A Statutory body under Ministry of Education, Govt. of India)

Nelson Mandela Marg,Vasant Kunj, New Delhi-110070 Website: www.aicte-india.org

APPROVAL PROCESS 2022-23

Extension of Approval (EoA)

F.No. South-West/1-10969432610/2022/EOA Date: 03-Jul-2022

To,

The Principal Secretary (Hr. & Tech Education)
Govt. of Karnataka, K. G.S., 6th Floor,
M.S. Building, R. N. 645,Dr. B. R. Ambedkar Road,
Bangalore-560001

Sub: Extension of Approval for the Academic Year 2022-23

Ref: Application of the Institution for Extension of Approval for the Academic Year 2022-23

Sir/Madam,

In terms of the provisions under the All India Council for Technical Education (Grant of Approvals for Technical Institutions) Regulations, 2022 Notified on 4th February, 2022 and amended on 24th February 2022 and norms standards, procedures and conditions prescribed by the Council from time to time, I am directed to convey the approval to

Permanent Id	1-10233900	**Application Id**	1-10969432610
Name of the Institution	NITTE MEENAKSHI INSTITUTE OF TECHNOLOGY	**Name of the Society/Trust**	NITTE EDUCATION TRUST
Institution Address	GOLLAHALLI, GOVINDAPURA,P.B NO 6429 YELAHANKA, BANGALORE-560064, BANGALORE, BANGALORE RURAL, Karnataka, 560064	**Society/Trust Address**	NITTE EDUCATION TRUST, UNIVERSITY ENCLAVE, DERALAKATTE, MANGALORE-575018,MANGALORE,D KANNADA(DK),Karnataka,575018
Institution Type	Private-Self Financing	**Region**	South-West
Year of Establishment	2001		

To conduct following Courses with the Intake indicated below for the Academic Year 2022-23

Level	Program	Course	Affiliating Body (University /Body)	Intake Approved for 2021-22	Intake Approved for 2022-23	NRI Approval Status	FN / Gulf quota/ OCI/ Approval Status
DIPLOMA	ENGINEERING AND TECHNOLOGY	AERONAUTICAL ENGINEERING	Directorate of Technical Education	60	60	NA	Yes
DIPLOMA	ENGINEERING AND TECHNOLOGY	CIVIL ENGINEERING	Directorate of Technical Education	60	60	NA	NA
DIPLOMA	ENGINEERING AND TECHNOLOGY	COMPUTER SCIENCE AND ENGINEERING	Directorate of Technical Education	60	60	NA	NA

Level	Program	Course	Affiliating Body (University /Body)	Intake Approved for 2021-22	Intake Approved for 2022-23	NRI Approval Status	FN / Gulf quota/ OCI/ Approval Status
DIPLOMA	ENGINEERING AND TECHNOLOGY	ELECTRICAL AND ELECTRONICS ENGINEERING	Directorate of Technical Education	30	30	NA	NA
DIPLOMA	ENGINEERING AND TECHNOLOGY	ELECTRONICS AND COMMUNICATIONS ENGINEERING	Directorate of Technical Education	30	30	NA	NA
DIPLOMA	ENGINEERING AND TECHNOLOGY	MECHANICAL ENGINEERING	Directorate of Technical Education	60	60	NA	NA
UNDER GRADUATE	ENGINEERING AND TECHNOLOGY	AERONAUTICAL ENGINEERING	Visvesvaraya Technological University, Belgaum	120	120	Yes	Yes
UNDER GRADUATE	ENGINEERING AND TECHNOLOGY	ARTIFICIAL INTELLIGENCE AND DATA SCIENCE	Visvesvaraya Technological University, Belgaum	60	60	NA	NA
UNDER GRADUATE	ENGINEERING AND TECHNOLOGY	ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING	Visvesvaraya Technological University, Belgaum	60	60	NA	NA
UNDER GRADUATE	ENGINEERING AND TECHNOLOGY	CIVIL ENGINEERING	Visvesvaraya Technological University, Belgaum	120	120	Yes	Yes
UNDER GRADUATE	ENGINEERING AND TECHNOLOGY	COMPUTER SCIENCE AND ENGINEERING	Visvesvaraya Technological University, Belgaum	180	180	Yes	Yes
UNDER GRADUATE	ENGINEERING AND TECHNOLOGY	ELECTRICAL AND ELECTRONICS ENGINEERING	Visvesvaraya Technological University, Belgaum	120	120	Yes	Yes
UNDER GRADUATE	ENGINEERING AND TECHNOLOGY	ELECTRONICS AND COMMUNICATIONS ENGINEERING	Visvesvaraya Technological University, Belgaum	180	180	Yes	Yes
UNDER GRADUATE	ENGINEERING AND TECHNOLOGY	INFORMATION SCIENCE AND ENGINEERING	Visvesvaraya Technological University, Belgaum	180	180	Yes	Yes

Level	Program	Course	Affiliating Body (University /Body)	Intake Approved for 2021-22	Intake Approved for 2022-23	NRI Approval Status	FN / Gulf quota/ OCI/ Approval Status
UNDER GRADUATE	ENGINEERING AND TECHNOLOGY	MECHANICAL ENGINEERING	Visvesvaraya Technological University, Belgaum	120	120	Yes	Yes
POST GRADUATE	ENGINEERING AND TECHNOLOGY	RENEWABLE ENERGY	Visvesvaraya Technological University, Belgaum	18	18	Yes	Yes
POST GRADUATE	ENGINEERING AND TECHNOLOGY	COMPUTER SCIENCE AND ENGINEERING	Visvesvaraya Technological University, Belgaum	18	18	Yes	Yes
POST GRADUATE	ENGINEERING AND TECHNOLOGY	VLSI DESIGN AND EMBEDDED SYSTEMS	Visvesvaraya Technological University, Belgaum	18	18	Yes	Yes
POST GRADUATE	MCA	MASTERS IN COMPUTER APPLICATIONS	Visvesvaraya Technological University, Belgaum	120	120	Yes	Yes
POST GRADUATE	ENGINEERING AND TECHNOLOGY	STRUCTURAL ENGINEERING	Visvesvaraya Technological University, Belgaum	24	24	Yes	Yes
POST GRADUATE	MANAGEMENT	MBA	Visvesvaraya Technological University, Belgaum	120	120	NA	Yes
POST GRADUATE	ENGINEERING AND TECHNOLOGY	DATA SCIENCE	Visvesvaraya Technological University, Belgaum	18	18	Yes	NA
POST GRADUATE	ENGINEERING AND TECHNOLOGY	AEROSPACE ENGINEERING	Visvesvaraya Technological University, Belgaum	18	18	Yes	NA
POST GRADUATE	ENGINEERING AND TECHNOLOGY	DEFENCE TECHNOLOGY	Visvesvaraya Technological University, Belgaum	18	18	NA	NA
POST GRADUATE	ENGINEERING AND TECHNOLOGY	ROBOTICS AND ARTIFICIAL INTELLIGENCE	Visvesvaraya Technological University, Belgaum	0	18##	NA	NA

Level	Program	Course	Affiliating Body (University /Body)	Intake Approved for 2021-22	Intake Approved for 2022-23	NRI Approval Status	FN / Gulf quota/ OCI/ Approval Status

Approved New Course(s)

Course(s) Applied for Closure by the Institution for the Academic Year 2022-23

Level	Program	Course	Affiliating Body (Univ/Body)	Course Closure Status	Intake Approved for 2022-23
POST GRADUATE	ENGINEERING AND TECHNOLOGY	MACHINE DESIGN	Visvesvaraya Technological University, Belgaum	Pending$	0

$ Due to non-submission of NOC's from University / Board and / or State Government

It is mandatory to comply with all the essential requirements as given in APH 2022-23 (Appendix 6)

Important Instructions

1. The State Government/ UT/ Directorate of Technical Education/ Directorate of Medical Education shall ensure that 10% of reservation for Economically Weaker Section (EWS) as per the reservation policy for admission, operational from the Academic year 2019-20 is implemented without affecting the reservation percentages of SC/ ST/ OBC (NCL)/ General. However, this would not be applicable in the case of Minority Institutions referred to the Clause (1) of Article 30 of Constitution of India. Such Institution shall be permitted to increase in annual permitted strength over a maximum period of two years.

2. The Institution offering courses earlier in the Regular Shift, First Shift, Second Shift/Part Time are now amalgamated as total intake and shall have to fulfil all facilities such as Infrastructure, Faculty and other requirements as per the norms specified in the Approval Process Handbook 2022-23 for the Total Approved Intake. Further, the Institutions Deemed to be Universities/ Institutions having Accreditation/ Autonomy status shall have to maintain the Faculty: Student ratio as specified in the Approval Process Handbook. All such Institutions/ Universities shall have to create the necessary Faculty, Infrastructure and other facilities WITHIN 2 YEARS to fulfil the norms based on the Affidavit submitted to AICTE beginning with the Academic Year 2022-23

3. Strict compliance of Anti-Ragging Regulation, Establishment of Committee for SC/ ST, Establishment of Internal Complaint Committee (ICC), Establishment of Online Grievance Redressal Mechanism, Barrier Free Built Environment for disabled and elderly persons, Fire and Safety Certificate should be maintained as Approval Process Handbook and provisions made in AICTE Regulation notified from time to time.

4. In case of any differences in content in this Computer generated Extension of Approval Letter, the content/information as approved by the Executive Council / General Council as available on the record of AICTE shall be final and binding.

Pharmacy Institute: In compliance with the order dated 05.03.2020 passed by the Hon'ble Supreme Court of India in Transferred Petitions (CIVIL) No 87-101 of 2014, for the existing institutions offering courses in Pharmacy Programme, approval of Pharmacy Council of India (PCI) is mandatory and AICTE approval is NOT required. The requirements for running the Programme (Diploma / UG / PG) such as Land & Build-up Area, Student-faculty ratio, Intake etc. will be as per the respective regulatory body (PCI).
In case of any inconsistency in the course name and intake for EoA issued by AICTE and the approval by PCI, the approval of PCI shall prevail.

Architecture Institute: In compliance with the order dated 08.11.2019 passed by the Hon'ble Supreme Court of Indian CA No.364/ 2005, for the existing Institutions offering Courses in Architecture Programme, approval by the Council of Architecture (CoA) is mandatory and AICTE approval is NOT required. The requirements for running the Programme (Diploma / UG / PG) such as Land & Build-up Area, Student-faculty ratio, Intake etc. will be as per respective regulatory body (CoA). In case of any inconsistency in the course name and intake for EoA issued by AICTE and the approval by CoA, the approval of CoA shall prevail.

Deemed to be University: Institutions Deemed to be Universities (Running Technical Education Programmes), it is mandatory to have AICTE approval from the Academic Year 2018-19 in compliance of the Hon'ble Supreme Court Order dated 03-11-2017 passed in CA No.17869- 17870 /2017.

Prof.Rajive Kumar
Member Secretary, AICTE

Copy to:

1. The Director Of Technical Education, Karnataka**

2. The Registrar,**
Visvesvaraya Technological University, Belgaum

3. The Principal / Director,
NITTE MEENAKSHI INSTITUTE OF TECHNOLOGY
Gollahalli, Govindapura,P.B No 6429
Yelahanka, Bangalore-560064,
Bangalore,Bangalore Rural,
Karnataka,560064

4. The Secretary / Chairman,
NITTE EDUCATION TRUST, UNIVERSITY ENCLAVE, DERALAKATTE, MANGALORE-575018
MANGALORE,D KANNADA(DK)
Karnataka,575018

5. The Regional Officer,
All India Council for Technical Education
Health Centre Building
Bangalore University Campus
Bangalore - 560 009, Karnataka

6. Guard File(AICTE)

Note: Validity of the Course details may be verified at http://www.aicte-india.org/

****** Individual Approval letter copy will not be communicated through Post/Email. However, consolidated list of Approved Institutions(bulk) will be shared through official Email Address to the concerned Authorities mentioned above.

This is a computer generated Statement. No signature Required

ACCOUNTED AUDITED STATEMENT

M. R. KAMATH, B.Com., F.C.A
CHARTERED ACCOUNTANT

Phone : OFFICE : 2427182
RES : 2456802
TEMPLE SQUARE
MANGALORE - 575001

AUDITOR'S REPORT

I have audited the attached Balance Sheet of **"Nitte Meenakshi Institute of Technology, Yelahanka, Bangalore"**, as at 31-03-2022 as also the Income and Expenditure Account for the year ended on that date annexed thereto. These financial statements are the responsibility of the management. My responsibility is to express an opinion on these financial statements based on my audit.

I have conducted my audit in accordance with the auditing standards generally accepted in India. Those standards require that I plan and perform the audit to obtain reasonable assurance about whether the financial statements are free of material misstatements. An audit includes examining on a test basis, evidence supporting the amounts and disclosures in the financial statements. An audit also includes assessing the accounting principles used and significant estimates made by the management as well as evaluating the overall financial statement presentation. I believe my audit provided a reasonable basis for my opinion. I report that:

1. I have obtained all the information and explanations which to the best of my knowledge and belief were necessary for the purpose of my audit.
2. The Balance Sheet and Income & Expenditure Account dealt by this Report are in agreement with the books of account.
3. In my opinion and to the best of my information and according to the explanations given to me, the accounts read together with the notes given thereon, give a true and fair view in conformity with the accounting principles generally accepted in India.

   i. in the case of the Balance Sheet of the state of affairs of the **"Nitte Meenakshi Institute of Technology, Yelahanka, Bangalore"**, as at 31st March, 2022 and

   ii. in the case of the Income and Expenditure Account of the Excess of Income over Expenditure of the **"Nitte Meenakshi Institute of Technology, Yelahanka, Bangalore"**, for the year ended 31st March, 2022.

M.R.Kamath
Chartered Accountant
Temple Square, Mangalore
Membership No. 10489
UDIN : **22010489AKYHOH6831**

Place: Mangalore
Date: 15.06.2022

M.R. KAMATH, B.Com., F.C.A.
M.No. 10489
TEMPLE SQUARE
MANGALORE
575 001
CHARTERED ACCOUNTANT

NITTE MEENAKSHI INSTITUTE OF TECHNOLOGY, BANGALORE

NITTE EDUCATION TRUST

BALANCE SHEET AS ON 31.03.2022

	SCH	AS AT 31.03.2022 Rupees		AS AT 31.03.2021 Rupees	
SOURCES OF FUND					
EXCESS OF INCOME OVER EXPENDITURE			413,47,44,866		370,33,36,119
TOTAL			**413,47,44,866**		**370,33,36,119**
APPLICATION OF FUNDS					
FIXED ASSETS					
Gross Block	1	108,23,90,351		103,34,41,588	
Less: Depreciation		41,33,52,749		35,93,20,295	
Net Block			66,90,37,602		67,41,21,293
CAPITAL WORK IN PROGRESS					
CURRENT ASSETS, LOANS AND ADVANCES					
Cash and bank balances		23,21,10,121		39,29,85,908	
Deposits with banks		134,70,83,808		75,51,56,037	
Other deposits		57,36,709		38,57,920	
Advance to suppliers-Capital		1,72,19,818		5,48,59,692	
Loans, advances and receivables		5,80,13,225		5,44,55,111	
Fees recivable		24,63,22,257		27,46,14,369	
		190,64,85,938		153,59,29,037	
Less: CURRENT LIABILITIES AND PROVISIONS					
Sundry Creditors		8,52,054		7,50,584	
Liability for Expenses		19,90,973		24,18,161	
Other Liabilities		6,82,91,390		6,00,17,908	
Caution and other deposits		6,96,55,993		6,26,86,874	
Advance fees		63,39,307		51,59,880	
		14,71,29,717	175,93,56,221	13,10,33,407	140,48,95,630
NITTE EDUCATION TRUST			170,63,51,043		162,43,19,196
TOTAL			**413,47,44,866**		**370,33,36,119**

AS PER MY REPORT ATTACHED

M. R Kamath, B. Com., F.C.A
Chartered Accountant

Place : Mangalore
Date: 15.06.2022

M.R. KAMATH, B.Com., F.C.A.
M.No. 10489
TEMPLE SQUARE
MANGALORE
575 001
CHARTERED ACCOUNTANT

For and on behalf of
Nitte Meenakshi Institute of Technology
Bangalore

Principal

Principal
Nitte Meenakshi Institute of Technology
Govindapura, Yelahanka,
BANGALORE-560 064

NITTE MEENAKSHI INSTITUTE OF TECHNOLOGY, BANGALORE

NITTE EDUCATION TRUST

INCOME AND EXPENDITURE ACCOUNT FOR THE YEAR ENDING 31.03.2022

	SCH	31.03.2022 Rupees	31.03.2021 Rupees
INCOME			
Fee collection		97,98,11,736	95,81,09,615
Bank interest		6,17,32,063	5,45,12,540
Other income		34,93,144	14,43,403
Research grants		1,33,56,595	90,73,579
Total Income		**105,83,93,538**	**102,31,39,137**
EXPENDITURE			
Employee Cost	2	32,90,14,186	30,06,09,777
Bank Charges		10,67,632	4,12,109
Operating and Administrative Cost	3	21,48,85,320	16,08,48,213
Research expenditure		73,88,143	41,06,399
Repairs and Maintenance	4	2,05,97,055	1,13,32,668
Depreciation		5,40,32,455	5,78,91,518
Total Expenditure		**62,69,84,791**	**53,52,00,684**
Surplus/(Deficit) Transferred to Balance Sheet		**43,14,08,747**	**48,79,38,453**

AS PER MY REPORT ATTACHED

M. R Kamath, B. Com., F.C.A
Chartered Accountant

Place : Mangalore
Date: 15.06.2022

M.R. KAMATH, B.Com., F.C.A. M.No. 10489 TEMPLE SQUARE MANGALORE 575 001 CHARTERED ACCOUNTANT

For and on behalf of
Nitte Meenakshi Institute of Technology
Bangalore

Principal

Principal
Nitte Meenakshi Institute of Technology
Govindapura. Yelahanka,
BANGALORE-560 064

NITTE EDUCATION TRUST | NITTE MEENAKSHI INSTITUTE OF TECHNOLOGY

Department of Computer Science & Engineering

Effective and Innovative Delivery Methods

Effective and Innovative Delivery Methods


Learning Activities
Quiz
Assignmen t
Programmi ng Assignmne t
Simulation based Assignmen t
Gate based questions
Surprize Test
Project Based Learning
Case Study
Flipped Classroom / Seminar
Video Based Learning (Coursera / NPTEL)
Guest Lectures
LMS

Table : Description of the Effective and Innovative Delivery Methods adopted

Sl.No	**Types of Activity**	**Purpose /Description**
1.	Quiz	Conventional assessment methods/tools require more preparation time and stressful to the students. To provide joyful learning experience at the same time assess the learning of the students, quiz proves to be an effective informal method of assessment. This learning activity helps to, provide joyful learning experience, to assess the learnt concepts, to provide quick review/recap of the concepts, to improve concentration and time management and to increase confidence.
2.	Group / Individual Writing Assignments	In the "group assignment" writing method, students are first asked to form compatible groups among them well in advance in the beginning of the semester. Later, the predefined assignment topics were randomly allotted to the students. The activity demands that students working in a group of 3–4 need to understand the broad statement of the given chapter-end assignment topics and collect the information from various sources including textbooks, Internet sources such as blogs, research journals, etc. Later, students need to prepare a report and submit in a stipulated period. Reports collected from students were evaluated for different criteria such as the depth and technical significance of the information collected, logical order of content preparation and presentation, and skills and creativities related to document preparation. Finally, the reports were discussed with the students in the class and awarded with marks. Skills such as writing, collection of information, depth of collected information, organization, teamwork, innovation, and creativity were evaluated for this practice.
3.	Programming Assignment	In programming assignment, the student need to implement solution to the specified problem. The purpose of programming assignments is to have students develop the skill of writing programs embodying concepts taught in class. Programming assignments can be done independently or in collaboration.
4.	Simulation based Assignment	Simulation-based assignment refers to the use of simulation software, tools, and serious games to enrich the teaching and learning processes. Students needs to solve the problem given by teachers and demonstrate the simulation using relevant software tools.
5.	GATE based questions	This activity helps students to prepare for the GATE / other competitive exams. Questions for GATE / other competitive exams are selected and encourage students to solve the question.
6.	Surprise test	'Surprise test' will affect students' engagement in the course and encourages the students to develop their knowledge, skill and attitude.
7.	Project Based Learning	Project-based learning frameworks in the curriculum tend to encourage students to work on discrete projects that incorporate multi-step problem solving, research, logical deduction, and iterative learning, as well as teamwork.

8.	Case Study	Case Study method is used to assist students in applying theory concept practically. This method allows the student to engage in the curriculum by adding a sense of realism to the contents of syllabus. This method includes student's active participation by Understanding and applying concept in practical use and also provides scope to their higher studies.
9.	Flipped Classroom	This is a blended learning, where students are assigned with some topics in prior, and when that concept would be discussed in the classroom, that student who is assigned with that topic, would talk about it and the teacher would give more insight on that and other students would give their viewpoint on that topic.
10.	Video Based learning (NPTEL)	The National Programme on Technology Enhanced Learning (NPTEL)'s goal is to improve the quality of engineering and science education in the country by creating content for undergraduate and postgraduate curricula utilising video and web-based courses. These courses cover university-required and AICTE-approved syllabus. In our curriculum, we have offered NPTEL courses as part of the program electives. Students are allowed to take the NPTEL courses as their program elective.
11.	Video Based learning (NPTEL)	The department has also offered the Coursera courses as program elective to the students. The coordinators carefully examine the Coursera catalog and select three courses and bundled them together to form the elective course. Courses are selected ensures that it improves the students ability to understand course in a better way, practical exposure and apply the concepts of the course to build the mini project.
12.	Talk by Industry/ Academic Experts	Industry experts can influence students to think, investigate, apply newfound knowledge, and follow a path of lifelong learning. Experts come from various disciplines and with different areas of expertise, and so students get introduced to potential careers and jobs they can opt for. Students get an idea about, how to face the interviews. It can also contribute to the teacher's knowledge and practices.

Sl. No	**Method**	**Sample Evaluation**	
		Course Title	**Proof**
1.	Quiz	Data Mining **(Quiz)**	https://drive.google.com/file/d/12s2Rf5k7Q0CTbyMUObEyGDx7QpHtP6CK/view?usp=sharing
2.	Assignment	Big Data Technologies	https://drive.google.com/file/d/1R_Vy5dqskAIHTUpbi3h6eUREFR4S5wDo/view?usp=sharing
3.	Simulation based Assignment	Formal Languages and Automata Theory	https://drive.google.com/file/d/13gSplDfaoog9kRxnW9Jo7v2K1Oabu60O/view?usp=sharing
4.	Surprise Test	Formal Languages and Automata Theory	https://drive.google.com/file/d/1-6TGPqmv8HyrxJmbkxtLTEnaXp0IyW3R/view?usp=sharing

5.	Flipped Classroom	Big Data Technologies **(Seminar)**	https://drive.google.com/file/d/19DnjOFXBr5tGgKASwpocK-MGqh8lh_LC/view?usp=sharing
		Introduction to Image Processing	https://drive.google.com/file/d/1L2q4INW8MtnciGVgplNNFxvQGJKkVBgU/view?usp=sharing
6.	Project Based Learning / Collaborative Learning	Object-Oriented Programming with C++	https://drive.google.com/file/d/1wwqtF5jivECk-SH5Kj8v-eg8DDa1MQ2H/view?usp=sharing
		Data Mining	https://drive.google.com/file/d/1cU2IZO623xjO0PnwEtBfzYoZYF6xGxk3/view?usp=sharing
		Introduction to Machine Learning	https://drive.google.com/file/d/1dfU1V_o4jTWL2Eh-hBaGKxLE8DKuGbb8/view?usp=sharing
7.	GATE oriented aptitude test	Database Management System	https://drive.google.com/file/d/1Yk6Ysy5v5yfhvlz4TokdoQQgW_axFleo/view?usp=sharing
8.	Programming Assignment	Operating System	https://drive.google.com/file/d/1VPYiTmYy4qMkQ_uRblA12kIRVXiyVyik/view?usp=sharing
		High Performance Computing	https://drive.google.com/file/d/1MhhDFB2rszyiZMfePTVRinw3PfRXH3am/view?usp=sharing
		Introduction to Image Processing	https://drive.google.com/file/d/1Tpty1bn6TCper70v9uSFDhzITpq-Ibv1/view?usp=sharing
9.	Case Study	Fundamental of Cyber Laws & Ethics	https://drive.google.com/file/d/1VK_ndVDmw00ESBUyqjiUKx4aMRr_o0_P/view?usp=sharing
		High Performance Computing	https://drive.google.com/file/d/1bp-4u1oVMhvNNnPzHve5if1ttbs-Ta-Y/view?usp=sharing
10.	Guest Lecture / Invited talk	Cloud Computing	Title of the webinar: Skill Development Webinar on “KUBERNETES” https://drive.google.com/file/d/1fSGwVAd65_lXfDe13xKiEGcH-k4SlTAZ/view?usp=sharing
		Internet of Things	Title of the talk: Problem Solving and Ideation Workshop for IoT Application https://drive.google.com/file/d/1fSGwVAd65_lXfDe13xKiEGcH-k4SlTAZ/view?usp=sharing

Following are some courses have encouraged for NPTEL / Coursera – Video based Learning

NPTEL course-based learning

Department has offered the NPTEL elective courses for students. Students can register for the NPTEL course. The course assessments are evaluated based on the assignment submission and the final course evaluation is computed based on the score obtained by the students in NPTEL written exam.

Following courses are offered for the students as 6th semester program electives

Sl.No	Course Title
1.	Introduction to Industry 4.0 and Industrial Internet of Things
2.	Entrepreneurship Essentials
3.	Fuzzy Logic, sets and systems and application
4.	Applied Multivariate Statistical Modeling
5.	Software Testing
6.	Business Ethics
7.	Data Analytics with Python

Following courses are offered for the students as 5th semester program electives

Sl.No	Course Title
1.	GPU Architecture and Programming
2.	Ethical Hacking
3.	Model Checking
4.	Social Networks
5.	The Joy of Computing using Python
6.	Reinforcement Learning
7.	Online Privacy
8.	Embedded Systems Design
9.	Getting Started with Competitive Programming
10.	Applied Multivariate Statistical Modeling

The below link provides the details of the NPTEL course enrolment and results.

https://docs.google.com/spreadsheets/d/1MQsOb2tFyU-PktLs9WVg5XaD8NeOPf0X/edit?usp=sharing&ouid=104122193656028611199&rtpof=true&sd=true

https://drive.google.com/drive/folders/1vcIVQAPagHP-guX348nKEF4DDiC1jOVq?usp=sharing

Coursera Course based learning

The department has also offered the Coursera courses as program elective to the students. The coordinators carefully examine the Coursera catalog and select three courses and bundled them together to form the elective course. Courses are selected ensures that it improves the student's ability to understand course in a better way, practical exposure and apply the concepts of the course to build the mini project.

Title of the Proposed Electives	**Title of the Coursera Courses**	**Type of Assignment**	**University**	**Proof**
Computer Vision	Introduction to Computer Vision and Image Processing	MCQ and Project	IBM	https://drive.google.com/file/d/1nMcb20561zxjOApIXUbYcsbivcLYn9Z0/view?usp=sharing
	Deep Learning in Computer Vision	MCQ and Project	HSE University	
	Advanced Computer Vision with TensorFlow	MCQ and Project	DeepLearning.AI	
Virtual Reality	Introduction to Virtual Reality	MCQ and Project	University of London	**https://drive.google.com/file/d/1E1TV_o1_Mp7M8-UcleAz5aeyqmWzKf6s/view?usp=sharing** **https://drive.google.com/file/d/1RAj7dLUoaQlhRwptooUmDUWjtpapovd-/view?usp=sharing**
	3D Models for Virtual Reality	MCQ and Project	University of London	
	Making Your First Virtual Reality Game	MCQ and Project	University of London	

Learning Management System (LMS)

Learning Management System (LMS)
To overcome the limitations of the conventional classroom teaching, LMS can be invaluable for the education sector as it enables sharing of the learning resources of all the courses at a single place and gives the privilege of accessing content anytime and anywhere.

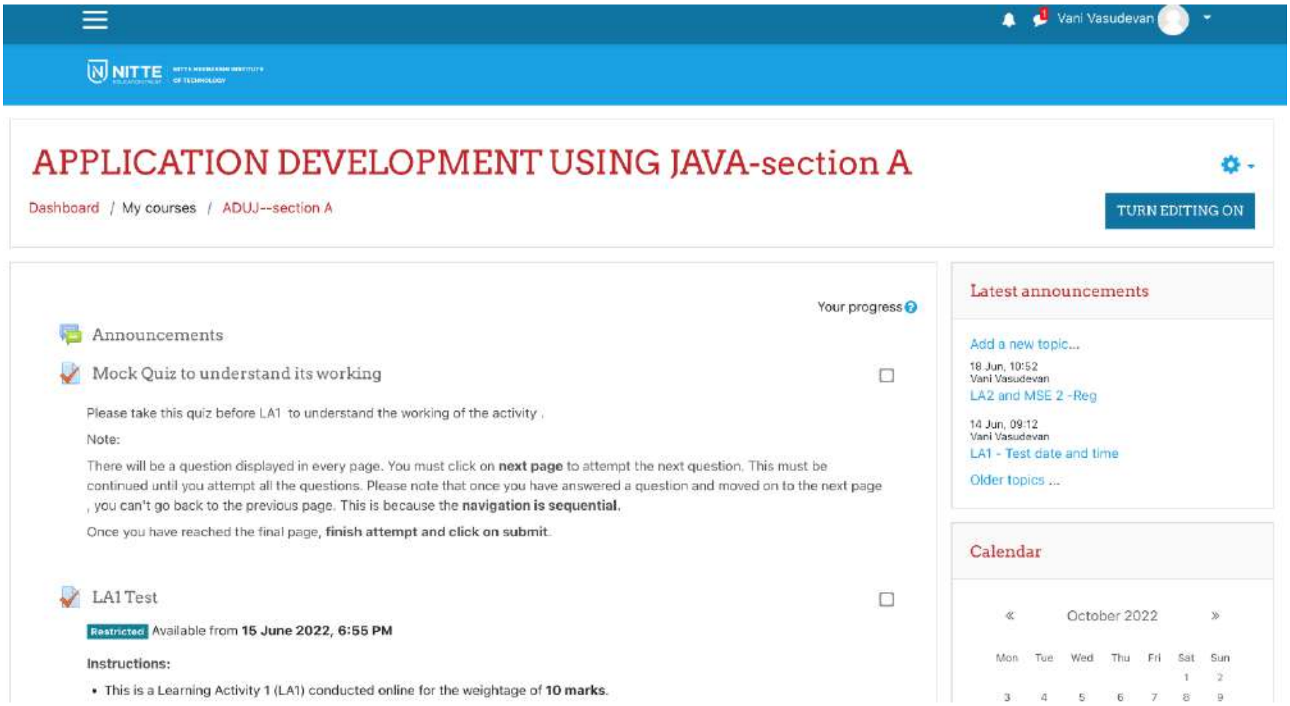
Following are the objectives of adopting LMS in learning practices:

1. To share the learning resources of all the courses at a single place
2. To give the privilege of accessing content anytime and anywhere
3. To make learning effective
4. To create online test/quiz/assignments
5. To monitor and communicate students' progress online.
6. To encourage communication between student and teacher in forums and discussions.
7. To ease process of evaluation and feedback

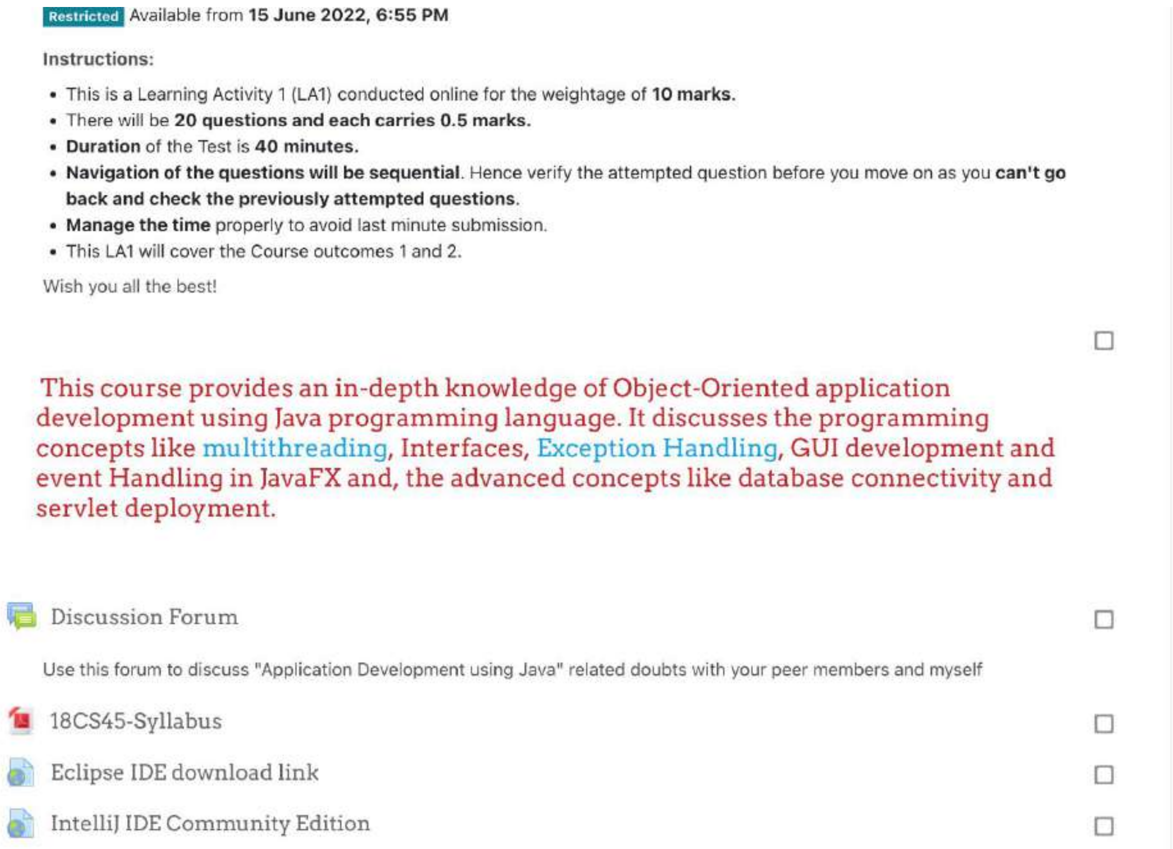
Using LMS teacher can

- shares learning material/resources to the class
- Schedules and conducts theory/practical sessions, Quiz, Assignment, tests etc.
- give project/activity/case study/survey based assignments to students.

Following are the some of the proofs for using LMS in learning practices



Scheduled Learning Assessment 1 Test for the subject Application Development Using JAVA subject



Restricted Available from **15 June 2022, 6:55 PM**

Instructions:

- This is a Learning Activity 1 (LA1) conducted online for the weightage of **10 marks.**
- There will be **20 questions and each carries 0.5 marks.**
- **Duration** of the Test is **40 minutes.**
- **Navigation of the questions will be sequential**. Hence verify the attempted question before you move on as you **can't go back and check the previously attempted questions.**
- **Manage the time** properly to avoid last minute submission.
- This LA1 will cover the Course outcomes 1 and 2.

Wish you all the best!

This course provides an in-depth knowledge of Object-Oriented application development using Java programming language. It discusses the programming concepts like multithreading, Interfaces, Exception Handling, GUI development and event Handling in JavaFX and, the advanced concepts like database connectivity and servlet deployment.

Discussion Forum

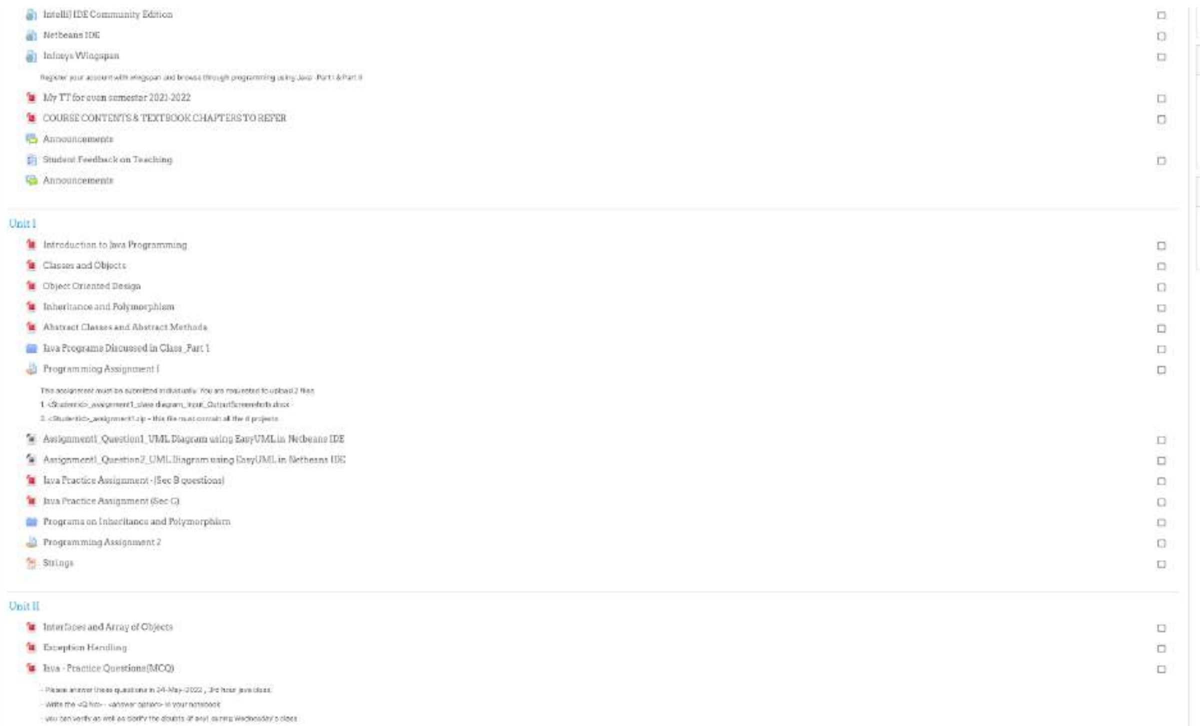
Use this forum to discuss "Application Development using Java" related doubts with your peer members and myself

18CS45-Syllabus

Eclipse IDE download link

IntelliJ IDE Community Edition

Scheduled Learning Assessment 1 Test along with instructions for the subject Application Development Using JAVA subject



IntelliJ IDE Community Edition

Netbeans IDE

Infosys Wingspan

My TT for even semester 2021-2022

COURSE CONTENTS & TEXTBOOK CHAPTERS TO REFER

Announcements

Student Feedback on Teaching

Announcements

Unit I

Introduction to Java Programming

Classes and Objects

Object Oriented Design

Inheritance and Polymorphism

Abstract Classes and Abstract Methods

Java Programs Discussed in Class_Part 1

Programming Assignment 1

Assignment1_Question1_UML Diagram using EasyUML in Netbeans IDE

Assignment1_Question2_UML Diagram using EasyUML in Netbeans IDE

Java Practice Assignment - (Sec B questions)

Java Practice Assignment (Sec C)

Programs on Inheritance and Polymorphism

Programming Assignment 2

Strings

Unit II

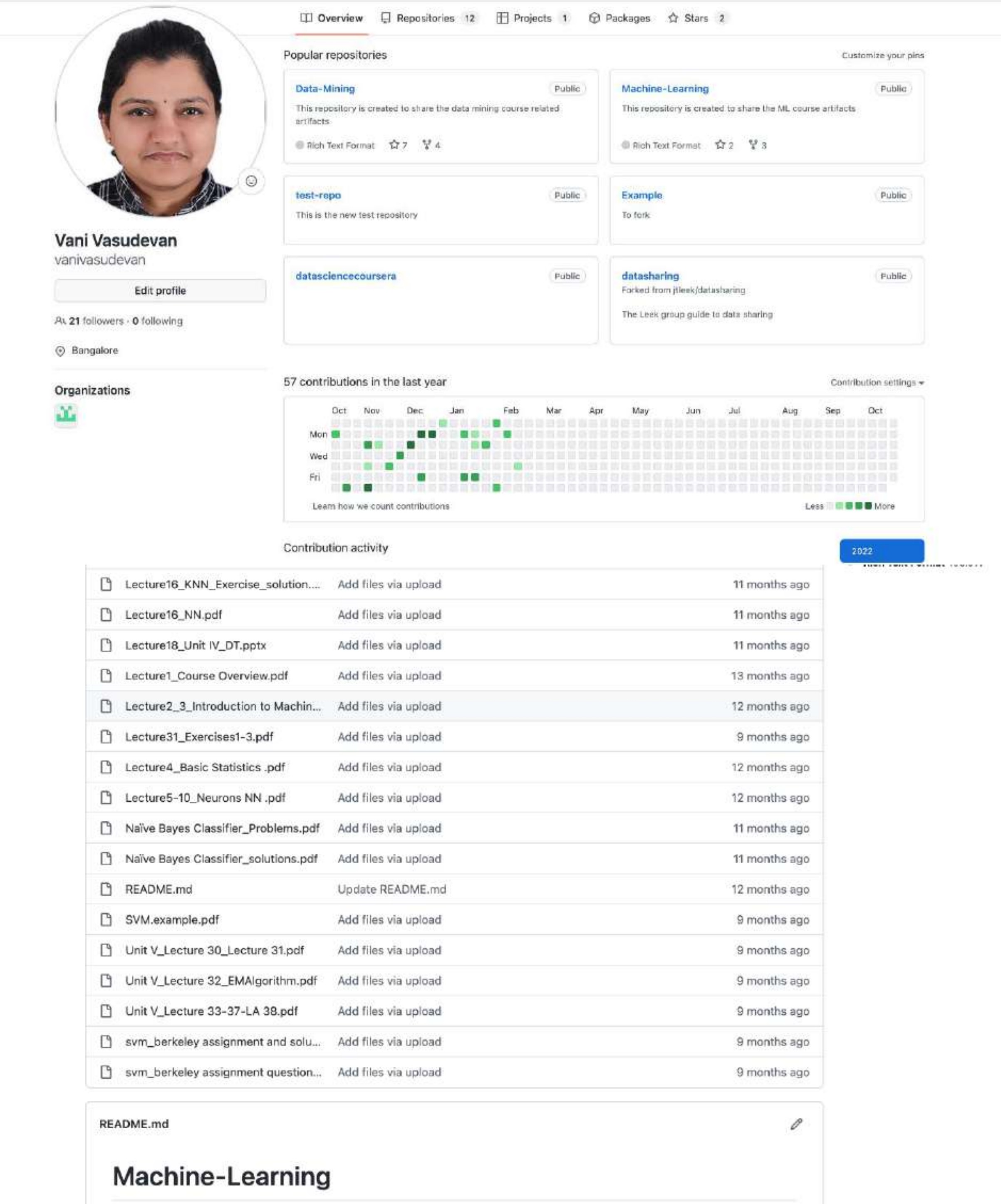
Interfaces and Array of Objects

Exception Handling

Java - Practice Questions(MCQ)

Shared teaching material of the subject Application Development Using JAVA through LMS.

Teachers also shares the teaching material through github and encourage students to use the github. Following is the proof of material shared to the students through github.



Shared teaching material of the subject Machine Learning through github.

Department of ECE

Innovations by the Faculty in Teaching and Learning

1. Innovation in teaching and learning includes following few of the important points
    - Demonstration using industrial standard simulation software
    - Group Assignments
    - Teaching through research papers
2. The objective of Innovation:

In India, it is observed that the subjects like Electromagnetic theory, Antenna and Wave Propagation, Microwave Engineering etc. is losing interest among the students due to its complicated mathematical nature and requirement of lot of imaginations. In spite of core subjects of the discipline the students adopt casual approach about these subjects and it remains effectively unexplored. As a result, RF communication based industries are lacking qualified antenna designers and microwave engineers to cater the needs.

Therefore, with the motivation developed during various faculty development programs on effective teaching, following are some innovative teaching and learning practices experimented during last year-

Demonstration using industrial standard simulation software–

The subjects mentioned above based upon laws of electricity and magnetism which were established through experimentation. Therefore they require strong physical reasoning to establish the electromagnetic phenomenon.

The parameters under investigations like radiation patterns require a strong imagination and thinking capability. Use of electromagnetic structure simulation software provided a virtual environment to observe and analyze the physical picture of every mathematical postulated one carries out.

The demonstration using simulation software enables the students to develop clear understanding of the concept maintaining the theoretical aspect in mind. It gives an understanding of the approach used by the industry to develop and design a prototype or a product.

Group Assignments–

The students were asked to submit a group assignments in the form of course project in a form to investigate any practical electromagnetic structure on several parameters and present the review. They were also asked to simulate the product on the EM software available in the laboratory. The objective is to develop technical and soft management skills in the student.

The students develop soft management skills like teamwork, coordination, decision making, organizational behaviour, leadership, time management and presentation skills along with the enhancement in technical skills through in-depth investigation, product design, prototype, working in RF environment and calibration of test instruments.

Teaching through research papers–

In order the encourage the students to read, understand and discuss the technical terms given in quality literature and understand its implementation in emerging technologies and recent advancement some of the topics from the syllabus are taught through research papers.

The students developed their habit to refer classic papers from reputed journals and transactions like IEEE Transaction on Antenna and Propagation, Microwave Theory techniques, IET etc. They developed their understanding over the recent advancement in the field; know the peer community and familiar with technical way of documentation.

2. Ask Open-Ended Questions

All our faculties ask open-ended questions, there can be various answers and points of view. Student answers can lead to strong collaboration, exciting conversations, new ideas, as well as encourage leadership skills.

3. Use Problem-Finding

Using this strategy, our teachers provide students with the opportunity to think deeply, ask critical questions and apply creative ways to solve problems.

4. LCD projectors in the Class room and laboratories to Demonstrate through Videos, animations and Lectures

5. Industrial visits are organized for pre-final and final year students

6. Organized Technical talk/workshop/conference/Guest lectures

7. Conduction of Surprise test, group assignments

8. Hands on Sessions

9. Certification Based Learning

Certification based learning enable the student to attain Lifelong learning skills and improves their knowledge in the area of study. Certification from reputed organization will benefit for their career growth. For few of the courses, we have implemented Certification Based Learning.

C Programming, Object Oriented Programming with C++,Data Structures using C,Phython, Machine learning

Python for Data Science. At the end of the course, students will take online examination to obtain the certificates from IIT Bombay Spoken Tutorial Microsoft Course era etc.

Conduction of Tutorial Classes

Course Coordinator will prepare the Tutorial Sheet which will be reviewed by DUGC During the tutorial hour, student will solve the problems in group which will enhance their communication and ability to work in group

Tutorial classes will be moderated by one or two faculty members In couple of courses, student’s interaction with the group is considered for evaluation In programming-based courses, students are using laptops or apps to solve the given problem

Course Projects

Problem statements related to modules of real-world applications are defined by course coordinator It is mandatory to follow Software Development Life Cycle. Effective Rubric has been designed to evaluate the course project.

FACULTY PROFILES
2022-2023

NITTE EDUCATION TRUST

NITTE MEENAKSHI INSTITUTE OF TECHNOLOGY
An Autonomous Institution Approved by UGC/AICTE/Govt. of Karnataka
Accredited by NBA (Tier-I) and NAAC 'A+' Grade
Affiliated to Visvesvaraya Technological University, Belagavi
Post Box No. 6429, Yelahanka, Bengaluru-560064, Karnataka, INDIA

KNOWLEDGE • CHARACTER • UNITY

AERONAUTICAL ENGINEERING

Faculty Details 2022-2023

Sl. No.	Name of the Faculty Member	Qualification	Area of Specialization	Designation
1	Dr. Srikanth H V	Ph.D	Thermal Engineering	Asso. Prof and HoD
2	Dr.Prahalad N Tengli	Ph.D	Mechanical Engineering	Professor
3	Mr. G NarahariDatta	M.E	Space Engineering and Rocketry	Professor & Scientific Officer
4	Group Captain. A Somaih	M.Tech	Aeronautical Engineering	Adjunct Prof
5	Dr.Vinayaka N	Ph.D	Mechanical Engineering	Asso. Prof
6	Mr. Siddalingappa PK	M.Tech, (PhD)	Aeronautical Engineering	Asst. Prof
7	Mr. Sridhar K	M.Tech	Aeronautical Engineering	Asst. Prof
8	Mr. Prashant Manvi	M.Sc (Engg)	Aircraft Design	Asst. Prof
9	Mr. Santosh Hosur	M.Tech	Aerospace Propulsion Technology	Asst. Prof
10	Mr. Gandham Ram Vishal	M.Tech (PhD)	Aeronautical Engineering	Asst. Prof
11	Mrs. JhumkiNandy	M.E	Space Engineering and Rocketry	Asst. Prof
12	Dr.Rajadurai M	Ph.D	Aerospace Materials	Asst. Prof
13	Mr. Abhishek	M.Tech	Aeronautical Engineering	Asst. Prof
14	Ms. Vishali	M.Tech	Avionics	Asst. Prof
15	Mr. Shivaji Lamani	M.Tech	Aerospace Propulsion Technology	Asst. Prof
16	Mrs. Thara L	M.Tech	Avionics	Asst. Prof
17	Mrs Shreelakshmi	M.Tech	Aerospace Propulsion Technology	Asst. Prof
18	Mr. Koushik Kumar	M.Tech (PhD)	Aeronautical Engineering	Asst. Prof.
19	Mr. Mallappa Jabade	M.Tech	Aerospace Engineering	Asst. Prof.

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KNOWLEDGE • CHARACTER • UNITY

Profile of the Faculty

BRANCH: AERONAUTICAL ENGINEERING

Name	Dr.Srikanth H V	
Designation	Associate Professor & HoD (i/c)	
Department	**Aeronautical Engineering**	
Date of Joining the Institution	19.08.2013	
Date of Birth	24.08.1988	
Faculty Unique ID	1-9321368516	
Email Id	srikanth.hv@nmit.ac.in	

Education Qualifications:

SL.No	Degree Obtained	Year of Obtaining the highest degree	Class/ Grade obtained
1	UG	2010	SC
2	PG	2012	FC
3	PhD	2019	
4			
5			

Total Work Experience in Years:

SL.No	Work Experience	Total in Years
1	Teaching	10 Years
2	Research & Industry	**NIL**
3		
4	others	

Area of Specialization: Thermal Engineering, Propulsion

Courses taught at	Undergraduate	1.Thermodynamics 2. Heat & Mass transfer 3. Aircraft Propulsion 4. Aircraft materials 4. Control Engineering
	Post Graduate	1.Rockets and missiles, 2. Researchmethodology & IPR

Research Guidance (Number of Students):UG students- 12

No. of papers published:

SL.No	Type	Numbers
1	National	
2	International Journals	20
3	Conferences	12
4	Others	

Master (Completed(Year of Completion)/Ongoing): 2 completed, 2 ongoing

Ph.D. (Completed Year of Completion)/Ongoing): 2 ongoing

Projects Carried out :

1. To study the effect of pressure oscillations in a Solid Rocket Motor using CFD, ARDE,Pune, Rs. 949000/-
2. Study on Production and Characterization of Biodiesel Derived from Plant and Animal Origin, Seed money for research, TEQIP-II, Rs. 1,00,000/-
3. A study on crystallization properties of biodiesel and improving with cold flow improvers,KSCST, Rs.14000/-
4. Experimental and numerical on the performance of Eppler airfoil for low Reynold's number flows,KSCST, Rs.8000/-
5. Enhancement of Aerodynamic characteristics of Airfoil. KSCST,Rs. 6000/-

Patents (Filed & Granted):

SL No	Topic	**Patent Application No**	Filed/ Granted
1	Electric Vehicle Manufacturing Process: Intelligent Electric Vehicle Manufacturing Process and Methods to Improve the Production.	202111037455	Published
2	Automatic irrigation and fertigation using ML and mobile based application	202241021997	Published
3	Development Of Annular Combustor With Gyrated Fuel Injection Technique For Gas Turbine Application	202241015081	published

Technology Transfer:

No. of Books published with details: 2

Profile of the Faculty

AERONAUTICAL ENGINEERING

Name	Dr. Vinayaka N	
Designation	Associate Professor	
Department	**Aeronautical Engineering**	
Date of Joining the Institution	04-August-2017	
Date of Birth	19-August-1988	
Faculty Unique ID	1-3594126999	
Email Id	vinayaka.n@nmit.ac.in	vn23design.engg@gmail.com

Education Qualifications:

SL.No	Degree Obtained	Year of Obtaining the highest degree	Class/ Grade obtained
1	UG	2010	First Class
2	PG	2012	First Class
3	Ph.D.	2020	Distinction
4	Others	-	-
5	-	-	-

Total Work Experience in Years:

Sl.No	Work Experience	Total in Years
1	Teaching	9.75 years = 9 years 9 months
2	Research	-
3	Industry	0.92 years = 11 months
4	others	-

Area of Specialization:

Courses taught at	Undergraduate	1. Solid Mechanics 2. Heat and Mass Transfer 3. Vibrations and Aeroelasticity 4. Entrepreneurship and IPR 5. Finite Element Methods 6. Aircraft Materials and Manufacturing. 7. Design of Machine Elements 8. CAAED laboratory 9. Solid Mechanics laboratory 10. Composite material laboratory 11. Aircraft Structures laboratory Manufacturing Process laboratory

	Post Graduate	1. Aircraft Structures and Materials 2. Structural Dynamics 3. Aero-structural Dynamics

Research Guidance (Number of Students): UG students - 21

No. of papers published:

SL.No	Type	Numbers
1	National	-
2	International Journals	19
3	Conferences	9
4	Others	-

Master (Completed(Year of Completion)/Ongoing): Completed-2, Ongoing -02

Ph.D. (Completed Year of Completion)/Ongoing): 0

Projects Carried out :

FUNDED PROJECTS LIST GRANTED AND COMPLETED	
1.	Year: 2017-18 Funded by: **NMIT, Bengaluru** Project Title:“Design and Development of Micro-Turbo Jet Engine” Grant Amount: **Rs. 1,00,000/-** Present Status: Completed Year: 2015-16 Funded by: **IEDC (Innovation Entrepreneurship Development Cell) under DST.** Project Title:“Electrical Power Generation using a Speed Breaker”Grant Amount: **Rs. 1,00,000/-** Present Status: Completed Year:2014-15 Funded by: **NMIT, Bengaluru** Project Title:“Design and Fabrication of Formula Hybrid SAE Car”Grant Amount: **Rs. 6,50,000/-** Present Status: Completed Year:2014-15 Funded by: **NMIT, Bengaluru** Project Title:“Design and Fabrication of Formula SUPRA-SAE Car”Grant Amount: **Rs. 4,50,000/-** Present Status: Completed Year: 2012-13 Funded by: **NMIT, Bengaluru** Project Title:“Design and Fabrication of Student Formula Car”Grant Amount: **Rs.1,50,000/-** Present Status: Completed

Patents (Filed & Granted):

SL. No	Topic	Patent Application No	Filed/ Granted
1	Emergency Medicine Delivery Transportation Using UAV	2021103791	Patent Granted , Australian
2	An IOT Based Lithium Ion Battery Management For MicroMobility	2021104264	Patent Granted , Australian
3	A Lightweight Mono Frame Chassis For E-Skater Scooter ByNatural Fiber Metal Laminates	2021104116	Patent Granted, Australian
4	An IOT Based System For Monitoring Volume Of FuelPumped Into An Automobile.	2021103853	Patent Granted Australian
5	A Self-Mating Beam For Structural Systems	348514-001	Patent Published, Indian

6	Hybrid PV and Wind based maximum power extractioncontrol algorithm for smart micro-grid	1187619	Copyright Published, Canadian
7	Electric vehicle chassis with easily removable battery modulereplacement	1188548	Copyright Published, Canadian
8	A Foldable Electric Vehicle Chassis	353912-001	Patent Published, Indian
9	A 3D printer with multi material capabilities	355435-001	Patent Published, Indian
10	Advanced Robot for Manufacturing Assembly Self-Balancing Electric Scooter	202241027022	Patent Published, Indian
11	The multi-instrumented monitoring of self-heating testscarried out on a interlock woven composites.	202241044832	Patent Published, Indian
12	Treatment of Bamboo with polypropylene for use instructural concrete	202241045336	Patent Published,Indian

Technology Transfer: Nil

No. of Books published with details: 01

Book Title: Additive Manufacturing.
Authors: Dr. Vinayaka N, Dr. Nikhil Rangaswamy, Dr. Santosh Kumar Sahu, Dr. VinayakMalik.
Publisher Name and year : Scientific International Publishing House, 2022.
ISBN: 978-93-94002-63-0.

Profile of the Faculty

AERONAUTICAL ENGINEERING

Name	Siddalingappa P Kodigaddi	
Designation	Assistant Professor	
Department	**Aeronautical Engineering**	
Date of Joining the Institution	19-01-2015	
Date of Birth	31-07-1990	
Faculty Unique ID	1-2482403112	
Email Id	siddalingappa.pk@nmit.ac.in	

Education Qualifications:

SL.No	Degree Obtained	Year of Obtaining the highest degree	Class/ Grade obtained
1	UG	2012	FCD
2	PG	2014	FCD
3	PhD	-	
4	Others	-	
5			

Total Work Experience in Years:

SL.No	Work Experience	Total in Years
1	Teaching	08
2	Research	00
3	Industry	00
4	others	00

Area of Specialization:

Courses taught at	Diploma/ Post Diploma	NIL
	Undergraduate	1. Aerodynamics 1 2. Aerodynamics 2 3. Flight Testing 4. Industrial Aerodynamics 5. Advances Aerodynamics

		6. Windtunnel Techniques 7. Introduction aircraft engineering and design 8. Material Science and metallurgy 9. Aerodynamics lab 10. CADD lab 11. Manufacturing Process lab
	Post Graduate	1. Aerodynamic lab 2. Computation lab
	Post Graduate Diploma Level	NIL

Research Guidance (Number of Students):UG students- 40

No. of papers published: 08

SL.No	Type	Numbers
1	National	00
2	International Journals	04
3	Conferences	04
4	Others	-

Master (Completed (Year of Completion)/Ongoing):

Ph.D. (Completed Year of Completion)/Ongoing):

Projects Carried out : **10**

Patents (Filed & Granted):01

SL No	Topic	**Patent Application No**	Filed/ Granted
1	Design and development of Amphibious Drone	361989-001	Filed

Technology Transfer: NIL

No. of Books published with details: NIL

Profile of the Faculty

BRANCH: AERONAUTICAL ENGINEERING

Name	Group Captain. Chodumada Aiyanna Somiah	
Designation	Adjunct Professor	
Department	**Aeronautical Engineering**	
Date of Joining theInstitution	07-09-2022	
Date of Birth	25-03-65	
Faculty Unique		
Email Id	Chodumada.aiyanna@nmit.ac.in	

Education Qualifications:

SL.No	Degree Obtained	Year of Obtaining the highest degree	Class/ Grade obtained
1	UG	BE, Mechanical	First
2	PG	M.Tech, Mechanical	FCD
3	PhD		
4	Others		
5			

Total Work Experience in Years:

SL.No	Work Experience	Total in Years
1	Teaching	08
2	Research	
3	Industry	33 (Indian Air Force)
4	others	

Area of Specialization:

1. Aircraft Maintenance on MiG27 Aircraft

	Diploma/ Post Diploma	1

Courses thought at	Undergraduate	1 Non destructive Testing
	Post Graduate	1. Solid rocket propulsion 2. Aero decelerators 3. Basic Aerodynamics

Research Guidance (Number of Students):UG students-

No. of papers published:

SL.No	Type	Numbers
1	National	
2	International Journals	
3	Conferences	10

Master (Completed (Year of Completion)/Ongoing): 1996

Ph.D. (Completed Year of Completion)/Ongoing):

Projects Carried out :

Patents (Filed & Granted):

SL No	Topic	**Patent Application No**	Filed/ Granted
1			

Technology Transfer:

No. of Books published with details:

Profile of the Faculty

BRANCH: AERONAUTICAL ENGINEERING

Name	Dr Rajadurai M	
Designation	Assistant Professor	
Department	**Aeronautical Engineering**	
Date of Joining the Institution	15.11.2021	
Date of Birth	13.04.1990	
Faculty Unique	1-10937948768	
Email Id	rajadurai.m@nmit.ac.in	

Education Qualifications:

SL. No.	Degree Obtained	Year of Obtaining the highest degree	Class/ Grade obtained
1	UG	2012	First class with Distinction, University Rank Holder
2	PG	2014	First class
3	PhD	2021	First class

Total Work Experience in Years:

SL. No.	Work Experience	Total in Years
1	Teaching	8 years 6 months
2	Research	6 Years 6 months
3	Industry	-

Area of Specialization:

Courses taught at	Diploma/ Post Diploma	-
	Undergraduate	1. Introduction to Aerospace/Aeronautical Engineering 2. Strength of Materials 3. Engineering Drawing/Graphics 4. Aerodynamics 5. Propulsion 6. Aircraft Structures 7. Rockets and Missiles 8. Composite Materials 9. Aircraft general engineering and maintenance practice

	Post Graduate	1. Introduction to Aerospace structures and materials 2. Aerospace structures
	Post Graduate Diploma Level	-

Research Guidance (Number of Students):UG students-

No. of papers published: 11

SL.No	Type	Numbers
1	National	3
2	International Journals	8
3	Conferences	2

Master (Completed (Year of Completion)/Ongoing): 2014

Ph.D. (Completed Year of Completion)/Ongoing): 2021

Projects Carried out: Design and Development of Polymer Matrix Composite (PMC) based Lip Seal for Aero Engine (GTRE Project, applied)

Patents (Filed & Granted): Nil

SL No	Topic	**Patent Application No**	Filed/ Granted
1			
2			

Technology Transfer: Yes, Project consultancy work with LadderMinds company

No. of Books published with details: Nil

Profile of the Faculty

BRANCH: AERONAUTICAL ENGINEERING

Name	Mr.Sridhar K	
Designation	Assistant Professor	
Department	**Aeronautical Engineering**	
Date of Joining the Institution	25.07.2016	
Date of Birth	31.01.1990	
Faculty Unique	1-3208850397	
Email Id	Sridhar.kanagaraj@nmit.ac.in	

Education Qualifications:

SL.No	Degree Obtained	Year of Obtaining the highest degree	Class/ Grade obtained
1	UG	2011	FCD
2	PG	2015	FC
3	PhD		
4	Others		
5			

Total Work Experience in Years:

SL.No	Work Experience	Total in Years
1	Teaching	11 years
2	Research	
3	Industry	
4	others	

Area of Specialization:

		1. Strength of Material

Courses taught at	Undergraduate	2. Theory of Machines 3. Aircraft Structure-I 4. Aircraft Structure-II 5. Vibration and Aeroelasticity 6. Finite Elements methods 7. Aircraft Materials 8. Elements of Aeronautics 9. Aircraft System & Instrumentation.
	Post Graduate	1. Finite Element Methods

Research Guidance (Number of Students):UG students- 24

No. of papers published:

SL.No	Type	Numbers
1	National	
2	International Journals	5
3	Conferences	2
4	Others	

Master (Completed(Year of Completion)/Ongoing):

Ph.D. (Completed Year of Completion)/Ongoing):

Projects Carried out :

Patents (Filed & Granted):

SL No	Topic	**Patent Application No**	Filed/ Granted
1	Development of Annular combustor with gyrated fuel injection technique for the gas turbine application	202241015081	Filed
2			

Technology Transfer: Nil

No. of Books published with details: Nil

Profile of the Faculty

BRANCH: AERONAUTICAL ENGINEERING

Name	Prashant Manvi	
Designation	Assistant Professor	
Department	**Aeronautical Engineering**	
Date of Joining theInstitution	25/07/2016	
Date of Birth	06/03/1990	
Faculty Unique	1-3208847220	
Email Id	prashant.manvi@nmit.ac.in	

Education Qualifications:

SL.No	Degree Obtained	Year of Obtaining the highest degree	Class/ Grade obtained
1	UG	2011	First Class
2	PG	2013	First Class
3	PhD		
4	Others		
5			

Total Work Experience in Years: 9 Years 5 months

SL.No	Work Experience	Total in Years
1	Teaching	9 Years 5 months
2	Research	
3	Industry	
4	others	

Area of Specialization: Flight Mechanics

Courses taught at	Undergraduate	1. Aircraft Stability & Control 2. Aircraft Performance 3. Airport Planning & Management 4. UAV Design 5. Aircraft Maintenance Repair &Overhaul 6. Non Destructive Testing 7. Management & Organization Behaviour 8. Aircraft Systems & Instruments 9. Smart Materials & NanoTechnology

Research Guidance (Number of Students):UG students- 36

No. of papers published:

SL.No	Type	Numbers
1	National	
2	International Journals	04
3	Conferences	04
4	Others	

Master (Completed (Year of Completion)/Ongoing):

Ph.D. (Completed Year of Completion)/Ongoing):

Projects Carried out:

Patents (Filed & Granted):

SL No	Topic	**Patent Application No**	Filed/ Granted
1			
2			

Technology Transfer:

No. of Books published with details:

Profile of the Faculty

BRANCH: AERONAUTICAL ENGINEERING

Name	Santosh Hosur	
Designation	Assistant Professor	
Department	**Aeronautical Engineering**	
Date of Joining the Institution	01/03/2017	
Date of Birth	27/04/1992	
Faculty Unique	1-3584840214	
Email Id	Santosh.hosur@nmit.ac.in	

Education Qualifications:

SL.No	Degree Obtained	Year of Obtaining the highest degree	Class/ Grade obtained
1	UG	2014	FCD
2	PG	2016	FCD (Gold medal)
3	PhD		
4	Others		
5			

Total Work Experience in Years:

SL.No	Work Experience	Total in Years
1	Teaching	5.9
2	Research	2.5
3	Industry	
4	others	

Area of Specialization:
Aircraft Propulsion, Aerothermodynamics, CFD, Aircraft Materials, Aviation management.

Courses taught at	Undergraduate	1 Aerothermodynamics 2 Aircraft Propulsion. 3 Introduction to Aircraft Engineering and Design 4. Aviation Management. 5. Aviation safety management and accident investigation 6. Aircraft Materials etc .

