M.I.E.T. ENGINEERING COLLEGE

(Autonomous)

Tiruchirappalli-620007

Curriculum & Syllabus

(Regulations 2024)



B.Tech. Artificial Intelligence and Data Science

M.I.E.T. ENGINEERING COLLEGE

(AUTONOMOUS)

(Approved by AICTE, New Delhi and Affiliated to Anna University, Chennai)
Accredited by NBA (CIVIL, CSE, ECE, EEE & MECH)
Accredited with 'A+' grade by NAAC
(An ISO 9001:2015 Certified Institution)
(Recognized by UGC under section 2(f) & 12(B) of UGC Act, 1956)
TRICHY - PUDUKKOTTAI MAIN ROAD, TRICHY - 620 007

DEPARTMENT OF ARTIFICIAL INTELLIGENCE AND DATA SCIENCE



CURRICULUM AND SYLLABUS

B.Tech. ARTIFICIAL INTELLIGENCE AND DATA SCIENCE
(Regulation 2024)

Vision

To achieve excellent standards of quality-education by using the latest tools, nurturing collaborative culture and disseminating customer-oriented innovations to relevant areas of academia and industry towards serving the greater cause of society.

Mission

- To develop professionals who are skilled in the area of Artificial Intelligence and Data Science.
- To impart quality and value-based education and contribute towards the innovation of computing, expert system, Data Science to raise satisfaction level of all stakeholders.
- To apply new advancements in high performance computing hardware and software in the works undertaken.
- Equip the students with high quality education and research in emerging technology.
- To inculcate the analytical and logical skills in the field of Artificial Intelligence and Data Science.

Program Outcomes (POs)

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 modeling 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

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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 lifelong learning in the broadest context of technological change.

Program Specific Outcomes (PSO)

1. Able to apply AI and data analytics in decision-making process and manage complex problems in engineering, business and governance.
2. Able to carry essential research using advanced AI technologies to generate insights and solve critical societal challenges.

Program Educational Objectives (PEO)

1. Apply fundamental knowledge in science, mathematics, AI, data science and statistics to build intelligent data-driven systems and solutions.
2. Enhance technical and research skills to develop innovative, sustainable AI solutions for real-world challenges.
3. Demonstrate logical thinking, ethical values and teamwork to accomplish multidisciplinary projects for economic development.

Mapping of PEOs with POs & PSOs

PEOs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
PEO1	3	3	3	3	3	3	3	3	3	3	3	3	3	3
PEO2	3	3	3	3	3	3	3	3	3	3	3	3	3	3
PEO3	2	2	2	2	3	3	3	3	3	3	3	3	2	2

CHOICE BASED CREDIT SYSTEM
CURRICULUM AND SYLLABUS FOR SEMESTERS I TO VIII

SEMESTER I

S. NO.	COURSE CODE	COURSE TITLE	CATE GORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS PER WEEK	CREDITS
				L	T	P		
1.	24IP1101	Induction Programme	-	-	-	-	-	0
2.	24HS1101	Professional English	HSMC	3	0	2	5	4
3.	24MU1101	Matrices and Calculus	BSC	3	1	0	4	4
4.	24PH1101	Engineering Physics	BSC	3	0	2	5	4
5.	24CY1101	Engineering Chemistry	BSC	3	0	2	5	4
6.	24GE1101	Problem Solving and Python Programming	ESC	3	0	2	5	4
7.	24GE1102	Heritage of Tamils – தமிழர் மரபு	HSMC	1	0	0	1	1
8.	24GE1201	Professional Development	ESC	0	0	4	4	2
			Total	**16**	**1**	**12**	**29**	**23**

SEMESTER II

S. NO.	COURSE CODE	COURSE TITLE	CATE GORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS PER WEEK	CREDITS
				L	T	P		
1.	24HS2101	Writing Skills for Professionals / Language Elective	HSMC	3	0	0	3	3
2.	24MU2101	Statistics and Numerical Methods	BSC	3	1	0	4	4
3.	24PH2101	Material Science	BSC	3	0	0	3	3
4.	24GE2101	Engineering Graphics	ESC	2	0	4	6	4
5.	24GE2102	Fundamentals of Building and Mechanical Sciences	ESC	3	0	2	5	4
6.	24CS2101	Programming in C	PCC	3	0	2	5	4
7.	24GE2103	Tamils and Technology தமிழரும் ததொழில்நுட்பமும்	HSMC	1	0	0	1	1
8.	24GE2201	Engineering Practice Laboratory	ESC	0	0	4	4	2
			Total	**18**	**1**	**12**	**31**	**25**

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SEMESTER III

S. NO.	COURSE CODE	COURSE TITLE	CATE GORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS PER WEEK	CREDITS
				L	T	P		
1.	24MU3104	Discrete Mathematics	BSC	3	1	0	4	4
2.	24IT3101	Computer Organization and Logic Design	PCC	3	0	0	3	3
3.	24AI3101	Database Concepts	PCC	3	0	0	3	3
4.	24CS3103	Data Structures and Algorithms	PCC	3	0	2	5	4
5.	24AI3102	Principles of Data Science	PCC	3	0	0	3	3
6.	24AI3103	Artificial Intelligence	PCC	3	0	2	5	4
7.	24MC31XX	Mandatory course I	MC	1	0	0	1	0
8.	24AI3201	Database Management Laboratory	PCC	0	0	3	3	1.5
9.	24IT3202	Computer Organization and Logic Design Laboratory	PCC	0	0	3	3	1.5
			Total	**19**	**1**	**10**	**30**	**24**

SEMESTER IV

S. NO.	COURSE CODE	COURSE TITLE	CATE GORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS PER WEEK	CREDITS
				L	T	P		
1.	24AI4101	Exploring Data with Probability and Statistics	PCC	3	0	0	3	3
2.	24AI4102	Operating Systems	PCC	3	0	2	5	4
3.	24AI4103	Machine Learning	PCC	3	0	0	3	3
4.	24AI4104	Data Visualization Techniques	PCC	3	0	0	3	3
5.	24IT4103	Network Technologies	PCC	3	0	2	5	4
6.	24CY4101	Environmental Science	BSC	2	0	0	2	2
7.	24AI4201	Data Visualization Laboratory	PCC	0	0	3	3	1.5
8.	24AI4202	Machine Learning Laboratory	PCC	0	0	3	3	1.5
9.	24GE4201	Technical Seminar	EEC	0	0	2	2	1
			Total	**17**	**0**	**12**	**30**	**2** **3**

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SEMESTER V

S. NO.	COURSE CODE	COURSE TITLE	CATEGORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS PER WEEK	CREDITS
				L	T	P		
1.	24AI5101	Deep Learning	PCC	3	0	0	3	3
2.	24AI5102	Text and Speech Analytics	PCC	3	0	0	3	3
3.	24IT5102	Full Stack Web Development	PCC	3	0	0	3	3
4.	24AI5103	Big Data Intelligence	PCC	3	0	0	3	3
5.	24ITPEXX	Professional Elective I	PEC	3	0	2	5	4
6.	24ITPEXX	Professional Elective II	PEC	3	0	2	5	4
7.	24MC51XX	Mandatory Course II	MC	1	0	0	1	0
8.	24AI5201	Deep Learning Laboratory	PCC	0	0	3	3	1.5
9.	24IT5202	Full Stack Web Development Laboratory	PCC	0	0	3	3	1.5
			Total	**19**	**0**	**10**	**29**	**23**

SEMESTER VI

S. NO.	COURSE CODE	COURSE TITLE	CATEGORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS PER WEEK	CREDITS
				L	T	P		
1.	24AI6101	App Development	PCC	3	0	2	5	4
2.	24OXIXXX	Open Elective I	OEC	3	0	2	5	4
3.	24AIPEXX	Professional Elective III	PEC	3	0	0	3	3
4.	24XXPEXX	Professional Elective IV	PEC	3	0	0	3	3
5.	24XXPEXX	Professional Elective V	PEC	3	0	0	3	3
6.	24AIPEXX	Professional Elective VI	PEC	3	0	0	3	3
7.	24IT6201	Mobile Application Development Laboratory	PCC	0	0	3	3	1.5
8.	24AI6202	Skill Development Laboratory	ESC	0	0	3	3	1.5
9.	24PD6201	NCC/NSS/NSO*#	-	2	0	0	2	2*#
			Total	**18**	**0**	**10**	**28**	**23**

*# **Guidelines for evaluation is provided in detail in the regulation/syllabus. The grades earned by the student will be recorded in the Mark Sheet, however the same shall not be considered for the computation of CGPA.**

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SEMESTER VII

S. NO.	COURSE CODE	COURSE TITLE	CATEGORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS PER WEEK	CREDITS
				L	T	P		
1.	24HS7101	Professional Ethics in Engineering	HSMC	2	0	0	2	2
2.	24XXPEXX	Professional Elective VII	PEC	3	0	2	5	4
3.	24XXPEXX	Professional Elective VIII	PEC	3	0	2	5	4
4.	24OXTXXX	Open Elective II	OEC	3	0	0	3	3
5.	24OXTXXX	Open Elective III	OEC	3	0	0	3	3
6.	24AI7501	Mini Project	EEC	0	0	4	4	2
7.	24IS7201	Internship##	EEC	-	-	-	-	1
8.	24CA7201	Case Study***	EEC	-	-	-	-	1
			Total	**14**	**0**	**8**	**22**	**20**

##Students should undergo Internship for a period of 2-4 weeks during 6th Semester vacation.

*****Students should perform case study during 6th Semester vacation.**

SEMESTER VIII

S. NO.	COURSE CODE	COURSE TITLE	CATEGORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS PER WEEK	CREDITS
				L	T	P		
1.	24AI8501	Project Work	EEC	0	0	20	20	10
			Total	**0**	**0**	**20**	**20**	**10**

BASIC SCIENCE COURSES (BSC)

S. NO.	COURSE CODE	COURSE TITLE	CATEGORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS PER WEEK	CREDITS
				L	T	P		
1.	24MU1101	Matrices and Calculus	BSC	3	1	0	4	4
2.	24PH1101	Engineering Physics	BSC	3	0	2	5	4
3.	24CY1101	Engineering Chemistry	BSC	3	0	2	5	4
4.	24MU2101	Statistics and Numerical Methods	BSC	3	1	0	4	4
5.	24PH2101	Material Science	BSC	3	0	0	3	3
6.	24MU3104	Discrete Mathematics	BSC	3	1	0	4	4
7.	24CY4101	Environmental Science	BSC	2	0	0	2	2
							Total	**25**

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ENGINEERING SCIENCE COURSES (ESC)

S. NO.	COURSE CODE	COURSE TITLE	CATE GORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS PER WEEK	CREDITS
				L	T	P		
1.	24GE1101	Problem Solving and Python Programming	ESC	3	0	2	5	4
2.	24GE1201	Professional Development	ESC	0	0	4	4	2
3.	24GE2101	Engineering Graphics	ESC	2	0	4	6	4
4.	24GE2102	Fundamentals of Building and Mechanical Sciences	ESC	3	0	2	5	4
5.	24GE2201	Engineering Practice Laboratory	ESC	0	0	4	4	2
6.	24AI6202	Skill Development Laboratory	ESC	0	0	3	3	1.5
							Total	**17.5**

HUMANITIES, SOCIAL SCIENCES AND MANAGEMENT COURSES (HSMC)

S. NO.	COURSE CODE	COURSE TITLE	CATE GORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS PER WEEK	CREDITS
				L	T	P		
1.	24HS1101	Professional English	HSMC	3	0	2	5	4
2.	24GE1102	Heritage of Tamils – தமிழர் மரபு	HSMC	1	0	0	1	1
3.	24HS2101	Writing Skills for Professionals / Language Elective	HSMC	3	0	0	3	3
4.	24GE2103	Tamils and Technology தமிழரும் ததொழில்நுட்பமும்	HSMC	1	0	0	1	1
5.	24HS7101	Professional Ethics in Engineering	HSMC	2	0	0	2	2
							Total	**11**

EMPLOYABILITY ENHANCEMENT COURSES (EEC)

S. NO.	COURSE CODE	COURSE TITLE	CATE GORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS PER WEEK	CREDITS
				L	T	P		
1.	24GE4201	Technical Seminar	EEC	0	0	2	2	1
2.	24AI7501	Mini Project	EEC	0	0	4	4	2
3.	24IS7201	Internship	EEC	-	-	-	-	1
4.	24CA7201	Case Study	EEC	-	-	-	-	1
5.	24AI8501	Project Work	EEC	0	0	20	20	10
							Total	**15**

PROFESSIONAL CORE COURSES (PCC)

S. NO.	COURSE CODE	COURSE TITLE	CATEGORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS PER WEEK	CREDITS
				L	T	P		
1.	24CS2101	Programming in C	PCC	3	0	2	5	4
2.	24IT3101	Computer Organization and Logic Design	PCC	3	0	0	3	3
3.	24AI3101	Database Concepts	PCC	3	0	0	3	3
4.	24CS3103	Data Structures and Algorithms	PCC	3	0	2	5	4
5.	24AI3102	Principles of Data Science	PCC	3	0	0	3	3
6.	24AI3103	Artificial Intelligence	PCC	3	0	2	5	4
7.	24AI3201	Database Management Laboratory	PCC	0	0	3	3	1.5
8.	24IT3202	Computer Organization and Logic Design Laboratory	PCC	0	0	3	3	1.5
9.	24AI4101	Exploring Data with Probability and Statistics	PCC	3	0	0	3	3
10	24AI4102	Operating Systems	PCC	3	0	2	5	4
11	24AI4103	Machine Learning	PCC	3	0	0	3	3
12	24AI4104	Data Visualization Techniques	PCC	3	0	0	3	3
13	24IT4103	Network Technologies	PCC	3	0	2	5	4
14	24AI4201	Data Visualization Laboratory	PCC	0	0	3	3	1.5
15	24AI4202	Machine Learning Laboratory	PCC	0	0	3	3	1.5
16	24AI5101	Deep Learning	PCC	3	0	0	3	3
17	24AI5102	Text and Speech Analytics	PCC	3	0	0	3	3
18	24IT5102	Full StackWeb Development	PCC	3	0	0	3	3
19	24AI5103	Big Data Intelligence	PCC	3	0	0	3	3
20	24AI5201	DeepLearning Laboratory	PCC	0	0	3	3	1.5
21	24IT5202	Full StackWeb Development Laboratory	PCC	0	0	3	3	1.5
22	24AI6101	App Development	PCC	3	0	2	5	4
23	24IT6201	Mobile Application Development Laboratory	PCC	0	0	3	3	1.5
							Total	**64.5**

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PROFESSIONAL ELECTIVE COURSES (PEC)
SEMESTER V, PROFESSIONAL ELECTIVE I & II
SECURITY

S. NO.	COURSE CODE	COURSE TITLE	CATE GORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS PER WEEK	CREDITS
				L	T	P		
1.	24ITPE01	Network Security	PEC	3	0	2	5	4
2.	24ITPE02	Digital and Mobile Forensics	PEC	3	0	2	5	4
3.	24ITPE03	Social Network Security	PEC	3	0	2	5	4
4.	24ITPE04	Modern Cryptography	PEC	3	0	2	5	4
5.	24ITPE05	Digital marketing	PEC	3	0	2	5	4
6.	24ITPE06	Cyber security	PEC	3	0	2	5	4
7.	24ITPE07	Ethical Hacking	PEC	3	0	2	5	4
8.	24ITPE08	Web Application Security	PEC	3	0	2	5	4

SEMESTER VI, PROFESSIONAL ELECTIVE III & IV
ARTIFICIAL INTELLIGENCE

S. NO.	COURSE CODE	COURSE TITLE	CATE GORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS PER WEEK	CREDITS
				L	T	P		
1.	24AIPE09	Neural Networks and Deep Learning	PEC	3	0	0	3	3
2.	24AIPE10	Ethics and AI	PEC	3	0	0	3	3
3.	24ITPE11	UI and UX Design	PEC	3	0	0	3	3
4.	24ITPE12	Information Retrieval Techniques	PEC	3	0	0	3	3
5.	24ITPE13	Computer Vision	PEC	3	0	0	3	3
6.	24AIPE14	Open-Source Technology	PEC	3	0	0	3	3
7.	24AIPE15	Reinforcement Learning	PEC	3	0	0	3	3
8.	24ITPE16	Soft Computing	PEC	3	0	0	3	3

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SEMESTER VI, PROFESSIONAL ELECTIVE V & VI
CLOUD SERVICE

S. NO.	COURSE CODE	COURSE TITLE	CATE GORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS PER WEEK	CREDITS
				L	T	P		
1.	24AIPE17	Cloud Computing	PEC	3	0	0	3	3
2.	24AIPE18	Virtualization	PEC	3	0	0	3	3
3.	24AIPE19	Cloud Services Management	PEC	3	0	0	3	3
4.	24AIPE20	Quantum Computing	PEC	3	0	0	3	3
5.	24AIPE21	Data Warehousing	PEC	3	0	0	3	3
6.	24AIPE22	Storage Technologies	PEC	3	0	0	3	3
7.	24AIPE23	Engineering Secure Software Systems	PEC	3	0	0	3	3
8.	24AIPE24	Cloud Deployment and Management	PEC	3	0	0	3	3

SEMESTER VII, PROFESSIONAL ELECTIVE VII & VIII
DATA SCIENCE

S. NO.	COURSE CODE	COURSE TITLE	CATE GORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS PER WEEK	CREDITS
				L	T	P		
1.	24ITPE25	Devops	PEC	3	0	2	5	4
2.	24AIPE26	Exploratory Data Analysis	PEC	3	0	2	5	4
3.	24AIPE27	Optimization Techniques	PEC	3	0	2	5	4
4.	24AIPE28	Applied DataScience with Python Specialization	PEC	3	0	2	5	4
5.	24ITPE29	Image and video Analytics	PEC	3	0	2	5	4
6.	24ITPE30	Multimedia Data Compression and Storage	PEC	3	0	2	5	4
7.	24ITPE31	Natural Language Processing	PEC	3	0	2	5	4
8.	24AIPE32	Cognitive Science	PEC	3	0	2	5	4

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MANDATORY COURSES (MC)

MANDATORY COURSES I

S. NO.	COURSE CODE	COURSE TITLE	CATEGORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS PER WEEK	CREDITS
				L	T	P		
1.	24MC3101	Legal System of India	MC	3	0	0	3	0
2.	24MC3102	IPR and Patent Drafting	MC	3	0	0	3	0
3.	24MC3103	Literary Forms and Techniques	MC	3	0	0	3	0
4.	24MC3104	Disaster Risk Reduction and Management	MC	3	0	0	3	0
5.	24MC3105	Film Appreciation	MC	3	0	0	3	0
6.	24MC3106	Women and Gender Studies	MC	3	0	0	3	0

MANDATORY COURSES II

S. NO.	COURSE CODE	COURSE TITLE	CATEGORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS PER WEEK	CREDITS
				L	T	P		
1.	24MC5101	Food and Nutrition	MC	3	0	0	3	0
2.	24MC5102	Design Thinking	MC	3	0	0	3	0
3.	24MC5103	History of Science and Technology in India	MC	3	0	0	3	0
4.	24MC5104	Political and Economic Thought for a Humane Society	MC	3	0	0	3	0
5.	24MC5105	State, Nation Building and Politics in India	MC	3	0	0	3	0
6.	24MC5106	Industrial Safety	MC	3	0	0	3	0

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OPEN ELECTIVE COURSES (OEC)

OPEN ELECTIVE I

S. NO.	COURSE CODE	COURSE TITLE	CATEGORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS PER WEEK	CREDITS
				L	T	P		
1.	24OCI101	Estimation and Costing of Building	OEC	3	0	2	5	4
2.	24OCI102	Quality assessment of Building Materials	OEC	3	0	2	5	4
3.	24OCI103	Project Management	OEC	3	0	2	5	4
4.	24OCI104	Building planning using Vaastu Sastra	OEC	3	0	2	5	4
5.	24OEI101	Control Systems Engineering	OEC	3	0	2	5	4
6.	24OEI1	Power Electronics and						4
7.	24OEI1							4
8.	24OEI1							4
9.	24OMI1							4
10	24OMI1							4
11	24OMI1							4
12	24OMI1							4
13	24OBI101	Digital Signal Processing	OEC	3	0	2	5	4
14	24OBI102	IoT and Sensors Types	OEC	3	0	2	5	4
15	24OBI103	Medical Diagnostic and Therapeutic Equipments	OEC	3	0	2	5	4
16	24OBI104	Biomedical Instrument and Design	OEC	3	0	2	5	4

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OPEN ELECTIVE II & III

S. NO.	COURSE CODE	COURSE TITLE	CATEGORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS PER WEEK	CREDITS
				L	T	P		
1.	24OCT201	Building Planning and Approval	OEC	3	0	0	3	3
2.	24OCT202	Energy Efficient Building	OEC	3	0	0	3	3

3.	24OCT203	Environmental Impact Assessment	OEC	3	0	0	3	3
4.	24OCT204	Rehabilitation of Structures	OEC	3	0	0	3	3
5.	24OCT205	Drinking water supply and Treatment	OEC	3	0	0	3	3
6.	24OCT206	Project Scheduling and Optimization using CPM and PERT Techniques	OEC	3	0	0	3	3
7.	24OET101	Electrical Vehicle Technologies	OEC	3	0	0	3	3
8.	24OET102	Power System	OEC	3	0	0	3	3
9.	24OET103	Circuit Theory	OEC	3	0	0	3	3
10	24OET104	Advanced Electrical Machines	OEC	3	0	0	3	3
11	24OET105	Hybrid Renewable Power Generation	OEC	3	0	0	3	3
12	24OET106	Electrical Maintenance and Safety	OEC	3	0	0	3	3
13	24OMT201	Bioenergy Conversion Technologies	OEC	3	0	0	3	3
14	24OMT202	Automotive Materials, Components, Design and Testing	OEC	3	0	0	3	3
15	24OMT203	Green Manufacturing Design and Practices	OEC	3	0	0	3	3
16	24OMT204	Semiconductor Manufacturing	OEC	3	0	0	3	3
17	24OMT205	Future Energy Resources and Mobility	OEC	3	0	0	3	3
18	24OMT206	Failure Analysis and NDT Techniques	OEC	3	0	0	3	3
19	24OBT201	Hospital Management	OEC	3	0	0	3	3
20	24OBT202	Assist Devices	OEC	3	0	0	3	3
21	24OBT203	Robotics in Medicine	OEC	3	0	0	3	3
22	24OBT204	DSP Architecture	OEC	3	0	0	3	3
23	24OBT205	Image Processing Techniques	OEC	3	0	0	3	3
24	24OBT206	Wireless Sensor Networks	OEC	3	0	0	3	3

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SUMMARY

S.No.	Subject Area	Credits Per Semester								Credits Total
		I	II	III	IV	V	VI	VII	VIII	
1.	Basic Science Course (BSC)	12	7	4	2	-	-	-	-	**25**
2.	Professional core courses (PCC)	-	4	20	20	15	5.5	-	-	**64.5**
3.	Professional Elective Courses (PEC)	-	-	-	-	8	12	8	-	**28**
4.	Open Elective Courses (OEC)	-	-	-	-	-	4	6	-	**10**
5.	Employability Enhancement Courses (EEC)	-	-	-	1	-	-	4	10	**15**
6.	Engineering Science Courses (ESC)	6	10	-	-	-	1.5	-	-	**17.5**
7.	Mandatory Courses (MC)	-	-	-	-	-	-	-	-	**-**
8.	Humanities, Social Sciences and Management Courses (HSMC)	5	4	-	-	-	-	2	-	**11**
Total Credit		**23**	**25**	**24**	**23**	**23**	**23**	**20**	**10**	**171**

TOTAL CREDITS TO BE EARNED FOR THE AWARD OF THE DEGREE =171

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24HS1101 PROFESSIONAL ENGLISH **L T P C**
3 0 2 4

COURSE OBJECTIVES

- To enable the students to learn the fundamentals of English grammar.
- To develop the ability to write complex texts and essays that are relevant to authentic contexts.
- To present their opinions through letters and reports that will be relevant for their future endeavours.