Research Guidance (Number of Students):UG students-

No. of papers published:

SL.No	Type	Numbers
1	National	
2	International Journals	2
3	Conferences	4
4	Others	

Master (Completed (Year of Completion)/Ongoing): Completed (2016)

Ph.D. (Completed Year of Completion)/Ongoing): Ongoing

Projects Carried out : **Design and Development of Amphibious Drone**

Patents (Filed & Granted):

SL No	Topic	**Patent Application No**	Filed/ Granted
1	**Amphibious Drone**	361989-001	
2			

Technology Transfer:

No. of Books published with details:

Profile of the Faculty

BRANCH: AERONAUTICAL ENGINEERING

Name	Gandham Ram Vishal	
Designation	Assistant Professor	
Department	**Aeronautical Engineering**	
Date of Joining the Institution	25/10/2018	
Date of Birth	01/02/1988	
Faculty Unique	1-4359560684	
Email Id	Ramvishal.g@nmit.ac.in	

Education Qualifications:

SL.No	Degree Obtained	Year of Obtaining the highest degree	Class/ Grade obtained
1	UG	2010	First class
2	PG	2012	First class
3	PhD	Pursuing	
4	Others		
5			

Total Work Experience in Years:

SL.No	Work Experience	Total in Years
1	Teaching	12
2	Research	
3	Industry	
4	others	

Area of Specialization:

		1. Engineering Mechanics

Courses taught at	Undergraduate	2. Aircraft Structures- I & II 3. Aircraft Designing 4. Mechanical Vibrations & Aeroelasticity 5. Finite Element Method 6. Experimental Stress Analysis 7. Solid Mechanics 8. IPR
	Post Graduate	1. Composite Materials and Structures 2. Advance Aircraft Structures

Research Guidance (Number of Students):UG students-

No. of papers published:

SL.No	Type	Numbers
1	National	
2	International Journals	3
3	Conferences	3
4	Others	

Master (Completed (Year of Completion)/Ongoing): 2010

Ph.D. (Completed Year of Completion)/Ongoing): Ongoing

Projects Carried out : **5**

Patents (Filed & Granted):

SL No	Topic	**Patent Application No**	Filed/ Granted
1			
2			

Technology Transfer:

No. of Books published with details:

Profile of the Faculty

BRANCH: AERONAUTICAL ENGINEERING

Name	Jhumki Nandy	
Designation	Assistant Professor	
Department	**Aeronautical**	
Date of Joining	24/07/2020	
Date of Birth	19/11/1982	
Faculty Unique	1-9568773977	
Email Id	jhumki.nandy@nmit.ac.in	

Education Qualifications:

SL.No	Degree Obtained	Year of Obtaining the highest degree	Class/ Grade obtained
1	UG	B.E in Aeronautical Engineering	1ST CLASS
2	PG	M.E in Space Engineering & Rocketry	1ST CLASS
3	PhD	Nil	
4	Others	Nil	
5			

Total Work Experience in Years:8.3 Years

SL.No	Work Experience	Total in Years
1	Teaching	7
2	Research	NIL
3	Industry	1.3
4	others	NIL

Area of Specialization: Propulsion

Courses taught at		
	Undergraduate	1.Aircraft System & Instruments 2. Flight Testing 3. Aircraft Propulsion 4. Mechanics Of Flight 5. Fluid Mechanics & Machinery 6. Aircraft Structure-Ii 7. Computational Fluid Dynamics 8. Aero Thermodynamics 9. Aircraft Maintenance & Repair 10. System Modelling & Simulation 11.Control Engineering 12. Aerodynamics-I 13. Aerodynamics-II
	Post Graduate	1

Research Guidance (Number of Students):UG students-40

No. of papers published: 06

SL.No	Type	Numbers
1	National	2
2	International Journals	2
3	Conferences	2
4	Others	

Master (Completed (Year of Completion)/Ongoing): June,2014

Ph.D. (Completed Year of Completion)/Ongoing): NIL
Projects Carried out: 10
Patents (Filed & Granted): NIL

SL No	Topic	**Patent Application No**	Filed/ Granted
1			
2			

Technology Transfer: NIL
No. of Books published with details: NIL

Profile of the Faculty

BRANCH: AERONAUTICAL ENGINEERING

Name	VISHALI	
Designation	ASSISTANT PROFESSOR	
Department	**AERONAUTICAL**	
Date of Joining the Institution	08-08-2022	
Date of Birth	25-09-1994	
Faculty Unique	1-24065701231	
Email Id	vishali.thakur@nmit.ac.in	

Education Qualifications:

SL.No	Degree Obtained	Year of Obtaining the highest degree	Class/ Grade obtained
1	UG	2015	First
2	PG	2018	Second
3	PhD		
4	Others		
5			

Total Work Experience in Years:

SL.No	Work Experience	Total in Years
1	Teaching	1
2	Research	
3	Industry	
4	others	

Area of Specialization: Avionics

Courses taught at	Undergraduate	1 Aviation Safety management and accident investigations 2. UAV. .

Research Guidance (Number of Students):UG students-

No. of papers published:

SL.No	Type	Numbers
1	National	
2	International Journals	
3	Conferences	
4	Others	

Master (Completed (Year of Completion)/Ongoing): 2018

Ph.D. (Completed Year of Completion)/Ongoing):

Projects Carried out :

Patents (Filed & Granted):

SL No	Topic	**Patent Application No**	Filed/ Granted
1			
2			

Technology Transfer:

No. of Books published with details:

Profile of the Faculty

BRANCH: AERONAUTICAL ENGINEERING

Name	Abhishek T K	
Designation	Assistant Professor	
Department	**Aeronautical engineering**	
Date of Joining the Institution	03/09/2022	
Date of Birth	16/10/1995	
Faculty Unique	1-9313719115	
Email Id	Abhishek.tk@nmit.ac.in	

Education Qualifications:

SL.No	Degree Obtained	Year of Obtaining the highest degree	Class/ Grade obtained
1	UG	2017	FCD
2	PG	2020	FC
3	PhD		
4	Others		
5			

Total Work Experience in Years: 03

SL.No	Work Experience	Total in Years
1	Teaching	02
2	Research	
3	Industry	01
4	others	

Area of Specialization: Aerodynamics

Courses taught at	Diploma/ Post Diploma	
	Undergraduate	1 Aerodynamics 2 CFD 3 Aircraft stability and control 4 Airspace engineering 5 Helicopter dynamics 6 Aircraft system and instrumentation 7 Wind tunnel theory 8 Flight Mechanics
	Post Graduate	
	Post Graduate Diploma Level	

Research Guidance (Number of Students):UG students- 08

No. of papers published: 05

SL.No	Type	Numbers
1	National	
2	International Journals	
3	Conferences	05
4	Others	

Master (Completed (Year of Completion)/Ongoing): 2020

Ph.D. (Completed Year of Completion)/Ongoing):

Projects Carried out : 05

Patents (Filed & Granted):

SL No	Topic	**Patent Application No**	Filed/ Granted
1			

Technology Transfer:

No. of Books published with details:

Profile of the Faculty

BRANCH: AERONAUTICAL ENGINEERING

Name	SHIVAJI LAMANI	
Designation	ASSISTANT PROFESSOR	
Department	**AE**	
Date of Joining the Institution	15-09-2022	
Date of Birth	04-05-1993	
Faculty Unique	1-7402618097	
Email Id	Shivaji.lamani@nmit.ac.in	

Education Qualifications:

SL.No	Degree Obtained	Year of Obtaining the highest degree	Class/ Grade obtained
1	UG	2015	FC
2	PG	2017	FCD
3	PhD		
4	Others		
5			

Total Work Experience in Years:

SL.No	Work Experience	Total in Years
1	Teaching	4.9 Years
2	Research	
3	Industry	
4	others	

Area of Specialization:

Courses taught at	Diploma/ Post Diploma	
	Undergraduate	Aircraft Propulsion -4 Heat and mass Transfer-2 Gas Turbine Technology-2 Aircraft Stability and control-2

		Composites Materials&Structures-1 Measurement and Metrology-2 Flight Vehicle Design-1 Helicopter Dynamics-2 Aerodynamics-I-1
	Post Graduate	
	Post Graduate Diploma Level	.

Research Guidance (Number of Students):UG students-

No. of papers published:

SL.No	Type	Numbers
1	National	
2	International Journals	2
3	Conferences	1
4	Others	

Master (Completed (Year of Completion)/Ongoing):

Ph.D. (Completed Year of Completion)/Ongoing):

Projects Carried out :

Patents (Filed & Granted):

SL No	Topic	**Patent Application No**	Filed/ Granted
1			
2			

Technology Transfer:

No. of Books published with details:

Profile of the Faculty

BRANCH: AERONAUTICAL ENGINEERING

Name	Thara L	
Designation	Assistant Professor	
Department	**Aeronautical Engineering**	
Date of Joining the Institution	1st September 2022	
Date of Birth	10^{th} June 1987	
Faculty Unique	1-36515582911	
Email Id	Thara.l.ae@nmit.ac.in	

Education Qualifications:

SL.No	Degree Obtained	Year of Obtaining the highest degree	Class/ Grade obtained
1	UG	2010	Second
2	PG	2012	First
3	PhD	-	-
4	Others	-	-
5			

Total Work Experience in Years:

SL.No	Work Experience	Total in Years
1	Teaching	-
2	Research	-
3	Industry	-
4	others	2.8

Area of Specialization:

Courses taught at	Diploma/ Post Diploma	.
	Undergraduate	Telecommunication Engineering
	Post Graduate	Avionics
	Post Graduate Diploma Level	-

Research Guidance (Number of Students):UG students-

No. of papers published:

SL.No	Type	Numbers
1	National	-
2	International Journals	-
3	Conferences	-
4	Others	-

Master (Completed (Year of Completion)/Ongoing): 2012

Ph.D. (Completed Year of Completion)/Ongoing): -

Projects Carried out :

Patents (Filed & Granted):-

SL No	Topic	**Patent Application No**	Filed/ Granted
1	-	-	-
2	-	-	-

Technology Transfer: -

No. of Books published with details:
-

Profile of the Faculty

BRANCH: AERONAUTICAL ENGINEERING

Name	T SREELAKSHMI	
Designation	ASSISTANT PROFESSOR	
Department	**AE**	
Date of Joining the Institution	17/10/2022	
Date of Birth	23/06/1990	
Faculty Unique	1-3540997156	
Email Id	Sree.lakshmi@nmit.ac.in	

Education Qualifications:

SL.No	Degree Obtained	Year of Obtaining the highest degree	Class/ Grade obtained
1	UG	2013	70
2	PG	2017	81
3	PhD		
4	Others		
5			

Total Work Experience in Years:

SL.No	Work Experience	Total in Years
1	Teaching	3
2	Research	
3	Industry	
4	others	

1. **Area of Specialization:** Aerospace Propulsion Technology

Courses taught at		1. Aerodynamics-II

	Undergraduate -	2 Fluid mechanics

Research Guidance (Number of Students):UG students-

No. of papers published:

SL.No	Type	Numbers
1	National	
2	International Journals	2
3	Conferences	1
4	Others	

Master (Completed (Year of Completion)/Ongoing):

Ph.D. (Completed Year of Completion)/Ongoing):

Projects Carried out:

Patents (Filed & Granted):

SL No	Topic	**Patent Application No**	Filed/ Granted
1			
2			

Technology Transfer:

No. of Books published with details:

Profile of the Faculty

BRANCH: AERONAUTICAL ENGINEERING

Name	R. KOUSIK KUMAAR	
Designation	ASSISTANT PROFESSOR	
Department	**AERO**	
Date of Joining the Institution	21/11/2022	
Date of Birth	02/01/1990	
Faculty Unique	1-3592847793	
Email Id	kousikrangaraj@gmail.com	

Education Qualifications:

SL.No	Degree Obtained	Year of Obtaining the highest degree	Class/ Grade obtained
1	B.E. – AERONAUTICAL ENGG	2011	FIRST
2	M.TECH – AERONAUTICAL ENGG	2013	FIRST
3	PhD		

Total Work Experience in Years:

SL.No	Work Experience	Total in Years
1	Teaching	08 YEARS 05 MONTHS
2	Research	06 YEARS (Ph.D)
3	Industry	-
4	Others	-

Area of Specialization: Aeronautical Engineering

	Diploma/ Post Diploma	NIL
	Undergraduate	1. Aircraft Structures - II 2. Aircraft Structures - I 3. Finite Element Methods

Courses taught at		4. Strength of Materials 5. Composite Materials and Structures
	Post Graduate	1. Aircraft Structural Mechanics 2. Finite Element Methods 3. Propeller Aerodynamics
	Post Graduate Diploma Level	NIL

Research Guidance (Number of Students):UG students- 68

No. of papers published: 10

SL.No	Type	Numbers
1	National	NIL
2	International Journals	10
3	Conferences	07
4	Others	-

Master (Completed (Year of Completion)/Ongoing): **Completed (2013)**

Ph.D. (Completed Year of Completion)/Ongoing): **Ongoing (Thesis submitted expected to complete by FEB 2023)**

Projects Carried out: **Nil**

Patents (Filed & Granted): 01 patent filed.

SL No	Topic	**Patent Application No**	Filed/ Granted
1	FLYING THERMODYNAMIC DUCT	200054/03-05-2021	Filed

Technology Transfer:

No. of Books published with details:

1. **Kousik Kumaar.R**, **'*Aircraft Materials and Processes* (ISBN.NO: 978-81-936020-1-0)'** for Anna University R2013 & R2017 Aeronautical Engineering Course.

2. **Kousik Kumaar.R,** Kesavan. M, Muthumari. T**, '*Fatigue and Fracture Mechanicsfor Aerostructures* (ISBN.NO: 978-81-955396-0-4)'** for Anna University R2017 Aeronautical Engineering Course.

3. Dr. R. Ramaswamy**, Kousik Kumaar.R,** Kesavan. M**, '*Modelling and Simulationof Biomass Gasifier* (ISBN.NO: 978-81-955396-8-0)'**.

4. **Kousik Kumaar.R**, M. Kesavan, S. Rathinavel, ***'Computer Aided Simulation Laboratory (ISBN.NO: 978-81-957772-2-8)'*** for Anna University R2017 AeronauticalEngineering Course.

Profile of the Faculty

BRANCH: AERONAUTICAL ENGINEERING

Name	Mallappa Jabade	
Designation	Assistant Professor	
Department	**Aeronautical Engineering**	
Date of Joining the Institution	14/12/2022	
Date of Birth	19/01/1994	
Faculty Unique	1-35799111161	
Email Id	mallappa.jabade@nmit.ac.in	

Education Qualifications:

SL.No	Degree Obtained	Year of Obtaining the highest degree	Class/ Grade obtained
1	UG	Jan, 2018	First
2	PG	Feb, 2021	First
3	PhD		
4	Others		
5			

Total Work Experience in Years:

SL.No	Work Experience	Total in Years
1	Teaching	1 Year
2	Research	3 Years, 10 Months
3	Industry	
4	others	

Area of Specialization: Aerospace Propulsion, Cryogenic and Semi-Cryogenic rocket propulsion, Data Analytics, Machine Learning, Data mining.

Courses taught at		

	Undergraduate	1 2 3 . .

Research Guidance (Number of Students):UG students-

No. of papers published:

SL.No	Type	Numbers
1	National	1
2	International Journals	
3	Conferences	2
4	Others	

Master (Completed (Year of Completion)/Ongoing): May, 2020

Ph.D. (Completed Year of Completion)/Ongoing):

Projects Carried out :

Patents (Filed & Granted):

SL No	Topic	**Patent Application No**	Filed/ Granted
1			
2			

Technology Transfer:

No. of Books published with details:

BRANCH: Artificial Intelligence and Data Science

SL No	Name	Designation
1.	Dr.P.V.R. Murthy	Professor
2.	Dr. GOURISH GOUDAR	Assistant Professor
3.	NAYANA B P	Assistant Professor
4.	SHYAMASHRI DAS	Assistant Professor

Profile of the Faculty

BRANCH: Artificial Intelligence and Data Science

Name	Dr.P.V.R. Murthy
Designation	Professor
Department	**AI&DS**
Date of Joining the Institution	21.04.2022
Date of Birth	26.06.1959
Faculty Unique	1-9596369671
Email Id	pvr.murthy@nmit.ac.in

Education Qualifications:

SL.No	Degree Obtained	Year of Obtaining the highest degree	Class/ Grade obtained
1	M.Sc(Tech) Computer Science (Integrated, BITS(Pilani))	1982	6.61/10
2	PG		
3	PhD	1991	
4	Others		
5			

Total Work Experience in Years:

SL.No	Work Experience	Total in Years
1	Teaching	22 years
2	Research	32 years
3	Industry	10 years
4	others	

Area of Specialization: Computer Science (Program Analysis, Concurrency, Artificial Intelligence)

	Diploma/ Post Diploma	
	Undergraduate	1 Artificial Intelligence 2 Discrete Mathematics 3 Formal Languages and

<table>
<tr><td rowspan="3">Courses taught at</td><td></td><td>Automata
4 Data Structures
5 Python Programming
.
.</td></tr>
<tr><td>Post Graduate</td><td>1 Distributed Computing
2 Software Engineering
3 Discrete Mathematics
4 Data Structures and Programming Principles</td></tr>
<tr><td>Post Graduate Diploma Level</td><td></td></tr>
</table>

Research Guidance (Number of Students):UG students- 10

No. of papers published:

SL.No	Type	Numbers
1	National	2
2	International Journals	2
3	Conferences	30
4	Others	

Master (Completed (Year of Completion)/Ongoing): completed in 1982

Ph.D. (Completed Year of Completion)/Ongoing): completed in 1991

Projects Carried out : Research projects in software architecture, Automatic test generation and Refactoring have been carried out at Siemens Corporate Technology. University Collaboration projects with IITs have been carried out.

Patents (Filed & Granted):

SL No	Topic	**Patent Application No**	Filed/ Granted
1	Path Coverage Criterion in Specification based Testing based on an Extended Context Free Grammar based Test Specification Model and a new Test Generation Algorithm	US 7930682 B2	Granted
2	System and Method for Identifying Opportunities for Refactoring in an Object-oriented Program	US 8,381,179 B2	Granted

Technology Transfer:

No. of Books published with details:

Profile of the Faculty

BRANCH: ARTIFICIAL INTELLIGENCE AND DATA SCIENCE

Name	Dr. GOURISH GOUDAR	
Designation	Assistant Professor	
Department	ARTIFICIAL INTELLIGENCE AND DATA SCIENCE	
Date of Joining the Institution	16/August/2022	
Date of Birth	14/April/1989	
Faculty Unique	1-23594293961	
Email Id	gourish.goudar@nmit.ac.in	

Education Qualifications:

SL.No	Degree Obtained	Year of Obtaining the highest degree	Class/ Grade obtained
1	UG	2011	First class with Distinction
2	PG	2015	First class with Distinction
3	PhD	2022	--
4	Others		
5			

Total Work Experience in Years:

SL.No	Work Experience	Total in Years
1	Teaching	2
2	Research	5
3	Industry	1.5
4	others	

Area of Specialization: Future Networks, Computer Vision (Intelligent Transportation Systems), Machine Learning and Mathematical Modeling.

<table>
<tr><td rowspan="4">Courses taught at</td><td>Diploma/ Post Diploma</td><td></td></tr>
<tr><td>Undergraduate</td><td>1 Operating Systems
2 UNIX
3 Computer Organization and Architecture.
4 Compiler Design
5 Database Management Systems
6 Statistics using R</td></tr>
<tr><td>Post Graduate</td><td></td></tr>
<tr><td>Post Graduate Diploma Level</td><td></td></tr>
</table>

Research Guidance (Number of Students):UG students-

No. of papers published:

SL.No	Type	Numbers
1	National	
2	International Journals	3
3	Conferences	4
4	Others	

Master (Completed (Year of Completion)/Ongoing): Completed (2015)

Ph.D. (Completed Year of Completion)/Ongoing): Completed (2022)

Projects Carried out :

Patents (Filed & Granted):

SL No	Topic	**Patent Application No**	Filed/ Granted
1			
2			

Technology Transfer:

No. of Books published with details:

NITTE EDUCATION TRUST

NITTE MEENAKSHI INSTITUTE OF TECHNOLOGY
An Autonomous Institution Approved by UGC/AICTE/Govt. of Karnataka
Accredited by NBA (Tier-I) and NAAC 'A+' Grade
Affiliated to Visvesvaraya Technological University, Belagavi
Post Box No. 6429, Yelahanka, Bengaluru-560064, Karnataka, INDIA

KNOWLEDGE ■ CHARACTER ■ UNITY

Profile of the Faculty

BRANCH: ARITIFICIAL INTELLIGENCE & DATA SCIENCE

Name	NAYANA B P
Designation	Assistant Professor
Department	**AI&DS**
Date of Joining the Institution	17-09-2022
Date of Birth	28-10-1992
Faculty Unique	1-4754661576
Email Id	nayana.bp@nmit.ac.in

Education Qualifications:

SL.No	Degree Obtained	Year of Obtaining the highest degree	Class/ Grade obtained
1	UG	2014	65.88
2	PG	2016	68.88
3	PhD	-	-
4	Others	-	-
5			

Total Work Experience in Years:

SL.No	Work Experience	Total in Years
1	Teaching	5
2	Research	-
3	Industry	-
4	others	-

Area of Specialization:

	Diploma	1) UNIX 2) Operating System
		1) User Interface Design 2) Operating System

Courses taught at	Undergraduate	3) Information Network Security 4) File structures 5) Management & Entrepreneurship 6) Data Structures 7) Big Data Analytics 8) Machine Learning
	Post Graduate	Nil
	Post Graduate Diploma Level	Nil

Research Guidance (Number of Students):UG students-

No. of papers published:

SL.No	Type	Numbers
1	National	-
2	International Journals	-
3	Conferences	1
4	Others	-

Master (Completed (Year of Completion)/Ongoing):
Completed (2016)

Ph.D. (Completed Year of Completion)/Ongoing):

Projects Carried out : 5

Patents (Filed & Granted):

SL No	Topic	**Patent Application No**	Filed/ Granted
1	-	-	-
2	-	-	-

Technology Transfer: Nil

No. of Books published with details: Nil

Profile of the Faculty

BRANCH: ARTIFICIAL INTELLIGENCE AND DATA STRUCTURES

Name	SHYAMASHRI DAS	
Designation	Assistant Professor	
Department	**AI & DS**	
Date of Joining the Institution	25th Aug, 2022	
Date of Birth	26/10/1995	
Faculty Unique	1-24278129253	
Email Id	shyamashri.das@gmail.com	

Education Qualifications:

SL.No	Degree Obtained	Year of Obtaining the highest degree	Class/ Grade obtained
1	UG	2019	1
2	PG	2022	1
3	PhD		
4	Others		
5			

Total Work Experience in Years:

SL.No	Work Experience	Total in Years
1	Teaching	
2	Research	
3	Industry	
4	others	

Area of Specialization: Data Science

Courses taught at	Diploma/ Post Diploma	
	Undergraduate	
	Post Graduate	

	Post Graduate Diploma Level	

Research Guidance (Number of Students):UG students-

No. of papers published:

SL.No	Type	Numbers
1	National	
2	International Journals	
3	Conferences	
4	Others	

Master (Completed (Year of Completion)/Ongoing):

Ph.D. (Completed Year of Completion)/Ongoing):

Projects Carried out :

Patents (Filed & Granted):

SL No	Topic	**Patent Application No**	Filed/ Granted
1			
2			

Technology Transfer:

No. of Books published with details:

Post Box No. 6429, Yelahanka, Bengaluru-560064, Karnataka, INDIA

DEPARTMENT OF ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING

FACULTY LIST

Sl No	Faculty Name	Designation
1	Dr. PIYUSH KUMAR PAREEK	PROFESSOR & HOD
2	Mr. SUNIL KUMAR V	
3	Mrs. MADHURA G K	
4	Mrs. ARUNA T M	

NITTE MEENAKSHI INSTITUTE OF TECHNOLOGY
An Autonomous Institution Approved by UGC/AICTE/Govt. of Karnataka
Accredited by NBA (Tier-I) and NAAC 'A+' Grade
Affiliated to Visvesvaraya Technological University, Belagavi
Post Box No. 6429, Yelahanka, Bengaluru-560064, Karnataka, INDIA

Profile of the Faculty

BRANCH: ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING

Name	Dr. PIYUSH KUMAR PAREEK
Designation	PROFESSOR & HOD
Department	**AIML**
Date of Joining the Institution	5/1/2022
Date of Birth	04/03/1988
Faculty Unique	1-11313996708
Email Id	piyush.kumar@nmit.ac.in

Education Qualifications:

SL.No	Degree Obtained	Year of Obtaining the highest degree	Class/ Grade obtained
1	UG	2010	II
2	PG	2012	FCD
3	PhD	2016	NA
4	Post Doc Pursuing	2021(Registered) – Dec 2023 Expected to Complete	
5			

Total Work Experience in Years:

SL.No	Work Experience	Total in Years
1	Teaching	11
2	Research	1
3	Industry	-
4	Others	-

Area of Specialization:

Courses taught at	Undergraduate	1) C Programming 2) Software Engineering 3) IoT 4) Management & Entrepreneurship 5) Research Methodology 6) IPR

	Post Graduate	1) Research Methodology 2) IPR

Research Guidance (Number of Students):UG students-

No. of papers published: 202

SL.No	Type	Numbers
1	National	30
2	International Journals	70
3	Conferences	102
4	Others	-

Master (Completed (Year of Completion)/Ongoing):

Ph.D. (Completed Year of Completion)/Ongoing): 6 Awarded in VTU, 4 Pursuing in VTU

Projects Carried out:

Patents (Filed & Granted):

SL No	Topic	**Patent Application No**	Filed/ Granted
1	Greenhouse Agriculture in an Iot And ML-Driven Controlled Environment	202241001146	Filed
2	Food Spoilage Detection system using Artificial Intelligence	202241023803	Filed
3	CROP GROWTH MONITORING SYSTEM	202241027766	Filed
4	IOT-BASED INTELLIGENT AGRICULTURE SYSTEM WITH ARTIFICIAL INTELLIGENCE	202022103610	Filed
5	A system for determination of noise type in microarray images	20221110011513000DE	GRANTED
6	A robust internet of things (iot) security management system	20221110011513400DE	GRANTED

Technology Transfer: -

No. of Books published with details:

An Adoptive Model for Lean software Development , Published by LAP LAMBERT Academic Publishing, 2017, ISBN 10: 3659950785ISBN 13: 9783659950780

Software Engineering and Its Applications: A Handbook , Published by New Delhi Publishers, 2020 , ISBN 10: 9388879848ISBN 13: 9789388879842

Recommendation Based Interaction , Published by LAP Lambert Academic Publishing, 2022 ISBN 10: 6139459338ISBN 13: 9786139459339

Profile of the Faculty

BRANCH: ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING

Name	V Sunil Kumar	
Designation	Assistant professor	
Department	**AI & ML**	
Date of Joining the Institution	06-10-2022	
Date of Birth	10-06-1988	
Faculty Unique	1-9324405165	
Email Id	Sunil.kumar@nmit.ac.in	

Education Qualifications:

SL.No	Degree Obtained	Year of Obtaining the highest degree	Class/ Grade obtained
1	UG	2010	FC
2	PG	2020	FCD
3	PhD		

Total Work Experience in Years:

SL.No	Work Experience	Total in Years
1	Teaching	3 Years
2	Research	
3	Industry	4 Years
4	others	

Area of Specialization:

Courses taught at	Undergraduate	1.C Programming 2.Data Structures 3.Python Programming 4.Java Programming 5.Algorithms 6.Data Science
	Post Graduate	1.Advanced Algorithms 2.Research Methodology

Research Guidance (Number of Students):UG students- 8

No. of papers published:

SL.No	Type	Numbers
1	National	-
2	International Journals	2
3	Conferences	1
4	Others	-

Master (Completed (Year of Completion)/Ongoing): 2020

Ph.D. (Completed Year of Completion)/Ongoing):

Projects Carried out :
Sybil Attack Detection in VANET using Direct Trust Calculation
.Net Application for Banking
IOT Based Health Monitoring System
Offline Handwritten Signature Verification System in Image Processing
Project Management with PERT-CPM

Patents (Filed & Granted):

SL No	Topic	**Patent Application No**	Filed/ Granted
1			
2			

Technology Transfer:

No. of Books published with details:

Profile of the Faculty

BRANCH: ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING

Name	MADHURA G K	
Designation	ASSISTANT PROFESSOR	
Department	**AIML**	
Date of Joining the Institution	17/08/2022	
Date of Birth	01/07/1984	
Faculty Unique	1-3541802203	
Email Id	madhura.gk@nmit.ac.in	

Education Qualifications:

SL.No	Degree Obtained	Year of Obtaining the highest degree	Class/ Grade obtained
1	UG	2006	II
2	PG	2015	FCD
3	PhD		

Total Work Experience in Years:

SL.No	Work Experience	Total in Years
1	Teaching	8.5
2	Research	0
3	Industry	0
4	Others	0

Area of Specialization:

Courses taught at	Undergraduate	1) OS 2) DBMS 3) C Programming 4) AI & ML 5) Data Mining 6) Big Data 7) SAN 8) Unix 9) Data Communication SMS

Research Guidance (Number of Students):UG students-20

No. of papers published:

SL.No	Type	Numbers
1	National	4
2	International Journals	2
3	Conferences	2
4	Others	

Master (Completed (Year of Completion)/Ongoing): 2015

Ph.D. (Completed Year of Completion)/Ongoing):

Projects Carried out:

Sentiment Analysis for Product recommendation using Twitter data

Web page designing using ASP.net

Patents (Filed & Granted):

SL No	Topic	**Patent Application No**	Filed/ Granted
1			
2			

Technology Transfer: NIL

No. of Books published with details: NIL

Profile of the Faculty

BRANCH: ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING

Name	Aruna T M	
Designation	Assistant Professor	
Department	AI&ML	
Date of Joining the Institution	12/12/2022	
Date of Birth	15/08/1988	
Faculty Unique	1-2333394597	
Email Id	aruna.tm@nmit.ac.in	

Education Qualifications:

SL.No	Degree Obtained	Year of Obtaining the highest degree	Class/ Grade obtained
1	UG	2011	FC
2	PG	2014	FCD
3	PhD		
4	Others		
5			

Total Work Experience in Years:

SL.No	Work Experience	Total in Years
1	Teaching	8
2	Research	1
3	Industry	
4	others	

Area of Specialization:

Courses taught at	Undergraduate	1 C Programming 2 C++ 3 Java 4 Unix Shell Programming 5 Design and analysis of algorithms 6 DBMS 7 Web Technologies 8 Software testing 9 SAN

		10 C#

Research Guidance (Number of Students):UG students- Nil

No. of papers published: 15

SL.No	Type	Numbers
1	National	6
2	International Journals	5
3	Conferences	4
4	Others	

Master (Completed (Year of Completion)/Ongoing): 2014

Ph.D. (Completed Year of Completion)/Ongoing): Ongoing-2022

Projects Carried out :Nil

Patents (Filed & Granted):Nil

SL No	Topic	**Patent Application No**	Filed/ Granted
1			
2			

Technology Transfer: Nil

No. of Books published with details: Nil

DEPARTMENT OF PHYSICS

Sl.No	Name	Designation
1	Dr. Hitha D Shetty	Professor and Head
2	Dr. Abdul Sattar	Professor
3	Mrs. Jyothi G B	Asst. Professor
4	Mrs. Kavitha Kamath	Asst. Professor
5	Dr. Habibuddin Sheik	Adjunct. Professor
6	Mr. Shivaprasad H B	Asst. Professor
7	Mr. Ashok Reddy	Asst. Professor
8	Mrs. Jyothi Gupta	Asst. Professor
9	Dr. Devarajan Alagarasan	Asst. Professor
10	Mr. K Naveen Kumar	Asst. Professor
11	Mr. Prashantha Murahari	Asst. Professor
12	Mrs. Ranjitha K	Asst. Professor

Profile of the Faculty

DEPARTMENT: PHYSICS

Name	Dr. Hitha D Shetty
Designation	Professor and Head
Department	Physics
Date of Joining the Institution	15.10.2001
Date of Birth	06.05.1977
Faculty Unique	1-419906861
Email Id	hitha.d.shetty@nmit.ac.in

Education Qualifications:

SL.No	Degree Obtained	Year of Obtaining the highest degree	Class/ Grade obtained
1	UG	1998	First class with distinction
2	PG	2000	First Rank/First class with distinction
3	PhD	2019	
4	Others		

Total Work Experience in Years:

SL.No	Work Experience	Total in Years
1	Teaching	22
2	Research	10
3	Industry	

Area of Specialization: Nano composites and their studies

Courses taught at	**Diploma/ Post Diploma**	
	Undergraduate	1. Engineering Physics 2. Engineering Physics Lab
	Post Graduate	

	Post Graduate Diploma Level	1. 2.

Research Guidance (Number of Students): UG students- 02
Ph.D-01

No. of papers published: 6

SL.No	Type	Numbers
1	National	00
2	International Journals	05
3	Conferences	01
4	Others	

Master (Completed (Year of Completion)/Ongoing): Ongoing

Ph.D. (Completed Year of Completion)/Ongoing): Ongoing

Projects Carried out : 01 From VGST, Govt. of Karnataka- Grant amount 15 Lakhs

Patents (Filed & Granted):

SL No	Topic	Patent Application No	Filed/ Granted
1			

Technology Transfer:

No. of Books published with details:

Profile of the Faculty

DEPARTMENT: PHYSICS

Name	Dr. Sheik Abdul Sattar	
Designation	Professor	
Department	**Physics**	
Date of Joining the Institution	17/02/2014	
Date of Birth	10/12/1971	
Faculty Unique	1-2183526434	
Email Id	Sheik.abdul.sattar@nmit.ac.in	

Education Qualifications:

SL.No	Degree Obtained	Year of Obtaining the highest degree	Class/ Grade obtained
1	Ph.D.	2013	-
2	PG	1994	First
3	M.Phil.	2004	First
4	Others		

Total Work Experience in Years:

SL.No	Work Experience	Total in Years
1	Teaching	27.5
2	Research	6
3	Industry	-
4	others	

Area of Specialization:

Courses taught at	Diploma/ Post Diploma	-
	Undergraduate	1. Engineering Physics 2. Applied Physics
	Post Graduate	-
	Post Graduate Diploma Level	

Research Guidance (Number of Students):UG students-
Ph.D- 02

No. of papers published: 32

SL.No	Type	Numbers
1	National	-
2	International Journals	25
3	Conferences	7
4	Others	-

Master (Completed (Year of Completion)/Ongoing):

Ph.D. (Completed Year of Completion)/Ongoing): 01

Projects Carried out: 02

Patents (Filed & Granted): Nil

SL No	Topic	Patent Application No	Filed/ Granted
1			
2			

Technology Transfer: Nil

No. of Books published with details: Nil

Profile of the Faculty

DEPARTMENT: PHYSICS

Name	JYOTHI.G.B.
Designation	Assistant Professor
Department	**PHYSICS**
Date of Joining the Institution	03-09-2001
Date of Birth	01.06.1970
Faculty Unique	1-2183526439
Email Id	Jyothi.gb@nmit.ac.in

Education Qualifications:

SL.No	Degree Obtained	Year of Obtaining the highest degree	Class/ Grade obtained
1	UG	1991	First/3rd RANK
2	PG	1993	First/1st RANK
3	Ph.D.		

Total Work Experience in Years:

SL.No	**Work Experience**	**Total in Years**
1	Teaching	27
2	Research	03
3	Industry	
4	others	

Area of Specialization:

Courses taught at	Diploma/ Post Diploma	1 2
	Undergraduate	1. Engineering Physics 2 Engineering Physics Lab
	Post Graduate	1 2
	Post Graduate Diploma Level	1 2

Research Guidance (Number of Students):UG students-

No. of papers published: 00

SL.No	Type	Numbers
1	National	
2	International Journals	
3	Conferences	
4	Others	

Master (Completed(Year of Completion)/Ongoing):

Ph.D. (Completed Year of Completion)/Ongoing):

Projects Carried out :

Patents (Filed & Granted):

SL No	Topic	Patent Application No	Filed/ Granted
1			
2			

Technology Transfer:

No. of Books published with details:

NITTE EDUCATION TRUST

NITTE MEENAKSHI INSTITUTE OF TECHNOLOGY
An Autonomous Institution Approved by UGC/AICTE/Govt. of Karnataka
Accredited by NBA (Tier-I) and NAAC 'A+' Grade
Affiliated to Visvesvaraya Technological University, Belagavi
Post Box No. 6429, Yelahanka, Bengaluru-560064, Karnataka, INDIA

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Profile of the Faculty

DEPARTMENT: PHYSICS

Name	Mrs. Kavitha Kamath
Designation	Asst. Professor
Department	**Physics**
Date of Joining the Institution	03/04/2007
Date of Birth	20/05/1975
Faculty Unique	1-419906865
Email Id	Kavitha.kamath@nmit.ac.in

Education Qualifications:

SL.No	**Degree Obtained**	**Year of Obtaining the highest degree**	**Class/ Grade obtained**
1	M.Sc	1997	First Class with Distinction
2	B. Sc	1995	First Class with Distinction
3	Ph.D.		

Total Work Experience in Years:

SL.No	**Work Experience**	**Total in Years**
1	Teaching	19 years 8 months
2	Research	-
3	Industry	-
4	others	

Area of Specialization:

Courses taught at	Diploma/ Post Diploma	-
	Undergraduate	1. Engineering Physics 2. Engineering Physics Lab
	Post Graduate	-
	Post Graduate Diploma Level	

Research Guidance (Number of Students):UG students-

No. of papers published: 1

SL.No	Type	Numbers
1	National	-
2	International Journals	-
3	Conferences	1
4	Others	-

Master (Completed (Year of Completion)/Ongoing): -

Ph.D. (Completed Year of Completion)/Ongoing): -

Projects Carried out :-Nil

Patents (Filed & Granted): Nil

SL No	Topic	Patent Application No	Filed/ Granted
1			
2			

Technology Transfer: Nil

No. of Books published with details: Nil

NITTE EDUCATION TRUST

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Post Box No. 6429, Yelahanka, Bengaluru-560064, Karnataka, INDIA

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Profile of the Faculty

DEPARTMENT: PHYSICS

Name	Dr. Habibuddin Shaik
Designation	Assistant Professor
Department	**PHYSICS**
Date of Joining the Institution	15-Dec-2014
Date of Birth	30-April-1985
Faculty Unique	1-2482403497
Email Id	habibuddin.shaik@nmit.ac.in skhabibuddin@gmail.com

Education Qualifications:

SL.No	**Degree Obtained**	**Year of Obtaining the highest degree**	**Class/ Grade obtained**
1	UG	2004	First class with Distinction
2	PG	2006	First class with Distinction
3	PhD	2014	First class with Distinction
4	Others		

Total Work Experience in Years:

SL.No	**Work Experience**	**Total in Years**
1	Teaching	8
2	Research	13
3	Industry	1
4	others	

Area of Specialization:

Courses taught at	Diploma/ Post Diploma	1 2
	Undergraduate	1. Engineering Physics 2. Engineering physics Lab
	Post Graduate	1 Nanoelectronics 2
	Post Graduate Diploma Level	1 2

Research Guidance (Number of Students):UG students- 20
PG Students- 2
Ph.D-3

No. of papers published: 48

SL.No	Type	Numbers
1	National	
2	International Journals	31
3	Conferences	17
4	Others	

Master (Completed (Year of Completion)/Ongoing): 2006

Ph.D. (Completed Year of Completion)/Ongoing): 2014

Projects Carried out : 6

Patents (Filed & Granted):1

SL No	Topic	Patent Application No	Filed/ Granted
1	Low Cost CORONA Poling Unit.	201741004614	Filed
2			

Technology Transfer:

No. of Books published with details:

NITTE EDUCATION TRUST

NITTE MEENAKSHI INSTITUTE OF TECHNOLOGY

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Affiliated to Visvesvaraya Technological University, Belagavi
Post Box No. 6429, Yelahanka, Bengaluru-560064, Karnataka, INDIA

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Profile of the Faculty

DEPARTMENT: PHYSICS

Name	SHIVAPRASAD H B
Designation	Assistant Professor
Department	**PHYSICS**
Date of Joining the Institution	17-08-2010
Date of Birth	02-03-1973
Faculty Unique	1-419906869
Email Id	shivaprasad.hb@nmit.ac.in

Education Qualifications:

SL.No	Degree Obtained	Year of Obtaining the highest degree	Class/ Grade obtained
1	UG	1997	Second Class
2	PG (M.Sc)	1999	Second Class
3	PG (M.Tech)	2001	First Class
4	Ph.D.		

Total Work Experience in Years:

SL.No	**Work Experience**	**Total in Years**
1	Teaching	17
2	Research	03
3	Industry	
4	others	

Area of Specialization:

Courses taught at	Diploma/ Post Diploma	1 2
	Undergraduate	1.Engineering Physics 2 Engineering Physics Lab
	Post Graduate	1 2
	Post Graduate Diploma	1

	Level	2

Research Guidance (Number of Students):UG students-

No. of papers published: 00

SL.No	Type	Numbers
1	National	
2	International Journals	
3	Conferences	
4	Others	

Master (Completed(Year of Completion)/Ongoing):

Ph.D. (Completed Year of Completion)/Ongoing):

Projects Carried out :

Patents (Filed & Granted):

SL No	Topic	Patent Application No	Filed/ Granted
1			
2			

Technology Transfer:

No. of Books published with details:

Profile of the Faculty

DEPARTMENT: PHYSICS

Name	ASHOK REDDY G V
Designation	Assistant Professor
Department	**PHYSICS**
Date of Joining the Institution	10-02-2011
Date of Birth	11.05.1981
Faculty Unique	1-721888035
Email Id	ashokreddy.gv@nmit.ac.in

Education Qualifications:

SL.No	Degree Obtained	Year of Obtaining the highest degree	Class/ Grade obtained
1	UG	2006	First Class
2	PG (M.Sc)-Physics	2008	First Class
3	PG (M.Phil)-Physics	2009	First Class
4	Ph.D.		

Total Work Experience in Years:

SL.No	**Work Experience**	**Total in Years**
1	Teaching	14
2	Research	8
3	Industry	
4	others	

Area of Specialization:

Courses taught at	Diploma	1Applied Science 2 Applied Science Lab
	Undergraduate	1. Engineering Physics 2 Engineering Physics Lab
	Post Graduate	1 2
	Post Graduate Diploma	1

	Level	2

Research Guidance (Number of Students):UG students-

No. of papers published: 14

SL.No	Type	Numbers
1	National	
2	International Journals	09
3	Conferences	05
4	Others	

Master (Completed(Year of Completion)/Ongoing):

Ph.D. (Completed Year of Completion)/Ongoing):

Projects Carried out : 01 From VGST, Govt. of Karnataka- Grant amount 15 Lakhs

Patents (Filed & Granted):

SL No	Topic	Patent Application No	Filed/ Granted
1			
2			

Technology Transfer:

No. of Books published with details: 00

Profile of the Faculty

DEPARTMENT: PHYSICS

Name	Jyothi Gupta	
Designation	Asst. Prof.	
Department	**Physics**	
Date of Joining the Institution	1/08/2012	
Date of Birth	29/06/1981	
Faculty Unique	7728	
Email Id	jyothi.gupta@nmit.ac.in	

Education Qualifications:

SL.No	**Degree Obtained**	**Year of Obtaining the highest degree**	**Class/ Grade obtained**
1	UG	2002	First class with distinction
2	PG	2004	First class with distinction
3	PhD	-	-
4	Others	-	-

Total Work Experience in Years: 18 years

SL. No	**Work Experience**	**Total in Years**
1	Teaching	18 years
2	Research	5 years
3	Industry	nil
4	others	nil

Area of Specialization: NA

	Diploma/ Post Diploma	1 2
	Undergraduate	1 Engineering Physics theory 2 Engineering Physics lab

<table>
<tr><td rowspan="2">Courses taught at</td><td>Post Graduate</td><td>1</td></tr>
<tr><td>Post Graduate Diploma Level</td><td>1</td></tr>
<tr><td colspan="3">Research Guidance (Number of Students):UG students- 00</td></tr>
<tr><td colspan="3">No. of papers published: 11</td></tr>
</table>

SL.No	Type	Numbers
1	**National**	-
2	**International Journals**	8
3	**Conferences**	3
4	**Others**	-

Master Completed (Year of Completion):

Ph.D. (Completed Year of Completion)/Ongoing):

Projects Carried out :

Patents (Filed & Granted):

SL No	Topic	Patent Application No	Filed/ Granted
1			
2			

Technology Transfer: nil

No. of Books published with details: nil

Profile of the Faculty

DEPARTMENT: PHYSICS

Name	Dr. Devarajan Alagarasan	
Designation	Assistant Professor	
Department	Physics	
Date of Joining the Institution	07-12-2022	
Date of Birth	08-06-1983	
Faculty Unique	35388632791	
Email Id	alagarasan.d@nmit.ac.in	

Education Qualifications:

SL.No	Degree Obtained	Year of Obtaining the highest degree	Class/ Grade obtained
1	UG	2004	First
2	PG (M.Sc)-Physics	2007	First
3	PG (M.Tech)-Nano science and Technology	2009	
4	PhD	2018	
5	PG Diploma in Yoga	2013	First
6	PG (M.Sc.)-Yoga	2015	First

Total Work Experience in Years:

SL.No	Work Experience	Total in Years
1	Teaching	1
2	Research	10
3	Industry	

Area of Specialization:

Courses taught at	Diploma/ Post Diploma	1.
	Undergraduate	1. Engineering Physics 2. Engineering Physics Lab 3. UG Lab for Bachelor

		of Science
	Post Graduate	1
	Post Graduate Diploma Level	1 2

Research Guidance (Number of Students):UG students-10

No. of papers published: 45

SL.No	Type	Numbers
1	National	1
2	International Journals	43
3	Conferences	1
4	Others	

Master Completed (Year of Completion):

Ph.D. (Completed Year of Completion):

Projects Carried out:

Patents (Filed & Granted):

SL No	Topic	Patent Application No	Filed/ Granted
1			
2			

Technology Transfer:

No. of Books published with details:

Profile of the Faculty

BRANCH: PHYSICS

Name	KILARI NAVEEN KUMAR
Designation	Assistant Professor
Department	Physics
Date of Joining the Institution	01/07/2022
Date of Birth	21/03/1995
Faculty Unique	1-24697883187
Email Id	naveen.kumar@nmit.ac.in

Education Qualifications:

SL.No	Degree Obtained	Year of Obtaining the highest degree	Class/ Grade obtained
1	UG	2015	First class with Distinction
2	PG	2017	First Class with Distinction
3	PhD	-	-
4	Others CSIR-UGC NET	2018	-

Total Work Experience in Years:

SL.No	Work Experience	Total in Years
1	Teaching	01
2	Research	04
3	Industry	-
4	others	-

Area of Specialization: Vacuum and Thin Film Technology

Courses taught at	**Diploma/ Post Diploma**	1 2.
		1 Engineering Physics Theory

	Undergraduate	2 Engineering Physics Lab
	Post Graduate	1 2
	Post Graduate Diploma Level	1 2

Research Guidance (Number of Students):UG students- 20

No. of papers published:

SL.No	Type	Numbers
1	National	-
2	International Journals	20
3	Conferences	03
4	Others	-

Master (Completed (Year of Completion): Ongoing

Ph.D. (Completed Year of Completion)/Ongoing):

Projects Carried out :

-

Patents (Filed & Granted):

SL No	Topic	Patent Application No	Filed/ Granted
1			
2			

Technology Transfer:

No. of Books published with details:

Profile of the Faculty

Name	Mr Prashantha Murahari	
Designation	Assistant Professor	
Department	Physics	
Date of Joining the Institution	01.08.2022	
Date of Birth	25.05.1985	
Faculty Unique	1-33548911406	
Email Id	prashantha.murahari@nmit.ac.in	

Education Qualifications:

SL.No	Degree Obtained	Year of Obtaining the highest degree	Class/ Grade obtained
1	UG	2005	First
2	PG	2007	First
3	PhD		
4	Others		

Total Work Experience in Years:

SL.No	Work Experience	Total in Years
1	Teaching	2
2	Research	15
3	Industry	

Area of Specialization: Condensed matter physics

Courses taught at	**Diploma/ Post Diploma**	
	Undergraduate	1. Engineering Physics Theory 2. Engineering Physics Lab 3. UG Lab for Bachelor of Science
	Post Graduate	1 2

	Post Graduate Diploma Level	1 2

Research Guidance (Number of Students):UG students-

No. of papers published: 41

SL.No	Type	Numbers
1	National	01
2	International Journals	34
3	Conferences	06
4	Others	02 Book chapters

Master (Completed (Year of Completion)/Ongoing):

Ph.D. (Completed Year of Completion)/Ongoing):

Projects Carried out :

Patents (Filed & Granted):

SL No	Topic	Patent Application No	Filed/ Granted
1			

Technology Transfer:

No. of Books published with details:

Profile of the Faculty

DEPARTMENT: PHYSICS

Name	RANJITHA K
Designation	Assistant Professor
Department	PHYSICS
Date of Joining the Institution	01-08-2022
Date of Birth	03.06.1991
Faculty Unique	1-3741540288
Email Id	k.ranjitha@nmit.ac.in

Education Qualifications:

SL.No	Degree Obtained	Year of Obtaining the highest degree	Class/ Grade obtained
1	UG	2012	First
2	PG	2014	First
3	PhD		
4	Others		

Total Work Experience in Years:

SL.No	Work Experience	Total in Years
1	Teaching	06
2	Research	02
3	Industry	

Area of Specialization:

Courses taught at	Diploma/ Post Diploma	1 2
	Undergraduate	1. Engineering Physics 2. Engineering Physics Lab
	Post Graduate	1 2
	Post Graduate Diploma Level	1 2

Research Guidance (Number of Students):

No. of papers published: 05

SL.No	Type	Numbers
1	National	
2	International Journals	02
3	Conferences	3
4	Others	

Master (Completed(Year of Completion):

Ph.D. (Completed Year of Completion)/Ongoing):

Projects Carried out :

Patents (Filed & Granted):

SL No	Topic	Patent Application No	Filed/ Granted
1			
2			

Technology Transfer:

No. of Books published with details:

Profile of the Faculty

CHEMISTRY

Name	Dr Srilatha Rao P	
Designation	Professor	
Department	**Chemistry**	
Date of Joining the Institution	18-12-2001	
Date of Birth	02-10-1978	
Faculty Unique	1-416769971	
Email Id	srilatha_rao_p@nmit.ac.in	srilatha_rao_p@yahoo.com

Education Qualifications:

SL.No	Degree Obtained	Year of Obtaining the highest degree	Class/ Grade obtained
1	UG	1999	I class 81.5%
2	PG	2001	I class 64.5%
3	PhD	2007	-
4	Others		
5			

Total Work Experience in Years:

SL.No	Work Experience	Total in Years
1	Teaching	21
2	Research	6
3	Industry	-
4	others	-

Area of Specialization:

Courses taught at	Diploma/ Post Diploma	
	Undergraduate	Yes
	Post Graduate	
	Post Graduate Diploma Level	

Research Guidance (Number of Students):PG students- 2

No. of papers published:

SL.No	Type	Numbers

1	National	1
2	International Journals	23
3	Conferences	02
4	Others	01

Master (Completed (Year of Completion)/Ongoing): Completed 2001

Ph.D. (Completed Year of Completion)/Ongoing): Completed 2007

Projects Carried out :03

Patents (Filed & Granted):

SL No	Topic	**Patent Application No**	Filed/ Granted
1	A method for isolation and characterization of active coagulants from members of Fabaceae and Plantae family seeds: A water treatment method.	202041039 247	Filed
2	Production of paper from Desmostachya Bipinnata (Dharbe) from Malnad region	201641025 426	Published
3.	Cerotoxid metal matrix	C22C1/10	Granted

Technology Transfer: nil

No. of Books published with details: nil

Profile of the Faculty

BRANCH:CHEMISTRY

Name	Dr. Aravinda T	
Designation	Associate Professor	
Department	**Chemistry**	
Date of Joining the Institution	01-08-2012	
Date of Birth	22-07-1981	
Faculty Unique	1-2183525919	
Email Id	aravinda.t@gmail.com	

Education Qualifications:

SL.No	Degree Obtained	Year of Obtaining the highest degree	Class/ Grade obtained
1	UG	2004	1 Class
2	PG	2006	1 Class
3	PhD	2010	—-
4	Others		—--
5			

Total Work Experience in Years:

SL.No	Work Experience	Total in Years
1	Teaching	12
2	Research	16
3	Industry	00
4	others	00

Area of Specialization:

Courses taught at	Diploma/ Post Diploma	1 Organic 2 Bio Organic 3 In Organic Chemistry . .
	Undergraduate	1 Engineering Chemistry

Research Guidance (Number of Students):UG students-

No. of papers published:

SL.No	Type	Numbers
1	National	02

2	International Journals	40
3	Conferences	20
4	Others	

Master (Completed (Year of Completion)/Ongoing): NIl

Ph.D. (Completed Year of Completion)/Ongoing): Ongoing (01)

Projects Carried out :

Synthesis of Pseudopeptides and its biological application, TEQIP(II), Seed Money (NMIT), 1.2 Lakhs, 2014-15, Completed

Evolvement of metal oxide Nanoparticles as a catalyst: Therapeutic advantages of transition metal Pseduopeptides in organic process and DNA studies. SERB, DST, 44.61, 2017-20, Completed.

An innovative Study: Synthesis, DNA activity of heterocyclic novel ligands and their transition metal complexes as antitumor drugs. VGST, 5 Lakhs, 2019-20, Completed.

A New Approach: DNA Studies and Synthetic Protocols of Se Nanoparticles in Organic Synthesis, AICTE (RPS), 25 L, **On going.**

Patents (Filed & Granted):

SL No	Topic	**Patent Application No**	Filed/ Granted
1	plified method for isolation and characterization of active coagulants ı member of Fabaceae and Plantae family Seeds: A Potential Water tment Method.	202041039247	Filed
2			

Technology Transfer:

No. of Books published with details: Nil

Profile of the Faculty

Department CHEMISTRY

Name	Dr. A S Sowmyashree
Designation	Assistant Professor
Department	**Chemistry**
Date of Joining the Institution	07-09-2011
Date of Birth	23-02-1987
Faculty Unique	1-1484183703
Email Id	sowmyashree.as@nmit.ac.in

Education Qualifications:

SL.No	Degree Obtained	Year of Obtaining the highest degree	Class/ Grade obtained
1	UG	2009	1 Class
2	PG	2011	1 Class
3	PhD	2022	—--
4	Others		
5			

Total Work Experience in Years:

SL.No	Work Experience	Total in Years
1	Teaching	11.5
2	Research	05
3	Industry	00
4	others	00

Area of Specialization:

Courses taught at	Diploma/ Post Diploma	1 Electrochemistry: Corrosion Inhibition study.
	Undergraduate	1 Engineering Chemistry

Research Guidance (Number of Students):UG students- Nil

No. of papers published:

SL.No	Type	Numbers
1	National	00
2	International Journals	10

3	Conferences	10
4	Others	00

Master (Completed (Year of Completion)/Ongoing): Nil

Ph.D. (Completed Year of Completion)/Ongoing): Nil

Projects Carried out : 01, Seedmoney NMIT/Teqip. 1 Lakh

Patents (Filed & Granted): 01

SL No	Topic	**Patent Application No**	Filed/ Granted
1	A Method for preparing raw material for paper industry	201641025426	Filed
2			

Technology Transfer:

No. of Books published with details:

Profile of the Faculty

DEPARTMENT OF CHEMISTRY

Name	Mrs. Sadhana H Upadhya	
Designation	Assistant professor	
Department	**Chemistry**	
Date of Joining the Institution	01/08/2012	
Date of Birth	02/02/1990	
Faculty Unique	1-1484183924	
Email Id	sadhanaupadhya.h@nmit.ac.in	

Education Qualifications:

SL.No	Degree Obtained	Year of Obtaining the highest degree	Class/ Grade obtained
1	UG	2010	First class with distinction
2	PG	2012	First class
3	PhD	Pursuing	
4	Others		
5			

Total Work Experience in Years:

SL.No	Work Experience	Total in Years
1	Teaching	10 y
2	Research	
3	Industry	
4	others	

Area of Specialization:

Courses taught at	Undergraduate	1.Engineering chemistry Theory 2. Engineering chemistry Lab

Research Guidance (Number of Students):UG students-

No. of papers published:

SL.No	Type	Numbers
1	National	
2	International Journals	04
3	Conferences	

4	Others	

Master (Completed (Year of Completion)/Ongoing):

Ph.D. (Completed Year of Completion)/Ongoing):

Projects Carried out :

Patents (Filed & Granted):

SL No	Topic	**Patent Application No**	Filed/ Granted
1			
2			

Technology Transfer:

No. of Books published with details:

Profile of the Faculty

DEPARTMENT: Chemistry

Name	Dr. Kshama Shetty S	
Designation	Assistant Professor	
Department	**Chemistry**	
Date of Joining the Institution	1 Oct 2020	
Date of Birth	30 July 1989	
Faculty Unique	1-9323651596	
Email Id	kshama.shetty@nmit.ac.in	

Education Qualifications:

SL.No	Degree Obtained	Year of Obtaining the highest degree	Class/ Grade obtained
1	UG	2010	Distinction
2	PG	2012	Distinction
3	PhD	2016	7.1
4	Others		
5			

Total Work Experience in Years:

SL.No	Work Experience	Total in Years
1	Teaching	4.5
2	Research	4
3	Industry	0
4	others	0

Area of Specialization:

Courses taught at	Undergraduate	1Engineering Chemistry theory 2Engineering chemistry lab

Research Guidance (Number of Students):UG students-

No. of papers published:

SL.No	Type	Numbers
1	National	
2	International Journals	7
3	Conferences	
4	Others	

Master (Completed (Year of Completion)/Ongoing): completed 2012

Ph.D. (Completed Year of Completion)/Ongoing): completed 2016
Projects Carried out :
Patents (Filed & Granted):

SL No	Topic	**Patent Application No**	Filed/ Granted
1	An ionic liquid-based composition	2022103114123700DE	Granted
2	Electrochemical Cell	364538-001	Filed
3	Biomedical dustbin	360348-001	Filed
4	Biomedical refrigerator	360347-001	Filed
5	Corrosion cell	364539-001	Filed

Technology Transfer:
No. of Books published with details

Profile of the Faculty

CHEMISTRY

Name	Mrs Shwetha K
Designation	Asst. Professor
Department	**Chemistry**
Date of Joining the Institution	7-01-2019
Date of Birth	25-09-1993
Faculty Unique	
Email Id	shwetha.k@nmit.ac.in

Education Qualifications:

SL.No	Degree Obtained	Year of Obtaining the highest degree	Class/ Grade obtained
1	UG	2014	I class
2	PG	2016	I class
3	PhD	Pursuing	-
4	Others		
5			

Total Work Experience in Years:

SL.No	Work Experience	Total in Years
1	Teaching	6
2	Research	1
3	Industry	-
4	others	-

Area of Specialization:

Courses taught at	Diploma/ Post Diploma	
	Undergraduate	Yes
	Post Graduate	
	Post Graduate Diploma Level	

Research Guidance (Number of Students):PG students- 0

No. of papers published: 3

SL.No	Type	Numbers
1	National	0
2	International Journals	3

3	Conferences	0
4	Others	0

Master (Completed (Year of Completion)/Ongoing): Completed 2001

Ph.D. (Completed Year of Completion)/Ongoing): Completed 2007

Projects Carried out :03

Patents (Filed & Granted):

SL No	Topic	**Patent Application No**	Filed/ Granted
3.	Cerotollid metal matrix	C22C1/10	Granted

Technology Transfer: nil

No. of Books published with details: nil

Profile of the Faculty

CHEMISTRY

Name	Dr Padmalatha Rao
Designation	Professor
Department	**Chemistry**
Date of Joining the Institution	16/12/2022
Date of Birth	24/03/1962
Faculty Unique	
Email Id	Padmalatha.rao@nmit.ac.in

Education Qualifications:

SL.No	Degree Obtained	Year of Obtaining the highest degree	Class/ Grade obtained
1	UG	B.Sc (1984)	First Class, 7^{th} Rank
2	PG	M.Sc (1986)	First Class, 2^{nd} Rank
3	PhD	1997	
4	Others		
5			

Total Work Experience in Years:

SL.No	Work Experience	Total in Years
1	Teaching	35
2	Research	25
3	Industry	nil
4	others	

Area of Specialization: Physical Chemistry

Courses taught at	Diploma/ Post Diploma	1 Chemistry
	Undergraduate	1. Engg Chemistry 2. Technical Chemistry for Chemical Engineering
	Post Graduate	M.Sc (Chemistry) All Physical chemistry Topics

Research Guidance (Number of Students):UG students- Nil

No. of papers published:

SL.No	Type	Numbers
1	National	12

2	International Journals	59
3	Conferences	75
4	Others	

Master (Completed (Year of Completion)/Ongoing): 07

Ph.D. (Completed Year of Completion)/Ongoing): 06 (2008, 15,17,18,21,2022) I on going

Projects Carried out :nil

Patents (Filed & Granted):nil

SL No	Topic	**Patent Application No**	Filed/ Granted
1			
2			

Technology Transfer: nil

No. of Books published with details: nil

Profile of the Faculty

BRANCH: Chemistry

Name	Sandeep Kumar	
Designation	Professor	
Department	**Chemistry**	
Date of Joining the Institution	23.12.2019	
Date of Birth	1.12.1959	
Faculty Unique	1-9571838997	
Email Id	Sandeep.kumar@nmit.ac.in	

Education Qualifications:

SL.No	Degree Obtained	Year of Obtaining the highest degree	Class/ Grade obtained
1	UG	1978	1st
2	PG	1980	1st
3	PhD	1986	
4	Others		
5			

Total Work Experience in Years:

SL.No	Work Experience	Total in Years
1	Teaching	0
2	Research	41
3	Industry	0
4	others	

Area of Specialization:

Courses taught at	Diploma/ Post Diploma	
	Undergraduate	.
	Post Graduate	
	Post Graduate Diploma Level	1

Research Guidance (Number of Students):UG students-

No. of papers published:

SL.No	Type	Numbers
1	National	
2	International Journals	290
3	Conferences	11

4	Others	19

Master (Completed (Year of Completion)/Ongoing):

Ph.D. (Completed Year of Completion)/Ongoing):

Projects Carried out :

Patents (Filed & Granted):

SL No	Topic	**Patent Application No**	Filed/ Granted
1			8
2			

Technology Transfer:

No. of Books published with details: 3

Profile of the Faculty

BRANCH: APPLIED SCIENCES AND HUMANITIES DEPARTMENT

Name	Dr. Parashuram L.	
Designation	Assistant Professor	
Department	**Chemistry**	
Date of Joining the Institution	1st April 2022	
Date of Birth	25th March 1989	
Faculty Unique	8841	
Email Id	parashuram.l@nmit.ac.in	

Education Qualifications:

Sl. No.	Degree Obtained	Year of Obtaining the highest degree	Class/ Grade obtained
1	UG	2009	I
2	PG	2011	Gold Medallist
3	PhD	2020	NA
4	Others		
5			

Total Work Experience in Years:

Sl. No.	Work Experience	Total in Years
1	Teaching	11 Years 5 Months
2	Research	11 Years 5 Months
3	Industry	NA
4	others	

Area of Specialization: Physical Chemistry (Electrochemistry, Heterogeneous Catalysis, Electrochemical Sensors, Supercapacitors, Energy Materials)

Courses taught at	Diploma/ Post Diploma	
	Undergraduate	1 BE (Engineering Chemistry/Applied Chemistry) 3
	Post Graduate	
	Post Graduate Diploma Level	

Research Guidance (Number of Students): Ph. D. students- Two (2)

No. of papers published:

Sl. No.	Type	Numbers
1	National	4
2	International Journals	40
3	Conferences	05
4	Others	

Master (Completed (Year of Completion)/Ongoing): 2011

Ph.D. (Completed Year of Completion)/Ongoing): 2020

Projects Carried out: NA

Patents (Filed & Granted): Published-2, Filed-1

SL No	Topic	**Patent Application No**	Filed/ Granted
1	Novel Method Calix[4]Arene Anchored WS_2 as a Versatile Nanocatalyst for Alkyne-Azide Cycloaddition	202041056566	Published
2	A Novel Electrode Ensemble Sensor-A Highly Selective and Sensitive Electrochemical Tool for the Detection of Staphylococcus Aureus	202141045142	Published
3	A Novel Protocol for the Fabrication of Ultrahydrophobic Material Based on Highly Functional Carbon Dots with Halloysite Nanotubes.	202141036698	Filed

Technology Transfer: NA

No. of Books published with details: 1 Method Development and Validation for the Assay of Antihistamines (Publisher Lap Lambert Academic Publisher)

Profile of the Faculty

BRANCH: ELECTRONICS AND COMMUNICATION ENGINEERING

Name	Gururaj Kudur Jayaprakash	
Designation	Assistant Professor	
Department	**Chemistry**	
Date of Joining the Institution	04-04-2022	
Date of Birth	14-01-1989	
Faculty Unique	2483	
Email Id	Gururaj.kj@nmit.ac.in	

Education Qualifications:

SL.No	Degree Obtained	Year of Obtaining the highest degree	Class/ Grade obtained
1	UG	2009	First class with distinction
2	PG	2011	First class with distinction
3	PhD	2017	First class with distinction
4	Others		
5			

Total Work Experience in Years:

SL.No	Work Experience	Total in Years
1	Teaching	4
2	Research	4
3	Industry	0
4	others	

Area of Specialization:
Computational Chemistry and electrochemical sensors

Courses taught at	Diploma/ Post Diploma	
	Undergraduate	1 Organic Spectroscopy 2 Basic Chemistry 3 Chemistry for B-Tech
	Post Graduate	1 Environmental Chemistry 2 Inorganic Chemistry 3 Inorganic Spectroscopy
	Post Graduate Diploma Level	1

Research Guidance (Number of Students):UG students-6

No. of papers published:

SL.No	Type	Numbers
1	National	
2	International Journals	34
3	Conferences	5
4	Others	

Master (Completed (Year of Completion)/Ongoing): 6

Ph.D. (Completed Year of Completion)/Ongoing): 2

Projects Carried out :

Patents (Filed & Granted):

SL No	Topic	**Patent Application No**	Filed/ Granted
1			
2			

Technology Transfer:

No. of Books published with details:

Profile of the Faculty

BRANCH: Basic Sciences

Name	Dr. PRAVEEN NAIK
Designation	Assistant Professor
Department	**Chemistry**
Date of Joining the Institution	21-07-2022
Date of Birth	06-08-1989
Faculty Unique	8903
Email Id	praveen.naik@nmit.ac.in

Education Qualifications:

SL.No	Degree Obtained	Year of Obtaining the highest degree	Class/ Grade obtained
1	UG	2011	First
2	PG	2013	First
3	PhD	2018	NA
4	Others		
5			

Total Work Experience in Years:

SL.No	Work Experience	Total in Years
1	Teaching	6 months
2	Research	4 years 1 month (post-doctoral research experience)
3	Industry	Nil
4	others	Ph.D full time (4 years 2 Months)

Area of Specialization:

Courses taught at	Diploma/ Post Diploma	
	Undergraduate	1 Engineering Chemistry
	Post Graduate	
	Post Graduate Diploma Level	

Research Guidance (Number of Students):UG students-

No. of papers published:

SL.No	Type	Numbers
1	National	Nil
2	International Journals	21
3	Conferences	3

4	Others	

Master (Completed (Year of Completion)/Ongoing):

Ph.D. (Completed Year of Completion)/Ongoing):

Projects Carried out :

Patents (Filed & Granted):

SL No	Topic	**Patent Application No**	Filed/ Granted
1			
2			

Technology Transfer:

No. of Books published with details:

Profile of the Faculty

Name	SWAMYNATHAN K	
Designation	ASSISTNT PROFESSOR	
Department	**CHEMISTRY**	
Date of Joining the Institution	02-12-2020	
Date of Birth	01-06-1987	
Faculty Unique	1-9324060632	
Email Id	Swamynathan.k@nmit.ac.in	

Education Qualifications:

SL.No	Degree Obtained	Year of Obtaining the highest degree	Class/ Grade obtained
1	UG	2004	First
2	PG	2007	First
3	PhD	2020	NA
4	Others		
5			

Total Work Experience in Years:

SL.No	Work Experience	Total in Years
1	Teaching	2 years
2	Research	3 years
3	Industry	0
4	others	0

Area of Specialization:
Organic soft materials for diverse applications

Courses taught at	Diploma/ Post Diploma	
	Undergraduate	1 Engineering chemistry 2 Engineering chemistry Laboratory
	Post Graduate	
	Post Graduate Diploma Level	

Research Guidance (Number of Students):UG students-

No. of papers published:

SL.No	Type	Numbers
1	National	

2	International Journals	15
3	Conferences	
4	Others	

Master (Completed (Year of Completion)/Ongoing): NA

Ph.D. (Completed Year of Completion)/Ongoing): NA

Projects Carried out :

Patents (Filed & Granted):

SL No	Topic	**Patent Application No**	Filed/ Granted
1			
2			

Technology Transfer:

No. of Books published with details:

Faculty List-2022-2023

BRANCH: Mathematics

Sl. No.	Name of the Faculty	Designation	Qualification	DOJ
1	Dr. Indira R	Professor & Head	M.Sc., Ph.D	05-12-2007
2	Dr. Dhananjayamurthy B V	Professor	M.Sc., Ph.D	08-08-2001
3	Dr. Chandrakala S B	Associate Professor	M.Sc., Ph.D	16-08-2006
4	Dr. Padmavathi R	Associate Professor	M.Sc., Ph.D	23-08-2010
5	Dr. Jagadeesha S	Associate Professor	M.Sc., Ph.D	03-09-2010
6	Mrs. Sumashree P	Assistant Professor	M.Sc., (Ph.D)	19-11-2001
7	Mrs. Rashmi K R	Assistant Professor	M.Sc., (Ph.D)	16-08-2011
8	Mrs. Swathi H R	Assistant Professor	M.Sc., (Ph.D)	12-08-2014
9	Mr. Pramod S	Assistant Professor	M.Sc., (Ph.D)	19-01-2017
10	Dr. Kiran S	Assistant Professor	M.Sc., Ph.D	05-08-2019
11	Dr. Sreekala C K	Assistant Professor	M.Sc., Ph.D	12-04-2020
12	Dr. U Manjulamma	Assistant Professor	M.Sc., Ph.D	04-12-2021
13	Mrs. Sushma T C	Assistant Professor	M.Sc., (Ph.D)	06-06-2022

Profile of the Faculty

Name	Dr. Indira R	
Designation	Professor and Head	
Department	**Mathematics**	
Date of Joining the Institution	5/12/2007	
Date of Birth	22/5/1970	
Faculty Unique	1-419906943	
Email Id	Indira.r@nmit.ac.in	

Education Qualifications:

SL.No	Degree Obtained	Year of Obtaining the highest degree	Class/ Grade obtained
1	UG	1990	First
2	PG	1992	First
3	PhD	2001	
4	Others	NET-CSIR	
5			

Total Work Experience in Years:

SL.No	Work Experience	Total in Years
1	Teaching	24
2	Research	4
3	Industry	0
4	others	0

Area of Specialization:

Courses taught at	Undergraduate	1. Engg. mathematics 2. Linear Algebra 3. Probability and Random process .4. Discrete Mathematical structures Numerical methods
	Post Graduate	1. Applied mathematics

Research Guidance (Number of Students):UG students-

No. of papers published:

SL.No	Type	Numbers
1	National	
2	International Journals	35
3	Conferences	

4	Others	

Master (Completed (Year of Completion)/Ongoing):

Ph.D. (Completed Year of Completion)/Ongoing):
Completed - 5 Ongoing - 4

Projects Carried out :

Patents (Filed & Granted):

SL No	Topic	**Patent Application No**	Filed/ Granted
1			
2			

Technology Transfer:

No. of Books published with details:

Profile of the Faculty

Name	Dr.Dhananjayamurthy BV
Designation	Professor
Department	**Mathematics**
Date of Joining the Institution	08-08-2001
Date of Birth	20-07-1973
Faculty Unique	1-419907191
Email Id	Dhananjayamurthy.bv@nmit.ac.in

Education Qualifications:

SL.No	Degree Obtained	Year of Obtaining the highest degree	Class/ Grade obtained
1	UG - BSc	1995	First
2	PG	1997	First
3	PhD	2016	
4	Others		
5			

Total Work Experience in Years:

SL.No	Work Experience	Total in Years
1	Teaching	25
2	Research	
3	Industry	
4	others	

Area of Specialization:

Courses taught at		
	Undergraduate	1. Engineering Mathematics 2. Discrete Mathematics.
	Post Graduate	1 Advanced Mathematics.

Research Guidance (Number of Students):UG students-

No. of papers published: 16

SL.No	Type	Numbers
1	National	3
2	International Journals	13
3	Conferences	
4	Others	

Master (Completed (Year of Completion)/Ongoing):

Ph.D. (Completed Year of Completion)/Ongoing): Ongoing - 02

Projects Carried out : nil

Patents (Filed & Granted):

SL No	Topic	**Patent Application No**	Filed/ Granted
1		-	-
2			

Technology Transfer:

No. of Books published with details: nil

Profile of the Faculty

Name	Dr. Chandrakala S.B	
Designation	Associate Professor	
Department	**Mathematics**	
Date of Joining the Institution	16^{th} August 2006	
Date of Birth	1^{st} June 1974	
Faculty Unique ID	1-419907199	
Email Id	chandrakala.sb@nmit.ac.in	

Education Qualifications:

SL.No	Degree Obtained	Year of Obtaining the highest degree	Class/ Grade obtained
1	UG	1995	1^{st} class
2	PG	1999	2^{nd} class
3	PhD	2015	VTU
4	Others		
5			

Total Work Experience in Years:

SL.No	Work Experience	Total in Years
1	Teaching	23
2	Research	7
3	Industry	------
4	others	-----

Area of Specialization: Graph Theory, Discrete Mathematics, Linear Algebra, Combinatorics

Courses taught at	Undergraduate	1. Engineering Mathematics I-IV 2. Discrete Mathematics 3. Graph Theory
	Post Graduate	1.Linear Algebra (M.Tech) 2. Advanced Mathematics(M.Tech VLSI/Renewable Energy/ CSE/ Structures) 3. Advanced Mathematics (MCA) 4. Operation Research (MCA)

Research Guidance (Number of Students):Ph.D students Guided -01
Guiding 01

No. of papers published: 25

SL.No	Type	Numbers
1	National	01
2	International Journals	22
3	Conferences	----
4	Others Book Chapters	02

Master (Completed (Year of Completion)/Ongoing):

Ph.D. (Completed Year of Completion)/Ongoing): Completed – 01, Ongoing - 01

Projects Carried out : ---

Patents (Filed & Granted): -------

SL No	Topic	**Patent Application No**	Filed/ Granted
1			
2			

Technology Transfer: ---------

No. of Books published with details: ------------

Profile of the Faculty

Name	Dr PADMAVATHI,R	
Designation	ASSO PROFESSOR	
Department	**Mathematics**	
Date of Joining the Institution	23/08/2010	
Date of Birth	27/06/73	
Faculty Unique	1-421092357	
Email Id	padmavathi.r@nmit.ac.in	

Education Qualifications:

SL.No	Degree Obtained	Year of Obtaining the highest degree	Class/ Grade obtained
1	UG	1994	2 nd class
2	PG	1996	1 st class
3	PhD	2015	
4	Others	-	
5		-	

Total Work Experience in Years:

SL.No	Work Experience	Total in Years
1	Teaching	23
2	Research	
3	Industry	
4	others	

Area of Specialization:

Courses taught at	Undergraduate	1. engg maths 1,2,3,4
	Post Graduate	1 m.tech (ec and defence technology) .

Research Guidance (Number of Students):UG students- 01

No. of papers published:

SL.No	Type	Numbers
1	National	
2	International Journals	5
3	Conferences	3
4	Others	

Master (Completed (Year of Completion)/Ongoing):
Ph.D. (Completed Year of Completion)/Ongoing): Ongoing - 01
Projects Carried out :
Patents (Filed & Granted):

SL No	Topic	**Patent Application No**	Filed/ Granted
1		nil	
2		nil	

Technology Transfer:
No. of Books published with details: nil

Profile of the Faculty

Name	Dr. Jagadeesha S
Designation	Associate Professor
Department	Mathematics
Date of Joining the Institution	03.09.2010
Date of Birth	21.05.1982
Faculty Unique	1-421092511
Email Id	jagadeesha.s@nmit.ac.in

Education Qualifications:

SL.No	Degree Obtained	Year of Obtaining the highest degree	Class/ Grade obtained
1	UG	2002	FC
2	PG	2006	FC
3	PhD	2018	---
4	Others – UG – B.Ed	2003	FC
5	Others – PG – M.Phil	2007	FC

Total Work Experience in Years:

SL.No	Work Experience	Total in Years
1	Teaching	16
2	Research	5
3	Industry	00
4	Others	00

Area of Specialization: Bio Fluid Dynamics

Courses taught at	Undergraduate	1 Engineering Mathematics – I, II, III, IV 2 Advanced Mathematics – I, II 3 Calculus and Algebra 4 Advanced Calculus and Numerical Methods
	Post Graduate	1 Advanced Numerical Methods 2 Advanced Mathematics for Structural Engineering

Research Guidance (Number of Students): UG students - 00

No. of papers published: 13

SL. No	Type	Numbers
1	National	01
2	International Journals	09
3	Conferences	02
4	Others (Book Chapter)	01

Master (Completed (Year of Completion)/Ongoing):

Ph.D. (Completed Year of Completion)/Ongoing): 01 - Ongoing

Projects Carried out :

Patents (Filed & Granted): 00

SL No	Topic	**Patent Application No**	Filed/ Granted
1			

Technology Transfer: Nil

No. of Books published with details: 00

Profile of the Faculty

Name	Mrs Sumashree.P	
Designation	Assistant professor	
Department	**Mathematics**	
Date of Joining the Institution	19-11-2001	
Date of Birth	16-02-1977	
Faculty Unique	1-419907195	
Email Id	sumashree.p@nmit.ac.in	

Education Qualifications:

SL.No	Degree Obtained	Year of Obtaining the highest degree	Class/ Grade obtained
1	UG	1997	First Class
2	PG	1999	First Class (#rd Rank)
3	PhD		
4	Others		
5			

Total Work Experience in Years:

SL.No	Work Experience	Total in Years
1	Teaching	23
2	Research	
3	Industry	
4	others	

Area of Specialization:

Courses taught at	Diploma/ Post Diploma	1.Applied Mathematics-I 2Applied Mathematics-II
	Undergraduate	1 Engineering Mathematics-I 2 Engineering Mathematics-II 3Engineering Mathematics-III 4. Engineering Mathematics-I 5. Calculus & Algebra 6. Advanced Calculus & Numerical Methods
	Post Graduate	1. Advanced Mathematics(MTech-Structural Engg)

Research Guidance (Number of Students):UG students-

No. of papers published:

SL.No	Type	Numbers
1	National	
2	International Journals	
3	Conferences	
4	Others	

Master (Completed (Year of Completion)/Ongoing):

Ph.D. (Completed Year of Completion)/Ongoing):

Projects Carried out :

Patents (Filed & Granted):

SL No	Topic	**Patent Application No**	Filed/ Granted
1			
2			

Technology Transfer:

No. of Books published with details:

Profile of the Faculty

Name	RASHMI K.R	
Designation	Assistant Professor	
Department	**Mathematics**	
Date of Joining the Institution	16-08-2011	
Date of Birth	13-04-1982	
Faculty Unique Id	1-3747863695	
Email Id	rashmikr@nmit.ac.in	

Education Qualifications:

SL.No	Degree Obtained	Year of Obtaining the highest degree	Class/ Grade obtained
1	UG	2002	First
2	PG	2007	First
3	PhD		
4	Others		
5			

Total Work Experience in Years:

SL.No	Work Experience	Total in Years
1	Teaching	15
2	Research	-
3	Industry	-
4	others	

Area of Specialization:

Courses taught at	Undergraduate	1 Engineering mathematics I 2 Engineering mathematics II 3 Engineering mathematics III 4 Engineering mathematics IV . .

Research Guidance (Number of Students):UG students-

No. of papers published:

SL.No	Type	Numbers

1	National	1
2	International Journals	1
3	Conferences	1
4	Others	

Master (Completed (Year of Completion)/Ongoing): 2007

Ph.D. (Completed Year of Completion)/Ongoing): ongoing

Projects Carried out : **NIL**

Patents (Filed & Granted):NIL

SL No	Topic	**Patent Application No**	Filed/ Granted
1			
2			

Technology Transfer: NA

No. of Books published with details: ---

Profile of the Faculty

Name	SWATHI H R	
Designation	Assistant Professor	
Department	**Mathematics**	
Date of Joining the Institution	12-08-2014	
Date of Birth	18-09-1985	
Faculty Unique	1-2482444063	
Email Id	swathi.hr@nmit.ac.in	

Education Qualifications:

SL.No	Degree Obtained	Year of Obtaining the highest degree	Class/ Grade obtained
1	UG	2006	First class
2	PG	2008	First class
3	PhD	--	
4	Others		
5			

Total Work Experience in Years:

SL.No	Work Experience	Total in Years
1	Teaching	10.5 years
2	Research	---
3	Industry	
4	others	

Area of Specialization:

Courses taught at	Undergraduate	Engg Mathematics for B.E

Research Guidance (Number of Students):UG students-

No. of papers published:

SL.No	Type	Numbers
1	National	---
2	International Journals	---
3	Conferences	---
4	Others	---

Master (Completed (Year of Completion)/Ongoing):

Ph.D. (Completed Year of Completion)/Ongoing):

Projects Carried out :
Patents (Filed & Granted):

SL No	Topic	**Patent Application No**	Filed/ Granted
1			
2			

Technology Transfer:
No. of Books published with details:

Profile of the Faculty

Name	Pramod S	
Designation	Assistant Professor	
Department	**Mathematics**	
Date of Joining the Institution	19/01/2017	
Date of Birth	05/11/1989	
Faculty Unique	1-3367574324	
Email Id	Pramod.s@nmit.ac.in	

Education Qualifications:

SL.No	Degree Obtained	Year of Obtaining the highest degree	Class/ Grade obtained
1	UG	2009	FC
2	PG	2012	FC
3	PhD	2019 (Pursuing)	
4	Others		
5			

Total Work Experience in Years:

SL.No	Work Experience	Total in Years
1	Teaching	11
2	Research	5
3	Industry	
4	others	

Area of Specialization:

ourses taught at	Undergraduate	1 Engineering Mathematics 2 Discrete Mathematics
	Post Graduate	1 Discrete Mathematics

Research Guidance (Number of Students):UG students-

No. of papers published:

SL.No	Type	Numbers
1	National	
2	International Journals	01
3	Conferences	
4	Others	

Master (Completed (Year of Completion)/Ongoing):

Ph.D. (Completed Year of Completion)/Ongoing):

Projects Carried out :

Patents (Filed & Granted):

SL No	Topic	**Patent Application No**	Filed/ Granted
1			
2			

Technology Transfer:

No. of Books published with details:

Profile of the Faculty

Name	Dr Kiran S	
Designation	Assistant Professor	
Department	**Mathematics**	
Date of Joining the Institution	05-08-2019	
Date of Birth	07-01-1976	
Faculty Unique	1-3750039955	
Email Id	kiran.s@nmit.ac.in	

Education Qualifications:

SL.No	Degree Obtained	Year of Obtaining the highest degree	Class/ Grade obtained
1	UG	1996	Second class
2	PG	2000	First class
3	PhD	2019	--
4	M.Phil	2009	First class
5			

Total Work Experience in Years:

SL.No	Work Experience	Total in Years
1	Teaching	20
2	Research	
3	Industry	
4	others	

Area of Specialization:

Courses taught at	Undergraduate	1. Calculus 2. Linear Algebra 3. Numerical Methds 4. OR Statistics and Probability
	Post Graduate	1. Calculus 2. Linear Algebra 3. Numerical Methds 4. OR 5. Statistics and Probability.

Research Guidance (Number of Students):UG students- nil

No. of papers published:

SL.No	Type	Numbers

1	National	2
2	International Journals	6
3	Conferences	7
4	Others	

Master (Completed (Year of Completion)/Ongoing):

Ph.D. (Completed Year of Completion)/Ongoing): Ongoing - 01

Projects Carried out : nil

Patents (Filed & Granted): 1

SL No	Topic	**Patent Application No**	Filed/ Granted
1	Probabilistic Method in Applied Mathematics for Farming System Tracking through Machine Learning and the Internet of Things (IoT)	202241069480 A	Granted
2	Real Time Financial Signal Representation And Trading Using Neural Networks	202211056740	Filed

Technology Transfer: Nil

No. of Books published with details: 2

1. Fluid Mechanics ISBN – 978-93-95936-04-0
2. Fundamentals of Fluid Dynamics ISBN – 978-93-95936-02-6

Profile of the Faculty

Name	Dr Sreekala. C. K	
Designation	Assistant Professor	
Department	**Mathematics**	
Date of Joining the Institution	12-04-2020	
Date of Birth	04-05-1977	
Faculty Unique	1-3596605859	
Email Id	Sreekala.ck@nmit.ac.in	

Education Qualifications:

SL.No	Degree Obtained	Year of Obtaining the highest degree	Class/ Grade obtained
1	UG		
2	PG		
3	PhD	2019	
4	Others		
5			

Total Work Experience in Years:

SL.No	Work Experience	Total in Years
1	Teaching	18
2	Research	
3	Industry	
4	others	

Area of Specialization: Fluid dynamics, Graph theory

Courses taught at	Undergraduate	1 B.E 2 BSc

Research Guidance (Number of Students):UG students- 2

No. of papers published:

SL.No	Type	Numbers
1	National	
2	International Journals	10
3	Conferences	2
4	Others	

Master (Completed (Year of Completion)/Ongoing): 2000

Ph.D. (Completed Year of Completion)/Ongoing): 2019

Projects Carried out :Nil

Patents (Filed & Granted): Nil

SL No	Topic	**Patent Application No**	Filed/ Granted
1			
2			

Technology Transfer: Nil

No. of Books published with details: Nil

Profile of the Faculty

Name	Sushma T C
Designation	Assistant Professor
Department	**Mathematics**
Date of Joining the Institution	06/06/2022
Date of Birth	20/05/1986
Faculty Unique	1-23119446978
Email Id	sushma.tc@nmit.ac.in

Education Qualifications:

SL.No	Degree Obtained	Year of Obtaining the highest degree	Class/ Grade obtained
1	UG		
2	PG	2008	First(FCD)
3	PhD	Pursuing	
4	Others		
5			

Total Work Experience in Years:

SL.No	Work Experience	Total in Years
1	Teaching	12
2	Research	
3	Industry	
4	others	

Area of Specialization:

Fluid Mechanics Courses taught at	Undergraduate	1.BE 2.BSc 3.Integrated BSc BEd.
	Post Graduate	1MSc(1&3rd semester)

Research Guidance (Number of Students):UG students-

No. of papers published:

SL.No	Type	Numbers
1	National	
2	International Journals	
3	Conferences	
4	Others	

Master (Completed (Year of Completion)/Ongoing):
Ph.D. (Completed Year of Completion)/Ongoing):
Projects Carried out :
Patents (Filed & Granted):

SL No	Topic	**Patent Application No**	Filed/ Granted
1			
2			

Technology Transfer:
No. of Books published with details:

Profile of the Faculty

BRANCH: ENGLISH

Name	Priyanka Tresa Paul
Designation	Assistant Professor
Department	**English**
Date of Joining the Institution	10. 01. 2022
Date of Birth	10. 05. 1996
Faculty Unique	1-10981741301
Email Id	priyanka.tresapaul@nmit.ac.in

Education Qualifications:

SL.No	Degree Obtained	Year of Obtaining the highest degree	Class/ Grade obtained
1	UG	2017	First class
2	PG	2019	First class
3	PhD		
4	Others		
5			

Total Work Experience in Years:

SL.No	Work Experience	Total in Years
1	Teaching	18 months
2	Research	
3	Industry	
4	others	

Area of Specialization:
English and Comparative Literature

Courses taught at	Diploma/ Post Diploma	
	Undergraduate	1. Communicative English 2. Professional Writing Skills in English

Research Guidance (Number of Students):UG students-

No. of papers published:

SL.No	Type	Numbers

1	National	
2	International Journals	1
3	Conferences	
4	Others	

Master (Completed (Year of Completion)/Ongoing): 2019

Ph.D. (Completed Year of Completion)/Ongoing):

Patents (Filed & Granted):

SL No	Topic	**Patent Application No**	Filed/ Granted
1			
2			

Technology Transfer:

No. of Books published with details:

Profile of the Faculty

BRANCH: ENGLISH

Name	Akshara M R
Designation	Assistant Professor
Department	**English**
Date of Joining the Institution	24.11.2022
Date of Birth	19.05.1995
Faculty Unique	1-35107742671
Email Id	akshara.mr@nmit.ac.in

Education Qualifications:

SL.No	Degree Obtained	Year of Obtaining the highest degree	Class/ Grade obtained
1	UG	2017	First Class
2	PG	2019	First Class
3	PhD		
4	Others		
5			

Total Work Experience in Years:

SL.No	Work Experience	Total in Years
1	Teaching	2
2	Research	
3	Industry	
4	others	

Area of Specialization:

Courses taught at	Diploma/ Post Diploma	1 Teaching Skills
	Undergraduate	1 Communicative English 2 Language Papers
	Post Graduate	1 British Poetry 2 British Novel 3 American Literature

Research Guidance (Number of Students):UG students-

No. of papers published:

SL.No	Type	Numbers
1	National	

2	International Journals	
3	Conferences	
4	Others	

Master (Completed (Year of Completion)/Ongoing): 2019

Ph.D. (Completed Year of Completion)/Ongoing):

Projects Carried out :

Patents (Filed & Granted):

SL No	Topic	**Patent Application No**	Filed/ Granted
1			
2			

Technology Transfer:

No. of Books published with details:

Profile of the Faculty

BRANCH: ENGLISH

Name	Ann Theres Joy	
Designation	Assistant Professor	
Department	**English**	
Date of Joining the Institution	02.12.21	
Date of Birth	07.02.1996	
Faculty Unique	1-10935596671	
Email Id	annatheres.joy@nmit.ac.in	

Education Qualifications:

SL.No	Degree Obtained	Year of Obtaining the highest degree	Class/ Grade obtained
1	UG	2017	First Class/ Distinction
2	PG	2019	First Class/ Distinction
3	PhD		
4	Others	2018	First class/ Distinction
5			

Total Work Experience in Years:

SL.No	Work Experience	Total in Years
1	Teaching	3
2	Research	
3	Industry	
4	others	

Area of Specialization:

Courses taught at	Diploma/ Post Diploma	1 Teaching Skills
	Undergraduate	1 Communicative English 2. General English 3. Life Skills 4. Environmental science 5. Phonetics
	Post Graduate	1 Post Colonial literature 2 Literary Theory 3 Linguistics

Research Guidance (Number of Students):UG students-

No. of papers published:

SL.No	Type	Numbers
1	National	
2	International Journals	2
3	Conferences	
4	Others	

Master (Completed (Year of Completion): 2019

Ph.D. (Completed Year of Completion)/Ongoing):

Projects Carried out :

Technology Transfer:

No. of Books published with details:

DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

Sl. No.	Name	Designation
1	Dr. Nalini N.	Professor & HoD
2	Dr. Saroja Devi H.	Professor
3	Dr. Krishna Rao Venkatesh	Professor
4	Dr. Vijaya Shetty S.	Professor
5	Dr. Vani V.	Professor
6	Dr. Jyothi Neeli	Professor
7	Ms. Archana Naik	Associate Professor
8	Dr. Sujatha Joshi	Associate Professor
9	Dr. Chaitra H. V.	Associate Professor
10	Dr. Vasanthakumar G. U.	Associate Professor
11	Dr. N. Srinivasa	Associate Professor
12	Dr. Dileep Reddy Bolla	Associate Professor
13	Dr. Nagarathna P	Associate Professor
14	Ms. Uma R.	Assistant Professor
15	Ms. Deepthi Shetty	Assistant Professor
16	Ms. Shruti B. V.	Assistant Professor
17	Ms. Jagdevi N. Kalshetty	Assistant Professor
18	Ms. Ramya Srikanteswara	Assistant Professor
19	Ms. Nirmala J. Saunshimath	Assistant Professor
20	Mr. E. G. Satish	Assistant Professor
21	Ms. Sowmya M. R.	Assistant Professor
22	Ms. Shobha	Assistant Professor
23	Ms. Shilpa Ankalaki	Assistant Professor
24	Ms. MamathaBai B. G.	Assistant Professor
25	Ms. Ushashree P.	Assistant Professor
26	Ms. Sharmila Shanthi Sequeira	Assistant Professor
27	Mr. P. Ramesh Naidu	Assistant Professor
28	Ms. Sandhya B R	Assistant Professor
29	Mr. Janardhan D R	Assistant Professor
30	Ms. Trisheela S	Assistant Professor
31	Ms. Jayashree	Assistant Professor
32	Ms. Pushpanjali	Assistant Professor
33	Ms. Shruthi Shetty J	Assistant Professor
34	Mr. Santhosh Kumar G	Assistant Professor
35	Ms. Sowmya P	Assistant Professor
36	Mr. Jayashankar Nelamane Srinivasa Rao	Adjunct Faculty

Profile of the Faculty
BRANCH: COMPUTER SCIENCE AND ENGINEERING

Name	**Dr.Nalini.N**
Designation	Professor and HoD Dean-Students' Welfare
Department	**CSE**
Date of Joining the Institution	22.07.2009
Date of Birth	**15-07-1973**
Faculty Unique	1-408348719
Email Id	**nalini.n@nmit.ac.in**

Education Qualifications:

SL.No	Degree Obtained	Year of Obtaining the highest degree	Class/ Grade obtained
1	UG	1996	First Class
2	PG	1999	First Class
3	PhD	2008	-

Total Work Experience in Years:

SL.No	Work Experience	Total in Years
1	Teaching	26 years
2	Research	
3	Industry	

Area of Specialization:

Courses taught at	Post Graduate	1. Cyber Security 2. E-Commerce and Web Security 3. Machine Learning 4. Mobile Communications
	Post Graduate Diploma Level	NA

Research Guidance (Number of Students):UG/PHD students- 200

No. of papers published:

SL.No	Type	Numbers
1	National	10
2	International Journals	48
3	Conferences	74
4	Others	-

Master (Completed (Year of Completion)/Ongoing): 1999

Ph.D. (Completed Year of Completion)/Ongoing): 2008

Projects Carried out :

Principal Investigator-VGST Funded project on "Adaptive Fault Tolerant Framework for Cloud Computing Applications" –from 2016 to 2019-Completed

AICTE-RPS Funded Project on "Cryptanalysis of Stream and Block Ciphers Using Optimization Techniques" from 1/4/2011 to 31/3/2013.-Completed.

Patents (Filed & Granted):

SL No	Topic	**Patent Application No**	Filed/ Granted
1	Internet of Things (IOT) based poultry management system	202241034718	Filed/Published
2	Smart waste management System	202241021353	Filed/Published
3	An Application for Divyang to use voice mail	202241022232	Filed/Published
4	Voice Recognition Pen	361853-001	Filed/Published
5	Online Password Generator	361859-001	Filed/Published
6	Robotic Washing Machine	333000-001	Filed/Published
7	Thefted Vehicle Identification Number	201741041975	Filed/Published
8	Machine Learning Supported Predictive System and Method of Analysing the emotion of customers thereof	202141022674	Filed/Published
9	Navigation Assistance and Collision avoidance for the Visually Imapired	201841033897	Filed/Published

Technology Transfer: -----------

No. of Books published with details: 09

Sl. No.	Book Name	Authors	Published By	lSSNnSBN number	Year of Publication
1	Optimization of data Processing in Cloud Environment	jagdevi N Kalshetty and Dr.Nalini N	LAMBERT ACADEMIC PUBLISHING	ISBN-978-620-4-74808-5	2022.
2	Proceedings of the Emerging Research in Computing, Information , Communication and Applications ERCICA 2020-Volume 1	N.R.Shetty, L..M.Pamaik, H.C.Nagaraj, Prasad N H, Nalini N	LNEE Series by Springer	Hardcover ISBN: 978-981-16-1337-1 E-Book ISBN: 978-981-16-1338-8 Series ISSN: 1876-1100 ' Series E-ISSN: 1876-1119	2022
3	Proceedings of the Emerging	N.R.Sheny. L.M.Pamaik.	LNEE Series by Springer	Hardcover ISBN:978-981-16-1341-8 E-Book	2022

	Researh in Computing, Informa tion. Communication and Applications ERCICA 2020-Volume 2	H.C.Nagara j, Prasad N H, Nalini N		ISBN: 978-981-16-1342-S Series ISSN: 1876-1100 , Se1ies E-ISSN: 1876-1119	
4	Cloud Computing for Beginners	Aparnarajesh Aanakuri,N Nalini ,.M I Thariq Hussan	Central West Publishing	ISBN-13: 978-1925823950 ISBN-10:1925823954	2021
5	lNTERNET OF THlNGS : Advanced Wirtless Technologies for Smart Ecosystems	Mr. Sridhar Manda , Dr. N. Nalini ' Dr.A. ARUN KUMAR	Amazon	ISBN-13 :979-8666447802 hnps://www.amazon.com	2020
6	Proceedings of the Fourth In t. Conference Proceedings on "Emerging Research in Computing, Information. Communication and Applications"	N.R.Shetty. L.M.Patnaik, H.C.Nagaraj, Prasad N H, Nalini N	AISC Series-Springer	Volu me 1: ISBN No: 978-981-10-4740-4, Hardcover, published by Springer. Volume 2: ISBN No: 978-981-10-4741-1(e-book) published by Springer.	2016
7	Proceedings of the Third Int. Conference Proceedings on "Emerging Research in Computing, Information, Communication and Applications	Prof.N.R.Shetty, Dr.Prasad N,H, Dr.Nalini.N	Springer	Volume 1: ISBN No: 978-81-322-2549-2, Volume 1: ISBN No: 978-81-322-2550-8 (e-book) Volu me 2: ISBN No: 978-81-322-2552-2 Volume 2: ISBN No: 978-81-322-2553-9 Ce-book)	2015

8	Proceedings of the Second Int. Conference Proceedings on "Emerging Research in Computing, Information, Commw1ication and Applications"	Prof.N.R.Sheny, Dr.Prasad N,H, Dr.Nalini.N	Elsevier	Volume 1: ISBN No: 978-93-5107-260-7, Volume 2: ISBN No: 978-93-5107-102·0, Volume 3:ISBN No: 978-93-5107-263-8	2014
9	Proceedings or the Firs1 International Conference on "Emerging Research in Computing, Information, Communication and Applications"	Prof.N.R.Shetty, Dr.Prasad NJ!, Dr.Nalini.N	Elsevier	Volu me 1: ISBN No: 978-93-5107-102-o.	2013

Profile of the Faculty

BRANCH: Computer Science and Engineering

Name	Dr. SAROJADEVI H.	
Designation	Professor	
Department	**CSE**	
Date of Joining the Institution	01.07.2010	
Date of Birth	02.10.1962	
Faculty Unique	1-409753303	
Email Id	sarojadevi.n@nmit.ac.in	

Education Qualifications:

SL.No	Degree Obtained	Year of Obtaining the highest degree	Class/ Grade obtained
1	UG	1985	II
2	PG	1990	I
3	PhD	2003 (IISC)	-

Total Work Experience in Years:

SL.No	Work Experience	Total in Years
1	Teaching	27
2	Research	20
3	Industry	4
4	others	1 PostDoc

Area of Specialization:

Courses taught at	Diploma/ Post Diploma	1.
	Undergraduate	1. Parallel Processing 2 Java 3 Advanced OS 4. Building Enterprise applications 5. Compiler Design 6. Cloud computing 7. Data Analytics using R program 8. Storage Area Networks 9. Deep Learning 10. Natural Language Processing 11. Information security
	Post Graduate	1. Computer networks 2. Formal models 3. Computer systems performance analysis 4. Cloud Computing

		5. Deep learning

Research Guidance (Number of Students):UG students- 11

No. of papers published:

SL.No	Type	Numbers
1	National	16
2	International Journals	65
3	Conferences	65

Master (Completed (Year of Completion)/Ongoing):
TWO projects completed ; ongoing : nil

Ph.D. (Completed Year of Completion)/Ongoing):
Ongoing = 4; completed 6

Projects Carried out :
7 funded projects
4 industry projects
35 UG/PG projects

Patents (Filed & Granted):

SL No	Topic	**Patent Application No**	Filed/ Granted
1	Image Captioning using Deep Learning	202241050400	Filed& published
2	Finger Pen for Divyang	357180-001	Design IPR Granted
3	Augmented Reality Application for Preschool and Kindergarten Kids	202241008749	Published
4	Optimal Controller Node Identification Software in a Ring Connected Binary Tree Structure	diary no-13550/2021-CO/SW	Copyright IPR Filed
5	A Middleware Implementation of Interconnecting Medical Devices Using HL – 7	201741041973	Published

Technology Transfer: ---

No. of Books published with details:
Two books; 9 book chapters

Books:

1. H. Sarojadevi, Title: "Processor Directed Cache Coherence Mechanism", ISBN978-3-659-11944-6, LAP publishing house, Germany, April 2012
2. H. Sarojadevi, Title: “Nanotechnology for Mobile Communication System, ISBN: 978-3-659-48128-4, LAP publishing house, Germany, November 2013

Book Chapters:

1. H.Sarojadevi, Pallavi M., Mohan B.A., Ramya S, Sushma M.
A new Design approach for developing Electronic Health Record Application on Android, Chapter 98, Elsevier book ERCICA (Emerging Research in Computing, Information, Communication and Applications), ISBN 9789351071020, 2013
2. Vijaya Shetty S. and Sarojadevi H., Performance Analysis of Transactional

applications in AMD quad core and Intel i5 processor, Elsevier book series, Advanced research in Engineering & technology, Vol.8, ISSN 2214-0344, pages 381-388, 2014

3. S. V. Shetty, H. Sarojadevi and B. Sriram, A Highly Robust Proxy Enabled Overload Monitoring System (P-OMS) for E-Business Web Servers, Computational Intelligence in Data Mining - Volume 3 pp 385-394, part of Smart Innovation, Systems and Technologies book series (SIST, volume 33), (SCOPUS) ISBN 978-81- 322-2201- 9, online ISBN 978-81- 322-2202- 6, DOI https://doi.org/10.1007/978-81- 322-2202- 6_35, Springer New Delhi, 2014
4. Sarojadevi H. and Mohan BA, Title: Energy Efficient Hybrid Protocol for Routing Based on Mobile Data Collectors in Wireless Sensor Network, Springer Book title : Smart Computing and Informatics, subtitle: Proceedings of the First International Conference on SCI'16, Volume 77, ISBN 9789811055430 ,
   Springer (SCOPUS) Series title: Smart Innovation, Systems and Technologies, 2017
5. Mohan BA and Saroja Devi H., Smart Innovation Systems and Technologies book series 2019, ISBN 978-981-13-1920-4, Vo.104, Article: Energy efficient protocols for WSNs: A Comparative Analysis, October 2018.
6. Mohan BA, and Dr. Sarojadevi H., An Innovative IoT and Middleware based Architecture for Real Time Patient Health Monitoring, Springer (SCOPUS) ERCICA-July18, ISBN 9789811360008, DOI 10.1007/978-981-13-6001-5, January 2019.
7. Nagamani H.S. and Dr. Sarojadevi H., Research methods for plant health detection using Computer Vision Techniques: A Survey, Advanced Engineering Research and Applications, Research India publications, book chapter 18, pp226-235, Vol. XI, ISBN 978-93-89116-38-0, December 2019.
8. N. Sreenivasa, B. A. Mohan, Roshan Fernandies, H. Sarojadevi, E. G. Satish, and Abrar Ahmed, The AgroCart Android Application to Manage Agriculture System, Springer book SCOPUS, pp701-718, ISSN 1876-1100 ISSN 1876-1119 (electronic) Lecture Notes in Electrical Engineering ISBN 978-981-19-5481-8 ISBN 978-981-19-5482-5 (eBook) https://doi.org/10.1007/978-981-19-5482-5, 2022
9. Deepthi Shetty, H. Sarojadevi, Onkar Bharatesh Kakamari, Savitha Shetty, Saritha Shetty, Radhika V. Shenoy, B. N. Rashmi, M. S. Sneha Dechamma, and G. Tanmaya, Machine Learning-Based Social Distance Detection: An Approach Using OpenCV and YOLO Framework . Springer book SCOPUS, pp 931-946, ISSN 1876-1100 ISSN 1876-1119 (electronic) Lecture Notes in Electrical Engineering ISBN 978-981-19-5481-8 ISBN 978-981-19-5482-5 (eBook) https://doi.org/10.1007/978-981-19-5482-5 , 2022

Profile of the Faculty

BRANCH: COMPUTER SCIENCE AND ENGINEERING

Name	Krishnarao Venkatesh	
Designation	Professor	
Department	**CSE**	
Date of Joining the Institution	July 30th, 2015	
Date of Birth	September 24th, 1952	
Faculty Unique	1-2661302953	
Email Id	krishnarao.venkatesh@nmit.ac.in	

Education Qualifications:

SL.No	Degree Obtained	Year of Obtaining the highest degree	Class/ Grade obtained
1	UG	1973	First
2	PG	1975, 1977	Distinction
3	PhD	1988	No grades awarded

Total Work Experience in Years:

SL.No	Work Experience	Total in Years
1	Teaching	7 years
2	Research	
3	Industry (R&D)	38 years

Area of Specialization:

Courses taught at	Undergraduate	1. Design of Digital & Analog Circuits 2. Data Structures 3. Introduction to Embedded Systems 4. Cyber Physical Systems 5. Introduction to IOT 6. Advanced Algorithms 7. High Performance Computing
	Post Graduate	1 Advanced Data Structures 2 Advanced Algorithms 3 Hybrid Computing

Master (Completed (Year of Completion)/Ongoing): ----

Ph.D. (Completed Year of Completion)/Ongoing):

Projects Carried out :

Over hundred projects of strategic and tactical importance developed when I was in the industry. In NMIT an aid for the Visually impaired has been developed with grants from DST.

Profile of the Faculty

BRANCH: COMPUTER SCIENCE AND ENGINEERING

Name	DR. VIJAYA SHETTY S	
Designation	PROFESSOR	
Department	**CSE**	
Date of Joining the Institution	1-3-2005	
Date of Birth	1-3-1968	
Faculty Unique	1-407247875	
Email Id	Vijayashetty.s@nmit.ac.in	

Education Qualifications:

SL.No	Degree Obtained	Year of Obtaining the highest degree	Class/ Grade obtained
1	UG	1990	FC
2	PG	2008	FCD
3	PhD	2018	-

Total Work Experience in Years:

SL.No	Work Experience	Total in Years
1	Teaching	28
2	Research	15
3	Industry	2
4	others	

Area of Specialization: Distributed Computing

Courses taught at	Undergraduate	1Data Structures 2 OOP with Java 3 OOP with C++ 4.Data Mining 5. DBMS 6. PRINCIPLES OF PARELLEL PROGRAMMING 7. CRYPTOGRAPHY AND NETWORK SECURITY
	Post Graduate	1COMPUTER ARCHITECTURE 2DISTRIBUTED COMPUTING

Research Guidance (Number of Students):UG students-100

No. of papers published: 35

SL.No	Type	Numbers
1	National	2
2	International Journals	13
3	Conferences	20
4	Others	

Master (Completed (Year of Completion)/Ongoing): 2008

Ph.D. (Completed Year of Completion)/Ongoing): 2018

Projects Carried out :3

1. **Title:** "IoT based Car Maintenance Assist".
   Amount Sanctioned: 1,60,000/- (One Lakh sixty Thousand)
   Funding: under TEQIP Seed Money Projects
   Status: completed

2. **Title**: An Intelligent English Essay Scoring System for Rural Educational Institutes using
   NLP and Sentiment Analysis
   Funding Agency: KSCST
   Grant:Rs. 4,000/
   Status: completed

3. **Title**: A Kannada Handwritten Character Recognition and Speech Conversion System to Promote
   Digital Learning of Kannada Language in Rural Schools
   Funding Agency: KSCST
   Grant: Rs. 3,000/

Patents (Filed & Granted):

SL No	Topic	**Patent Application No**	Filed/ Granted
1	Coding Decoding of Answer Scripts	331/CHE/2015 A	FILED
2	A Multifaceted Road Safety System for Vehicles	202241023388	FILED
3.	Teaching aid for teaching concepts of stacks in computer science education	5014/CHE/2014	FILED

Technology Transfer: -

No. of Books published with details: -

Profile of the Faculty

BRANCH: Computer Science and Engineering

Name	**Dr.Vani V**	
Designation	**Professor**	
Department	**CSE**	
Date of Joining the Institution	**01-Sep-2021**	
Date of Birth	**22-Feb-1978**	
Faculty Unique	**1-10522197831**	
Email Id	**Vani.v@nmit.ac.in**	

Education Qualifications:

SL.No	Degree Obtained	Year of Obtaining the highest degree	Class/ Grade obtained
1	**UG**	**1999**	**First Class**
2	**PG**	**2002**	**First Class with Distinction**
3	**PhD**	**2013**	**-**
4	**Others(Diploma in Computer Technology)**	**1996**	**First Class with Distinction**

Total Work Experience in Years:

SL.No	Work Experience	Total in Years
1	Teaching	**19 years**
2	Research	
3	Industry	**4 years 5 months**
4	others	

Area of Specialization: Machine Learning, Image Processing, Multimedia, Software Engineering, Computer Graphics and Computer Vision

Courses taught at	Undergraduate	**1 Data Mining** **2 Introduction to Machine Learning** **3 Application Development using Java**
	Post Graduate	**1 Machine Learning and Intelligent Data Analytics** **2 Image Processing and Computer Vision**

Research Guidance (Number of Students):UG students-

No. of papers published:

SL.No	Type	Numbers
1	National	**4**
2	International Journals	**14**
3	Conferences	**17**
4	Others (Book and Book Chapters)	**1 and 9**

Master (Completed (Year of Completion): **2002**

Ph.D. (Completed Year of Completion): **2013**

Projects Carried out:

Patents (Filed & Granted): Indian Patents Published: 2 International Patents(German) Granted: 3

SL No	Topic	Patent Application No	Filed/ Granted
1	**Multimedia Projection Mapping System for Cosmetic Surgeries**	G11872DE	Granted
2	**An Internet of Things (IoT) Based Baggage Tracking System**	G11868DE	Granted
3	**An Aural Therapy Support System**	G11869DE	Granted
4.	**I-Monitor – An AI enabled IoT Device To Monitor The Elderly Adults**	202241010309	Filed & published
5.	**Determining Nutritional Composition of Food from the Images**	202241021388	Filed & published

Technology Transfer:

No. of Books published with details: 1

1. S., Mohan and **Vani V**., editors. *Multi-Core Computer Vision and Image Processing for Intelligent Applications*.IGI Global, 2017. https://doi.org/10.4018/978-1-5225-0889-2

Profile of the Faculty

BRANCH: COMPUTER SCIENCE AND ENGINEERING

Name	Dr. JYOTI NEELI	
Designation	Professor	
Department	**CSE**	
Date of Joining the Institution	10/10/2022	
Date of Birth	02/06/1977	
Faculty Unique	1-424592587	
Email Id	Jyothi.neeli@nmit.ac.in	

Education Qualifications:

SL.No	Degree Obtained	Year of Obtaining the highest degree	Class/ Grade obtained
1	UG	1999	FCD
2	PG	2007	FC
3	PhD	2022	-
4	Others		
5			

Total Work Experience in Years:20 Years

SL.No	Work Experience	Total in Years
1	Teaching	20 years
2	Research	-
3	Industry	-
4	others	-

Area of Specialization: Computer Science & Information Science Engg

Courses taught at	Undergraduate	1. Data Communication 2 Computer Networks 3 Information & Network security 4. Cryptography 5. IOT 6. Analog & Digital Electronics 7. Logic Design 8.Introduction to Image Processing 9.Software Engineering 10.Software Testing 11. C Programming 12. System Modelling & Simulation 13. Operating Systems

		14. Computer Organization 15. Object-oriented modeling & design.

Research Guidance (Number of Students):UG students-4

No. of papers published: 14

SL.No	Type	Numbers
1	National	-
2	International Journals	12
3	Conferences	1
4	Others-Book Chapters	1

Master (Completed (Year of Completion)/Ongoing): M.Tech(2007)

Ph.D. (Completed Year of Completion)/Ongoing): Ph.D(2022)

Projects Carried out : NIL

Patents (Filed & Granted):4

SL No	Topic	**Patent Application No**	Filed/ Granted
1	An artificial Intelligence & Internet of things based automated system for Animal health care monitoring system	2020101719	Granted
2	Big data model with lower cost and efficient security constraints for new generation medical systems	202141044793	Published
3	Intelligent SIM: Multiple company Mobile number installed in single SIM	202141051542A	Published
4	“Big Data and cloud Bursting Real-time intelligent scheduling using Machine Learning	202141052902	Published

Technology Transfer:

- Resource person and Co-ordinator for two day workshop on “Automation testing tool”, on 10th and 11th March 2017 at Global Academy of Technology.

No. of Books published with details: NIL

Profile of the Faculty

BRANCH: COMPUTER SCEINCE AND ENGINEERING

Name	Archana Naik	
Designation	Associate Professor	
Department	**CSE**	
Date of Joining the Institution	08-07-2002	
Date of Birth	11-04-1980	
Faculty Unique	1-409753375	
Email Id	Archana.naik@nmit.ac.in	

Education Qualifications:

SL.No	Degree Obtained	Year of Obtaining the highest degree	Class/ Grade obtained
1	UG	2001	1st class
2	PG	2007	1st Class
3	PhD	Ongoing	

Total Work Experience in Years:

SL.No	Work Experience	Total in Years
1	Teaching	20
2	Research	3

Area of Specialization:

Courses taught at	Undergraduate	1. Artificial Intelligence & Neural Networks 2. Big Data Technologies 3. Finite Automata 4. Advanced Computer Architecture 5. High Performance Computing 6. Logic Design 7. Operating Systems 8. Compiler Design 9. Microprocessors 10. Computer Networks.
	Post Graduate	1. Computer Networks 2. Operating Systems 3. Big Data Analytics

Research Guidance (Number of Students):UG students- 30

No. of papers published:

SL.No	Type	Numbers
1	National	1
2	International Journals	8

3	Conferences	4
4	Others	2

Master (Completed (Year of Completion)/Ongoing): 2007

Ph.D. (Completed Year of Completion)/Ongoing): Ongoing

Projects Carried out : 00

Patents (Filed & Granted): 01

SL No	Topic	**Patent Application No**	Filed/ Granted
1	A Multifaceted Road Safety System for Vehicles	202241023388	Filed

Technology Transfer: 00

No. of Books published with details:
00

Profile of the Faculty

BRANCH: Computer Science and Engineering

Name	Dr. Sujata Joshi
Designation	Associate Professor
Department	**CSE**
Date of Joining the Institution	23.8.2010
Date of Birth	01.12.1972
Faculty Unique	1-409528751
Email Id	sujata.joshi@nmit.ac.in

Education Qualifications:

SL.No	Degree Obtained	Year of Obtaining the highest degree	Class/ Grade obtained
1	UG	1995	2
2	PG	2007	1
3	PhD	2021	1

Total Work Experience in Years:

SL.No	Work Experience	Total in Years
1	Teaching	24
2	Research	8
3	Industry	2

Area of Specialization:

Courses taught at	Diploma/ Post Diploma	1Data Structures 2C Programming 3DBMS
	Undergraduate	1Data Mining 2Data Structures 3Machine Learning.
	Post Graduate	1Deep Learning

Research Guidance (Number of Students):UG students-

No. of papers published:

SL.No	Type	Numbers
1	National	2
2	International Journals	6
3	Conferences	9
4	Others	

Master (Completed (Year of Completion)/Ongoing): Completed 2007
Ph.D. (Completed Year of Completion)/Ongoing): Completed 2021
Projects Carried out : **NIL**
Patents (Filed & Granted):

SL No	Topic	**Patent Application No**	Filed/ Granted
1			FILED
2			FILED

Technology Transfer:
No. of Books published with details: NIL

Profile of the Faculty
BRANCH: Computer Science and Engineering

Name	Dr Chaitra HV
Designation	Associate Professor
Department	**CSE**
Date of Joining the Institution	16/1/2008
Date of Birth	22-12-1979
Faculty Unique	1-409753235
Email Id	chaitra.hv@nmit.ac.in

Education Qualifications:

SL.No	Degree Obtained	Year of Obtaining the highest degree	Class/ Grade obtained
1	UG	2003	First Class
2	PG	2010	First Class
3	PhD	2020	VTU

Total Work Experience in Years:

SL.No	Work Experience	Total in Years
1	Teaching	18
2	Research	8

Area of Specialization:

Courses taught at	Undergraduate	1 Artificial Intelligence and Neural Networks 2 Operating Systems 3Big Data 4. Cyber Security 5. Green Computing 6. Unix 7. Data Mining
	Post Graduate	1 Big data 2 Advanced Operating Systems 3

Research Guidance (Number of Students):UG students-20

No. of papers published:

SL.No	Type	Numbers
1	National	1
2	International Journals	8
3	Conferences	5
4	Others	

Master (Completed (Year of Completion)/Ongoing): 2010

Ph.D. (Completed Year of Completion)/Ongoing): 2020

Projects Carried out : 1

Patents (Filed & Granted):)1

SL No	Topic	**Patent Application No**	Filed/ Granted
1	IOT AND CLOUD BASED SECURITY SYSTEM FOR SMART VEHICLE" in August 2021	202141034157	filed

Technology Transfer:

No. of Books published with details: 01

1. A secure Data Aggregation Technique in Wireless Sensor Network(2022) Chaitra HV https://www.lulu.com/en/us/shop/dr-chaitra-hv/a-secure-data-aggregation-technique-in-wireless-sensor-network/ebook/product-krv5k2.html?page=1&pageSize=4 , ISBN 978-1-387-91505-7

Profile of the Faculty

BRANCH: COMPUTER SCIENCE AND ENGINEERING

Name	Dr. Vasanthakumar G U	
Designation	Assistant Professor	
Department	**CSE**	
Date of Joining the Institution	03.09.2019	
Date of Birth	30.08.1978	
Faculty Unique	1-7419844603	
Email Id	vasanth.gu@nmit.ac.in	

Education Qualifications:

SL.No	Degree Obtained	Year of Obtaining the highest degree	Class/ Grade obtained
1	UG	2001	I
2	PG	2006	I
3	PhD	2018 (Full Time)	NA

Total Work Experience in Years:

SL.No	Work Experience	Total in Years
1	Teaching	11.1 years
2	Research	8 Years
3	Industry	2.5 Years
4	others	

Area of Specialization:

Courses taught at	Undergraduate	1. Software Engineering 2. Operating Systems 3. Computer Networks 4. C Programming 5. Green Computing 6. Entrepreneurship Development Management & IPR

Research Guidance (Number of Students): 1 Research Scholar

UG students- 2 Groups (Final Year)

3 Groups (Pre-Final Year)

No. of papers published:

SL.No	Type	Numbers
1	National	-
2	International Journals	7
3	Conferences	10
4	Others	5

Master (Completed (Year of Completion)/Ongoing): 2006

Ph.D. (Completed Year of Completion)/Ongoing): 2018

Projects Carried out:

1. Intelligent and Smart Weather Station (using TinyML and Edge AI) (Ongoing)
2. ROBOSLAM (Ongoing)
3. ROBOSWARM (Ongoing)
4. Prediction of Chronic Renal Disease (Ongoing)
5. Object Detection using Sensors for Visually Impaired (Ongoing)
6. Indian Sign Language Interpreter (Completed)
7. Helmet Detection System in Real Time (Completed)

Patents (Filed & Granted):

SL No	Topic	**Patent Application No**	Filed/ Granted
1	IoT and Cloud Based Agricultural Monitoring System	202141026215 A	Filed & Published
2	A Compact IoT Based Indoor Air Monitoring System	202141023368 A	Filed & Published

Technology Transfer:

No. of Books published with details:

1. Vasanthakumar G U et al., Guest Editor of Advances in Computational Intelligence, Security and Internet of Things, Springer Publication, Scopus Indexed, ISBN: 9811536651, 9789811536663, March 2020.

Profile of the Faculty

BRANCH: COPUTER SCIENCE AND ENGINEERING

Name	Dr.N.Sreenivasa	
Designation	Associate Professor	
Department	**CSE**	
Date of Joining the Institution	14 December 2005	
Date of Birth	27/03/1976	
Faculty Unique	1-4493838284	
Email Id	Sreenivasa.n@nmit.ac.in	

Education Qualifications:

SL.No	Degree Obtained	Year of Obtaining the highest degree	Class/ Grade obtained
1	UG	2000	Pass
2	PG	2010	First class with Distinction
3	PhD	2020	--

Total Work Experience in Years:

SL.No	Work Experience	Total in Years
1	Teaching	20
2	Research	07

Area of Specialization:

Courses taught at	Undergraduate	1. CO&A 2. Advance CO &A 3. EDM&IPR 4. C Programming 5. OOMD 6. USP 7. Green Computing 8. USP 9. OS

Research Guidance (Number of Students):UG students-90

No. of papers published:

SL.No	Type	Numbers
1	National	03
2	International Journals	11

3	Conferences	09
4	Others	03

Master (Completed (Year of Completion)/Ongoing): 2010

Ph.D. (Completed Year of Completion)/Ongoing): 2020

Projects Carried out :

Technology Transfer:

No. of Books published with details: 01

1. Sreenivasa N (2022) " Heterogeneous Parallel Processing: Time Driven Computation Schemes" LABERT ACADEMEIC PUBLISHING" DoI :: 9786205518151

Profile of the Faculty
BRANCH: COMPUTER SCIENCE AND ENGINEERING

Name	Dr. Dileep Reddy Bolla
Designation	Associate Professor
Department	**CSE**
Date of Joining the Institution	09-10-2022
Date of Birth	31-08-1988
Faculty Unique	1-10603175861
Email Id	dileep.bolla@gmail.com dileep.bolla@nmit.ac.in

Education Qualifications:

SL.No	Degree Obtained	Year of Obtaining the highest degree	Class/ Grade obtained
1	UG	2009	FC
2	PG	2011	FCD
3	PhD	2019	--

Total Work Experience in Years:

SL.No	Work Experience	Total in Years
1	Teaching	12 years
2	Research	07 years
3	Industry	6 months

Area of Specialization:

Courses taught at	Undergraduate	1. Internet of Things 2. 5G Mobile Communication 3. Introduction to Software Technologies 4. Design of Digital circuits 5. Introduction to Embedded systems 6. Microprocessor and microcontroller lab 7. DADC lab 8. Python programming Lab 9. Cryptography and Network Security lab 5G Innovation Lab
	Post Graduate	1. Wireless Mobile Networks 2. Cyber Forensics

Research Guidance (Number of Students):UG students-

No. of papers published:

SL.No	Type	Numbers
1	National	0
2	International Journals	9
3	Conferences	35
4	Others	--

Master (Completed (Year of Completion)/Ongoing): **Completed in 2011**

Ph.D. (Completed Year of Completion)/Ongoing): **Completed in 2019**

Projects Carried out :

1. **Intelligent Miniature Autonomous Vehicle**
2. **Video summarization on e-sport**
3. **Intelligent and Smart weather station (using TinyML and Edge AI)**
4. **An innovative road and traffic safety management system using iot**
5. **Tecki-case**
6. **Travel buddy / Easygo**
7. **Robo slam**
8. **Robo swarm**

Patents (Filed & Granted):

SL No	Topic	**Patent Application No**	Filed/ Granted
1	An Energy Efficient Routing protocol for Spectrum Management in Cognitive Radio networks	International German Patent Number: **20 2022 106 109**	Granted

Technology Transfer:

- **Evaluator** to carry out Assessment and evaluation n Yukthi- National Innovation Repository (NIR).
- **Innovation Ambassador (Level-2)** for Ministry of Education (MoE), Govt. of India Institution's Innovation Council (IIC).
- **Evaluator and Mentor** for Smart India Hackathon (SIH) to bring in next generation evolution by inclusion of new methodology to inculcate the culture of startup and innovation ecosystem across different age groups.

No. of Books published with details:

Book chapter published in

1. Intelligent Miniature Autonomous Vehicle. In: Jacob, I.J., Kolandapalayam Shanmugam, S., Bestak, R. (eds) Expert Clouds and Applications. Lecture Notes in Networks and Systems, vol 444. Springer, Singapore. https://doi.org/10.1007/978-981-19-2500-9_52
2. Energy-Efficient Dynamic Source Routing in Wireless Sensor Networks. In: Shetty, N.R., Patnaik, L.M., Prasad, N.H. (eds) Emerging Research in Computing, Information, Communication and Applications. Lecture Notes in Electrical Engineering, vol 928. Springer, Singapore. https://doi.org/10.1007/978-981-19-5482-5_65.

Profile of the Faculty
BRANCH: COMPUTER SCIENCE AND ENGINEERING

Name	Dr P NAGARATHNA	
Designation	ASSOC PROF	
Department	**CSE**	
Date of Joining the Institution	19-11-2021	
Date of Birth	01-06-1975	
Faculty Unique	1-10893090061	
Email Id	nagaratna.p@nmit.ac.in	

Education Qualifications:

SL.No	Degree Obtained	Year of Obtaining the highest degree	Class/ Grade obtained
1	UG	1998	Distinction
2	PG	2005	First class
3	PhD	2020	--

Total Work Experience in Years:

SL.No	Work Experience	Total in Years
1	Teaching	14
2	Research	6
3	Industry	2
4	others	--

Area of Specialization: WIRELESS SENSOR NETWORKS

Courses taught	Undergraduate	1.Data Structures using C/C++ 2.Computer Networks I & II 3.Software Project Management 4.Object Oriented programming Programming in C.
	Post Graduate	1 Distributed Operating systems 2 Advanced Computer Networks 3 Protocol Engineering.

Research Guidance (Number of Students):UG students-

No. of papers published:

SL.No	Type	Numbers
1	National	02

2	International Journals	03
3	Conferences	9
4	Others	--

Master (Completed (Year of Completion)/Ongoing): 2005

Ph.D. (Completed Year of Completion)/Ongoing): 2020

Projects Carried out :

Patents (Filed & Granted):NIL

SL No	Topic	**Patent Application No**	Filed/ Granted
1	ACCIDENT DETECTION AND NOTIFICATION SYSTEM”	202241057152	--
2	SYSTEM FOR STATISTIC STACK USAGE ANALYSIS TOOL	202241057589	--

Technology Transfer:

No. of Books published with details:

Profile of the Faculty

BRANCH: COMPUTER SCIENCE AND ENGINEERING

Name	UMA R	
Designation	Assistant Professor	
Department	**CSE**	
Date of Joining the Institution	7th February 2008	
Date of Birth	18/5/1982	
Faculty Unique	1-450425562	
Email Id	uma.r@nmit.ac.in	

Education Qualifications:

SL.No	Degree Obtained	Year of Obtaining the highest degree	Class/ Grade obtained
1	UG	2005	First class
2	PG	2012	First class

Total Work Experience in Years: 17 years

SL.No	Work Experience	Total in Years
1	Teaching	17years

Area of Specialization: Compiler design, Network on chip, Web Technology

Courses taught at	Undergraduate	1 Compiler design 2 Web Technology 3 C programming 4.C++
	Post Graduate	1 Web Technology 2 C++

Research Guidance (Number of Students):

No. of papers published: 10

SL.No	Type	Numbers
1	National	2
2	International Journals	1
3	Conferences	7

Master (Completed (Year of Completion)/Ongoing): 2012

Ph.D. (Completed Year of Completion)/Ongoing): Ongoing

Technology Transfer: ----

Profile of the Faculty

CP\OMPUTER SCIENCE AND ENGINEERINGENGINEERING

Name	DEEPTHI SHETTY	
Designation	ASSSITANT PROFESSOR	
Department	**CS & E**	
Date of Joining the Institution	15TH FEBRUARY 2008	
Date of Birth	27TH OCTOBER 1984	
Faculty Unique	1-415280689	
Email Id	deepthi.shetty@nmit.ac.in	

Education Qualifications:

SL.No	Degree Obtained	Year of Obtaining the highest degree	Class/ Grade obtained
1	UG	2006	Second
2	PG	2011	First
3	PhD	registered-ongoing	

Total Work Experience in Years:

SL.No	Work Experience	Total in Years
1	Teaching	16
2	Research	2

Area of Specialization:

Courses taught at	Undergraduate	1 DATA MINING 2 COMPUTER NETWORKS 3 OPERATING SYSTEM 4 COMPUTER ORGANIZATION & ARCHITECTURE 5. NATURAL LANGUAGE PROCESSING

Research Guidance (Number of Students):UG students-

No. of papers published:

SL.No	Type	Numbers
1	National	1
2	International Journals	
3	Conferences	4
4	Others	

Master (Completed (Year of Completion)/Ongoing): 2011

Ph.D. (Completed Year of Completion)/Ongoing): ONGOING

Projects Carried out :

Patents (Filed & Granted):

SL No	Topic	**Patent Application No**	Filed/ Granted
1	I-Monitor	202241010309	Published
2			

Technology Transfer:

No. of Books published with details: NIL

Profile of the Faculty

BRANCH: COMPUTER SCIENCE AND ENGINEERING

Name	Dr.B.V.Shruti
Designation	Assistant Professor
Department	**CSE**
Date of Joining the Institution	01/08/2008
Date of Birth	27/08/1983
Faculty Unique	1-450425548
Email Id	Shruthi.bv@nmit.ac.in

Education Qualifications:

SL.No	Degree Obtained	Year of Obtaining the highest degree	Class/ Grade obtained
1	UG	2005	FC
2	PG	2009	FC
3	PhD	2022	PASS

Total Work Experience in Years:

SL.No	Work Experience	Total in Years
1	Teaching	15
2	Research	10

Area of Specialization: Wireless Sensor Networks

Courses taught at	Undergraduate	1.Cyber Laws and Ethics, 2.Enterpreneurship Management and Development IPR 3.Computer Organization and Architecture. 4.Introduction to Unix 5.Operation Research

Research Guidance (Number of Students):UG students-50students

No. of papers published:

SL.No	Type	Numbers
1	National	
2	International Journals	4
3	Conferences	2

4	Others	

Master (Completed (Year of Completion)/Ongoing):

Ph.D. (Completed Year of Completion)/Ongoing):

Projects Carried out :

Patents (Filed & Granted):

SL No	Topic	**Patent Application No**	Filed/ Granted
1	I-Monitor – An AI-enabled IOT device to monitor the Elderly Adults	202241010309	Filed and Published
2			

Technology Transfer:

No. of Books published with details:

Profile of the Faculty

BRANCH: COMPUTER SCIENCE AND ENGINEERING

Name	Jagadevi.N.Kalshetty
Designation	Assistant Professor
Department	**CSE**
Date of Joining the Institution	15-9-2008
Date of Birth	05-09-1984
Faculty Unique	1-409528539
Email Id	Jagadevi.n.kalshetty@nmit.ac.in

Education Qualifications:

SL.No	Degree Obtained	Year of Obtaining the highest degree	Class/ Grade obtained
1	UG	2008	FC
2	PG	2014	7.56(CGPA)
3	PhD	pursuing	

Total Work Experience in Years:

SL.No	Work Experience	Total in Years
1	Teaching	14
2	Research	05

Area of Specialization:

Courses taught at	Undergraduate	1 C Programming 2 Building Enterprise Application 3EDMIPR 4. Cyber Laws and Ethics 5. Virtual Reality 6. Introduction to Web Programming 7. Advanced Web Programming.
	Post Graduate	1.Virtual and Augmented Reality

Research Guidance (Number of Students):UG students-2 batches(8 Students)

No. of papers published:18

SL.No	Type	Numbers
1	National	2
2	International Journals	2
3	Conferences	14
4	Others	

Master (Completed(Year of Completion)/Ongoing): 2014 Completed

Ph.D. (Completed Year of Completion)/Ongoing):Ongoing(CV Completed)

Projects Carried out :

- “Agricultural Robot Using Android Application”.
- “An Intelligent Surveillance for Home Security”.
- “DRINA: A Novel algorithm for In-Network Aggregation in Wireless Sensor Network”.
- “Wireless Sensor Network Security Model Using Zero Knowledge Protocol”
- “Eventual Clusterer: A Modular Approach to Designing Hierarchical Consensus Protocols in MANET’S.
- “Data Security in Cloud Computing”.
- “IoT Based Heart Rate Monitoring System”
- “Smart monitoring for waste management using IOT”
- “Smart Water Quality Monitoring System using IOT”

Patents (Filed & Granted):

SL No	Topic	**Patent Application No**	Filed/ Granted
1	“Smart Waste Management System”,	202241021353	Patent Published
2	“ Food Spoilage Detection System using Artificial Intelligence”	202241023803	Patent Published

Technology Transfer:

1. **No. of Books published with details: “OPTIMISATION OF DATA PROCESSING IN CLOUD ENVIRONMENT”** Has been published by LAMBERT publications Germany with **ISBN: 974-620-4-74808-5.**

Profile of the Faculty

BRANCH: COMPUTER SCIENCE AND ENGINEERING

Name	Ramya.Srikanteswara
Designation	Assistant Professor
Department	**CSE**
Date of Joining the Institution	17-08-2009
Date of Birth	25-08-1981
Faculty Unique	1-409528653
Email Id	ramya.srikanteswara@nmit.ac.in

Education Qualifications:

SL.No	Degree Obtained	Year of Obtaining the highest degree	Class/ Grade obtained
1	UG	2004	FC
2	PG	2009	FCD

Total Work Experience in Years:

SL.No	Work Experience	Total in Years
1	Teaching	15.4
2	Research	5
3	Industry	1

Area of Specialization: Image processing and Machine learning

Courses taught at	Undergraduate	1.DESIGN AND ANALYSIS OF ALGORITHMS 2.DBMS 3. DESIGN OF DIGITAL AND ANALOG CIRCUITS 4.CLOUD COMPUTING 5.INFORMATION SECURITY 6.COMPUTER NETWORKS
	Post Graduate Diploma Level	

Research Guidance (Number of Students):UG students- 3 batches(4 students each)

No. of papers published: 19

SL.No	Type	Numbers
1	National	0

2	International Journals	4
3	Conferences	15

Master (Completed (Year of Completion)/Ongoing): Completed 2009

Ph.D. (Completed Year of Completion)/Ongoing): Ongoing

Projects Carried out :

1**PROJECT (THROUGH TEQIP FUNDING AT NMIT,BANGALORE):“**An Effect ive network management system using SDN over LAN**”**

14 student projects

Travel Guide App Using Android, Women Security Using IoT, IoT based smart food storage , Mess management system using android , Waste management system for trains , Flight delay prediction and analysis using R , Multi cloud computing , Object Detection and Voice Guidance for Blind , An IoT based framework for identification of covid , IOT based automatic medicine reminder , Sign language interpreter , Automatic text summarization using abstractive method with transformers and bert , EDITH: the voice assistant

Patents (Filed & Granted):

SL No	Topic	**Patent Application No**	Filed/ Granted
1	Smart waste management system	202241021353	Published

Technology Transfer:

No. of Books published with details: NIL

Profile of the Faculty

BRANCH: Computer Science and Engineering

Name	Nirmala JS	
Designation	Assistant Professor	
Department	**CSE**	
Date of Joining the Institution	27/8/2010	
Date of Birth	26/2/1976	
Faculty Unique	1-409528401	
Email Id	Nirmala.saunshimath@nmit.ac.in	

Education Qualifications:

SL.No	Degree Obtained	Year of Obtaining the highest degree	Class/ Grade obtained
1	UG	1999	Second Class
2	PG	2008	First Class with Distinction

Total Work Experience in Years:

SL.No	Work Experience	Total in Years
1	Teaching	20
2	Research	8
3	Industry	1

Area of Specialization:

Courses taught at	Undergraduate	1 Artificial Intelligence 2 Computer Graphice 3 Software Engineering 4. Computer Organization 5. Agile 6. Unix 7. Data Mining 8.EDM IPR . .
	Post Graduate	1 Image Processing 2 ADBMS 3

Research Guidance (Number of Students):UG students-20

No. of papers published:

SL.No	Type	Numbers
1	National	2
2	International Journals	6
3	Conferences	4
4	Others	

Master (Completed (Year of Completion)/Ongoing): 2008

Ph.D. (Completed Year of Completion)/Ongoing): Ongoing

Projects Carried out : 1

Patents (Filed & Granted):)1

SL No	Topic	**Patent Application No**	Filed/ Granted
1	Augmented Reality Application for Pre school and Kindergarden Kids	202241008749	Published
2			

Technology Transfer:

No. of Books published with details: 01

Profile of the Faculty

BRANCH: COMPUTER SCIENCE and ENGINEERING

Name	E G Satish	
Designation	Assistant Professor	
Department	**CSE**	
Date of Joining the Institution	01-08-2011	
Date of Birth	04-04-1984	
Faculty Unique	1-721888031	
Email Id	Satish.eg@nmit.ac.in	

Education Qualifications:

SL.No	Degree Obtained	Year of Obtaining the highest degree	Class/ Grade obtained
1	UG	2005	First Class
2	PG	2010	First Class with Distincton
3	PhD	Pursing	

Total Work Experience in Years:

SL.No	Work Experience	Total in Years
1	Teaching	12
2	Research	03
3	Industry	01

Area of Specialization: Network on Chip, IoT,Computer Networks

Courses taught at	Undergraduate	Computer Organization and Architecture Advanced Computer Architecture Cloud Computing Distributed Transaction Processing Introduction to Embedded Systems Software Engineering Software Testing

		EDM & IPR Computer Concepts and Programming Cyber Security .