UNIT I FUNDAMENTALS & SUMMATION **9**

Grammar & Vocabulary: Parts of Speech, Articles, Pronoun, Homonyms & Homophones, Word Formation (Prefix and Suffix). **Listening:** Telephonic Conversations - different viewpoints on a topic. **Speaking:** Self-Introduction Conversation - politeness strategies; asking for information to fill details in a form **Reading:** Reading biographies, travelogues, newspaper reports. **Writing**: Report writing (Accident report, Survey Report), Checklist.

UNIT II PROBLEM SOLVING & RECOMMENDATIONS **9**

Grammar & Vocabulary: Abbreviations & Acronyms, Tenses, Subject -Verb Agreement, Active, Passive and Impersonal Passive Voice. **Listening:** Listening to anecdotes, stories & event narration. **Speaking:** Narrating personal experiences/ events, Extempore, Story-Telling. **Reading:** Reading Editorials; and Opinion Blogs. **Writing**: Letter Writing (Complaint Letter, Response to complaint), Recommendations.

UNIT III DESCRIPTION OF A PROCESS OR PRODUCT AND USAGE OF IMPERATIVE **9**

Grammar & Vocabulary: Adjective, Degrees of Comparison, Imperative and Gerund, One Word Substitution. **Listening:** Classroom Lecture, advertisements about products. **Speaking –** Picture description; giving instruction to use the product; presenting a product. **Reading:** Reading advertisements, gadget reviews; user manuals. **Writing**: Instructions, Process and Product Description.

UNIT IV DRAFTING AND RESUME MAKING **9**

Grammar & Vocabulary: Collocations, Conjunction, Framing Question Tags/ "Wh" questions. **Listening:** TED talks, educational videos. **Speaking –** Small Talk; Mini presentations and making recommendations. **Reading**: Reading brochures (technical context). **Writing:** Email writing and Email etiquette- Job Application Letter and Resume.

UNIT V EXPRESSING IDEAS **9**

Grammar & Vocabulary: Discourse Markers, Cause and Effect words, Modal verbs, Spotting Errors. **Listening:** Panel Discussions, listening to debates.**Speaking:** Group discussions, Debates and Expressing opinions & Role play. **Reading:** Reading Newspaper articles; Journal reports. **Writing:** Essay writing (Narrative, Descriptive), Reading Comprehension, Transcoding (Bar chart, Pie chart, Table).

TOTAL: 45 PERIODS

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LIST OF ACTIVITIES

1. Self-Introduction-Politeness Strategies.
2. Extempore.
3. Story Telling.
4. Picture Description.
5. Product Description.
6. Presentations.
7. Group Discussion.
8. Role-Play.
9. Debates and Expressing Opinions.
10. Narrating Personal Experiences.
11. Reading Biographies, Travelogues.
12. Reading Advertisements, User Manuals.

TOTAL: 30 PERIODS

COURSE OUTCOMES

On successful completion of this course, the students will be able to

CO1: Explain the basic grammatical structures and use them in right context.
CO2: Write complaint letters and recommendations with utmost accuracy.
CO3: Describe about products and processes clearly.
CO4: Write a job application letter and resume without flaws.
CO5: Speak fluently and interpret information presented in tables, charts and other graphic forms.

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TEXT BOOKS

1. English for Engineers & Technologists Orient Blackswan Private Ltd. Department of English, Anna University, 2020.
2. Dr S Gunasekaran, "A Workbook of Professional English", Vishnu Prints Media, 2021.
3. Meenakshi Raman & Sangeeta Sharma, "Technical Communication – Principles and Practices", Oxford Univ. Press, 2022.

REFERENCE BOOKS

1. Raymond Murphy, "Essential English Grammar", 2nd Edition, Cambridge University Press, 2024.
2. Brain Chanen, "IB English A: Language and Literature", Oxford Publications, 2019.
3. Phil Williams, "Advanced Writing Skills for Students of English", Goodwill Publishing House, 2022.
4. Stella Cortrell, "The Study Skills Handbook", Red Globe Press, 2019.
5. Adrian Wall, "English for Academic Correspondence and Socializing", Springer Publications, 2017.

Mapping of COs with POs and PSOs

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	-	-	-	-	-	-	-	2	2	2	2	2	2	-
CO2	-	-	-	-	-	-	-	2	2	2	2	2	2	-
CO3	-	-	-	-	-	-	-	2	2	2	2	2	2	-
CO4	-	-	-	-	-	-	-	2	2	2	2	2	2	-
CO5	-	-	-	-	-	-	-	2	2	2	2	2	2	-
AVG	-	-	-	-	-	-	-	**2**	**2**	**2**	**2**	**2**	**2**	-

1-Low, 2-Medium, 3-High, "-" – No correlation

24MU1101 MATRICES AND CALCULUS **L T P C**

3 1 0 4

COURSE OBJECTIVES

- To familiarize the students with Eigen values and Eigen vectors to reduce the quadratic form to canonical form.
- To familiarize the students with differential calculus and functions of several variables.
- To make the students to solve the problems on integration and multiple integration.

UNIT I MATRICES **9+3**

Eigen values and Eigenvectors of a real matrix – Characteristic equation – Properties of Eigen values and Eigenvectors – Cayley-Hamilton theorem (without proof) – Diagonalization of matrices by orthogonal transformation – Reduction of a quadratic form to canonical form by orthogonal transformation – Nature of quadratic forms.

UNIT II DIFFERENTIAL CALCULUS **9+3**

Limit of a function – Continuity – Derivatives – Differentiation rules (sum, product, quotient, chain rules) – Implicit differentiation – Logarithmic differentiation – Applications: Maxima and Minima of functions of one variable.

UNIT III FUNCTIONS OF SEVERAL VARIABLES **9+3**

Partial differentiation – Homogeneous functions and Euler's theorem (without proof) – Jacobians – Taylor's series for functions of two variables – Applications: Maxima and minima of functions of two variables and Lagrange's method of undetermined multipliers.

UNIT IV INTEGRAL CALCULUS **9+3**

Definite and Indefinite integrals – Substitution rule – Techniques of Integration: Integration by parts, Trigonometric integrals, Trigonometric substitutions, Integration of rational functions by partial fraction, Integration of irrational functions – Improper integrals.

UNIT V MULTIPLE INTEGRALS **9+3**

Double integrals – Change of order of integration – Double integrals in polar coordinates – Area enclosed by plane curves – Triple integrals – Volume of solids – Change of variables in double and triple integrals.

TOTAL: 60 PERIODS

COURSE OUTCOMES

On successful completion of this course, the students will be able to

CO1: Apply matrix algebra methods for solving various application problems.
CO2: Apply differential calculus methods in solving various application problems.
CO3: Apply the differential calculus ideas on several variable functions.
CO4: Apply different methods of integration in solving practical problems.
CO5: Apply multiple integral methods in solving areas, volumes and other practical problems.

TEXT BOOKS

1. T. Veerarajan, "Engineering Mathematics (Volume I & II)", McGraw Hill Education, New Delhi, 2018.
2. B. S. Grewal, "Higher Engineering Mathematics", Khanna Publishers, 45th Edition, 2024.
3. Erwin Kreyszig, "Advanced_Engineering Mathematics", Wiley India Pvt Ltd., New Delhi, 2015.

REFERENCE BOOKS

1. B.V .Ramana, "Higher Engineering Mathematics ", McGraw Hill Education Pvt. Ltd., New Delhi, 2016.
2. John Bird, "Bird's Higher Engineering Mathematics", 9th Edition, Routledge Taylor and Fransis Group, 2021.
3. H.Anton, I.Bivens. I and S. Davis, "Calculus ", Wiley, 10th Edition, 2016.
4. R.K. Jain and S.R.K. Iyengar, "Advanced Engineering Mathematics", Narosa Publications, New Delhi, 5th Edition, 2016.
5. G.B.Thomas, J.Hass and M.D.Weir, "Thomas Calculus ", 14th Edition, Pearson India, 2018.

Mapping of COs with POs and PSOs

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	2	3	-	2	-	-	-	-	-	-	-	-	2	-
CO2	2	3	-	2	-	-	-	-	-	-	-	-	2	-
CO3	2	3	-	2	-	-	-	-	-	-	-	-	2	-
CO4	2	3	-	2	-	-	-	-	-	-	-	-	2	-
CO5	2	3	-	2	-	-	-	-	-	-	-	-	2	-
AVG	2	3	-	2	-	-	-	-	-	-	-	-	2	-

1-Low, 2-Medium, 3-High, "-" – No correlation

24PH1101 ENGINEERING PHYSICS **L T P C**
3 0 2 4

COURSE OBJECTIVES

- To make the students to understand the properties of matter.
- To analysis the ultrasonic wave and laser with applications.
- To get knowledge on optical fibers and the importance of quantum theory.

UNIT I PROPERTIES OF MATTER **9**

Introduction – Elasticity – Hooke's Law – Stress –strain diagram – Types of modulus of elasticity –bending of beams – bending moment – cantilever: theory and experiment – uniform and non-uniform bending: theory and experiment – twisting couple – torsion pendulum: theory and experiment – I – shaped girders.

UNIT II ULTRASONICS AND BIO MEDICAL APPLICATIONS **9**

Introduction – Production of ultrasonics: magnetostriction effect and piezo electric effect – Velocity measurement: acoustic grating – Industrial applications: drilling, welding, soldering and cleaning –SONAR – Non Destructive testing – pulse echo system through transmission and reflection modes- A, B and C – scan displays, Clinical Applications -Sonograms.

UNIT III LASERS **9**

Introduction – Einstein's theory – Population inversion, pumping – Types of lasers; Nd-YAG Laser, He-Ne Laser, Semiconductor lasers (homo junction & hetero junction) – Industrial Applications-Lasers in welding, heat treatment, cutting.

UNIT IV FIBER OPTICS **9**

Principle and propagation of light in optical fibres – Acceptance angle and Numerical Aperture-Types of optical fibres (material, refractive index, mode) – Optical Loss in optical fibre – attenuation, dispersion, bending – Fibre optical communication system (Block diagram) – Endoscope.

UNIT V QUANTUM PHYSICS **9**

Black body radiation – Planck's theory (derivation) – Compton effect – Theory and experimental verification – Matter waves – Schrodinger's wave equation – Time independent and time dependent equations – Physical significance of wave function–Transmission Electron microscope –Scanning electron microscope.

TOTAL: 45 PERIODS

LIST OF EXPERIMENTS

1. Determination of rigidity modulus – Torsion pendulum.
2. Determination of unknown mass of a body for known rigidity modulus – Torsion pendulum.
3. Determination of Young's modulus by non – uniform bending method.
4. Determination of unknown mass of a body for known Young's modulus by non – uniform bending method.
5. Determination of Young's modulus by uniform bending method.

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6. Determination of unknown mass of a body for known Young's modulus by uniform bending method.
7. Determination of wavelength of Laser by diffraction grating method.
8. Determination of thickness of material using Air wedge.
9. Determination of width of the groove in a CD using Laser Diffraction.
10. Determination of Compressibility of given liquid using Ultrasonic interferometer.
11. Simple harmonic oscillations of cantilever.
12. Determination of unknown mass of a body for known Young's modulus by cantilever simple harmonic oscillations.

TOTAL: 30 PERIODS

COURSE OUTCOMES

On successful completion of this course, the students will be able to

CO1: Gain knowledge on basics of properties of matter.
CO2: Acquire knowledge on magnetic ultrasonic waves and its applications.
CO3: Demonstrate the strong fundamental knowledge in Laser.
CO4: Acquire knowledge on function of fiber optical devices and its applications.
CO5: Use the concepts of quantum physics.

TEXT BOOKS

1. Bhattacharya D K & Poonam T, "Engineering Physics", Oxford University Press,2015.
2. Gaur R K & Gupta S L, "Engineering Physics", Dhanpat Rai Publishers, 2018.
3. Arthur Beiser, Shobhit Mahajan Sand Rai Choudhury, "Concepts of Modern Physics", McGraw-Hill (Indian Edition), 2017.

REFERENCE BOOKS

1. Serway R A & Jewett J W, "Physics for Scientists and Engineers", Cengage Learning, 2016.
2. Tipler P A & Mosca G, "Physics for Scientists and Engineers with Modern Physics", W.H. Freeman, 2017.
3. K Thyagarajan & A Ghatak, "Lasers: Fundamentals and Applications", Laxmi Publications, (Indian Edition), 2019.
4. D. Halliday, R. Resnick and J Walker, "Principles of Physics", Wiley (Indian Edition), 2015.
5. Pandey B K & Chaturvedi S "Engineering Physics", Cengage Learning India, 2012.

Mapping of COs with POs and PSOs

COs	Pos												PSOs	
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
CO1	3	2	3	3	-	-	-	-	-	-	-	3	2	-
CO2	3	2	3	2	-	-	-	-	-	-	-	3	2	-
CO3	3	2	2	2	-	-	-	-	-	-	-	2	2	-
CO4	3	2	3	2	-	-	-	-	-	-	-	2	2	-
CO5	3	2	3	2	-	-	-	-	-	-	-	3	2	-
AVG	**3**	**2**	**2.8**	**2.8**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**2.6**	**2**	**-**

1-Low, 2-Medium, 3-High, "-" – No correlation

24CY1101 ENGINEERING CHEMISTRY **L T P C**
3 0 2 4

COURSE OBJECTIVES

- To familiarize students about the treatment of boiler feed water.
- To gain the knowledge about the various types of batteries and fuels.
- To understand the properties of Engineering materials and Nanomaterials.

UNIT I WATER TECHNOLOGY **9**

Hardness of water - Types - Boiler troubles - Scale - Sludge - Caustic embrittlement - Priming and Foaming - Softening of boiler feed water - Internal conditioning (phosphate, calgon and carbonate conditioning) - External conditioning - Ion Exchange process - Zeolite process.

UNIT II ENERGY STORAGE **9**

Batteries - Types of batteries - Primary battery - Dry cell, Secondary battery - Lead acid battery and Lithium- ion-battery - Fuel cells - H_2-O_2 fuel cell- E-Vehicles - Advantages of E-Vehicles.

UNIT III ENGINEERING MATERIALS **9**

Refractories - classification - properties and applications of refractories - Abrasives - properties and Applications of abrasives - Cement - composition of cement - setting and hardening of cement - Glass - Manufacture - Types of glass and its uses.

UNIT IV NANOCHEMISTRY **9**

Nanomaterials - Distinction between Nanoparticles, Molecules and Bulk materials - Types of Nanomaterials - Nanoparticle - Nanowire and Nanotube - Preparation of Nanomaterials - sol-gel- solvothermal Methods and Applications of Nanomaterials in Agriculture and Medicine field.

UNIT V FUELS **9**

Fuels - Coal - Analysis of coal (Proximate Analysis)-Refining of Petroleum - Fractional Distillation - Manufacture of metallurgical coke (Otto Hoffmann method) - Manufacture of synthetic petrol (Bergius process) - Power alcohol – Biodiesel.

TOTAL:45 PERIODS

LIST OF EXPERIMENTS

1. Estimation of total, temporary and permanent Hardness of the sample water by EDTA method.
2. Estimation of strength of given Hydrochloric acid using pH meter.
3. Estimation of strength of given Hydrochloric acid using conductivity meter.
4. Determination of strength of acids in a mixture of acids using conductivity meter.
5. Estimation of amount of $BaCl_2$ present in the given solution using Std.Na_2SO_4 using conductivity meter.
6. Estimation of iron content of the given solution using potentiometer.
7. Estimation of amount of Cl^- ion present in the given solution by Argentometric method.

8. Determination of alkalinity of the water sample using HCl with Na_2CO_3 as the primary standard.
9. Prepare Na_2CO_3 as primary standard and using it to estimate the acidity present in the given water sample.
10. Estimation of copper content of the given solution by EDTA method.
11. Determination of Dissolved oxygen content of water sample by Winkler's method.
12. Preparation of Biodiesel by using vegetable oil.

TOTAL: 30 PERIODS

COURSE OUTCOMES

On successful completion of this course, the students will be able to

CO1: Assess water impurities, determining hardness and eliminating substances responsible for hardness.

CO2: Identify diverse energy resources and effectively apply them in various sectors of the energy industry.

CO3: Assess engineering materials that meet industry specifications and requirements.

CO4: Identify and apply basic concepts of Nano science and technology in designing the synthesis of Nanomaterials for Engineering and Technology.

CO5: Recommend suitable fuels for engineering processes and applications.

TEXT BOOKS

1. P C Jain and Monica Jain, "Engineering Chemistry", Dhanpat Rai Publishing Company(P) Ltd, New Delhi, 17th Edition, 2022.
2. Friedrich Emich, "Engineering Chemistry", Scientific International Pvt. Ltd., New Delhi, 2017.
3. S S Dara, "A text book of Engineering Chemistry", S Chand Publishing, 12th Edition, 2018.

REFERENCE BOOKS

1. Hammer Sr and Hammer Jr, "Water and waste water technology", Pearson Education India, 7th Edition, 2015.
2. Nihal Kularatna and Kosala Gunawardane," Energy Storage Devices for Renewable Energy-based Systems, Academic Pr, 2nd Edition, 2021.
3. Kenneth G Budinski, Michael K Budinski," Engineering Materials", Pearson, 9th Edition, 2016.
4. Chattopadhyay K K, "Introduction to Nanoscience and Nanotechnology", Prentice Hall India Learning Private Limited, 2021.
5. James G Speight, "Handbook of Natural Gas Analysis", Wiley, 1st Edition, 2018.

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Mapping of COs with POs and PSOs

COs	POs												PSOs	
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
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	-
CO5	2	2	2	2	-	2	-	-	-	-	-	2	2	-
AVG	**2**	**2**	**2**	**2**	**-**	**2**	**-**	**-**	**-**	**-**	**-**	**2**	**2**	**-**

1-Low, 2-Medium, 3-High, "-" – No correlation

24GE1101 PROBLEM SOLVING AND PYTHON PROGRAMMING **L T P C**
3 0 2 4

COURSE OBJECTIVES

- To understand the basics of algorithmic problem solving.
- To learn to solve problems using Python conditionals and loops.
- To define Python functions and use function calls to solve problems.

UNIT I COMPUTATIONAL THINKING AND PROBLEM SOLVING **9**

Fundamentals of Computing – Identification of Computational Problems – Algorithms, building blocks of algorithms (statements, state, control flow, functions), notation (pseudo code, flowchart, programming language), algorithmic problem solving, simple strategies for developing algorithms (iteration, recursion). Illustrative problems: find minimum in a list, insert a card in a list of sorted cards, guessan integer number in a range, Towers of Hanoi.

UNIT II DATA TYPES, EXPRESSIONS, STATEMENTS **9**

Python interpreter and interactive mode, debugging; values and types: int, float, Boolean, string, and list; variables, expressions, statements, tuple assignment, precedence of operators, comments; Illustrative programs: exchange the values of two variables, circulate the values of n variables, distance between two points.

UNIT III CONTROL FLOW, FUNCTIONS, STRINGS **9**

Conditionals: Boolean values and operators, conditional (if), alternative (if – else), chained conditional (if el if – else); 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, linear search, binary search.

UNIT IV LISTS, TUPLES, DICTIONARIES **9**

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: simple sorting, histogram, Students marks statement, Retail bill preparation.

UNITV FILES, MODULES, PACKAGES **9**

Files and exceptions: text files, reading and writing files, format operator; command line arguments, errors and exceptions, handling exceptions, modules, packages; Illustrative programs: word count, copy file, Voter ‘s age validation, Marks range validation (0-100).

TOTAL: 45 PERIODS

LIST OF EXPERIMENTS

1. Calculate the GCD of two numbers.
2. Find the square root of an integer using Newton ‘s method.
3. Find power of a number using Exponential operator.
4. Find the maximum of a list of numbers.
5. Develop a program to search the given numbers using linear search and binary search.
6. Develop a program that sorts a list by implementing selection sort, insertion sort.
7. Develop a program that sorts a list by implementing mergesort.
8. Program to print n prime numbers.
9. Find multiplication of two matrices.
10. Programs that take command line arguments (word count).
11. Find the most frequent words in a text read from a file.
12. Simulate elliptical orbits and bouncing ball using Py game.

TOTAL: 30 PERIODS

COURSE OUTCOMES

On successful completion of this course, the students will be able to

CO1: Develop algorithmic solutions to simple computational problems.

CO2: Write simple Python programs using conditionals, loops and functions for solving problems.

CO3: Decompose a Python program into functions.

CO4: Represent compound data using Python lists, tuples, and dictionary e set c.

CO5: Read and write data from / to files in Python programs.

TEXT BOOKS

1. Allen B Downey,”” Think Python: How to Think like a Computer Scientist”, 2nd Edition, O ‘Reilly Publishers, 2016.
2. Karl Beecher,” Computational Thinking: A Beginner's Guide to Problem Solving and Programming”, 1st Edition, BCS Learning & Development Limited,2017.
3. Eric Matthes, “Python Crash Course: Python for beginners”, 3rd Edition, No Strach Press Limited, 2024.

REFERENCE BOOKS

1. Paul Deitel and Harvey Deitel, “Python for Programmers, Pearson Education”, 1st Edition, 2021.
2. G Venkatesh and Madhavan Mukund,”” Computational Thinking: A Primer for Programmers and Data Scientists”, 1st Edition, Notion Press, 2021.

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3. John V Guttag, "Introduction to Computation and Programming Using Python: With Applications to Computational Modeling and Understanding Data", Third Edition, MIT Press, 2021.
4. Eric Matthes, "Python Crash Course, A Hands – on Project Based Introduction to Programming", 2nd Edition, No Starch Press, 2019.
5. Martin C Brown, " Python: The Complete Reference", 4th Edition, Mc-Graw Hill, 2018.

Mapping of COs with POs and PSOs

COs	POs												PSOs	
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
CO1	3	3	3	2	3	-	-	-	-	-	-	-	-	2
CO2	3	3	3	2	3	-	-	-	-	-	-	-	-	2
CO3	3	3	3	2	3	-	-	-	-	-	-	-	-	2
CO4	3	3	3	2	3	-	-	-	-	-	-	-	-	2
CO5	3	3	3	2	3	-	-	-	-	-	-	-	-	2
AVG	**3**	**3**	**3**	**2**	**3**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**2**

1-Low, 2-Medium, 3-High, "-" – No correlation

24GE1102 தமிழர் மரபு **L T P C**
1 0 0 1

பாடத்தின் நோக்கங்கள்

- மொணவர்கள் தமொழி மற்றும் இலக்கியம் பற்றி கற்றறிதல்.
- தமிழர்களின் பொரம்பரிய மரபு மற்றும் நொட்டுப்புற கலலகலள அறிந்F தகொள்ளுதல்.
- தமிழர்களின் திலணக்ககொட்பொடுகள் மற்றும் இந்திய பண்பொட்டிற்குத் தமிழர்களின் பங்களிப்பு பற்றி அறிந்F தகொள்ளுதல்.

அலகு I மமாழி மற்றும் இலக்கியம் **3**

இந்திய தமொழிக் குடும்பங்கள் - திரொவிட தமொழிகள் - தமிழ் ஒரு தெம்தமொழி - தமிழ் தெவ்விலக்கியங்கள் - ெங்க இலக்கியத்தின் ெமயெ்

ெொர்பற்ற தன்லம – ெங்க இலக்கியத்தில் பகிர்தல் அறம் - திருக்குறளில் கமலொண்லமக் கருத்Fக்கள் - தமிழ்க் கொப்பியங்கள் - தமிழகத்தில்

ெமண தபௌத்த ெமயங்களின் தொக்கம் - பக்தி இலக்கியம், ஆழ்வொர்கள் மற்றும் நொயன்மொர்கள் -சிற்றிலக்கியங்கள் - தமிழில் நவீன இலக்கியத்தின் வளர்ெ்சி - தமிழ் இலக்கிய வரலொற்றில் பொரதியொர் மற்றும் பொரதிதொென் ஆகிகயொரின் பங்களிப்பு.