Research Guidance (Number of Students):UG students-55

No. of papers published:

SL.No	Type	Numbers
1	National	1
2	International Journals	8
3	Conferences	8
4	Others	

Master (Completed (Year of Completion)/Ongoing): 2010

Ph.D. (Completed Year of Completion)/Ongoing): Ongoing

Projects Carried out :

Technology Transfer:

No. of Books published with details:

Profile of the Faculty

BRANCH: COMPUTER SCIENCE AND ENGINEERING

Name	Sowmya M. R.
Designation	Assistant Professor
Department	CSE
Date of Joining the Institution	01-08-2013
Date of Birth	24-12-1982
Faculty Unique	1-4641373260
Email Id	sowmya.mr@nmit.ac.in

Education Qualifications:

SL.No	Degree Obtained	Year of Obtaining the highest degree	Class/ Grade obtained
1	UG	2005	First Class
2	PG	2010	First Class with Distinction
3	PhD	Pursuing	
5			

Total Work Experience in Years:

SL.No	Work Experience	Total in Years
1	Teaching	14
2	Research	02

Area of Specialization:

Courses taught at	Undergraduate	1 Computer Networks 2 Big Data Analytics 3 Business Intelligence and its Application 4. Python Programming 5. C programming 6. Storage Area Networks 7. Operating Systems 8. Computer Organization 9. Database Management System

Research Guidance (Number of Students):UG students- 48

No. of papers published:

SL.No	Type	Numbers
1	National	-
2	International Journals	-
3	Conferences	6
4	Others	-

Master (Completed (Year of Completion)/Ongoing): 2010

Ph.D. (Completed Year of Completion)/Ongoing): 2020 Ongoing

Projects Carried out : Projects related to AI, DataScience and IoT(Guided)
Patents (Filed & Granted): NIL
Technology Transfer:
No. of Books published with details:

Profile of the Faculty

BRANCH: ELECTRONICS AND COMMUNICATION ENGINEERING

Name	SHOBHA	
Designation	ASSISTANT PROFESSOR	
Department	**CSE**	
Date of Joining the Institution	12/08/2013	
Date of Birth	17/01/1981	
Faculty Unique	1-3538932514	
Email Id	shobha.p@nmit.ac.in	

Education Qualifications:

SL.No	Degree Obtained	Year of Obtaining the highest degree	Class/ Grade obtained
1	UG	2002	Distinction
2	PG	2010	8.72
3	PhD	2020(reg- ongoing)	

Total Work Experience in Years:

SL.No	Work Experience	Total in Years
1	Teaching	14
2	Research	10

Area of Specialization:

Courses taught at	Undergraduate	1. Design of Analog and Digital Circuits 2. Logic Design 3. Basic Electronics 4. Principles of Data Communication 5. Signals and Systems 6. Digital communication 7. Internet Tools and Technology 8. Storage Device Technology 9. Formal language and finite automata. 10. Microprocessor 11. Introduction to Wireless and Finite automata 12. Application development using Java

Research Guidance (Number of Students):UG students- 50

No. of papers published:

SL.No	Type	Numbers
1	National	1
2	International Journals	2
3	Conferences	9
4	Others	

Master (Completed (Year of Completion)/Ongoing): 2010

Ph.D. (Completed Year of Completion)/Ongoing): 2020 ongoing

Projects Carried out :01

Patents (Filed & Granted):

SL No	Topic	**Patent Application No**	Filed/ Granted
1	System for head mounted device based multiple choice test conduction for candidates sitting in close proximity on 23/06/2015.	Application No: 3137/CHE/2015. Publication date: 30/12/2016	Published
2			

Technology Transfer:

No. of Books published with details:

Profile of the Faculty

BRANCH: COMPUTER SCIENCE AND ENGINEERING

Name	Shilpa Ankalaki	
Designation	Assistant Professor	
Department	**CSE**	
Date of Joining the Institution	01-08-2014	
Date of Birth	07-07-1990	
Faculty Unique	1-2380744533	
Email Id	Shilpa.a@nmit.ac.in Shilpaa336@gmail.com	

Education Qualifications:

SL.No	Degree Obtained	Year of Obtaining the highest degree	Class/ Grade obtained
1	UG	2012	FCD
2	PG	2014	FCD
3	PhD	Thesis Submitted	
5			

Total Work Experience in Years:

SL.No	Work Experience	Total in Years
1	Teaching	8.5
2	Research	4

Area of Specialization:

Courses taught at	Undergraduate	1. Data Structures using C 2. Introduction to Image Processing 3. Data Mining and Data Warehousing 4. Artificial Intelligence and Neural Network 5. C Programming 6. Data Structures using C++ 7. Python Programming
	Post Graduate	1. Machine Learning Techniques 2. Deep Learning 3. Managing Big Data 4. Advances in Operating System 5. Storage Area Networks

Research Guidance (Number of Students):UG students- 3 Teams UG

No. of papers published:

SL.No	Type	Numbers
1	National	1
2	International Journals	17
3	Conferences	10
4	Others	1 Book Chapter

Master (Completed (Year of Completion)/Ongoing):
2014

Ph.D. (Completed Year of Completion)/Ongoing):
Thesis Submitted

Projects Carried out :

Profile of the Faculty

BRANCH: COMPUTER SCIENCE AND ENGINEERING

Name	MAMATHA BAI B G
Designation	Assistant Professor
Department	**CSE**
Date of Joining the Institution	19-Aug-2015
Date of Birth	03-Nov-1990
Faculty Unique	1-2896874895
Email Id	mamathabai.bg@nmit.ac.in

Education Qualifications:

SL.No	Degree Obtained	Year of Obtaining the highest degree	Class/ Grade obtained
1	UG	2012	FCD
2	PG	2015	FCD
3	PhD	Cleared VTU ETR	

Total Work Experience in Years:

SL.No	Work Experience	Total in Years
1	Teaching	8
2	Research	0
3	Industry	0

Area of Specialization:

Courses taught at	Undergraduate	1. Software Engineering 2. Introduction to Software Testing 3. Introduction to Cloud Computing 4. Database Management Systems 5. Data Structures 6. Computer Concepts and C Programming
	Post Graduate	1. Cloud Computing 2. Big Data Analytics 3. Advanced Operating Systems 4. Machine Learning

Research Guidance (Number of Students):UG students- 3 Teams (10 Students)

No. of papers published: 12

SL.No	Type	Numbers
1	National	1
2	International Journals	3
3	Conferences	8
4	Others	

Master (Completed (Year of Completion)/Ongoing): 2015

Ph.D. (Completed Year of Completion)/Ongoing): Cleared VTU ETR
Projects Carried out : • Pneumonia Prediction Using Deep Learning • Data Mining Techniques in the Agricultural Sector • Disease Prediction and Performance Analysis using Data Analytics • Implementation of Cure Clustering Algorithm for Video Summarization and Healthcare Applications in Big Data • Analysis and Detection of Diabetes Using Data Mining Techniques—A Big Data Application in Health Care • Statistical Analysis and Prediction of Medical Data using Data Mining Techniques ensuring Data Confidentiality • Diagnosis of Cardiotocography for Analysis and Prediction of Treatment during Pregnancy

Profile of the Faculty

BRANCH: COMPUTER SCIENCE AND ENGINEERING

Name	USHASHREE P	
Designation	ASSISTANT PROFESSOR	
Department	**CSE**	
Date of Joining the Institution	2nd Nov 2015	
Date of Birth	10-11-1988	
Faculty Unique	1-2896919976	
Email Id	ushashree.sgs@nmit.ac.in	

Education Qualifications:

SL.No	Degree Obtained	Year of Obtaining the highest degree	Class/ Grade obtained
1	UG	2009	distinction
2	PG	2012	distinction

Total Work Experience in Years:

SL.No	Work Experience	Total in Years
1	Teaching	13
2	Research	

Area of Specialization:

Courses taught at	Undergraduate	1 High Performance computing 2 Formal LAnguages and automata Theory 3 Big Data Technologies

Research Guidance (Number of Students):UG students-2 team

No. of papers published: on going

SL.No	Type	Numbers
1	National	
2	International Journals	
3	Conferences	
4	Others	

Master (Completed (Year of Completion)/Ongoing):

Ph.D. (Completed Year of Completion)/Ongoing):

Projects Carried out :

Patents (Filed & Granted):

SL No	Topic	**Patent Application No**	Filed/ Granted
1	SMART WASTE MANAGEMENT	202241021353	FILED

Technology Transfer:

No. of Books published with details:

Profile of the Faculty

BRANCH: COMPUTER SCIENCE AND ENGINEERING

Name	Ms. Sharmila Shanthi Sequeira
Designation	Assistant Professor
Department	**CSE**
Date of Joining the Institution	2/5/2012
Date of Birth	19/08/1987
Faculty Unique	1-3227921756
Email Id	sharmila.sequeira@nmit.ac.in

Education Qualifications:

SL.No	Degree Obtained	Year of Obtaining the highest degree	Class/ Grade obtained
1	UG	2009	First Class
2	PG	2011	FCD
3	PhD	---	

Total Work Experience in Years:

SL.No	Work Experience	Total in Years
1	Teaching	11.7
2	Research	2
3	Industry	
4	Others	

Area of Specialization: Computer Networks Security, Cyber Security

Courses taught at	Undergraduate	1. Object Oriented Modeling Design 2. Data Communications 3. Computer Networks 4. Unix Shell Programming 5. Unix System Programming 6. Cloud Computing 7. Computer Concepts Programming 8. Cryptography and Network Security 9. Operating systems 10. Cyber Laws and Ethics Cyber Security

Research Guidance (Number of Students):UG students- 25

No. of papers published:

SL.No	Type	Numbers
1	National	-
2	International Journals	1
3	Conferences	4
4	Others	

Master (Completed (Year of Completion)/Ongoing): Completed (2011)

Ph.D. (Completed Year of Completion)/Ongoing):

Projects Carried out:

Patents (Filed & Granted):

SL No	Topic	**Patent Application No**	Filed/ Granted
1			
2			

Technology Transfer:

No. of Books published with details:

Profile of the Faculty

BRANCH: ELECTRONICS AND COMMUNICATION ENGINEERING

Name	Dr. P Ramesh Naidu	
Designation	Asst. Prof	
Department	**CSE**	
Date of Joining the Institution	01/01/2018	
Date of Birth	15/07/1981	
Faculty Unique	1-3623900915	
Email Id	ramesh.naidu@nmit.ac.in	

Education Qualifications:

SL.No	Degree Obtained	Year of Obtaining the highest degree	Class/ Grade obtained
1	UG	2005	First class
2	PG	2010	First class
3	PhD	2022	-

Total Work Experience in Years:

SL.No	Work Experience	Total in Years
1	Teaching	16.5
2	Research	6
3	Industry	1

Area of Specialization:

Courses taught at	Undergraduate	1 Java 2 Web Technologies 3 Data Structures 4. OPP with C++ 5. Cloud Computing

Research Guidance (Number of Students):UG students- 24

No. of papers published:

SL.No	Type	Numbers
1	National	3
2	International Journals	8
3	Conferences	13
4	Others	

Master (Completed (Year of Completion)/Ongoing): 2010
Ph.D. (Completed Year of Completion)/Ongoing): 2022
Projects Carried out: 01
Patents (Filed & Granted):

SL No	Topic	**Patent Application No**	Filed/ Granted
1	OPTIMIZATION OF MOTORCYCLE PITCH USING NONLINEAR CONTROLLER	202141002572	Published
2	DETECTION OF GLAUCOMA USING IMAGE PROCESSING	202141026746	Published
3	SMART HEALTH MONITORING SYSTEM ENABLED SMART GRID USING ML AND BIG DATA ANALYTICS	202221002405	Published
4	AUTOMATED SKIN DISEASES DETECTION USING MACHINE LEARNING APPROACH	202241045839	Published

Technology Transfer:
No. of Books published with details: 01

Profile of the Faculty

BRANCH:COMPUTER SCIENCE & ENGINEERING

Name	Sandhya B R	
Designation	Assistant Professor	
Department	**CSE**	
Date of Joining the Institution	02/09/2022	
Date of Birth	20/02/1985	
Faculty Unique	1-7385137998	
Email Id	sandhya.br@nmit.ac.in sandhyais.skitblr@gmail.com	

Education Qualifications:

SL.No	Degree Obtained	Year of Obtaining the highest degree	Class/ Grade obtained
1	UG	2006	First Class
2	PG	2012	First Class with distinction
3	PhD	---	---

Total Work Experience in Years:

SL.No	Work Experience	Total in Years
1	Teaching	9 years,10 Months
2	Research	
3	Industry	2 years,1Month

Courses taught at	Undergraduate	1. C programming Language 2. Data Mining 3. Introduction to Python Programming 4. Machine Learning 5. Discrete Mathematics 6. Design and Analysis of Algorithms 7. Software Engineering 8. Management Information Systems 9. User Interface Design 10. Software Testing

Research Guidance (Number of Students):UG students-

No. of papers published:

SL.No	Type	Numbers
1	National	4
2	International Journals	4
3	Conferences	7

Master (Completed (Year of Completion)/Ongoing): 2012

Ph.D. (Completed Year of Completion)/Ongoing): NA

Projects Carried out : NIL

Patents (Filed & Granted):NIL

SL No	Topic	**Patent Application No**	Filed/ Granted
1			
2			

Technology Transfer:
NIL

No. of Books published with details:
NIL

Profile of the Faculty
BRANCH: COMPUTER SCIENCE AND ENGINEERING

Name	JANARDHANA D R
Designation	ASSISTANT PROFESSOR
Department	**CSE**
Date of Joining the Institution	11-11-2021
Date of Birth	13-07-1984
Faculty Unique	1-2491129212
Email Id	janardhana.dr@nmit.ac.in

Education Qualifications:

SL.No	Degree Obtained	Year of Obtaining the highest degree	Class/ Grade obtained
1	UG	2006	First Class
2	PG	2009	First Class
3	PhD	---	--
5			

Total Work Experience in Years:

SL.No	Work Experience	Total in Years
1	Teaching	13 years 6 months
2	Research	

Area of Specialization: IoT Security, Network Security, Data Science

Courses taught at	Undergraduate	1.Computer Networks 2. Information Security 3. Mobile Application Development 4. Computer Organization 5. Cryptography and Network Security 6. Unix Shell Programming 7. Analog and Digital Electronics 8. Internet of Things 9. Microprocessor and Embedded Systems 10. Data Communication
	Post Graduate	1.Advanced Computer Networks

Research Guidance (Number of Students):UG students- 13 teams (Each team of 4 Members)

No. of papers published: 17

SL.No	Type	Numbers
1	National	1
2	International Journals	6
3	Conferences	8
4	Others	2

Master (Completed (Year of Completion)/Ongoing): 2009

Ph.D. (Completed Year of Completion)/Ongoing): Ongoing

Projects Carried out : Nil

Patents (Filed & Granted): Nil

SL No	Topic	**Patent Application No**	Filed/ Granted
1			
2			

Technology Transfer:

No. of Books published with details:

Profile of the Faculty

BRANCH: COMPUTER SCIENCE AND ENGINEERING

Name	S TRISHEELA	
Designation	Assistant Professor	
Department	**CSE**	
Date of Joining the Institution	13/12/2021	
Date of Birth	11/04/1980	
Faculty Unique	1-11313996702	
Email Id	trisheela.s@nmit.ac.in	

Education Qualifications:

SL.No	Degree Obtained	Year of Obtaining the highest degree	Class/ Grade obtained
1	UG	2005	First Class
2	PG	2013	First Class with Distinction
3	PhD	Pursuing	

Total Work Experience in Years:

SL.No	Work Experience	Total in Years
1	Teaching	11.8 Yrs
2	Research	02

Area of Specialization: Machine Learning, Software Engineering, Image Processing, Theory of Computation

Courses taught at	Undergraduate	1)Finite Automata and Formal Language 2)Compiler Design 3)Programming in C 4)Data Structure 5)Mobile Applications and Development 6)Introduction to Web Technology 7)Operating System
	Post Graduate	1) Internet of Things

Research Guidance (Number of Students):UG students- 6

No. of papers published:

SL.No	Type	Numbers
1	National	
2	International Journals	1
3	Conferences	4

Master (Completed (Year of Completion)/Ongoing): Completed

Ph.D. (Completed Year of Completion)/Ongoing): Ongoing

Projects Carried out: Transfer knowledge provides flexibility and self-learning opportunities to students in a remote setting in addition to optimized time, cost, and efforts for medical institutions to set up the physical simulation for practicing purposes is also achieved. and got a grant in various Competitions from KSCST with the funding of (11500/-), VTU (Best Project), College(Level(3500/-), and Srishti(3500/-).

Patents (Filed & Granted):

SL No	Topic	**Patent Application No**	Filed/ Granted
1	SYSTEM FOR STATISTIC STACK USAGE ANALYSIS TOOL	202241057589	Filed
2			

Technology Transfer: Guided Students on Virtual Reality

No. of Books published with details:

Profile of the Faculty

BRANCH: COMPUTER SCIENCE AND ENGINEERING

Name	JAYAHSREE
Designation	ASSISTANT PROFESSOR
Department	**CSE**
Date of Joining the Institution	02-02-2022
Date of Birth	08-06-1985
Faculty Unique	1-3551381983
Email Id	Jayashree.cse@nmit.ac.in

Education Qualifications:

SL.No	Degree Obtained	Year of Obtaining the highest degree	Class/ Grade obtained
1	UG	2007	I
2	PG	2010	I
3	PhD	---	---

Total Work Experience in Years:

SL.No	Work Experience	Total in Years
1	Teaching	8
2	Research	3
3	Industry	1

Area of Specialization:

Courses taught at	Undergraduate	1Information science and engineering
	Post Graduate	1 computer science and engineering

Research Guidance (Number of Students):UG students-

No. of papers published:

SL.No	Type	Numbers
1	National	
2	International Journals	4
3	Conferences	5
4	Others	

Master (Completed (Year of Completion)/Ongoing):

Ph.D. (Completed Year of Completion)/Ongoing):

Projects Carried out :

Patents (Filed & Granted):

SL No	Topic	**Patent Application No**	Filed/ Granted
1			
2			

Technology Transfer:

No. of Books published with details:

Profile of the Faculty

BRANCH:COMPUTER SCIENCE & ENGINEERING

Name	M K PUSHPANJALI	
Designation	Assistant Professor	
Department	**CSE**	
Date of Joining the Institution	6-10-2022	
Date of Birth	11-01-1993	
Faculty Unique	1-7379121682	
Email Id	Pushpanjali.mk@nmit.ac.in	

Education Qualifications:

SL.No	Degree Obtained	Year of Obtaining the highest degree	Class/ Grade obtained
1	UG	2015	
2	PG	2017	
3	PhD	---	

Total Work Experience in Years:

SL.No	Work Experience	Total in Years
1	Teaching	2 years 11months
2	Research	---

Area of Specialization:

Courses taught at	Undergraduate	1.cloud computing AWS 2.PSP 3.WEB 4.DBMS

Research Guidance (Number of Students):UG students-

No. of papers published:

SL.No	Type	Numbers
1	National	
2	International Journals	3
3	Conferences	
4	Others	

Master (Completed (Year of Completion)/Ongoing):

2017
Ph.D. (Completed Year of Completion)/Ongoing):
Projects Carried out :
Patents (Filed & Granted):

SL No	Topic	**Patent Application No**	Filed/ Granted
1			
2			

Technology Transfer:
No. of Books published with details:

Profile of the Faculty

BRANCH: COMPUTER SCIENCE AND ENGINEERING

Name	SHRUTHI SHETTY J
Designation	Assistant Professor
Department	**CSE**
Date of Joining the Institution	08-08-2022
Date of Birth	03-03-1991
Faculty Unique	1-10650275033
Email Id	shruthi.shetty@nmit.ac.in

Education Qualifications:

SL.No	Degree Obtained	Year of Obtaining the highest degree	Class/ Grade obtained
1	UG	2012	FCD
2	PG	2015	FCD
3	PhD	-	

Total Work Experience in Years:

SL.No	Work Experience	Total in Years
1	Teaching	8years
2	Research	-
3	Industry	-
4	others	-

Area of Specialization:

Courses taught at	Undergraduate	1. Data Structures with C++ 2. Object Oriented Programming with Java 3. Database Management Systems(DBMS) 4. Computer Organization(CO) 5. Software Engineering(SE) 6. Discrete Mathematical Structure(DMS) 7. Operation Research(OR) 8. Programming with C and Data Structures(PCD) 9. Object Oriented Programming Concepts(OOC)

		10. Automata theory and Computability(ATC) 11. Web Technology and its Applications(WTA)

Research Guidance (Number of Students):UG students-

No. of papers published:

SL.No	Type	Numbers
1	National	1
2	International Journals	0
3	Conferences	2
4	Others	

Master (Completed (Year of Completion)/Ongoing):

Ph.D. (Completed Year of Completion)/Ongoing):

Projects Carried out :Implementation of Security in Distributed Storage Systems.

Patents (Filed & Granted):

SL No	Topic	**Patent Application No**	Filed/ Granted
1			
2			

Technology Transfer:

No. of Books published with details:

Profile of the Faculty

BRANCH: COMPUTER SCIENCE & ENGINEERING

Name	Sowmya P
Designation	Assistant Professor
Department	**CSE**
Date of Joining the Institution	01/07/2022
Date of Birth	08/10/1987
Faculty Unique	1-9312875134
Email Id	sowmya.p@nmit.ac.in

Education Qualifications:

SL.No	Degree Obtained	Year of Obtaining the highest degree	Class/ Grade obtained
1	UG	2009	FCD
2	PG	2020	8.78 CGPI
3	PhD	---	

Total Work Experience in Years:

SL.No	Work Experience	Total in Years
1	Teaching	6
2	Research	
3	Industry	
4	others	

Area of Specialization:

Courses taught at	Undergraduate	1 OOP with Java 2 Introduction to Python 3 Introduction to C . .

Research Guidance (Number of Students):UG students-

No. of papers published: 3

SL.No	Type	Numbers
1	National	
2	International Journals	1
3	Conferences	2

Master (Completed (Year of Completion)/Ongoing): 2020

Ph.D. (Completed Year of Completion)/Ongoing): _

Projects Carried out :Detection of Fake and Clone Profiles in Online Social Networks

Patents (Filed & Granted):

SL No	Topic	**Patent Application No**	Filed/ Granted
1			
2			

Technology Transfer:

No. of Books published with details:

Profile of the Faculty

BRANCH: COMPUTER SCIENCE AND ENGINEERING

Name	Jayashankar Nelamane Srinivasa Rao	
Designation	Adjunct Faculty	
Department	**CSE**	
Date of Joining the Institution	04/11/2022	
Date of Birth	20/5/1970	
Faculty Unique		
Email Id	jayashankarns@gmail.com	

Education Qualifications:

SL.No	Degree Obtained	Year of Obtaining the highest degree	Class/ Grade obtained
1	UG	1992	First Class
2	PG	--	
3	PhD	---	
4	Others(Diploma in Computer Science and Engg)	1988	State 3rd Rank

Total Work Experience in Years:

SL.No	Work Experience	Total in Years
1	Teaching	
2	Research	
3	Industry	26
4	others	

Area of Specialization:

Courses taught at	Diploma/ Post Diploma	1. Micro processors 2. Programming
	Undergraduate	1. Networking 2. Antennas

Research Guidance (Number of Students):UG students-

No. of papers published:

SL.No	Type	Numbers
1	National	
2	International Journals	
3	Conferences	
4	Others	

Master (Completed (Year of Completion)/Ongoing):

Ph.D. (Completed Year of Completion)/Ongoing):

Projects Carried out :
1. CAP, MCDS, CMP, ODSC, OCIP, Jenkins
2. AOS Scalability
3. AOS Scalability
4. HP-CM-ESG
5.GSK ADS factory
6.Ness Intranet
7.Portal Release Engineering Management
8.Quality Assurance
9.Ulysses
10.Alcatel Test Automation

Patents (Filed & Granted):

SL No	Topic	**Patent Application No**	Filed/ Granted
1			
2			

Technology Transfer:

No. of Books published with details:

Profile of the Faculty

BRANCH: CIVIL ENGINEERING

Sl. No.	Name of the Full-time teacher	Designation	Nature of appointment (Against Sanctioned post, temporary, permanent)
1	Dr. Bharathi Ganesh	Prof. & Head	Permanent
2	Dr.Pranesh R.N	Prof.	Permanent
3	Dr.G Raghava	Prof.	Permanent
4	Mrs Prathima G	Assoc.Prof.	Permanent
5	Dr. Jairaj C	Assoc.Prof.	Permanent
6	Dr. Megha Kulkarni	Assoc.Prof.	Permanent
7	Mr. Muralidhar H	Asst. Prof.	Permanent
8	Mr.Umashankar Patil G H	Asst. Prof.	Permanent
9	Mrs. Shwetha.K.G	Asst. Prof.	Permanent
10	Mr.Shreyas.A.V	Asst Prof.	Permanent
11	Mrs.Shruthi.B.S	Asst. Prof.	Permanent
12	Mr. Mahesh Kumar C L	Asst. Prof.	Permanent
13	Mr. Vishwachethan S G	Asst. Prof.	Permanent
14	Mr. Manjunath L	Asst. Prof.	Permanent
15	Mrs. Bharti Prasad	Asst. Prof.	Permanent
16	Mrs.Sushmitha S	Asst. Prof.	Permanent
17	Mrs.Mrinal	Asst Prof.	Permanent
18	Mrs.Nanditha.V.K	Asst Prof.	Permanent
19	Mrs.Moulya.H.V	Asst Prof.	Permanent
20	Mrs.Gana.G.S	Asst Prof.	Permanent
21	Dr.Krishnamurthy	Asst Prof.	Permanent
22	Dr. P.V Mallikarjun	Asst Prof.	Permanent
23	Dr. Goutham Nair	Asst Prof.	Permanent
24	Dr.Shalini G	Assc.Prof.	Permanent

Profile of the Faculty

BRANCH: CIVIL ENGINEERING

Name	Dr.Bharathi Ganesh
Designation	Professor & Head
Department	**Civil Engineering**
Date of Joining the Institution	18th Dec. 2015
Date of Birth	28th Feb. 1967
Faculty Unique ID	1-2910984283
Email Id	Bharathi.ganesh@nmit.ac.in

Education Qualifications:

SL.No	Degree Obtained	Year of Obtaining the highest degree	Class/ Grade obtained
1	UG	1990	FC
2	PG	2007	FCD
3	PhD	2015	-
4	Others	Nil	-
5			

Total Work Experience in Years:

SL.No	Work Experience	Total in Years
1	Teaching	28
2	Research	2
3	Industry	2
4	others	-

Area of Specialization:

	Diploma/ Post Diploma	Taught almost all Courses of Diploma in Civil Engineering
		Taught almost all Courses of UG- Civil Engineering and PG- Structural

Courses taught at	Undergraduate	Engineering including laboratory Courses
	Postgraduate	Taught almost all Courses of UG-Civil Engineering and PG- Structural Engineering including laboratory courses
	Post Graduate Diploma Level	Nil – I was not a part of any PGD

Research Guidance (Number of Students):UG students –

- ✓ Guided 62 projects of UG with each batch of 4 students
- ✓ Guided 43 Projects Work of PG – Individual/Independent project

No. of papers published:

SL. No	Type	Numbers
1	National	04
2	International Journals	06
3	Conferences	39
4	Others	14

Master (Completed (Year of Completion)/Ongoing): 2007

Ph.D. (Completed Year of Completion)/Ongoing): 2015

Projects Carried out:
4 KSCST Projects
Applied for projects applied to DST / VGST and FIST – 4 numbers each worth Rs.20 lacs
Applied for MODROBS – Rs. 20 lacs

Patents (Filed & Granted):

SL No	Topic	**Patent Application No**	Filed/ Granted
1	A PROCESS OF ASSESSMENT OF STRENGTHS OF CONCRETE WITH C AND D WASTES AS INGREDIENTS	202241031596	Filed on 02/06/2022 14:24:16
2	INTELLIGENT SOLAR PHOTOVOLTAIC POWER PLANT	202241032747	Filed on 08/06/2022 16:01:40

Technology Transfer: Nil

No. of Books published with details: Nil

No. of Lecture Notes & Book Chapters published – 02 and 02

Profile of the Faculty

Name	G. Raghava	
Designation	Professor	
Department	**CIVIL**	
Date of Joining the Institution	10th July 2019	
Date of Birth	20th July 1957	
Faculty Unique	1-7419656111	
Email Id	raghava.g@nmit.ac.in	

Education Qualifications:

SL. No.	Degree Obtained	Year of Obtaining the highest degree	Class/ Grade obtained
1	UG – B.E. Civil Engineering	1980	First Class with Distinction
2	PG – M.Tech. Industrial Structures	1984	First Class with Distinction
3	PhD – Civil Engineering	1999	Not applicable; degree awarded based on research
4	Others		
5			

Total Work Experience in Years:

SL. No.	Work Experience	Total in Years
1	Teaching	4
2	Research	34
3	Industry	Nil
4	others	Nil

Area of Specialization: Fatigue and fracture in structures and structural components; Corrosion fatigue; Experimental investigations on large size structural components;

Courses taught at	Diploma/ Post Diploma	
	Undergraduate	1. Design and Drawing of Steel Structures 2. Disaster Management and Mitigation Engineering
	Post Graduate	
	Post Graduate Diploma Level	

Research Guidance (Number of Students): UG students -
PG students - 21

No. of papers published:

SL. No.	Type	Numbers
1	National	14
2	International Journals	36
3	Conferences	115
4	Others	28

Master (Completed (Year of Completion)/Ongoing): Completed (1984)

Ph.D. (Completed Year of Completion)/Ongoing): Completed (1999)

Projects Carried out: During my service at CSIR-SERC as a scientist, I have carried out many projects for government and private organisations, public and private sector agencies. It was a service of 34 years and the list of projects is long.

Patents (Filed & Granted): Nil

SL No	Topic	**Patent Application No**	Filed/ Granted
1			
2			

Technology Transfer: Nil

No. of Books published with details:
Editor of three books

1. Ramachandra Murthy, D.S. and Raghava, G. (editors), Fatigue and Fracture Behaviour of Components and Structures, Allied Publishers Private Limited, Chennai, February 2003.
2. Raghava, G. and Gandhi, P. (editors), Advanced Course on Fatigue and Fracture Behaviour of Materials, Components and Structures (ACFF'09), Structural Engineering Research Centre, Chennai, Sigma Publications, Chennai, February 2009.
3. G. Raghava, G., Shamsher Bahadur Singh, and Sajith, A. S. (Ed.), "Recent Advances in Civil Engineering", Select Proceedings of ERCAM 2021, Lecture Notes in Civil Engineering, Volume 265, Springer Nature Singapore Pte Ltd., July 2022, https://doi.org/10.1007/978-981-19-2836-9.

Profile of the Faculty

Name	Dr NAGENDRA V	
Designation	ADJUNCT PROFESSOR	
Department	**CIVIL**	
Date of Joining the Institution	25-08-2022	
Date of Birth	13-06-1961	
Faculty Unique		
Email Id	nagendra.v@nmit.ac.in	

Education Qualifications:

SL.No	Degree Obtained	Year of Obtaining the highest degree	Class/ Grade obtained
1	UG	1984	1st class
2	PG	1990	1st class
3	PhD	2018	----
4	Others		
5			

Total Work Experience in Years:

SL.No	Work Experience	Total in Years
1	Teaching	35
2	Research	10
3	Industry	Nil
4	others	Nil

Area of Specialization: Structures-Concrete

Courses taught at	Diploma/ Post Diploma	
	Undergraduate	1 SOM 2 RCC 3STEEL STRUCTURES
	Post Graduate	1ADVANCE RCC 2 ADVANCE CONCRETE TECHNOLOGY

	Post Graduate Diploma Level	

Research Guidance (Number of Students):UG students-

No. of papers published: 08

SL.No	Type	Numbers
1	National	
2	International Journals	08
3	Conferences	01
4	Others	

Master (Completed (Year of Completion)/Ongoing): 1990

Ph.D. (Completed Year of Completion)/Ongoing): 2018

Projects Carried out :

Patents (Filed & Granted):Nil

SL No	Topic	**Patent Application No**	Filed/ Granted
1	---	---	
2			

Technology Transfer:

No. of Books published with details: Nill

Profile of the Faculty

Name	Dr.Megha Kulkarni	
Designation	Associate Professor	
Department	**CIVIL**	
Date of Joining the Institution	04.09.2021	
Date of Birth	23.01.1979	
Faculty Unique	1-10563051451	
Email Id	megha.nk@nmit.ac.in	

Education Qualifications:

SL.No	Degree Obtained	Year of Obtaining the highest degree	Class/ Grade obtained
1	UG	2001	FC
2	PG	2007	FCD
3	PhD	2017	NA
4	Others		
5			

Total Work Experience in Years:

SL.No	Work Experience	Total in Years
1	Teaching	19
2	Research	10
3	Industry	04
4	others	

Area of Specialization:

Courses taught at	Diploma/ Post Diploma	
	Undergraduate	1.Water Treatment Technology 2. Waste water treatment and management 3.Solid waste management 4. Rural water supply and sanitation 5.Industrial waste water treatment 6.Environmental impact assessment 7.Air pollution and control

		8.Fluid Mechanics 9.Irrigation engineering & Hydraulic structures 10.Hydraulics & hydraulic machines 11.Elements of civil engineering& engineering mechanics 12.Transportation engineering
	Post Graduate	1. Green Building
	Post Graduate Diploma Level	1 2 3

Research Guidance (Number of Students):UG students-125

No. of papers published:

SL.No	Type	Numbers
1	National	2
2	International Journals	5
3	Conferences	7
4	Others	

Master (Completed (Year of Completion)/Ongoing):01-2017

Ph.D. (Completed Year of Completion)/Ongoing): 2

Projects Carried out :

Patents (Filed & Granted):01

SL No	Topic	**Patent Application No**	Filed/ Granted
1	Alternative sustainable material developed utilizing generated waste for diverse applications	2022103114122300EN	Granted
2			

Technology Transfer:

No. of Books published with details:

Profile of the Faculty

Name	Dr.G.Shalini	
Designation	Associate Professor	
Department	**CIVIL**	
Date of Joining the Institution	25-01-2022	
Date of Birth	09-07-1977	
Faculty Unique	1-433756759	
Email Id	Shalini.g@nmit.ac.in	

Education Qualifications:

SL.No	Degree Obtained	Year of Obtaining the highest degree	Class/ Grade obtained
1	UG	(2000) Bachelor of Science, Physics, Mathematics, Geology from Kuvempu University (KU)	2nd classs
2	PG	**(2002)Master of Science**, *Applied Geology,Kuvempu University (**KU**)*	1st classs
3	PhD	(2008) Satellite Based study of sediment transport along the coast of Uttara Kannada District, Karnataka,*under the guidance of **Prof. V. S.Hegde***, Visvesvaraya Technological University ***(VTU)****.*	
4	Others		
5			

Total Work Experience in Years:

SL.No	Work Experience	Total in Years
1	Teaching	15

2	Research	19
3	Industry	nil
4	others	nil

Area of Specialization:

Courses taught at	Diploma/ Post Diploma	
	Undergraduate	1. Applied Engineering Geology, 2. Water Resource Management 3. Material of construction, 4. Environmental Sciences, 5. Photogrammetry and Remote sensing, 6. Geographic Information System (GIS) 7. Ground water Hydraulics **Laboratory courses Handled** 1. Engineering Geology Laboratory 2. Surveying Practice
	Post Graduate	
	Post Graduate Diploma Level	

Research Guidance (Number of Students):UG students-
Coastal related studies – 15 batches
Water resources related 12 batches
Environmental & other- 6 batches
Total = 33

No. of papers published:

SL.No	Type	Numbers
1	National	05
2	International Journals	13
3	Conferences	12
4	Others	01 (Book Chapter)

Master (Completed(Year of Completion)/Ongoing): 2002

Ph.D. (Completed Year of Completion)/Ongoing): 2008

Projects Carried out : 06 (01 ongoing)

Patents (Filed & Granted):

SL No	Topic	**Patent Application No**	Filed/ Granted
1			
2			

Technology Transfer:

No. of Books published with details:

Profile of the Faculty

Name	Prathima G	
Designation	Associate Professor	
Department	**CIVIL**	
Date of Joining the Institution	20/07/2011	
Date of Birth	06/06/1976	
Faculty Unique	1-721887639	
Email Id	Prathima.g@nmit.ac.in	

Education Qualifications:

SL.No	Degree Obtained	Year of Obtaining the highest degree	Class/ Grade obtained
1	UG	1999	First Class with Distinction
2	PG	2011	First Class with Distinction
3	PhD	(2022)	(pursing)
4	Others		
5			

Total Work Experience in Years:

SL.No	Work Experience	Total in Years
1	Teaching	12 Years
2	Research	06 Years
3	Industry	08 Years
4	others	

Area of Specialization:

Courses taught at	Diploma/ Post Diploma	
	Undergraduate	1. Engineering Mechanics 2. Highway Engineering 3. Railway and Airport Engineering 4. Quantity Surveying and Estimation
	Post Graduate	
	Post Graduate Diploma Level	

Research Guidance (Number of Students):UG students- 04 students / batch /year

No. of papers published:

SL.No	Type	Numbers
1	National	
2	International Journals	02
3	Conferences	06
4	Others	

Master (Completed (Year of Completion)/Ongoing): Yes, 2011

Ph.D. (Completed Year of Completion)/Ongoing): Ongoing - 2022

Projects Carried out: On Concrete and Concrete Pavements

Patents (Filed & Granted): Nil

SL No	Topic	**Patent Application No**	Filed/ Granted
1	Nil	--	--
2			

Technology Transfer: -

No. of Books published with details: Nil

Profile of the Faculty

Name	Muralidhara H	
Designation	Assistant Professor	
Department	**CIVIL**	
Date of Joining the Institution	16/02/2012	
Date of Birth	21/01/1984	
Faculty Unique	1-1481088479	
Email Id	muralidhar.h@nmit.ac.in	

Education Qualifications:

SL.No	Degree Obtained	Year of Obtaining the highest degree	Class/ Grade obtained
1	UG	2008	FCD
2	PG	2011	FCD
3	PhD	Pursuing	
4	Others		
5			

Total Work Experience in Years:

SL.No	Work Experience	Total in Years
1	Teaching	12
2	Research	2
3	Industry	2
4	others	Nil

Area of Specialization:

Courses taught at	Diploma/ Post Diploma	
	Undergraduate	1 Highway Engineering 2 Pavement Design 3 Traffic Engineering 4 Quantity Surveying and Estimation 5 Fundamentals of Surveying 6 Advanced Surveying 7 Building materials of Construction

		8 Engineering Mechanics 9 Air Pollution and Control 10 Railway and Airport Engineering
	Post Graduate	
	Post Graduate Diploma Level	

Research Guidance (Number of Students):UG students-

No. of papers published:

SL.No	Type	Numbers
1	National	NIL
2	International Journals	NIL
3	Conferences	3
4	Others	NIL

Master (Completed (Year of Completion)/Ongoing): 2011

Ph.D. (Completed Year of Completion)/Ongoing): Perusing Registered in 2021 @ NITK Surthkal

Projects Carried out :

1. **Black Spot Study In Ramanagar Dist – PRAMCI**
2. **Traffic Inventory Study -**
3. **Traffic Congestion Study – Traffic Dept**

Patents (Filed & Granted):

SL No	Topic	**Patent Application No**	Filed/ Granted
1			
2			

Technology Transfer:

No. of Books published with details: NIl

Profile of the Faculty

Name	Shwetha K G	
Designation	Assistant Professor	
Department	**CIVIL ENGINEERING**	
Date of Joining the Institution	11.08.2014	
Date of Birth	02.10.1989	
Faculty Unique	1-2380776423	
Email Id	shwetha.kg@nmit.ac.in	

Education Qualifications:

SL.No	Degree Obtained	Year of Obtaining the highest degree	Class/ Grade obtained
1	UG	2011	FCD
2	PG	2013	FCD
3	PhD	Pursuing	-
4	Others		
5			

Total Work Experience in Years: 9.5Years

SL.No	Work Experience	Total in Years
1	Teaching	**9.5Years**
2	Research	**Nil**
3	Industry	Nil
4	others	

Area of Specialization: CAD Structures

Courses taught at	Diploma/ Post Diploma	
	Undergraduate	1. Engineering Mechanics 2. Alternative Building Materials and Technologies 3. Structural Analysis-I 4. Structural Analysis-II 5. Building Materials and Construction 6. Building planning and drawing

<table>
<tr><td rowspan="3"></td><td></td><td>7. Entrepreneurship and IPR
8. Theory of masonry structures.</td></tr>
<tr><td>Post Graduate</td><td>1. Project Guidance.</td></tr>
<tr><td>Post Graduate Diploma Level</td><td>1. Nil</td></tr>
</table>

Research Guidance (Number of Students):UG students- 35 (9 Batch)

No. of papers published:

SL.No	Type	Numbers
1	National	1
2	International Journals	15
3	Conferences	22
4	Others (Book Chapters)	6

Master (Completed (Year of Completion)/Ongoing): 2013

Ph.D. (Completed Year of Completion)/Ongoing): Ongoing

Projects Carried out :1 at KSCST

Project Reference No : 42S_BE_2198

Project Title : Effect of Super Plasticizer and Copper Ore Tailings On Strength And Workability Characteristics of Recycled Aggregate Geopolymer Concrete

Name of the Co-Guide : Mrs.Shwetha K G

Total (In Rs.) :8000rs

Patents (Filed & Granted): Nil

SL No	Topic	**Patent Application No**	Filed/ Granted
1	Nil		

Technology Transfer: Nil

No. of Books published with details: Nil

Profile of the Faculty

Name	SHRUTHI B S	
Designation	ASSISTANT PROFESSOR	
Department	**CV**	
Date of Joining the Institution	8-8-2015	
Date of Birth	26-10-1986	
Faculty Unique	1-2908274128	
Email Id	shruthi.bs@nmit.ac.in	

Education Qualifications:

SL.No	Degree Obtained	Year of Obtaining the highest degree	Class/ Grade obtained
1	UG	2009	FCD
2	PG	2012	FCD
3	PhD	2022-	
4	Others		
5			

Total Work Experience in Years:

SL.No	Work Experience	Total in Years
1	Teaching	9
2	Research	-
3	Industry	2
4	others	

Area of Specialization:

Courses taught at	Diploma/ Post Diploma	
	Undergraduate	concrete technology, Engineering Mechanics, transportation Engineering, building material
	Postgraduate	Advanced concrete technology, design and drawing of bridges
	Post Graduate Diploma Level	

Research Guidance (Number of Students):UG students- 20

No. of papers published:

SL.No	Type	Numbers
1	National	-
2	International Journals	-
3	Conferences	1
4	Others	

Master (Completed (Year of Completion)/Ongoing): Completed 2012

Ph.D. (Completed Year of Completion)/Ongoing): Ongoing

Projects Carried out :

Patents (Filed & Granted):-

SL No	Topic	**Patent Application No**	Filed/ Granted
1			
2			

Technology Transfer:

No. of Books published with details:

Profile of the Faculty

Name	Mahesh Kumar C L	
Designation	Assistant Professor	
Department	**CIVIL ENGINEERING**	
Date of Joining the Institution	01.08.2016	
Date of Birth	21.06.1989	
Faculty Unique	1-3186136720	
Email Id	maheshkumar.cl@nmit.ac.in	

Education Qualifications:

SL.No	Degree Obtained	Year of Obtaining the highest degree	Class/ Grade obtained
1	UG	2011	FCD
2	PG	2013	FCD
3	PhD	Pursuing	-
4	Others		
5			

Total Work Experience in Years: 9.5Years

SL.No	Work Experience	Total in Years
1	Teaching	**9.5Years**
2	Research	**Nil**
3	Industry	Nil
4	others	

Area of Specialization: CAD Structures

Courses taught at	Diploma/ Post Diploma	
	Undergraduate	9. Engineering Mechanics 10. Precast & Prefabricated Structures. 11. Construction resources planning and management 12. Structural Analysis-II 13. Design and Drawing of RC Bridges.

		14. Building Materials and Construction 15. Alternative Building Materials and Technologies 16. Building planning and drawing
	Post Graduate	1. Project Guidance.
	Post Graduate Diploma Level	1. Nil

Research Guidance (Number of Students):UG students- 43 (11 Batch)

No. of papers published:

SL.No	Type	Numbers
1	National	1
2	International Journals	16
3	Conferences	26
4	Others (Book Chapters)	12

Master (Completed (Year of Completion)/Ongoing): 2013

Ph.D. (Completed Year of Completion)/Ongoing): Ongoing

Projects Carried out :1 at KSCST
Project Reference No : 42S_BE_2198
Project Title : Effect of Super Plasticizer and Copper Ore Tailings On Strength And Workability Characteristics of Recycled Aggregate Geopolymer Concrete
Name of the Guide : Mr. Mahesh Kumar C L
Name of the Co-Guide : Mrs.Shwetha K G
Total (In Rs.) :8000rs

Patents (Filed & Granted): Nil

SL No	Topic	**Patent Application No**	Filed/ Granted
1			
2			

Technology Transfer: Nil

No. of Books published with details: Nil

Profile of the Faculty

Name	Mr Vishwachetan S G	
Designation	Assistant Professor	
Department	**CIVIL**	
Date of Joining the Institution	13 07 2017	
Date of Birth	31 07 1991	
Faculty Unique	1-9324060768	
Email Id	Vishwa.chetan@nmit.ac.in	

Education Qualifications:

SL.No	Degree Obtained	Year of Obtaining the highest degree	Class/ Grade obtained
1	UG	2013	FCD
2	PG	2015	FCD
3	PhD		
4	Others		
5			

Total Work Experience in Years:

SL.No	Work Experience	Total in Years
1	Teaching	7.6
2	Research	
3	Industry	2.0
4	others	

Area of Specialization: Geotechnical Engineering

Courses taught at	Diploma/ Post Diploma	
	Undergraduate	1 Geotechnical Engineering -I 2 Geotechnical Engineering – II 3 Ground Improvement Technique 4 Transportation Engineering II 5 Reinforced Earth Structure 6 Concrete Technology 7 Surveying Theory I

	Post Graduate	1 Design Concept of sub structure
	Post Graduate Diploma Level	

Research Guidance (Number of Students):UG students- 15 batch (60students)

No. of papers published: NIL

SL.No	Type	Numbers
1	National	
2	International Journals	
3	Conferences	
4	Others	

Master (Completed(Year of Completion)/Ongoing):

Ph.D. (Completed Year of Completion)/Ongoing):

Projects Carried out :

Patents (Filed & Granted):

SL No	Topic	**Patent Application No**	Filed/ Granted
1			
2			

Technology Transfer:

No. of Books published with details:NIL

Profile of the Faculty

<table>
<tr><td>Name</td><td>Bharti Prasad</td><td rowspan="6"></td></tr>
<tr><td>Designation</td><td>Assistant Professor</td></tr>
<tr><td>Department</td><td>CIVIL</td></tr>
<tr><td>Date of Joining the Institution</td><td>07.08.2017</td></tr>
<tr><td>Date of Birth</td><td>06.02.1986</td></tr>
<tr><td>Faculty Unique</td><td>1-3577741596</td></tr>
<tr><td>Email Id</td><td>bharti.prasad@nmit.ac.in</td><td></td></tr>
</table>

Education Qualifications:

SL.No	Degree Obtained	Year of Obtaining the highest degree	Class/ Grade obtained
1	UG	2008	1st
2	PG	2012	1st
3	PhD		
4	Others		
5			

Total Work Experience in Years:

SL.No	Work Experience	Total in Years
1	Teaching	6
2	Research	0.5
3	Industry	2.5
4	others	

Area of Specialization:

<table>
<tr><td rowspan="2">Courses taught at</td><td>Diploma/ Post Diploma</td><td>NA</td></tr>
<tr><td>Undergraduate</td><td>1. Fluid Mechanics
2. Hydraulics and Hydraulic Machines
3. Engineering Mechanics
4. Geotechnical Engineering, I
5. Geotechnical Engineering II</td></tr>
</table>

		6. Irrigation and Hydraulic Structures 7. Rural Water Supply and Sanitation
	Post Graduate	NA
	Post Graduate Diploma Level	NA

Research Guidance (Number of Students):UG students-36

No. of papers published: 02

SL.No	Type	Numbers
1	National	01
2	International Journals	
3	Conferences	01
4	Others	

Master (Completed (Year of Completion)/Ongoing):

Ph.D. (Completed Year of Completion)/Ongoing): 2021

Projects Carried out:

"DESIGN OF SEDIMENT FILTER FOR TAP WATER" funded by Karnataka State Council for Science and Technology

Patents (Filed & Granted): NA

SL No	Topic	**Patent Application No**	Filed/ Granted
1			

Technology Transfer: NA

No. of Books published with details: NA

Profile of the Faculty

Name	Manjunatha L	
Designation	Assistant Professor	
Department	**CIVIL**	
Date of Joining the Institution	04/10/2017	
Date of Birth	05/06/1985	
Faculty Unique	1-3556352794	
Email Id	manjunath.l@nmit.ac.in	

Education Qualifications:

SL.No	Degree Obtained	Year of Obtaining the highest degree	Class/ Grade obtained
1	UG	2007	FCD
2	PG	2009	FCD
3	PhD	Submitted the thesis	Submitted the thesis
4	Others		
5			

Total Work Experience in Years:

SL.No	Work Experience	Total in Years
1	Teaching	13
2	Research	
3	Industry	
4	others	

Area of Specialization: Structural Engineering

Courses taught at	Diploma/ Post Diploma	1
	Undergraduate	1. Strength of Materials 2. Structural Analysis -1 3. Structural Analysis -2 4. Design of RC structures 5. Design of PSC Structures 6. Design of Steel Structures 7. Building Planning and Drawing 8. Advanced RCC

		9. Matrix and FEM Analysis 10. Engineering Mechanics 11. Fluid Mechanics 12. Hydraulics and Hydraulic machinery
	Post Graduate	1. Advanced Design of Steel Structures 2. Advanced PSC Structures 3. Design of Tall Structures 4. Structural Dynamics and Earthquake Engineering
	Post Graduate Diploma Level	

Research Guidance (Number of Students):UG students- 32 Students
PG Students-21

No. of papers published:

SL.No	Type	Numbers
1	National	2
2	International Journals	8
3	Conferences	2
4	Others	

Master (Completed (Year of Completion)/Ongoing): Completed (2009)

Ph.D. (Completed (Year of Completion)/Ongoing): Ongoing (submitted June-2022)

Projects Carried out: Strengthening of Columns using Precast Segments and FRP Wrapping
Strengthening of Beams Using Precast Segments and FRP Wrapping
Strengthening of Steel Sections using FRP wrapping
Strengthening of composite slabs using FRP wrapping
Strengthening of Masonry Arch using FRCM
Development of IOS application of Design of composite Slabs, Hollow core Slab, Retrofitting of Columns, Retrofitting of Beams **,**
Strengthening of Infilled frames using FRP Wrapping.

Patents (Filed & Granted):

SL No	Topic	**Patent Application No**	Filed/ Granted
1	Online Class Magic Box	**202041055101**	Published Awaiting Request for Examination

Technology Transfer:

No. of Books published with details:

1-Co-Author for "Elements of Civil Engineering and Engineering Mechanics" – Published in 2010

3 Book chapters in Lecture Notes in Civil Engineering Volume 265

Recent Advances in Civil Engineering- eBook ISBN, 978-981-19-2836-9, Print ISBN 978-981-19-2835-2

1. Effect of CFRP Anchors in Strengthening of RC Beams Using Precast RC Segmen Followed by CFRP Wrapping , Md. Samiuddin, L. Manjunatha, H. Sharada Bai, H. Yashaswini, and R. K. Veeresh Kumar
2. Finite Element Analysis of Shape Modified Compression Members Wrapped with CFRP, L. Manjunatha, A. R. Raghuveer, B. V. Sachin, and H. Sharada Bai
3. Behaviour of RC Compressive Members Retrofitted with Micro-concrete and CFRP Wrapping, Krishna Bahadur Paija Pun, Bharathi Ganesh, L. Manjunatha, K. J. Chandrika, C. Pavan Kumar, and H. Sharada Bai

Profile of the Faculty

Name	Sushmitha	
Designation	Assistant Professor	
Department	**CIVIL**	
Date of Joining the Institution	01/08/2018	
Date of Birth	13/07/1994	
Faculty Unique	1-4367345293	
Email Id	sushmitha.s@nmit.ac.in	

Education Qualifications:

SL.No	Degree Obtained	Year of Obtaining the highest degree	Class/ Grade obtained
1	UG	2016	FCD
2	PG	2018	FCD
3	PhD	NA	
4	Others	NA	
5			

Total Work Experience in Years:

SL.No	Work Experience	Total in Years
1	Teaching	4 years 4 months
2	Research	NIL
3	Industry	NIL
4	others	NIL

Area of Specialization: Structural Engineering

Courses taught at	Diploma/ Post Diploma	
	Undergraduate	1. Engineering Mechanics 2. Water Supply Engineering 3. Environmental Engineering 1 4. Environmental Engineering 2 5. Design and drawing of RC Structural Elements

		6. Disaster management and mitigation engineering 7. Elements of Civil Engineering and Engineering Mechanics 8. Design of Pre-stressed Concrete Structures.
	Post Graduate	
	Post Graduate Diploma Level	

Research Guidance (Number of Students) : UG students - 24

No. of papers published:

SL.No	Type	Numbers
1	National	
2	International Journals	
3	Conferences	1
4	Others	

Master (Completed (Year of Completion)/Ongoing) : 2021

Ph.D. (Completed Year of Completion)/Ongoing): NIL

Projects Carried out :

Patents (Filed & Granted):

SL No	Topic	**Patent Application No**	Filed/ Granted
1			
2			

Technology Transfer:

No. of Books published with details:

Profile of the Faculty

Name	MRINAL	
Designation	Assistant Professor	
Department	**CIVIL**	
Date of Joining the Institution	01-07-2019	
Date of Birth	27-08-1995	
Faculty Unique	1-7419538840	
Email Id	mrinal.bhandary@nmit.ac.in	

Education Qualifications:

SL.No	Degree Obtained	Year of Obtaining the highest degree	Class/ Grade obtained
1	UG	2017	FCD
2	PG	2019	FCD
3	PhD	Pursuing	
4	Others		
5			

Total Work Experience in Years: 3.6 years

SL.No	Work Experience	Total in Years
1	Teaching	3.6 years
2	Research	-
3	Industry	-
4	others	-

Area of Specialization: Environmental Engineering

Courses taught at	Diploma/ Post Diploma	
	Undergraduate	1. Environmental Engineering-II 2. Green Technology 3. Environmental Engineering Laboratory 4. Air and Noise Pollution and Control Engineering 5. Industrial Waste Water Treatment

		6. Hydraulics & Hydraulic Machines Laboratory 7. Water Supply Engineering 8. Engineering Mechanics 9. Strength of Materials Laboratory 10. Advanced Surveying 11. Environmental and Sustainable Engineering 12. Elements of Civil Engineering & Mechanics 13. Wastewater Treatment & Sanitary Engineering
	Post Graduate	
	Post Graduate Diploma Level	

Research Guidance (Number of Students):UG students- 15 students (4 batches in which 2 are ongoing)

No. of papers published:

SL.No	Type	Numbers
1	National	-
2	International Journals	-
3	Conferences	-
4	Others	-

Master (Completed (Year of Completion)/Ongoing): -

Ph.D. (Completed Year of Completion)/Ongoing): -

Projects Carried out :

Patents (Filed & Granted):

SL No	Topic	**Patent Application No**	Filed/ Granted
1	-		
2	-		

Technology Transfer:

No. of Books published with details:

Profile of the Faculty

Name	Nanditha Vinod Kumar	
Designation	Assistant Professor	
Department	**CIVIL**	
Date of Joining the Institution	01/08/2019	
Date of Birth	30/04/1991	
Faculty Unique	1-7419127516	
Email Id	nanditha.vinod@nmit.ac.in	

Education Qualifications:

SL.No	Degree Obtained	Year of Obtaining the highest degree	Class/ Grade obtained
1	UG	2014	First class with Distinction
2	PG	2018	First class with Distinction
3	PhD		
4	Others		
5			

Total Work Experience in Years:

SL.No	Work Experience	Total in Years
1	Teaching	6
2	Research	
3	Industry	
4	others	

Area of Specialization:

Courses taught at	Diploma/ Post Diploma	
	Undergraduate	1. Structural Analysis I 2. Highway Engineering 3. Elements of Civil Engineering and Mechanics 4. Railway Engineering 5. Fundamentals of Surveying 6. Advanced Surveying

		7. Construction Equipment and Technology 8. Alternative Building Materials and Technology 9. Surveying I 10. Surveying II 11.Ground Improvement Technology 12.Transportation I 13. Transportation II 14. Construction Technology
	Post Graduate	1. Advanced Prestressed Concrete Structures
	Post Graduate Diploma Level	

Research Guidance (Number of Students):UG students- 4

No. of papers published:

SL.No	Type	Numbers
1	National	-
2	International Journals	-
3	Conferences	-
4	Others	-

Master (Completed (Year of Completion)/Ongoing): -

Ph.D. (Completed Year of Completion)/Ongoing): -

Projects Carried out :

Patents (Filed & Granted):

SL No	Topic	**Patent Application No**	Filed/ Granted
1			
2			

Technology Transfer: -

No. of Books published with details: -

Profile of the Faculty

Name	Mrs. Moulya H.V
Designation	Assistant Professor
Department	CIVIL
Date of Joining the Institution	04-09-2019
Date of Birth	25-01-1990
Faculty Unique	1-7419538708
Email Id	moulya.hv@nmit.ac.in

Education Qualifications:

SL.No	Degree Obtained	Year of Obtaining the highest degree	Class/ Grade obtained
1	UG	2013	75%
2	PG	2016	91%
3	PhD	Applied on July 2017	Pursuing (Course Completed)
4	Diploma	2010	70%
5			

Total Work Experience in Years:

SL.No	Work Experience	Total in Years
1	Teaching	6 Year
2	Research	5 Year
3	Industry	1 Year
4	others	

Area of Specialization:
Construction Technology, Geopolymer concrete, Primavera, Concrete Technology

Courses taught at	Diploma/ Post Diploma	1 2 3
	Undergraduate	1. Building Material and Construction 2. Construction Equipment and Technology 3. Quantity Estimation 4. Transportation Engineering 5. Town Planning 6. Construction Resource Planning and Management 7. Construction Finance and Planning Management 8. Advanced Concrete Technology 9. Entrepreneurship Development and IPR 10. Extensive Survey

<table>
<tr><td rowspan="3"></td><td></td><td>11. Concrete and Highway Laboratory
12. Building Material Testing Laboratory
13. Strength of Material Laboratory
14. Hydraulic and Hydraulics Laboratory
15. Primavera Laboratory
16. CADD Laboratory</td></tr>
<tr><td>Post Graduate</td><td>Nil</td></tr>
<tr><td>Post Graduate Diploma Level</td><td>Nil</td></tr>
<tr><td colspan="3">Research Guidance (Number of Students):UG students-10 Batch=40students</td></tr>
<tr><td colspan="3">No. of papers published:</td></tr>
</table>

SL.No	Type	Numbers
1	National	1
2	International Journals	
3	Conferences	2
4	Others	

Master (Completed (Year of Completion)/Ongoing): 2016

Ph.D. (Completed Year of Completion)/Ongoing): Ongoing

Projects Carried out :

Patents (Filed & Granted):

SL No	Topic	**Patent Application No**	Filed/ Granted
1	Nil		
2	Nil		

Technology Transfer:

No. of Books published with details: Nil

Profile of the Faculty

Name	Gautam Sreekumaran Nair	
Designation	Assistant Professor	
Department	**CIVIL**	
Date of Joining the Institution	06/09/2021	
Date of Birth	13/11/1990	
Faculty Unique		
Email ID	gs.nair@nmit.ac.in	

Education Qualifications:

Sl. No.	Degree obtained	Year of obtaining the highest degree	Class/Grade obtained
1	UG (B.E. Civil Engg.)	2012	First Class
2	PG (M.Tech. Civil Engg.)	2015	First Class
3	PhD	2015 - Ongoing	-
4	Others		

Total Work Experience in Years:

Sl. No.	Work Experience	Total in Years
1	Teaching	1 year 3 months
2	Research	6 years 4 months
3	Industry	-
4	Others	-

Area of Specialization: Seismic soil – pipeline interaction; Geotechnical earthquake engineering; Soil – structure interaction; Numerical modeling using FEM

Courses taught at	Diploma/ Post Diploma	
	Undergraduate	1 - Elements of Civil Engineering and Engineering Mechanics 2 – Dynamics of Structures and Earthquake Engineering 3 – Strength of Materials
	Post Graduate	1 – Design of Tall Structures 2 – Restoration and Rehabilitation of Structures
	Post Graduate Diploma Level	

Research Guidance (Number of Students): 0 (UG); 6 (PG – 3 completed; 3 ongoing)

No. of papers published: 07

Sl. No.	Type	Numbers
1	National	-
2	International journals	03 (2 in ASCE; 1 in ASME)
3	Conferences	04 (Book chapters published by Springer and Bloomsbury)
4	Others	-

Master (Completed (Year of Completion)/Ongoing): Completed – 03 (2022); Ongoing – 03

Ph.D. (Completed Year of Completion)/Ongoing): NIL

Projects Carried out: NIL

Patents (Filed & Granted): NIL

SL No	Topic	**Patent Application No**	Filed/ Granted
1			
2			

Technology Transfer: NIL

No. of Books published with details: NIL

Profile of the Faculty

Name	Dr. Chethan Kumar B	
Designation	Assistant Professor	
Department	**CIVIL**	
Date of Joining the Institution	12-09-2022	
Date of Birth	19-11-1989	
Faculty Unique ID	1-27167126471	
Email Id	chethankumar.b@nmit.ac.in	

Education Qualifications:

SL.No	Degree Obtained	Year of Obtaining the highest degree	Class/ Grade obtained
1	UG	BE (2011)	FCD
2	PG	MTech (2013)	FCD
3	PhD	2022	-
4	Others		
5			

Total Work Experience in Years:

SL.No	Work Experience	Total in Years
1	Teaching	2
2	Research	6
3	Industry	
4	others	

Area of Specialization:

Courses taught at	Diploma/ Post Diploma	
	Undergraduate	1 Elements of Civil Engineering 2 Structural Analysis 1 and 2 3 Design of Steel Structures
	Post Graduate	
	Post Graduate Diploma Level	

Research Guidance (Number of Students):UG students- 4

No. of papers published:

SL.No	Type	Numbers
1	National	4
2	International Journals	14
3	Conferences	8
4	Others	

Master (Completed (Year of Completion)/Ongoing): 2

Ph.D. (Completed Year of Completion)/Ongoing): -

Projects Carried out :

Patents (Filed & Granted):

SL No	Topic	**Patent Application No**	Filed/ Granted
1			
2			

Technology Transfer:

No. of Books published with details:

Profile of the Faculty

Name	DR. SUMARAJ	
Designation	ASSISTANT PROFESSOR	
Department	**CIVIL**	
Date of Joining the Institution	14/09/2022	
Date of Birth	28/04/1989	
Faculty Unique	1-10994236379	
Email Id	sumaraj.r@nmit.ac.in	

Education Qualifications:

SL.No	Degree Obtained	Year of Obtaining the highest degree	Class/ Grade obtained
1	UG	2011	FCD/9.17/10
2	PG	2014	9.77/10
3	PhD	2022	NA
4	Others		
5			

Total Work Experience in Years:

SL.No	Work Experience	Total in Years
1	Teaching	2
2	Research	5
3	Industry	0
4	others	4

Area of Specialization:

Courses taught at	Diploma/ Post Diploma	NA
	Undergraduate	1. Water supply Engineering 2. Waste water treatment and Engineering 3. Solid Waste Management 4. Environmental Studies 5. Sustainable Rural Development 6. Environmental Management
	Post Graduate	1 Advanced Wastewater Treatment

		2 Industrial Wastewater Treatment
	Post Graduate Diploma Level	NA

Research Guidance (Number of Students):UG students- 3 batches, 12 students

No. of papers published:

SL.No	Type	Numbers
1	National	1
2	International Journals	3
3	Conferences	5
4	Others	

Master (Completed (Year of Completion)/Ongoing): 2014, IIT Kharagpur

Ph.D. (Completed Year of Completion)/Ongoing): PhD completed in 2022. University of Auckland, New Zealand

Projects Carried out:
Microbial Fuel Cell, Nutrient adsorption, Heavy metal adsorption, Air pollution monitoring, Wastewater treatment

Patents (Filed & Granted): NA

SL No	Topic	**Patent Application No**	Filed/ Granted
1			
2			

Technology Transfer: NA

No. of Books published with details: NA

Profile of the Faculty

Name	Nitin A V	
Designation	Assistant Professor	
Department	**CIVIL**	
Date of Joining the Institution	20-10-2022	
Date of Birth	20-03-1998	
Faculty Unique		
Email Id	nitin.av@nmit.ac.in	

Education Qualifications:

SL.No	Degree Obtained	Year of Obtaining the highest degree	Class/ Grade obtained
1	UG	2020	FCD
2	PG	2022	FCD
3	PhD	N/A	N/A
4	``		
5			

Total Work Experience in Years:

SL.No	Work Experience	Total in Years
1	Teaching	N/A
2	Research	N/A
3	Industry	N/A
4	others	N/A

Area of Specialization: Structural Engineering

Courses taught at	Diploma/ Post Diploma	
	Undergraduate	1. Water Supply Engineering 2. C-Programming 3. Concrete and Highway Material Testing Laboratory
	Post Graduate	
	Post Graduate Diploma Level	

Research Guidance (Number of Students):UG students-

No. of papers published:

SL.No	Type	Numbers
1	National	
2	International Journals	
3	Conferences	
4	Others	

Master (Completed (Year of Completion)/Ongoing):

Ph.D. (Completed Year of Completion)/Ongoing):

Projects Carried out :

Patents (Filed & Granted):

SL No	Topic	**Patent Application No**	Filed/ Granted
1			
2			

Technology Transfer:

No. of Books published with details:

BRANCH: ELECTRONICS AND COMMUNICATION ENGINEERING

Faculty List for - 2022-2023

Sl. No.	Name of the faculty	Designation	Qualification	DOJ
1.	Dr. H C Nagaraj	Principal	Ph.D	28-12-2001
2.	Dr. V. Sridhar	Prof	Post doc	04-10-2018
3.	Dr. Ramachandra A. C.	Prof	Ph.D	11-12-2017
4.	Prof. Sitaram V Yaji	Prof	M.E.	04-05-2015
5.	Dr. Rajesh. N	Prof	Ph.D	19-07-2002
6.	Dr. Manjula. B.M	Prof	Ph.D	03-10-2002
7.	Dr. KarunakarRai. B	Prof	Ph.D	20-10-2007
8.	Dr. Parameshachari B D	Prof	Ph.D	24.08.2022
9.	Dr. Roopa	Prof	PhD	01-08-2022
10.	Dr. Smitha .G. Prabhu	Assoc. Prof	Ph.D	02-05-2015
11.	Dr. PrasannaPaga	Assoc. Prof	Ph.D	01-08-2006
12.	Dr. SowmyaMadhavan	Assoc. Prof	Ph.D	22-08-2007
13.	Dr. Shashidhara.K. S	Assoc. Prof	Ph.D	28-07-2008
14.	Dr. Rekha Phadke	Assoc Prof	Ph.D	02-08-2010
15.	Dr. Naveen I G	Assoc. Prof	Ph.D	13-06-2022
16.	Ms. Naina R. Karkal	Assoc. Prof	M.Tech(Ph.D)	01-08-2007
17.	Ms. Ayesha Siddiqua	Asst. Prof	M.Tech(Ph.D)	11-08-2009
18.	Ms. Pramodhini.R	Asst. Prof	M.Tech(Ph.D)	05-03-2010
19.	Ms. Kushalatha.M. R	Asst. Prof	M.Tech(Ph.D)	27-08-2010
20.	Dr. Badarla Sri Pavan	Asst. Prof	Ph.D	01-08-2012
21.	Ms. Divya.G	Asst. Prof	M.Tech(Ph.D)	01-07-2013
22.	Ms. LathaKumari .K. R	Asst. Prof	M.Tech	19-08-2013
23.	Ms. Nithya .G	Asst. Prof	M.Tech(Ph.D)	02-08-2018
24.	Ms. Chaithra.K. N	Asst. Prof	M.Tech(Ph.D)	12-08-2014
25.	Ms. Prajna.K. B	Asst. Prof	M.Tech(Ph.D)	10-07-2017
26.	Ms. Ashitha.V. Naik	Asst. Prof	M.Tech	21-08-2017
27.	Ms.SeemaSreekumar	Asst. Prof	M.Tech(Ph.D)	02-07-2018
28.	Ms. Sthuthi. A	Asst. Prof	M.Tech	01-04-2017
29.	Dr. ThimmarajaYadava G	Asst. Prof	Ph.D	05-10-2020
30.	Dr. Sunil S Harakkannanavar	Asst. Prof	Ph.D	01-04-2021
31.	Dr. SapnaKumari C	Asst. Prof	Ph.D	06-04-2021
32.	Dr. Shilpa M	Asst. Prof	Ph.D	08-11-2021
33.	Dr.Vishwanath	Asst. Prof	Ph.D	01-12-2021
34.	Mr.Satish BM	Asst. Prof	M.Tech(Ph.D)	01-01-2022
35.	Dr. HarshaKaramchandani	Asst. Prof	Ph.D	07-06-2022
36.	Dr. Vinaykumar R	Asst. Prof	Ph.D	29-08-2022

37.	Dr. Manohara H T	Asst. Prof	Ph.D	06-06-2022
38.	Dr. Rajani N	Asst. Prof	Ph.D	16-09-2022
39.	Mr. Shubhra Charkraborthy	Asst. Prof	M.Tech(Ph.D)	01-09-2022
40.	Mr. Pradeep kumar	Asst. Prof	M.Tech(Ph.D)	30-08-2022
41.	Smitha Sharath Shankar	Asst. Prof	M.Tech(Ph.D)	02/01/2023
42.	Mr. Srinivas K.S	Asst. Prof	M.Tech	17-02-2021

NITTE EDUCATION TRUST

NITTE MEENAKSHI INSTITUTE OF TECHNOLOGY

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Affiliated to Visvesvaraya Technological University, Belagavi
Post Box No. 6429, Yelahanka, Bengaluru-560064, Karnataka, INDIA

KNOWLEDGE ▪ CHARACTER ▪ UNITY

Profile of the Faculty

BRANCH: ELECTRONICS AND COMMUNICATION ENGINEERING

Name	Dr.V Sridhar
Designation	Professor,Dean Academics
Department	**ECE**
Date of Joining the Institution	04/10/2018
Date of Birth	10/08/1958
Faculty Unique	1-4739259864
Email Id	dean-academics@nmit.ac.in

Education Qualifications:

SL.No	Degree Obtained	Year of Obtaining the highest degree	Class/ Grade obtained
1	UG	B.E (E & C), From University of Mysore, Year 1980	FIRST CLASS
2	PG	M.E (E & C), From Jadavpur Univeristy, Calcutta, Year 1986	FIRSTCLASS
3	PhD	IIT –DELHI, Year-1996	Awarded
4	Others	Post Doctoral R/s, UNITEN, Malaysia, year 2000-2002	Awarded

Total Work Experience in Years:

SL.No	Work Experience	Total in Years
1	Teaching	From Dec1980 till date- 44 years
2	Research	
3	Administrative	
4	Others (RE (VTU), & Act. VC)	

Area of Specialization:
VLSI and Biomedical Instrumentation

Courses taught at		
	Undergraduate	1.Basic Electronics 2.Analog Electronics 3.Digital Electronics 4.Communication System 5.Analog Communication 6.Biomdical Signal Processing 7.Fundamentals of VLSI
	Postgraduate	CMOS Circuit design VLSI Technology
	Post Graduate Diploma Level	

Research Guidance (Number of Students):UG students-

No. of papers published:

SL.No	Type	Numbers
1	National	4
2	International Journals	50
3	Conferences	54
4	Others	

Master (Completed (Year of Completion)/Ongoing): 1986

Ph.D. (Completed Year of Completion)/Ongoing): 1996

Projects Carried out : NA

Patents (Filed & Granted):

SL No	Topic	**Patent Application No**	Filed/ Granted
1	Blockchain-gestütztes durchsuchbares Verschlüsselungssystem für die Verschlüsselung und Speicherung elektronischer Gesundheitsdaten (EHRs)	G11863DE	Granted on 30/10/2022

Technology Transfer: Nil

No. of Books published with details: 3

1) Network Theory –A simplified Approach,
   Authors: V. Sridhar and others - MEDTECH Publication – 2020
   ISBN:978-93-89393-29-3
2) Engineering Statistics and Linear Algebra
   Authors: V.Sridhar and others- New Age International Publishers-2022
   ISBN:978-81-224-7214-1
3) Control Engineering:
   Authors: V.Sridhar and others-New Age International Publishers-2022
   ISBN:978-81-2247217-2

Technology Transfer:

No. of Books published with details:

Profile of the Faculty

BRANCH: ELECTRONICS AND COMMUNICATION ENGINEERING

Name	Dr. Ramachandra A C	
Designation	Professor and Head	
Department	**ECE**	
Date of Joining the Institution	11/12/2017	
Date of Birth	16/08/1970	
Faculty Unique	1-3581233603	
Email Id	ramachandra.ac@nmit.ac.in	

Education Qualifications:

SL. No.	Degree Obtained	Year of Obtaining the highest degree	Class/ Grade obtained
1	UG	1994	First Class
2	PG	2002	First Class
3	Ph.D.	2014	-

Total Work Experience in Years:

SL. No.	Work Experience	Total in Years
1	Teaching	25
2	Research	05
3	Industry	-
4	others	-

Area of Specialization:

Courses taught at	Diploma Diploma	
	Undergraduate	1. Analog Electronic Circuits 2. Linear Integrated Circuits 3. Microprocessor 4. Logic Design 5. Power Electronics 6. Filed Theory 7. VLSI 8. Cellular Mobile Communication 9. Introduction to Data Analytics 10. Basic Electronics 11. C Programming
	Post Graduate	1. Automotive Electronics 2. Advanced Embedded Systems

	Post Graduate Level	
Research Guidance (Number of Students):UG students-		

No. of papers published:

SL. No.	Type	Numbers
1	National	06
2	International Journals	25
3	Conferences	30
4	Others	10

Master (Completed (Year of Completion)/Ongoing):

Ph.D. (Completed Year of Completion)/Ongoing):

Projects Carried out :

Patents (Filed & Granted):

SL. No.	Topic	**Patent Application No**	Filed/ Granted
1	An Efficient Infant Carrycot Monitoring System	202241001978	Published
2	Smart Incubator	202241002003	Published
3	Detection and Removal of Weed Plants using Smart Agribot	202241012661	Filed

Technology Transfer:

No. of Books published with details:

Profile of the Faculty

BRANCH: ELECTRONICS AND COMMUNICATION ENGINEERING

Name	Sitaram Vishnu Yaji	
Designation	Professor	
Department	**ECE**	
Date of Joining the Institution	4-5-2015	
Date of Birth	03-07-1959	
Faculty Unique	1-2656327385	
Email Id	Sitaram.yaji@nmit.ac.in	

Education Qualifications:

SL.No	Degree Obtained	Year of Obtaining the highest degree	Class/ Grade obtained
1	UG	1982	First class with distinction
2	PG	1985	First class
3	PhD		
4	Others		
5			

Total Work Experience in Years: 39

SL.No	Work Experience	Total in Years
1	Teaching	7
2	Research	
3	Industry	25
4	Others (Corporate Training)	7

Area of Specialization: TCP/IP Networking, Embedded system (ES)

Courses taught at	Undergraduate	1 DS using C++ 2 ES 3 Computer Networks and Applications 4 IP Networking.
	Post Graduate	1 Advanced ES 2 Embedded Linux

	Post Graduate Diploma Level	1 ES

Research Guidance (Number of Students):UG students-

No. of papers published:

SL.No	Type	Numbers
1	National	
2	International Journals	
3	Conferences	4
4	Others	

Master (Completed (Year of Completion)/Ongoing): 1985

Ph.D. (Completed Year of Completion)/Ongoing):

Projects Carried out : UG and PG projects

Patents (Filed & Granted):

SL No	Topic	**Patent Application No**	Filed/ Granted
1	Method of managing signal processing resources	US7426182B1	Granted

Technology Transfer:

No. of Books published with details:

Profile of the Faculty

BRANCH: ELECTRONICS AND COMMUNICATION ENGINEERING

Name	Dr. Rajesh N	
Designation	Professor	
Department	**ECE**	
Date of Joining the Institution	19-07-2002	
Date of Birth	07-06-1976	
Faculty Unique	1-450312958	
Email Id	rajesh.n@nmit.ac.in	

Education Qualifications:

SL.No	Degree Obtained	Year of Obtaining the highest degree	Class/ Grade obtained
1	UG	1998	FC
2	PG	2002	FCD
3	PhD	2018	
4	Others		
5			

Total Work Experience in Years:

SL.No	Work Experience	Total in Years
1	Teaching	21
2	Research	01
3	Industry	02
4	others	

Area of Specialization:

Courses taught at	Undergraduate	1. Signals and Systems 2. Digital Signal Processing 3. Digital Image Processing 4. Multimedia Communication 5. Digital Electronics 6. Applied Digital Signal Processing 7. Computer Organisation and Architecture

		8. Real Time Operating Systems 9. Essentials of NCC 10. Power Electronics 11. Information Theory and Coding 12. Foundations of Machine Learning.
	Post Graduate	1. Applied Digital Signal Processing 2. Image Processing 3. VLSI Signal Processing 4. Multimedia Communication Foundations of Machine Learning

Research Guidance (Number of Students):UG students-

No. of papers published:

SL.No	Type	Numbers
1	National	04
2	International Journals	02
3	Conferences	15
4	Others	

Master (Completed (Year of Completion)/Ongoing): 2002

Ph.D. (Completed Year of Completion)/Ongoing): 2018

Projects Carried out :

Patents (Filed & Granted):

SL No	Topic	**Patent Application No**	Filed/ Granted
1	An Efficient Infant Carrycot Monitoring System	202241001978	Published
2			

Technology Transfer: NIL

No. of Books published with details: NIL

Profile of the Faculty

BRANCH: ELECTRONICS AND COMMUNICATION ENGINEERING

Name	Dr.Manjula B M	
Designation	Professor	
Department	**ECE**	
Date of Joining the Institution	03/10/2002	
Date of Birth	10/05/1977	
AICTE Unique ID	1-410763109	
Email Id	manjula.bm@nmit.ac.in	

Education Qualifications:

SL.No	Degree Obtained	Year of Obtaining the highest degree	Class/ Grade obtained
1	UG	2000	First Class
2	PG	2007	First Class
3	PhD	2020	Awarded
4	Others	--	
5			

Total Work Experience in Years:

SL.No	Work Experience	Total in Years
1	Teaching	22
2	Research	05
3	Industry	---
4	others	--

Area of Specialization:

Courses taught at	Undergraduate	1.Control System 2.Digital Signal Processing 3.Biomedical Digital Signal Processing 4.Network Analysis 5.Power Electronics 6.Analog Electronics 7.Digital Electronics

		8.Basic Electronics 9.Linear Integrated Circuit 10.Operation Research 11.Fundamentals of VLSI

Research Guidance (Number of Students):UG students-02 Batches

No. of papers published: 19

SL.No	Type	Numbers
1	National	0
2	International Journals	16
3	Conferences	3
4	Others	--

Master (Completed (Year of Completion)/Ongoing): 2007

Ph.D. (Completed Year of Completion)/Ongoing): 2019

Projects Carried out : 1. **ANALYSIS OF NOISE REMOVAL TECHNIQUES FOR ECG**

Patents (Filed & Granted):

SL No	Topic	**Patent Application No**	Filed & Granted
1	IOT and cloud-based security system for smart Vehicle	202141034157	Filed
2	Detection and removal of weed plant using smart Agribot	202241012661	Filed

Technology Transfer: NIL

No. of Books published with details: NIL

Profile of the Faculty

BRANCH: ELECTRONICS AND COMMUNICATION ENGINEERING

Name	Dr.Karunakara Rai B	
Designation	Professor	
Department	**ECE**	
Date of Joining the Institution	29/10/2007	
Date of Birth	22/06/1974	
Faculty Unique	1-412297243	
Email Id	karunakara.rai@nmit.ac.in	

Education Qualifications:

SL.No	Degree Obtained	Year of Obtaining the highest degree	Class/ Grade obtained
1	UG -- BE	1998	First class
2	PG -- MS	2001	FCD
3	PG -- M.Tech	2010	FC
4	PhD	2020	-----
5	PG Diploma in Journalism	2005	-----
6			

Total Work Experience in Years:

SL.No	Work Experience	Total in Years
1	Teaching	22
2	Research	7
3	Industry	2
4	others	

Area of Specialization:
Computer Network, Network Virtualisation, Processor Architecture

Courses taught at	Undergraduate (last Five years)	1. Arm Programming Optimisation 2. Digital Electronics 3. Wireless Communication

		4. Computer Organisation 5. 8051 Microcontroller 6. Entrepreneurship Development &IPR 7. Advanced Microcontroller 8. Basic Electronics
	Post Graduate (last two years)	1. Embedded System Architecture and Software 2. Advanced Embedded Systems

Research Guidance (Number of Students): 1

No. of papers published:

SL.No	Type	Numbers
1	National	2
2	International Journals	7
3	Conferences	3
4	Others	

Projects Carried out:
Funded FDP - 01

Patents (Filed & Granted):

SL No	Topic	**Patent Application No**	Filed/ Granted
1	Smart garbage management system using Interment of Things	202141018948A	Filed
2	An efficient adaptive beam former for cellular communications	202141016330	Filed

Technology Transfer: Nil

No. of Books published with details: Nil

Profile of the Faculty

BRANCH: ELECTRONICS AND COMMUNICATION ENGINEERING

Name	**Dr. Parameshachari B.D**	
Designation	Professor	
Department	**ECE**	
Date of Joining the Institution	24.08.2022	
Date of Birth	07.07.1981	
Faculty Unique	1-2647929583	
Email Id	paramesh@nmit.ac.in	

Education Qualifications:

SL.No	Degree Obtained	Year of Obtaining the highest degree	Class/ Grade obtained
1	UG	2003	FC
2	PG	2008	FC
3	PhD	2015	Awarded
4	Others		
5			

Total Work Experience in Years: 19 Years

SL.No	Work Experience	Total in Years
1	Teaching	19
2	Research	10
3	Industry	-
4	others	-

Area of Specialization: Image Processing, Network Security, Pattern Recognition, Data Science, IOT

Courses taught at	Undergraduate	1. Wireless Communications 2. 4G & LTE Satellite Communication
	Post Graduate	1. Advanced Digital Communications 3. LTE 4G Broadband

Research Guidance (Number of Students):UG students-

No. of papers published: 110

SL.No	Type	Numbers
1	National	-
2	International Journals	80
3	Conferences	30
4	Others	--

Master (Completed (Year of Completion)/Ongoing): 2008

Ph.D. (Completed Year of Completion)/Ongoing): 2015

Projects Carried out : Image Encryption and Decryption for real time Applications"
Ref: Project ID-RDGP2015057

Patents (Filed & Granted):

SL No	Topic	**Patent Application No**	Filed/ Granted
1	An artificial intelligence based system to identify the medical condition prior to doctor consultation	2021101576	Granted
2	Optical coherence tomography angiography (OCTA) device for screening retinal vascular abnormalities	340522-001	Filed

Technology Transfer: --

No. of Books published with details: 02

1. Research Innovations and Trends on Computer Vision and Recognition Systems, Apple Academic Press Inc. https://www.appleacademicpress.com/research-innovations-and-trends-on-computer-vision-and-recognition-systems-/960
2. Human-Computer Interaction and Beyond: Advances Towards Smart and Interconnected Environmentshttps://benthambooks.com/book/9789814998819/preface/

Profile of the Faculty

BRANCH: ELECTRONICS AND COMMUNICATION ENGINEERING

Name	Dr. Roopa K	
Designation	Professor	
Department	**ECE**	
Date of Joining the Institution	1-8-2022	
Date of Birth	27/12/1968	
Faculty Unique	1-7343417355	
Email Id	roopa.k@nmit.ac.in	

Education Qualifications:

SL.No	Degree Obtained	Year of Obtaining the highest degree	Class/ Grade obtained
1	UG; first class	2017	
2	PG; Distinction		
3	PhD		
4	Others		
5			

Total Work Experience in Years: 23.8

SL.No	Work Experience	Total in Years
1	Teaching	16.8
2	Research	
3	Industry	7
4	others	

Area of Specialization: Image Processing

Courses taught at	Undergraduate	1. Introduction to Data Analytics 2. Digital System Design

Research Guidance (Number of Students):UG students-25

No. of papers published: 15

SL.No	Type	Numbers
1	National	1
2	International Journals	5
3	Conferences	9
4	Others	

Master (Completed (Year of Completion)/Ongoing): Completed in 2007

Ph.D. (Completed Year of Completion)/Ongoing): completed in 2017

Projects Carried out :

Patents (Filed & Granted):nil

SL No	Topic	**Patent Application No**	Filed/ Granted
1			
2			

Technology Transfer: nil

No. of Books published with details: nil

Profile of the Faculty

BRANCH: ELECTRONICS AND COMMUNICATION ENGINEERING

Name	Dr. Smitha G Prabhu
Designation	Associate Professor
Department	**ECE**
Date of Joining the Institution	2-05-2015
Date of Birth	22-07-1978
Faculty Unique	1-2656389648
Email Id	smitha.prabhu@nmit.ac.in

Education Qualifications:

SL.No	Degree Obtained	Year of Obtaining the highest degree	Class/ Grade obtained
1	UG	2000	FCD
2	PG	2007	FCD
3	PhD	Yet to receive Degree Certificate	
4	Others		
5			

Total Work Experience in Years:

SL.No	Work Experience	Total in Years
1	Teaching	21 years
2	Research	5 years
3	Industry	
4	Others	

Area of Specialization:

Courses taught at	Diploma/ Post Diploma	
	Undergraduate	1 Network Analysis 2 Fields and Waves 3 VLSI & Embedded Systems
	Post Graduate	
	Post Graduate Diploma Level	

Research Guidance (Number of Students):UG students-

No. of papers published:

SL.No	Type	Numbers
1	National	
2	International Journals	5
3	Conferences	5
4	Others	

Master (Completed (Year of Completion)/Ongoing): 2007

Ph.D. (Completed Year of Completion)/Ongoing): 2022

Projects Carried out :

Patents (Filed & Granted):

SL No	Topic	**Patent Application No**	Filed/ Granted
1	Smart Incubator	202241002003	Published
2			

Technology Transfer:

No. of Books published with details:

Profile of the Faculty

BRANCH: ELECTRONICS AND COMMUNICATION ENGINEERING

Name	Dr.PRASANNA G PAGA	
Designation	ASSOCIATE PROFESSOR	
Department	**E&CE**	
Date of Joining the Institution	01/08/2006	
Date of Birth	23-02-1978	
Faculty Unique	1-410763027	
Email Id	prasanna.paga@nmit.ac.in	

Education Qualifications:

SL.No	Degree Obtained	Year of Obtaining the highest degree	Class/ Grade obtained
1	UG	2000	FCD
2	PG	2006	FC
3	PhD	2019	-
4	Others		
5			

Total Work Experience in Years:

SL.No	Work Experience	Total in Years
1	Teaching	18
2	Research	06
3	Industry	0.5
4	others	

Area of Specialization: ANTENNAS

Courses taught at	Undergraduate:	1.WIRELESS COMMUNICATION 2 LTE AND BEYOND 5G 3 COMMUNICATION SYSTEMS II 4.MICROWAVE AND RADIATING SYSTEMDS 5.ANTENNA AND WAVE PROPAGATION 6.MICROWAVE ENGIEERING AND RADAR

		7. FIELD THEORY 8.MICROCONTROLLER 8051 .
	Post Graduate	1.RF AND MICROWAVE CIRCUIT DESIGN 2. ANTENNA THEORY AND DESIGN

Research Guidance (Number of Students):UG students- 100

No. of papers published:

SL.No	Type	Numbers
1	National	-
2	International Journals	14
3	Conferences	12
4	Others	

Master (Completed (Year of Completion)/Ongoing): 2004

Ph.D. (Completed Year of Completion)/Ongoing): 2019

Projects Carried out :

1.DESIGN AND SIMULATION OF A LUNEBURG LENS AND DIELECTRIC FOCAL PLANAR ARRAY FOR SIMULTANEOUS MULTIPLE BEAMS FOR 5G mm wave APPLICATIONS
2.DESIGN AND SIMULATION OF A DUAL BAND 4X4 MIMO ANTENNA FOR 5G.
3.DESIGN AND SIMULATION OF A PHASED ARRAY ANTENNA FOR 5G.
4. Design of a circularly polarized patch antenna for 5G sub 6 GHz applications .
5. Design and analysis of OFDM communication systems using different modulation techniques.
6. Transmission and reception of AIS messages for satellite Applications
7. Design and Analysis of Gain in Dual band Monopole Antenna with different Electromagnetic Band Gap structures

8. Design and Analysis of Dual Band Monopole Antenna with and without CSRR in the Ground plane
9. Design and Analysis of a two element series fed patch antenna for 28GHz mm wave band applications.
10. Enhancement of Gain of Printed T Monopole Antenna Using Uniplanar EBG for ISM Band (2.4GHz) Applications”
11. Mutual coupling Reduction between patch Antenna arrays using Electromagnetic Band Gap structures
12. Performance Analysis of co- axial feed and Microstrip line feed techniques for Microstrip Antenna for C Band Radar based applications.
13. Performance Analysis of co- axial feed and Microstrip line feed techniques for Microstrip Antenna with Electromagnetic Band Gap structures for C Band Radar based applications.es fed patch antenna array for 5G
14. Design of a Omni Directional Antennas
15. Design of a phased antennas array for 2.4GHz Applications
16. Design of a polarization reconfigurable Antenna for 2.4GHz Application.

Patents (Filed & Granted):

SL No	Topic	**Patent Application No**	Filed/ Granted
1	An efficient Adaptive Beam former for cellular communication	202141016330 A	Filed and published
2			

Technology Transfer: nil

No. of Books published with details: nil

Profile of the Faculty

BRANCH: ELECTRONICS AND COMMUNICATION ENGINEERING

Name	SOWMYA MADHAVAN	
Designation	Associate Professor	
Department	**ECE**	
Date of Joining the Institution	22/07/2007	
Date of Birth	26/05/1983	
Faculty Unique ID	1-450313190	
Email Id	sowmya.madhavan@nmit.ac.in	

Education Qualifications:

SL.No	Degree Obtained	Year of Obtaining the highest degree	Class/ Grade obtained
1	UG	2005	First Class with Distinction
2	PG	2008	First Class
3	PhD	2021	NA
4	Others		
5			

Total Work Experience in Years:

SL.No	Work Experience	Total in Years
1	Teaching	15
2	Research	9
3	Industry	0
4	others	--

Area of Specialization: Electronics (VLSI Design)

Courses taught at	Undergraduate	1. Fundamentals of VLSI Design 2. Analog Electronic Circuits 3. FPGA Architecture and Applications . .

	Post Graduate	1. CMOS VLSI Design 2. VLSI Physical Design 3. Analog and Mixed Mode VLSI Design . .

Research Guidance (Number of Students):UG students- 09

No. of papers published:

SL.No	Type	Numbers
1	National	00
2	International Journals	05
3	Conferences	10
4	Others	03

Master (Completed (Year of Completion)/Ongoing): 2008

Ph.D. (Completed Year of Completion)/Ongoing): 2021

Projects Carried out : A Novel Bus Controller For Advanced Microcontroller Bus Architecture, Design and Verification of 1X5 ROUTER, Hand Written Digit Recognition and Prototyping on FPGA.

Patents (Filed & Granted): NIL

SL No	Topic	**Patent Application No**	Filed/ Granted
1			
2			

Technology Transfer: NA

No. of Books published with details: NA

Profile of the Faculty

BRANCH: ELECTRONICS AND COMMUNICATION ENGINEERING

Name	Dr.Shashidhara K S
Designation	Associate Professor
Department	**ECE**
Date of Joining the Institution	28th July 2008
Date of Birth	14th January 1975
Faculty Unique	1-410763363
Email Id	Shashidhar.ks@nmit.ac.in

Education Qualifications:

SL.No	Degree Obtained	Year of Obtaining the highest degree	Class/ Grade obtained
1	UG	2000	First class
2	PG	2002	First class
3	PhD	2020	
4	Others		
5			

Total Work Experience in Years:

SL.No	Work Experience	Total in Years
1	Teaching	18
2	Research	
3	Industry	
4	others	

Area of Specialization: VLSI Signal Processing, 5G, Low power VLSI architecture

Courses taught at	Undergraduate	1.CMOS VLSI Design 2. Digital Electronics 3. Analog Electronics 4. Control System 5. Network Analysis 6. ASIC Design 7. DSD using Verilog 8. System Verilog

		9. Internet of Things 10. Linear Integrated Circuits 11. Digital Signal Processing 12. FPGA Architecture and Applications
	Post Graduate	1. Embedded system design using Verilog 2. System On Chip 3. ASIC design 4. Statistical Signal Processing.

Research Guidance (Number of Students):
UG students-10

No. of papers published:

SL.No	Type	Numbers
1	National	
2	International Journals	5
3	International Conferences	12
4	Others/	5

Master (Completed (Year of Completion)/Ongoing): Completed(2003)

Ph.D. (Completed Year of Completion)/Ongoing): Completed(2020)

Projects Carried out : 5

Patents (Filed & Granted): 4-Filed

SL No	Topic	**Patent Application No**	Filed/ Granted
1	Industrial Safety Monitoring and Accident Reporting System Using IOT	202041054629A	Published
2	AN EFFICIENT ADAPTIVE BEAMFORMER FOR CELLULAR COMMUNICATIONS	202141016330 A	Published
3	SMART GARBAGE MANAGEMENT SYSTEM USING INTELLIGENCE OF THINGS	20141018948 A	Published
4	SIMULTANEOUS DIRECTION-OF-ARRIVAL ESTIMATION OF UNCORRELATED, CORRELATED AND COHERENT SOURCE SIGNALS WITHOUT ESTIMATION A SOURCE NUMBER.	202241024626 A	Published

Technology Transfer:

No. of Books published with details: 1

Profile of the Faculty

BRANCH: ELECTRONICS AND COMMUNICATION ENGINEERING

Name	Dr.Rekha Phadke	
Designation	Associate Professor	
Department	**ECE**	
Date of Joining the Institution	01-01-2010	
Date of Birth	06-07-1976	
Faculty Unique	1-450313284	
Email Id	Rekha.phadke@nmit.ac.in	

Education Qualifications:

SL.No	Degree Obtained	Year of Obtaining the highest degree	Class/ Grade obtained
1	UG	1998	First class
2	PG	2007	First class with Distinction
3	PhD	2021	
4	Others		
5			

Total Work Experience in Years:

SL.No	Work Experience	Total in Years
1	Teaching	19
2	Research	9
3	Industry	1
4	others	

Area of Specialization:

Courses taught at	Undergraduate	1Basic Electronics 2Digital Electronics 3Microcontroller and ARM 4DSD using Verilog 5Data structures using C and C++ 6Cryptography

		7Forecasting Perspectives using R 8Python Programming
	Post Graduate	1 Advanced Digital Design .

Research Guidance (Number of Students):UG students- 4

No. of papers published:

SL.No	Type	Numbers
1	National	6
2	International Journals	4
3	Conferences	6
4	Others	2

Master (Completed (Year of Completion)/Ongoing): Completed (2007)

Ph.D. (Completed Year of Completion)/Ongoing): Completed (2021

Projects Carried out: Electrochemical Sensor in IISc nanoscience clean lab

Patents (Filed & Granted): NIL

SL No	Topic	**Patent Application No**	Filed/ Granted
1			
2			

Technology Transfer:
NIL

No. of Books published with details: NIL

Profile of the Faculty

BRANCH: ELECTRONICS AND COMMUNICATION ENGINEERING

Name	Dr.NAVEEN I.G	
Designation	Associate Professor	
Department	ECE	
Date of Joining the Institution	13/06/2022	
Date of Birth	24/12/1981	
Faculty Unique	1-23733596613	
Email Id	naveen.ig@nmit.ac.in	

Education Qualifications:

SL.No	Degree Obtained	Year of Obtaining the highest degree	Class/ Grade obtained
1	UG	2004	1st Class
2	PG	2007	1st Class
3	PhD	2022	

Total Work Experience in Years: 16 Years

SL.No	Work Experience	Total in Years
1	Teaching	15 Years
2	Research	06 Years
3	Industry	01 Years
4	others	--

Area of Specialization: VLSI Design

Courses taught at	Undergraduate	1.Basic Electronics 2. Digital System Design 3. Microcontroller 4. Hardware Description Language using Verilog 5. VLSI Design 6. Information Theory and Coding 7..Embedded System Design

		8. GSM 9. RTOS 10.Programming using C
	Post Graduate	1.Advances in VLSI Design 2. ASIC Design 3. Error control coding 4.CMOS VLSI Design 5.Analog and Mixed mode VLSI 6.RTES .

Research Guidance (Number of Students):UG students- 75

No. of papers published: 23

SL.No	Type	Numbers
1	National	-
2	International Journals	17
3	Conferences	06
4	Others	-

Master (Completed (Year of Completion)/Ongoing): 2007

Ph.D. (Completed Year of Completion)/Ongoing): -- 2022

Projects Carried out : --

Patents (Filed & Granted):

SL No	Topic	**Patent Application No**	Filed/ Granted
1	AN IOT BASED RADIO CONTROLLED ‘ROBOTIC MACHIAVELLIAN’, TERRAIN DEMINER USING DEMINING TECHNIQUES	202241052593	Filed

Technology Transfer: --

No. of Books published with details: --

Profile of the Faculty

BRANCH: ELECTRONICS AND COMMUNICATION ENGINEERING

Name	Ayesha Siddiqua	
Designation	Assistant Professor	
Department	**ECE**	
Date of Joining the Institution	11th August 2009	
Date of Birth	24th July 1983	
Faculty Unique	1-410763443	
Email Id	Ayesha.siddiqua@nmit.ac.in	

Education Qualifications:

SL.No	Degree Obtained	Year of Obtaining the highest degree	Class/ Grade obtained
1	UG	2006	First class
2	PG	2009	FCD
3	PhD	-	-
4	Others	-	-
5			

Total Work Experience in Years:

SL.No	Work Experience	Total in Years
1	Teaching	13.4
2	Research	-
3	Industry	-
4	others	-

Area of Specialization: Digital Communication

Courses taught at	Undergraduate	1Digital Electronics 2 Signals and systems 3 Advanced Microcontroller 4. 8051 Microcontroller 5. Information theory and coding 6. Optical fiber communication 7. Wireless sensor networks .

		.
	Post Graduate	1WIreless Mobile Networks 2 Optical Communication Networking

Research Guidance (Number of Students):UG students-Two for the academic year 2022-23

No. of papers published:

SL.No	Type	Numbers
1	National	
2	International Journals	1
3	Conferences	
4	Others	

Master (Completed (Year of Completion)/Ongoing): Completed in 2009

Ph.D. (Completed Year of Completion)/Ongoing): ongoing

Projects Carried out :

Patents (Filed & Granted):

SL No	Topic	**Patent Application No**	Filed/ Granted
1			
2			

Technology Transfer:

No. of Books published with details:

Profile of the Faculty

BRANCH: ELECTRONICS AND COMMUNICATION ENGINEERING

Name	Ms. Pramodhini R	
Designation	Assistant Professor	
Department	**ECE**	
Date of Joining the Institution	05-03-2010	
Date of Birth	11-11-1982	
Faculty Unique	1-410763429	
Email Id	pramodhini.r@nmit.ac.in	

Education Qualifications:

SL.No	Degree Obtained	Year of Obtaining the highest degree	Class/ Grade obtained
1	UG	2005	First class
2	PG	2009	FCD
3	PhD	2022	Registered
4	Others		
5			

Total Work Experience in Years:

SL.No	Work Experience	Total in Years
1	Teaching	14
2	Research	1
3	Industry	-
4	others	-

Area of Specialization: Digital Communication and Networking

Courses taught at	Undergraduate	1 Information Theory and Coding 2 Basic Electronics 3 Computer Communication Networks (CCN) 4 Digital communication (DC)

		5 DSP Algorithms and Architecture (DSPA&A) 6 Computer communication networks (CCN) 7 Communication Systems 1 8 Linear Integrated Circuits 9 Signals and Systems 10 Digital Switching systems (DSS) 11 Analog Communication 12 Optical Fiber Communication 13 Digital Switching System 14 Entrepreneurship and IPR Operations Research
		15

Research Guidance (Number of Students):UG students- 50

No. of papers published: 09

SL.No	Type	Numbers
1	National	0
2	International Journals	3
3	Conferences	6
4	Others	

Master (Completed (Year of Completion)/Ongoing): 2009

Ph.D. (Completed Year of Completion)/Ongoing): Ongoing

Projects Carried out : Handwritten Digit Recognition using FGPA, Social distance monitoring using deep learning

Patents (Filed & Granted):Nil

SL No	Topic	**Patent Application No**	Filed/ Granted
1			
2			

Technology Transfer:

No. of Books published with details: Nil

Profile of the Faculty

BRANCH: ELECTRONICS AND COMMUNICATION ENGINEERING

Name	**Mrs. Kushalatha. M.R.**	
Designation	Assistant Professor	
Department	**ECE**	
Date of Joining the Institution	02/08/2010	
Date of Birth	06/05/1984	
Faculty Unique	1-410763267	
Email Id	kushalatha.mr@nmit.ac.in	

Education Qualifications:

SL.No	Degree Obtained	Year of Obtaining the highest degree	Class/ Grade obtained
1	UG	2005	FCD
2	PG	2014	FCD
3	PhD		
4	Others		
5			

Total Work Experience in Years:14

SL.No	Work Experience	Total in Years
1	Teaching	14
2	Research	3
3	Industry	
4	others	

Area of Specialization: Signal processing, Remote Sensing

Courses taught at	Undergraduate	1. Wireless Communication 2. Analog Communication 3.Power Electronics 4. Digital Signal Processing 5. Digital Image Processing 6. Operation Research 7. Control Systems

		8. Network Analysis 9. Basic Electronics 10.Power Electronics Lab 11. Microcontroller Lab-8051 12. Advanced Microcontroller Lab 13. Digital Signal Processing Lab 15. Advanced Communication Lab 16. Digital Electronics 17. Digital Electronics Lab
	Post Graduate	1.Advanced Mathematics 2.Research Methodology and IPR

Research Guidance (Number of Students):UG students-20

No. of papers published: 9

SL.No	Type	Numbers
1	National	
2	International Journals	9
3	Conferences	
4	Others	

Master (Completed (Year of Completion)/Ongoing): 2014

Ph.D. (Completed Year of Completion)/Ongoing): Ongoing

Projects Carried out :

Patents (Filed & Granted):nil

SL No	Topic	**Patent Application No**	Filed/ Granted
1			
2			

Technology Transfer: -

No. of Books published with details: Nil

Profile of the Faculty

BRANCH: ELECTRONICS AND COMMUNICATION ENGINEERING

Name	Dr. Badarla Sri Pavan	
Designation	Assistant Professor	
Department	**ECE**	
Date of Joining the Institution	01/08/2012	
Date of Birth	22/08/1985	
Faculty Unique	1-1486822355	
Email Id	sripavan.rvce@gmail.com badarla.sri.pavan@nmit.ac.in	

Education Qualifications:

SL.No	Degree Obtained	Year of Obtaining the highest degree	Class/ Grade obtained
1	UG	2006	First class
2	PG	2012	First class with Distinction
3	PhD	2022	9.23
4	Others		
5			

Total Work Experience in Years:

SL.No	Work Experience	Total in Years
1	Teaching	07
2	Research	04
3	Industry	03
4	others	

Area of Specialization: Wireless Networks and Wireless Communications

Courses taught at	Undergraduate	1 Analog Communication 2. Communication Networks and Protocols 3. Ad-Hoc wireless networks 4 Analog electronic circuits 5. Field and waves 6. Digital signal processing

		7. Signals & systems 8. Control systems 9. Network analysis
	Post Graduate	1 Protocol engineering 2 Advanced computer network

Research Guidance (Number of Students):UG students- 06 batches

No. of papers published: 21

SL.No	Type	Numbers
1	Book Chapters	03
2	Journals	08
3	Conferences	10
4	Others	

Master (Completed (Year of Completion)): 2012

Ph.D. (Completed Year of Completion): 2022

Projects Carried out : ---

Patents (Granted): 02

SL No	Topic	**Patent Application No**	Filed/ Granted
1	Communication System and Method for Grouping Stations based on Data Rates in Multi-rate IoT Networks	202141048504	Granted
2	Communication System and Method for Channel Access in WLAN using Non-Orthogonal Multiple Access	202141031388	Granted

Technology Transfer: ---

No. of Books published with details: ---

Profile of the Faculty

BRANCH: ELECTRONICS AND COMMUNICATION ENGINEERING

Name	G.Divya	
Designation	Assistant Professor	
Department	**ECE**	
Date of Joining the Institution	1/7/2013	
Date of Birth	22-03-1982	
Faculty Unique	1-2183131854	
Email Id	divya.g@nmit.ac.in	

Education Qualifications:

SL.No	Degree Obtained	Year of Obtaining the highest degree	Class/ Grade obtained
1	UG	2003	First class
2	PG	2012	First class Distinction

Total Work Experience in Years:12

SL.No	Work Experience	Total in Years
1	Teaching	12

Area of Specialization:

Courses taught at	Undergraduate	1.Basic electronics 2.Information Theory and Coding 3.Linear Integrated Circuits 4.Microcontroller 5.ARM Optimization 6.Computer Communication Networks 7.Signal and Systems

Research Guidance (Number of Students):UG students-NA

No. of papers published:

SL.No	Type	Numbers
1	National	
2	International Journals	6
3	Conferences	
4	Others	

Master (Completed(Year of Completion)/Ongoing): Completed

Ph.D. (Completed Year of Completion)/Ongoing):Ongoing

Projects Carried out :Object and face detection for Visually Impaired People

Patents (Filed & Granted):NIL

SL No	Topic	**Patent Application No**	Filed/ Granted
1			
2			

Technology Transfer:NA

No. of Books published with details:

Profile of the Faculty

BRANCH: ELECTRONICS AND COMMUNICATION ENGINEERING

Name	Lathakumari K R	
Designation	Assistant Professor	
Department	**ECE**	
Date of Joining the Institution	19-08-2013	
Date of Birth	13/07/1980	
Faculty Unique	1-2183132084	
Email Id	lathakumari.kr@nmit.ac.in	

Education Qualifications:

SL.No	Degree Obtained	Year of Obtaining the highest degree	Class/ Grade obtained
1	UG	BE	FC
2	PG	MTech	FCD
3	PhD	-	-
4	Others	-	-
5			

Total Work Experience in Years:

SL.No	Work Experience	Total in Years
1	Teaching	9
2	Research	-
3	Industry	-
4	others	-

Area of Specialization: VLSI and Embedded System

Courses taught at	Undergraduate	1.Basic Electronics 2.Digital Electronics 3.Signals and Systems 4.Linear Integrated Circuits 5.Microprocessor and Microcontroller 6.DSD using Verilog

Research Guidance (Number of Students):UG students- nil

No. of papers published: one

SL.No	Type	Numbers
1	National	
2	International Journals	one
3	Conferences	
4	Others	

Master (Completed (Year of Completion)/Ongoing): 2013

Ph.D. (Completed Year of Completion)/Ongoing): NA

Projects Carried out :nil

Patents (Filed & Granted): Nil

SL No	Topic	**Patent Application No**	Filed/ Granted
1			
2			

Technology Transfer: NIL

No. of Books published with details: NIL

Profile of the Faculty

BRANCH: ELECTRONICS AND COMMUNICATION ENGINEERING

Name	Prajna K B	
Designation	Assistant Professor	
Department	**ECE**	
Date of Joining the Institution	10-07-2017	
Date of Birth	04-11-1991	
Faculty Unique	1-3546980110	
Email Id	prajnabopaiah3@gmail.com	

Education Qualifications:

SL.No	Degree Obtained	Year of Obtaining the highest degree	Class/ Grade obtained
1	UG	2013	FCD
2	PG	2015	FCD
3	PhD		
4	Others		
5			

Total Work Experience in Years:

SL.No	Work Experience	Total in Years
1	Teaching	8
2	Research	
3	Industry	
4	others	

Area of Specialization: Data Science and Machine learning

Courses taught at	Undergraduate	1. Introduction to Python Programming 2. DSD using Verilog 3. Real Time Operating System 4. Data Structures using C++ 5. Concepts of Computer Programming 6. Cryptography

		7. Avionics 8. Basic electronics 9. Digital electronics .
	Post Graduate	
	Post Graduate Diploma Level	

Research Guidance (Number of Students): UG students- Guided around 16 UG student project batches in 8 years

No. of papers published: 13

SL.No	Type	Numbers
1	National	
2	International Journals	10
3	Conferences	3
4	Others	

Master (Completed (Year of Completion)/Ongoing): Completed 2015

Ph.D. (Completed Year of Completion)/Ongoing): Ongoing

Projects Carried out :

Patents (Filed & Granted):

SL No	Topic	**Patent Application No**	Filed/ Granted
1			
2			

Technology Transfer:

No. of Books published with details:

Profile of the Faculty

BRANCH: ELECTRONICS AND COMMUNICATION ENGINEERING

Name	ASHITHA V NAIK	
Designation	ASSISTANT PROFESSOR	
Department	**ECE**	
Date of Joining the Institution	21-08-2017	
Date of Birth	31-03-1986	
Faculty Unique	1-2183131859	
Email Id	Ashitha.v@nmit.ac.in	

Education Qualifications:

SL.No	Degree Obtained	Year of Obtaining the highest degree	Class/ Grade obtained
1	UG	2008	SC
2	PG	2012	FCD
3	PhD		
4	Others		
5			

Total Work Experience in Years:

SL.No	Work Experience	Total in Years
1	Teaching	08
2	Research	NIL
3	Industry	NIL
4	others	NIL

Area of Specialization: Digital Electronics And Communication

Courses taught at	Undergraduate	1 BASIC ELECTRONICS 2 DIGITAL ELECTRONICS 3 ANALOG ELECTRONICS 4 LINEAR INTEGRATED CIRCUITS 4 INFORMATION THEORY AND CODING 5.ANALOG ELECTRONICS LAB

		6.ADVANCED COMMUNICATION LAB

Research Guidance (Number of Students):UG students-04

No. of papers published:

SL.No	Type	Numbers
1	National	
2	International Journals	04
3	Conferences	
4	Others	

Master (Completed (Year of Completion)/Ongoing): 2012

Ph.D. (Completed Year of Completion)/Ongoing):

Projects Carried out :01(UG_Batch)

Patents (Filed & Granted):

SL No	Topic	**Patent Application No**	Filed/ Granted
1	NIL		

Technology Transfer: NIL

No. of Books published with details: NIL

Profile of the Faculty

BRANCH: ELECTRONICS AND COMMUNICATION ENGINEERING

Name	Ms. Nithya G	
Designation	Assistant Professor	
Department	**ECE**	
Date of Joining the Institution	31/06/2016	
Date of Birth	07/06/1990	
Faculty Unique	1-3722348454	
Email Id	nithya.g@nmit.ac.in	

Education Qualifications:

SL.No	Degree Obtained	Year of Obtaining the highest degree	Class/ Grade obtained
1	UG	2013	First class with Distinction
2	PG	2015	First class with Distinction
3	PhD	-	
4	Others		
5			

Total Work Experience in Years:

SL.No	Work Experience	Total in Years
1	Teaching	4
2	Research	7
3	Industry	-
4	others	-

Area of Specialization: VLSI, MEMS, Thin film deposition

Courses taught at	Undergraduate	1. C programming 2. Linear Integrated circuits 3. Basic electronics 4. Data structures using C++ 5. ARM Microcontroller 6. Automotive electronics

Research Guidance (Number of Students): UG students- 19

No. of papers published:

SL.No	Type	Numbers
1	National	
2	International Journals	9
3	Conferences	
4	Others	

Master (Completed): 2015

Ph.D. (Ongoing): 2025

Projects Carried out:

1. Simulation and Fabrication of Tungsten-Oxide Thin Films for Electrochromic Applications.

2. Design and Simulation of MEMS Accelerometer with Displacement Amplifying Compliant Mechanism (DACM)

3. A GMID Technique: Design and Implementation of OPAMP Circuitry

4. MEMS Gyroscope with Parallel Beam Suspension

5. Design and Simulation of MEMS Capacitive Pressure Sensor

6. Design, Analysis and Simulation of MEMS-based electrostatic actuator

7. Design and Simulation of Innovative Indigenous MEMS Devices

Patents (Filed & Granted):

SL No	Topic	**Patent Application No**	Filed/ Granted
1			
2			

Technology Transfer: NIL

No. of Books published with details: NIL

Profile of the Faculty

BRANCH: ELECTRONICS AND COMMUNICATION ENGINEERING

Name	Ms. Sthuthi A	
Designation	Assistant Professor	
Department	**ECE**	
Date of Joining the Institution	1/4/2017	
Date of Birth	15/01/1992	
Faculty Unique	1-3722425258	
Email Id	Sthuti.a@nmit.ac.in	

Education Qualifications:

SL.No	Degree Obtained	Year of Obtaining the highest degree	Class/ Grade obtained
1	UG	2013	74.98(FCD)
2	PG	2015	77.2(FCD)
3	PhD		
4	Others		
5			

Total Work Experience in Years:

SL.No	Work Experience	Total in Years
1	Teaching	3
2	Research	5
3	Industry	-
4	others	-

Area of Specialization:

Courses taught at	Undergraduate	1. Analog Electronic Circuits 2. Solid state devices 3 Linear Integrated circuits

Research Guidance (Number of Students):UG students-

No. of papers published:

SL.No	Type	Numbers
1	National	
2	International Journals	5
3	Conferences	
4	Others	

Master (Completed (Year of Completion)/Ongoing): 2015

Ph.D. (Completed Year of Completion)/Ongoing):

Projects Carried out :

Patents (Filed & Granted):

SL No	Topic	**Patent Application No**	Filed/ Granted
1			
2			

Technology Transfer:

No. of Books published with details:

Profile of the Faculty

BRANCH: ELECTRONICS AND COMMUNICATION ENGINEERING

Name	Dr. Thimmaraja Yadava G	
Designation	Assistant Professor	
Department	**ECE**	
Date of Joining the Institution	05.10.2020	
Date of Birth	26.01.1990	
Faculty Unique	1-10588599352	
Email ID	thimmaraja.yg@nmit.ac.in	

Education Qualifications:

SL. No	Degree Obtained	Year of Obtaining the degree	Class/ Grade obtained
1	UG	2011	72.38
2	PG	2014	83.20
3	PhD	2020	Awarded

Total Work Experience in Years:

SL. No	Work Experience	Total in Years
1	Teaching	6
2	Research	3
3	Industry	1

Area of Specialization: Speech Processing and its Applications

Courses taught at	Undergraduate	• Microwave and Radiating Systems • Computer Communication Networks • Fundamentals of VLSI Design • Optical Fiber Communication • Low Power VLSI Design • Advances in VLSI Design • Digital Switching Systems • Nanoelectronics • Basic Electronics • Arduino and Raspberry Pi • VLSI Lab (Cadence) • Computer Networks Lab (NS2)

	Postgraduate	• Advances in Image Processing • Digital VLSI Design • VLSI and Embedded Systems Lab-II

Research Guidance (Number of Students):UG students- 30

No. of papers published: 25

SL. No	Type	Numbers
1	National	1
2	International Journals	14
3	Conferences	7
4	Book Chapters	3

Master (Completed (Year of Completion)/Ongoing): 2014

Ph.D. (Completed Year of Completion)/Ongoing): 2020

Projects Carried out:

1. Received a grant of INR **10.00 Lakh** from VTU under Research Grants Scheme - 2021. The details of the grant are as follows:
   - **Project Title:** Development of Real Time System for End-to-End Continuous Kannada Speech recognition
   - **Role:** Principal Investigator (PI)
   - **Status:** Ongoing
2. Submitted a project proposal to VGST – 2022 under K – FIST L1 scheme. The details of the proposal are as follows:
   - Proposal Title: Establishment of IoT laboratory for problem-based learning
   - VGST Reference No.: VRN/002984/21-22
   - **Status: Shortlisted and Called for the Presentation**
   - Role: Co-PI

Patents (Filed & Granted):

SL No	Topic	Patent Application No	Filed/ Granted
1	Real time implementation of face mask detection and alert system	202241026822	Published

Technology Transfer:

No. of Books published with details: Nil

Profile of the Faculty

BRANCH: ELECTRONICS AND COMMUNICATION ENGINEERING

Name	Dr. Sunil S. Harakannanavar	
Designation	Assistant Professor	
Department	**ECE**	
Date of Joining the Institution	01.04.2021	
Date of Birth	01.06.1986	
Faculty Unique	1-9572547439	
Email Id	Sunilsh143@gmail.com	

Education Qualifications:

Sl. No	Degree Obtained	Year of Obtaining the highest degree	Class/ Grade obtained
1	UG	BE	First Class
2	PG	M. Tech	First Class with Distinction
3	PhD	PhD	Awarded
4	Others		

Total Work Experience in Years: 10.8 Years

Sl. No	Work Experience	Total in Years
1	Teaching	10.8 Years
2	Research	4

Area of Specialization: Image Processing

Courses taught at	Undergraduate	1 Analog Communication 2 Digital Switching Systems 3 DSP algorithms and Architecture 4 Optical Fibre Communication 5 Digital Image Processing 6 Information Theory and Coding

		7 Wireless Communication 8 Wireless Sensor Networks 9 Analog Circuits 10 Management and Entrepreneurship

Research Guidance (Number of Students):UG students- 88

No. of papers published: **21**

Sl. No	Type	Numbers
1	National	Nil
2	International Journals	21
3	Conferences	11
4	Others	---

Master (Completed (Year of Completion)/Ongoing): **2012**

Ph.D. (Completed Year of Completion)/Ongoing): **2020**

Projects Carried out:

DEVELOPMENT OF SIGNAL DE-NOISING AND PROCESSING ALGORITHM FOR TIP CLEARANCE SIGNAL funded by DRDO-GTRE, Bangalore for 10 Lakhs

Patents (Filed & Granted): **03**

Sl. No	Topic	Patent Application No	Filed/ Granted
1	DEVELOPMENT OF WIRELESS SENSOR NETWORK BASED SMART SYSTEM FOR PREVENTING RAILWAY ACCIDENTS" application number for the patent.	202041055057	Filed and published
2	Granted Australian Innovation Patent AN ARTIFICIAL INTELLIGENCE BASED HEART DISEASE MONITORING SYSTEM.	2021101570	Published and granted
3	Granted Australian Innovation Patent IOT BASED AGRI ROBOTIC HANDS FOR PLUCKING UNDER GROUND CROPS & AUTOMATIC SPRAYING.	2021101375	Published and granted

Technology Transfer:

No. of Books published with details: 01

1. A Textbook "Introduction to Information Theory and Coding" as per CBCS Scheme for 5th Semester Electronics and Communication Engineering/Telecommunication Engineering prescribed syllabus of

Visvesvaraya Technological University, Belagavi, Published by Mayas Publishers, Chennai (TN), 2018. ISBN: 9789387756205.

2. Editor for book Series “Futuristic Trends in Artificial Intelligence” with Series Code IIP_V2_2022_BS_09_04, IIP International Publishers. It will be indexed in RSquareL and other indexing platforms including Amazon, Google Books etc.
https://www.iipproceedings.org/fullviewdetails.php?id=18&title=iip-v2-2022-bs-09-04-futuristic-trends-in-artificial-intelligence

Profile of the Faculty

BRANCH: ELECTRONICS AND COMMUNICATION ENGINEERING

Name	Dr sapna kumari C	
Designation	Assistant professor	
Department	**ECE**	
Date of Joining the Institution	05/04/2021	
Date of Birth	29/10/1971	
Faculty Unique	1-9586257708	
Email Id	sapna.kumari@nmit.ac.in	

Education Qualifications:

SL.No	Degree Obtained	Year of Obtaining the highest degree	Class/ Grade obtained
1	UG	1995	59%
2	PG	2008	7.93
3	PhD	2019	
4	Others		
5			

Total Work Experience in Years:

SL.No	Work Experience	Total in Years
1	Teaching	22
2	Research	
3	Industry	
4	others	

Area of Specialization: VLSI

Courses taught at	Undergraduate	1 1. Microcontroller 8051 2. Microprocessor 8086. 3. Programming in C++ 4. Fundamental of CMOS VLSI Design 5. Digital electronics 6 Basic Electronics 7 Information Theory and Coding

		8 Digital Switching Systems 9. Real time system 10. Digital system design 11. Advance Embedded Systems 12. DSD using verilog . .

Research Guidance (Number of Students):UG students-50

No. of papers published: 15

SL.No	Type	Numbers
1	National	
2	International Journals	14
3	Conferences	02
4	Others	

Master (Completed (Year of Completion)/Ongoing): 2008

Ph.D. (Completed Year of Completion)/Ongoing): 2019

Projects Carried out :

Patents (Filed & Granted):

SL No	Topic	**Patent Application No**	Filed/ Granted
1	A NOVEL VLSI BASED ARCHITECTURE FOR STROKE DETECTION USING OPTIMIZED RESOURCE ALLOCATION	202141047825 A	Published
2			

Technology Transfer:

No. of Books published with details:

Profile of the Faculty

BRANCH: ELECTRONICS AND COMMUNICATION ENGINEERING

Name	Dr.Viswanatha V	
Designation	Asst.Professor	
Department	**ECE**	
Date of Joining the Institution	01/12/2021	
Date of Birth	22/10/1980	
Faculty Unique ID	1-10877709991	
Email Id	viswanatha.v@nmit.ac.in	

Education Qualifications:

SL.No	Degree Obtained	Year of Obtaining the highest degree	Class/ Grade obtained
1	UG	2007	First
2	PG	2010	First
3	PhD	2021	-
4	Others		
5			

Total Work Experience in Years:

SL.No	Work Experience	Total in Years
1	Teaching	13
2	Research	05

Area of Specialization: Embedded Systems and IoT

Courses taught at	Undergraduate	1.Microcontrollers 2.ARM Programming 3.Embedded Systems 4.Embedded C Programming 5.Artificial Neural Networks 6.Internet of Things 7.RTOS

Research Guidance (Number of Students):UG students- 30

No. of papers published:

SL.No	Type	Numbers
1	National	-
2	International Journals	20
3	Conferences	04
4	Others	-

Master (Completed (Year of Completion)/Ongoing): 2010

Ph.D. (Completed Year of Completion)/Ongoing): 2021

Projects Carried out :

1). **Home Surveillance System using Raspberry Pi 3 B.**
Hardware & Software Used: Development tool & board : Thonny , Raspberry Pi 3 B
Code : Python
Platform : Linux
Simulation tool: PSIM 8.8

2). **IoT based Live Weather Station Monitoring Using ESP32.**
Hardware & Software Used: Development tool & board : Arduino IDE , ESP32
Code : C,C++
Platform : Windows 10
Cloud platform: Arduino IoT Cloud

3). **IoT based Smart Agriculture System Using ESP32.**
Hardware & Software Used: Development tool & board : Arduino IDE , ESP32
Code : C,C++
Platform : Windows 10
Cloud platform: Arduino IoT Cloud

4). **IoT based Live Weather Station Monitoring Using ESP32.**
Hardware & Software Used: Development tool & board : Arduino IDE , ESP32
Code : C,C++
Platform : Windows 10
Cloud platform: Arduino IoT Cloud

5).**Bluetooth based Wireless Printer Using Arduino Mega microcontroller**
Hardware & Software Used: Development tool & board : Arduino IDE , Arduino Mega
Code : C,C++
Platform : Windows 10

6). **IoT based Liquid level measurement and Alert system for Cryogenic Tank.**
Hardware & Software Used: Development tool & board : Arduino IDE , ESP32
Code : C,C++
Platform : Windows 10

Cloud platform: ThinkgSpeak

7). **Home Automation Using Arduino and Bluetooth .**
Hardware & Software Used: Development tool & board : Arduino , Arduino unoR3
Code : Embedded C
Platform : Windows 10

8). **Arduino based digital control of buck converter for low power applications.**
Hardware & Software Used: Development tool & board : Arduino IDE , Arduino unoR3
Code : Embedded C
Platform : Windows 10
Simulation tool: PSIM 8.8 & Simulink

9). **DSP based embedded system design for DC-DC converters.**
Hardware & Software Used: Development tool & board : CCS 8 , TMS320F28335
Code : Embedded C
Platform : Windows 10
Simulation tool: PSIM 8.8 & MATLAB/Simulink

10). **Advanced vehicle security and accident management system with CAN protocol & thr microcontrollers.**
Hardware & Software Used: Development tool & board : Arduino IDE, Arduino unoR3
Code : Embedded C
Platform : Windows 10

11). **Home Automation and Security Using Raspberry pi pico**
Hardware & Software Used: Development tool & board : Arduino IDE , Raspberry pi pico

Code : MicroPython
Platform : Windows 10

12). **Internet of Things (IoT) Based Multilevel Drunken Driving Detection and Prevention System using Raspberry Pi 3.**
Hardware & Software Used: Development tool & board : Thonny , Raspberry Pi3
Code : Python
Platform : Linux

Patents (Filed & Granted):

SL No	Topic	**Patent Application No**	Filed/ Granted
1	Efficient Battery Management in DC Micro-Grid System using DSP Control and Bidirectional DC-DC Converter	202141016107	Granted

2	Low Cost Advanced IoT System in Agriculture for Smart	202241071867	Filed
3	Bluetooth Based Wireless Thermal Printer for Restaurant and Hospital Management	202241071860	Filed
4	Bluetooth based home automation		
5	IoT based Weather Box		

Technology Transfer: nil

No. of Books published with details: nil

Profile of the Faculty

BRANCH: ELECTRONICS AND COMMUNICATION ENGINEERING

Name	Mr.Sathisha B M	
Designation	Assistant Professor	
Department	**ECE**	
Date of Joining the Institution	01-01-2022	
Date of Birth	23-07-1987	
Faculty Unique	7701208824	
Email Id	sathishldc@gmail.com	Sathisha.bm@nmit.ac.in

Education Qualifications:

SL.No	Degree Obtained	Year of Obtaining the highest degree	Class/ Grade obtained
1	UG	2009	First Class With Distinction
2	PG	2013	First Class With Distinction
3	PhD	-	-
4	Others		
5			

Total Work Experience in Years:

SL.No	Work Experience	Total in Years
1	Teaching	12
2	Research	03

Area of Specialization:

Courses taught at	Diploma/ Post Diploma	1.Digital Communication Engineering
	Undergraduate	Principles of Communication Systems Communication systems Digital communication Network analysis Wireless communication IOT and Wireless systems

		LTE and Beyond 5G Digital signal processing Digital logic design Telecommunication Basic Electronics Engineering

Research Guidance (Number of Students):UG students-

No. of papers published:

SL.No	Type	Numbers
1	National	02
2	International Journals	03
3	Conferences	05
4	Patents	04

Master (Completed (Year of Completion)/Ongoing): 2013

Ph.D. (Completed Year of Completion)/Ongoing): 2017 Registered

Projects Carried out : **Robust Automatic Estimation Of Ejection Fraction Using Cardiac Magnetic Resonance Images**

This research is about a development of customized wavelet lifting transform with Quartic polynomial which has several advantages like reduced latency, less memory requirement and also the accuracy as it is a lossless technique to identify the contour, segmentation of left ventricle and estimation of left ventricular volume automatically This research will also propose a new method called direct LL-mask band scheme (DLLBS) that will be based on the 2-D integer symmetric mask-based discrete wavelet transform (SMDWT) to track the contour of the left ventricle at endocardial or epicardial layers through all the cardiac cycles to measure the ventricular volume and the ejection fraction.

Patents (Filed & Granted):

SL No	Topic	Patent Application No	Filed/ Granted
1	**An Integrated IoT Augmented Reality Based Framework for Health Monitoring System**	202231044023 A	Published
2	**Motor Cycle Pitch with Non-linear control and accident –avoidance system using IOT**	202141002572A	Published
3	**Industrial safety Monitoring and Accident reporting System using IOT**	202041054629 A	Published
4	**A compact IOT based Indoor air monitoring system**	202141023368 A	Published

Technology Transfer:

No. of Books published with details:

Profile of the Faculty

BRANCH: ELECTRONICS AND COMMUNICATION ENGINEERING

Name	Dr. Manohara H.T
Designation	Assistant Professor
Department	**ECE**
Date of Joining the Institution	06/06/2022
Date of Birth	26/12/1988
Faculty Unique	1-23601402221
Email Id	Manohara.ht@nmit.ac.in

Education Qualifications:

SL.No	Degree Obtained	Year of Obtaining the highest degree	Class/ Grade obtained
1	UG	2010	First Class
2	PG	2012	First Class
3	PhD	2022	NA
4	Others		
5			

Total Work Experience in Years: 9years 11months

SL.No	Work Experience	Total in Years
1	Teaching	4 years 6 months
2	Research	5 years 5 months
3	Industry	
4	others	

Area of Specialization:

Courses taught at	Diploma	1. Power Electronics 2. Electrical Power Generation 3. Transmission and Distribution 4. Digital Electronics Lab 5. Microprocessor
	Undergraduate	1. Signals and System 2. Digital Signal Processing 3. Network Analysis

		4. Mechatronics 5. Basic Electrical Engineering 6. Renewable Energy Sources 7. Power Electronics Lab 8. AEC lab 9. Logic Design Lab 10. Logic Design 11. Basic Electronics lab
	Post Graduate	1. Mixed Mode VLSI Design

Research Guidance (Number of Students):UG students- 4

No. of papers published:

SL.No	Type	Numbers
1	National	NA
2	International Journals	01 (SCIE indexed having 1.4 IF)
3	Conferences	04 (IEEE and Springer)
4	Others	01 (communicated to Q3 journal)

Master (Completed(Year of Completion)/Ongoing): Completed -2012

Ph.D. (Completed Year of Completion)/Ongoing): Completed -2022

Projects Carried out: Optimization techniques for processor energy minimization in real-time environment.

Patents (Filed & Granted): NA

SL No	Topic	**Patent Application No**	Filed/ Granted
1			

Technology Transfer: learning New Version of MATLAB R 2022b

No. of Books published with details: NA

Profile of the Faculty

BRANCH: ELECTRONICS AND COMMUNICATION ENGINEERING

Name	Dr.Vinaykumar R	
Designation	Assistant Professor	
Department	**ECE**	
Date of Joining the Institution	29/08/2022	
Date of Birth	19/06/1984	
Faculty Unique ID	1-9315770305	
Email Id	vinaykumar.r@nmit.ac.in, vinaykumar.r1984@gmail.com	

Education Qualifications:

SL.No	Degree Obtained	Year of Obtaining the highest degree	Class/ Grade obtained
1	UG	2009	FCD
2	PG	2011	First Rank with Distinction
3	PhD	2021	Awarded

Total Work Experience in Years: 8 years

SL.No	Work Experience	Total in Years
1	Teaching	5
2	Research	3
3	Industry	-
4	others	-

Area of Specialization: Nanomaterials and Technology, Nanoelectronics, High-frequency Ferrite Ceramics for Microwave devices and Antennas applications

Courses taught at	Undergraduate	1. Basic Electronics 2. RF and Microwave Engineering 3. RADAR and Navigation Aids 4. Elements of Avionics 5. IOT applications 6. Digital Electronics Circuits

		7. Analog Electronics Circuits 8. Microprocessors and Microcontrollers 9. Analog and Digital Communication systems 10. Optical Communication 11. Power Electronics
	Post Graduate	1. Nanomaterial Testing and Characterization 2. Thin-film Instrumentation 3. Analytical instrumentation

Research Guidance (Number of Students):UG students- 4

No. of papers published: 11

SL.No	Type	Numbers
1	National	-
2	International Journals	8
3	Conferences	3
4	Others	-

Master (Completed (Year of Completion)/Ongoing): NIL

Ph.D. (Completed Year of Completion)/Ongoing): NIL

Projects Carried out: NIL

Technology Transfer:

1. Awards or Scholarships:

- Received SERB-DST Young Scientist Travel Grant to attend an International Conference at Singapore.
- First Rank holder in M.Tech in Nanoscience and Technology
- SERB-DST India three-year SRF Fellowship
- MHRD India PhD Fellowship
- Institute Topper in Diploma

2. Technical Skills

- Experience in the synthesis of magnetic nanomaterials and characterizations.
- Knowledge of magnetic materials and magnetism.
- Experience in ferromagnetic oxide materials.
- Knowledge and Proficiency in the tools like MATLAB, ANSYS-HFFS for the antenna, and Multisim (National Instruments) for circuit design and simulation.
- Proficiency in Assembly Languages -8085,8086,8051, ARM7, VHDL
- Proficiency in Programming Languages: C, C++

No. of Books published with details: NIL

Profile of the Faculty

BRANCH: ELECTRONICS AND COMMUNICATION ENGINEERING

Name	SUBHRA CHAKRABORTY	
Designation	Assistant Professor	
Department	**ECE**	
Date of Joining the Institution	29/08/2022	
Date of Birth	10/01/1979	
Faculty Unique	1 - 25007225525	
Email Id	subhra.chakraborty @nmit.ac.in	

Education Qualifications:

SL.No	Degree Obtained	Year of Obtaining the highest degree	Class/ Grade obtained
1	UG	2003	FCD
2	PG	2008	FC
3	PhD	Pursuing	
4	Others		

Total Work Experience in Years:

SL.No	Work Experience	Total in Years
1	Teaching	**16 Years 4 Months**
2	Research	**Nil**
3	Industry	**Nil**
4	others	

Area of Specialization: Biomedical Signal Processing, Microcontroller, Cybersecurity

Courses taught at	Undergraduate	1. Microcontroller & Application 2. NETWORK THEORY 3. Information Theory and Coding 4. MICROCONTROLLER 5. MICROWAVE & RADIATING SYSTEM 6. Management & Entrepreneurship 7. ARM MICROCONTROLLER & EMBEDDED SYSTEM

		8. ELECTRONIC INSTRUMENTATION 9. EMBEDDED SYSTEM DESIGN 10. DSP ALGORITHM & ARCHITECTURE 11. NETWORK SECURITY 12. TRANSMISSION LINE & WAVEGUIDES 13. BIOMEDICAL SIGNAL PROCESSING 14. CONTROL SYSTEMS 15. RADAR ENGINEERING
	Post Graduate	1. LINEAR ALGEBRA 2. SYNTHESIS AND OPTIMIZATION OF DIGITAL CIRCUITS 3. RF & MICROWAVE CIRCUIT DESIGN

Research Guidance (Number of Students):UG students- 68

No. of papers published:

SL.No	Type	Numbers
1	National	03
2	International Journals	02
3	Conferences	06
4	Others	

Master (Completed (Year of Completion)/Ongoing): **2008**

Ph.D. (Completed Year of Completion)/Ongoing): **Ongoing**

Projects Carried out: **24 UG Projects, 6 PG Projects**

Patents (Filed & Granted): **Nil**

SL No	Topic	**Patent Application No**	Filed/ Granted
1			
2			

Technology Transfer: Nil

No. of Books published with details: Nil

Profile of the Faculty

BRANCH: ELECTRONICS AND COMMUNICATION ENGINEERING

Name	Dr.Rajani N	
Designation	Assistant Professor	
Department	**ECE**	
Date of Joining the Institution	16/09/2022	
Date of Birth	25/04/1986	
Faculty Unique	1-11097495921	
Email Id	Rajani.n@nmit.ac.in	

Education Qualifications:

SL.No	Degree Obtained	Year of Obtaining the highest degree	Class/ Grade obtained
1	UG	2009	SC
2	PG	2012	FCD
3	PhD	2022	
4	Others		
5			

Total Work Experience in Years:

SL.No	Work Experience	Total in Years
1	Teaching	3
2	Research	5
3	Industry	0
4	others	

Area of Specialization:

Courses taught at	Undergraduate	1Electronics and Communication Eng.
	Post Graduate	1Digital Communication and Networking

Research Guidance (Number of Students):UG students-4

No. of papers published:

SL.No	Type	Numbers
1	National	
2	International Journals	3
3	Conferences	3
4	Others	

Master (Completed (Year of Completion)/Ongoing):

Ph.D. (Completed Year of Completion)/Ongoing):

Projects Carried out :

Patents (Filed & Granted):

SL No	Topic	**Patent Application No**	Filed/ Granted
1			
2			

Technology Transfer:

No. of Books published with details:

Profile of the Faculty

BRANCH: ELECTRONICS AND COMMUNICATION ENGINEERING

Name	SUGANYA.E	
Designation	ASSISTANT PROFESSOR	
Department	**ECE**	
Date of Joining the Institution	1.12.2022	
Date of Birth	9^{th} August 1987	
Faculty Unique	**8990-**INSTITUTION ID **1-10609747688**-AICTE FACULTY ID	
Email Id	suganya.eswaran@nmit.ac.in	

Education Qualifications:

SL.No	Degree Obtained	Year of Obtaining the highest degree	Class/ Grade obtained
1	UG	2009	First class with Distinction
2	PG	2012	First class with Distinction(9.15 CGPA)
3	PhD	Pursuing	
4	Others		
5			

Total Work Experience in Years:

SL.No	Work Experience	Total in Years
1	Teaching	9 years
2	Research	
3	Industry	
4	others	

Area of Specialization:

	Undergraduate	1.RF and Microwave Engineering 2.Wireless Communication 3.Communication Theory

Courses taught at		4.Digital Communication 5.Electromagnetic Fields 6.Electromagnetic Theory 7.Wireless Networks 8.RF System Design 9.Medical Electronics 10.Digital Electronics 11.Digital Image Processing

Research Guidance (Number of Students):UG students-16 batches

No. of papers published:

SL.No	Type	Numbers
1	National	-
2	International Journals	11 (6 Scopus & 5 International journals)
3	Conferences	8 International & 4 National
4	Others	-

Master (Completed (Year of Completion)/Ongoing):
2012

Ph.D. (Completed Year of Completion)/Ongoing): Pursuing

Projects Carried out :
2

Patents (Filed & Granted): NIL

SL No	Topic	**Patent Application No**	Filed/ Granted
1			
2			

Technology Transfer: CERTIFIED IN ANTENNA DESIGN ENGINEERING

No. of Books published with details: 3

EEE Faculty List-2022-23

Sl.No	Faculty Name	Designation
1	Dr. Premila Manohar	Prof. & HoD
2	Dr. Vasudha Hegde	Professor
3	Dr. T C Balachandra	Professor
4	Dr. Rajkiran Ballal	Professor
5	Dr. Samanvitha N	Professor
6	Dr. Shefali Jagwani	Assoc. Prof.
7	Ms. Veena S	Assoc. Prof.
8	Dr. Prashanth V	Assoc. Prof.
9	Dr. Aruna M	Assoc. Prof.
10	Ms. Sridevi H R	Asst. Prof.
11	Ms. Sowmya Raman	Asst. Prof.
12	Ms. Sujatha Shivashimpeger	Asst. Prof.
13	Mr. Sudeep Shetty	Asst. Prof.
14	Mr. Nagaraj M J	Asst. Prof.
15	Ms. Shruti Gatade	Asst. Prof.
16	Mr. Anand S	Asst. Prof.
17	Ms. Meghana A	Asst. Prof.
18	Ms. Smitha B	Asst. Prof.
19	Dr. Shreeram V Kulkarni	Asst. Prof.
20	Dr. Pavana	Asst. Prof.
21	Dr. Pramod Bhat Nempu	Asst. Prof.
22	Dr. CH Hussaian Basha	Asst. Prof.
23	Dr. Singaravelan A	Asst. Prof.
24	Dr. Likhitha R	Asst. Prof.
25	Dr. Ramakrishna Reddy K	Asst. Prof. (New)
26	Ms. Chaitra Hebbar	Asst. Prof. (Diploma)
27	Ms.Savitha M	Asst. Prof. (Diploma)

NITTE EDUCATION TRUST

NITTE MEENAKSHI INSTITUTE OF TECHNOLOGY

An Autonomous Institution Approved by UGC/AICTE/Govt. of Karnataka
Accredited by NBA (Tier-I) and NAAC 'A+' Grade
Affiliated to Visvesvaraya Technological University, Belagavi
Post Box No. 6429, Yelahanka, Bengaluru-560064, Karnataka, INDIA

KNOWLEDGE ▪ CHARACTER ▪ UNITY

Profile of the Faculty

BRANCH: ELECTRICAL AND ELECTRONICS ENGINEERING

Name	Premila Manohar	
Designation	Professor & HoD	
Department	**EEE**	
Date of Joining the Institution	11th Dec 2021	
Date of Birth	18th May 1958	
Faculty Unique	1-470711407	
Email Id	premila.manohar@nmit.ac.in	

Education Qualifications:

SL.No	Degree Obtained	Year of Obtaining the highest degree	Class/ Grade obtained
1	UG	1982	FCD
2	PG	1985	FCD
3	PhD	1991	-
4	Others		
5			

Total Work Experience in Years:

SL.No	Work Experience	Total in Years
1	Teaching	22
2	Research	20
3	Industry	07
4	others	

Area of Specialization:

	Undergraduate	1. Basic Electrical Engg 2. Transmission and Distribution 3. Introduction to MEMS

<table>
<tr><td rowspan="3">Courses taught at</td><td></td><td>4. HVDC Transmission
.</td></tr>
<tr><td>Post Graduate</td><td>1. Dynamics of control systems
2. Design of control systems
3. Solar Energy Technology
Machine Learning applications in Renewable Energy</td></tr>
<tr><td>Post Graduate Diploma Level</td><td>1
2</td></tr>
<tr><td colspan="3">Research Guidance (Number of Students): UG students - 44</td></tr>
</table>

No. of papers published:

SL.No	Type	Numbers
1	National	-
2	International Journals	15
3	Conferences	42
4	Others	-

Master (Completed (Year of Completion)/Ongoing): 22

Ph.D. (Completed Year of Completion)/Ongoing): 5/2

Projects Carried out : 2

Patents (Filed & Granted):

SL No	Topic	Patent **Application No**	Filed/ Granted
1	Breath Fresh	333526-001	Granted
2	A WEARABLE INHALER	202141003659 A	Published 22/10/2021

Technology Transfer: --

No. of Books published with details: --

Profile of the Faculty

BRANCH: ELECTRICAL AND ELECTRONICS ENGINEERING

Name	Dr. Vasudha Hegde
Designation	Professor
Department	**EEE**
Date of Joining the Institution	14/07/2009
Date of Birth	23/10/1972
Faculty Unique	1-412297413
Email Id	vasudha.hegde@nmit.ac.in

Education Qualifications:

SL.No	Degree Obtained	Year of Obtaining the highest degree	Class/ Grade obtained
1	UG	1995	FCD
2	PG	2007	FCD
3	PhD	2020	
4	Others		
5			

Total Work Experience in Years:

SL.No	Work Experience	Total in Years
1	Teaching	22
2	Research	NIL
3	Industry	2
4	others	

Area of Specialization:

Courses taught at	Undergraduate	1 Basic Electrical Engineering 2. Analog Electronics Circuits 3. Industrial Drives and control 4. Transmission and distribution.
	Postgraduate	1. Large scale integration of Renewable energy sources. 2. Power system Engineering

Research Guidance (Number of Students):UG students- 18
PG students: 05

No. of papers published:

SL.No	Type	Numbers
1	National	1
2	International Journals	6
3	Conferences	17
4	Others	

Master (Completed (Year of Completion)/Ongoing): NIL

Ph.D. (Completed Year of Completion)/Ongoing): NIL

Projects Carried out : Design and development of

Patents (Filed & Granted):

SL No	Topic	Patent **Application No**	Filed/ Granted
1	Novel islanding detection technique based on Piezoelectric Sensors for grid integrated DG	202241050451/ 2022	Filed

Technology Transfer: NIL

No. of Books published with details: NIL

Profile of the Faculty

BRANCH: ELECTRICAL AND ELECTRONICS ENGINEERING

Name	T C BALACHANDRA
Designation	PROFESSOR
Department	**EEE**
Date of Joining the Institution	23.05.2018
Date of Birth	22.08.1957
Faculty Unique	1-4395628342
Email Id	balachandratc24@gmail.com

Education Qualifications:

SL.No	Degree Obtained	Year of Obtaining the highest degree	Class/ Grade obtained
1	UG	1980	I
2	PG	1985	I
3	PhD	1995	
4	Others		
5			

Total Work Experience in Years:

SL.No	Work Experience	Total in Years
1	Teaching	20
2	Research	07
3	Industry	07
4	others	

Area of Specialization:
High Voltage engineering

	Undergraduate	1 Switchhear and Protectin 2. High Voltage Engineering 3. Reliability Engineering 4. Fundamentals of AI.

Courses taught at	Post Graduate	1. Energy Sources & Conversion Technology 2. Wind Energy Technology Predictive Analytics

Research Guidance (Number of Students): UG students-

No. of papers published:

SL.No	Type	Numbers
1	National	01
2	International Journals	06
3	Conferences	21
4	Others	04

Master (Completed (Year of Completion)/Ongoing : 1985

Ph.D. (Completed Year of Completion)/Ongoing): 1995

Projects Carried out : 1 (Funded by NRB)

Patents (Filed & Granted): 1

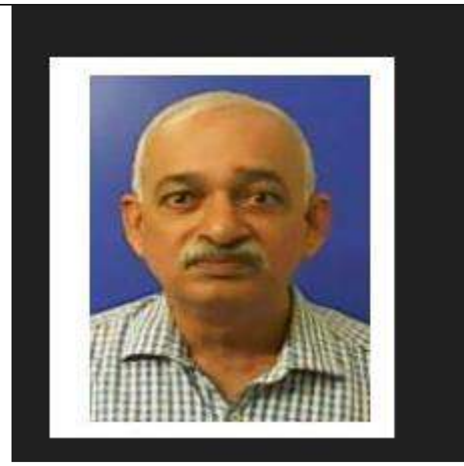
SL No	Topic	**Patent Application No**	Filed/ Granted
1	Novel Technique for Estimation of Electrical Conductivity of Paramagnetic Materials	20 2022 106 110 (German Patent)	Granted
2			

Technology Transfer: Nil

No. of Books published with details: Nil

Profile of the Faculty

BRANCH: ELECTRICAL AND ELECTRONICS ENGINEERING



Name	Dr. Rajkiran Ballal i	
Designation	Professor	
Department	**EEE**	
Date of Joining the Institution	01-02-2021	
Date of Birth	26-08-1960	
Faculty Unique	1-9571321700	
Email Id	rajkiran.dballal@nmit.ac.in	rajkiran.ballal@gmail.com

Education Qualifications:

SL.No	Degree Obtained	Year of Obtaining the highest degree	Class/ Grade obtained
1	UG	1984	II
2	PG	1992	I
3	PhD	2010	
4	Others		
5			

Total Work Experience in Years:

SL.No	Work Experience	Total in Years
1	Teaching	38
2	Research	06
3	Industry	01
4	others	0

Area of Specialization:

Courses taught at	Undergraduate	1 All EEE subjects
	Post Graduate	1 Power Electronics.

Research Guidance (Number of Students):UG students-

No. of papers published:

SL.No	Type	Numbers
1	National	10
2	International Journals	6
3	Conferences	4
4	Others	0

Master (Completed (Year of Completion)/Ongoing): 01 at NMIT

Ph.D. (Completed Year of Completion)/Ongoing): 3 completed and 2 ongoing.

Projects Carried out : -

Patents (Filed & Granted):

SL No	Topic	Patent **Application No**	Filed/ Granted
1	NIL		
2			

Technology Transfer:
NIL

No. of Books published with details: NIL

Profile of the Faculty

BRANCH: ELECTRICAL AND ELECTRONICS ENGINEERING

Name	Dr N Samanvita
Designation	Prof
Department	**EEE**
Date of Joining the Institution	17/1/2011
Date of Birth	09/2/1984
Faculty Unique	1-423218479
Email Id	samanvitha.n@nmit.ac.in

Education Qualifications:

SL.No	Degree Obtained	Year of Obtaining the highest degree	Class/ Grade obtained
1	UG	2005	FCD
2	PG	2007	FCD
3	PhD	2018	
4	Others		
5			

Total Work Experience in Years:

SL.No	Work Experience	Total in Years
1	Teaching	14
2	Research	
3	Industry	
4	others	

Area of Specialization:

Courses taught at	Undergraduate	1. Basic Electrical Engg 2. Quantum Computing 3. Artificial Intelligence 4. OOPS using C++ 5. Linear Integrated Circuits

Research Guidance (Number of Students):UG students-

No. of papers published:

SL.No	Type	Numbers
1	National	
2	International Journals	8
3	Conferences	14
4	Others	

Master (Completed (Year of Completion)/Ongoing): Completed

Ph.D. (Completed Year of Completion)/Ongoing): Completed

Projects Carried out :NA

Patents (Filed & Granted):

SL No	Topic	**Patent Application No**	Filed/ Granted
1	A Clutch Lever Restriction Assembly	202141038532	Granted
2	“An Adjustable Stand For Portable Electronic Device With Angle Display	348074-001	Granted

Technology Transfer:

No. of Books published with details:

Profile of the Faculty

BRANCH: ELECTRICAL AND ELECTRONICS ENGINEERING

Name	Dr. Shefali Jagwani	
Designation	Associate Professor	
Department	**EEE**	
Date of Joining the Institution	01/08/2018	
Date of Birth	31/January/1988	
Faculty Unique	1-4399896384	
Email Id	shefali.jagwani@nmit.ac.in	

Education Qualifications:

SL.No	Degree Obtained	Year of Obtaining the highest degree	Class/ Grade obtained
1	UG	2009	1st
2	PG	2011	1st
3	PhD	2019	
4	Others		
5			

Total Work Experience in Years: 11

SL.No	Work Experience	Total in Years
1	Teaching	6.5
2	Research	3
3	Industry	
4	others	

Area of Specialization:

Courses taught at	Undergraduate	1 Power Electronics 2 Advanced Power Electronics 3 Electric and Hybrid Vehicle 4 Basic Electrical Engineering 5 Electrical and Electronics Engineering Materials

		6 Energy Environment and Sustainability
	Post Graduate	1 Energy Materials

Research Guidance (Number of Students):UG students- 15

No. of papers published:

SL.No	Type	Numbers
1	National	3
2	International Journals	4
3	Conferences	9
4	Others	

Master (Completed(Year of Completion)/Ongoing): 2011

Ph.D. (Completed Year of Completion)/Ongoing): 2019

Projects Carried out : Control of Switched Reluctance Machine for Wind Energy Conversion Systems

Patents (Filed & Granted):

Technology Transfer:

No. of Books published with details: 1

Electrical and Electronics Materials
DP Kothari, M Jain, S Jagwani
Narosa Publications, Delhi - 2016

Scholar articles

Profile of the Faculty

BRANCH: ELECTRICAL AND ELECTRONICS ENGINEERING

Name	VEENA.S
Designation	Assistant Professor
Department	**E&EE**
Date of Joining the Institution	16.08.2004
Date of Birth	30.07.1980
Faculty Unique	1-450425450
Email Id	veena.s@nmit.ac.in

Education Qualifications:

SL.No	Degree Obtained	Year of Obtaining the highest degree	Class/ Grade obtained
1	UG	2004	FCD
2	PG	2011	FC
3	PhD	perusing	
4	Others		
5			

Total Work Experience in Years:

SL.No	Work Experience	Total in Years
1	Teaching	18
2	Research	-
3	Industry	
4	others	

Area of Specialization: VLSI design and Embedded Systems, Microelectromechanical systems

Courses taught at	Undergraduate	1. Basic Electrical Engineering 2. Digital Electronics 3. DC Machines 4. Microcontrollers 5. Transformers and Induction Machines 6. Industrial Automation and PLC

		7. Power system Analysis and Stability 8. High Voltage 9. Industrial Drives and Application 10. Artificial Intelligence 11. Computer Communication Network 12. Embedded Systems
	Post Graduate	1. Instrumentation and Control of Energy Systems Energy sources and Conversion Technology

Research Guidance (Number of Students):UG students- 16 batches (4 students in each batch)

No. of papers published:

SL.No	Type	Numbers
1	National	
2	International Journals	1
3	Conferences	17
4	Others	

Master (Completed (Year of Completion)/Ongoing): 1 completed

Ph.D. (Completed Year of Completion)/Ongoing): NA

Projects Carried out:

Patents (Filed & Granted): 1

SL No	Topic	Patent **Application No**	Filed/ Granted
1	Novel Technique for Estimation of Electrical Conductivity of Paramagnetic Materials	20 2022 106 110 (German Patent)	Granted
2			

Technology Transfer:

No. of Books published with details:

Profile of the Faculty

BRANCH: ELECTRICAL AND ELECTRONICS ENGINEERING

Name	Dr Aruna M	
Designation	Associate Professor	
Department	**EEE**	
Date of Joining the Institution	30/08/2022	
Date of Birth	10/09/1967	
Faculty Unique	1-3391953604	
Email Id	aruna.m@nmit.ac.in	

Education Qualifications:

SL.No	Degree Obtained	Year of Obtaining the highest degree	Class/ Grade obtained
1	UG	1992	II
2	PG	2007	I
3	PhD	2018	
4	Others		
5			

Total Work Experience in Years:

SL.No	Work Experience	Total in Years
1	Teaching	17
2	Research	3
3	Industry	2
4	others	10 [Entrepreneur]

Area of Specialization:

Courses taught at	Undergraduate	1.Basic Electrical Engineering 2. Power System Analysis 3. Renewable energy Sources 4.Energy conversion systems 5. Testing and commissioning of electrical equipment

		6.Power system operation and control 7.High voltage Engineering 8.Power system Protection 9.Control system
	Postgraduate	1.Integration of renewable energy 2.Insulator in power system 3.Economic operation and control of Power system 4. High voltage power transformer

Research Guidance (Number of Students):UG students-

No. of papers published:

SL.No	Type	Numbers
1	National	
2	International Journals	5
3	Conferences	30
4	Others	

Master (Completed (Year of Completion)/Ongoing): Completed

Ph.D. (Completed Year of Completion)/Ongoing): Completed

Projects Carried out: Power system operation and control, Waste management, Renewable energy projects, Solar dual axis tracking, Lithium Ferro Phosphate Battery, Material analysis [SEM, XRD, TGA, DSC, DGA]

Patents (Filed & Granted):

SL No	Topic	Patent **Application No**	Filed/ Granted
1	"Artificial intelligence and voice based patients monitoring system"	202041048080A, dated 13/11/2020	Filed
2	"Wireless Power Transmission based on road electric vehicle mobile charging"	202141001285A, dated 11/01/2021	Filed

Technology Transfer:

No. of Books published with details:

Profile of the Faculty

BRANCH: ELECTRICAL AND ELECTRONICS ENGINEERING

Name	Dr. Prasanth Venkatareddy
Designation	Associate Professor
Department	**EEE**
Date of Joining the Institution	01/07/2021
Date of Birth	11/Jan/1979
Faculty Unique	1-10537051661
Email Id	prasanth.v@nmit.ac.in

Education Qualifications:

SL.No	Degree Obtained	Year of Obtaining the highest degree	Class/ Grade obtained
1	UG	2003	1st
2	PG	2005	1st
3	PhD	2021	
4	Others		
5			

Total Work Experience in Years:

SL.No	Work Experience	Total in Years
1	Teaching	17
2	Research	-
3	Industry	1.5
4	others	

Area of Specialization:

Courses taught at	Undergraduate	1 Basic Electrical Engineering 2. Electrical Circuit Analysis 3 Control Systems 4 Signals and Systems 5 Electrical Drives

Research Guidance (Number of Students):UG students- 15

No. of papers published:

SL.No	Type	Numbers
1	National	

2	International Journals	08
3	Conferences	10
4	Others	

Master (Completed (Year of Completion)/Ongoing): Completed 2005

Ph.D. (Completed Year of Completion)/Ongoing): Completed 2021

Projects Carried out : Robust control Systems, Domestic Home Automation

Patents (Filed & Granted):

SL No	Topic	**Patent Application No**	Filed/ Granted
1	**A spectro-temporal discriminative random field-based speech enhancement**	2022110114094600DE	Granted
2	"***An Adjustable Stand for Portable Electronic Device with Angle Display***".	348074-001	Granted
3	***"Oral Radiography".***	360383-001	Filed and published
4	"***A Clutch lever restriction assembly***".	202141038532	Granted

Technology Transfer: Wimax technology

No. of Books published with details: NIL

Profile of the Faculty

BRANCH: ELECTRICAL AND ELECTRONICS ENGINEERING

Name	Sridevi H R
Designation	Assistant Professor
Department	**EEE**
Date of Joining the Institution	30/08/2004
Date of Birth	23/01/1983
Faculty Unique	1-2183249254
Email Id	sridevi.hr@nmit.ac.in

Education Qualifications:

SL.No	Degree Obtained	Year of Obtaining the highest degree	Class/ Grade obtained
1	UG	2004	FCD
2	PG	2011	FCD
3	PhD	Pursuing	
4	Others		
5			

Total Work Experience in Years:

SL.No	Work Experience	Total in Years
1	Teaching	18
2	Research	-
3	Industry	Nil
4	others	Nil

Area of Specialization: Power Electronics, Power systems

Courses taught at	Undergraduate	1. Basic Electrical Engineering 2. Electrical circuit analysis 3. Signals & Systems

		4. Digital Signal processing 5. Switch gear & protection 6. Computer techniques in power systems 7. Electrical Power quality Micro and Smart Grid
	Post Graduate	1. Wind energy and design aspects 2. Instrumentation and control of energy systems

Research Guidance (Number of Students):UG students-15 batches

No. of papers published:

SL.No	Type	Numbers
1	National	
2	International Journals	02
3	Conferences	11
4	Others	

Master (Completed (Year of Completion)/Ongoing): 2022 – 01 completed
2019 -02 completed

Ph.D. (Completed Year of Completion)/Ongoing): NA

Projects Carried out :

Patents (Filed & Granted):

SL No	Topic	Patent **Application No**	Filed/ Granted
1			
2			

Technology Transfer:

No. of Books published with details:

Profile of the Faculty

BRANCH: ELECTRICAL AND ELECTRONICS ENGINEERING

Name	Sowmya Raman	
Designation	Assistant Professor	
Department	**EEE**	
Date of Joining the Institution	20/08/2011	
Date of Birth	21/11/1987	
Faculty Unique	1-721625798	
Email Id	sowmya.raman@nmit.ac.in	

Education Qualifications:

SL.No	Degree Obtained	Year of Obtaining the highest degree	Class/ Grade obtained
1	UG	2009	1
2	PG	2011	1
3	PhD		
4	Others		
5			

Total Work Experience in Years:

SL.No	Work Experience	Total in Years
1	Teaching	11
2	Research	
3	Industry	
4	others	

Area of Specialization:

Courses taught at	Undergraduate	1. Digital Electronics 2. Microcontroller 3. Programmable Logic Controller 4. Linear Integrated Circuits 5. Measurements & Transducers 6. Control Systems

		7. Power System Analysis & Stability 8. Basic Electrical Engineering 9. Operations Research 10. Analog Electronics Circuits.

Research Guidance (Number of Students):UG students-10

No. of papers published:

SL.No	Type	Numbers
1	National	
2	International Journals	
3	Conferences	6
4	Others	

Master (Completed(Year of Completion)/Ongoing): Completed

Ph.D. (Completed Year of Completion)/Ongoing):

Projects Carried out :

Patents (Filed & Granted):

SL No	Topic	Patent **Application No**	Filed/ Granted
1			
2			

Technology Transfer:

No. of Books published with details:

Profile of the Faculty

BRANCH: ELECTRICAL AND ELECTRONICS ENGINEERING

Name	Sujatha Shivashimpeger
Designation	Assistant Professor
Department	**EEE**
Date of Joining the Institution	25/08/2011
Date of Birth	22/06/1976
Faculty Unique	
Email Id	sujata.s@nmit.ac.in

Education Qualifications:

SL.No	Degree Obtained	Year of Obtaining the highest degree	Class/ Grade obtained
1	UG	1999	First Class
2	PG	2009	First class with distinction
3	PhD		
4	Others		
5			

Total Work Experience in Years:

SL.No	Work Experience	Total in Years
1	Teaching	16
2	Research	
3	Industry	
4	others	

Area of Specialization: Computer applications in Industrial drives(CAID)

Courses taught at	Diploma/ Post Diploma	1 2
	Undergraduate	1. Basic Electrical Engg 2. Microcontroller 3. Network 4. Analysis & Synthesis 5. Linear Integrated Circuits

		6. Switch gear & Protection 7. HVDC
	Post Graduate	4. Solar Energy Technologies 5. Wind energy design aspects 6.
	Post Graduate Diploma Level	1 2

Research Guidance (Number of Students): UG students - 30

No. of papers published:

SL.No	Type	Numbers
1	National	2
2	International Journals	1
3	Conferences	4
4	Others	

Master (Completed (Year of Completion)/Ongoing): 22

Ph.D. (Completed Year of Completion)/Ongoing): 5/2

Projects Carried out : Bio mass Production

Patents (Filed & Granted):

SL No	Topic	Patent **Application No**	Filed/ Granted
1			
2			

Technology Transfer: --

No. of Books published with details: --

Profile of the Faculty

BRANCH: ELECTRICAL AND ELECTRONICS ENGINEERING

Name	SUDEEP SHETTY	
Designation	Assistant Professor	
Department	EEE	
Date of Joining the Institution	10/12/2015	
Date of Birth	25/05/1986	
Faculty Unique	1-2908509407	
Email Id	sudeep.shetty@nmit.ac.in	

Education Qualifications:

SL.No	Degree Obtained	Year of Obtaining the highest degree	Class/ Grade obtained
1	UG	2007	FC
2	PG	2014	FCD
3	PhD	Persuing	-
4	Others	-	-
5			

Total Work Experience in Years:

SL.No	Work Experience	Total in Years
1	Teaching	07
2	Research	-
3	Industry	05
4	others	-

Area of Specialization:
Electric Drives

	Undergraduate	1 Basic Electrical Engineering 2 Electrical Machine Design 3 Power Electronics 4 Control System

Courses taught at		5 Industrial Drives & Control 6 Energy Audit and Economics 7 Reactive Power Managemet
	Post Graduate	1 Energy Audit and Economics

Research Guidance (Number of Students):UG students- 15

PG student :1

No. of papers published:

SL.No	Type	Numbers
1	National	01
2	International Journals	02
3	Conferences	04
4	Others	-

Master (Completed (Year of Completion)/Ongoing): Completed

Ph.D. (Completed Year of Completion)/Ongoing): - Ongoing

Projects Carried out: NIl

Patents (Filed & Granted):
NIL

SL No	Topic	Patent **Application No**	Filed/ Granted
1			
2			

Technology Transfer: -

No. of Books published with details: -

Profile of the Faculty

BRANCH: ELECTRICAL AND ELECTRONICS ENGINEERING

Name	NAGARAJ M J	
Designation	Assistant Professor	
Department	EEE	
Date of Joining the Institution	17/02/2016	
Date of Birth	13/02/1974	
Faculty Unique	1-2908122888	
Email Id	nagaraj.mj@nmit.ac.in	

Education Qualifications:

SL.No	Degree Obtained	Year of Obtaining the highest degree	Class/ Grade obtained
1	UG	2005	FCD
2	PG	2014	FCD
3	PhD	-	-
4	Others	-	-
5			

Total Work Experience in Years:

SL.No	Work Experience	Total in Years
1	Teaching	08
2	Research	-
3	Industry	22
4	others	-

Area of Specialization:

	Undergraduate	1 Basic Electrical Engineering 2 DC & Synchronous Machines 3 Transformers & Induction Machines 4 Switch Gear & Protection

Courses taught at		5 Programmable Logic Controllers 6 Industrial Automation & PLC 7 VLSI Design & Embedded Systems 8 Electrical Machine Design
	Post Graduate	1 Solar Radiations & Energy Conversions 2 Solar Energy System Design

Research Guidance (Number of Students):UG students- 20

No. of papers published:

SL.No	Type	Numbers
1	National	01
2	International Journals	02
3	Conferences	13
4	Others	-

Master (Completed (Year of Completion)/Ongoing): Completed

Ph.D. (Completed Year of Completion)/Ongoing): -

Projects Carried out : MODROB (Power System Protection & Advanced Machines Lab)

Patents (Filed & Granted):

SL No	Topic	Patent **Application No**	Filed/ Granted
1			
2			

Technology Transfer: -

No. of Books published with details: -

Profile of the Faculty

BRANCH: ELECTRICAL AND ELECTRONICS ENGINEERING

Name	Dr. Shruti Gatade	
Designation	Assistant Professor	
Department	**EEE**	
Date of Joining the Institution	18/08/2016	
Date of Birth	12/01/1991	
Faculty ID	1-3209622577	
Mail	shruti.gatade@nmit.ac.in	

Education Qualifications:

SL.No	Degree Obtained	Year of Obtaining the highest degree	Class/ Grade obtained
1	BE in Electrical and Electronics Engineering	2012	1st
2	MTech in VLSI Design and Embedded Systems	2016	1st
3			
4			
5			

Total Work Experience in Years:

SL.No	Work Experience	Total in Years
1	Teaching	6
2	Research	
3	Industry	1
4	others	

Area of Specialization:

	Undergraduate	1.Microcontroller 2 Linear integrated circuits 3AI Applications in Power systems

Courses taught at		4Object Oriented Programming using C++ 5. Sensors and Transducers 6.Programmable Logic Controller 7. Electrical Power Generation Transmission and Distribution 8.Entrepreneurship Development Management and IPR

Research Guidance (Number of Students):UG students- 10

No. of papers published:

SL.No	Type	Numbers
1	National	
2	International Journals	
3	Conferences	8
4	Others	

Master (Completed (Year of Completion)/Ongoing): NIL

Ph.D. (Completed Year of Completion)/Ongoing): NIL

Projects Carried out :

Patents (Filed & Granted):

SL No	Topic	**Patent Application number**	**Status**

Technology Transfer:

No. of Books published with details:

Profile of the Faculty

BRANCH: ELECTRICAL AND ELECTRONICS ENGINEERING

Name	Mr. ANAND S	
Designation	ASSISTANT PROFESSOR	
Department	**EEE**	
Date of Joining the Institution	02/01/2017	
Date of Birth	20/04/1990	
Faculty Unique	1-3547813913	
Email Id	anand.s@nmit.ac.in	

Education Qualifications:

SL.No	Degree Obtained	Year of Obtaining the highest degree	Class/ Grade obtained
1	UG	2011	FCD
2	PG	2014	FC
3	PhD		
4	Others		
5			

Total Work Experience in Years:

SL.No	Work Experience	Total in Years
1	Teaching	7.5
2	Research	
3	Industry	1
4	others	

Area of Specialization: POWER ELECTRONICS

Courses taught at	Undergraduate	1. Operational Research 2. Digital Electronics 3. Industrial Drives and Controls 4. Control Systems. 5. Basic Electrical Engineering 6. Transducers and Smart Instruments.

		7. Switch Gear and Protection

Research Guidance (Number of Students):UG students-8

No. of papers published:

SL.No	Type	Numbers
1	National	
2	International Journals	1
3	Conferences	3
4	Others	

Master (Completed (Year of Completion)/Ongoing): 2014

Ph.D. (Completed Year of Completion)/Ongoing): -

Projects Carried out : Simulation and Implementation of battery management system

Patents (Filed & Granted):

SL No	Topic	**Patent Application No**	Filed/ Granted
1	A driving device utilizing renewable energy device	347902-001	Granted

Technology Transfer:

No. of Books published with details: NIL

Profile of the Faculty

BRANCH: ELECTRICAL AND ELECTRONICS ENGINEERING

Name	Mrs. Meghana A	
Designation	Assistant Professor	
Department	**EEE**	
Date of Joining the Institution	13/06/2018	
Date of Birth	17/Sept/1990	
Faculty Unique	1-4317404727	
Email Id	meghana.a@nmit.ac.in	

Education Qualifications:

SL.No	Degree Obtained	Year of Obtaining the highest degree	Class/ Grade obtained
1	UG	2012	First class
2	PG	2016	First class with distinction
3	PhD	----	
4	Others		
5			

Total Work Experience in Years:

SL.No	Work Experience	Total in Years
1	Teaching	4
2	Research	
3	Industry	
4	others	

Area of Specialization: Electrical & Electronics Engineering

	Undergraduate	1 Industrial drives & control 2 Measurents and Transducers

<table>
<tr><td rowspan="3">Courses taught at</td><td></td><td>3 Sensors & Transducers
4 Non-conventional energy sources</td></tr>
<tr><td></td><td></td></tr>
<tr><td>Post Graduate</td><td>1 Instrumentation and control of energy systems</td></tr>
<tr><td colspan="3">Research Guidance (Number of Students):UG students- 10</td></tr>
<tr><td colspan="3">No. of papers published:</td></tr>
</table>

SL.No	Type	Numbers
1	National	
2	International Journals	1
3	Conferences	3
4	Others	

Master (Completed (Year of Completion)): 2016

Ph.D. (Completed Year of Completion)/Ongoing): NIL

Projects Carried out :

Patents (Filed & Granted):

SL No	Topic	**Patent Application No**	Filed/ Granted
1			
2			

Technology Transfer:

No. of Books published with details:

Profile of the Faculty

BRANCH: ELECTRICAL AND ELECTRONICS ENGINEERING

Name	SMITHA. B	
Designation	ASSISTANT PROFESSOR	
Department	**EEE**	
Date of Joining the Institution	01/08/2018	
Date of Birth	01/06/1979	
Faculty Unique	1-4316951714	
Email Id	Smitha.b@nmit.ac.in	

Education Qualifications:

SL.No	Degree Obtained	Year of Obtaining the highest degree	Class/ Grade obtained
1	UG	2001	FC
2	PG	2018	FCD
3	PhD		
4	Others		
5			

Total Work Experience in Years:

SL.No	Work Experience	Total in Years
1	Teaching	5
2	Research	
3	Industry	
4	others	

Area of Specialization: RENEWABLE ENERGY

Courses taught at	Undergraduate	1. Entrepreneurship Management Development and IPR 2. Renewable Energy Sources 3. Fundamental Of Artificial Intelligent. 4. Operational Research 5. Electrical Power Generation, Transmission, and Distribution.

		6. Digital Electronics
		1. Solar Energy Technology 2. Wind Energy Design and Analysis.

Research Guidance (Number of Students):UG students-5

No. of papers published:

SL.No	Type	Numbers
1	National	
2	International Journals	1
3	Conferences	4
4	Others	

Master (Completed (Year of Completion)/Ongoing): 2018

Ph.D. (Completed Year of Completion)/Ongoing):

Projects Carried out :

Patents (Filed & Granted):

SL No	Topic	Patent **Application No**	Filed/ Granted
1			
2			

Technology Transfer:

No. of Books published with details:

Profile of the Faculty

BRANCH: ELECTRICAL AND ELECTRONICS ENGINEERING

Name	Dr. Shreeram Vishwanath Kulkarni
Designation	Assistant Professor
Department	**EEE**
Date of Joining the Institution	03-06-2019
Date of Birth	02-07-1991
Faculty Unique	1-7430745318
Email Id	Shreeram.kulkarni@nmit.ac.in

Education Qualifications:

SL.No	Degree Obtained	Year of Obtaining the highest degree	Class/ Grade obtained
1	UG	2013	FC
2	PG	2016	FCD
3	PhD	2022	

Total Work Experience in Years:

SL.No	Work Experience	Total in Years
1	Teaching	3.7
2	Research	2.5

Area of Specialization:

Courses taught at	Undergraduate	1 Basic Electrical Engineering 2 Electrical Circuit Analysis 3 Electromagnetic Fields and Waves 4 Power System Stability and Analysis 5 Computer Techniques in Power Systems 6 Introduction to Micro and Smart Grid

		7 Basic Electrical Engineering Laboratory 8 Electrical Machine Laboratory 9 Power System Simulation Laboratory
	Post Graduate	1 Micro and Smart Grid

Research Guidance (Number of Students):UG students- 20
PG students- 01

No. of papers published:

SL.No	Type	Numbers
1	National	01
2	International Journals	02
3	Conferences	06
4	Others	05

Master: 01

Ph.D.: NIL

Projects Carried out: Operation and Control of Distributed Generation Sources in Microgrid

Patents (Filed & Granted):

SL No	Topic	Patent **Application No**	Filed/ Granted
1	A NOVEL ISLANDING DETECTION TECHNIQUE BASED ON PIEZOELECTRIC SENSORS FOR GRID-INTEGRATED DG	202241050451	Granted
2	Design and Analysis of Underwater Bifacial Solar Photovoltaic Cell	202241050453	Granted
3	System for contactless estimation of electrical conductivity of paramagnetic materials	2022103114121800DE	Granted

Technology Transfer:

No. of Books published with details:

Profile of the Faculty

BRANCH: ELECTRICAL AND ELECTRONICS ENGINEERING

Name	Dr. Pavana	
Designation	Assistant Professor	
Department	**EEE**	
Date of Joining the Institution	16/11/2021	
Date of Birth	20/12/1989	
Faculty Unique	1-10893187121	
Email Id	pavana.prabhu@nmit.ac.in	

Education Qualifications:

SL.No	Degree Obtained	Year of Obtaining the highest degree	Class/ Grade obtained
1	UG	2011	1st
2	PG	2013	1st
3	PhD	2021	

Total Work Experience in Years:

SL.No	Work Experience	Total in Years
1	Teaching	2
2	Research	1
3	Industry	-
4	others	-

Area of Specialization:

Courses taught at	Undergraduate	1 Analog Electronics 2 Power Electronics 3 Electric Vehicle Technology 4 Battery Management Systems-1 5 Battery Management Systems-2
	Post Graduate	1 Power Electronics for Renewable Energy

Research Guidance (Number of Students):UG students- 4

No. of papers published:

SL.No	Type	Numbers
1	National	
2	International Journals	2
3	Conferences	3
4	Others	

Master (Completed(Year of Completion)/Ongoing): NIL

Ph.D. (Completed Year of Completion)/Ongoing):NIL

Projects Carried out :

Patents (Filed & Granted):

SL No	Topic	Patent **Application No**	Filed/ Granted

Technology Transfer:

No. of Books published with details:

Profile of the Faculty

BRANCH: ELECTRICAL AND ELECTRONICS ENGINEERING

Name	Dr. Pramod Bhat Nempu	
Designation	Assistant Professor	
Department	**EEE**	
Date of Joining the Institution	01-12-2021	
Date of Birth	20-05-1993	
Faculty Unique	1-10893152021	
Email Id	pramod.bhat@nmit.ac.in	pramodbhatn@gmail.com

Education Qualifications:

SL.No	Degree Obtained	Year of Obtaining the highest degree	Class/ Grade obtained
1	UG	2014	FCD
2	PG	2016	FCD
3	PhD	2020	-
4	Others	-	-
5			

Total Work Experience in Years:

SL.No	Work Experience	Total in Years
1	Teaching	2
2	Research	-
3	Industry	0
4	others	0

Area of Specialization:

Courses taught at	Undergraduate	1. Basic Electrical Engineering 2. Electrical Machines 3. High Voltage Engineering.

Research Guidance (Number of Students):UG students- NIL

No. of papers published:

SL.No	Type	Numbers

1	National	0
2	International Journals	9
3	Conferences	5
4	Others	0

Master (Completed (Year of Completion)/Ongoing): 0

Ph.D. (Completed Year of Completion)/Ongoing): 0

Projects Carried out : NA

Patents (Filed & Granted): NA

SL No	Topic	Patent **Application No**	Filed/ Granted
1	NIL	-	-
2			

Technology Transfer:
NIL

No. of Books published with details: NIL

Profile of the Faculty

BRANCH: ELECTRICAL AND ELECTRONICS ENGINEERING

Name	**Dr. CH HUSSAIAN BASHA**	
Designation	Assistant Professor	
Department	**EEE**	
Date of Joining the Institution	19/08/2022	
Date of Birth	20/10/1991	
Faculty Unique	1-9500519215	
Email Id	hussaian.basha@nmit.ac.in	

Education Qualifications:

SL.No	Degree Obtained	Year of Obtaining the highest degree	Class/ Grade obtained
1	UG	2013	Distinction
2	PG	2016	Distinction
3	PhD	2022	
4	Others		
5			

Total Work Experience in Years:

SL.No	Work Experience	Total in Years
1	Teaching	3
2	Research	-
3	Industry	-
4	others	-

Area of Specialization:

Courses taught at	Undergraduate	1. Power Electronics & Drives 2. Artificial Neural Network 3. Solar Systems 4. Analog Electronics 4. Linear Integrated Circuits

		5. Power System Operation and Control
	Post Graduate	1. Power Electronics Applications in RES

Research Guidance (Number of Students):UG students- 8

No. of papers published:

SL.No	Type	Numbers
2	International Journals	14
3	Conferences	22
4	Book Chapters	4

Master (Completed (Year of Completion)/Ongoing): Completed 2016

Ph.D. (Completed Year of Completion)/Ongoing): Completed 2022

Projects Carried out : Power Electronics, Fuel Cell, MPPT, Solar PV, & Artificial Intelligence

Patents (Filed & Granted):

SL No	Topic	**Patent Application No**	Filed/ Granted
1	A MAXIMUM POWER POINT TRACKING DEVICE FOR SOLAR PV SYSTEM	202221020052	Filed
2			

Profile of the Faculty

BRANCH: ELECTRICAL AND ELECTRONICS ENGINEERING

Name	Dr. Singaravelan Arumugam	
Designation	Assistant Professor	
Department	**EEE**	
Date of Joining the Institution	24/08/2022	
Date of Birth	04/May/1987	
Faculty Unique	1-4796492167	
Email Id	singaravelan.arumugam@nmit.ac.in	

Education Qualifications:

SL.No	Degree Obtained	Year of Obtaining the highest degree	Class/ Grade obtained
1	UG	2010	1st
2	PG	2013	1st
3	PhD	2019	
4	Others		
5			

Total Work Experience in Years:

SL.No	Work Experience	Total in Years
1	Teaching	8
2	Research	3
3	Industry	
4	others	

Area of Specialization:

Courses taught at	Undergraduate	1 Power System Analysis 2 Microcontroller 3 Linear integrated circuits 4 Industrial Automation 5 Fundamentals of AI

Research Guidance (Number of Students):UG students- 15

No. of papers published:

SL.No	Type	Numbers
1	National	
2	International Journals	6
3	Conferences	11
4	Others	

Master (Completed (Year of Completion)/Ongoing): NIL

Ph.D. (Completed Year of Completion)/Ongoing): NIL

Projects Carried out : Smart Grid - Demand Side Management

Patents (Filed & Granted):

SL No	Topic	Patent **Application No**	Filed/ Granted
1	Collaborative Robot to Serve Patients and to Collect Infectious Wastage at the Isolation Ward	202041056571 E-2/3846/2020-CHE A	Filed
2	Home Energy Management Device for Demand Response Program to Reduce Consumption Cost and Peak Demand	E-2/2088/2021-CHE 202141029341 Dt. 30/06/2021	Filed

Technology Transfer:

No. of Books published with details:

Profile of the Faculty

BRANCH: ELECTRICAL AND ELECTRONICS ENGINEERING

Name	LIKHITHA R	
Designation	Assistant Professor	
Department	**EEE**	
Date of Joining the Institution	29/08/2022	
Date of Birth	18/10/1986	
Faculty Unique	1-460544151	
Email Id	likhitha.pes@gmail.com	

Education Qualifications:

SL.No	Degree Obtained	Year of Obtaining the highest degree	Class/ Grade obtained
1	UG	2008	FC
2	PG	2011	FC
3	PhD	2022	
4	Others		
5			

Total Work Experience in Years:

SL.No	Work Experience	Total in Years
1	Teaching	13
2	Research	
3	Industry	NIL
4	others	NIL

Area of Specialization:

	Undergraduate	1. Basic Electrical Engineering 2. Electrical circuit analysis 3. Signals & Systems 4. Digital Signal processing

Courses taught at		5. Transformers and induction machine 6. Transmission and distribution

Research Guidance (Number of Students):UG students - 8

No. of papers published:

SL.No	Type	Numbers
1	National	
2	International Journals	6
3	Conferences	10
4	Others	

Master (Completed (Year of Completion)/Ongoing): Completed (2011)

Ph.D. (Completed Year of Completion)/Ongoing): Completed(2022)

Projects Carried out :

Patents (Filed & Granted):

SL No	Topic	**Patent Application No**	Filed/ Granted
1			
2			

Technology Transfer: NIL

No. of Books published with details: NIL

Profile of the Faculty

BRANCH: ELECTRICAL AND ELECTRONICS ENGINEERING

Name	Dr. Ramakrishna Reddy	
Designation	Assistant Professor	
Department	**EEE**	
Date of Joining the Institution	28/10/2022	
Date of Birth	22/Aug/1987	
Faculty Unique		
Email Id	ramakrishna.reddy@nmit.ac.in	

Education Qualifications:

SL.No	Degree Obtained	Year of Obtaining the highest degree	Class/ Grade obtained
1	UG	2008	1st
2	PG	2010	1st
3	PhD	2019	-
4	Others		
5			

Total Work Experience in Years:

SL.No	Work Experience	Total in Years
1	Teaching	08
2	Research	03
3	Industry	0
4	others	

Area of Specialization: Power system engineering

Courses taught at	Undergraduate	1 Basic Electrical Engineering 2. Electrical Circuit Analysis 3 High voltage engineering 4 Power system analysis

	Post Graduate	1. Optimization techniques

Research Guidance (Number of Students):UG students- 15

No. of papers published:

SL.No	Type	Numbers
1	National	0
2	International Journals	04
3	Conferences	02
4	Others	

Master (Completed (Year of Completion)/Ongoing): Completed 2010

Ph.D. (Completed Year of Completion)/Ongoing): Completed 2019

Projects Carried out : 0

Patents (Filed & Granted): 0

SL No	Topic	**Patent Application No**	Filed/ Granted
1			
2			
3			
4			

Technology Transfer: -

No. of Books published with details: NIL

NITTE EDUCATION TRUST

NITTE MEENAKSHI INSTITUTE OF TECHNOLOGY
An Autonomous Institution Approved by UGC/AICTE/Govt. of Karnataka
Accredited by NBA (Tier-I) and NAAC 'A+' Grade
Affiliated to Visvesvaraya Technological University, Belagavi
Post Box No. 6429, Yelahanka, Bengaluru-560064, Karnataka, INDIA

KNOWLEDGE ■ CHARACTER ■ UNITY

DEPARTMENT OF INFORMATION SCIENCE AND ENGINEERING

Sl. No	Names	Designation
1	Dr. Mohan S G	HOD & Professor
2	Dr. Swarnalatha K S	Professor
3	Mr. A Balachandra	Professor
4	Dr. Srinivas D B	Professor
5	Mr. Jagadish Patil. S	Professor
6	Dr. K Aditya Shastry	Professor
7	Dr. Vidyadevi G Biradar	Professor
8	Dr. Manoj Kumar M V	Associate Professor
9	Dr. Govindu Sreekar Shenoy	Associate Professor
10	Dr. Archana Mathur	Associate Professor
11	Dr. Sudhir Shenai	Associate Professor
12	Dr.Tejaswini R Murgod	Associate Professor
13	MS.Lakshmi M	Assistant Professor
14	Mr. Manjunatha B A	Assistant Professor
15	Mr. Rohith H P	Assistant Professor
16	Mrs. Deepika K M	Assistant Professor
17	Mr. Pramod Jain S A	Assistant Professor
18	Mr. Preetham N	Assistant Professor
19	Mrs. Tulasi Srinivas	Assistant Professor
20	Mrs. Vani E S	Assistant Professor
21	Mr. Mohan Kumar T G	Assistant Professor
22	Mrs. Sneha H R	Assistant Professor
23	Mrs. Sushma V	Assistant Professor
24	Ms. Ullal Akshatha Nayak	Assistant Professor
25	Mr. Prashanth B S	Assistant Professor
26	Mrs. Vani K S	Assistant Professor
27	Ms. Akarsha D P	Assistant Professor
28	Mrs. Deepthi K	Assistant Professor
29	Mr.Karthik D U	Assistant Professor
30	Ms.Priyanka K	Assistant Professor
31	Ms.Tejaswini N P	Assistant Professor
32	Mr.Mohan.M	Assistant Professor
33	Ms.Subashree D	Assistant Professor
34	Ms. Evangeline R C	Assistant Professor

Profile of the Faculty

BRANCH: Information Science and Engineering

A Balachandra	Dr Mohan SG	
Designation	Prof and Head	
Department	**ISE**	
Date of Joining the Institution	01-09-2021	
Date of Birth	12-05-1977	
Faculty Unique	8743	
Email Id	mohan.sg@nmit.ac.in	

Education Qualifications:

SL.No	Degree Obtained	Year of Obtaining the highest degree	Class/ Grade obtained
1	UG	1998	I class
2	PG	2002	I class with distinction
3	PhD	2009	NA

Total Work Experience in Years:

SL.No	Work Experience	Total in Years
1	Teaching	23
2	Research	2
3	Industry	3

Area of Specialization:

	Undergraduate	1 Operating System 2 Digital Image Processing 3 UI/UX Design 4. Python Programming

Courses taught at	Post Graduate	1 Computer Vision 2 Advanced computing 3 Machine Learning.

Research Guidance (Number of Students):UG students-07

No. of papers published:

SL.No	Type	Numbers
1	National	4
2	International Journals	22
3	Conferences	31
4	Others	15

Master (Completed (Year of Completion)/Ongoing): 2002

Ph.D. (Completed Year of Completion)/Ongoing): 2009

Projects Carried out :

Patents (Filed & Granted): Filed - 11

SL No	Topic	**Patent Application No**	Filed/ Granted
1			
2			

Technology Transfer: ---

No. of Books published with details:

1. Mohan S and Vani V (Eds), "Multicore Computer Vision and its applications", IGI Global, 2016, ISBN13: 9781522508892|ISBN10: 1522508899|EISBN13: 9781522508908|DOI: 10.4018/978-1-5225-0889-2, indexed in SCOPUS.
2. S, Mohan; Kumar, S Suresh (Eds.), Proceedings of the Fourth International Conference on Signal and Image Processing 2012 (ICSIP 2012), Volume 1 & 2 Series: Springer Lecture Notes in Electrical Engineering, Vol.221 & Vol. 222, 2013, (ISBN 978-81-322-0997-3) & (ISBN 978-81-322-1000-9) SCOPUS

Profile of the Faculty
BRANCH: Information Science and Engineering

Name	Dr.Swarnalatha KS	
Designation	Prof	
Department	**ISE**	
Date of Joining the Institution	12/03/2018	
Date of Birth	17/03/1978	
Faculty Unique	1-4909996152	
Email Id	swarnalatha.ks@nmit.ac.in	

Education Qualifications:

SL.No	Degree Obtained	Year of Obtaining the highest degree	Class/ Grade obtained
1	UG	2001	FCD
2	PG	2006	FCD
3	PhD	2016	-

Total Work Experience in Years:

SL.No	Work Experience	Total in Years
1	Teaching	22 years
2	Research	10
3	Industry	-

Area of Specialization:

Courses taught at	Undergraduate	1DBMS 2Software Engineering 3Digital Design
	Post Graduate	1Data Management 2Business Analytics

Research Guidance: 2 (Number of Students):UG students-

No. of papers published: 37

SL.No	Type	Numbers
1	National	
2	International Journals	2
3	Conferences	3
4	Others	

Master (Completed (Year of Completion)/Ongoing): 1992

Ph.D. (Completed Year of Completion)/Ongoing):
Projects Carried out :
Patents (Filed & Granted): 5 filed 1 granted

SL No	Topic	**Patent Application No**	Filed/ Granted
1			
2			

Technology Transfer:
No. of Books published with details: 1 Software engineering

Profile of the Faculty

BRANCH: Information Science and Engineering

Name	Mr.A.Balachandra
Designation	Prof
Department	**ISE**
Date of Joining the Institution	01 August 2018
Date of Birth	26 October 2022
Faculty Unique	1-36578855701
Email Id	Balachandra.a@nmit.ac.in

Education Qualifications:

SL.No	Degree Obtained	Year of Obtaining the highest degree	Class/ Grade obtained
1	UG		
2	PG	1988, 1992	
3	PhD	---	

Total Work Experience in Years:

SL.No	Work Experience	Total in Years
1	Teaching	7
2	Research	3 - 4
3	Industry	18
4	others	Training - 2

Area of Specialization:

Courses taught at	Undergraduate	1 Software Engineering 2 Computer Networks 3 Software Project Management
	Post Graduate	1 Systems Engineering 2 Software Engineering

Research Guidance (Number of Students):UG students-7

No. of papers published:

SL.No	Type	Numbers
1	National	
2	International Journals	2
3	Conferences	3

4	Others	

Master (Completed (Year of Completion)/Ongoing): 1992

Ph.D. (Completed Year of Completion)/Ongoing): NA

Projects Carried out - In progress:

1. Research in Software engineering – Auto code generators for automating software development and Testing
2. Commercialization of IOT based system for agricultural application – through research and development
3. Research and development of customer survey product feature analysis for prioritizing features and value during product development
4. Research and development of medical device through collaboration with Industry-academia (NMIT) collaboration for commercialization

Patents (Filed & Granted): 1 Filed

SL No	Topic	**Patent Application No**	Filed/ Granted
1	Title of Invention - "An integrated method and system for continuous blood glucose monitoring, real time insulin dose preparation and continual insulin administration." Date of filing: 15-06-2016; Date of publication: 09-06- 2017		

Technology Transfer:

No. of Books published with details:

Profile of the Faculty

BRANCH: Information Science and Engineering

Name	Dr.D B Srinivas	
Designation	Prof	
Department	**ISE**	
Date of Joining the Institution	28-07-2005	
Date of Birth	19 july 1973	
Faculty Unique	1-412297175	
Email Id	srinivas.db@nmit.ac.in	

Education Qualifications:

SL.No	Degree Obtained	Year of Obtaining the highest degree	Class/ Grade obtained
1	UG	1998	first class with distinction
2	PG	2002	First class with distinction
3	PhD	2018	
4	Diploma	1994	first class
5			

Total Work Experience in Years:

SL.No	Work Experience	Total in Years
1	Teaching	23 years
2	Research	2 years
3	Industry	1year

Area of Specialization:

Courses taught at	Undergraduate	1 Computer Networks 2. Cryptography and Network security 3. Software Defined Networks 4. Distributed Systems.
	Post Graduate	1 Advanced Computer networks 2 Cryptography and network security 3Data Management 4. Distributed Systems.

Research Guidance (Number of Students):UG students-

No. of papers published:

SL.No	Type	Numbers
1	National	1
2	International Journals	6
3	Conferences	6
4	Others	

Master (Completed (Year of Completion)/Ongoing): Master of Computer Science

Ph.D. (Completed Year of Completion)/Ongoing): 2018

Projects Carried out :

Patents (Filed & Granted):
2 files

SL No	Topic	**Patent Application No**	Filed/ Granted
1			
2			

Technology Transfer:

No. of Books published with details:

Profile of the Faculty

BRANCH: Information Science and Engineering

Name	Mr.S Jagadish Patil
Designation	Prof
Department	**ISE**
Date of Joining the Institution	08-07-2018
Date of Birth	22-07-1960
Faculty Unique	1-9572548032
Email Id	jagadish.patil@nmit.ac.in

Education Qualifications:

SL.No	Degree Obtained	Year of Obtaining the highest degree	Class/ Grade obtained
1	UG	1983	First class with distinction
2	PG	1996	ME(IISc, Bangalore) First class with distinction
3	PhD		
4	Others	1986	IES
5			

Total Work Experience in Years:

SL.No	Work Experience	Total in Years
1	Teaching	7
2	Research	14
3	Industry	18
4	others	

Area of Specialization:

Courses taught at	Undergraduate	1 Object Oriented Methodology and Design 2 Artificial Intelligence 3 Pulse and Digital Circuits
	Post Graduate	1 Time Series Regression and Forecasting

Research Guidance (Number of Students):UG students-

No. of papers published:

SL.No	Type	Numbers
1	National	
2	International Journals	1
3	Conferences	5
4	Others	

Master (Completed (Year of Completion)/Ongoing): 1996

Ph.D. (Completed Year of Completion)/Ongoing):

Projects Carried out :

Patents (Filed & Granted):

SL No	Topic	**Patent Application No**	Filed/ Granted
1			
2			

Technology Transfer:

No. of Books published with details:

Profile of the Faculty

BRANCH: Information Science and Engineering

Name	Dr. K Aditya Shastry	
Designation	Professor	
Department	**ISE**	
Date of Joining the Institution	22-03-2004	
Date of Birth	11-03-1979	
Faculty Unique	1-412297321	
Email Id	adityashastry.k@nmit.ac.in	

Education Qualifications:

SL.No	Degree Obtained	Year of Obtaining the highest degree	Class/ Grade obtained
1	UG	2000	First class
2	PG	2007	First class with distinction
3	PhD	2019	NA

Total Work Experience in Years:

SL.No	Work Experience	Total in Years
1	Teaching	18.3
2	Research	10
3	Industry	3

Area of Specialization:

Courses taught at	Undergraduate	1 Analysis and design of algorithms 2 Theory of computation 3 Machine Learning 4 Data Mining 5 Data Structures using C.
	Post Graduate	1 Machine Learning-I 2 Machine Learning-II 3 Wireless mobile networks.

Research Guidance (Number of Students):UG students-

No. of papers published: 49

SL.No	Type	Numbers
1	National	1
2	International Journals	12
3	Conferences	24
4	Others	12

Master (Completed (Year of Completion)/Ongoing):

Ph.D. (Completed Year of Completion)/Ongoing): 2019

Projects Carried out :

- Cloud based machine learning framework for chronic disease prediction-PI-VGST-15 Lakhs-Ongoing
- Multimodal data security framework - Co-PI-ISRO-3 Lakhs - 2018-19 (Completed)

Patents (Filed & Granted):

SL No	Topic	**Patent Application No**	Filed/ Granted
1	Deep learning based alzheimer disease detection system	2022103114124500DE	Granted
2	A deep learning based parkinson detection system	2022110114092200DE	Granted
3	Covid and Pneumonia detection system using convolutional neural network on chest X-ray images	202241073368	Filed
4	Quantum Computer for Credit Card Fraud Detection using Quantum Neural Techniques	202241073308	Filed
5	One Nation One Health Card and Patient Monitoring System Using IoT and Cloud	202241073369	Filed

Technology Transfer:

No. of Books published with details:

Profile of the Faculty
BRANCH: Information Science and Engineering

Name	Dr.Vidyadevi G Biradar	
Designation	Assoc . Prof	
Department	**ISE**	
Date of Joining the Institution	11-08-2008	
Date of Birth	06-08-1973	
Faculty Unique	1-407247871	
Email Id	vidyadevi.g.biradar@nmit.ac.in	

Education Qualifications:

SL.No	Degree Obtained	Year of Obtaining the highest degree	Class/ Grade obtained
1	UG	1996	first class with distinction
2	PG	2002	first class
3	PhD	2019	awarded

Total Work Experience in Years:

SL.No	Work Experience	Total in Years
1	Teaching	25
2	Research	10

Area of Specialization:

Courses taught at	Undergraduate	1digital image processing 2software engineering 3 machine learning & deep learning
	Post Graduate	1computer vision 2database management systems 3software engineering.

Research Guidance (Number of Students):UG students-

No. of papers published:

SL.No	Type	Numbers
1	National	03

2	International Journals	17
3	Conferences	02
4	Others	

Master (Completed (Year of Completion)/Ongoing): 2002

Ph.D. (Completed Year of Completion)/Ongoing): 2019

Projects Carried out : 10

Patents (Filed & Granted):

SL No	Topic	**Patent Application No**	Filed/ Granted
1	IMAGE CAPTIONING USING DEEP LEARNING	202241050400	Filed
2	FIRE HAZARDS DETECTION USING LIGHTWEIGHT DEEP LEARNING MODEL	202241050371	Granted
3	SYSTEM FOR COVID DETECTION	202241008585	Granted
4	CORROSION CELL	364538-001	Field
5	A GENERATIVE ADVERSARIAL NETWORKS - BASED TEXT TO IMAGE SYNTHESIS SYSTEM	202022106133	Granted

Technology Transfer:

No. of Books published with details:

Profile of the Faculty
BRANCH: Information Science and Engineering

Name	Dr.Manoj Kumar	
Designation	Assoc Prof	
Department	**ISE**	
Date of Joining the Institution	6 June 2018	
Date of Birth	24 July 1989	
Faculty Unique	1-4394656276	
Email Id	manoj.kumar@nmit.ac.in	

Education Qualifications:

SL.No	Degree Obtained	Year of Obtaining the highest degree	Class/ Grade obtained
1	UG	2010	FCD
2	PG	2012	FCD
3	PhD	2017	

Total Work Experience in Years:

SL.No	Work Experience	Total in Years
1	Teaching	10
2	Research	4
3	Industry	0.5

Area of Specialization:

Courses taught at	Undergraduate	1 Java 2 Statistics 3 Computer organization 4 Exploratory data analysis 5 Hybrid application development 6 Android application development 7 Data Mining
	Post Graduate	1 Machine Learning 2 Exploratory Data Analysis 3 Statistics for data science

Research Guidance (Number of Students):UG students-

No. of papers published: 40

SL.No	Type	Numbers
1	National	1
2	International Journals	10
3	Conferences	29
4	Others	0

Master (Completed (Year of Completion)/Ongoing):

Completed: 3
Ongoing: 1

Ph.D. (Completed Year of Completion)/Ongoing):

Completed: 0
Ongoing: 2

Projects carried out:

End-to-end Verifiable and Preferential Strategy based Electronic Voting System Using Delegated Proof of Stake on Blockchain
Competitive research funding scheme

- Funding Agency: Technical Education Quality Improvement Program (TEQIP III)
- Amount: 2 lakh rupees.
- Duration: 2020 - 2021

Development of algorithms for extraction of features from clinical reports and pattern recognition to predict treatment outcomes related to infectious diseases

- RGS-F: Research Grants for Scientist / Faculty (RGS/F)
- Vision Group of Science and Technology (VGST)
- Amount: 3 Lakh Rupees
- Duration: 2021 – 2022

Patents (Filed & Granted):

SL No	Topic	**Patent Application No**	Filed/ Granted
1	A system for classifying melanoma images	20221110115 11800DE	Filed
2			

Technology Transfer:

No. of Books published with details:

Profile of the Faculty

BRANCH: Information Science and Engineering

Name	Dr.Govind Sreekar Shenoy	
Designation	Assco. Prof	
Department	**ISE**	
Date of Joining the Institution	28/12/2020	
Date of Birth	14/08/1980	
Faculty Unique	1-9571032540	
Email Id	govind.shenoy@nmit.ac.in	

Education Qualifications:

SL.No	Degree Obtained	Year of Obtaining the highest degree	Class/ Grade obtained
1	UG	1999	First Class
2	PG	2006	Best Thesis (IISc)
3	PhD	2013	UPC Barcelona
4	Others		Post Doc from Edinburgh and Wisconsin

Total Work Experience in Years:

SL.No	Work Experience	Total in Years
1	Teaching	3.5
2	Research	13
3	Industry	2

Area of Specialization: Computer Architecture, IoT, Block Chain, DevOps

Courses taught at	Undergraduate	1 Computer organization and architecture 2 Micro-contoller 3 Green IT and Sustainability 4. IoT 5 Design and Analysis of Algorithms.
	Post Graduate	1 IoT Analytics

Research Guidance (Number of Students):UG students-10

No. of papers published:

SL.No	Type	Numbers
1	National	
2	International Journals	
3	Conferences	13
4	Others	

Master (Completed (Year of Completion)/Ongoing): 2006

Ph.D. (Completed Year of Completion)/Ongoing): 2013

Projects Carried out :

Patents (Filed & Granted):

SL No	Topic	**Patent Application No**	Filed/ Granted
1			
2			

Technology Transfer:

No. of Books published with details: Architecture Support for Intrusion Detection Systems. LAP Lambert Academic Publishing (13 October 2014)

- Language : English
- ISBN-10 : 3659612774
- ISBN-13 : 978-3659612770

Profile of the Faculty

BRANCH: Information Science and Engineering

<table>
<tr><td>Name</td><td>Dr.Archana Mathur</td><td rowspan="6"></td></tr>
<tr><td>Designation</td><td>Assoc. Prof</td></tr>
<tr><td>Department</td><td>ISE</td></tr>
<tr><td>Date of Joining the Institution</td><td>3-09-2019</td></tr>
<tr><td>Date of Birth</td><td>20-08-1977</td></tr>
<tr><td>1-7435643312</td><td>1-7435643312</td></tr>
<tr><td>Email Id</td><td>archana.mathur@nmit.ac.in</td><td></td></tr>
</table>

Education Qualifications:

SL.No	Degree Obtained	Year of Obtaining the highest degree	Class/ Grade obtained
1	UG	2000	FC
2	PG	2013	FCD
3	PhD	2021	NA

Total Work Experience in Years:

SL.No	Work Experience	Total in Years
1	Teaching	13.5
2	Research	5
3	Industry	0.5
4	others	

Area of Specialization:

<table>
<tr><td rowspan="2">Courses taught at</td><td>Undergraduate</td><td>1 Data Mining
2 Operating System
3 C# .net</td></tr>
<tr><td>Post Graduate</td><td>1 Machine Learning
2 Deep learning
3 Exploratory Data Analysis.
.</td></tr>
</table>

Research Guidance (Number of Students):UG students-

No. of papers published:

SL.No	Type	Numbers
1	National	
2	International Journals	16
3	Conferences	12
4	Others	1

Master (Completed (Year of Completion)/Ongoing): 2013

Ph.D. (Completed Year of Completion)/Ongoing): 2021

Projects Carried out :

1. Investigation of Chaos Dynamics in the Neural Networks - SERB (DST)

Patents (Filed & Granted):

SL No	Topic	**Patent Application No**	Filed/ Granted
1	**A system for effectively classifying exoplanets according to their habitability**	**202022100350.5**	Granted
2	An author-strain-independent scoring system to measure scientific independence	**202022101927**	Granted

Technology Transfer:

No. of Books published with details:

Profile of the Faculty

BRANCH: Information Science and Engineering

Name	Dr.Sudhir Shenai	
Designation	Assoc. Prof	
Department	**ISE**	
Date of Joining the Institution	28/04/2022	
Date of Birth	24/08/1976	
Faculty Unique	1-10734318271	
Email Id	sudhir.shenai@nmit.ac.in	

Education Qualifications:

SL.No	Degree Obtained	Year of Obtaining the highest degree	Class/ Grade obtained
1	UG	2000	II
2	PG	2005	I
3	PhD	2021	

Total Work Experience in Years:

SL.No	Work Experience	Total in Years
1	Teaching	19.7
2	Research	
3	Industry	2
4	others	

Area of Specialization: Cyber security , Block Chain, Artificial Intelligence

Courses taught at	Undergraduate	1 Computer Networks 2. Cryptography and Network Security 3. Artificial Intelligence 4. Cyber Security
	Post Graduate	1 Data Security and Privacy 2.Neural Networks 3.Cloud Computing

Research Guidance (Number of Students):UG students- 40 Projects , PG Projects 10

No. of papers published:

SL.No	Type	Numbers
1	National Conferences	2
2	International Journals	4
3	Conferences	7
4	Others	

Master (Completed (Year of Completion)/Ongoing): 2005

Ph.D. (Completed Year of Completion)/Ongoing): 2021

Projects Carried out :

Patents (Filed & Granted):

SL No	Topic	**Patent Application No**	Filed/ Granted
1			
2			

Technology Transfer:

No. of Books published with details:

Profile of the Faculty

BRANCH: Information Science and Engineering

Name	Dr.Tejaswini R Murgod	
Designation	Assoc. Prof	
Department	**ISE**	
Date of Joining the Institution	15/07/2022	
Date of Birth	23/06/1985	
Faculty Unique	1-23547204598	
Email Id	tejaswini.r@nmit.ac.in	

Education Qualifications:

SL.No	Degree Obtained	Year of Obtaining the highest degree	Class/ Grade obtained
1	UG	2008	FC
2	PG	2014	FCD
3	PhD	2022	
4	Others		
5			

Total Work Experience in Years: 13 .4 years

SL.No	Work Experience	Total in Years
1	Teaching	13.4 Years
2	Research	7

Area of Specialization: Wireless Sensor Networks

Courses taught at	Undergraduate	1 Database Management System 2 Full Stack Development 3 Data Structures 4. Operating System
	Post Graduate	1. Big Data Analytics 2 Storage Area Networks.