அலகு II மரபு - பாறற ஓவியங்கள் முதல் வீன ஓவியங்கள் வறர– சிற்பக்கறல **3**

நடுகல் முதல் நவீன சிற்பங்கள் வலர - ஐம்தபொன் சிலலகள் - பழங்குடியினர் மற்றும் அவர்கள் தயொரிக்கும் லகவிலனப் தபொருட்கள், தபொம்லமகள் - கதர் தெய்யும் கலல - சுடுமண் சிற்பங்கள் - நொட்டுப்புறத் ததய்வங்கள் - குமரி முலனயில் திருவள்ளுவர் சிலல - இலெக் கருவிகள் – மிருதங்கம், பலற, வீலண, யொழ், நொதஸ்வரம் - தமிழர்களின் ெமூக தபொருளொதொர வொழ்வில் ககொவில்களின் பங்கு.

அலகு III ாட்டுப்புறக் கறலகள் மற்றும் வீரவிறளயாட்டுகள் **3**

ததருக்கூத்F, கரகொட்டம், வில்லுப்பொட்டு, கணியொன் கூத்F, ஒயிலொட்டம், கதொல்பொலவக் கூத்F, சிலம்பொட்டம், வளரி, புலியொட்டம், தமிழர்களின் விலளயொட்டுகள்.

அலகு IV தமிழர்களின் திறைக்நகாட்பாடு 3

தமிழகத்தின் தொவரங்களும் விலங்குகளும் - ததொல்கொப்பியம் மற்றும் ெங்க இலக்கியத்தில் அகம் மற்றும் புறக்ககொட்பொடுகள் – தமிழர்கள் கபொற்றிய அறக்ககொட்பொடு - ெங்க கொலத்தில் தமிழகத்தில் எழுத்தறிவும், கல்வியும் - ெங்க கொல நகரங்களும் Fலறமுகங்களும் -
ெங்க கொலத்தில் ஏற்றுமதி மற்றும் இறக்குமதி - கடல்கடந்த நொடுகளில் கொழர்களின் தவற்றி.

அலகு V இ ்திய நதசிய இயக்கம் மற்றும் இ ்திய ப்பாட்டிற்குத் தமிழர்களின் பங்களிப்பு 3

இந்திய விடுதலலப் கபொரில் தமிழர்களின் பங்கு - இந்தியொவின் பிறப்பகுதிகளில் தமிழ்ப் பண்பொட்டின் தொக்கம் - சுயமரியொலத இயக்கம் - இந்திய மருத்Fவத்தில், சித்த மருத்Fவத்தின் பங்கு - கல்தவட்டுகள், லகதயழுத்Fப் படிகள் - தமிழ்ப் புத்தகங்களின் அெசு வரலொறு.

TOTAL: 15 PERIODS

பாடம றி முடிவுகள்

பொடதிட்டத்லத முடித்த பிறகு, மொணவர்கள் தெய்ய கூடியலவ:

CO1: தெம்தமொழி மற்றும் ெமகொல பலடப்புகளில் கவனம் தெலுத்தி, தமொழிப்புலலம மற்றும் இலக்கிய பகுப்பொய்வின் முக்கியத்Fவத்லத கற்றறிந்தனர்.

CO2: தமிழ் இலக்கியத்தின் பொரம்பரிய மரபு கலலகலள மொணவர்கள் அறிந்F தகொண்டனர்.

CO3: ெங்ககொல இலக்கியங்கலளயும் இக்கொல இலக்கிய கவிஞர்களின் தமிலழயும் மொணவர்கள் அறிந்F தகொண்டனர்.

CO4: தமிழ் இலக்கியத்தின் கலொெ்ெொர மற்றும் ெமூக தொக்கங்கலள அறிந்F தகொண்டனர்.

CO5: பண்லடக்கொல மக்களின் தமிழ் அலடயொளம் மற்றும் கலொெ்ெொர பொரம்பரியத்லதப் பற்றி கற்றறிந்தனர்.

பாட புத்தகங்கள்

1. கக கக பிள்லள "தமிழக வரலொறு - மக்களும் பண்பொடும்" தமிழ்நொடு பொடநூல் மற்றும் கல்வியியல் கழகம், 2004.
2. முலனவர் இல சுந்தரம், "கணினித் தமிழ்", விகடன் பிரசுரம், 2015.
3. டொக்டர். எஸ் வி சுப்ரமணியன், டொக்டர். கக டி திருநொவுக்கரசு, "தமிழர்களின் வரலொற்றுப் பொரம்பரியம்", ெர்வகதெ தமிழொய்வு நிறுவனம்.

குறிப்பு புத்தகங்கள்

1. டொக்டர். சிங்கொரகவலு, "தமிழர்களின் ெமூக வொழ்க்லக", ெர்வகதெ தமிழொய்வு நிறுவனம்.
2. கீழடி "லவலக ஆற்றின் கலரயில் உள்ள ெங்க நகர நொகரிகம் கூட்டு" ததொல்லியல் Fலற, தமிழ்நொடு பொடநூல் மற்றும் கல்வி கெலவகள் கழகம், தமிழ்நொடு, 2015.
3. டொக்டர். கக கக பிள்லள, "இந்திய வரலொறு" தவளியீடு ஆசிரியர்.
4. "தபொருலண நொகரிகம்", ததொல்லியல்Fலற & தமிழ்நொடு பொடநூல் மற்றும் கல்வி கெலவகள் கழகம்.
5. ஆர் பொலகிருஷ்ணன், "லவலக, சிந்F நொகரிகத்தின் பயணம்" தவளியீடு – EMRL.

Mapping of COs with POs and PSOs

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	-	-	-	-	-	2	-	2	-	-	-	-	-	-
CO2	-	-	-	-	-	2	-	2	-	-	-	-	-	-
CO3	-	-	-	-	-	2	-	2	-	-	-	-	-	-
CO4	-	-	-	-	-	2	-	2	-	-	-	-	-	-
CO5	-	-	-	-	-	2	-	2	-	-	-	-	-	-
AVG	-	-	-	-	-	**2**	-	**2**	-	-	-	-	-	-

1-Low, 2-Medium, 3-High, "-" – No correlation

24GE1201 PROFESSIONAL DEVELOPMENT **L T P C**
0 0 4 2

COURSE OBJECTIVES

- To be proficient in important Microsoft Office tools: MS WORD, EXCEL, POWER POINT.
- To be proficient in using MS WORD to create quality technical documents, by using standard templates, widely acceptable styles and formats, variety of features to enhance the present ability and overall utility value of content.
- To be proficient in using MS EXCEL for all data manipulation tasks including the common statistical, logical, mathematical etc., operations, conversion, analytics, search and explore, visualize, interlink, and utilizing many more critical features offered.

MSWORD **15**

- Create and format a document.
- Working with tables.
- Working with Bullets and Lists.
- Working with styles, shapes, smart art, charts.
- Inserting objects, charts and importing objects from other office tools.
- Creating and Using document templates.
- Inserting equations, symbols and special characters.
- Working with Table of contents and References, citations.
- Insert and review comments.
- Create bookmarks, hyperlinks, endnotes footnote.
- Viewing document in different modes.
- Working with document protection and security.
- Inspect document for accessibility.

MS EXCEL **15**

- Create worksheets, insert and format data.
- Work with different types of data: text, currency, date, numeric etc.
- Split, validate, consolidate, Convert data.
- Sort and filter data.
- Perform calculations and use functions: (Statistical, Logical, Mathematical, date, Time etc.,).
- Work with Lookup and reference formulae.
- Create and Work with different types of charts.
- Use pivot tables to summarize and analysis data.
- Perform data analysis using own formulae and functions.
- Combine data from multiple worksheets using own formulae and built-in functions to generate results.
- Export data and sheets to other file formats.
- Working with macros.
- Protecting data and Securing the workbook.

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MSPOWERPOINT **15**

- Select slide templates, layout and themes.
- Formatting slide content and using bullets and numbering.
- Insert and format images, smart art, tables, charts.
- Using Slide master, notes and handout master.
- Working with animation and transitions.
- Organize and Group slides.
- Import or create and use media objects: audio, video, animation.
- Perform slideshow recording and Record narration and create presentable videos.

TOTAL:45 PERIODS

COURSE OUTCOMES

On successful completion of this course, the students will be able to

CO1: Use MS Word to create quality documents, by structuring and organizing content.

CO2: Use MS Word for their day to day technical and academic requirements.

CO3: Use MS EXCEL to perform data operations and analytics, record, retrieve data as per requirements.

CO4: Use MS EXCEL to visualize data for ease of understanding.

CO5: Use MS PowerPoint to create high quality academic presentations by including common tables, charts, graphs, interlinking other elements, and using media objects.

Mapping of COs with POs and PSOs

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	-	-	-	-	-	-	-	2	2	2	2	2	2	-
CO2	-	-	-	-	-	-	-	2	2	2	2	2	2	-
CO3	-	-	-	-	-	-	-	2	2	2	2	2	2	-
CO4	-	-	-	-	-	-	-	2	2	2	2	2	2	-
CO5	-	-	-	-	-	-	-	2	2	2	2	2	2	-
AVG	-	-	-	-	-	-	-	**2**	**2**	**2**	**2**	**2**	**2**	-

1-Low, 2-Medium, 3-High, "-" – No correlation

24HS2101 WRITING SKILLS FOR PROFESSIONALS **L T P C**

3 0 0 3

COURSE OBJECTIVES

- To use appropriate language structures to write letters.
- To write reports and emails with ease.
- To think critically and write different types of essays.

UNIT I SELF EXPRESSION **9**

Grammar: Punctuation-Direct and Indirect Questions - Adverbs- Prepositions. **Vocabulary:** Commonly confused words. **Writing:** Extended Definitions- Letter to the Editor.

UNIT II FORMAL EXPRESSION **9**

Grammar: Phrasal Verbs, Adverbs, Simple, Compound and Complex Sentences. **Vocabulary:** Synonyms & Antonyms. **Writing:** Email Writing (formal & informal) –Report Writing (Industrial Visit & Field Visit).

UNIT III CREATIVE EXPRESSION **9**

Grammar: Prepositional Phrases, Numerical Adjectives, Compound Nouns. **Vocabulary:** British and American words. **Writing:** Compare and Contrast Essay, SOP.

UNIT IV EXPRESSION OF IDEAS **9**

Grammar: Direct and Indirect Speech, Relative Pronoun. **Vocabulary:** Idioms & phrases. **Writing:** Asking for information and making suggestions- Report Writing on College Event.

UNIT V PROFESSIONAL EXPRESSIONS **9**

Grammar: Fixed and Semi- fixed - Content vs Function words. **Vocabulary:** Jumbled Sentences. **Writing:** Accepting/ Declining an Offer/ invitation-Note- Making, Argumentative Essay.

TOTAL: 45 PERIODS

COURSE OUTCOMES

On successful completion of this course, the students will be able to

CO1: Enhance their grammatical competency for flawless writing.
CO2: Write reports, emails meeting professional expectations.
CO3: Use grammar to form correct sentences with maximum accuracy.
CO4: Present their ideas and opinions in a planned and logical manner.
CO5: Write essays on various topics.

TEXT BOOKS

1. English for Engineers & Technologists, Orient Blackswan Private Ltd. Department of English, Anna University, 2020.
2. English for Science & Technology Cambridge University Press, 2021.
3. Communication Skills for Professionals, Nira Konar Second Edition, PHI Learning Pvt. Ltd, 2021.

REFERENCE BOOKS

1. William Zinsser Paperback, "On Writing Well", Harper Perennial Publishers, 2016.
2. D S Paul, "Advanced Writing Skills", Good will Publishing House, 2022.
3. Matthew T Zakaria, "Successful Writing Skills", Commonwealth Publishers, 2022.
4. G S Hook, "Effective Communication", 2nd edition, Sannainvest Ltd., 2021.
5. Alan Baker, "Improve Your Communication Skills" (How to Build Trust, Be Heard and Communicate with Confidence), Kogan Page Publishers, 2019.

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Mapping of COs with POs and PSOs

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	-	-	-	-	-	-	-	2	2	2	2	2	2	-
CO2	-	-	-	-	-	-	-	2	2	2	2	2	2	-
CO3	-	-	-	-	-	-	-	2	2	2	2	2	2	-
CO4	-	-	-	-	-	-	-	2	2	2	2	2	2	-
CO5	-	-	-	-	-	-	-	2	2	2	2	2	2	-
AVG	-	-	-	-	-	-	-	**2**	**2**	**2**	**2**	**2**	**2**	-

1-Low, 2-Medium, 3-High, "-" – No correlation

24MU2101 STATISTICS AND NUMERICAL METHODS **L T P C**

3 1 0 4

COURSE OBJECTIVES

- To understand the concept of Correlation, Regression, Testing of hypothesis and design of experiments.
- To introduce the basic concepts of solving algebraic and transcendental equations.
- To understand the concept of numerical methods for solving differentiation and integration equations.

UNIT I CORRELATION AND REGRESSION **9+3**

Correlation – Coefficient of Correlation – Rank Correlation – Regression – Estimation of Regression lines.

UNIT II TESTING OF HYPOTHESIS & DESIGN OF EXPERIMENTS **9+3**

Sampling distributions – Small samples – t-test – Tests for single mean and difference of means – F-test – Tests for single variance and equality of variances – One way and two-way classifications – Completely randomized design – Randomized block design – Latin square design.

UNIT III SOLUTION OF EQUATIONS AND EIGENVALUE PROBLEMS **9+3**

Solution of Algebraic and Transcendental equations – Newton Raphson method – Solution of linear system of equations – Gauss elimination method – Pivoting – Gauss Jordan method – Inverse of Matrix by Gauss Jordan method – Iterative methods of Gauss Jacobi and Gauss Seidel – Eigen values of a matrix by Power Method.

UNIT IV INTERPOLATION, NUMERICAL DIFFERENTIATION AND NUMERICAL INTEGRATION **9+3**

Lagrange's and Newton's divided difference interpolations – Newton's forward and backward difference interpolation – Approximation of derivatives using interpolation polynomials – Numerical single and double integrations using Trapezoidal and Simpson's 1/3 rules.

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UNIT V NUMERICAL SOLUTION OF ORDINARY DIFFERENTIAL EQUATIONS 9+3

Single step methods: Taylor's series method – Euler's method – Modified Euler's method – Fourth order Runge-Kutta method for solving first order differential equations – Multi step methods: Milne's and Adam's – Bash forth predictor corrector methods for solving first order differential equations.

TOTAL: 60 PERIODS

COURSE OUTCOMES

On successful completion of this course, the students will be able to

CO1: Apply the correlation and regression equations for engineering problems.

CO2: Apply the concept of testing of hypothesis for small samples in real life problems and classifications of design of experiments in the field of agriculture.

CO3: Apply the numerical methods to solve the algebraic, transcendental and linear system of equations.

CO4: Apply interpolation techniques and numerical methods to solve the derivatives and integrals.

CO5: Apply various numerical methods for solving ordinary differential equations.

TEXT BOOKS

1. Gupta S.C., and Kapoor V. K., "Fundamentals of Mathematical Statistics", Sultan Chand & Sons, New Delhi, 12th Edition, 2020.
2. Gupta S.P., "Statistical Method", Sultan Chand & Sons, New Delhi, 46th Edition, 2019.
3. Grewal B. S., and Grewal J. S., "Numerical Methods in Engineering and Science", Khanna Publishers, 10th Edition, New Delhi, 2015.

REFERENCE BOOKS

1. Spiegel M.R., Schiller J., and Srinivasan R.A., "Schaum's easy Outlines on Probability and Statistics ", Tata McGraw Hill Edition, 4th Edition, 2020.
2. Devore J.L., "Probability and Statistics for Engineering and the Sciences", Cengage Learning, New Delhi, 9th Edition, 2020.
3. Johnson R. A., Miller I and Freund J., "Miller and Freund's Probability and Statistics for Engineers", Pearson Education, 9th Edition, 2020.
4. Burden R.L and Faires J.D, "Numerical Analysis", 9th Edition, Cengage Learning, 2016.
5. Jain M.K., Iyengar S.R.K. and Jain R.K., "Numerical Methods", New International Publishers, 8th Edition, 2022.

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Mapping of COs with POs and PSOs

COs	Pos												PSOs	
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
CO1	2	3	-	2	-	-	-	-	-	-	-	-	2	-
CO2	2	3	-	2	-	-	-	-	-	-	-	-	2	-
CO3	2	3	-	2	-	-	-	-	-	-	-	-	2	-
CO4	2	3	-	2	-	-	-	-	-	-	-	-	2	-
CO5	2	3	-	2	-	-	-	-	-	-	-	-	2	-
AVG	**2**	**3**	**-**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**2**	**-**

1-Low, 2-Medium, 3-High, "-" – No correlation

24PH2101 MATERIAL SCIENCE **L T P C**

3 0 0 3

COURSE OBJECTIVES

- To understand the properties of conducting and semiconducting materials.
- To acquire knowledge on magnetic and dielectric materials with their applications.
- To get an idea of nano structures and basics of quantum computing.

UNIT I CONDUCTING MATERIALS **9**

Conductors – classical free electron theory of metals – Electrical and thermal conductivity – Wiedemann – Franz law – Lorentz number – Draw backs of classical theory – Quantum theory – Fermi distribution function – Effect of temperature on Fermi Function – Density of energy states – carrier concentration in metals.

UNIT II SEMICONDUCTING MATERIALS **9**

Intrinsic semiconductor – intrinsic carrier concentration derivation – Fermi level – electrical conductivity – band gap determination – derivation of carrier concentration in n-type and p-type semiconductor – variation of Fermi level with temperature and impurity concentration – Hall effect –Determination of Hall coefficient – Applications.

UNIT III MAGNETIC MATERIALS **9**

Origin of magnetic moment – Bohr magneton – properties of Dia, Para and Ferro magnetic materials – Domain theory – Hysteresis – soft and hard magnetic materials – anti – ferromagnetic materials – Ferrites and its applications.

UNIT IV DIELECTRIC MATERIALS **9**

Electrical susceptibility – dielectric constant– electronic, ionic, orientational and space charge polarization–frequency and temperature dependence of polarization – internal field – Claussius – Mosotti relation (derivation) – dielectric loss – dielectric breakdown – ferro electricity and applications.

UNIT V NANO DEVICES AND QUANTUM COMPUTING **9**

Introduction – quantum confinement – quantum structures: quantum wells, wires and dots – Tunneling – Coulomb blockade – Single electron phenomena: single electron transistor –

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Quantum system for information processing – quantum states – classical bits – quantum bits – CNOT gate – advantage of quantum computing over classical computing.

TOTAL: 45 PERIODS

COURSE OUTCOMES

On successful completion of this course, the students will be able to

CO1: Gain knowledge on electrical and thermal properties of conducting materials.

CO2: Get adequate knowledge on charge carrier's distribution in different types of semiconductors.

CO3: Get the necessary understanding of functioning of Magnetic materials.

CO4: Get the necessary understanding of functioning of dielectric materials.

CO5: Gain knowledge on new engineering materials and their preparation methods.

TEXT BOOKS

1. S.O. Kasap, "Principles of Electronic Materials and Devices", Mc-Graw Hill, 2018.
2. Jasprit Singh, "Semiconductor Optoelectronics: Physics and Technology", Mc-Graw Hill India, 2019.
3. Parag K. Lala, "Quantum Computing: A Beginner's Introduction", McGraw-Hill Education, Indian Edition, 2020.

REFERENCE BOOKS

1. R. Balasubramaniam, Callister's, "Materials Science and Engineering". Wiley Indian Edition, 2015.
2. Wendelin Wright and Donald Askeland, "Essentials of Materials Science and Engineering", CL Engineering, 2015.
3. Charles Kittel, "Introduction to Solid State Physics", Wiley India Edition, 2019.
4. Mark Fox, "Optical Properties of Solids", Oxford Univ. Press, 2021.
5. B. Rogers, J. Adams and S. Pennathur, "Nanotechnology: Understanding Small Systems", CRC Press, 2017.

Mapping of COs with POs and PSOs

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	3	2	3	2	-	-	-	-	-	-	-	-	2	-
CO2	3	2	3	2	-	-	-	-	-	-	-	-	2	-
CO3	3	2	2	2	-	-	-	-	-	-	-	-	2	-
CO4	3	2	3	2	-	-	-	-	-	-	-	-	2	-
CO5	3	2	3	2	-	-	-	-	-	-	-	-	2	-
AVG	3	2	2.8	2	-	-	-	-	-	-	-	-	2	-

1-Low, 2-Medium, 3-High, "-" – No correlation

24GE2101 ENGINEERING GRAPHICS **L T P C**
2 0 4 4

COURSE OBJECTIVES

- Drawing engineering curves, freehand sketch of simple objects and orthographic projections.
- Drawing Projection, section and development of solids.
- Drawing isometric and perspective projections of simple solids.

CONCEPTS AND CONVENTIONS (Not for Examination)

Importance of graphics in engineering applications - Use of drafting instruments - BIS conventions and specifications — Size, layout and folding of drawing sheets — Lettering and dimensioning.

UNIT I PLANE CURVES AND FREEHAND SKETCHING **6+12**

Basic Geometrical constructions, Curves used in engineering practices: Conics – Construction of ellipse, parabola and hyperbola by eccentricity method – Construction of cycloid – construction of involutes of square and circle – Drawing of tangents and normal to the above curves. Visualization concepts and Free Hand sketching: Visualization principles – Representation of Three Dimensional objects – Layout of views- Freehand sketching of multiple views from pictorial views of objects.

UNIT II PROJECTION OF POINTS, LINES AND PLANE SURFACE **6+12**

Orthographic projection – principles – Principal planes – First angle projection-projection of points. Projection of straight lines (only First angle projections) inclined to both the principal planes – Determination of true lengths and true inclinations by rotating line method. Projection of planes (polygonal and circular surfaces) inclined to one principal plane by rotating object method.

UNIT III PROJECTION OF SOLIDS **6+12**

Projection of simple solids like prisms, pyramids, cylinder, cone and truncated solids when the axis is inclined to one of the principal planes and parallel to the other by rotating object method.

UNIT IV PROJECTION OF SECTIONED SOLIDS AND DEVELOPMENT OF SURFACES **6+12**

Sectioning of above solids in simple vertical position when the cutting plane is inclined to the one of the principal planes and perpendicular to the other — obtaining true shape of section. Development of lateral surfaces of simple and sectioned solids — Prisms, pyramids cylinders and cones.

UNIT V ISOMETRIC AND PERSPECTIVE PROJECTIONS **6+12**

Principles of isometric projection — isometric scale - isometric projections of simple solids and truncated solids - Prisms, pyramids, cylinders, cones- combination of two solid objects in simple vertical positions - Perspective projection of simple Solids-Prisms, pyramids and cylinders by visual ray method.

TOTAL: 90 PERIODS

COURSE OUTCOMES

On successful completion of this course, the students will be able to

CO1: Construct the conic curves, involutes and cycloid.

CO2: Solve practical problems involving projection of line and plane surfaces.

CO3: Explain the orthographic, isometric and perspective projections of simple solids.

CO4: Explore the development of section of solids and development of surfaces.

CO5: Utilize the isometric and perspective projections.

Publication of Bureau of Indian Standards

1. IS 10711 — 2001: Technical products Documentation — Size and lay out of drawing sheets.
2. IS 9609 (Parts 0 & 1) — 2001: Technical products Documentation — Lettering.
3. IS 10714 (Part 20) — 2001 & SP 46 — 2003: Lines for technical drawings.
4. IS 11669 — 1986 & SP 46 —2003: Dimensioning of Technical Drawings.
5. IS 15021 (Parts 1 to 4) — 2001: Technical drawings — Projection Methods.

TEXT BOOKS

1. Bhatt N.D. and Panchal V.M., "Engineering Drawing", Charotar Publishing House, 53rd Edition, 2019.
2. Natrajan K.V., "A text book of Engineering Graphics", Dhanalakshmi Publishers, Chennai, 2009.
3. Parthasarathy, N. S. and Vela Murali, "Engineering Drawing", Oxford University Press, 2015.

REFERENCE BOOKS

1. Venugopal K. and Prabhu Raja V., "Engineering Graphics", New Age International (P) Limited, 2008.
2. Basant Agarwal and Agarwal C.M., "Engineering Drawing", Tata McGraw Hill Publishing Company Limited, New Delhi, 2008.
3. Gopalakrishna K.R., "Engineering Drawing" (Vol. I & II combined), Subhas Stores, Bangalore, 2007.
4. Luzzader, Warren J and Duff, John M, "Fundamentals of Engineering Drawing with an introduction to Interactive Computer Graphics for Design and Production, Eastern Economy Edition, Prentice Hall of India Pvt. Ltd, New Delhi, 2005.
5. Shah M B, and Rana B C, "Engineering Drawing", Pearson, 2nd Edition, 2009.

Mapping of COs with POs and PSOs

COs	POs												PSOs	
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
CO1	2	3	3	2	-	-	-	-	2	2	-	-	2	-
CO2	2	3	3	2	-	-	-	-	2	2	-	-	2	-
CO3	2	3	3	2	-	-	-	-	2	2	-	-	2	-
CO4	2	3	3	2	-	-	-	-	2	2	-	-	2	-
CO5	2	3	3	2	-	-	-	-	2	2	-	-	2	-
AVG	**2**	**3**	**3**	**2**	**-**	**-**	**-**	**-**	**2**	**2**	**-**	**-**	**2**	**-**

1-Low, 2-Medium, 3-High, "-" – No correlation

24GE2102 FUNDAMENTALS OF BUILDING AND MECHANICAL SCIENCES **L T P C 3 0 2 4**

COURSE OBJECTIVES

- To provide the basic knowledge, concepts and specialized sub-disciplines of Civil and Mechanical Engineering.
- To introduce fundamental principles of surveying, building materials, and construction techniques.
- To impart knowledge on power plants, internal combustion engines, refrigeration, and air conditioning systems.

UNIT I OVERVIEW OF CIVIL ENGINEERING **5**

Civil Engineering contributions to the welfare of Society - Specialized sub disciplines in Civil Engineering – Structural, Construction, Geotechnical, Environmental, Transportation and Water Resources Engineering – National building code – terminologists: Plinth area, Carpet area, Floor area, Buildup area, Floor space index - Types of buildings: Residential buildings, Industrial buildings.

OVERVIEW OF MECHANICAL ENGINEERING **4**

Overview of Mechanical Engineering - Mechanical Engineering Contributions to the welfare of Society –Specialized sub disciplines in Mechanical Engineering – Manufacturing, Automation, Automobile and Energy Engineering - Interdisciplinary concepts in Mechanical Engineering.

UNIT II SURVEYING AND CIVIL ENGINEERIN MATERIALS **9**

Surveying: Objects – Classification – Principles – Measurements of Distances and angles – Leveling – Determination of areas– Contours. Civil Engineering Materials: Bricks – Stones – Sand – Cement – Concrete – Steel - Timber – Modern Materials, Thermal and Acoustic Insulating Materials, Decorative Panels, Water Proofing Materials. Modern uses of Gypsum, Pre-fabricated Building component (brief discussion only).

UNIT III BUILDING COMPONENTS AND INFRASTRUCTURE **9**

Building plans – Setting out of a Building - Foundations: Types of foundations - Bearing capacity and settlement – Brick masonry – Stone Masonry – Beams – Columns – Lintels – Roofing – Flooring – Plastering. Types of Bridges and Dams – Water Supply Network - Rain Water Harvesting – Solid Waste Management - Introduction to Highways and Railways - Introduction to Green Buildings.

UNIT IV INTERNAL COMBUSTION ENGINES AND POWER PLANTS **9**

Classification of Power Plants- Working principle of steam, Gas, Diesel, Hydro -electric and Nuclear Power plants- Internal combustion engines as automobile power plant – Working principle of Petrol and Diesel Engines – Four stroke and two stroke cycles – Comparison of four stroke and two stroke engines. Working principle of Boilers-Turbines, Reciprocating Pumps (single acting and double acting) and Centrifugal Pumps, Concept of hybrid engines. Industrial safety practices and protective devices.

UNIT V REFRIGERATION AND AIR CONDITIONING SYSTEM **9**

Terminology of Refrigeration and Air Conditioning. Principle of vapour compression and absorption system–Layout of typical domestic refrigerator–Window and Split type room Air conditioner. Properties of air - water mixture, concepts of psychometric and its process.

TOTAL: 45 PERIODS

LIST OF EXPERIMENTS

Basic Mechanical Laboratory: **15**

1. Study of IC Engines, Components.
2. Study of Steam Generators and Turbines.
3. Valve Timing and Port Timing Diagrams.
4. Determination of Viscosity –Red Wood Viscometer.
5. Determination of Flash Point and Fire Point.
6. Izod Impact Test.
7. Rockwell Hardness Test.

Basic Civil Laboratory: **15**

I. TESTS ON CEMENT

a. Determination of fineness of cement.
b. Determination of consistency of cement.
c. Determination of specific gravity of cement.
d. Determination of initial and final setting time of cement.

II. TESTS ON FINE AGGREGATE AND COURSE AGGREGATE

a. Determination of specific gravity and water absorption of fine aggregate.
b. Determination of grading of fine aggregate.
c. Determination of aggregate crushing value of coarse aggregate.
d. Determination of specific gravity and water absorption of coarse aggregate.

III. TESTS ON BRICKS

a. Determination of compressive strength of bricks.
b. Determination of water absorption of bricks.
c. Determination of efflorescence of bricks.

TOTAL: 30 PERIODS

COURSE OUTCOMES

On successful completion of this course, the students will be able to

CO1: Explain the role of Civil and Mechanical Engineering in societal development.
CO2: Recognize different types of building materials and their modern applications.
CO3: Comprehend the principles and methods used in surveying and leveling.
CO4: Explain the working principles of internal combustion engines and power plants.
CO5: Explore the refrigeration, air conditioning systems, and psychrometric processes.

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TEXT BOOKS

1. Satheesh Gopi, "Basic Civil Engineering", Pearson India, 2009.
2. Pravin Kumar, "Basic Mechanical Engineering", Pearson Education India, 2013.
3. G Shanmugam and M S Palanichamy, "Basic Civil and Mechanical Engineering", McGraw Hill Education; First edition, 2018.

REFERENCE BOOKS

1. Palanikumar K, "Basic Mechanical Engineering", ARS Publications, 2018.
2. Ramamrutham S, "Basic Civil Engineering", Dhanpat Rai Publishing Co.(P) Ltd, 2013.
3. Seetharaman S, "Basic Civil Engineering", Anuradha Agencies, 2005.
4. Shantha Kumar SRJ, "Basic Mechanical Engineering", Hi-tech Publications, Mayiladuthurai, 2000.
5. D Natarajan, Basic Civil and Mechanical Engineering, Anuradha Publications, 2013.

Mapping of COs with POs and PSOs

COs	POs												PSOs	
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
CO1	2	3	3	-	-	-	-	-	-	-	-	-	2	-
CO2	2	3	3	-	-	-	-	-	-	-	-	-	2	-
CO3	2	3	3	-	-	-	-	-	-	-	-	-	2	-
CO4	2	3	3	-	-	-	-	-	-	-	-	-	2	-
CO5	2	3	3	-	-	-	-	-	-	-	-	-	2	-
AVG	**2**	**3**	**3**	-	-	-	-	-	-	-	-	-	**2**	-

1-Low, 2-Medium, 3-High, "-" – No correlation

Velammal Institute of Education & Technology INSTITUTIONS Since 1984

24CS2101 PROGRAMMING IN C **L T P C**
3 0 2 4

COURSE OBJECTIVES

- To understand the constructs of C Language.
- To develop C Programs using basic programming constructs.
- To develop C programs using arrays and strings.

UNIT I BASICS OF C PROGRAMMING **9**

Introduction to programming paradigms – Applications of C Language – Structure of C program – C programming: Data Types – Constants – Enumeration Constants – Keywords – Operators: Precedence and Associativity – Expressions – Input / Output statements, Assignment statements – Decision making statements - Switch statement - Looping statements – Preprocessor directives - Compilation process.

UNIT II ARRAYS AND STRINGS **9**

Introduction to Arrays: Declaration, Initialization – One dimensional array – Two dimensional arrays – String operations: length, compare, concatenate, copy – Selection sort, linear and binary search.

UNIT III FUNCTIONS AND POINTERS **9**

Modular programming – Function proto type, function definition, function call, built – in functions (string functions, math functions) – Recursion, Binary Search using recursive functions – Pointers – Pointer operators – Pointer arithmetic – Arrays and pointers – Array of pointers – Parameter passing: Pass by value, Pass by reference.

UNIT IV STRUCTURES AND UNION **9**

Structure – Nested structures – Pointer and Structures – Array of structures –Self-referential structures Dynamic memory allocation – Singly linked list – typed ef – Union - Storage classes and Visibility.

UNIT V FILE PROCESSING **9**

Files – Types of file processing: Sequential access, Random access – Sequential access file – Random access file – Command line arguments.

TOTAL: 45 PERIODS

LIST OF EXPERIMENTS

1. Simple C programs using I/O statements, operators, and expressions.
2. Implement C Programs using decision - making constructs: if-else, goto, switch-case, break – continue.
3. Develop a C Programs using Loops: for, while, do-while.
4. Implement C Programs using Arrays: 1D and 2D, multi-dimensional arrays, traversal.
5. Develop C program using in-built mathematical and string functions.
6. Implement C Programs to perform String operations.
7. Implement C programs using Structures and Unions.
8. Functions: call, return, passing parameters by (value, reference), passing arrays to function
9. Implement recursive functions in C program.
10. C Program to print addresses and values of variables using Pointer.
11. Implement C Programs to perform arithmetic operations using Pointer.
12. Initialization of pointer variables, address of variable, accessing a variable through its pointer.

TOTAL: 30 PERIODS

COURSE OUTCOMES

On successful completion of this course, the students will be able to

CO1: Demonstrate knowledge on C Programming constructs.
CO2: Develop simple applications in C using basic constructs.
CO3: Design and implement applications using arrays and strings.
CO4: Develop and implement modular applications in C using functions.
CO5: Develop applications in C using structures and pointers.

TEXT BOOKS

1. Reema Thareja, “Programming in C”, Oxford University Press, Second Edition, 2016.
2. Kernighan, B Wand Ritchie, D. M, “The C Programming language”, Second Edition, Pearson Education, 2015.
3. Yashavant Kanetkar, “Authentic guide to C programming language”**,** Second Edition, 2024.

REFERENCE BOOKS

1. Paul Deitel and Harvey Deitel, "C How to Program with an Introduction to C++", Eighth edition, Pearson Education, 2018.
2. Yashwant Kanetkar, Let us C, 17th Edition, BPB Publications, 2020.
3. Byron S. Gottfried, "Schaum's Outline of Theory and Problems of Programming with C", McGraw – Hill Education, 1996.
4. Pradip Dey, Manas Ghosh, "Computer Fundamentals and Programming in C", Second Edition, Oxford University Press, 2013.
5. Anita Goeland Ajay Mittal, "Computer Fundamentals and Programming in C", 1st Edition, Pearson Education, 2013.

Mapping of COs with POs & PSOs

Cos	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	3	3	3	2	3	-	-	-	-	-	-	2	3	2
CO2	3	3	3	2	3	-	-	-	-	-	-	2	3	2
CO3	3	3	3	2	3	-	-	-	-	-	-	2	3	2
CO4	3	3	3	2	3	-	-	-	-	-	-	2	3	2
CO5	3	3	3	2	3	-	-	-	-	-	-	2	3	2
AVG	**3**	**3**	**3**	**2**	**3**	**-**	**-**	**-**	**-**	**-**	**-**	**2**	**3**	**2**

1 - Low, 2 - Medium, 3 – High, '-' No correlation

24GE2103 தமிழரும் மதாழில்நுட்பமும் **L T P C**
1 0 0 1

பாடத்தின் ந ாக்கங்கள்

- மொணவர்கள் தநெவு மற்றும் பொலனத் ததொழில்நுட்பத்லதக் கற்றறிதல்.
- கட்டிட மற்றும் உற்பத்தித் ததொழில்நுட்பத்லத அறிந்F தகொள்ளுதல்.
- கவளொண்லம, நீர்பொெனம் மற்றும் அறிவியல் தமிழ், கணினித் தமிழ் ததொழில்நுட்பத்லத அறிந்F தகொள்ளுதல்.

அலகு I ம சவு மற்றும் பாறனத் மதாழில்நுட்பம் **3**

ெங்க கொலத்தில் தநெவுத் ததொழில் - பொலனத் ததொழில்நுட்பம் - கருப்பு சிவப்பு பொண்டங்கள் - பொண்டங்களில் கீறல் குறியீடுகள்.

அலகு II வடிவறமப்பு மற்றும் கட்டிடத் மதாழில்நுட்பம் **3**

ெங்க கொலத்தில் வடிவலமப்பு மற்றும் கட்டுமொனங்கள் - ெங்க கொலத்தில் வீட்டுப்தபொருட்களில் வடிவலமப்பு - ெங்க கொலத்தில் கட்டுமொனப் தபொருட்களும் நடுகல்லும் - சிலப்பதிகொரத்தில் கமலட அலமப்பு பற்றிய விவரங்கள் - மொமல்லப்புரெ் சிற்பங்களும் ககொயில்களும் - கொழர் கொலத்Fப் தபருங்ககொயில்கள் மற்றும் பிற

வழிபட்டுத் தலங்கள்- நொயக்கர் கொலக் ககொயில்கள் - மொதிரி கட்டலமப்புகள் பற்றி அறிதல் -மFலர மீனொட்சி அம்மன் ஆலயம் மற்றும் திருமலல நொயக்கர் மஹொல் - தெட்டிநொட்டு வீடுகள் - பிரிட்டிஷ் கொலத்தில் தென்லனயில் இந்கதொ - ெகரொதெனிக் கட்டிடக்கலல.

அலகு III உற்பத்தித் மதாழில்நுட்பம் 3

கப்பல் கட்டும் கலல - உகலொகவியல் - இரும்புத் ததொழிற்ெொலல - இரும்லப உருக்குதல் - எ.ஃகு - வரலொற்றுெ் ெொன்றுகளொக தெம்பு மற்றும் தங்க நொணயங்கள் - நொணயங்கள் அெடித்தல் - மணி உருவொக்கும் ததொழிற்ெொலலகள் - கல்மணிகள், கண்ணொடி மணிகள் - சுடுமண்
மணிகள் - ெங்கு மணிகள் - எலும்புத் Fண்டுகள் - ததொல்லியல்
ெொன்றுகள் - சிலப்பதிகொரத்தில் மணிகளின் வலகள்.

அலகு VI நவளாை்றம மற்றும் ீர்பாசனத் மதாழில்நுட்பம் 3

அலண, ஏரி, குளம், மதகு - கொழர்கொலக் குமிழித் தூம்பின் முக்கியத்Fவம் - கொல்நலட பரொமரிப்பு - கொல்நலடகளுக்கொக வடிவலமக்கப்பட்ட கிணறுகள் - கவளொண்லம மற்றும் கவளொண்லமெ் ெொர்ந்த தெயல்பொடுகள் - கடல்ெொர் அறிவு - மீன்வளம் - முத்F மற்றும் முத்Fக்குளித்தல் - தபருங்கடல் குறித்த பண்லடய அறிவு - அறிவு ெொர் ெமூகம்.

அலகு V அறிவியல் தமிழ் மற்றும் கைித்தமிழ் 3

அறிவியல் தமிழின் வளர்ை்சி - கணித்தமிழ் வளர்ை்சி - தமிழ் நூல்கலள மின்பதிப்பு தெய்தல் - தமிழ் தமன்தபொருட்கள் உருவொக்கம் - தமிழ் இலணயக் கல்விக்கழகம் - தமிழ் மின் நூலகம் - இலணயத்தில் தமிழ் அகரொதிகள் - தொற்குலவத் திட்டம்.

TOTAL: 15 PERIODS

பாடம றி முடிவுகள்

பொடதிட்டத்லத முடித்த பிறகு, மொணவர்கள் தெய்ய கூடியலவ:

CO1: மொணவர்கள் தநெவு மற்றும் பொலனத் ததொழில்நுட்பத்லதக் கற்றறிந்தனர்.

CO2: கட்டிடத் ததொழில்நுட்ப முக்கியத்Fவத்லத அறிந்F தகொண்டனர்.

CO3: உற்பத்தித் ததொழில்நுட்பத்லத கற்றறிந்தனர்.

CO4: கவளொண்லம மற்றும் நீர்பொெனம் ததொழில்நுட்பங்கலள ததரிந்Fதகொண்டனர்.

CO5: அறிவியல் தமிழ் மற்றும் கணித் தமிழ் ததொழில்நுட்பத்லத

அறிந்Fதகொண்டனர்.

பாட புத்தகங்கள்

1. கக கக பிள்ளள "தமிழக வரலொறு - மக்களும் பண்பொடும்", தமிழ்நொடு பொடநூல் மற்றும் கல்வியியல் கழகம், 2004.
2. முலனவர் இல சுந்தரம், "கணினித் தமிழ்", விகடன் பிரசுரம், 2015.
3. டொக்டர். எஸ் வி சுப்ரமணியன், டொக்டர். கக டி திருநொவுக்கரசு, "தமிழர்களின் வரலொற்றுப் பொரம்பரியம்", ெர்வகதெ தமிழொய்வு நிறுவனம்.

குறிப்பு புத்தகங்கள்

1. டொக்டர் சிங்கொரகவலு, "தமிழர்களின் ெமூக வொழ்க்லக", ெர்வகதெ தமிழொய்வு நிறுவனம்.
2. கீழடி - "லவலக ஆற்றின் கலரயில் உள்ள ெங்க நகர நொகரிகம் கூட்டு" ததொல்லியல் Fலற & தமிழ்நொடு பொடநூல் மற்றும் கல்வி கெலவகள் கழகம், தமிழ்நொடு, 2015.
3. டொக்டர். கக கக பிள்ளள, "இந்திய வரலொறு" தவளியீடு ஆசிரியர்.
4. "தபொருலண நொகரிகம்", ததொல்லியல் Fலற, தமிழ்நொடு பொடநூல் மற்றும் கல்வி கெலவகள் கழகம்.
5. ஆர். பொலகிருஷ்ணன், "லவலக, சிந்F நொகரிகத்தின் பயணம்" தவளியீடு (EMRL).

Mapping of COs with POs and PSOs

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	-	-	-	-	-	2	-	2	-	-	-	-	-	-
CO2	-	-	-	-	-	2	-	2	-	-	-	-	-	-
CO3	-	-	-	-	-	2	-	2	-	-	-	-	-	-
CO4	-	-	-	-	-	2	-	2	-	-	-	-	-	-
CO5	-	-	-	-	-	2	-	2	-	-	-	-	-	-
AVG	-	-	-	-	-	**2**	-	**2**	-	-	-	-	-	-

1-Low, 2-Medium, 3-High, "-" – No correlation

24GE2201 ENGINEERING PRACTICES LABORATORY **L T P C**
0 0 4 2

COURSE OBJECTIVES

- To develop practical skills in handling and assembling various components used in household plumbing, woodworking, welding, and electronic circuits.
- To provide hands-on experience in operating basic tools and equipment essential for engineering practices.

- To provide hands-on experience in domestic wiring procedures practically.

GROUP – A (CIVIL & ELECTRICAL)

PART I CIVIL ENGINEERING PRACTICES **15**

PLUMBING WORK:

a) Connecting various basic pipe fittings like valves, taps, coupling, unions, reducers, elbows and other components which are commonly used in-household.
b) Preparing plumbing line sketches.
c) Laying pipe connection to the suction side of a pump, delivery side of a pump and pipes of different materials: Metal, plastic and flexible pipes used in house hold appliances.

WOOD WORK EXCERSIES:

a) Excises on sawing and planning of woods.
b) Prepare joints like T-Joint, Mortise joint and Tenon joint and Dovetail joint.
c) Studying joints in door panels, wooden furniture and common industrial trusses using models.

PART II ELECTRICAL ENGINEERING PRACTICES **15**

a) Introduction to switches, fuses, indicators and lamps - Basic switch board wiring with lamp, fan and three pin sockets.
b) Staircase wiring.
c) Fluorescent Lamp wiring with introduction to CFL and LED types.
d) Energy meter wiring and related calculations/ calibration.
e) Study of Iron Box wiring and assembly.
f) Study of Fan Regulator (Resistor type and Electronic type).

GROUP – B (MECHANICAL & ELECTRONICS)

PART III MECHANICAL ENGINEERING PRACTICES **15**

WELDING WORK:

a) Welding of Butt Joints, Lap Joints, and Tee Joints using arc welding.
b) Practicing gas welding.

BASIC MACHINING WORK:

a) Turning(simple).
b) Drilling and Tapping.

SHEET METAL WORK:

a) Making of a square tray.

STUDY AND ASSEMBLE THE FOLLOWING:

a) Assembling a centrifugal pump.
b) Assembling a household mixer.
c) Assembling an air conditioner.

FOUNDRY WORK:

a) Demonstrating of basic foundry operations.

PART IV ELECTRONIC ENGINEERING PRACTICES **15**

a) Soldering simple electronic circuits and checking continuity.

b) Assembling and testing electronic components on a small PCB.
c) Study an element of smart phone.
d) Assembly and dismantle of LED TV.
e) Assembly and dismantle of computer.
f) Assembly and dismantle of laptop.

TOTAL: 60 PERIODS

COURSE OUTCOMES

On successful completion of this course, the students will be able to

CO1: Proficiently connect and troubleshoot plumbing systems using various pipe fittings and materials.

CO2: Demonstrate competence in woodworking techniques including sawing, planing, and joint preparation.

CO3: Understand and execute electrical wiring tasks, including switchboard installations and appliance connections.

CO4: Gain practical skills in welding, machining, sheet metal work, and foundry operations.

CO5: Assemble and test electronic devices such as PCBs, smartphones, LED TVs, and computers, enhancing their understanding of electronic assembly and testing procedures.

Mapping of COs with POs and PSOs

COs	POs												PSOs	
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
CO1	3	3	3	2	2	-	-	-	2	-	-	2	2	-
CO2	3	3	3	2	2	-	-	-	2	-	-	2	2	-
CO3	3	3	3	2	2	-	-	-	2	-	-	2	2	-
CO4	3	3	3	2	2	-	-	-	2	-	-	2	2	-
CO5	3	3	3	2	2	-	-	-	2	-	-	2	2	-
AVG	**3**	**3**	**3**	**2**	**2**	**-**	**-**	**-**	**2**	**-**	**-**	**2**	**2**	**-**

1-Low, 2-Medium, 3-High, "-" – No correlation

24MU3104 DISCRETE MATHEMATICS **L T P C**

3 1 0 4

COURSE OBJECTIVES

- The students will gain knowledge on logical equivalence and equivalence rules to simplify logical expressions, predicate and quantifiers.
- To teach the basic concepts of combinatorics and generating functions to solve combinatorial problems.
- To familiarize the applications of algebraic structures and understand the concepts.

UNIT I LOGIC AND PROOFS **9+3**

Introduction to logic and proofs – Logical connectives – Propositional equivalences – logical equivalences and implication – Normal forms – Rules of inference - Predicates and quantifiers –Logical equivalences and implications for quantified statements – Nested quantifiers.

UNIT II COMBINATORICS **9+3**

Mathematical induction -The pigeonhole principle (without proof) –Inclusion and exclusion principle - Permutations and combinations - Recurrence relations – Solving linear recurrence relations -Generating functions.

UNIT III GRAPHS **9+3**

Graphs and graph models – Graph terminology and special types of graphs – Matrix representation of graphs – Graph isomorphism –Connectivity –Euler and Hamliton paths.

UNIT IV ALGEBRAIC STRUCTURES **9+3**

Algebraic systems- Semi groups and monoids- Groups- Subgroups- Homomorphism's - Normal subgroup and cosets - Lagrange's theorem- Definitions and examples of Rings and Fields.

UNIT V LATTICES AND BOOLEAN ALGEBRA **9+3**

Partial ordering - Posets - Lattices as Posets - Properties of lattices - Lattices as algebraic systems - Sub lattices - Direct product and homomorphism - Some special lattices - Boolean algebra.

TOTAL:60 PERIODS

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COURSE OUTCOMES

On successful completion of this course, the student will be able to

CO1: Solve the logic and proof problems.
CO2: Solve the combinations problems for generating functions.
CO3: Solve the shortest paths using Graph theory.
CO4: Apply algebraic structure technique for groups.
CO5: Solve the lattices for partial ordering set problems.

TEXT BOOKS

1. Tremblay.J.P. And Manohar. R, "Discrete Mathematical Structures with Applications to Computer Science", Tata McGraw Hill Publishing Company Limited, 1st Edition, New Delhi 2017.
2. Rosen. K.H., "Discrete Mathematics and its Applications", Tata McGraw Hill Publishing Company Limited, 8th Edition, New Delhi 2021.
3. Oscar Levin "Discrete Mathematics: An Open Introduction", 2nd edition, 12th Media Services 2016.

REFERENCE BOOKS

1. Koshy. T. "Discrete Mathematics with Applications", Elsevier India, 2014.
2. Lipschutz. S. and Mark Lipson., "Discrete Mathematics", Schaum's Outlines, Tata McGraw Hill Publishing Company Limited Co. Ltd., New Delhi, 3rd Edition, 2017.
3. Grimaldi. R.P. "Discrete and Combinatorial Mathematics: An Applied Introduction", 5th Edition, Pearson Education Asia, Delhi, 2019.
4. Veerarajan.T "Discrete Mathematics with Graph theory and Combinatorics", Tata McGraw -Hill Publishing Company Limited, New Delhi, 8th Edition 2019.
5. Sastry. C. V, Rakesh Nayak, "Discrete Mathematics", Wiley Publisher 2020.

Mapping of COs with POs & PSOs

Cos	POs												PSOs	
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
CO1	2	3	-	-	-	-	-	-	-	-	-	-	2	-
CO2	2	3	-	-	-	-	-	-	-	-	-	-	2	-
CO3	2	3	-	-	-	-	-	-	-	-	-	-	2	-
CO4	2	3	-	-	-	-	-	-	-	-	-	-	2	-
CO5	2	3	-	-	-	-	-	-	-	-	-	-	2	-
AVG	**2**	**3**	-	-	-	-	-	-	-	-	-	-	**2**	-

1-Low, 2-Medium, 3-High, "-" – No correlation

24IT3101 COMPUTER ORGANIZATION AND LOGIC DESIGN **L T P C**
3 0 0 3

COURSE OBJECTIVES

- To analyze and design combinational circuits.
- To analyze and design sequential circuits.
- To understand the basic structure and operation of a digital computer.

UNIT I COMBINATIONAL LOGIC **9**

Combinational Circuits – Karnaugh Map - Analysis and Design Procedures – Binary Adder – Subtractor – Decimal Adder - Magnitude Comparator – Decoder – Encoder – Multiplexers – Demultiplexers.

UNIT II SYNCHRONOUS SEQUENTIAL LOGIC **9**

Introduction to Sequential Circuits – Flip-Flops – operation and excitation tables, Triggering of FF, Analysis and design of clocked sequential circuits – Design – Moore/Mealy models, state minimization, state assignment, circuit implementation - Registers – Counters.

UNIT III COMPUTER FUNDAMENTALS **9**

Functional Units of a Digital Computer: Von Neumann Architecture – Operation and Operands of Computer Hardware Instruction–Instruction Set Architecture (ISA): Memory Location, Address and Operation – Instruction and Instruction Sequencing – Addressing Modes, Encoding of Machine Instruction – Interaction between Assembly and High Level Language.

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UNIT IV PROCESSOR **9**

Instruction Execution – Building a Data Path – Designing a Control Unit – Hardwired Control, Microprogrammed Control – Pipelining – Data Hazard – Control Hazards.

UNIT V MEMORY AND I/O **9**

Memory Concepts and Hierarchy – Memory Management – Cache Memories: Mapping and Replacement Techniques – Virtual Memory – DMA – I/O – Accessing I/O: Parallel and Serial Interface – Interrupt I/O – Interconnection Standards: USB, SATA.

TOTAL:45 PERIODS

COURSE OUTCOMES

On successful completion of this course, the students will be able to

CO1: Design various combinational digital circuits using logic gates.

CO2: Design sequential circuits and analyze the design procedures.

CO3: State the fundamentals of computer systems and analyze the execution of an instruction.

CO4: Analyze different types of control design and identify hazards.

CO5: Identify the characteristics of various memory systems and I/O communication.

TEXT BOOKS

1. M. Morris Mano, Michael D. Ciletti, "Digital Design: With an Introduction to the Verilog HDL, VHDL, and System Verilog", 6th Edition, Pearson Education, 2018.
2. David A. Patterson, John L. Hennessy, "Computer Organization and Design, The Hardware/ Software Interface 6th Edition, Morgan Kaufmann/Elsevier, 2020.
3. David money Harris and sarrah, Digital Design and Computer Architecture, 2nd.

REFERENCE BOOKS

1. Carl Hamacher, Zvonko Vranesic, Safwat Zaky, Naraig Manjikian, "Computer Organization and Embedded Systems", Sixth Edition, Tata McGraw-Hill, 2012.
2. William Stallings, "Computer Organization and Architecture – Designing for Performance", 10th Edition, Pearson Education, 2016.
3. M. Morris Mano, "Digital Logic and Computer Design", Pearson Education, 2016.
4. Charles H. Roth Jr., Larry L. Kinney "Fundamentals of Logic Design", 7th Edition, Cengage Learning, 2013.
5. Thomas L. Floyd "Digital Fundamentals",11th Edition, Pearson Education, 2014.

Mapping of COs with POs & PSOs

COs	POs												PSOs	
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
CO 1	3	3	3	3	3	2	1	1	1	1	2	3	2	3
CO 2	3	3	3	3	2	1	1	1	1	1	2	3	1	2
CO 3	3	3	3	3	2	2	1	1	1	1	2	3	2	3
CO 4	3	3	3	3	1	1	1	1	1	1	1	2	1	3
CO 5	3	3	3	3	1	2	1	1	1	1	1	2	1	2
AVG	**3**	**3**	**3**	**3**	**1.8**	**1.6**	**1**	**1**	**1**	**1**	**1.6**	**2.6**	**1.4**	**2.6**

1-Low, 2-Medium, 3-High, "-" – No correlation

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24AI3101 DATABASE CONCEPTS **L T P C**
3 0 0 3

COURSE OBJECTIVES

- To introduce database development life cycle and conceptual modeling.
- To learn SQL for data definition, manipulation and querying a database.
- To learn relational database design using conceptual mapping and normalization.

UNIT I CONCEPTUAL DATA MODELING **9**

Database environment – Database system development lifecycle – Requirements collection – Database design -Entity - Relationship model – Enhanced - ER model – UML class diagrams.

UNIT II RELATIONAL MODEL AND SQL **9**

Relational model concepts – Integrity constraints – SQL Data manipulation –SQL Data definition – Views - SQL programming.

UNIT III RELATIONAL DATABASE DESIGN AND NORMALIZATION **9**

ER and EER – to – Relational mapping – Update anomalies – Functional dependencies – Inference rules – Minimal cover – Properties of relational decomposition – Normalization (up to BCNF).

UNIT IV TRANSACTION MANAGEMENT **9**

Transaction concepts – properties – Schedules – Serializability – Concurrency Control – Two-phase locking techniques.

UNIT V OBJECT RELATIONAL AND NO-SQL DATABASES **9**

Mapping EER to ODB schema – Object identifier – reference types – row types – UDTs – Subtypes and supertypes – user-defined routines – Collection types – Object Query Language; No-SQL: CAP theorem – Document-based: MongoDB data model and CRUD operations; Column-based: H base data model and CRUD operations.

TOTAL:45 PERIODS

COURSE OUTCOMES

On successful completion of this course, the students will be able to

CO1: Explore the databased development life cycle and apply conceptual modeling.
CO2: Apply SQL and programming in SQL to create, manipulate and query the database.
CO3: Apply the conceptual – to -relational mapping and normalization to design relational database.
CO4: Determine the serializability of any non-serial schedule using concurrency Techniques.
CO5: Apply the data model and querying in Object-relational and No-SQL databases.

TEXT BOOKS

1. Thomas M. Connolly, Carolyn E. Begg, Database Systems – A Practical Approach to Design, Implementation, and Management, 6th Edition, Pearson Education, 2015.
2. Ramez Elmasri, Shamkant B. Navathe, "Fundamentals of Database Systems", 7th Edition, Pearson, 2017.
3. C.J. Date "An Introduction to Database Systems", 8th Edition, Pearson Education, 2003.

MIET Advanced Institute of Education & Technology INSTITUTIONS Since 1984

REFERENCE BOOKS

1. Toby Teorey, Sam Lightstone, Tom Nadeau, H. V. Jagadish, "Database Modeling and Design - Logical Design", Fifth Edition, Morgan Kaufmann Publishers, 2011.
2. Carlos Coronel, Steven Morris, and Peter Rob, Database Systems: Design, Implementation, and Management, Ninth Edition, Cengage learning, 2012.
3. Abraham Silberschatz, Henry F Korth, S Sudharshan, "Database System Concepts", 6th Edition, Tata Mc Graw Hill, 2011.
4. Hector Garcia - Molina, Jeffrey D Ullman, Jennifer Widom, "Database Systems: The Complete Book", 2nd edition, Pearson, 2008.
5. Raghu Ramakrishnan, "Database Management Systems", 4th Edition, Tata Mc Graw Hill, 2010.

Mapping of COs with POs & PSOs

COs	POs												PSOs	
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
CO 1	2	2	3	3	-	-	-	-	3	1	2	1	2	3
CO 2	2	3	1	3	1	-	-	-	1	2	2	1	3	3
CO 3	2	2	2	1	1	-	-	-	2	3	1	2	1	1
CO 4	2	2	3	1	-	-	-	-	1	2	1	2	2	2
CO 5	3	1	3	2	1	-	-	-	1	3	1	1	2	1
AVG	**2.2**	**2**	**2.4**	**2**	**1**	**-**	**-**	**-**	**1.6**	**2.2**	**1.4**	**1.4**	**2**	**2**

1-Low, 2-Medium, 3-High, "-" – No correlation

24CS3103 DATA STRUCTURES AND ALGORITHMS **L T P C**

3 0 2 4

COURSE OBJECTIVES

- To understand the concepts of ADTs and to design linear data structures – lists, stacks and queues.
- To understand non-linear datastructures – trees and graphs and sorting, searching and hashing algorithms.
- To critically analyze the efficiency of graph and different algorithm design techniques.

UNIT I ABSTRACT DATA TYPES **9**

Abstract Data Types (ADTs) – ADTs and classes – introduction to OOP – Classes in Python – Inheritance – Namespaces – Shallow and deep copying.Introduction to analysis of algorithms – Asymptotic notations – Divide & conquer – Recursion – Analyzing recursive algorithms.

UNIT II LINEAR DATA STRUCTURE **9**

Abstract Data Types (ADTs) -List ADT– Linked list implementations – Singly linked lists - circularly linked lists – Doubly linked lists – Applications of list – Polynomial ADT – Multi lists, Stack and Queue – Balancing symbols – Evaluating Arithmetic Expressions – Infix to Postfix Conversion – Function calls.

UNIT III MULTIWAY SEARCH TREES AND GRAPHS **9**

Tree ADT – Tree Traversals – Binary Tree ADT – Expression Trees – Binary search Tree ADT – AVL tree – Priority queue (Heaps) – Binary Heap. B- tree – B+ tree – Graph Definition - Representation of Graphs – Types of graph – Breadth-first traversal – Depth first Traversal – Bi-connectivity – Topological sort – Dijkstra's algorithm – Minimum Spanning Tree.

UNIT IV SEARCHING, SORTING AND HASHING TECHNIQUES **9**

Searching – Linear search – Binary Search. Sorting – Bubble sort – Selection sort – Insertion Sort – Shell Sort – Merge Sort – Analysis of Sorting Algorithms. Collision handling – Load Factors, and Efficiency – Hashing – Hash Functions – Separate Chaining – Open Addressing – Rehashing – Extendible Hashing.

UNIT V INTRODUCTION TO ALGORITHM TECHNIQUES **9**

Floyd- Warshall Algorithm – Network Flow – Ford-Fulkerson Method – Matching Maximum Bipartite Matching. Pattern Search – The Naive String – Matching Algorithm – Rabin-Karp Algorithm – Knuth-Morris-Pratt Algorithm. Greedy Techniques: Elements of greedy strategy – N Queen's problem – Optimal Merge Pattern – Huffman Trees.

TOTAL:45 PERIODS

LIST OF EXPERIMENTS

1. Linked list implementation of list.
2. Implementation of Stack and Queue ADTs.
3. Implementation of sorting and searching algorithms.
4. Implementation of Hash table.
5. Implementation of tree representation and traversal algorithm.
6. Implementation of binary search trees.
7. Implementation of single source shortest path algorithm.
8. Implement N Queens problem using Backtracking.

TOTAL:30 PERIODS

COURSE OUTCOMES

On successful completion of this course, the students will be able to

CO1: Explain abstract data types.

CO2: Design, Implement and Analyze Linear Data Structures such as Lists, Queues and Stacks according to the needs of different applications.

CO3: Model problems as graph problems and Implement efficient Graph Algorithms to solve them.

CO4: Analyze the various Searching and Sorting algorithms.

CO5: Solving Maximum flow problems using Ford- Fulkerson methods.

TEXT BOOKS

1. Michael T. Goodrich, Roberto Tamassia, and Michael H. Goldwasser, "Data Structures & Algorithms in Python", An Indian Adaptation, John Wiley & Sons Inc., 2021.
2. Mark Allen Weiss, "Data Structures and Algorithm Analysis in C", 2nd Edition, Pearson Education, 2005.
3. Thomas H.Cormen, Charles E.Leiserson, Ronald L.Rivest and Clifford Stein , "Introduction to Algorithms", 3rd Edition, Prentice Hall of India,2009.

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REFERENCE BOOKS

1. Alfred V. Aho, john E. Hopcrroft and Jeffrey D. Ullman, "Data Structures and Algorithms", Reprint Edition, Pearson Education, 2006.
2. S. Sridhar, "Design and Analysis of Algorithms", Oxford University Press, 2014.
3. Cay S. Horstmann, "Core Java Fundamentals", Volume 1, 11th edition, prentice Hall, 2018.
4. Rance D. Necaise, "Data Structures and Algorithms Using Python", John Wiley & Sons, 2011
5. Homas H.Cormen,Charles E.Leiserson,Ronald L.Rivest,Clifford Stein Also Known As:CLRS ,level:Intermediate to advanced

Mapping of COs with POs & PSOs

COs	POs												PSOs	
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
CO 1	2	2	1	2	2	-	-	-	1	1	1	2	2	2
CO 2	2	1	-	1	1	-	-	-	2	1	1	2	2	3
CO 3	2	2	1	2	2	1	1	-	1	2	1	3	2	2
CO 4	3	2	2	1	2	-	-	-	1	1	2	2	3	3
CO 5	2	2	1	2	2	-	-	-	1	1	1	2	2	2
AVG	**2.2**	**1.8**	**1.25**	**1.6**	**1.8**	**1**	**1**	**-**	**1.2**	**1.2**	**1.2**	**2.2**	**2.2**	**2.4**

1-Low, 2-Medium, 3-High, "-" – No correlation

24AI3102 PRINCIPLES OF DATA SCIENCE **L T P C**

3 0 0 3

COURSE OBJECTIVES

- To understand the data science fundamentals and process.
- To learn to describe the data for the data science process.
- To learn to describe the relationship between data.

UNIT I INTRODUCTION **9**

Data Science: Benefits and uses – facets of data - Data Science Process: Overview – Defining research goals – Retrieving data – Data preparation - Exploratory Data analysis – build the model– presenting findings and building applications - Data Mining - Data Warehousing – Basic Statistical descriptions of Data.

UNIT II DESCRIBING DATA **9**

Types of Data - Types of Variables -Describing Data with Tables and Graphs –Describing Data with Averages - Describing Variability - Normal Distributions and Standard (z) Scores.

UNIT III DESCRIBING RELATIONSHIPS **9**

Correlation –Scatter plots –correlation coefficient for quantitative data –computational formula for correlation coefficient – Regression –regression line –least squares regression line – Standard error of estimate – interpretation of r2 –multiple regression equations –regression towards the mean.

UNIT IV PYTHON LIBRARIES FOR DATA WRANGLING **9**

Basics of Numpy arrays –aggregations –computations on arrays –comparisons, masks, boolean logic – fancy indexing – structured arrays – Data manipulation with Pandas – data indexing and selection – operating on data – missing data – Hierarchical indexing – combining datasets – aggregation and grouping – pivot tables.

UNIT VDATA VISUALIZATION **9**

Importing Matplotlib – Line plots – Scatter plots – visualizing errors – density and contour plots – Histograms – legends –colors – subplots – text and annotation – customization – three-dimensional plotting - Geographic Data with Basemap - Visualization with Seaborn.

TOTAL:45 PERIODS

COURSE OUTCOMES

On successful completion of this course, the students will be able to

CO1: Define the data science process.

CO2: Explain the different types of data description for data science process.

CO3: Gain knowledge on relationships between data.

CO4: Use the Python Libraries for Data Wrangling.

CO5: Apply visualization Libraries in Python to interpret and explore data.

TEXT BOOKS

1. David Cielen, Arno D. B. Meysman, and Mohamed Ali, "Introducing Data Science", Manning Publications, 2016.
2. Robert S. Witte and John S. Witte, "Statistics", Eleventh Edition, Wiley Publications,2017.
3. Jake Vander Plas, "Python Data Science Handbook", O'Reilly,2016.

REFERENCE BOOKS

1. Allen B. Downey, "Think Stats: Exploratory Data Analysis in Python", Green Tea Press, 2014.
2. Cathy O'Neil & Rachel Schutt "Doing Data Science", 1st Edition, O'Reilly Media, 2013.
3. Joel Grus – Data Science from Scratch, 2nd Edition, O'Reilly Media, 2019.
4. Dwarakanath – Fundamentals of Data Science, 3rd Edition, Notion Press, 7 February 2022.
5. Pang-Ning Tan, Michael Steinbach, Anuj Karpatne & Vipin Kumar – Introduction to Data Mining, 2nd Edition, Pearson, 2018.

Mapping of COs with POs & PSOs

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	2	2	1	2	2	-	-	-	1	1	1	2	-	-
2	2	1	-	1	1	-	-	-	2	1	1	2	-	-
3	2	2	1	2	2	1	1	-	1	2	1	3	-	-
4	3	2	2	1	2	-	-	-	1	1	2	2	-	-
5	2	2	1	2	2	-	-	-	1	1	1	2	-	-
AVG	2.2	1.8	1.25	1.6	1.8	1	1	-	1.2	1.2	1.2	2.2	-	-

1-Low, 2-Medium, 3-High, "-" – No correlation

24AI3103 ARTIFICIAL INTELLIGENCE **L T P C**
3 0 2 4

COURSE OBJECTIVES

- To learn the basic AI approaches.
- To develop problem solving agents.
- To perform logical and probabilistic reasoning.

UNIT I INTELLIGENT AGENTS **9**

Introduction to AI – Agents and Environments – concept of rationality – nature of environments – structure of agents. Problem solving agents – search algorithms – uninformed search strategies.

UNIT II PROBLEM SOLVING **9**

Heuristic search strategies – heuristic functions. Local search and optimization problems – local search in continuous space – search with non-deterministic actions – search in partially observable environments – online search agents and unknown environments.

UNIT III GAME PLAYING AND CSP **9**

Game theory – optimal decisions in games – alpha-beta search – monte – carlo tree search– stochastic games – partially observable games. Constraint satisfaction problems – constraint propagation – backtracking search for CSP – local search for CSP – structure of CSP.

UNIT IV LOGICAL REASONING **9**

Knowledge-based agents – propositional logic – propositional theorem proving–propositional model checking – agents based on propositional logic. First-order logic – syntax and semantics –knowledge representation and engineering – inferences in first-order logic – forward chaining – backward chaining – resolution.

UNIT V PROBABILISTIC REASONING **9**

Acting under uncertainty – Bayesian inference – naïve Bayes models. Probabilistic reasoning – Bayesian networks – exact inference in BN – approximate inference in BN – causal networks.

TOTAL:45 PERIODS

LIST OF EXPERIMENTS

1. Implement Uninformed Search Algorithms.
2. Implement A Search Algorithm*.
3. Implement Hill Climbing & Simulated Annealing.
4. Implement Alpha-Beta Pruning.
5. Solve a CSP using Backtracking.
6. First-Order Logic Representation.
7. Implement Forward and Backward Chaining.
8. Implement a Naïve Bayes Classifier.

TOTAL:30 PERIODS

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COURSE OUTCOMES

On successful completion of this course, the students will be able to

CO1: Explain intelligent agent frame works.

CO2: Apply problem solving techniques.

CO3: Apply game playing and CSP techniques.

CO4: Perform logical reasoning.

CO5: Perform probabilistic reasoning under uncertainty.

TEXT BOOKS

1. Stuart Russell and Peter Norvig, "Artificial Intelligence – A Modern Approach", Fourth Edition, Pearson Education, 2021.
2. Elaine Rich, Kevin Knight, Shivashankar B. Nair "Artificial Intelligence" 3rd Edition, McGraw-Hill Education, 2009.
3. George F. Luger "Artificial Intelligence: Structures and Strategies for Complex Problem Solving",6th Edition, Pearson Education, 2009.

REFERENCE BOOKS

1. Dan W. Patterson, "Introduction to AI and ES", Pearson Education, 2007.
2. Nils J. Nilsson," The Quest for Artificial Intelligence",1st Edition, Cambridge University Press, 2009.
3. Patrick H. Winston, "Artificial Intelligence", Third Edition, Pearson Education, 2006.
4. Deepak Khemani, "Artificial Intelligence", Tata McGraw Hill Education, 2013.
5. Christopher M. Bishop, "Pattern Recognition and Machine Learning", Springer, 1st edition 2006.

Mapping of COs with POs & PSOs

COs	POs												PSOs	
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
CO 1	3	1	3	3	-	-	-	-	2	3	3	1	2	1
CO 2	2	2	1	1	1	-	-	-	2	2	3	1	3	2
CO 3	2	1	2	1	-	-	-	-	2	1	1	3	1	2
CO 4	2	1	2	2	-	-	-	-	2	1	2	2	1	3
CO 5	3	2	2	1	1	-	-	-	3	2	1	2	2	2
AVG	**2.4**	**1.4**	**2**	**1.6**	**1**	**-**	**-**	**-**	**2.2**	**1.8**	**2**	**1.8**	**1.8**	**2**

1-Low, 2-Medium, 3-High, "-" – No correlation

24AI3201 DATABASE MANAGEMENT LABORATORY **L T P C**

0 0 3 1.5

COURSE OBJECTIVES

- To understand the database development lifecycle.
- To learn database design using conceptual modeling, Normalization.
- To implement database using Data definition, Querying using SQL manipulation and SQL programming.

LIST OF EXPERIMENTS

1. Database Development Life cycle for Problem definition and Requirement analysis.
2. Database Development Life cycle for scope and constraints.
3. Database design using Conceptual modeling (ER-EER) – top – down approach. Mapping conceptual to relational database and validate using Normalization.
4. Implement the database using SQL Data definition with constraints, Views.
5. Query the database using SQL Manipulation.
6. Querying/Managing the database using SQL Programming for stored procedures/Functions.
7. Querying/Managing the database using SQL Programming for constraints and security using triggers.
8. Database design using Normalization – bottom- up approach.
9. Develop database applications using IDE/RAD tools (Eg: NetBeans, Visual Studio).
10. Database design using EER -to- ODB mapping/ UML class diagrams.
11. Object features of SQL-UDTs and sub-types, Tables using UDTs, Inheritance, Method definition.
12. Querying the Object – relational database using Object Query language.

TOTAL:45 PERIODS

COURSE OUTCOMES

On successful completion of this course, the students will be able to

CO1: Explain the database development lifecycle.

CO2: Design relational database using conceptual -to- relational mapping, Normalization.

CO3: Apply SQL for creation, manipulation and retrieval of data.

CO4: Develop a database application for real-time problems.

CO5: Design and query object-relational databases.

Mapping of COs with POs & PSOs

COs	POs												PSOs	
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
CO 1	3	1	3	3	-	-	-	-	1	1	1	3	2	2
CO 2	2	2	1	3	1	-	-	-	3	2	3	1	1	1
CO 3	2	1	3	1	-	-	-	-	3	3	1	1	2	1
CO 4	2	2	3	1	-	-	-	-	2	3	2	1	2	1
CO 5	3	3	1	3	1	-	-	-	1	3	2	3	3	3
AVG	**2.4**	**1.8**	**2.2**	**2.2**	**1**	**-**	**-**	**-**	**2**	**2.4**	**1.8**	**1.8**	**2**	**1.6**

1-Low, 2-Medium, 3-High, "-" – No correlation

24IT3202 COMPUTER ORGANIZATION AND LOGIC DESIGN LABORATORY

L T P C
0 0 3 1.5

COURSE OBJECTIVES

- To analyze and design combinational and sequential circuits.
- To understand the basic structure and operation of a digital computer.
- To study the design of data path unit, control unit for processor and to familiarize with the hazards.

LIST OF EXPERIMENTS

1. Verification of Boolean theorems using logic gates.
2. Design and implementation of combinational circuits using gates for arbitrary functions.
3. Implementation of 4-bit binary adder/subtractor circuits.
4. Implementation of code converters.
5. Implementation of BCD adder, encoder and decoder circuits.
6. Implementation of functions using Multiplexers.
7. Implementation of the synchronous counters.
8. Implementation of a Universal Shift register.
9. Simulator based study of Computer Architecture.
10. Simulating a Simple Instruction Cycle and Addressing Modes.
11. Simulation of Memory Access and I/O Interfaces.
12. Designing a Simple CPU Datapath and Control Unit.

TOTAL:45 PERIODS

COURSE OUTCOMES

On successful completion of this course, the students will be able to

CO1: Design various combinational digital circuits using logic gates.

CO2: Design sequential circuits and analyze the design procedures.

CO3: State the fundamentals of computer systems and analyze the execution of an instruction.

CO4: Analyze different types of control design and identify hazards.

CO5: Identify the characteristics of various memory systems and I/O communication.

Mapping of COs with POs & PSOs

COs	POs												PSOs	
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
CO 1	3	3	3	3	3	2	1	1	1	1	2	3	2	3
CO 2	3	3	3	3	2	1	1	1	1	1	2	3	1	2
CO 3	3	3	3	3	2	2	1	1	1	1	2	3	2	3
CO 4	3	3	3	3	1	1	1	1	1	1	1	2	1	3
CO 5	3	3	3	3	1	2	1	1	1	1	1	2	1	2
AVG	**3**	**3**	**3**	**3**	**1.8**	**1.6**	**1**	**1**	**1**	**1**	**1.6**	**2.6**	**1.4**	**2.6**

1-Low, 2-Medium, 3-High, "-" – No correlation

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24AI4101 EXPLORING DATA WITH PROBABILITY AND STATISTICS **L T P C**
3 0 0 3

COURSE OBJECTIVES

- This course aims at providing the required skill to apply the statistical tools in engineering problems.
- To introduce the basic concepts of probability and random variables.
- To introduce the basic concepts of two-dimensional random variables.

UNIT I PROBABILITY AND RANDOM VARIABLES **9**

Axioms of probability–Conditional probability–Baye's theorem -Discrete and continuous random variables – Moments – Moment generating functions – Binomial, Poisson, Geometric, Uniform, Exponential and Normal distributions – Functions of a random variable.

UNIT II TWO – DIMENSIONAL RANDOM VARIABLES **9**

Joint distributions – Marginal and conditional distributions – Covariance – Correlation and linear regression – Transformation of random variables – Central limit theorem (for independent and identically distributed random variables).

UNIT III ESTIMATION THEORY **9**

Unbiased estimators - Efficiency - Consistency - Sufficiency -Robustness - Method of moments - Method of maximum Likelihood - Interval estimation of Means -Differences between means, variations and ratio of two variances.

UNIT IV NON – PARAMETRIC TESTS **9**

Introduction – The Sign test -The Signed – Rank test – Rank – sum tests – The U test – The H test - Tests based on Runs – Test of randomness – The Kolmogorov Tests.

UNIT V STATISTICAL QUALITY CONTROL **9**

Control charts for measurements ($\bar{X}$ and R charts) – Control charts for attributes (p, candnp charts) – Tolerance limits -Acceptance sampling.

TOTAL:45 PERIODS

COURSE OUTCOMES

On successful completion of this course, the students will be able to

CO1: Explore the concepts of probability and have knowledge of standard distributions which can describe real life phenomenon.

CO2: Explain the one and two dimensional random variables and apply in engineering applications.

CO3: Apply the concept of testing of hypothesis for small and large samples in real life problems.

CO4: Apply the basic concepts of classifications of design of experiments in the field of agriculture and statistical quality control.

CO5: Have the notion of sampling distributions and statistical techniques used in engineering and management problems.

TEXT BOOKS

1. Johnson. R.A., Miller. I. Rand Freund. J.E, " Miller and Freund's Probability and Statistics for Engineers", Pearson Education, Asia,9th Edition, 2016.
2. Milton.J.S.and Arnold.J.C.,"Introduction to Probability and Statistics", Tata McGraw Hill, 4th Edition, 2007.
3. JohnE. Freund, "Mathematical Statistics", Prentice Hall, 5th Edition,1992.

REFERENCE BOOKS

1. Gupta. S. C. and Kapoor. V. K., "Fundamentals of Mathematical Statistics", Sultan Chand & Sons, New Delhi, 12th Edition, 2020.
2. Devore. J.L., "Probability and Statistics for Engineering and the Sciences", Cengage Learning, New Delhi, 8th Edition, 2014.
3. Ross. S.M., "Introduction to Probability and Statistics for Engineers and Scientists", 5thEdition, Elsevier, 2014.
4. Spiegel. M.R., Schiller. J. and Srinivasan. R.A., "Schaum's Outline of Theory and Problems of Probability and Statistics", Tata McGraw Hill Edition, 4th Edition, 2012.
5. Walpole. R. E., Myers. R. H., Myers. S. L. and Ye. K., "Probability and Statistics for Engineers and Scientists", Pearson Education, Asia, 9th Edition, 2010.

Mapping of COs with POs & PSOs

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO 1	3	3	-	-	-	-	-	-	2	-	-	2	2	1
CO 2	3	3	-	-	-	-	-	-	2	-	-	2	1	3
CO 3	3	3	-	-	-	-	-	-	2	-	-	2	1	2
CO 4	3	3	3	2	-	-	-	-	2	-	-	2	1	2
CO 5	3	3	2	2	-	-	-	-	2	-	-	2	2	2
AVG	3	3	2.5	2	-	-	-	-	2	-	-	2	1.4	2

1-Low, 2-Medium, 3-High, "-" – No correlation

24AI4102 OPERATING SYSTEMS **L T P C**

3 0 2 4

COURSE OBJECTIVES

- To understand the basics and functions of operating systems.
- To understand Processes and Threads.
- To analyze Scheduling algorithms and process synchronization.

UNIT I INTRODUCTION **7**

Computer System -Elements and organization; Operating System Overview - Objectives and Functions - Evolution of Operating System; Operating System Structures – Operating System Services - User Operating System Interface - System Calls – System Programs -Design and Implementation - Structuring methods.

UNIT II PROCESS MANAGEMENT **11**

Processes - Process Concept - Process Scheduling - Operations on Processes - Inter-process Communication; CPU Scheduling - Scheduling criteria - Scheduling algorithms: Threads - Multithread Models – Threading issues; Process Synchronization - The critical-section problem – Synchronization hardware – Semaphores – Mutex-Classical problems of synchronization - Monitors; Deadlock - Methods for handling deadlocks, Deadlock prevention, Deadlock avoidance, Deadlock detection, Recovery from deadlock.

UNIT III MEMORY MANAGEMENT **10**

Main Memory – Swapping – Contiguous Memory Allocation – Paging – Structure of the Page Table- Segmentation, Segmentation with paging; Virtual Memory – Demand Paging – Copy on Write - Page Replacement - Allocation of Frames –Thrashing.

UNIT IV STORAGE MANAGEMENT **10**

Mass Storage system – Disk Structure - Disk Scheduling and Management; File-System Interface – File concept – Access methods – Directory Structure – Directory organization-File system mounting - File Sharing and Protection; File System Implementation - File System Structure - Directory implementation - Allocation Methods - Free Space Management; I/O Systems – I/O Hardware, Application I/O interface, Kernel I/O subsystem.

UNIT V VIRTUAL MACHINES AND MOBILE OS **7**

Virtual Machines – History, Benefits and Features, Building Blocks, Types of Virtual Machines and their Implementations, Virtualization and Operating-System Components; Mobile OS - iOS and Android.

TOTAL:45 PERIODS

LIST OF EXPERIMENTS

1. Installation of Operating system: Windows/Linux.
2. Illustrate UNIX commands and Shell Programming.
3. Write C programs to implement the various CPU Scheduling Algorithms.
4. Write a C program to avoid Deadlock using Banker's Algorithm.
5. Write a C program to Implement Deadlock Detection Algorithm.
6. Implement the paging Technique using C program.
7. Write C programs to implement the following Memory Allocation Methods
    a. First Fit
    b. Worst Fit
    c. Best Fit.
8. Implement the following File Allocation Strategies using C programs
    a. Sequential
    b. Indexed
    c. Linked.

TOTAL:30 PERIODS

COURSE OUTCOMES

On successful completion of this course, the students will be able to

CO1: Analyze various scheduling algorithms and process synchronization.

CO2: Explain deadlock, prevention and avoidance algorithms.

CO3: Compare and contrast various memory management schemes.
CO4: Explain the functionality of file systems I/O systems, and Virtualization.
CO5: Compare iOS and Android Operating Systems.

TEXT BOOKS

1. Abraham Silberschatz, Peter Baer Galvin and Greg Gagne, "Operating System Concepts", 9th Edition, John Wiley and Sons Inc., 2018.
2. Andrew S Tanenbaum, "Modern Operating Systems", Pearson, 4th Edition, New Delhi, 2016.
3. Dhananjay M. Dhamdhere, "Operating Systems: A Concept-Based Approach",2nd Edition, McGraw-Hill Education, 2006.

REFERENCE BOOKS

1. Ramaz Elmasri, A. Gil Carrick, David Levine, "Operating Systems – A Spiral Approach", Tata McGraw Hill Edition, 2010.
2. William Stallings, "Operating Systems: Internals and Design Principles", 7th Edition, Prentice Hall, 2018.
3. Achyut S. Godbole, Atul Kahate, "Operating Systems", McGraw Hill Education, 2016.
4. Crystal Panek, "Windows Operating System Fundamentals", Wiley, 2019.
5. Gary Nutt, "Operating Systems: A Modern Perspective",3rd Edition, Addison-Wesley, 2004.

Mapping of COs with POs & PSOs

COs	POs												PSOs	
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
CO 1	3	1	1	1	-	-	-	-	1	1	1	2	2	1
CO 2	2	3	1	3	1	-	-	-	3	2	2	3	3	3
CO 3	2	2	3	3	2	-	-	-	3	1	1	2	1	1
CO 4	2	2	1	2	1	-	-	-	1	3	2	1	1	1
CO 5	2	3	3	2	1	-	-	-	3	1	2	1	3	1
AVG	**2.2**	**2.2**	**1.8**	**2.2**	**1.25**	**-**	**-**	**-**	**2.2**	**1.6**	**1.6**	**1.8**	**2**	**1.4**

1-Low, 2-Medium, 3-High, "-" – No correlation

24AI4103 MACHINE LEARNING **L T P C**
3 0 0 3

COURSE OBJECTIVES

- To understand the basic concepts of machine learning.
- To understand and build supervised learning models.
- To understand and build unsupervised learning models.

UNIT I INTRODUCTION TO MACHINE LEARNING **8**

Review of Linear Algebra for machine learning; Introduction and motivation for machine learning; Examples of machine learning applications, Vapnik - Chervonenkis (VC) dimension,

Probably Approximately Correct (PAC) learning, Hypothesis spaces, Inductive bias, Generalization, Bias variance trade-off.

UNIT II SUPERVISED LEARNING **11**

Linear Regression Models: Least squares, single & multiple variables, Bayesian linear regression, gradient descent, Linear Classification Models: Discriminant function – Perceptron algorithm, Probabilistic discriminative model - Logistic regression, Probabilistic generative model – Naive Bayes, Maximum margin classifier – Support vector machine, Decision Tree, Random Forests.

UNIT III ENSEMBLE TECHNIQUES AND UNSUPERVISED LEARNING **9**

Combining multiple learners: Model combination schemes, Voting, Ensemble Learning - bagging, boosting, stacking, Unsupervised learning: K-means, Instance Based Learning: KNN, Gaussian mixture models and Expectation maximization.

UNIT IV NEURAL NETWORKS **9**

Multilayer perceptron, activation functions, network training – gradient descent optimization – stochastic gradient descent, error backpropagation, from shallow networks to deep networks –Unit saturation (aka the vanishing gradient problem) – ReLU, hyperparameter tuning, batch normalization, regularization, dropout.

UNITV DESIGN AND ANALYSIS OF MACHINE LEARNING EXPERIMENTS **8**

Guidelines for machine learning experiments, Cross Validation (CV) and resampling – K-fold CV, bootstrapping, measuring classifier performance, assessing a single classification algorithm and comparing two classification algorithms – *t* test, McNemar's test, K-fold CV paired *t* test.

TOTAL: 45 PERIODS

COURSE OUTCOMES

On successful completion of this course, the students will be able to:

CO1: Explain the basic concepts of machine learning.
CO2: Construct supervised learning models.
CO3: Construct unsupervised learning algorithms.
CO4: Evaluate and compare different models.
CO5: Evaluate the algorithms based on corresponding metrics identified.

TEXT BOOKS

1. Ethem Alpaydin, "Introduction to Machine Learning", MIT Press, Fourth Edition, 2020.
2. Stephen Marsland, "Machine Learning: An Algorithmic Perspective", 2nd Edition, CRC Press, 2014.
3. Kevin P. Murphy, "Machine Learning: A Probabilistic Perspective",1st Edition, MIT Press, 2012.

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REFERENCE BOOKS

1. Christopher M. Bishop, "Pattern Recognition and Machine Learning", Springer, 2006.
2. Tom Mitchell, "Machine Learning", Mc Graw Hill,3rd Edition,1997.
3. Mehryar Mohri, Afshin Rostamizadeh, Ameet Talwalkar, "Foundations of Machine Learning", Second Edition, MIT Press, 2018.
4. Ian Good fellow, Yoshua Bengio, Aaron Courville, "Deep Learning", MIT Press, 2016.
5. Sebastain Raschka, Vahid Mirjalili, "Python Machine Learning", Packt publishing, 3rd Edition, 2019.

Mapping of COs with POs & PSOs

COs	POs												PSOs		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO 1	2	1	2	1	-	-	-	-	3	3	2	2	2	2	1
CO 2	1	3	3	1	2	-	-	-	2	2	2	1	3	1	1
CO 3	2	1	3	3	2	-	-	-	1	1	1	1	1	2	1
CO 4	2	3	3	2	1	-	-	-	3	2	3	2	1	2	1
CO 5	1	1	3	3	1	-	-	-	3	1	1	3	3	3	2
AVG	**1.6**	**1.8**	**2.8**	**2**	**1.5**	**-**	**-**	**-**	**2.4**	**1.8**	**1.8**	**1.8**	**2**	**2**	**1.2**

1-Low, 2-Medium, 3-High, "-" – No correlation

24AI4104 DATA VISUALIZATION TECHNIQUES **L T P C**

3 0 0 3

COURSE OBJECTIVES

- To implement data visualization using Matplotlib.
- To perform univariate and bivariate data exploration and analysis.
- To use Data exploration and visualization techniques for multivariate and time series data.

UNIT I EXPLORATORY DATA ANALYSIS **9**

EDA fundamentals – Understanding data science – Significance of EDA – Making sense of data – Comparing EDA with classical and Bayesian analysis – Software tools for EDA - Visual Aids for EDA- Data transformation techniques-merging database, reshaping and pivoting, Transformation techniques - Grouping Datasets - data aggregation – Pivot tables and cross-tabulations.

UNIT II VISUALIZING USING MATPLOTLIB **9**

Importing Matplotlib – Simple line plots – Simple scatter plots – visualizing errors – density and contour plots – Histograms – legends – colors – subplots – text and annotation – customization – three-dimensional plotting - Geographic Data with Basemap - Visualization with Seaborn.

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UNIT III UNIVARIATE ANALYSIS **9**

Introduction to Single variable: Distributions and Variables - Numerical Summaries of Level and Spread - Scaling and Standardizing – Inequality - Smoothing Time Series.

UNIT IV BIVARIATE ANALYSIS **9**

Relationships between Two Variables - Percentage Tables - Analyzing Contingency Tables - Handling Several Batches - Scatterplots and Resistant Lines – Transformations.

UNIT V MULTIVARIATE AND TIME SERIES ANALYSIS **9**

Introducing a Third Variable - Causal Explanations - Three-Variable Contingency Tables and Beyond - Longitudinal Data – Fundamentals of TSA – Characteristics of time series data – Data Cleaning – Time-based indexing – Visualizing – Grouping – Resampling.

TOTAL:45 PERIODS

COURSE OUTCOMES

On successful completion of this course, the students will be able to

CO1: Explain the fundamentals of exploratory data analysis.
CO2: Implement the data visualization using Matplotlib.
CO3: Perform univariate data exploration and analysis.
CO4: Apply bivariate data exploration and analysis.
CO5: Use Data exploration and visualization techniques for multivariate and time series data.

TEXT BOOKS

1. Suresh Kumar Mukhiya, Usman Ahmed, "Hands-On Exploratory Data Analysis with Python", Packt Publishing, 2020.
2. Jake Vander Plas, "Python Data Science Handbook: Essential Tools for Working with Data", Oreilly, 1st Edition, 2016.
3. Catherine Marsh, Jane Elliott, "Exploring Data: An Introduction to Data Analysis for Social Scientists", Wiley Publications, 2nd Edition, 2008.

REFERENCE BOOKS

1. Eric Pimpler, "Data Visualization and Exploration with R", GeoSpatial Training service, 2017.
2. Claus O. Wilke, "Fundamentals of Data Visualization", O'reilly publications, 2019.
3. Matthew O. Ward, Georges Grinstein, Daniel Keim, "Interactive Data Visualization: Foundations, Techniques, and Applications", 2nd Edition, CRC press, 2015.
4. Vineet Raina, Srinath Krishna murthy, "Building an Effective Data Science Practice: A Framework to Bootstrap and Manage a Successful Data Science Practice", Apress, 2021.
5. Harold Abelson, Gerald Jay Sussman, Julie Sussman, "Structure and Interpretation of Computer Programs",2nd Edition, MIT Press, 1996.

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Mapping of COs with POs & PSOs

COs	POs												PSOs	
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
CO 1	3	1	3	3	-	-	-	-	2	3	3	3	2	2
CO 2	2	2	2	1	1	-	-	-	3	2	3	1	3	1
CO 3	2	1	2	1	1	-	-	-	3	2	1	2	2	2
CO 4	2	2	2	1	-	-	-	-	1	2	1	3	1	3
CO 5	3	1	1	2	1	-	-	-	3	2	1	2	2	2
AVG	**2.4**	**1.4**	**2**	**1.8**	**1**	**-**	**-**	**-**	**2.4**	**2.2**	**1.8**	**2.2**	**2**	**2**

1-Low, 2-Medium, 3-High, "-" – No correlation

24IT4103 NETWORK TECHNOLOGIES **L T P C**

3 0 2 4

COURSE OBJECTIVES

- To understand the concept of layering in networks.
- To know the functions of protocols of each layer of TCP/IP protocol suite.
- To visualize the end-to-end flow of information.

UNIT I INTRODUCTION AND APPLICATION LAYER **10**

Data Communication - Networks – Network Types – Protocol Layering – TCP/IP Protocol suite – OSI Model – Introduction to Sockets -Application Layer protocols: HTTP – FTP – Email protocols (SMTP - POP3 - IMAP - MIME) – DNS – SNMP.

UNIT II TRANSPORT LAYER **9**

Introduction - Transport-Layer Protocols: UDP – TCP: Connection Management – Flow control -Congestion Control - Congestion avoidance (DEC bit, RED) – SCTP – Quality of Service.

UNIT III NETWORK LAYER **7**

Switching: Packet Switching- Internet protocol - IPV4 – IP Addressing – Subnetting - IPV6, ARP, RARP, ICMP, DHCP.

UNIT IV ROUTING **7**

Routing and protocols: Unicast routing – Distance Vector Routing – RIP – Link State Routing – OSPF – Path-vector routing - BGP - Multicast Routing: DVMRP – PIM.

UNIT V DATALINK AND PHYSICAL LAYERS **12**

Data Link Layer – Framing – Flow control – Error control – Data – Link Layer Protocols – HDLC– PPP - Media Access Control – Ethernet Basics – CSMA/CD – Virtual LAN – Wireless LAN (802.11) - Physical Layer: Data and Signals - Performance – Transmission media- Switching – Circuit Switching.

TOTAL:45 PERIODS

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LIST OF EXPERIMENTS

1. Learn to use commands like TCP dump, netstat, if config, ns lookup and trace route. Capture ping and trace route PDUs using a network protocol analyzer and examine.
2. Write a HTTP web client program to download a webpage using TCP sockets.
3. Applications using TCP sockets like: a) Echo client and echo server. b) Chat.
4. Simulation of DNS using UDP sockets.
5. Use a tool like Wire shark to capture packets and examine the packets
6. Write a code simulating ARP/RARP protocols.
7. Study of Network simulator (NS) and Simulation of Congestion Control Algorithms using NS.
8. Study of TCP/UDP performance using Simulation tool.

TOTAL: 30 PERIODS

COURSE OUTCOMES

On successful completion of this course, the students will be able to

CO1: Explain the basic layers and its functions in computer networks.
CO2: Explore the basics of how data flows from one node to another.
CO3: Analyze routing algorithms.
CO4: Describe protocols for various functions in the network.
CO5: Analyze the working of various application layer protocols.

TEXT BOOKS

1. Ames F. Kurose, Keith W. Ross, "Computer Networking, A Top – Down Approach Featuring the Internet", Eighth Edition, Pearson Education, 2021.
2. Behrouz A. Forouzan, "Data Communications and Networking with TCP/IP Protocol Suite", Sixth Edition, TMH, 2022.
3. Andrew S. Tanenbaum, David J. Wetherall, "Computer Networks",5th Edition, Pearson Education, 2011.

REFERENCE BOOKS

1. Larry L. Peterson, Bruce S. Davie, "Computer Networks: A Systems Approach", Fifth Edition, Morgan Kaufmann Publishers Inc., 2012.
2. William Stallings, "Data and Computer Communications", Tenth Edition, Pearson Education, 2013.
3. Nader F. Mir, "Computer and Communication Networks", Second Edition, Prentice Hall, 2014.
4. Ying- DarLin, Ren- Hung Hwang, Fred Baker, "Computer Networks: An Open Source Approach", McGraw Hill, 2012.
5. D. M. George, "Elements of Computer Networking: An Integrated Approach", Universities Press, 2006.

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Mapping of COs with POs & PSOs

COs	POs												PSOs	
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
CO 1	3	1	2	3	-	-	-	-	1	1	3	1	3	2
CO 2	3	2	1	2	2	-	-	-	2	2	2	1	3	2
CO 3	2	2	3	2	1	-	-	-	3	3	1	2	1	1
CO 4	1	3	1	3	1	-	-	-	1	2	1	1	1	3
CO 5	3	3	1	1	2	-	-	-	2	2	2	2	2	2
AVG	**2.4**	**2.2**	**1.6**	**2.2**	**1.5**	**-**	**-**	**-**	**1.8**	**2**	**1.8**	**1.4**	**2**	**2**

1-Low, 2-Medium, 3-High, "-" – No correlation

24CY4101 ENVIRONMENTAL SCIENCE **L T P C**

2 0 0 2

COURSE OBJECTIVES

- To introduce the basic concepts of environment, ecosystems and biodiversity and emphasize on the biodiversity of India and its conservation.
- To impart knowledge on the causes, effects and control or prevention measures of environmental pollution and natural disasters.
- To facilitate the understanding of global and Indian scenario of renewable and non renewable resources, causes of their degradation and measures to preserve them.

UNIT I ENVIRONMENT AND BIODIVERSITY **6**

Definition - scope and importance of environment. Eco-system and Energy flow– ecological succession. Types of biodiversity: genetic, species and ecosystem diversity– values of biodiversity, India as a mega-diversity nation – hot-spots of biodiversity – threats to biodiversity: habitat loss, poaching of wildlife, man-wildlife conflicts – endangered and endemic species of India – conservation of biodiversity: In- situ and ex-situ.

UNIT II NATURAL RESOURCES **6**

Forest resources: deforestation, timber extraction, mining, dams and their effects on forests and tribal people. Water resources: over-utilization of surface and ground water. Mineral resources: environmental effects of extracting and using mineral resources. Food resources: World food problems, effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity.

UNIT III ENVIRONMENTAL POLLUTION **6**

Causes, Effects and Preventive measures of Water, Soil and Air Pollution. Environmental protection acts [Environment Act, Air Act, Water Act]. Disaster management: causes - effects - control measures of floods – earthquake.

UNIT IV NON-CONVENTIONAL ENERGY **6**

Energy management and conservation, New Energy Sources: Solar energy, Wind energy, Biomass energy, Hydrogen energy, Ocean energy resources, Tidal energy conversion. Concept, origin and power plants of geothermal energy.

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UNIT V SUSTAINABILITY MANAGEMENT **6**

Sustainable development, Unsustainability to sustainability, GDP, Carbon Credit, Carbon Footprint, Zero waste and R concept, Sustainable habitat: Green buildings, Green materials, Energy efficiency, Sustainable transports, Green Engineering.

TOTAL: 30 PERIODS

COURSE OUTCOMES

On successful completion of this course, the student will be able to

CO1: Explore the functions of environment, ecosystems and biodiversity.

CO2: Examine the relationship between natural resources and their environment.

CO3: Identify the causes, effects of environmental pollution.

CO4: Recognize the sources of Non-conventional energy.

CO5: Explain the needs of sustainable development and green materials.

TEXT BOOKS

1. Anubha Kaushik and C. P. Kaushik's "Perspectives in Environmental Studies", 6th Edition, New Age International Publishers ,2018.
2. Benny Joseph, "Environmental Science and Engineering", Tata McGraw-Hill, New Delhi, 2016.
3. Gilbert M. Masters, "Introduction to Environmental Engineering and Science", 2nd edition, Pearson Education,2004.

REFERENCE BOOKS

1. R. K. Trivedi, "Hand book of Environmental Laws, Rules, Guidelines, Compliances and Standards", Vol. I and II, Enviro Media. 38. edition 2010.
2. Cunningham, W. P. Cooper, T. H. Gorhani, "Environmental Encyclopedia", Jaico Publ., House, Mumbai, 2001.
3. Dharmendra S. Sengar, "Environmental law", Prentice hall of India PVT. LTD, New Delhi, 2007.
4. Rajagopalan, R, "Environmental Studies – From Crisisto Cure", Oxford University Press, Third Edition, 2015.
5. Erach Bharucha, "Textbook of Environmental Studies for Undergraduate Courses" Orient Blackswan Pvt. Ltd. 2013.

Mapping of COs with POs & PSOs

Cos	POs												PSOs	
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
CO 1	2	2	-	-	-	-	3	-	-	-	-	-	2	-
CO 2	2	2	-	-	-	-	3	-	-	-	-	-	2	-
CO 3	2	2	-	-	-	-	3	-	-	-	-	-	2	-
CO 4	2	2	-	-	-	-	3	-	-	-	-	-	2	-
CO 5	2	2	-	-	-	-	3	-	-	-	-	-	-	-
AVG	**2**	**2**	**-**	**-**	**-**	**-**	**3**	**-**	**-**	**-**	**-**	**-**	**2**	**-**

1-Low, 2-Medium, 3-High, "-" – No correlation

24AI4201 DATA VISUALIZATION LABORATORY **L T P C**
0 0 3 1.5

COURSE OBJECTIVES

- To implement data visualization using Matplotlib.
- To perform univariate data exploration and analysis.
- To use Data exploration and visualization techniques for multivariate and time series data.

LIST OF EXPERIMENTS

1. Install the data Analysis and Visualization tool: R/ Python /Tableau Public/ Power BI.
2. Perform exploratory data analysis (EDA) on with datasets like email data set. Export all your emails as a dataset, import them inside a pandas data frame, visualize them and get different insights from the data.
3. Working with NumPy arrays, Pandas data frames, Basic plots using Matplotlib.
4. Working with multiple datasets and reshape the data, to merge two dataset using merge () and joint () and use pivot ().
5. Explore various variable and row filters in R for cleaning data. Apply various plot features in R on sample data sets and visualize.
6. Perform Time Series Analysis and apply the various visualization techniques.
7. Perform Data Analysis and representation on a Map using various Map data sets with Mouse Rollover effect, user interaction, etc.
8. Build cartographic visualization for multiple datasets involving various countries of the world; states and districts in India etc.
9. Perform EDA on Wine Quality Data Set.
10. Use a case study on a data set and apply the various EDA and visualization techniques and present an analysis report.
11. Use seaborn for high level visualization of heatmaps.
12. Study interaction among more than two variables, style, size and hue in seaborn plots.

TOTAL:45 PERIODS

COURSE OUTCOMES

On successful completion of this course, the students will be able to

CO1: Explain the fundamentals of exploratory data analysis.

CO2: Implement the data visualization using Matplotlib.

CO3: Perform univariate data exploration and analysis.

CO4: Apply bivariate data exploration and analysis.

CO5: Use Data exploration and visualization techniques for multivariate and time series data.

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Mapping of COs with POs & PSOs

Cos	POs												PSOs	
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
CO 1	3	1	3	3	-	-	-	-	2	3	3	3	2	2
CO 2	2	2	2	1	1	-	-	-	3	2	3	1	3	1
CO 3	2	1	2	1	1	-	-	-	3	2	1	2	2	2
CO 4	2	2	2	1	-	-	-	-	1	2	1	3	1	3
CO 5	3	1	1	2	1	-	-	-	3	2	1	2	2	2
AVG	**2.4**	**1.4**	**2**	**1.6**	**1**	**-**	**-**	**-**	**2.4**	**2.2**	**1.8**	**2.2**	**2**	**2**

1-Low, 2-Medium, 3-High, "-" – No correlation

24AI4202 MACHINE LEARNING LABORATORY **L T P C**

0 0 3 1.5

COURSE OBJECTIVES

- To understand the datasets and apply suitable algorithms for selecting the appropriate features for analysis.
- To learn to implement supervised machine learning algorithms on standard datasets and evaluate the performance.
- To experiment the unsupervised machine learning algorithms on standard datasets and evaluate the performance.

LIST OF EXPERIMENTS

1. For a given set of training data examples stored in a .CSV file, implement and demonstrate the Candidate-Elimination algorithm to output a description of the set of all hypotheses consistent with the training examples.
2. 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.
3. Build an Artificial Neural Network by implementing the Back propagation algorithm and test the same using appropriate data sets.
4. Write a program to implement the naïve Bayesian classifier for a sample training datasets to redasa.CSV file and compute the accuracy with a few test datasets.
5. Implement naïve Bayesian Classifier model to classify a set of documents an measure the accuracy, precision, and recall.
6. Write a program to construct a Bayesian network to diagnose CORONA infection using standard WHO Data Set.
7. Implement linear regression from scratch and using libraries
8. Implement support vector machine by using iris dataset.
9. Implement Random forest algorithm in ensemble learning.
10. Apply EM algorithm to cluster a set of data stored in a.CSV file. Use the same dataset for clustering using the k-Means algorithm. Compare the results of these two algorithms.

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11. Write a program to implement *k*-Nearest Neighbour algorithm to classify the iris data set. Print both correct and wrong predictions.
12. Implement the non-parametric Locally Weighted Regression algorithm in order to fit data points. Select an appropriate data set for your experiment and draw graphs.

TOTAL:45 PERIODS

COURSE OUTCOMES

On successful completion of this course, students will be able to

CO1: Apply suitable algorithms for selecting the appropriate features for analysis.

CO2: Implement supervised machine learning algorithms on standard datasets and evaluate the performance.

CO3: Apply unsupervised machine learning algorithms on standard datasets and evaluate the performance.

CO4: Build the graph based learning models for standard datasets.

CO5: Assess and compare the performance of different ML algorithms and select the suitable one based on the application.

Mapping of COs with POs & PSOs

COs	POs												PSOs	
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
CO 1	2	2	2	1	-	-	-	-	1	2	3	3	3	2
CO 2	2	1	1	3	2	-	-	-	3	2	3	2	3	1
CO 3	2	2	1	1	2	-	-	-	1	1	1	1	2	3
CO 4	2	2	3	3	2	-	-	-	1	2	1	1	1	2
CO 5	2	2	3	1	2	-	-	-	3	1	1	1	2	1
AVG	**2**	**1.8**	**2**	**1.8**	**2**	**-**	**-**	**-**	**1.8**	**1.6**	**1.8**	**1.6**	**2.2**	**1.8**

1-Low, 2-Medium, 3-High, "-" – No correlation

24GE4201 TECHNICAL SEMINAR **L T P C**

0 0 2 1

COURSE OBJECTIVES

- To gain knowledge on literature survey in a selected area of study.
- To know an academic document from the literate and to give a presentation about it.
- To prepare a technical report.

COURSE SUMMARY

The course 'Technical Seminar' is anticipated to support a B.E./B.Tech graduate to read, understand, present and prepare report of an academic document. The learner shall search in the literature including peer reviewed journals, conference, books, project reports etc., and identify an appropriate paper/thesis/report in her/his area of interest, in consultation with her/his Technical seminar coordinator/guide. This course can help the learner to experience how a presentation can be made about a selected academic document and also empower her/him to prepare a technical report.

GENERAL GUIDELINES

1. The Department shall form an Internal Evaluation Committee (IEC) for the seminar for that program as the Chairperson/Chairman and seminar coordinator & seminar guide as members.
2. During the seminar presentation of a student, all members of IEC shall be present.
3. Formation of IEC and guide allotment shall be completed within a week after the University examination (or last working day) of the previous semester.
4. Guide shall provide required input to their students regarding the selection of topic/ paper.

Choosing a seminar topic: The topic for a UG seminar should be current and broad based rather than a very specific research work. It's advisable to choose a topic for the Seminar to be closely linked to the final year project area. Every member of the project team could choose or be assigned Seminar topics that covers various aspects linked to the Project area.

- A topic/paper relevant to the discipline shall be selected by the student during the semester break.
- Topic/Paper shall be finalized in the first week of the semester and shall be submitted to the IEC.
- The IEC shall approve the selected topic/paper by the second week of the semester.
- Accurate references from genuine peer reviewed published material to be given in the report and to be verified.

Evaluation pattern (Only internal evaluation)

Guide: (i) 20 marks (Background Knowledge – 10 & Relevance of the paper/topic selected – 10).

Seminar Coordinator: 20 marks (Seminar Diary – 10 (Each student shall maintain a seminar diary and the guide shall monitor the progress of the seminar work on a weekly basis and shall approve the entries in the seminar diary during the weekly meeting with the student), Attendance – 10).

Presentation: 40 marks to be awarded by the IEC (Clarity of presentation – 10, Interactions – 10 (to be based on the candidate's ability to answer questions during the interactive session of her/his presentation), Overall participation – 10 (to be given based on her/his involvement during interactive sessions of presentations by other students), Quality of the slides – 10).

Report: 20 marks to be awarded by the IEC (check for technical content, overall quality, templates followed, adequacy of references etc.).

COURSE OUTCOMES

CO1: Identify academic documents from the literature which are related to her/his areas of interest.

CO2: Read and apprehend an academic document from the literature which is related to her/ his areas of interest.

CO3: Prepare a presentation about an academic document.

CO4: Give a presentation about an academic document.

CO5: Prepare a technical report.

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Mapping of COs with POs & PSOs

Cos	POs												PSOs	
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
CO1	2	2	-	-	2	-	-	-	-	2	-	3	-	-
CO2	3	2	-	-	-	-	-	-	-	2	-	3	-	-
CO3	3	3	-	-	-	-	-	-	-	2	-	3	-	-
CO4	3	3	-	-	2	-	-	-	-	2	-	3	-	-
CO5	3	3	-	-	2	-	-	-	-	2	-	3	-	-
AVG	**2.8**	**2.6**	**-**	**-**	**2**	**-**	**-**	**-**	**-**	**2**	**-**	**3**	**-**	**-**

1-Low, 2-Medium, 3-High, '-'- No correlation

24AI5101 DEEP LEARNING **L T P C**

3 0 0 3

COURSE OBJECTIVES

- To understand and need and principles of deep neural networks.
- To understand CNN and RNN architectures of deep neural networks.
- To comprehend advanced deep learning models.

UNIT I DEEP NETWORKS BASICS **9**

Linear Algebra: Scalars -Vectors - Matrices and tensors; Probability Distributions - Gradient - based Optimization - Machine Learning Basics: Capacity - Over fitting and under fitting - Hyper parameters and validation sets - Estimators - Bias and variance - Stochastic gradient descent - Challenges motivating deep learning; Deep Networks: Deep feed forward networks; Regularization - Optimization.

UNIT II CONVOLUTIONAL NEURAL NETWORKS **9**

Convolution Operation - Sparse Interactions - Parameter Sharing - Equivariance - Pooling - Convolution Variants: Strided - Tiled - Transposed and dilated convolutions; CNN Learning: Non linearity Functions - Loss Functions - Regularization - Optimizers - Gradient Computation.

UNIT III RECURRENT NEURAL NETWORKS **10**

Unfolding Graphs - RNN Design Patterns: Acceptor - Encoder - Transducer; Gradient Computation - Sequence Modeling Conditioned on Contexts - Bidirectional RNN - Sequence to Sequence RNN - Deep Recurrent Networks - Recursive Neural Networks- Long Term Dependencies; Leaky Units: Skip connections and dropouts; Gated Architecture: LSTM.

UNIT IV MODEL EVALUATION **8**

Performance metrics - Baseline Models - Hyper parameters: Manual Hyperparameter – Automatic - Hyperparameter - Grid search - Random search - Debugging strategies.

UNIT V AUTO ENCODERS AND GENERATIVE MODELS **9**

Auto encoders: Under complete autoencoders – Regularized auto encoders – Stochastic encoders and decoders - Learning with auto encoders; Deep Generative Models: Variational auto encoders – Generative adversarial networks.

TOTAL: 45 PERIODS

COURSE OUTCOMES

On successful completion of this course, students will be able to:

CO1: Explain the basics in deep neural networks.

CO2: Apply Convolution Neural Network for image Processing.

CO3: Apply Recurrent Neural Network and its variants for text analysis.

CO4: Apply model evaluation for various applications.

CO5: Apply auto encoders and generative models for suitable applications.

TEXT BOOKS

1. Ian Good fellow, Yoshua Bengio, Aaron Courville, "Deep Learning", MIT Press, 2016.
2. Andrew Glassner, "Deep Learning: A Visual Approach", No Starch Press, 2021.
3. Francois Chollet, "Deep Learning with Python", Manning Publications, 2018.

REFERENCE BOOKS

1. Salman Khan, Hossein Rahmani, Syed Afaq Ali Shah, Mohammed Bennamoun, "A Guideto Convolutional Neural Networks for Computer Vision", Synthesis Lectures on Computer Vision, Morgan & Claypool publishers, 2018.
2. Yoav Goldberg, "Neural Network Methods for Natural Language Processing", Synthesis Lectures on Human Language Technologies, Morgan & Claypool publishers, 2017.
3. Terrence J. Sejnowski, "The Deep Learning Revolution", MIT Press, 2018.
4. Charu C. Aggarwal, "Neural Networks and Deep Learning: A Textbook", Springer International Publishing, 2018.
5. Josh Patterson, Adam Gibson, "Deep Learning: A Practitioner's Approach", O' Reilly Media, 2017.

Mapping of COs with POs & PSOs

COs	POs												PSOs	
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
CO 1	3	2	2	3	1	-	-	-	2	3	1	2	3	3
CO 2	2	2	2	3	3	-	-	-	1	2	2	3	1	1
CO 3	3	3	3	3	3	-	-	-	2	1	1	2	2	1
CO 4	3	3	1	1	1	-	-	-	1	3	1	3	2	1
CO 5	3	2	2	2	3	-	-	-	2	3	2	2	2	3
AVG	**2.8**	**2.4**	**2**	**2.4**	**2.2**	**-**	**-**	**-**	**1.6**	**2.4**	**1.4**	**2.4**	**2**	**1.8**

1-Low, 2-Medium, 3-High, '-'- No correlation

24AI5102 TEXT AND SPEECH ANALYTICS **L T P C**
3 0 0 3

COURSE OBJECTIVES

- Understand natural language processing basics.
- Apply classification algorithms to text documents.
- Build question-answering and dialogue systems.

UNIT I NATURAL LANGUAGE BASICS **9**

Foundations of natural language processing – Language Syntax and Structure- Text Preprocessing and Wrangling – Text tokenization – Stemming – Lemmatization – Removing stop-words – Feature Engineering for Text representation – Bag of Words model- Bag of N-Grams model – TF-IDF model.

UNIT II TEXT CLASSIFICATION **9**

Vector Semantics and Embeddings -Word Embeddings - Word2Vec model – Glove model – Fast Text model – Overview of Deep Learning models – RNN – Transformers – Overview of Text summarization and Topic Models.

UNIT III QUESTION ANSWERING AND DIALOGUE SYSTEMS **9**

Information retrieval – IR-based question answering – knowledge-based question answering – language models for QA – classic QA models – chatbots – Design of dialogue systems -– evaluating dialogue systems.

UNIT IV TEXT-TO-SPEECH SYNTHESIS **9**

Over view, Text normalization, Letter-to-sound Prosody, Evaluation, Signal processing - Concatenative and parametric approaches, Wave Net and other deep learning-based TTS systems.

UNIT V AUTOMATIC SPEECH RECOGNITION **9**

Speech recognition: Acoustic modelling – Feature Extraction - HMM, HMM-DNN systems.

TOTAL:45 PERIODS

COURSE OUTCOMES

On successful completion of the course, the students will be able to

CO1: Explain existing and emerging deep learning architectures for text and speech processing.

CO2: Apply deep learning techniques for NLP tasks, language modelling and machine translation.

CO3: Explain co reference and coherence for text processing.

CO4: Build question-answering systems, chatbots and dialogue systems.

CO5**:** Apply deep learning models for building speech recognition and text-to-speech systems.

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TEXT BOOKS

1. Daniel Jurafsky and James H. Martin, "Speech and Language Processing: An Introduction to Natural Language Processing, Computational Linguistics, and Speech Recognition", Third Edition, 2022.
2. Daniel Jurafsky, James H. Martin, "Speech and Language Processing",3rd Edition Pearson / Prentice Hall,
3. Christopher D. Manning, Hinrich Schütze, "Foundations of Statistical Natural Language Processing", MIT Press, 1999.

REFERENCE BOOKS

1. Dipanjan Sarkar, "Text Analytics with Python: A Practical Real-World approach to Gaining Actionable insights from your data", APress, 2018.
2. Tanveer Siddiqui, Tiwary U S, "Natural Language Processing and Information Retrieval", Oxford University Press, 2008.
3. Lawrence Rabiner, Biing-Hwang Juang, B. Yegnanarayana, "Fundamentals of Speech Recognition" 1st Edition, Pearson, 2009.
4. Steven Bird, Ewan Klein and Edward Loper, "Natural language processing with Python", O'REILLY.
5. Lawrence Rabiner, Biing-Hwang Juang, "Fundamentals of Speech Recognition", Prentice Hall, 1993.

Mapping of COs with POs & PSOs

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO 1	3	2	3	1	3	-	-	-	1	2	1	2	1	1
CO 2	3	1	2	1	3	-	-	-	2	2	1	3	3	2
CO 3	2	2	1	3	1	-	-	-	3	3	1	2	3	3
CO 4	2	1	1	1	2	-	-	-	2	1	2	2	3	1
CO 5	1	3	2	2	1	-	-	-	3	2	1	1	2	3
AVG	2.2	1.8	1.8	1.6	2	-	-	-	2.2	2	1.2	2	2.4	2

1-Low, 2-Medium, 3-High, '-'- No correlation

24IT5102 FULL STACK WEB DEVELOPMENT **L T P C**
3 0 0 3

COURSE OBJECTIVES

- To understand the various components of full stack development.
- To learn Node.js features and applications.
- To develop applications with MongoDB.

UNIT I BASICS OF FULL STACK **9**

Understanding the Basic Web Development Framework - User - Browser – Webserver - Backend Services–MVC Architecture – Understanding the different stacks –Therole of Express –Angular– Node – Mongo DB – React.

UNIT II NODE JS **9**

Basics of Node JS – Installation – Working with Node packages – Using Node package manager– Creating a simple Node.js application – Using Events – Listeners –Timers - Callbacks – Handling Data I/O – Implementing HTTP services in Node.js.

UNIT III MONGODB **9**

Understanding NoSQL and MongoDB – Building MongoDB Environment – User accounts – Access control–Administering databases – Managing collections – Connecting to MongoDB from Node.js – simple applications.

UNIT IV EXPRESS AND ANGULAR **9**

Implementing Express in Node.js - Configuring routes - Using Request and Response objects - Angular - Typescript - Angular Components - Expressions - Data binding - Built-in directives.

UNIT V REACT **9**

MERN STACK – Basic React applications – React Components – React State – Express RESTAPIs - Modularization and Webpack – Routing with React Router – Server-side rendering.

TOTAL:45 PERIODS

COURSE OUTCOMES

On successful completion of this course, students will be able to

CO1: Explain the various stacks available for web application development.
CO2: Use Node.js for application development.
CO3: Develop applications with MongoDB.
CO4: Use the features of Angular and Express.
CO5: Develop React applications.

TEXT BOOKS

1. Brad Dayley, Brendan Dayley, Caleb Dayley, “Node.js, MongoDB and Angular Web Development”, Addison - Wesley, Second Edition, 2018.
2. Vasan Subramanian, “Pro MERN Stack, Full Stack Web App Development with Mongo, Express, React, and Node”, Second Edition, Apress, 2019.
3. Full-Stack Web Development with Vue, Node, and MongoDB "by Aneeta Sharma.

REFERENCE BOOKS

1. Chris Northwood, “The Full Stack Developer: Your Essential Guide to the Everyday Skills Expected of a Modern Full Stack Web Developer”, A press; 1st Edition, 2018.
2. Kirupa Chinnathambi, “Learning React: A Hands – On Guide to Building Web Applications Using React and Redux”, Addison – Wesley Professional, 2nd Edition, 2018.
3. Shyam Seshadri, “Angular Up and Running”, O'Reilly Media; 2nd Edition, 2018.
4. David Choi, “Full-Stack React, TypeScript, and Node”, Packt Publishing, 1st Edition, 2022.
5. Alex Banks, Eve Porcello, “Learning React: Modern Patterns for Developing React Apps”, O’Reilly Media, 3rd Edition 2023.

Mapping of COs with POs & PSOs

COs	POs												PSOs	
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
CO 1	3	2	-	-	-	-	-	-	1	1	1	1	1	1
CO 2	3	3	3	3	2	1	-	-	2	-	2	3	2	2
CO 3	3	3	2	2	2	2	-	-	2	2	2	3	2	2
CO 4	3	3	2	2	2	1	-	-	1	1	2	2	2	1
CO 5	3	3	3	3	3	1	-	-	-	-	2	2	2	2
AVG	**3**	**2.8**	**2.5**	**2.5**	**2.25**	**1.25**	**-**	**-**	**1.5**	**1.3**	**1.8**	**2.2**	**1.8**	**1.6**

1-Low, 2-Medium, 3-High, '-'- No correlation

24AI5103 BIG DATA INTELLIGENCE **L T P C**

3 0 0 3

COURSE OBJECTIVES

- To understand big data.
- To learn and use NoSQL big data management.
- To learn map reduce analytics using Hadoop and related tools.

UNIT I UNDERSTANDING BIG DATA **9**

Introduction to big data – convergence of key trends – unstructured data – industry examples of big data– web analytics – big data applications – big data technologies – introduction to Hadoop – open source technologies – cloud and big data – mobile business intelligence – Crowd sourcing analytics – inter and trans firewall analytics.

UNIT II NOSQL DATA MANAGEMENT **9**

Introduction to NoSQL – aggregate data models – key-value and document data models – relationships – graph databases – schema less databases – materialized views – distribution models – master - slave replication – consistency - Cassandra – Cassandra data model – Cassandra examples – Cassandra clients.

UNIT III MAP REDUCE APPLICATIONS **9**

Map Reduce work flows – unit tests with MR Unit – test data and local tests–anatomy of Map Reduce job run – classic Map - reduce – YARN – failures in classic Map – reduce and YARN – job scheduling – shuffle and sort – task execution – Map Reduce types – input formats – output formats.

UNIT IV BASICS OF HADOOP **9**

Data format – analyzing data with Hadoop – scaling out – Hadoop streaming – Hadoop pipes – design of Hadoop distributed file system (HDFS) – HDFS concepts – Java interface – data flow – Hadoop I/O – data integrity – compression – serialization – Avro – file-based data structures - Cassandra – Hadoop integration.

UNIT V HADOOP RELATED TOOLS **9**

H base – data model and implementations – H base clients – H base examples – praxis.Pig – Grunt–pig data model – Pig Latin – developing and testing Pig Latin scripts. Hive – data types and file formats–Hive QL data definition – Hive QL data manipulation – Hive QL queries.

TOTAL:45 PERIODS

COURSE OUTCOMES

On successful completion of this course, students will be able to

CO1: Describe big data and use cases from selected business domains.

CO2: Explain NoSQL big data management.

CO3: Install, configure, and run Hadoop and HDFS.

CO4: Perform map-reduce analytics using Hadoop.

CO5: Use Hadoop - related tools such as H Base, Cassandra, Pig, and Hive for big data analytics.

TEXT BOOKS

1. Michael Minelli, Michelle Chambers, and Ambiga Dhiraj, "Big Data, Big Analytics: Emerging Business Intelligence and Analytic Trends for Today's Businesses", Wiley, 2013.
2. Eric Sammer, "Hadoop Operations", O' Reilley, 2012.
3. Pramod J. Sadalage, Martin Fowler, "NoSQL Distilled: A Brief Guide to the Emerging World of Polyglot Persistence", Addison-Wesley, 2013.

REFERENCE BOOKS

1. E. Capriolo, D. Wampler, and J. Rutherglen, "Programming Hive", O' Reilley,2012.
2. Lars George, "H Base: The Definitive Guide", O' Reilley, 2011.
3. Eben Hewitt, "Cassandra: The Definitive Guide", O' Reilley, 2010.
4. Alan Gates, "Programming Pig", O' Reilley, 2011.
5. Raj Kamal, "Big Data Analytics: Introduction to Hadoop, Spark and Machine Learning", McGraw Hill Education, 2019.

Mapping of COs with POs & PSOs

COs	POs												PSOs	
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
CO 1	3	3	3	3	3	-	-	-	2	2	3	1	1	3
CO 2	3	3	2	3	2	-	-	-	2	2	3	3	2	3
CO 3	3	3	3	2	3	-	-	-	2	2	1	2	2	3
CO 4	2	3	3	3	3	-	-	-	2	2	3	2	3	3
CO 5	3	3	3	3	3	-	-	-	3	1	3	2	3	2
AVG	**2.8**	**3**	**2.8**	**2.8**	**2.8**	**-**	**-**	**-**	**2.2**	**1.8**	**2.6**	**2**	**2.2**	**2.8**

1-Low, 2-Medium, 3-High, '-'- No correlation

24AI5201 DEEP LEARNING LABORATORY **L T P C**

0 0 3 1.5

COURSE OBJECTIVES

- To understand the tools and techniques to implement deep neural networks.
- To apply different deep learning architectures for solving problems.
- To implement generative models for suitable applications.

LIST OF EXPERIMENTS

1. Solving XOR problem using DNN.
2. Character recognition using CNN. Face recognition using CNN.
3. Language modeling using RNN.
4. Sentiment analysis using LSTM.
5. Parts of speech tagging using Sequence to Sequence architecture.
6. Machine Translation using Encoder – Decoder model.
7. Image augmentation using GANs.
8. Text Summarization using Transformer Models.
9. Implement CNN variant for classification
10. Object Detection using YOLO or SSD.
11. Mini-project on real world applications.
12. Evaluate model performs and perform tuning.

TOTAL:45 PERIODS

COURSE OUTCOMES

On successful completion of this course, students will be able to

CO1: Apply deep neural network for simple problems.

CO2: Apply Convolution Neural Network for image processing.

CO3: Apply Recurrent Neural Network and its variants for text analysis.

CO4: Apply generative models for data augmentation.

CO5: Develop real – world solutions using suitable deep neural networks.

Mapping of COs with POs & PSOs

COs	Pos												PSOs	
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
CO 1	3	2	1	1	1	-	-	-	3	2	3	2	3	3
CO 2	1	3	2	2	2	-	-	-	3	2	2	2	1	3
CO 3	3	2	1	2	1	-	-	-	2	3	1	1	2	3
CO 4	3	3	1	2	1	-	-	-	1	3	2	2	3	2
CO 5	3	3	3	3	2	-	-	-	1	2	3	1	3	3
AVG	**2.6**	**2.6**	**1.6**	**2**	**1.4**	**-**	**-**	**-**	**2**	**2.4**	**2.2**	**1.6**	**2.4**	**2.8**

1-Low, 2-Medium, 3-High, '-'- No correlation

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24IT5202 FULL STACK WEB DEVELOPMENT LABORATORY **L T P C**
0 0 3 1.5

COURSE OBJECTIVES

- To develop full stack applications with clear understanding of user interface, business logic and data storage.
- To design and develop user interface screens for a given scenario.
- To describe the different environments that web applications are deployed.

LIST OF EXPERIMENTS

The Instructor can choose the technology stack to develop the following full stack experiments– Based on the Full Stack Web Development Theory Course.

1. Develop a portfolio web site for yourself which gives details about yourself for a potential recruiter.
2. Create a web application to manage the TO – DO list of users, where users can login and manage their to-do items.
3. Create a simple micro blogging application (like twitter) that allows people to post their content which can be viewed by people who follow them.
4. Create a food delivery web site where users can order food from a particular restaurant listed in the website.
5. Develop a classified web application to buy and sell used products.
6. Develop a leave management system for an organization where user scan apply different types of leaves such as casual leave and medical leave. They also can view the available number of days.
7. Develop a simple dashboard for project management where the statuses of various tasks are available. New tasks can be added and the status of existing tasks can be changed among Pending, In Progress or Completed.
8. Develop an online survey application where a collection of questions is available and users are asked to answer any random 5 questions.
9. Blog Platform with Comments.
10. E-commerce Website.
11. Online Survey Application.
12. Leave Management System.

TOTAL: 45 PERIODS

COURSE OUTCOMES

On successful completion of this course, students will be able to

CO1: Design full stack applications with clear understanding of user interface, business logic and data storage.
CO2: Design and develop user interface screens.
CO3: Implement the functional requirements using appropriate tool.
CO4: Design and develop database based on the requirements.
CO5: Integrate all the necessary components of the application.

Mapping of COs with POs & PSOs

COs	POs												PSOs	
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
CO 1	3	3	3	1	3	1	1	1	2	1	1	1	2	2
CO 2	3	3	3	2	3	1	1	1	2	1	1	1	2	2
CO 3	3	3	3	3	3	1	1	1	2	1	1	1	2	2
CO 4	3	3	3	3	3	2	1	1	1	1	2	1	1	2
CO 5	3	3	3	3	2	1	1	1	1	1	1	1	2	2
AVG	**3**	**3**	**3**	**2.4**	**2.8**	**1.2**	**1**	**1**	**1.6**	**1**	**1.2**	**1**	**1.8**	**2**

1-Low, 2-Medium, 3-High, '-'- No correlation

24AI6101 APP DEVELOPMENT **L T P C**
3 0 2 4

COURSE OBJECTIVES

- To learn development of native applications with basic GUI Components.
- To develop cross – platform applications with even that handling.
- To develop applications with location and data storage capabilities.

UNIT I FUNDAMENTAL OF MOBILE APP DEVELOPMENT **9**

Basics of Web and Mobile application development, Native App, Hybrid App, Cross – platform App, what is Progressive Web App, Responsive Web design.

UNIT II NATIVE APP DEVELOPMENT USING JAVA **9**

Native Web App, Benefits of Native App, Scenarios to create Native App, Tools for creating Native App, Cons of Native App, Popular Native App Development Frameworks, Java & Kotlin for Android, Swift & Objective-C for iOS, Basics of React Native, Native Components, JSX, State, Props.

UNIT III HYBRID APP DEVELOPMENT **9**

Hybrid Web App, Benefits of Hybrid App, Criteria for creating Native App, Tools for creating Hybrid App, Cons of Hybrid App, Popular Hybrid App Development Frameworks, Ionic, Apache Cordova.

UNIT IV CROSS – PLATFORM APP DEVELOPMENT USING REACT – NATIVE **9**

What is Cross-platform App, Benefits of Cross-platform App, Criteria for creating Cross-platform App, Tools for creating Cross-platform App, Cons of Cross-platform App, Popular Cross- platform App Development Frameworks, Flutter, Xamarin, React-Native, Basics of React Native, Native Components, JSX, State, Props.

UNIT V NON – FUNCTIONAL CHARACTERISTICS OF APP FRAMEWORKS **9**

Comparison of different App frameworks, Build Performance, App Performance, Debugging capabilities, Time to Market, Maintainability, Ease of Development, UI/UX, Reusability.

TOTAL:45 PERIODS

LIST OF EXPERIMENTS

1. Using react native, build a cross platform application for a BMI calculator.
2. Using flutter, build a cross platform application for a body fat measuring.
3. Build a cross platform application for a simple expense manager which allows entering expenses and income on each day and displays category wise weekly income and expense.
4. Develop a cross platform application to convert units from imperial system to metric system (km to miles, kg to pounds etc.,)
5. Design and develop a cross platform application for day to day task (to - do) management. Design an android application using Cordova for a user login screen with username, password, reset button and a submit button. Also, include header image and a label. Use layout managers.
6. Design and develop an android application using Apache Cordova to find and display the current location of the user.
7. Write programs using Java to create Android application having Data bases For a simple library application.
8. For displaying books available, books lend, book reservation. Assume that student information is available in a database which has been stored in a database server.

TOTAL:30 PERIODS

COURSE OUTCOMES

On successful completion of this course, students will be able to

CO1: Develop Native applications with GUI Components.

CO2: Develop hybrid applications with basic event handling.

CO3: Implement cross – platform applications with location and data storage capabilities.

CO4: Implement cross platform applications with basic GUI and event handling.

CO5: Develop web applications with cloud database access.

TEXT BOOKS

1. Dawn Griffiths, David Griffiths, "Head First Android Development",1st Edition, O'Reilly Media, 2015.
2. Raymond K. Camden, "Apache Cordova in Action", Manning Publications, 2015.
3. Anthony Accomazzo, Houssein Djirdeh, Sophia Shoemaker, Devin Abbott, "Fullstack React Native: Create Beautiful Mobile Apps with JavaScript and React Native" Fullstack.io Publishing, 2017.

REFERENCE BOOKS

1. John Horton, "Android Programming for Beginners",2nd Edition, Packt Publishing, 2018.
2. Shaun Lewis, "Mike Dunn Native Mobile Development", BPB Publications, 2021.
3. Pawan Lingras, Matt Triff, Rucha Lingras, "Building Cross-Platform Mobile and Web Apps for Engineers and Scientists: An Active Learning Approach", Springer, 2017.
4. John M. Wargo, "Apache Cordova 4 Programming", Addison-Wesley Professional, 2015.
5. Dan Ward, "React Native Cookbook",2nd Edition, Packt Publishing, 2019.

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Mapping of COs with POs & PSOs

COs	POs												PSOs	
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
CO 1	2	2	1	2	3	-	-	-	1	1	2	1	2	3
CO 2	2	1	3	2	2	-	-	-	3	2	2	3	3	2
CO 3	2	2	2	1	2	-	-	-	1	1	1	1	1	1
CO 4	1	3	1	1	3	-	-	-	1	1	3	2	1	3
CO 5	1	1	3	1	3	-	-	-	1	1	2	1	3	2
AVG	**1.6**	**1.8**	**2**	**1.4**	**2.6**	**-**	**-**	**-**	**1.4**	**1.2**	**2**	**1.6**	**2**	**2.2**

1-Low, 2-Medium, 3-High, '-'- No correlation

24IT6201 MOBILE APPLICATIONS DEVELOPMENT LABORATORY **L T P C**
0 0 3 1.5

COURSE OBJECTIVES

- To use Flutter / Kotlin multi-platform environment for building cross-platform mobile applications.
- To demonstrate the knowledge of different programming techniques and patterns.
- To identify the components and structure of mobile application development frameworks.

LIST OF EXPERIMENTS

1. Study and installation of Flutter / Kotlin multi-platform environment.
2. Develop an application that uses Widgets, GUI components, Fonts, and Colors.
3. Develop an active calculator application.
4. Develop a gaming application that uses 2 – D animations and gestures.
5. Develop a movie rating application (similar to IMDB).
6. Develop an application to connect to a web service and to retrieve data with HTTP.
7. Develop a simple shopping application.
8. Design a web server supporting push notifications.
9. Develop an application by integrating Google maps.
10. Mini Projects involving Flutter / Kotlin multi-platform.
11. Design and develop an android application using Apache Cordova to find and display the current location of the user.
12. Write programs using Java to create Android application having Databases for a simple library application.

TOTAL:45 PERIODS

COURSE OUTCOMES

On successful completion of this course, students will be able to

CO1: Design and build simple mobile applications supporting multiple platforms.

CO2: Apply various programming techniques and patterns to build mobile applications.

CO3: Build real – time mobile applications for society/environment.

CO4: Build gaming and multimedia based mobile applications.

CO5: Build AI based mobile applications for society ethical practices.

Mapping of COs with POs & PSOs

COs	POs												PSOs	
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
CO 1	3	3	3	1	3	1	1	1	2	1	1	1	2	2
CO 2	3	3	3	2	3	1	1	1	2	1	1	1	2	2
CO 3	3	3	3	3	3	3	2	2	3	3	3	3	3	3
CO 4	3	3	3	3	3	2	1	1	1	1	2	1	1	2
CO 5	3	3	3	3	2	1	1	1	1	1	1	1	2	2
AVG	**3**	**3**	**3**	**2.4**	**2.8**	**1.6**	**1.2**	**1.2**	**1.8**	**1.4**	**1.6**	**1.4**	**2**	**2.2**

1-Low, 2-Medium, 3-High, '-'- No correlation

24AI6202 SKILL DEVELOPMENT LABORATORY **L T P C**

0 0 3 1.5

COURSE OBJECTIVES

- Develop proficiency in deep learning concepts and hands-on experience in building and training neural network models for real-world applications.
- Enhance problem-solving and analytical abilities through regular aptitude tests and coding challenges.
- Improve communication, collaboration, and critical thinking skills via structured group discussions and presentations.

LIST OF EXPERIMENTS

1. Group Discussions (GD) Practice: Improve communication, critical thinking, teamwork, and confidence.
2. Aptitude Tests: Enhance problem-solving, logical reasoning, and quantitative skills.
3. Model Resume Building:
    - Header (Name, Contact info, LinkedIn/GitHub links)
    - Objective/Summary (brief career goal)
    - Education (degrees, institutions, year, percentage/CGPA)
    - Skills (programming languages, tools, technologies)
    - Projects (brief description, technologies used, outcomes)
    - Internships/Work Experience
    - Certifications & Achievements
    - Extracurriculars (optional)
4. Mock Interviews & Soft Skills:
    - Behavioral interviews
    - Technical interviews (concept questions, coding)
    - Communication & interpersonal skills coaching
5. Integration with Technical Labs:
    - After every technical project, present findings or demo in a group discussion format.
    - Use aptitude sessions to warm up before coding challenges.
    - Prepare resumes highlighting recent projects for placement drives.

TOTAL: 45 PERIODS

COURSE OUTCOMES

On successful completion of this course, students will be able to

CO1**:** Improve communication, teamwork, and critical thinking through group discussions.

CO2: Solve aptitude questions using logical and quantitative reasoning.

CO3: Build a professional resume highlighting skills, projects, and achievements.

CO4: Face technical and HR interviews with confidence and clarity.

CO5: Present technical work and apply soft skills in placement activities.

Mapping of COs with POs & PSOs

COs	POs												PSOs	
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
CO 1	3	3	3	1	3	1	1	1	2	1	1	1	2	2
CO 2	3	3	3	2	3	1	1	1	2	1	1	1	2	2
CO 3	3	3	3	3	3	3	2	2	3	3	3	3	3	3
CO 4	3	3	3	3	3	2	1	1	1	1	2	1	1	2
CO 5	3	3	3	3	2	1	1	1	1	1	1	1	2	2
AVG	**3**	**3**	**3**	**2.4**	**2.8**	**1.6**	**1.2**	**1.2**	**1.8**	**1.4**	**1.6**	**1.4**	**2**	**2.2**

1-Low, 2-Medium, 3-High, '-'- No correlation

24PD6201 NCC/NSS/NSO **L T P C**
0 0 0 2

All students shall enroll on admission in any one of the personality and character development program. NCC/NSS/NSO/YRC/SPORTS is a mandatory requirement and undergo training / conduct activities for about 80 hours and attend a camp of about seven days. The training shall include classes on hygiene and health awareness and also training in first aid. Alternately activities of science, literature and arts also help for personality and character development. The training activities will normally be during weekends and the camp will normally be during vacation period. A certificate will be given by the authorities concerned and duly forwarded by the Head of the Department to the Controller of Examinations for the purpose of record and scrutiny. No fee shall be charged for all these activities.

(OR)

Enroll as a student member of a recognized professional society/other bodies such as

- Student Chapters of Institution of Engineers (India)/ISTE/ Department Association
- Student Chapters of other Professional bodies like ICI, IEEE, SAE, ASHRAE, CSI, IEI, IIC, IGS, IETE, IWS etc. Students will have activities to improve technical skills, innovative skills, and career development.

24HS7101 PROFESSIONAL ETHICS IN ENGINEERING **L T P C**
2 0 0 2

COURSE OBJECTIVES

- To enable the students to create an awareness on professional ethics.
- To Impart Moral and Social Values.
- To learn the moral leadership and corporate responsibility.

UNIT I SOCIAL ETHICS **6**

Application of ethical reasoning to social problems – Gender bias and issues –Social discrimination – Constitutional protection and policies – Inclusive practices. Engineering as Experimentation – Engineers as responsible Experimenters – Codes of Ethics – A Balanced Outlook on Law.

UNIT II ENGINEERING ETHICS **6**

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 III SCIENTIFIC ETHICS **6**

Transparency and Fairness in scientific pursuits – Scientific inventions for the betterment of society - Unfair application of scientific inventions – Role and Responsibility of Scientist in the modern society.

UNIT IV SAFETY, RESPONSIBILITIES AND RIGHTS **6**

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 V GLOBAL ISSUES **6**

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.

TOTAL:30 PERIODS

COURSE OUTCOMES

On successful completion of this course, the student will be able to

CO1: Describe the human values with regard to the individual lifestyle for the society.
CO2: Explain the role of ethics to the engineering field.
CO3: Describe how engineering is applied in association with ethics based on engineering experimentation.
CO4: Explain the engineering ethics-based safety, responsibilities and rights.
CO5: Discuss the global issues of professional ethics in engineering.

TEXT BOOKS

1. Mike Martin and Roland Schinzinger, "Ethics in Engineering". McGraw-Hill, New York, 2005.
2. Edmund G Seebauer and Robert L Barry, "Fundamentals of Ethics for Scientists and Engineers", Oxford University Press, Oxford, 2001.
3. Charles B. Fleddermann, "Engineering Ethic", Pearson Prentice Hall, New Jersey, 2004.

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REFERENCE BOOKS

1. Luke W. Galen "The Nonreligious: Understanding Secular People and Societies", Oxford University Press,2016.
2. Bullivant, Stephen; Lee, Lois, "Secularism: A Dictionary of Atheism", Oxford University Press, 2016.
3. Soumitro Banerjee, "Research Methodology for Natural Sciences", IISc Press, January 2022.
4. Govindarajan M, Natarajan S, Senthil Kumar V. S, "Engineering Ethics", Prentice Hall of India, New Delhi, 2014.
5. Laura P. Hartman and Joe Desjardins, ―Business Ethics: Decision Making for Personal Integrity and Social Responsibility‖ Mc Graw Hill education, India Pvt. Ltd.,New Delhi, 2013.

Mapping of COs with POs & PSOs

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO 1	-	-	-	-	-	-	2	-	3	3	-	3	-	-
CO 2	-	-	-	-	-	-	2	-	3	3	-	3	-	-
CO 3	-	-	-	-	-	-	2	2	3	3	-	3	-	-
CO 4	-	-	-	-	-	-	2	2	3	3	-	3	-	-
CO 5	-	-	-	-	-	-	2	2	3	3	-	3	-	-
AVG	-	-	-	-	-	-	**2**	**2**	**3**	**3**	-	**3**	-	-

1-Low, 2-Medium, 3