Research Guidance (Number of Students):UG students-
8 (2 Batches)

No. of papers published:

SL.No	Type	Numbers
1	National	
2	International Journals	12
3	Conferences	3

Master (Completed (Year of Completion)/Ongoing): Completed 2014

Ph.D. (Completed Year of Completion)/Ongoing): Completed 2022

Projects Carried out :

Patents (Filed & Granted):

SL No	Topic	**Patent Application No**	Filed/ Granted
1			
2			

Technology Transfer:

No. of Books Chapter published with details:

1. **Dr. Tejaswini R Murgod , Dr. S. Meenakshi Sundaram & Sowmya M**

Book Title : Technology Road Mapping for Quantum Computing and Engineering
Chapter Title: Computational Intelligence for Sustainable Development
Publisher : NOVA Science Publishers, USA (Scopus Indexed) Publication Date : November 2022
Link : https://novapublishers.com/shop/computational-intelligence-for-sustainable-development/
DOI :10.52305/GYYT9161 ISBN: 979-8-88697-198-9

Profile of the Faculty

BRANCH: Information Science and Engineering

Name	Ms. Lakshmi M	
Designation	Assoc.Prof	
Department	**ISE**	
Date of Joining the Institution	03-12-2009	
Date of Birth	06-04-1982	
Faculty Unique	1-412297413	
Email Id	lakshmi.m@nmit.ac.in	

Education Qualifications:

SL.No	Degree Obtained	Year of Obtaining the highest degree	Class/ Grade obtained
1	UG	2005	FC
2	PG	2009	FC
3	PhD	--	--
4	Others	Diploma -2000	FC
5			

Total Work Experience in Years:

SL.No	Work Experience	Total in Years
1	Teaching	16
2	Research	1
3	Industry	2

Area of Specialization:

Courses taught at	Undergraduate	1DATA STRUCTURES USING C 2ANALYSIS AND DESIGN OF ALGORITHMS 3 PYTHON PROGRAMMING 4. OPERATING SYSTEMS 5. UNIX SYSTEM PROGRAMMING

<table>
<tr><td rowspan="2"></td><td></td><td>6. DISTRIBUTED SYSTEMS
7. SOFTWARE PROJECT MANAGEMENT
8. FUNDAMENTALS OF JAVA
9. VENTURE PROCESS MANAGEMENT& IPR.</td></tr>
<tr><td>Post Graduate</td><td>1 Adhoc networks
.</td></tr>
</table>

Research Guidance (Number of Students):UG students-

No. of papers published:

SL.No	Type	Numbers
1	National	--
2	International Journals	--
3	Conferences	5

Master (Completed (Year of Completion)/Ongoing): 2009

Ph.D. (Completed Year of Completion)/Ongoing):

Projects Carried out :

Patents (Filed & Granted):

SL No	Topic	**Patent Application No**	Filed/ Granted
1			
2			

Technology Transfer:

No. of Books published with details: Book chapter titled "Intelligent Framework for Smart Traffic Management System" has been published in the book "IoT and Big Data Analytics for Smart Cities" which is indexed in Scopus and published by Taylor and Francis. The published book chapter can be found in the below link:
https://www.taylorfrancis.com/chapters/edit/10.1201/9781003217404-5/intelligent-framework-smart-traffic-management-system-aditya-shastry-sanjay-lakshmi

Profile of the Faculty

BRANCH: Information Science and Engineering

Name	Dr.Manjunath B A	
Designation	Assistant Professor	
Department	**ISE**	
Date of Joining the Institution	26/08/2008	
Date of Birth	20/06/1984	
Faculty Unique	1-412297471	
Email Id	manjunatha.ba@nmit.ac.in	

Education Qualifications:

SL.No	Degree Obtained	Year of Obtaining the highest degree	Class/ Grade obtained
1	UG	2006	FC
2	PG	2009	FCD
3	PhD	2022	

Total Work Experience in Years:

SL.No	Work Experience	Total in Years
1	Teaching	15
2	Research	10
3	Industry	
4	others	

Courses taught at	Undergraduate	1 Network security, 2 Operating system 3 statistics for data science.
	Post Graduate	1Business analytics.

Research Guidance (Number of Students):UG students- 1

No. of papers published: 10

SL.No	Type	Numbers
1	National	
2	International Journals	4

3	Conferences	6
4	Others	

Master (Completed (Year of Completion)/Ongoing): 2009

Ph.D. (Completed Year of Completion)/Ongoing): 2022

Projects Carried out :

Patents (Filed & Granted):

SL No	Topic	**Patent Application No**	Filed/ Granted
1	Quantum computer for credit card fraud detection using quantum neural techniques	202241073308	filed
2			

Technology Transfer:

No. of Books published with details:

Profile of the Faculty

BRANCH: Information Science and Engineering

Name	Mr.Rohith HP	
Designation	Asst.Prof	
Department	**ISE**	
Date of Joining the Institution	03/09/2010	
Date of Birth	13/03/1985	
Faculty Unique	1-2914908947	
Email Id	rohith.hp@nmit.ac.in	

Education Qualifications:

SL.No	Degree Obtained	Year of Obtaining the highest degree
1	UG	2003
2	PG	2010
3	PhD	Pursuing

Total Work Experience in Years:

SL.No	Work Experience	Total in Years
1	Teaching	12
2	Research	10

Area of Specialization:

Courses taught at	Undergraduate	1Natural Language Processing 2 Web Technology 3 Java 4 Digital Design 5 Venture Process Management
	Post Graduate	1 Cryptography and Network Security.

Research Guidance (Number of Students):UG students- 01

No. of papers published:

SL.No	Type	Numbers
1	National	
2	International Journals	2
3	Conferences	1

4	Others		

Master (Completed (Year of Completion)/Ongoing):

Ph.D. (Completed Year of Completion)/Ongoing): Comprehensive viva completed

Projects Carried out :

Patents (Filed & Granted):

SL No	Topic
1	Decentralized prediction market using blockchain technology
2	One Nation One Health Card and Patient Monitoring System Using IoT and Cloud

Technology Transfer:

No. of Books published with details:

Profile of the Faculty

BRANCH: Information Science and Engineering

Name	Ms.Deepika KM	
Designation	Asst.Prof	
Department	**ISE**	
Date of Joining the Institution	25/07/2011	
Date of Birth	03/01/1987	
Faculty Unique	1-723828422	
Email Id	deepika.km@nmit.ac.in	

Education Qualifications:

SL.No	Degree Obtained	Year of Obtaining the highest degree	Class/ Grade obtained
1	UG	2009	FCD
2	PG	2011	FCD
3	PhD	Pursuing	

Total Work Experience in Years:

SL.No	Work Experience	Total in Years
1	Teaching	12 Years
2	Research	1.5 Years

Area of Specialization: Cloud Security

Courses taught at	Undergraduate	1. Scalable Computing 2. Parallel Computing 3. Java Application Development 4. Blockchain Essentials and DApps 5. UNIX Shell Programming 6. UNIX System Programming 7. Client-Server Programming 8. Ad-hoc Networks 9. Computer Networks 10. Storage Area Networks 11. System Software

		12. Software Testing
	Post Graduate	1. Optical Networks 2. Wireless Communication 3. Ad-hoc Networks 4. Machine Learning Scalable Computing

Research Guidance (Number of Students):UG students-10

No. of papers published:

SL.No	Type	Numbers
1	National	00
2	International Journals	03
3	Conferences	12
4	Others	

Master (Completed (Year of Completion)/Ongoing): 2011

Ph.D. (Completed Year of Completion)/Ongoing): Ongoing

Projects Carried out :

Patents (Filed & Granted):

SL No	Topic	**Patent Application No**	Filed/ Granted
1	Decentralized prediction market using blockchain technology	202241073370	Filed
2	One Nation One Health Card and Patient Monitoring System Using IoT and Cloud	202241073369	Filed
3	Covid and Pneumonia detection system using convolutional neural network on chest X-ray images	202241073368	Filed
4	Quantum Computer for Credit Card Fraud Detection using Quantum Neural Techniques	202241073308	Filed

Technology Transfer:

No. of Books published with details: NIL

Profile of the Faculty

BRANCH: Information Science and Engineering

Name	Mr.Pramod Jain SA	
Designation	Asst.Prof	
Department	**ISE**	
Date of Joining the Institution	02/05/2012	
Date of Birth	28/10/1987	
Faculty Unique	1-2486466749	
Email Id	pramodjain.sa@nmit.ac.in	

Education Qualifications:

SL.No	Degree Obtained	Year of Obtaining the highest degree	Class/ Grade obtained
1	UG	2010	First Class
2	PG	2017	First Class
3	PhD	-	-

Total Work Experience in Years:

SL.No	Work Experience	Total in Years
1	Teaching	5
2	Research	
3	Industry	-
4	others	5

Area of Specialization:

Courses taught at	Undergraduate	1. Principles of Analog and Digital Design 2. Microprocessor 3 Digital Design 4. Microcontrollers 5. Computer Organization and Architecture

Research Guidance (Number of Students):UG students-

No. of papers published:

SL.No	Type	Numbers
1	National	3

2	International Journals	
3	Conferences	3
4	Others	

Master (Completed (Year of Completion)/Ongoing): Completed - 2017

Ph.D. (Completed Year of Completion)/Ongoing):

Projects Carried out :

Patents (Filed & Granted):

SL No	Topic	**Patent Application No**	Filed/ Granted
1			
2			

Technology Transfer:

No. of Books published with details:

Profile of the Faculty

BRANCH: Information Science and Engineering

Name	Mr.Preetham N
Designation	Asst.Prof
Department	**ISE**
Date of Joining the Institution	01-08-2013
Date of Birth	22-10-1986
Faculty Unique	1-9571838755
Email Id	preetham.nagaraju@nmit.ac.in

Education Qualifications:

SL.No	Degree Obtained	Year of Obtaining the highest degree	Class/ Grade obtained
1	UG	2009	FC
2	PG	2013	FCD
3	PhD	---	--

Total Work Experience in Years:

SL.No	Work Experience	Total in Years
1	Teaching	9 years 4 months
2	Research	3
3	Industry	1 year 6 months
4	others	

Area of Specialization:

Courses taught at	Undergraduate	1. Scalable Computing 2. Parallel Computing 3. UNIX Shell Programming 4. UNIX System Programming 5. Client-Server Programming 6. Ad-hoc Networks 7. Cloud Computing 8. Green IT 9. Computer Networks Lab
	Post Graduate	1 Wireless sensor Networks 2 Cloud Computing.

		.

Research Guidance (Number of Students):UG students-

No. of papers published:

SL.No	Type	Numbers
1	National	03
2	International Journals	0
3	Conferences	03
4	Others	

Master (Completed (Year of Completion)/Ongoing): 2013

Ph.D. (Completed Year of Completion)/Ongoing): Pursuing (NITK, Surathkal)

Projects Carried out : DIT Sponsored project, IEDC sponsored projects

Patents (Filed & Granted):

SL No	Topic	**Patent Application No**	Filed/ Granted
1	Nil		
2			

Technology Transfer:

No. of Books published with details: 01 (Book Chapter) K Aditya Shastry, Sanjay H A, Lakshmi M, Preetham N, "Book Chapter 1 - Deep learning for medical informatics and public health", Artificial Intelligence and machine Learning for Open-world Novelty, Advances in Computers Serial, ELSEVIER, 2021.

Profile of the Faculty

BRANCH: Information Science and Engineering

Name	Ms.Vani ES	
Designation	Asst.Prof	
Department	**ISE**	
Date of Joining the Institution	01/08/2016	
Date of Birth	27/05/1991	
Faculty Unique	8188	
Email Id	vani.es@nmit.ac.in	

Education Qualifications:

SL.No	Degree Obtained	Year of Obtaining the highest degree	Class/ Grade obtained
1	UG	2013	FCD
2	PG	2015	FCD
3	PhD	-	-

Total Work Experience in Years:

SL.No	Work Experience	Total in Years
1	Teaching	6.4 years
2	Research	-
3	Industry	-
4	others	-

Area of Specialization:

Courses taught at	Undergraduate	1. Digital Design 2.Microcontroller 3.Computer Networks.
	Post Graduate	1.Network Programming 2.IoT3.

Research Guidance (Number of Students):UG students-

No. of papers published: 5

SL.No	Type	Numbers
1	National	
2	International Journals	1

3	Conferences	4
4	Others	

Master (Completed (Year of Completion)/Ongoing): 2015

Ph.D. (Completed Year of Completion)/Ongoing): Pursuing

Projects Carried out :

Patents (Filed & Granted):

SL No	Topic	**Patent Application No**	Filed/ Granted
1			
2			

Technology Transfer: Nil

No. of Books published with details: Nil

Profile of the Faculty

BRANCH: Information Science and Engineering

Name	Mr.Mohan Kumar TG	
Designation	Asst.Prof	
Department	**ISE**	
Date of Joining the Institution	15/12/2017	
Date of Birth	24/04/1991	
Faculty Unique	1-3586629615	
Email Id	mohankumar.tg@nmit.ac.in	

Education Qualifications:

SL.No	Degree Obtained	Year of Obtaining the highest degree	Class/ Grade obtained
1	UG	2012	First Class
2	PG	2014	First Class with Distinction
3	PhD	2020 Registered (Pursuing)	
4	Others		
5			

Total Work Experience in Years: 8.4 Years

SL.No	Work Experience	Total in Years
1	Teaching	8.4 Years
2	Research	
3	Industry	
4	others	

Area of Specialization: Cloud Computing, Cloud Security

Courses taught at	Undergraduate	1. Discrete Mathematics 2. Design and Analysis of Algorithms 3. C Programming 4. Network & Information Security 5. Formal Language & Automata Theory 6. DevOps 7. Data Structures

		8. Computer Networks 9. Advanced Computer Architecture 10. System Simulation Modeling

Research Guidance (Number of Students):UG students-

No. of papers published: 4

SL.No	Type	Numbers
1	National	
2	International Journals	4
3	Conferences	5
4	Others	

Master (Completed (Year of Completion)/Ongoing): 2014

Ph.D. (Completed Year of Completion)/Ongoing): Pursuing

Projects Carried out :

Patents (Filed & Granted): 1

SL No	Topic	**Patent Application No**	Filed/ Granted
1	Santulan: A device for Car safety	202041053586	Published
2			

Technology Transfer: NIL

No. of Books published with details: NIL

Profile of the Faculty

BRANCH: Information Science and Engineering

Name	Ms.Sneha HR
Designation	Asst.Prof
Department	**ISE**
Date of Joining the Institution	06/06/2018
Date of Birth	12/08/1990
Faculty Unique	1-4333404206
Email Id	sneha.hr@nmit.ac.in

Education Qualifications:

SL.No	Degree Obtained	Year of Obtaining the highest degree	Class/ Grade obtained
1	UG	2012	First Class with Distinction
2	PG	2017	First Class with Distinction
3	PhD	Registered in 2020(Pursuing)	

Total Work Experience in Years:

SL.No	Work Experience	Total in Years
1	Teaching	5
2	Research	
3	Industry	2.8
4	others	

Area of Specialization: Machine Learning and Artificial Intelligence

Courses taught at	Undergraduate	1.Computer Organization 2.Fundamentals of Java 3.Cloud Computing 4. Artificial Intelligence 5.Operating Systems 6.Web Technology 7.System Programming Lab 8. Data Structures Lab 9. Design of Algorithms lab

		10.Hybrid Application Development 11. MAchine Learning Lab

Research Guidance (Number of Students):UG students- 8 Students

No. of papers published:

SL.No	Type	Numbers
1	National	
2	International Journals	
3	Conferences	6
4	Others	

Master (Completed (Year of Completion)/Ongoing):

Ph.D. (Completed Year of Completion)/Ongoing):

Projects Carried out :

Patents (Filed & Granted):

SL No	Topic	**Patent Application No**	Filed/ Granted
1			
2			

Technology Transfer: NIL

No. of Books published with details: NIL

Profile of the Faculty

BRANCH: Information Science and Engineering

Name	Ms.Sushma V	
Designation	Asst.Prof	
Department	**ISE**	
Date of Joining the Institution	02/07/2018	
Date of Birth	14/5/1987	
Faculty Unique	1-4332116764	
Email Id	sushma.v@nmit.ac.in	

Education Qualifications:

SL.No	Degree Obtained	Year of Obtaining the highest degree	Class/ Grade obtained
1	UG	2009	SC
2	PG	2018	FCD
3	PhD	Registered(2022)	
4	Others		
5			

Total Work Experience in Years:

SL.No	Work Experience	Total in Years
1	Teaching	7
2	Research	
3	Industry	
4	others	

Area of Specialization:

Courses taught at	Undergraduate	1 web technology 2 software project management 3 Green IT and sustainability 4 Fundamentals of Java 5 Mobile app development 6 Cloud Computing 7 FOSS and Cyber Laws 8 data structures lab 9 CN lab

		10 ADA lab 11 DBMS lab . .

Research Guidance (Number of Students):UG students-

No. of papers published:

SL.No	Type	Numbers
1	National	
2	International Journals	
3	Conferences	4
4	Others	1

Master (Completed (Year of Completion)/Ongoing): 2018

Ph.D. (Completed Year of Completion)/Ongoing): ongoing

Projects Carried out :

Patents (Filed & Granted):

SL No	Topic	**Patent Application No**	Filed/ Granted
1			
2			

Technology Transfer:

No. of Books published with details:

Profile of the Faculty

BRANCH: Information Science and Engineering

Name	Ms.Ullal Akshatha Nayak
Designation	Asst.Prof
Department	**ISE**
Date of Joining the Institution	01/08/2018
Date of Birth	24/03/1989
Faculty Unique	1-4335075384
Email Id	akshatha.n@nmit.ac.in

Education Qualifications:

SL.No	Degree Obtained	Year of Obtaining the highest degree	Class/ Grade obtained
1	UG	2010	FC
2	PG	2014	FCD
3	PhD	Registered(2022)	

Total Work Experience in Years:

SL.No	Work Experience	Total in Years
1	Teaching	7.4
2	Research	
3	Industry	2
4	others	

Area of Specialization:

<table>
<tr><td rowspan="2">Courses taught at</td><td>Undergraduate</td><td>1 C Programming
2 OOPS With C++
3 Java Programming
4. Venture Process Management
5. Python Programming
6. Web Technology
7. Software Project Management
8. Design of Algorithms Lab
9. Software Engineering
10. FOSS & Cyber Laws.</td></tr>
<tr><td>Post Graduate</td><td>1 Cloud Computing..</td></tr>
<tr><td colspan="3">Research Guidance (Number of Students):UG students-</td></tr>
</table>

No. of papers published:

SL.No	Type	Numbers
1	National	1
2	International Journals	0
3	Conferences	6
4	Others	

Master (Completed (Year of Completion)/Ongoing): 2014

Ph.D. (Completed Year of Completion)/Ongoing): Ongoing

Projects Carried out :

Patents (Filed & Granted):

SL No	Topic	**Patent Application No**	Filed/ Granted
1	Assistive Device for hearing, visually and vocally impaired people	202241049898	Filed
2			

Technology Transfer:

No. of Books published with details: Nil

Profile of the Faculty

BRANCH: Information Science and Engineering

Name	Mr.Prashanth	
Designation	Asst.Prof	
Department	**ISE**	
Date of Joining the Institution	15-7-2019	
Date of Birth	27-01-1989	
Faculty Unique	1-9571490373	
Email Id	prashanth.bs@nmit.ac.in	

Education Qualifications:

SL.No	Degree Obtained	Year of Obtaining the highest degree	Class/ Grade obtained
1	UG	2010	FC
2	PG	2012	FCD
3	PhD	Pursuing(2020-)	
4	Others		

Total Work Experience in Years:

SL.No	Work Experience	Total in Years
1	Teaching	9.5
2	Research	1
3	Industry	NA
4	others	NA

Area of Specialization:

1. Android and Mobile App Development
2. Bigdata and Hadoop
3. Concept Drift and Non Stationary Learning
4. Machine Learning
5. Deep Learning

Courses taught at	Diploma/ Post Diploma	1 Computer Organization 2 Web Development
	Undergraduate	1 Computer Graphics 2 Electronic Circuits 3 Embedded Systems

		4 Android Application Development 5 Hybrid App Development 6 Big Data 7 Data Structures using C 8 Software Architectures
	Post Graduate	1 Advances in operating System 2 Wireless and Mobile Networks 3 Mobile App Development

Research Guidance (Number of Students):UG students-

No. of papers published:

SL.No	Type	Numbers
1	National	2
2	International Journals	2
3	Conferences	11
4	Others	2

Master (Completed (Year of Completion)/Ongoing): 2012

Ph.D. (Completed Year of Completion)/Ongoing): Ongoing

Projects Carried out :
Development of algorithms for extraction of features from clinical reports and pattern recognition to predict treatment outcomes related to infectious diseases

- RGS-F: Research Grants for Scientist / Faculty (RGS/F)
- Vision Group of Science and Technology (VGST)
- Amount: 3 Lakh Rupees
- Duration: 2021 – 2022

Patents (Filed & Granted):

SL No	Topic	**Patent Application No**	Filed/ Granted
1	A system for classifying melanoma images	20221110115 11800DE	Filed

Technology Transfer:

No. of Books published with details: NA

Profile of the Faculty

BRANCH: Information Science and Engineering

Name	Ms.Vani KS	
Designation	Asst.Prof	
Department	**ISE**	
Date of Joining the Institution	01/09/2021	
Date of Birth	10/06/1980	
Faculty Unique	8734	
Email Id	Vani.ks@nmit.ac.in	

Education Qualifications:

SL.No	Degree Obtained	Year of Obtaining the highest degree	Class/ Grade obtained
1	UG	2002	FCD
2	PG	2009	FCD
3	PhD	--	--

Total Work Experience in Years:

SL.No	Work Experience	Total in Years
1	Teaching	19
2	Research	
3	Industry	
4	others	

Courses taught at	Undergraduate	1Machine Learning 2 Web Application Development 3 Mobile Application Development .Computer Graphics Computer Networks .

Research Guidance (Number of Students):UG students-

No. of papers published:

SL.No	Type	Numbers

1	National	
2	International Journals	7
3	Conferences	5
4	Others	

Master (Completed (Year of Completion)/Ongoing):
2009

Ph.D. (Completed Year of Completion)/Ongoing):

Projects Carried out :

Patents (Filed & Granted):

SL No	Topic	**Patent Application No**	Filed/ Granted
1			
2	Nil		

Technology Transfer: Nil

No. of Books published with details:
nil

Profile of the Faculty

BRANCH: Information Science and Engineering

Name	Ms.Akarsha DP
Designation	Asst.Prof
Department	**ISE**
Date of Joining the Institution	01/10/2021
Date of Birth	24/11/1997
Faculty Unique	1-10617543851
Email Id	akarsha.dp@nmit.ac.in

Education Qualifications:

SL.No	Degree Obtained	Year of Obtaining the highest degree	Class/ Grade obtained
1	UG	2019	First Class
2	PG	2021	First Class
3	PhD	--	

Total Work Experience in Years:

SL.No	Work Experience	Total in Years
1	Teaching	1 year 2 months
2	Research	

Area of Specialization:

Courses taught at	Undergraduate	1Machine Learning 2Web Technology 3Big data Hybrid course 4 Java Application Hybrid course 5 Gaming and Animation .

Research Guidance (Number of Students):UG students-

No. of papers published:

SL.No	Type	Numbers
1	National	

2	International Journals	
3	Conferences	5
4	Others	

Master (Completed (Year of Completion)/Ongoing): M.Tech completed ,2021.

Ph.D. (Completed Year of Completion)/Ongoing):

Projects Carried out :

Patents (Filed & Granted):

SL No	Topic	**Patent Application No**	Filed/ Granted
1			
2			

Technology Transfer:

No. of Books published with details:

Pai, M., Rajarajeswari, S., Akarsha, D.P., Ashwini, S.D. (2022). Analytical Study on Load Balancing Algorithms in Cloud Computing. In: Jeena Jacob, I., Gonzalez-Longatt, F.M., Kolandapalayam Shanmugam, S., Izonin, I. (eds) Expert Clouds and Applications. Lecture Notes in Networks and Systems, vol 209. Springer, Singapore. https://doi.org/10.1007/978-981-16-2126-0_50

Profile of the Faculty

BRANCH: Information Science and Engineering

Name	Ms.Deepthi K	
Designation	Assistant Professor	
Department	**ISE**	
Date of Joining the Institution	02-11-2021	
Date of Birth	28-07-1980	
Faculty Unique	1-464714879	
Email Id	deepthi.k@nmit.ac.in	

Education Qualifications: M.Tech(CSE), (Ph.D)

SL.No	Degree Obtained	Year of Obtaining the highest degree	Class/ Grade obtained
1	UG	2002	First Class
2	PG	2010	FCD
3	PhD	Pursuing	

Total Work Experience in Years:

SL.No	Work Experience	Total in Years
1	Teaching	19
2	Research	02

Area of Specialization:

Courses taught at	Undergraduate	1. Analysis and Design of Algorithms 2. Operating Systems 3. Theory of Computation 4. Data Structures 5. Information Security
	Post Graduate	1 Introduction to Data Management.

Research Guidance (Number of Students):UG students- 02

No. of papers published:

SL.No	Type	Numbers
1	National	

2	International Journals	06
3	Conferences	01
4	Others	

Master (Completed (Year of Completion)/Ongoing): Completed, 2010

Ph.D. (Completed Year of Completion)/Ongoing): Ongoing

Projects Carried out :

Patents (Filed & Granted):

SL No	Topic	**Patent Application No**	Filed/ Granted
1			
2			

Technology Transfer:

No. of Books published with details: 1 Book Chapter

Chapter Name: Food Management System in Society 5.0 in
Book Titled: Society 5.0: Smart Future Towards Enhancing the Quality of Society
ISSN 2662-6829 ISSN 2662-6837 (electronic) Advances in Sustainability Science and Technology ISBN 978-981-19-2160-5 ISBN 978-981-19-2161-2 (eBook)
https://doi.org/10.1007/978-981-19-2161-2

Profile of the Faculty

BRANCH: Information Science and Engineering

Name	Mr.Karthik DU	
Designation	Asst.Prof	
Department	**IS&E**	
Date of Joining the Institution	05/05/2022	
Date of Birth	17/12/1990	
Faculty Unique	1-2483128766	
Email Id	karthik.du@nmit.ac.in	karthiikdu@gmail.com

Education Qualifications:

SL.No	Degree Obtained	Year of Obtaining the highest degree	Class/ Grade obtained
1	UG	2012	First Class
2	PG	2014	FCD
3	PhD	pursuing	
4	Others		
5			

Total Work Experience in Years:

SL.No	Work Experience	Total in Years
1	Teaching	7.4
2	Research	2
3	Industry	1
4	others	

Area of Specialization:

Courses taught at	Undergraduate	1. C programming 2. Computer Organization 3. Big Data 4. Micro processors 5. Embedded systems . .

Research Guidance (Number of Students):UG students- NIL

No. of papers published:

SL.No	Type	Numbers
1	National	2
2	International Journals	2
3	Conferences	2
4	Others	

Master (Completed (Year of Completion)/Ongoing): 2014

Ph.D. (Completed Year of Completion)/Ongoing): ongoing

Projects Carried out :

Patents (Filed & Granted):

SL No	Topic	**Patent Application No**	Filed/ Granted
1	A NOVEL METHOD FOR AUTOMATED PLANT DISEASE DETECTION & DIAGNOSTIC SYSTEM USING PARALLEL ANN	202041010556	Filed
2			

Technology Transfer:

No. of Books published with details:

Profile of the Faculty

BRANCH: Information Science and Engineering

Name	Ms.Priyanka K	
Designation	Asst.Prof	
Department	**ISE**	
Date of Joining the Institution	08/08/2022	
Date of Birth	04/07/1995	
Faculty Unique	1-4708458674	
Email Id	priyankak040795@gmail.com	priyanka.k@nmit.ac.in

Education Qualifications:

SL.No	Degree Obtained	Year of Obtaining the highest degree	Class/ Grade obtained
1	UG	2016	FCD
2	PG	2018	FCD- 2nd Topper
3	PhD	Pursuing	
4	Others		
5			

Total Work Experience in Years:

SL.No	Work Experience	Total in Years
1	Teaching	4
2	Research	
3	Industry	
4	others	

Area of Specialization: Internet of Things, Computer Networks,Machine Learning

Courses taught at	Undergraduate	1 Database Management System 2 Computer Networks 3 Embedded Computing 4 Internet of Things 5 BigData Analytics

Research Guidance (Number of Students):UG students- 10

No. of papers published: 6

SL.No	Type	Numbers
1	National	
2	International Journals	7
3	Conferences	3
4	Others	

Master (Completed (Year of Completion)/Ongoing): 2018

Ph.D. (Completed Year of Completion)/Ongoing): pursuing

Projects Carried out :

Patents (Filed & Granted): Filed and Published

SL No	Topic	**Patent Application No**	Filed/ Granted
1	Utpatti-Farmers Online Market APP	202141034018 A	Published
2	IoT and AI based Intelligent Rover to Discover Habitable-Zones on Planets	202141053443 A	Published

Technology Transfer:

No. of Books published with details:

1. **Practical approach to Learn Computer Networks** ISBN-978-93-5593-068-2, December 2021
2. **A Pragmatic Guide to Web Development** ISBN-978-93-5593-810-7, December 2021

Profile of the Faculty

BRANCH: Information Science and Engineering

Name	Mr.Mohan M	
Designation	Asst.Prof	
Department	**ISE**	
Date of Joining the Institution	16-08-2022	
Date of Birth	11-07-1990	
Faculty Unique	1-23594293968	
Email Id	mohan.m@nmit.ac.in	

Education Qualifications:

SL.No	Degree Obtained	Year of Obtaining the highest degree	Class/ Grade obtained
1	UG	2013	FCD
2	PG	2015	FC
3	PhD		
4	Others		
5			

Total Work Experience in Years:

SL.No	Work Experience	Total in Years
1	Teaching	5months
2	Research	-
3	Industry	
4	others	Enterpreneur

Area of Specialization:

Courses taught at	Undergraduate	1Data Structures using C 2 Python

Research Guidance (Number of Students):UG students-

No. of papers published:

SL.No	Type	Numbers
1	National	
2	International Journals	
3	Conferences	
4	Others	

Master (Completed (Year of Completion)/Ongoing): 2015

Ph.D. (Completed Year of Completion)/Ongoing):

Projects Carried out :

Patents (Filed & Granted):

SL No	Topic	**Patent Application No**	Filed/ Granted
1			
2			

Technology Transfer:

No. of Books published with details:

Profile of the Faculty

BRANCH: Information Science and Engineering

Name	Mrs.Tejaswini N P	
Designation	Asst.Prof	
Department	**ISE**	
Date of Joining the Institution	26/08/2022	
Date of Birth	23/07/1988	
Faculty Unique	1-9314379533	
Email Id	tejaswini.np@nmit.ac.in	

Education Qualifications:

SL.No	Degree Obtained	Year of Obtaining the highest degree	Class/ Grade obtained
1	UG	B.E	FC(66%)
2	PG	M.Tech	FCD(74)
3	PhD	Pursuing	Cleared CW
4	Others		
5			

Total Work Experience in Years:6.4

SL.No	Work Experience	Total in Years
1	Teaching	6.4
2	Research	4
3	Industry	-
4	others	-

Area of Specialization: Computer Science

Courses taught at	Diploma/ Post Diploma	1Web technology 2 Management & entrepreneurship 3 Basics of C 4 Computer Graphics
	Undergraduate	1ADA 2 FAFL 3 Embedded system 4 Compiler designer

		5 Computer graphics 6 SMS 7. Web technology 8. OS. 9 Software Testing 10 Big Data Analytics 11 Analog and Digital electronics 12. Basics of Python

Research Guidance (Number of Students):UG students-

No. of papers published:

SL.No	Type	Numbers
1	National	3
2	International Journals	5
3	Conferences	6
4	Others	

Master (Completed (Year of Completion)/Ongoing): 2013

Ph.D. (Completed Year of Completion)/Ongoing): ongoing(Registered in 2018)

Projects Carried out : IoT projects

Patents (Filed & Granted): Nil

SL No	Topic	**Patent Application No**	Filed/ Granted
1			
2			

Technology Transfer:

No. of Books published with details:

Profile of the Faculty
BRANCH: Information Science and Engineering

Name	Ms.Subashree D	
Designation	Asst.Prof	
Department	**ISE**	
Date of Joining the Institution	12/10/2022	
Date of Birth	15/09/1990	
Faculty Unique	1-7450913693	
Email Id	subhashree.d@nmit.ac.in	subashreedoss@gmail.com

Education Qualifications: M.E(CSE)

SL.No	Degree Obtained	Year of Obtaining the highest degree	Class/ Grade obtained
1	UG	2012	FCD
2	PG	2014	FC
3	PhD		
4	Others		
5			

Total Work Experience in Years:4.7 Years

SL.No	Work Experience	Total in Years
1	Teaching	4.7
2	Research	
3	Industry	
4	others	

Area of Specialization:

Courses taught at	Undergraduate	1-DataBase Management Systems 2- Computer Networks 3- C programming 4- Data Structures using C 5- Management Information Systems

Research Guidance (Number of Students):UG students-8

No. of papers published: 4

SL.No	Type	Numbers
1	National	
2	International Journals	03
3	Conferences	01
4	Others	

Master (Completed (Year of Completion)/Ongoing): 2014

Ph.D. (Completed Year of Completion)/Ongoing):

Projects Carried out :

Patents (Filed & Granted):01

SL No	Topic	**Patent Application No**	Filed/ Granted
1	An enhanced model for providing a reliable and secure environment to handle attacksin cloud environment using machine learning.	202041050273	Published
2			

Technology Transfer: -

No. of Books published with details: -

Profile of the Faculty

BRANCH: Information Science and Engineering

Name	Ms.Tulasi Srinivas	
Designation	Asst.Prof	
Department	**ISE**	
Date of Joining the Institution	11/07/2016	
Date of Birth	7/11/1991	
Faculty Unique	1-3187184607	
Email Id	tulasi.s@nmit.ac.in	

Education Qualifications:

SL.No	Degree Obtained	Year of Obtaining the highest degree	Class/ Grade obtained
1	UG	2013	FCD
2	PG	2015	FCD
3	PhD	-	

Total Work Experience in Years:

SL.No	Work Experience	Total in Years
1	Teaching	6.4
2	Research	2
3	Industry	1
4	others	

Area of Specialization:

Courses taught at	Undergraduate	1.ADA 2.DBMS 3WT 4.DS
	Post Graduate	1.WSMN

Research Guidance (Number of Students):UG students-

No. of papers published: 5

SL.No	Type	Numbers
	National	
2	International Journals	2
3	Conferences	3
4	Others	

Master (Completed (Year of Completion)/Ongoing): 2015

Ph.D. (Completed Year of Completion)/Ongoing): Pursuing

Projects Carried out :

Patents (Filed & Granted):

SL No	Topic	**Patent Application No**	Filed/ Granted
1			
2			

Technology Transfer: Nil

No. of Books published with details: Nil

Profile of the Faculty

BRANCH: Information Science and Engineering

Name	Evangeline R C
Designation	Assistant Professor
Department	**ISE**
Date of Joining the Institution	07/12/2022
Date of Birth	14/12/1990
Faculty Unique	1-35133111351
Email Id	evangeline.rc@nmit.ac.in

Education Qualifications:

SL.No	Degree Obtained	Year of Obtaining the highest degree	Class/ Grade obtained
1	UG	2012	7.42 CGPA
2	PG	2014	7.07 CGPA
3	PhD		
4	Others		
5			

Total Work Experience in Years:

SL.No	Work Experience	Total in Years
1	Teaching	1.9
2	Research	
3	Industry	1.11
4	others	

Area of Specialization:

Courses taught at	Undergraduate	1Python Programming 2Database Management System 3Web Technologies . .

Research Guidance (Number of Students):UG students-

No. of papers published:

SL.No	Type	Numbers
1	National	
2	International Journals	1
3	Conferences	1
4	Others	

Master (Completed (Year of Completion)/Ongoing): 2014

Ph.D. (Completed Year of Completion)/Ongoing):

Projects Carried out :

Patents (Filed & Granted):

SL No	Topic	**Patent Application No**	Filed/ Granted
1			
2			

Technology Transfer:

No. of Books published with details:

Faculty Profile

Mechanical Engineering Department

Sl No.	Faculty Names	Designation
1	Dr. J. Sudheer Reddy	Professor
2	Dr. Madhusudhan	Professor
3	Dr. P B Shetty	Professor
4	Dr. Kiran Aithal S	Professor
5	Dr. Kapilan N	Prof & Head
6	Dr. Shailesh Rao A	Professor
7	Mr. Hemanth Kumar N	Assoc Prof
8	Dr. Chethan K S	Assoc Prof
9	Mr. Manjunath H N	Asst Prof
10	Dr. Ramesh Babu N	Assoc Prof
11	Dr. Arun Kumar GL	Asst Prof
12	Dr. Praveen B A	Asst Prof
13	Mrs. Krupa R	Asst Prof
14	Dr. Shiv Pratap Singh	Asst Prof
15	Mr. Prashanth N	Asst Prof
16	Dr. Avinash L	Asst Prof
17	Mr. Mahadeva Prasad	Asst Prof
18	Dr. Sriram Mukunda	Asst Prof
19	Mr. Vikram KV	Asst Prof
20	Mr. Girish Prasad M	Asst Prof
21	Mr. Ananda MN	Asst Prof
22	Mr. Puneeth Kumar MV	Asst Prof
23	Mr. Ganesh K	Asst Prof
24	Mr. Bharath V	Asst Prof
25	Dr. Pradeep V Badiger	Asst Prof
26	Ms. Preethi J Aradhya	Asst Prof
27	Dr. Abdulrajak Buradi	Asst Prof
28	Dr. Vijay Kumar S	Asst Prof
29	Dr. Kiran M C	Asst Prof
30	Mr. Vasudeva Upadhyaya	Asst. Prof
31	Dr. Manoj I V	Asst. Prof
32	Dr. Harish Kumar L	Asst. Prof
33	Dr. Chethan D	Asst. Prof
34	Mr. Raghavendra Galgali	Asst. Prof
35	Dr. P G Mukunda	Professor

Profile of the Faculty

BRANCH: MECHANICAL ENGINEERING

Name	Dr.Sudheer Reddy	
Designation	Professor	
Department	**ME**	
Date of Joining the Institution	31-07-2003	
Date of Birth	26-05-1978	
Faculty Unique	1-407246775	
Email Id	Sudheerreddy.j@nmit.ac.in	

Education Qualifications:

SL.No	Degree Obtained	Year of Obtaining the highest degree	Class/ Grade obtained
1	UG	2000	FCD
2	PG	2002	FCD
3	PhD	2011	
4	Others (PGDM for working Executives)	2015	
5			

Total Work Experience in Years:

SL.No	Work Experience	Total in Years
1	Teaching	19
2	Research	11
3	Industry	
4	others	

Area of Specialization:

	Undergraduate	1Strength of Materials 2 Design of Machine Elements 3 Applied Thermodynamics 4 Operations Research 5 Mechatronics 6 Rapid Prototyping .
	Post Graduate	1 Experimental Stress Analysis.

Research Guidance (Number of Students):UG students-

No. of papers published:

SL.No	Type	Numbers
1	National	02
2	International Journals	20
3	Conferences	11
4	Others	

Master (Completed (Year of Completion)/Ongoing): 02 completed

Ph.D. (Completed Year of Completion)/Ongoing): 02 completed
02 Ongoing

Projects Carried out

- Design and Fabrication of video Laryngoscope with styletoscope integrated with mobile phone to overcome difficulty in airway management for elderly, DST (SEED / TIDE / 002 / 2017)
- Fund for Improvement of S&T Infrastructure in Universities and Higher Educational Institutions (FIST) - level-I, DST
- Establishment of Centre for Applied Mechatronics to Promote Multidisciplinary Training, Research and Development, AICTE - Modernisation and Removal Of Obsolescence
- Innovation and Entrepreneurship Development Center' (IEDC) funded by National Science and Technology Entrepreneurship Development Board (DST- NSTEDB), New Delhi, during April 2010-2015, with a Grant of Rs 45 Lakhs

Patents (Filed & Granted):

SL No	Topic	**Patent Application No**	Filed/ Granted
1	"Range Extender Engine For Hybrid Electric Vehicles', Kirana K K, Sudheer Reddy	201941054031, 1/57107/2019-CHE	Published
2	Portable Mobile Disinfection Device for Disinfecting a Given Facility	202141042150	Filed

Technology Transfer:

No. of Books published with details:

Profile of the Faculty

BRANCH: MECHANICAL ENGINEERING

Name	Kiran Aithal S
Designation	Professor
Department	**ME**
Date of Joining the Institution	19/08/2004
Date of Birth	20/03/1973
Faculty Unique	1-409547293
Email Id	kiranaithal.s@nmit.ac.in

Education Qualifications:

SL.No	Degree Obtained	Year of Obtaining the highest degree	Class/ Grade obtained
1	UG	1995	First
2	PG	1998	First
3	PhD	2013	-
4	Others		
5			

Total Work Experience in Years:

SL.No	Work Experience	Total in Years
1	Teaching	24
2	Research	-
3	Industry	01
4	others	

Area of Specialization:

Courses taught at	Undergraduate	1FEM 2 Vibrations 3 Energy Environment & Sustainability 4 Mechanics of Materials .
	Post Graduate	1 Theory of Elasticity 2 Advanced FEM 3 Conceptual Design

Research Guidance (Number of Students):UG students-90

No. of papers published:

SL.No	Type	Numbers

1	National	01
2	International Journals	37
3	Conferences	05
4	Others	

Master (Completed (Year of Completion)/Ongoing): 1998

Ph.D. (Completed Year of Completion)/Ongoing): 2013

Projects Carried out: -

Patents (Filed & Granted):

SL No	Topic	**Patent Application No**	Filed/ Granted
1	A Novel Method for Machining Coupons of Glass Reinforced Hybrid Laminate	374902 - 6132/CHE/2014	Granted
2	Design & Development of Geriatric Support System	202241041446	Pub
3	Development of Smart Window Systems with Integrated Air-Purifiers	202241044130	Pub
4	Real-Time Onboard Truckload Weighing System	201941054030	Pub
5	Automated Center Stand For Motorcycles	202041057527	9ub

Technology Transfer: -

No. of Books published with details: 01- Elements of Aeronautics, Subhas Stores publications

Profile of the Faculty

BRANCH: ELECTRONICS AND COMMUNICATION ENGINEERING

Name	Dr. N. Kapilan	
Designation	Professor and Head	
Department	**ME**	
Date of Joining the Institution	09-09-2020	
Date of Birth	21-07-1974	
Faculty Unique	1-9575796772	
Email Id	kapilan.n@nmit.ac.in	

Education Qualifications:

SL.No	Degree Obtained	Year of Obtaining the highest degree	Class/ Grade obtained
1	UG	1996	1st Class
2	PG	2002	Distinction
3	PhD	2011	NA
4	Others		
5			

Total Work Experience in Years:

SL.No	Work Experience	Total in Years
1	Teaching	23
2	Research	12
3	Industry	1
4	others	

Area of Specialization:

Courses taught at	Undergraduate	1. Basic Thermodynamics 2. Applied thermodynamics 3. Fluid Mechanics 4. Heat and mass transfer 5. Elements of Mechanical Engg 6. Computer aided engineering drawing 7. Turbomachinery 8. Renewable energy sources 9. HVAC

Research Guidance (Number of Students):UG students-

No. of papers published:

SL.No	Type	Numbers
1	National Journals	02
2	International Journals	52
3	Conferences	17
4	Others	

Master (Completed (Year of Completion)/Ongoing):
Completed : 04
On-going : 00

Ph.D. (Completed Year of Completion)/Ongoing):
Completed : 03
On-going : 04

Projects Carried out :

Patents (Filed & Granted):

SL No	Topic	**Patent Application No**	Filed/ Granted
1	Air treatment apparatus for contagious respiratory patient	202141035026	Filed
2	Method and Apparatus for Solar Photovoltaic Panel Cooling		Filed

Technology Transfer: Nil

No. of Books published with details: Dr R.P.Reddy and N.Kapilan, Elements of Mechanical Engineering, Himalaya Publishing House, 2014.

Profile of the Faculty

BRANCH: MECHANICAL ENGINEERING

Name	Dr Shailesh Rao A	
Designation	Professor	
Department	**Mechanical Engineering**	
Date of Joining the Institution	29th August 2022	
Date of Birth	14th November 1975	
Faculty Unique	1-4488113197	
Email Id	shailesh.rao@nmit.ac.in	

Education Qualifications:

SL.No	Degree Obtained	Year of Obtaining the highest degree	Class/ Grade obtained
1	UG	1997	First Class
2	PG	2002	First Class with distinction
3	PhD	2010	
4	Others		
5			

Total Work Experience in Years:

SL.No	Work Experience	Total in Years
1	Teaching	23
2	Research	09
3	Industry	03
4	others	

Area of Specialization: Machining Characteristics, Smart Agriculture with Data Techniques

Courses taught at	Undergraduate	1 Statistical Quality Control with R 2 Mechanics of Materials 3 Computer Aided Engg. Drawing
	Post Graduate	1 Micro Machining 2 Additive Manufacturing 3

Research Guidance (Number of Students):UG students-

No. of papers published:

SL.No	Type	Numbers

1	National	
2	International Journals	23
3	Conferences	14
4	Others	

Master (Completed (Year of Completion)/Ongoing): 02

Ph.D. (Completed Year of Completion)/Ongoing): 04

Projects Carried out :

Received project grant from VTU, Belgaum, leading as Principal Investigator for the project titled 'Modelling and Analysis of Molten Metal Behaviour in Centrifugal Casting' (Rs. 8.62 lakhs) in the year 2010-13

Patents (Filed & Granted):

SL No	Topic	**Patent Application No**	Filed/ Granted
1			
2			

Technology Transfer:

No. of Books published with details:

Profile of the Faculty

BRANCH: MECHANICAL ENGINEERING

Name	Hemanth Kumar N	
Designation	Assoc. Professor	
Department	**ME**	
Date of Joining the Institution	11-06-2011	
Date of Birth	11-05-1974	
Faculty Unique	1-722578485	
Email Id	Hemanthkumar.n@nmit.ac.in	

Education Qualifications:

SL.No	Degree Obtained	Year of Obtaining the highest degree	Class/ Grade obtained
1	UG	1999	First class with distinction
2	PG	2007	First class with distinction Secured Third Rank
3	PhD	Registerd on 2021 from Jain (Deamed to be university)	Completed course work, Work is under progress
4	Others		
5			

Total Work Experience in Years:22 years

SL.No	Work Experience	Total in Years
1	Teaching	15
2	Research	2
3	Industry	5
4	others	

Area of Specialization: Manufacturing Science and Engineering

Courses taught at	Diploma/ Post Diploma	1 Strength of Materials
	Undergraduate	1 Computer Aided Engg Drawing 2 Mechanics of Materials 3 Advanced Manufacturing Technology 4 Operations Research 5 Non traditional Machining

		6 Manufacturing Technology 7Elements of Mechanical Engg 8Material science and Engg etc .

Research Guidance (Number of Students):UG students- 4 batches

No. of papers published:01

SL.No	Type	Numbers
1	National	01
2	International Journals	
3	Conferences	
4	Others	

Master (Completed(Year of Completion)/Ongoing): 2007

Ph.D. (Completed Year of Completion)/Ongoing): Ongoing

Projects Carried out : Four

Patents (Filed & Granted): 01 Filed

SL No	Topic	**Patent Application No**	Filed/ Granted
1	CNG KIT: INTELLIGENT CNG KIT DESIGN FOR TWO WHEELERS	202041030475	17/07/2020 Date of filing
2			

Technology Transfer:Nil

No. of Books published with details: Nil

Profile of the Faculty

BRANCH: MECHANICAL ENGINEERING

Name	Dr Chethan K S
Designation	Associate Professor
Department	**ME**
Date of Joining the Institution	07th September 2009
Date of Birth	11th July 1984
Faculty Unique	1-409547840
Email Id	chethan.ks@nmit.ac.in

Education Qualifications:

SL.No	Degree Obtained	Year of Obtaining the highest degree	Class/ Grade obtained
1	UG	2006	FC
2	PG	2012	FCD
3	PhD	2021	-
4	Others		
5			

Total Work Experience in Years:

SL.No	Work Experience	Total in Years
1	Teaching	13
2	Research	-
3	Industry	03
4	others	

Area of Specialization:

Courses taught at	Undergraduate	1 Computer Aided Engineering Drawing 2 Machine Drawing 3 Fluid Mechanics 4 Heat Transfer 5 Energy Environment & Sustainable Development

Research Guidance (Number of Students):UG students – 60 students

No. of papers published:

SL.No	Type	Numbers
1	National	03

2	International Journals	14
3	Conferences	03
4	Others	

Master (Completed (Year of Completion)/Ongoing): 2012

Ph.D. (Completed Year of Completion)/Ongoing): 2021

Projects Carried out:

Patents (Filed & Granted):

SL No	Topic	**Patent Application No**	Filed/ Granted
1	Portable Mobile Disinfection Device for Disinfecting a Given Facility	202141042150	Filed
2	Development of smart window systems with integrated air-purifiers	202241041446	Filed

Technology Transfer: -

No. of Books published with details: -

Profile of the Faculty

BRANCH: MECHANICAL ENGINEERING

Name	MANJUNATH HN.	
Designation	Assistant Professor	
Department	**ME**	
Date of Joining the Institution	02-08-2011	
Date of Birth	11-10-1987	
Faculty Unique	1-721714902	
Email Id	manjunath.hn@nmit.ac.in	

Education Qualifications:

SL.No	Degree Obtained	Year of Obtaining the highest degree	Class/ Grade obtained
1	UG	2009	FCD
2	PG	2011	FC
3	PhD	Pursuing	NA
4	Others	Diploma	FCD
5			

Total Work Experience in Years:

SL.No	Work Experience	Total in Years
1	Teaching	12
2	Research	NIL
3	Industry	NIL
4	others	NIL

Area of Specialization: Thermal Power Engineeing

Courses taught at	Undergraduate	1. Fluid Mechanics 2. Heat Transfer 3. Automotive Technology 4. Energy, Environment & Sustainable Development 5. Computer Aided engineering drawing 6. Innovation & Design thinking 7. Emerging Technologies in renewable energy Tribology
		8.
	Post Graduate	1. Finite element method

		2. Design of Transfer equipments 3. Advanced Power plant cycles 4. Non-Conventional energy resources 5. Computational Fluid dynamics
	Post Graduate Diploma Level	NA

Research Guidance (Number of Students):UG students-15

No. of papers published:

SL.No	Type	Numbers
1	National	03
2	International Journals	10
3	Conferences	07
4	Others	02

Master (Completed): 2011

Ph.D. Ongoing): Pursuing

Projects Carried out :04

Patents (Filed & Granted):

SL No	Topic	**Patent Application No**	Filed/ Granted
1	Four -Wheel laterally Travelable Mechanism	1817/CHE/2015	Filed
2			

Technology Transfer:

1. **low cost & sustainable smart windows with integrated air purifier for rural healthcare centers**
2. **Design and Development of Foldable suitcase vehicle**
3. **Design and Development of 4-wheel all-terrain vehicle for agricultural applications**

No. of Books published with details: NIL

Profile of the Faculty

BRANCH: MECHANICAL ENGINEERING

Name	Dr. Praveen B A	
Designation	Assistant Professor	
Department	**ME**	
Date of Joining the Institution	17/08/2012	
Date of Birth	28/05/1986	
Faculty Unique	1-1480794470	
Email Id	praveen.ba@nmit.ac.in	

Education Qualifications:

SL. No	Degree Obtained	Year of Obtaining the highest degree	Class/ Grade obtained
1	UG	2008	First Class with Distinction
2	PG	2012	First Class with Distinction
3	PhD	2021	-
4	MBA	2014	First Class
5			

Total Work Experience in Years:

SL. No	Work Experience	Total in Years
1	Teaching	10 years and 4 month
2	Research	02 years
3	Industry	02 years
4	others	

Area of Specialization: Composites Materials and Additive Manufacturing

Courses taught at	Undergraduate	1. Computer Aided Engineering Drawing 2. Digital Manufacturing 3. Computer Integrated Manufacturing 4. CAD/CAM/CIM 5. Elements of Mechanical Engineering 6. Total Quality Management 7. Theory of Machines Rapid Prototyping
	Postgraduate	1. Rapid Prototyping 2. Advanced Manufacturing Technology 8. CAD/CAM/CIM

Research Guidance (Number of Students):UG students: 22

No. of papers published:

SL. No	Type	Numbers
1	National	01
2	International Journals	31
3	Conferences	12
4	Others	

Master (Completed (Year of Completion)/Ongoing): Completed - 2012

Ph.D. (Completed Year of Completion)/Ongoing): Completed - 2021

Projects Carried out: Masters (02), Undergraduate (02)

Patents (Filed & Granted):

Sl. No	Topic	Patent Application No	Filed/ Granted
1	Solar Powered Rice Puffing Machine	201941054029	Published
2	Design and Fabrication of Rocker Bogie Mechanism Automated-Combat Rover	202041057528	Published
3	Smart Robotic Material Transporter	202241050096	Published

Technology Transfer: Nil

No. of Books published with details: Nil

Profile of the Faculty

BRANCH: MECHANICAL ENGINEERING

Name	Krupa R	
Designation	Asst. Professor	
Department	**ME**	
Date of Joining the Institution	02-01-2013	
Date of Birth	29-01-1988	
Faculty Unique	1-1547574095	
Email Id	Krupa.r@nmit.ac.in	

Education Qualifications:

SL.No	Degree Obtained	Year of Obtaining the highest degree	Class/ Grade obtained
1	UG		
2	PG	2012	FC
3	PhD		
4	Others		
5			

Total Work Experience in Years:

SL.No	Work Experience	Total in Years
1	Teaching	10
2	Research	
3	Industry	
4	others	

Area of Specialization: Thermal Power Engineering

Courses taught at	Undergraduate	1 Elements of Mechanical Engg. 2 Heat Transfer 3 Renewable energy Resources 4. Solid Waste Management 5. Instrumentation and control systems 6. Biomass Energy Systems 7.Automotive Engineering 8. Project Management Finance and Accounting 9.Entrprenuership and IPR 10.Alternative fuels
	Post Graduate	1. Non-conventional Energy Systems .

Research Guidance (Number of Students):UG students- 35

No. of papers published: 6

SL.No	Type	Numbers
1	National	2
2	International Journals	4
3	Conferences	
4	Others	

Master (Completed (Year of Completion)/Ongoing): 2012

Ph.D. (Completed Year of Completion)/Ongoing): ongoing

Projects Carried out : Vertical axis wind turbine efficiency and performance ,

Patents (Filed & Granted):

SL No	Topic	**Patent Application No**	Filed/ Granted
1	A Novel System For Controlling Employees Attrition Rate	202141023567	Granted
2	Integration of student life cycle management with SAP	202141022954	Granted

Technology Transfer:

No. of Books published with details:

Profile of the Faculty

BRANCH: MECHANICAL ENGINEERING

Name	Dr.Shiv Pratap Singh Yadav	
Designation	Assistant Professor	
Department	**ME**	
Date of Joining the Institution	19 June 2013	
Date of Birth	19 April 1989	
Faculty Unique	7818	
Email Id	shivpratpsinghyadav@nmit.ac.in	

Education Qualifications:

SL.No	Degree Obtained	Year of Obtaining the highest degree	Class/ Grade obtained
1	UG	2010	First Class with Distinction
2	PG	2013	Distinction
3	PhD	2021	
4	Others		
5			

Total Work Experience in Years:

SL.No	Work Experience	Total in Years
1	Teaching	9 year 6 months
2	Research	4 months
3	Industry	2 months
4	others	

Area of Specialization: Machine Design,Six Sigma,Total quality Management,Contact Mechanics

	Undergraduate	1.Design of machine elements-1 2 Design of machine elements-II 3.Mechanical Vibrations 4.Tribology 5.Supply Chain Management 6.Total Quality Management 7.Entrepreneurship Development and IPR

		8.Project Management and Finance Accounting 9.Innovation Design Thinking 10.Elements of Mechanical Engineering
	Post Graduate	1.Advance Mechanical Vibrations

Research Guidance (Number of Students):UG students-70

No. of papers published:

SL.No	Type	Numbers
1	National	1
2	International Journals	30
3	Conferences	3
4	Others	

Master (Completed (Year of Completion)/Ongoing): 2012

Ph.D. (Completed Year of Completion)/Ongoing): 2021

Projects Carried out :

Patents (Filed & Granted):

SL No	Topic	**Patent Application No**	Filed/ Granted
1	1. SYSTEM AND METHOD FOR INDOOR CLOTHES DRYER USING DIRECT TRANSPORTATION OF SOLAR LIGHT	2021101539	Granted

Technology Transfer:

No. of Books published with details:

Profile of the Faculty

BRANCH: MECHANICAL ENGINEERING

Name	Dr ARUN KUMAR G L
Designation	Assistant Professor
Department	**ME**
Date of Joining the Institution	09/01/2012
Date of Birth	02/05/1987
Faculty Unique	1-1480729717
Email Id	arunkumar.gl@nmit.ac.in

Education Qualifications:

SL.No	Degree Obtained	Year of Obtaining the highest degree	Class/ Grade obtained
1	UG	2009	FC
2	PG	2012	FCD
3	PhD	2021	-
4	Others		
5			

Total Work Experience in Years:

SL.No	Work Experience	Total in Years
1	Teaching	12
2	Research	
3	Industry	
4	others	

Area of Specialization: Thermal Power Engineering

Courses taught at	Undergraduate	1 Heat Transfer 2. Basic Thermodynamics 3. Applied Thermodynamics 4. Computational Fluid Dynamics 5.Aerodynamics 6.Solar Energy 7.Internal Combustion Engines 8.Renewable Energy Resources 9.Atumotive Engineering .
	Post Graduate	1.Advance Power Plant Cycles 2 Advanced Heat Transfer 3 Internal Combustion Engines.

Research Guidance (Number of Students):UG students- 45

No. of papers published:

SL.No	Type	Numbers
1	National	02
2	International Journals	11
3	Conferences	02
4	Others	02

Master (Completed (Year of Completion)/Ongoing): 2012/Completed

Ph.D. (Completed Year of Completion)/Ongoing): 2021/Completed

Projects Carried out : **05**

- Patents (Filed & Granted):

SL No	Topic	**Patent Application No**	Filed/ Granted
1	IOT BASED AUTOMATED SYSTEM FOR FREEWAY FRAMEWORK 3Application No.	202141039583	Published 2021
2			

Technology Transfer:

No. of Books published with details:

Profile of the Faculty

BRANCH: MECHANICAL ENGINEERING

Name	**Dr AVINASH L**
Designation	**Assistant Professor**
Department	**ME**
Date of Joining the Institution	11-08-2014
Date of Birth	02-08-1988
Faculty Unique	1-2380801569
Email Id	avinash.l@nmit.ac.in

Education Qualifications:

S/No	Degree Obtained	Year of Obtaining the highest degree	Class/ Grade obtained
1	UG	2010	FC
2	PG	2013	FCD
3	PhD	2021	FC
4	Others		
5			

Total Work Experience in Years: 8 Years and 4 Months

S. No	Work Experience	Total in Years
1	Teaching	8.4
2	Research	8
3	Industry	
4	others	

Area of Specialization:

Courses taught at	Undergraduate	1. CAED 2. DME-I DME-II
	Postgraduate	1. TBD 3. MCM

Research Guidance (Number of Students):UG students- 15

No. of papers published:

S. No	Type	Numbers
1	National	04
2	International Journals	31
3	Conferences	06
4	Others (Book Chapter)	02

Master (Completed (Year of Completion)/Ongoing): 06

Ph.D. (Completed Year of Completion)/Ongoing): NA

Projects Carried out: NiL

Patents (Filed & Granted):

SL No	Topic	**Patent Application No**	Filed/ Granted
1	System and Method for Indoor Clothes Dryer using Direct Transportation of Solar Light (Australia Government/ IP Australia)	2021101539	**Patent Granted**
2	The Smart Factory Controlling System. (Australia Government/ IP Australia)	2021102649	**Patent Granted**

Technology Transfer:

No. of Books published with details: “Numerical Validation of Octopus Wheel Rim using FEA” LAP Lambert Academic Publishing (21 April 2015), ISBN-10: 3659696056; ISBN-13 : 978-3659696053

Profile of the Faculty

BRANCH: MECHANICAL ENGINEERING

Name	Prashanth N	
Designation	Asst Professor	
Department	**ME**	
Date of Joining the Institution	01-7-2013	
Date of Birth	23-07-1987	
Faculty Unique	1-2183200529	
Email Id	prashanth.n@nmit.ac.in	

Education Qualifications:

SL.No	Degree Obtained	Year of Obtaining the highest degree	Class/ Grade obtained
1	BE Mechanical Engineering	2009	First Class with Distinction
2	M.Tech Production Engineering and System Technology	2011	CGPA: 9.62/10 First Rank Holder-Gold Medalist
3	PhD-Robotics (Part Time)	2018-2023	Comprehensive Viva Completed-Research in Progress
4	Diploma-Mechatronics Engineering	2006	First Class

Total Work Experience in Years:

SL.No	Work Experience	Total in Years
1	Teaching	9.5
2	Research	4
3	Industry	2
4	others	-

Area of Specialization:		
Courses taught at	Undergraduate	1. Applied Mechatronics 2. Industrial Robotics 3. Control Engineering 4. Computer Integrated Manufacturing 5. Design for Manufacture 6. Data Analytics 7. Industry 4.0 Theory of Machines
	Post Graduate	1. Mechatronics System Design 8. Robotics

Research Guidance (Number of Students):UG students-50+

No. of papers published:

SL.No	Type	Numbers
1	National	01
2	International Journals	04
3	Conferences	09
4	Others (Copyrights)	01

Master (Completed (Year of Completion)/Ongoing): Completed (2011)

Ph.D. (Completed Year of Completion)/Ongoing): Ongoing (2018-2023)

Projects Carried out :

SINO	**Project Title**	**Grant Amount (Rs)**	**Grant Agency**	**Role**	**Status**
1	Establishment of Centre for Robotics Research to Promote Multidisciplinary Research in Engineering Education	60 Lakhs	VGST, Govt of Karnataka	Principal Investigator (2019 Onwards) Co-Investigator (2016-2019)	Ongoing
2	Design and Development of Advanced Multi Drive Mobile Robot	1.5 Lakhs	KSCST, Govt of Karnataka	Principal Investigator	Ongoing
3	Design and Development of Humanoid Robotic Head	1 Lakh	IEDC, DST, Govt of India	Principal Investigator	Completed
4	Design & Development of Multipurpose Transplanter	Rs 8000	KSCST, Govt of Karnataka	Project Supervisor	Completed
5	Design and Development of Multi	Rs 8000	KSCST, Govt of Karnataka	Project Supervisor	Completed

	Drive Mobile Robot for Space and Military Applications				
6	Design and Development Segropactor	Rs 7000	KSCST, Govt of Karnataka	Project Supervisor	Completed
7	Design and Development of 2nd Generation Advanced Robot for Interactive Applications	Rs 2.5 Lakhs	NMIT	Principal Investigator	Completed

Patents (Filed & Granted):

SL No	Topic	**Patent Application No**	Filed/ Granted
1	Design and Development of Remote Controlled Multipurpose Transplanter	202241013644-	Published

Technology Transfer: Nil

No. of Books published with details: Nil

Profile of the Faculty

BRANCH: MECHANICAL ENGINEERING

Name	Mahadeva Prasad
Designation	Assistant Professor
Department	**ME**
Date of Joining the Institution	01/09/2014
Date of Birth	23/04/1984
Faculty Unique	1-2380801509
Email Id	Mahadeva.prasad@nmit.ac.in

Education Qualifications:

SL.No	Degree Obtained	Year of Obtaining the highest degree	Class/ Grade obtained
1	UG	2007	First class
2	PG	2013	First class
3	PhD		
4	Others		
5			

Total Work Experience in Years:

SL.No	Work Experience	Total in Years
1	Teaching	8
2	Research	
3	Industry	6.6
4	others	

Area of Specialization:

Courses taught at	Undergraduate	1.Composite Materials and Mechanics 2.Hydraulics and Pneumatic 3.Theory of Machines 4.Farm Engineering 5.Elements of Mechanical Engineering

Research Guidance (Number of Students):UG students-

No. of papers published:

SL.No	Type	Numbers
1	National	1
2	International Journals	
3	Conferences	2

4	Others	

Master (Completed (Year of Completion)/Ongoing): 2013

Ph.D. (Completed Year of Completion)/Ongoing): 2022(Registered)

Projects Carried out :2

Patents (Filed & Granted):

SL No	Topic	**Patent Application No**	Filed/ Granted
1	Smart Robotic Materials Transporter	202241050096	Published
2			

Technology Transfer: Nil

No. of Books published with details: Nil

Profile of the Faculty

BRANCH: MECHANICAL ENGINEERING

Name	Dr. Sriram Mukunda	
Designation	Assistant Professor	
Department	**ME**	
Date of Joining the Institution	01/01/2015	
Date of Birth	26/11/1978	
Faculty Unique	1-452648921	
Email Id	sriram.mukunda@nmit.ac.in	

Education Qualifications:

Sl.No	Degree Obtained	Year of Obtaining the highest degree	Class/ Grade obtained
1	UG	2003	First
2	PG	2011	First
3	PhD	2021	First
4	Others (MS in Automotive Engg)	2005	First
5			

Total Work Experience in Years:

Sl. No	Work Experience	Total in Years
1	Teaching	14
2	Research	06
3	Industry	04
4	others	

Area of Specialization:

Courses taught at	Undergraduate	1. Elements of Mechanical Engineering 2. Operations research 3. Industrial Engg Management 4. Engg materials and metallurgy 5. Automotive fundamentals 6.. Automotive powertrain 7. Automotive IC engines 8. Automotive electronics 9. Mechatronics 10. Electronic devices and microcontrollers 11. Manufacturing technology

		12. Advanced manufacturing technology 13.Composite Materials

Research Guidance (Number of Students):UG students- 03

No. of papers published:

Sl. No	Type	Numbers
1	National	01
2	International Journals	04
3	Conferences	03
4	Others	

Master (Completed (Year of Completion)/Ongoing): Completed in year 2011

Ph.D. (Completed Year of Completion)/Ongoing): Completed in the year 2021

Projects Carried out:
1. Study of Microstructure and Mechanical Testing of Aluminum - Carbon Nanotube Metal Matrix Composites
2. Modelling and Analysis of foot mate Power Generation system
3. Design and Fabrication of Bluetooth Controlled Smart Pesticide Spraying Robot

Patents (Filed & Granted):

SL No	Topic	**Patent Application No**	Filed/ Granted
1	Design and Fabrication of Footmate Power Generation System	202241050686	Filed and published
2	Design and Fabrication of Bluetooth Controlled Smart Pesticide Spraying Robot	202241050679	Filed and published

Technology Transfer:

No. of Books published with details:
02 books published as of date

1. Arjun Siddharth, Vinyas Mahesh, Vishwas Mahesh, Sriram Mukunda, Satishkumar A, Dinesh Kumar Harursampath, “Effect of external resistances on energy harvesting behavior of porous functionally graded magneto-electro-elastic beam”. Mathematical methods in Dynamic Systems, CRC Press, Taylor and Francis, EDS: S. Chakravarty, Jena S K.

2. Vinyas Mahesh, Sriram Mukunda, Vishwas Mahesh, “Free vibration properties of the natural fiber-based epoxy composites”. Epoxy based bio composites, CRC Press, Taylor and Francis.

Profile of the Faculty

BRANCH: MECHANICAL ENGINEERING

Name	Vikram Kedambadi Vasu
Designation	Assistant Professor
Department	**ME**
Date of Joining the Institution	06/09/2016
Date of Birth	29/05/1987
Faculty Unique	1-3180254257
Email Id	vikram.k@nmit.ac.in

Education Qualifications:

SL. No	Degree Obtained	Year of Obtaining the highest degree	Class/ Grade obtained
1	UG	2008	First Class
2	PG	2012	First Class with Distinction
3	PhD	Pursuing	
4	Others		
5			

Total Work Experience in Years:

SL. No	Work Experience	Total in Years
1	Teaching	10
2	Research	
3	Industry	
4	others	

Area of Specialization: Nanocomposites and Micro-machining

Courses taught at	Diploma/ Post Diploma	
	Undergraduate	1. Computer Aided Engineering Drawing 2. Digital Manufacturing 3. Computer Integrated Manufacturing 4. CAD/CAM/CIM 5. Elements of Mechanical Engineering 6. Total Quality Management 7. Theory of Machines 8. Rapid Prototyping
	Postgraduate	1. Rapid Prototyping 2. Advanced Manufacturing Technology
	Post Graduate Diploma Level	

Research Guidance (Number of Students):UG students: 32

No. of papers published:

SL. No	Type	Numbers
1	National	01
2	International Journals	07
3	Conferences	03
4	Others	

Master (Completed (Year of Completion)/Ongoing): Completed - 2012

Ph.D. (Completed Year of Completion)/Ongoing): Ongoing

Projects Carried out: Masters (02), Undergraduate (08)

Patents (Filed & Granted):

Sl. No	Topic	Patent Application No	Filed/ Granted
1	Frictionless Vertical Axis Wind Maglev Turbine	201941054028	Published
2	Range Extender Engine for Hybrid Electric Vehicles	201941054031	Published
3	Design, Analysis and Fabrication of Voice Operated Pneumatic Exo Skeleton Arm for Monoplegia, Quadriplegia, and Industrial Applications	202041057529	Published
4	Design And Fabrication of Solar Powered Treadmill Bicycle	202041057530	Published
5	A Method and System for Efficiently Paying and Collecting Fine in a Traffic Violation	202141062255	Published
6	A Fuel System for a Vehicle	202141062256	Published
7	Stir Casting Route for Processing Metal matrix Nanocomposites	202241027779	Published
8	Smart Robotic Material Transporter	202241050096	Published

Technology Transfer: Nil

No. of Books published with details: 01 – Total Quality Management – Suggi Publishing

Profile of the Faculty

BRANCH: MECHANICAL ENGINEERING

Name	GIRISH PRASAD M	
Designation	ASSISTANT PROFESSOR	
Department	**ME**	
Date of Joining the Institution	01-12-2016	
Date of Birth	20-06-1992	
Faculty Unique	1-3363601493	
Email Id	girishprasad.m@nmit.ac.in girishprasad1992@gmail.com	

Education Qualifications:

SL.No	Degree Obtained	Year of Obtaining the highest degree	Class/ Grade obtained
1	UG	2014	Distinction
2	PG	2016	Distinction
3	PhD	Pursuing	
4	Others		
5			

Total Work Experience in Years:

SL.No	Work Experience	Total in Years
1	Teaching	6
2	Research	
3	Industry	
4	others	

Area of Specialization: Thermal Power Engineering

Courses taught at	Undergraduate	1. Heat Transfer 2. Fluid Machinery 3. Alternate Fuels 4. Energy Engineering 5. Elements of Mechanical Engineering 6. Computer Aided Engineering Drawing 7. Manufacturing Technology-1 8. Automotive Engineering-Power Train . .

	Post Graduate	1. Design of equipments for thermal power plants 2. Solar Energy Technology 3. I C Engines . .

Research Guidance (Number of Students):UG students- 15

No. of papers published:

SL.No	Type	Numbers
1	National	
2	International Journals	3
3	Conferences	2
4	Others	

Master (Completed (Year of Completion)/Ongoing): 1

Ph.D. (Completed Year of Completion)/Ongoing):

Projects Carried out :

Patents (Filed & Granted): 1

SL No	Topic	**Patent Application No**	Filed/ Granted
1	**DESIGN AND FABRICATION OF FOOTMATE POWER GENERATION SYSTEM**	**202241050686**	Filed & Published
2			

Technology Transfer:

No. of Books published with details:

Profile of the Faculty

BRANCH: MECHANICAL ENGINEERING

Name	Ananda M N	
Designation	Assistant Professor	
Department	**MECHANICAL**	
Date of Joining the Institution	21/08/2017	
Date of Birth	06/09/1992	
Faculty Unique	1-3722348454	
Email Id	ananda.mn@nmit.ac.in	

Education Qualifications:

SL.No	Degree Obtained	Year of Obtaining the highest degree	Class/ Grade obtained
1	UG	2014	First class with distinction
2	PG	2017	First class with distinction
3	PhD		
4	Others		
5			

Total Work Experience in Years:

SL.No	Work Experience	Total in Years
1	Teaching	5
2	Research	0
3	Industry	0
4	others	0

Area of Specialization: Machine Design

Courses taught at	Undergraduate	1.Elements of Mechanical Engineering 2.Dynamics of Machines 3.Design of machine Elements 4.Design of Transmission Elements 5.Kinematics of machines

Research Guidance (Number of Students):UG students-04

No. of papers published: 5

SL.No	Type	Numbers
1	National	
2	International Journals	
3	Conferences	2

4	Others	3

Master (Completed (Year of Completion)): 2017

Ph.D. (Completed Year of Completion)/Ongoing):

Projects Carried out :

Patents (Filed & Granted):

SL No	Topic	**Patent Application No**	Filed/ Granted
1			
2			

Technology Transfer:

Profile of the Faculty

BRANCH: MECHANICAL ENGINEERING

Name	GANESH K	
Designation	Assistant Professor	
Department	**ME**	
Date of Joining the Institution	17/11/2017	
Date of Birth	10/07/1991	
Faculty Unique Id	1-3714111044	
Email Id	ganesh.k@nmit.ac.in	

Education Qualifications:

SL.No	Degree Obtained	Year of Obtaining the highest degree	Class/ Grade obtained
1	UG	2013	First Class
2	PG	2015	Distinction
3	PhD		
4	Others		
5			

Total Work Experience in Years:

SL.No	Work Experience	Total in Years
1	Teaching	6.4 years
2	Research	
3	Industry	
4	others	

Area of Specialization:

Courses taught at	Undergraduate	1. Elements of Mechanical Engineering 2. Applied Thermodynamics 3. Alternative fuels and Energy Technologies 4. Fluid Mechanics 5. Systems for Energy Storage 6. Biomass energy systems 7. Flow measurement and Fluid machinery lab 8. Heat transfer lab 9. Engineering Workshop lab 10. Manufacturing lab 11. Professional Practice – II lab 12. Metrology and Measurements lab

Research Guidance (Number of Students):UG students- 20

No. of papers published:

SL.No	Type	Numbers
1	National	
2	International Journals	
3	Conferences	2
4	Others	

Master (Completed (Year of Completion)/Ongoing): Completed - 2015

Ph.D. (Completed Year of Completion)/Ongoing): Ongoing

Projects Carried out :

1. Synthesis and characterization of Shape memory effect of Cu-Al-Ni alloys
2. Effect of Nano particles on the performance of Desert cooler
3. Design and fabrication of Foldable Bicycle
4. Experimental investigation on effect of Nano particles on performance and emission characteristics of diesel engine fueled with waste cooking oil biodiesel.
5. Effect of Nano fluid on performance of Evaporating cooling system

Patents (Filed & Granted):

SL No	Topic	**Patent Application No**	Filed/ Granted
1			
2			

Technology Transfer:

No. of Books published with details:

Profile of the Faculty

BRANCH: MECHANICAL ENGINEERING

Name	Bharath V	
Designation	Assistant Professor	
Department	**ME**	
Date of Joining the Institution	19/11/2018	
Date of Birth	27/12/1989	
Faculty Unique	1-4560195025	
Email Id	bharath.v@nmit.ac.in	

Education Qualifications:

SL.No	Degree Obtained	Year of Obtaining the highest degree	Class/ Grade obtained
1	UG	2011	First Class
2	PG	2014	First Class with Distinction
3	PhD	—-	—
4	Others	—-	—-
5			

Total Work Experience in Years:

SL.No	Work Experience	Total in Years
1	Teaching	8.5
2	Research	2
3	Industry	—-
4	others	—-

Area of Specialization: Engineering Analysis and Design

	Diploma/ Post Diploma	—

Courses taught at		
	Undergraduate	1: Elements of Mechanical Engineering 2 Design of Machine Elements 3 Fluid Mechanics 4 Industrial Engineering and Technology Management 5) Industrial product Design and Development 6) Project Management, Finance and Accounting 7) Entrepreneurship and Intellectual Property Rights 8) Renewable Energy 9) Hydraulics and Pneumatics 10) Operations Management 11) Total Quality Management
	Post Graduate	1 Computational Fluid Dynamics
	Post Graduate Diploma Level	—

Research Guidance (Number of Students):UG students- 45

No. of papers published: 5

SL.No	Type	Numbers
1	National	-
2	International Journals	3
3	Conferences	2
4	Others	

Master (Completed (Year of Completion)/Ongoing): Completed /2014

Ph.D. (Completed Year of Completion)/Ongoing):

Projects Carried out : **CFD Applications in the areas of Agriculture, Green Buildings**

Patents (Filed & Granted):

SL No	Topic	**Patent Application No**	Filed/ Granted
1	—-	—	—

Profile of the Faculty

BRANCH: MECHANICAL ENGINEERING

Name	Dr Pradeep V Badiger	
Designation	Assistant Professor	
Department	**ME**	
Date of Joining the Institution	01-Feb-2019	
Date of Birth	22-June-1992	
Faculty Unique	1-7418413267	
Email Id	pradeep.v.badiger@nmit.ac.in	

Education Qualifications:

SL.No	Degree Obtained	Year of Obtaining the highest degree	Class/ Grade obtained
1	UG	2013	FC
2	PG	2015	FCD
3	PhD	2018	FCD
4	Others		
5			

Total Work Experience in Years:08

SL.No	Work Experience	Total in Years
1	Teaching	05
2	Research	3.5
3	Industry	Nil
4	others	

Area of Specialization:

Courses taught at	Diploma/ Post Diploma	Nil
	Undergraduate	1. MEMS 2. MT-1 3. MT-2 4. M&M 5. CAED
	Postgraduate	1. MEMS
	Post Graduate Diploma Level	Nil

Research Guidance (Number of Students):UG students-04

No. of papers published:

SL.No	Type	Numbers
1	National	
2	International Journals	11
3	Conferences	05
4	Others	

Master (Completed (Year of Completion)/Ongoing): Completed 2015

Ph.D. (Completed Year of Completion)/Ongoing): Completed 2019

Projects Carried out : **03**

Patents (Filed & Granted):01

SL No	Topic	**Patent Application No**	Filed/ Granted
1	Indian Patent:- Design and Fabrication of Solar Powered Treadmill Bicycle	**202041057530**	Filed
2			

Technology Transfer: Nil

No. of Books published with details: Nil

Profile of the Faculty

BRANCH: MECHANICAL ENGINEERING

NAME	PREETHI J ARADHYA	
Designation	Asst. Professor	
Department	**ME**	
Date of Joining the Institution	11-02-2019	
Date of Birth	08-07-1994	
Faculty Unique	1-7419656352	
Email Id	Krupa.r@nmit.ac.in	

Education Qualifications:

SL.No	Degree Obtained	Year of Obtaining the highest degree	Class/ Grade obtained
1	UG		
2	PG	2018	FCD
3	PhD		
4	Others		
5			

Total Work Experience in Years:

SL.No	Work Experience	Total in Years
1	Teaching	3.5
2	Research	
3	Industry	
4	others	

Area of Specialization: Thermal Power Engineering

Courses taught at	Undergraduate	1 Elements of Mechanical Engg. 2 Heat Transfer 3 SQCR 4. HVAC and Heat pumps 5. Applied Thermodynamics

Research Guidance (Number of Students):UG students-8

No. of papers published: 2

SL.No	Type	Numbers
1	National	2
2	International Journals	
3	Conferences	
4	Others	

Master (Completed (Year of Completion)/Ongoing): 2018

Ph.D. (Completed Year of Completion)/Ongoing): ongoing

Projects Carried out :

Patents (Filed & Granted):

SL No	Topic	**Patent Application No**	Filed/ Granted
1	A Method For Wasteland Assessment and Oil Extraction From Prosopis Julifera	202141037360	Granted

Technology Transfer:

No. of Books published with details:

Profile of the Faculty

BRANCH: MECHANICAL ENGINEERING

Name	DR. ABDULRAJAK BURADI	
Designation	Assistant Professor	
Department	**Mechanical Engineering**	
Date of Joining the Institution	01-01-2020	
Date of Birth	12-06-1987	
Faculty Unique	1-7418413171	
Email Id	abdulrajak.buradi@nmit.ac.in	

Education Qualifications:

SL.No	Degree Obtained	Year of Obtaining the highest degree	Class/ Grade obtained
1	UG	2009	65.06%
2	PG	2013	70.62%
3	PhD	2019	7.25 CGPA
4	DIPLOMA	2006	73.72%
5	SSLC	2003	61.28%

Total Work Experience in Years:

SL.No	Work Experience	Total in Years
1	Teaching	7 Years
2	Research	5 Years
3	Industry	
4	others	

Area of Specialization:

Courses taught at	Undergraduate	1 Fluid Mechanics 2 Fluid Machinery 3 Computational Fluid Dynamics 4 Automotive Engineering- Vehicle Dynamics 5 Heat and Mass Transfer 6 Applied Thermodynamics 7 Basic Thermodynamics

	Post Graduate	1 Thermal Systems for Thermal Engineering 2 Industrial Safety

Research Guidance (Number of Students): UG students- 9 Batches

No. of papers published:

SL.No	Type	Numbers
1	National	-
2	International Journals	40
3	Conferences	39
4	Others	-

Master (Completed (Year of Completion)/Ongoing): 2013

Ph.D. (Completed Year of Completion)/Ongoing): 2019

Projects Carried out :

Patents (Filed & Granted): 3 Patents Published

SL No	Topic	**Patent Application No**	Filed/ Granted/Published
1	***Modified Rotor For Wind Turbine To Enhance The Efficiency***	202031056823 A	Filled and Published
2	***Filtration of Crude Biodiesel using Reverse Osmosis Membrane***	202241007851 A	Filled and Published
3	***The Methodology of Frequency Characterization for More Complex Geometries in a Diesel Engine***	202231006305 A	Filled and Published

Technology Transfer: NA

No. of Books published with details: 2

1. ***Book Title:*** *"Energy Storage Devices for Wind Power Generation" (Amazon Kindle Edition)* ***Authors: Dr. Abdulrajak Buradi****, Subhashree Priyadarshini and Bibhu Prasad Ganthia, (2021).* ***Published Date:*** *11-10-2021,* ***BFC Publications Private Limited, Lucknow-226010****, India. ASIN No: B09BKVN64F, Pages: 1-67. Volume: 1.*
2. ***Book Title:*** *"Handbook on Installation Commissioning and Testing of Electrical Substation" (In Press),* ***Authors:*** *Bibhu Prasad Ganthia,* ***Dr. Abdulrajak Buradi****, Subash Ranjan Kabit, Monalisa Mohanty and Sthitprajna Mishra (2021).* ***BLUE HILL Publications,*** *ISBN No: 978-93-92929-20-5 (Print) and 978-93-92929-25-0 (E-Book).*

Profile of the Faculty

BRANCH: MECHANICAL ENGINEERING

Name	Dr. Vijay Kumar S	
Designation	Assistant Professor	
Department	**Mechanical Engineering**	
Date of Joining the Institution	07/09/2020	
Date of Birth	07/06/1986	
Faculty Unique	1-9324060762	
Email Id	vijaykumar.s@nmit.ac.in	

Education Qualifications:

SL.No	Degree Obtained	Year of Obtaining the highest degree	Class/ Grade obtained
1	UG	2008	FC
2	PG	2013	FCD
3	PhD	2020	FCD
4	Others		
5			

Total Work Experience in Years:

SL.No	Work Experience	Total in Years
1	Teaching	10.8
2	Research	4
3	Industry	NIL
4	others	NIL

Area of Specialization:

Courses taught at	Undergraduate	1 Data Analytics 2 Heat transfer 3 Applied Thermodynamics 4. ANN and Fuzzy logics 5. CAED.
	Post Graduate	1 Artificial Intelligence

Research Guidance (Number of Students):UG students- 03

No. of papers published: 39

SL.No	Type	Numbers
1	National	04
2	International Journals	21
3	Conferences	15
4	Others	

Master (Completed (Year of Completion)/Ongoing): NIL

Ph.D. (Completed Year of Completion)/Ongoing): 01

Projects Carried out : NIL

Patents (Filed & Granted): 01

SL No	Topic	**Patent Application No**	Filed/ Granted
1	An IOT based pollution management system to monitor the pollutants released into air or water bodies from industries.	2021103904	Granted
2			

Technology Transfer: Training the students in the area of Power BI and SQL related to production, manufacturing and other small scale industries

No. of Books published with details: NIL

Profile of the Faculty

BRANCH: MECHANICAL ENGINEERING

Name	DR. KIRAN M C
Designation	ASSISTANT PROFESSOR
Department	**ME**
Date of Joining the Institution	01/07/2021
Date of Birth	20/06/1989
Faculty Unique	1-10553569305
Email Id	kiran.mc@nmit.ac.in

Education Qualifications:

SL.No	Degree Obtained	Year of Obtaining the highest degree	Class/ Grade obtained
1	UG	2011	FC
2	PG	2013	FCD
3	PhD	2018	
4	Others		
5			

Total Work Experience in Years:

SL.No	Work Experience	Total in Years
1	Teaching	5 years
2	Research	5 Years
3	Industry	Nil
4	others	Nil

Area of Specialization:

Courses taught at	Undergraduate	1 Kinematics of Machine 2 Dynamics of Machine 3 Finite element method 4 Control engineering 5 Applied Mechatronics
	Post Graduate	1 Theory of Elasticity 2 Theory of Plasticity

Research Guidance (Number of Students):UG students- 12

No. of papers published:

SL.No	Type	Numbers
1	National	Nil
2	International Journals	16
3	Conferences	3
4	Others	

Master (Completed (Year of Completion)/Ongoing): NIL

Ph.D. (Completed Year of Completion)/Ongoing): Nil

Projects Carried out : Nil

Patents (Filed & Granted): nil

SL No	Topic	**Patent Application No**	Filed/ Granted
1			
2			

Technology Transfer: nil

No. of Books published with details: nil

Profile of the Faculty

BRANCH: MECHANICAL ENGINEERING

Name	VASUDEVA UPADHYAYA	
Designation	ASSISTANT PROFESSOR	
Department	**ME**	
Date of Joining the Institution	20.06.2022	
Date of Birth	02.08.1961	
Faculty Unique	1-23554131621	
Email Id	Vasudeva.upadhyaya@nmit.ac.in	

Education Qualifications:

SL.No	Degree Obtained	Year of Obtaining the highest degree	Class/ Grade obtained
1	UG	B.E(Mechanical)1984	First Class
2	PG		
3	PhD	M.Tech(CIM)2010	FCD
4	Others		
5			

Total Work Experience in Years:

SL.No	Work Experience	Total in Years
1	Teaching	12
2	Research	
3	Industry	22
4	others	2

Area of Specialization: Computer Integrated Manufacturing

Courses taught at	Undergraduate	1.CIM 2.Mechatronics 3.Management &Entrepreneurship 4.Automation and Robotics 5.Rapid Prototyping 6.Supply chain management

		.
	Post Graduate	1.PLM 2.Mechatronics systems

Research Guidance (Number of Students):UG students-

No. of papers published:

SL.No	Type	Numbers
1	National	01
2	International Journals	
3	Conferences	02
4	Others	FDP-15

Master (Completed (Year of Completion)/Ongoing):

Ph.D. (Completed Year of Completion)/Ongoing):

Projects Carried out :

Patents (Filed & Granted):

SL No	Topic	**Patent Application No**	Filed/ Granted
1			
2			

Technology Transfer:

No. of Books published with details:

Profile of the Faculty

BRANCH: MECHANICAL ENGINEERING

Name	Dr.Manoj.I.V	
Designation	Assistant Professor	
Department	**ME**	
Date of Joining the Institution	20/06/2022	
Date of Birth	02/07/1990	
Faculty Unique	1-23594293980	
Email Id	manoj.iv@nmit.ac.in	

Education Qualifications:

SL.No	Degree Obtained	Year of Obtaining the highest degree	Class/ Grade obtained
1	UG	2012	FCD
2	PG	2015	FCD
3	PhD	2021	FCD
4	Others		
5			

Total Work Experience in Years:

SL.No	Work Experience	Total in Years
1	Teaching	3
2	Research	5
3	Industry	1
4	others	-

Area of Specialization: Product Design and Manufacturing, Non-conventional Machining, Machine learning, Artificial Neural Network and data analytics.

Courses taught at	Undergraduate	1. Elements of Mechanical Engineering 2. Introduction to Python Programming 3. Product life cycle management . .
	Post Graduate	1. Smart Materials and Systems

Research Guidance (Number of Students):UG students-2 Batchs(8Students)

No. of papers published: 19

SL.No	Type	Numbers
1	National	2
2	International Journals	7
3	Conferences	10
4	Others (Copyrights)	Slant Type Taper Fixture (Report number: L-81981/2019)

Master (Completed (Year of Completion)/Ongoing): 2015

Ph.D. (Completed Year of Completion)/Ongoing): 2021

Projects Carried out :

Patents (Filed & Granted):

SL No	Topic	**Patent Application No**	Filed/ Granted
1			
2			

Technology Transfer:

No. of Books published with details:

Profile of the Faculty

BRANCH: MECHANICAL ENGINEERING

Name	Dr Chethan D	
Designation	AP	
Department	**ME**	
Date of Joining the Institution	29-08-2022	
Date of Birth	15-04-1983	
Faculty Unique	1-4850078837	
Email Id	Chethan.d@nmit.ac.in	

Education Qualifications:

Sl.No	Degree Obtained	Year of Obtaining the highest degree	Class/ Grade obtained
1	UG	2005	First
2	PG	2007	First
3	PhD	2021	Completed
4	Others		
5			

Total Work Experience in Years:

SL.No	Work Experience	Total in Years
1	Teaching	12
2	Research	04
3	Industry	
4	others	

Area of Specialization: Materials

Courses taught at	Undergraduate	1 Mechanics of Materials 2 Dynamics of Machines 3 Design of Machine Elements 4 Operations Research 5 CAED 6 Tribology 7 TQM

	Post Graduate	1 Operations Research 2 Operations Management

Research Guidance (Number of Students):UG students- 20

No. of papers published:

Sl.No	Type	Numbers
1	National	4
2	International Journals	3
3	Conferences	4
4	Others	

Master (Completed (Year of Completion)/Ongoing): 2007

Ph.D. (Completed Year of Completion)/Ongoing): 2021

Projects Carried out :

Patents (Filed & Granted):

SL No	Topic	**Patent Application No**	Filed/ Granted
1			
2			

Technology Transfer:

No. of Books published with details:

Profile of the Faculty

BRANCH: MECHANICAL ENGINEERING

Name	Dr. Harish Kumar L	
Designation	Assistant Professor	
Department	**ME**	
Date of Joining the Institution	03/08/2015	
Date of Birth	09/08/1991	
Faculty Unique	1-2898192668	
Email Id	harish.kumar@nit.ac.in	

Education Qualifications:

SL.No	Degree Obtained	Year of Obtaining the highest degree	Class/ Grade obtained
1	UG	2013	First Class
2	PG	2015	First Class with Distinction
3	PhD	2022	-
4	Others	-	-
5			

Total Work Experience in Years:

SL.No	Work Experience	Total in Years
1	Teaching	7 years 5 months
2	Research	6 years
3	Industry	-
4	others	-

Area of Specialization: Renewable Energy, Nanomaterials, Thermal , green functionalization of nanomaterials, Automotive.

Courses taught at	Undergraduate	1 Thermal Science & Engineering 2 Automotive Engineering 3 Innovative and Design Thinking 4 Solar Energy 5 IC Engines 6 Heat & Mass Transfer

Research Guidance (Number of Students):UG students-

No. of papers published: 09

SL.No	Type	Numbers
1	National	
2	International Journals	04
3	Conferences	05
4	Others	

Master (Completed (Year of Completion)/Ongoing): Completed 2015

Ph.D. (Completed Year of Completion)/Ongoing): Completed 2022

Projects Carried out :

Title	**Duration**	**~Amount (INR)**
Design and Development of Solar Vehicle for the participation in ESVC Solar Vehicle Championship 2023	Sept 2022 – ongoing *	4-5 Lakhs
Thermal and economic analysis of a liquid flat-plate solar collector system using green carbon nanofluids	May 2019 – till present	50 lakhs
Solar Vehicle for the participation in Electric Solar Vehicle Championship 2019.	Aug 2018 – Mar 2019	1.67 Lakhs
Formula vehicle for the participation in SAE-formula and Formula Bharath 2018-19	Jan 2018 - May 2019	9 Lakhs
2-Wheeler Hybrid Scooter for the participation in SAE EGA hybrid Championship 2018.	Aug 2017- Mar 2018	1.2 Lakhs
Solar Vehicle for the participation in Indian Solar Vehicle Championship 2018.	Sept 2017- Feb 2018	1.5 Lakhs
2-Seater ATV for the participation in Rally Car Design Challenge 2018.	Jun 2017- Feb 2018	3.4 Lakhs

Design and development of a dish type solar concentrator for power generation	Nov 2017 - May 2018	1 Lakh
Design and Development of a Hybrid Energy Tree	Dec 2016 - May 2017	1.5 Lakhs
Thermic Transient Analysis of Al 18%-Si through experiment and simulation	Mar 2015 - Aug 2015	10000

Patents (Filed & Granted):

SL No	Topic	**Patent Application No**	Filed/ Granted
1			
2			

Technology Transfer:

No. of Books published with details:

Profile of the Faculty

BRANCH: MECHANICAL ENGINEERING

Name	Dr. P G Mukunda	
Designation	Professor	
Department	**ME**	
Date of Joining the Institution	01/01/2015	
Date of Birth	07/03/1938	
Faculty Unique	1-409546943	
Email Id	sriram.mukunda@nmit.ac.in	

Education Qualifications:

Sl.No	Degree Obtained	Year of Obtaining the highest degree	Class/ Grade obtained
1	UG	1955	First Class with Distinction
2	PG	1962	First Class with Distinction
3	PhD	1971	First Class
4	Others (D.I.I.Sc)	1957	First Class with Distinction
5			

Total Work Experience in Years:

Sl. No	Work Experience	Total in Years
1	Teaching	58
2	Research	40
3	Industry	
4	others	

Area of Specialization:

Courses taught at	Undergraduate	1. Metrology& Measurements 2. Engg materials and metallurgy 3. Manufacturing technology 4. Advanced manufacturing technology 5.Composite Materials

		6. Smart Materials 7. Material Selection in Engg Design
	Post Graduate	1. Composite Materials

Research Guidance (Number of Students):UG students- 04

No. of papers published:

Sl. No	Type	Numbers
1	National	50
2	International Journals	40
3	Conferences	60
4	Others	

Master (Completed (Year of Completion)/Ongoing): Completed in year 1962

Ph.D. (Completed Year of Completion)/Ongoing): Completed in the year 1971

Projects Carried out:
1. Study of Microstructure and Mechanical Testing of Aluminum - Carbon Nanotube Metal Matrix Composites

Patents (Filed & Granted):

SL No	Topic	**Patent Application No**	Filed/ Granted
1			
2			

Technology Transfer:

No. of Books published with details:

Profile of the Faculty

BRANCH: MECHANICAL ENGINEERING

Name	Raghavendra G Galgali	
Designation	Assistant Professor	
Department	**ME**	
Date of Joining the Institution	06/10/2022	
Date of Birth	04/12/1977	
Faculty Unique	1-2494225965	
Email Id	Raghavendra.gg@nmit.ac.in	

Education Qualifications:

SL.No	Degree Obtained	Year of Obtaining the highest degree	Class/ Grade obtained
1	UG	BE Mechanical	First class
2	PG	MTech CIM	FCD
3	PhD	Pursuing	
4	Others		
5			

Total Work Experience in Years:

SL.No	Work Experience	Total in Years
1	Teaching	7.5
2	Research	
3	Industry	7
4	others	

Area of Specialization:

Courses taught at	Undergraduate	1 CIM 2 Automation and Robotics 3 Mechatronics 4. MMM . .

Research Guidance (Number of Students):UG students-

No. of papers published:

SL.No	Type	Numbers
1	National	
2	International Journals	
3	Conferences	
4	Others	

Master (Completed (Year of Completion)/Ongoing): 2002

Ph.D. (Completed Year of Completion)/Ongoing): Ongoing

Projects Carried out :

Patents (Filed & Granted):

SL No	Topic	**Patent Application No**	Filed/ Granted
1			
2			

Technology Transfer:

No. of Books published with details:

Profile of the Faculty

BRANCH: MECHANICAL ENGINEERING

Name	BALACHANDRA P SHETTY	
Designation	Professor	
Department	**ME**	
Date of Joining the Institution	04-07-2003	
Date of Birth	08-10-1959	
Faculty Unique	1-409547836	
Email Id	pb.shetty@nmit.ac.in	

Education Qualifications:

SL.No	Degree Obtained	Year of Obtaining the highest degree	Class/ Grade obtained
1	UG	1982	
2	PG	1999	
3	PhD	2008	
4	Others		
5			

Total Work Experience in Years:

SL.No	Work Experience	Total in Years
1	Teaching	14
2	Research	6
3	Industry	20
4	others	

Area of Specialization:

Courses taught at	Diploma/ Post Diploma	1Aeronautics 2.Computer Programing.
	Undergraduate	1.Python Programing 2. Advance Python Programing 3.Elements of Aeronautics 4.Machinics of Materials 5.Theory of Machines 6.Aerodynamics

		7.Aircraft Structures .
	Post Graduate	
	Post Graduate Diploma Level	.

Research Guidance (Number of Students):UG students-30/4

No. of papers published:

SL.No	Type	Numbers
1	National	6
2	International Journals	14
3	Conferences	6
4	Others	

Master (Completed (Year of Completion)/Ongoing): 4/0

Ph.D. (Completed Year of Completion)/Ongoing): 5/1

Projects Carried out : DST Project (Rs 57.38 Lakhs)

Patents (Filed & Granted):

SL No	Topic	**Patent Application No**	Filed/ Granted
1	A Novel Method for machining coupans of Glass Reinforced Hybrid Laminae	6132/CHE/2014	Granted
2	Laryngoscope With Camera Fitting Arrangement	202`41015149	Filed

Technology Transfer:

No. of Books published with details: Two(printed), : Helicopter Technology and Elements of Aeronautics
Two(online): Aircraft Structures, Mechanics Of Materials

Faculty Profiles

Diploma faculty List

SL No	Name	Dept	Designation
1.	Mr.Anand Kumar Y. C.	CSE	Lecturer
2.	Ms,Manjula k	CSE	Lecturer
3.	Mr.N.V.Rajan	CSE	Lecturer
4.	Ms,Savitra Kallihal	CSE	Lecturer
5.	Ms,Shalini joseph	CSE	Lecturer
6.	Ms,Archana K N	BS and Humanitics	Lecturer
7.	Ms,Gagana	BS and Humanitics	Lecturer
8.	Mr.Daivanvesh sarathy g	**AE**	Lecturer
9.	Ms,Santhoshini s	**ECE**	Lecturer
10.	Mr.Deepak k v	**EEE**	Lecturer
11.	Ms,Lavanya s p	**EEE**	Lecturer
12.	Ms,Chaithra hebbar j	**EEE**	Lecturer
13.	Mr.Thontadarya bs	**EEE**	Lecturer
14.	Anilkumar t m	**EEE**	Lecturer
15.	Ms,Savita muchakhandi	**EEE**	Lecturer
16.	Mr.Swamyraj rahul bhise	**AE**	Lecturer
17.	Mr.Mangesh mogarkar	**ME**	Lecturer
18.	Mr.Srinivas mt	**ME**	Lecturer
19.	Mr.Jullya naik l	**ME**	Lecturer
20.	Mr.Akash	**ME**	Lecturer
21.	Mr.Anil kumar m	**ME**	Lecturer

Profile of Diploma Faculties

BRANCH: COMPUTER SCIENCE & ENGINEERING

Name	ANAND KUMAR Y. C.	
Designation	Lecture in Diploma CSE	
Department	**CSE**	
Date of Joining the Institution	16/01/2015	
Date of Birth	22/09/1989	
Faculty Unique	1-2470582313	
Email Id	ycanand1989@gmail.com anandkumar.yc@nmit.ac.in	

Education Qualifications:

SL.No	Degree Obtained	Year of Obtaining the highest degree	Class/ Grade obtained
1	UG	2011	FCD
2	PG		
3	PhD		
4	Others		
5			

Total Work Experience in Years:

SL.No	Work Experience	Total in Years
1	Teaching	8.12
2	Research	
3	Industry	3
4	others	

Area of Specialization: Computer Science

Courses taught at	Diploma/ Post Diploma	1.Programming with C 2. Data structure Using C 3. Java 4. Operating System 5. NSM
	Undergraduate	
	Post Graduate	
	Post Graduate Diploma Level	

Research Guidance (Number of Students):UG students-

No. of papers published:

SL.No	Type	Numbers
1	National	
2	International Journals	
3	Conferences	
4	Others	

Master (Completed(Year of Completion)/Ongoing):

Ph.D. (Completed Year of Completion)/Ongoing):

Projects Carried out :

Patents (Filed & Granted):

SL No	Topic	**Patent Application No**	Filed/ Granted
1			
2			

Technology Transfer:

No. of Books published with details:

Profile of the Faculty

BRANCH: COMPUTER SCIENCE & ENGINEERING

Name	MANJULA K	
Designation	Lecturer in Diploma CSE	
Department	**CSE**	
Date of Joining the Institution	01/12/2021	
Date of Birth	02/05/1991	
Faculty Unique	1-7451114684	
Email Id	manjulasce@gmail.com	

Education Qualifications:

SL.No	Degree Obtained	Year of Obtaining the highest degree	Class/ Grade obtained
1	UG	2012	First
2	PG		
3	PhD		
4	Others		
5			

Total Work Experience in Years:

SL.No	Work Experience	Total in Years
1	Teaching	8
2	Research	
3	Industry	
4	others	

Area of Specialization: Computer Science

Courses taught at	Diploma/ Post Diploma	1.Python 2.Ds with python 3.Java 4.C programming 5.IOT
	Undergraduate	

	Post Graduate	
	Post Graduate Diploma Level	

Research Guidance (Number of Students):UG students-

No. of papers published:

SL.No	Type	Numbers
1	National	
2	International Journals	
3	Conferences	
4	Others	

Master (Completed(Year of Completion)/Ongoing):

Ph.D. (Completed Year of Completion)/Ongoing):

Projects Carried out :

Patents (Filed & Granted):

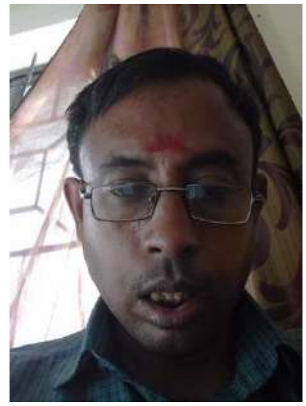
SL No	Topic	**Patent Application No**	Filed/ Granted
1			
2			

Technology Transfer:

No. of Books published with details:

Profile of the Faculty

BRANCH: COMPUTER SCIENCE & ENGINEERING

Name	N.V.Rajan	
Designation	Lecture in Diploma CSE	
Department	**CSE**	
Date of Joining the Institution	12/10/2022	
Date of Birth	25/07/1977	
Faculty Unique		
Email Id	nv_raajan81@yahoo.com	

Education Qualifications:

SL.No	Degree Obtained	Year of Obtaining the highest degree	Class/ Grade obtained
1	UG	1998	First Class
2	PG		
3	PhD		
4	Others		
5			

Total Work Experience in Years:

SL.No	Work Experience	Total in Years
1	Teaching	1
2	Research	
3	Industry	18
4	others	

Area of Specialization: Computer Science

Courses taught at	Diploma/ Post Diploma	1.Programming with C 2. Data structure Using C 3. Java 4. Operating System 5. Python 6.Compiler Design
	Undergraduate	

	Post Graduate	
	Post Graduate Diploma Level	

Research Guidance (Number of Students):UG students-

No. of papers published:

SL.No	Type	Numbers
1	National	
2	International Journals	
3	Conferences	
4	Others	

Master (Completed(Year of Completion)/Ongoing):

Ph.D. (Completed Year of Completion)/Ongoing):

Projects Carried out :

Patents (Filed & Granted):

SL No	Topic	**Patent Application No**	Filed/ Granted
1			
2			

Technology Transfer:

No. of Books published with details:

Profile of the Faculty

BRANCH: COMPUTER SCIENCE AND ENGINEERING

Name	SAVITRA KALLIHAL	
Designation	LECTURER	
Department	**CSE**	
Date of Joining the Institution	01/01/2018	
Date of Birth	05/01/1985	
Faculty Unique	1-3357008002	
Email Id	Savitrakallihal@gmail.com	

Education Qualifications:

SL.No	Degree Obtained	Year of Obtaining the highest degree	Class/ Grade obtained
1	UG		
2	PG	2019	First class
3	PhD		
4	Others		
5			

Total Work Experience in Years:

SL.No	Work Experience	Total in Years
1	Teaching	10 years
2	Research	Nil
3	Industry	Nil
4	others	1 year

Area of Specialization:

Courses taught at	Diploma/ Post Diploma	1 C- PROGRAMMING 2 DATA STRUCTURE 3 SOFTWARE ENGINEERING 4 NETWORK SECURITY 5 SOFTWARE TESTING

		6 COMPUTER NETWORK .
	Undergraduate	
	Post Graduate	
	Post Graduate Diploma Level	

Research Guidance (Number of Students):UG students-

No. of papers published:

SL.No	Type	Numbers
1	National	
2	International Journals	
3	Conferences	
4	Others	

Master (Completed(Year of Completion)/Ongoing):

Ph.D. (Completed Year of Completion)/Ongoing):

Projects Carried out :

Patents (Filed & Granted):

SL No	Topic	**Patent Application No**	Filed/ Granted
1			
2			

Technology Transfer:

No. of Books published with details:

Profile of the Faculty

BRANCH: COMPUTER SCIENCE & ENGINEERING

Name	SHALINI JOSEPH	
Designation	Lecture in Diploma CSE	
Department	**CSE**	
Date of Joining the Institution	22/11/2016	
Date of Birth	30/04/1990	
Faculty Unique	1-3563039023	
Email Id	shalurose1990@gmail.com shalini.joseph@nmit.ac.in	

Education Qualifications:

SL.No	Degree Obtained	Year of Obtaining the highest degree	Class/ Grade obtained
1	UG	2011	First
2	PG		
3	PhD		
4	Others		
5			

Total Work Experience in Years:

SL.No	Work Experience	Total in Years
1	Teaching	6.7
2	Research	
3	Industry	1.4
4	others	

Area of Specialization: Computer Science

Courses taught at	Diploma/ Post Diploma	1DBMS 2IOT 3Software Testing 4.Software Engineering
	Undergraduate	
	Post Graduate	

	Post Graduate Diploma Level	

Research Guidance (Number of Students):UG students-

No. of papers published:

SL.No	Type	Numbers
1	National	
2	International Journals	
3	Conferences	
4	Others	

Master (Completed(Year of Completion)/Ongoing):

Ph.D. (Completed Year of Completion)/Ongoing):

Projects Carried out :

Patents (Filed & Granted):

SL No	Topic	**Patent Application No**	Filed/ Granted
1			
2			

Technology Transfer:

No. of Books published with details:

Profile of the Faculty

BRANCH: Basic science and humanities

Name	Archana K N
Designation	Lecturer
Department	**BS and H**
Date of Joining the Institution	12 Feb 2018
Date of Birth	25 May 1984
Faculty Unique	1-4996278953
Email Id	Archana.kn@nmit.ac.in

Education Qualifications: MSc.mathematics

SL.No	Degree Obtained	Year of Obtaining the highest degree	Class/ Grade obtained
1	UG	2003	First class
2	PG	2005	First class
3	PhD		
4	Others		
5			

Total Work Experience in Years: 13

SL.No	Work Experience	Total in Years
1	Teaching	13
2	Research	
3	Industry	
4	others	

Area of Specialization:

Courses taught at	Diploma/ Post Diploma	1 Mathematics 2 Statistics lab
	Undergraduate	1BE mathematics
	Post Graduate	
	Post Graduate Diploma Level	

Research Guidance (Number of Students):UG students-

No. of papers published:

SL.No	Type	Numbers
1	National	
2	International Journals	
3	Conferences	
4	Others	

Master (Completed (Year of Completion)/Ongoing):

Ph.D. (Completed Year of Completion)/Ongoing):

Projects Carried out :

Patents (Filed & Granted):

SL No	Topic	**Patent Application No**	Filed/ Granted
1			
2			

Technology Transfer:

No. of Books published with details:

Profile of the Faculty

BRANCH: Basic science and humanities

Name	Gagana	
Designation	Lecturer	
Department	**BS and H**	
Date of Joining the Institution	14 Feb 2022	
Date of Birth	28 Nov 1998	
Faculty Unique		
Email Id	Gagana.nmit@nmit.ac.in	

Education Qualifications: MSc.Mathematics

SL.No	Degree Obtained	Year of Obtaining the highest degree	Class/ Grade obtained
1	UG	2019	Distinction
2	PG	2021	Distinction
3	PhD		
4	Others		
5			

Total Work Experience in Years: 13

SL.No	Work Experience	Total in Years
1	Teaching	1
2	Research	
3	Industry	
4	others	

Area of Specialization:

	Diploma/ Post Diploma	1 Mathematics 2 Statistics lab
	Undergraduate	
	Post Graduate	
Courses taught at	Post Graduate Diploma Level	

Research Guidance (Number of Students):UG students-

No. of papers published:

SL.No	Type	Numbers
1	National	
2	International Journals	
3	Conferences	
4	Others	

Master (Completed (Year of Completion)/Ongoing):

Ph.D. (Completed Year of Completion)/Ongoing):

Projects Carried out :

Patents (Filed & Granted):

SL No	Topic	**Patent Application No**	Filed/ Granted
1			
2			

Technology Transfer:

No. of Books published with details:

Profile of the Faculty

BRANCH: AERONAUTICAL ENGINEERING

Name	Daivanvesh Sarathy G	
Designation	LECTURER	
Department	**AE**	
Date of Joining the Institution	20/10/2022	
Date of Birth	09/03/2000	
Faculty Unique		
Email Id	Daivanvesh.sarathy@nmit.ac.in	

Education Qualifications:

SL.No	Degree Obtained	Year of Obtaining the highest degree	Class/ Grade obtained
1	UG	2022	1st class
2	PG	-	-
3	PhD	-	-
4	Others	-	-
5			

Total Work Experience in Years:

SL.No	Work Experience	Total in Years
1	Teaching	0
2	Research	0
3	Industry	0
4	others	0

Area of Specialization:

Courses taught at	Diploma/ Post Diploma	1. Fluid Mechanics 2. Aircraft Materials 3. Fluid Mechanics Lab 4. Elements of aeronautics
	Undergraduatt	
	Post Graduate	
	Post Graduate Diploma Level	

Research Guidance (Number of Students):UG students-

No. of papers published:

SL.No	Type	Numbers
1	National	0
2	International Journals	0
3	Conferences	0
4	Others	0

Master (Completed (Year of Completion)/Ongoing):

Ph.D. (Completed Year of Completion)/Ongoing):

Projects Carried out : Drone Detection anti drone technology

Patents (Filed & Granted):

SL No	Topic	**Patent Application No**	Filed/ Granted
1			
2			

Technology Transfer:

No. of Books published with details:

Profile of the Faculty

BRANCH: ELECTRONICS AND COMMUNICATION ENGINEERING

Name	SANTHOSHINI S
Designation	HoD in Polytechnic
Department	**ECE**
Date of Joining the Institution	12-09-2016
Date of Birth	11-04-1987
Faculty Unique	1-3562920996
Email Id	Santhoshini.s@nmit.ac.in

Education Qualifications:

SL.No	Degree Obtained	Year of Obtaining the highest degree	Class/ Grade obtained
1	UG	2008	FIRST/78%
2	PG	2020	FCD/CGPA8.84
3	PhD	-	
4	Others	-	
5			

Total Work Experience in Years:

SL.No	Work Experience	Total in Years
1	Teaching	10.3
2	Research	-
3	Industry	-
4	others	0.10

Area of Specialization:

Courses taught at	Diploma/ Post Diploma	1.DIGITAL ELECTRONICS 2.LOGIC DESIGN USING VERILOG 3.IIOT 4.MICROCONTROLLER & IT'S APPLICATIONS 5.FUNDAMENTALS OF ELECTRICAL & ELECTRONICS 6.PROJECT MANAGEMENT SKILLS

		7.MEDICAL ELECTRONICS
	Undergraduate	1.MICROCONTROLLER 2.DIGITAL ELECTRONICS 3. BASICS OF ELECTRONICS. 4.SATELLITE COMMUNICATION
	Post Graduate	
	Post Graduate Diploma Level	

Research Guidance (Number of Students):UG students-

No. of papers published:

SL.No	Type	Numbers
1	National	-
2	International Journals	01
3	Conferences	-
4	Others	

Master (Completed(Year of Completion)/Ongoing): COMPLETED(2020)

Ph.D. (Completed Year of Completion)/Ongoing):**ONGOING**

Projects Carried out:

1.**High precision industrial machine speed control through wireless**
2. An efficient infant carrycot monitoring system.

3.Guided projects for Diploma students

Patents (Filed & Granted):01 PUBLISHED

SL No	Topic	**Patent Application No**	Filed/ Granted
1	**AN EFFICENT INFANT CARRYCOT MONITORING SYSTEM**	202241001978	PUBLISHED
2			

Technology Transfer:

No. of Books published with details:

Profile of the Faculty

BRANCH: ELECTRONICS AND COMMUNICATION ENGINEERING

Name	DEEPAK K V	
Designation	LECTURER	
Department	**ECE**	
Date of Joining the Institution	04/08/2015	
Date of Birth	14/04/1988	
Faculty Unique	1-2897248527	
Email Id	Deepak.anji@gmail.com	

Education Qualifications:

SL.No	Degree Obtained	Year of Obtaining the highest degree	Class/ Grade obtained
1	UG	2011	First Class
2	PG		
3	PhD		
4	Others		
5			

Total Work Experience in Years:

SL.No	Work Experience	Total in Years
1	Teaching	7.5
2	Research	
3	Industry	
4	others	

Area of Specialization:

Courses taught at	Diploma/ Post Diploma	1 BASIC OF ELECTRICAL AND ELECTRONICS 2 INDUSTRIAL AUTOMATION 3 MEDICAL ELETRONICS
	Undergraduate	
	Post Graduate	
	Post Graduate Diploma Level	

Research Guidance (Number of Students):UG students-

No. of papers published:

SL.No	Type	Numbers
1	National	
2	International Journals	
3	Conferences	
4	Others	

Master (Completed(Year of Completion)/Ongoing):

Ph.D. (Completed Year of Completion)/Ongoing):

Projects Carried out :

Patents (Filed & Granted):

SL No	Topic	**Patent Application No**	Filed/ Granted
1			
2			

Technology Transfer:

No. of Books published with details:

Profile of the Faculty

BRANCH: ELECTRICAL AND ELECTRONICS ENGINEERING

Name	LAVANYA S P	
Designation	LECTURER	
Department	**EEE**	
Date of Joining the Institution	01/10/2016	
Date of Birth	28/09/1988	
Faculty Unique	1-3357007735	
Email Id	lavugowda30@gmail.com	

Education Qualifications:

SL.No	Degree Obtained	Year of Obtaining the highest degree	Class/ Grade obtained
1	UG		
2	PG	2015	‘O’
3	PhD		
4	Others		
5			

Total Work Experience in Years:

SL.No	Work Experience	Total in Years
1	Teaching	6.2
2	Research	
3	Industry	2.10
4	others	

Area of Specialization:

Courses taught at	Diploma/ Post Diploma	1.Analog and Digital Electronics 2.Transmission and Distribution 3. Fundamentals of Electrical and Electronics 4. Communication and Computer Networks 5. Basic Management Skills and Energy Management

	Undergraduate	
	Post Graduate	
	Post Graduate Diploma Level	

Research Guidance (Number of Students):UG students-

No. of papers published:

SL.No	Type	Numbers
1	National	0
2	International Journals	1
3	Conferences	0
4	Others	0

Master (Completed(Year of Completion)/Ongoing): 2015

Ph.D. (Completed Year of Completion)/Ongoing):

Projects Carried out :

Patents (Filed & Granted):

SL No	Topic	**Patent Application No**	Filed/ Granted
1			
2			

Technology Transfer:

No. of Books published with details:

Profile of the Faculty

BRANCH: ELECTRICAL AND ELECTRONICS ENGINEERING

Name	CHAITHRA HEBBAR J	
Designation	LECTURER	
Department	**EEE**	
Date of Joining the Institution	6/8/2014	
Date of Birth	18/6/1986	
Faculty Unique	1-2385018731	
Email Id	Chaithra.sjce@gmail.com	

Education Qualifications:

SL.No	Degree Obtained	Year of Obtaining the highest degree	Class/ Grade obtained
1	UG		
2	PG	2011	‘O’
3	PhD		
4	Others		
5			

Total Work Experience in Years:

SL.No	Work Experience	Total in Years
1	Teaching	10
2	Research	
3	Industry	
4	others	

Area of Specialization:

Courses taught at	Diploma/ Post Diploma	1.Analog and Digital Electronics 2.Power Electronics 3. Fundamentals of Electrical and Electronics 4. Mechatronics
	Undergraduate	
	Post Graduate	

	Post Graduate Diploma Level	

Research Guidance (Number of Students):UG students-

No. of papers published:

SL.No	Type	Numbers
1	National	0
2	International Journals	0
3	Conferences	0
4	Others	0

Master (Completed(Year of Completion)/Ongoing): 2011

Ph.D. (Completed Year of Completion)/Ongoing):

Projects Carried out :

Patents (Filed & Granted):

SL No	Topic	**Patent Application No**	Filed/ Granted
1			
2			

Technology Transfer:

No. of Books published with details:

Profile of the Faculty

BRANCH: EEE (DIPLOMA)

Name	THONTADARYA BS	
Designation	LECTURER	
Department	**EEE(DIPLOMA)**	
Date of Joining the Institution	01/01/2018	
Date of Birth	24/10/1987	
Faculty Unique	1-3747189644	
Email Id	thontas6@gmail.com	

Education Qualifications:

SL.No	Degree Obtained	Year of Obtaining the highest degree	Class/ Grade obtained
1	UG	2012	First class
2	PG	2016	First class
3	PhD		
4	Others		
5			

Total Work Experience in Years:

SL.No	Work Experience	Total in Years
1	Teaching	4years 11 months
2	Research	
3	Industry	3years
4	others	

Area of Specialization: EEE

Courses taught at	Diploma/ Post Diploma	1power electronics 2electrical power generation 3switch gear and protection
	Undergraduate	
	Post Graduate	
	Post Graduate Diploma Level	

Research Guidance (Number of Students):UG students-

No. of papers published:

SL.No	Type	Numbers
1	National	6
2	International Journals	1
3	Conferences	1
4	Others	

Master (Completed (Year of Completion)/Ongoing): completed 2016

Ph.D. (Completed Year of Completion)/Ongoing):

Projects Carried out :

Patents (Filed & Granted):

SL No	Topic	**Patent Application No**	Filed/ Granted
1			
2			

Technology Transfer:

No. of Books published with details:

Profile of the Faculty

BRANCH: EEE (DIPLOMA)

Name	ANILKUMAR T M	
Designation	LECTURER	
Department	**EEE**	
Date of Joining the Institution	01/01/2016	
Date of Birth	24/05/1987	
Faculty Unique	1-2897431108	
Email Id	Anil.atm560@gmail.com	

Education Qualifications:

SL.No	Degree Obtained	Year of Obtaining the highest degree	Class/ Grade obtained
1	UG	2010	First class
2	PG	2015	First class
3	PhD		
4	Others		
5			

Total Work Experience in Years:

SL.No	Work Experience	Total in Years
1	Teaching	8years 11 months
2	Research	
3	Industry	
4	others	

Area of Specialization: EEE

Courses taught at	Diploma/ Post Diploma	1electrical machine 2electrical power generation 3switch gear and protection 4industrial drives and control
	Undergraduate	
	Post Graduate	
	Post Graduate Diploma Level	

Research Guidance (Number of Students):UG students-

No. of papers published:

SL.No	Type	Numbers
1	National	
2	International Journals	
3	Conferences	
4	Others	

Master (Completed (Year of Completion)/Ongoing): completed 2015

Ph.D. (Completed Year of Completion)/Ongoing):

Projects Carried out :

Patents (Filed & Granted):

SL No	Topic	**Patent Application No**	Filed/ Granted
1			
2			

Technology Transfer:

No. of Books published with details:

Profile of the Faculty

BRANCH: ELECTRICAL AND ELECTRONICS ENGINEERING

Name	SAVITA MUCHAKHANDI
Designation	Lecturer
Department	**EEE**
Date of Joining the Institution	18/0/2016
Date of Birth	01/05/1983
Faculty Unique	1-9540448451
Email Id	Savitakr@gmail.com

Education Qualifications:

SL.No	Degree Obtained	Year of Obtaining the highest degree	Class/ Grade obtained
1	UG	2006	
2	PG	2014	
3	PhD		
4	Others		
5			

Total Work Experience in Years:

SL.No	Work Experience	Total in Years
1	Teaching	08
2	Research	
3	Industry	
4	others	

Area of Specialization:

Courses taught at	Diploma/ Post Diploma 1.	1Electrical Estimation and Costing 2Digital Electronics 3Basic Electrical power systems 4.Analog Electronics
	ndergraduate	
	Post Graduate	
	Post Graduate Diploma Level	

Research Guidance (Number of Students):UG students-

No. of papers published:

SL.No	Type	Numbers
1	National	
2	International Journals	
3	Conferences	
4	Others	

Master (Completed(Year of Completion)/Ongoing):

Ph.D. (Completed Year of Completion)/Ongoing):

Projects Carried out :

Patents (Filed & Granted):

SL No	Topic	**Patent Application No**	Filed/ Granted
1			
2			

Technology Transfer:

No. of Books published with details:

Profile of the Faculty

BRANCH: AERONAUTICAL ENGINEERING

Name	SWAMYRAJ RAHUL BHISE	
Designation	LECTURER	
Department	**AE**	
Date of Joining the Institution	13/08/2022	
Date of Birth	19/10/1999	
Faculty Unique		
Email Id	Swmyraj.bhise@nmit.ac.in	

Education Qualifications:

SL.No	Degree Obtained	Year of Obtaining the highest degree	Class/ Grade obtained
1	UG	2022	1st class
2	PG	-	-
3	PhD	-	-
4	Others	-	-
5			

Total Work Experience in Years:

SL.No	Work Experience	Total in Years
1	Teaching	0
2	Research	0
3	Industry	0
4	others	0

Area of Specialization:

Courses taught at	Diploma/ Post Diploma	1. Drone Technology 2. Low sped aerodynamics 3. Aircraft materials and manufacturing technology 4. Low sped aerodynamics lab 5. Aircraft materials and manufacturing technology Lab

	Undergraduate	
	Post Graduate	
	Post Graduate Diploma Level	

Research Guidance (Number of Students):UG students-

No. of papers published:

SL.No	Type	Numbers
1	National	0
2	International Journals	0
3	Conferences	0
4	Others	0

Master (Completed (Year of Completion)/Ongoing):

Ph.D. (Completed Year of Completion)/Ongoing):

Projects Carried out : **Thrust vector control model rocket with self landing capability**

Patents (Filed & Granted):

SL No	Topic	**Patent Application No**	Filed/ Granted
1			
2			

Technology Transfer:

No. of Books published with details:

Profile of the Faculty

BRANCH: MECHANICAL ENGINEERING

Name	Mangesh Mogarkar	
Designation	LECTURER	
Department	**ME**	
Date of Joining the Institution	16/03/2022	
Date of Birth	26/01/1997	
Faculty Unique		
Email Id	Mangesh.bm@nmit.ac.in	

Education Qualifications:

SL.No	Degree Obtained	Year of Obtaining the highest degree	Class/ Grade obtained
1	UG	2019	1st class
2	PG	-	-
3	PhD	-	-
4	Others	-	-
5			

Total Work Experience in Years:

SL.No	Work Experience	Total in Years
1	Teaching	2
2	Research	0
3	Industry	2
4	others	0

Area of Specialization:

Courses taught at	Diploma/ Post Diploma	1. Computer aided engineering Graphics 2. Materials for engineering 3. Product design and Development 4. CNC Lab 5. Thermodynamics 6. Thermodynamics Lab

		7. Aircraft Materials & Manufacturing Technology Lab
	Undergraduate	
	Post Graduate	
	Post Graduate Diploma Level	

Research Guidance (Number of Students):UG students-

. of papers published:

SL.No	Type	Numbers
1	National	0
2	International Journals	0
3	Conferences	0
4	Others	0

Master (Completed (Year of Completion)/Ongoing):

Ph.D. (Completed Year of Completion)/Ongoing):

Projects Carried out : Automatic River Cleaning system

Patents (Filed & Granted):

SL No	Topic	**Patent Application No**	Filed/ Granted
1			
2			

Technology Transfer:

No. of Books published with details:

Profile of the Faculty

BRANCH: MECHANICAL ENGINEERING

Name	SRINIVAS MT	
Designation	HOD	
Department	**ME**	
Date of Joining the Institution	08-11-2021	
Date of Birth	15-02-1979	
Faculty Unique	1-7982753986	
Email Id	Srinivas.mt@nmit.ac.in	

Education Qualifications:

SL.No	Degree Obtained	Year of Obtaining the highest degree	Class/ Grade obtained
1	UG	2006	FC
2	PG	2011	FCD
3	PhD		
4	Others		
5			

Total Work Experience in Years:

SL.No	Work Experience	Total in Years
1	Teaching	12
2	Research	
3	Industry	04
4	others	

Area of Specialization:

Courses taught at	Diploma/ Post Diploma	1. Mechanics of material 2. Machine Tool Technology 3. Machine Design 4. Automobile Engineering 5.Hydraulics and Pneumatics .
		1. Elements of Mechanical Engineering

	Undergraduate	2. Mechanics of Materials. 3. Kinematics of Machines 4. Machine Design 1 & 2 5. Automotive Engineering 6. CAED .
	Post Graduate	1. Non Traditional Machine 2. Advance Manufacturing Technology
	Post Graduate Diploma Level	

Research Guidance (Number of Students):UG students-

No. of papers published: 03

SL.No	Type	Numbers
1	National	
2	International Journals	3
3	Conferences	1
4	Others	

Master (Completed(Year of Completion)/Ongoing): 2011

Ph.D. (Completed Year of Completion)/Ongoing):

Projects Carried out : 2

Patents (Filed & Granted):

SL No	Topic	**Patent Application No**	Filed/ Granted
1			
2			

Technology Transfer:

No. of Books published with details:

Profile of the Faculty

BRANCH: MECHANICAL ENGINEERING

Name	JULLYA NAIK L	
Designation	LECTURER	
Department	**ME**	
Date of Joining the Institution	01-07-2022	
Date of Birth	01-05-1964	
Faculty Unique	1-760832464	
Email Id	ljnaiksrsit@gmail.com	

Education Qualifications:

SL.No	Degree Obtained	Year of Obtaining the highest degree	Class/ Grade obtained
1	UG	1995	SC
2	PG	2003	FC
3	PhD	Pursuing	
4	Others		
5			

Total Work Experience in Years:

SL.No	Work Experience	Total in Years
1	Teaching	28
2	Research	
3	Industry	
4	others	

Area of Specialization:

Courses taught at	Diploma/ Post Diploma	1. CNC Programming and Machining 2. Computer Integrated Manufacturing 3. Manufacturing Process. 4. Materials for Engineering
		1. EME 2.CAED

	Undergraduate	3. Manufacturing Process 1,2 & 3. 4. Metal Forming Process 5. Control Engineering. 6. Foundry Technology 7. Non Traditional Machining 8. Thermodynamics 9. Kinematics of Machining 10. Machine Drawing. 11. Computer Integrated Manufacturing 12. Mechatronics. 13. Microprocessor
	Post Graduate	
	Post Graduate Diploma Level	

Research Guidance (Number of Students):UG students- 100+

No. of papers published: 06

SL.No	Type	Numbers
1	National	5
2	International Journals	3
3	Conferences	2
4	Others	

Master (Completed(Year of Completion)/Ongoing): 2003.

Ph.D. (Completed Year of Completion)/Ongoing):

Projects Carried out : 3

Patents (Filed & Granted):

SL No	Topic	**Patent Application No**	Filed/ Granted
1			
2			

Technology Transfer:

No. of Books published with details:

Profile of the Faculty

BRANCH: MECHANICAL ENGINEERING

Name	AKASH
Designation	LECTURER
Department	**ME**
Date of Joining the Institution	01-07-2022
Date of Birth	21-03-1994
Faculty Unique	1-24378249361
Email Id	akash.biradar@nmit.ac.in

Education Qualifications:

SL.No	Degree Obtained	Year of Obtaining the highest degree	Class/ Grade obtained
1	UG	2015	FC
2	PG	2019	FC
3	PhD		
4	Others		
5			

Total Work Experience in Years:

SL.No	Work Experience	Total in Years
1	Teaching	0.6
2	Research	1
3	Industry	
4	others	2

Area of Specialization:

Courses taught at	Diploma/ Post Diploma	1. Estimation and Costing 2. Elements of Industrial Automation. 3. Fluid Power Engineering 4. CAED
	Undergraduate	
	Post Graduate	
	Post Graduate Diploma Level	

Research Guidance (Number of Students):UG students-

No. of papers published:01

SL.No	Type	Numbers
1	National	
2	International Journals	
3	Conferences	1
4	Others	

Master (Completed(Year of Completion)/Ongoing): 2019

Ph.D. (Completed Year of Completion)/Ongoing):

Projects Carried out : 2

Patents (Filed & Granted):

SL No	Topic	**Patent Application No**	Filed/ Granted
1			
2			

Technology Transfer:

No. of Books published with details:

Profile of the Faculty

BRANCH: MECHANICAL ENGINEERING

Name	ANIL KUMAR M	
Designation	LECTURER	
Department	MECHANICAL	
Date of Joining the Institution	05-09-2022	
Date of Birth	26-11-1988	
Faculty Unique	1-36515412201	
Email Id	anil3086@gmail.com	

Education Qualifications:

SL.No	Degree Obtained	Year of Obtaining the highest degree	Class/ Grade obtained
1	UG	2011	7.58 CGPA
2	PG		
3	PhD		
4	Others		
5			

Total Work Experience in Years:

SL.No	Work Experience	Total in Years
1	Teaching	0.5
2	Research	
3	Industry	9
4	others	

Area of Specialization:

Courses taught at	Diploma/ Post Diploma	ADVANCE MANUFACTURING TECHNOLOGY

Research Guidance (Number of Students):UG students-

No. of papers published:

SL.No	Type	Numbers
1	National	
2	International Journals	
3	Conferences	
4	Others	

Master (Completed(Year of Completion)/Ongoing):

Ph.D. (Completed Year of Completion)/Ongoing):

Projects Carried out :01

Patents (Filed & Granted):

SL No	Topic	**Patent Application No**	Filed/ Granted
1			
2			

Technology Transfer:

No. of Books published with details: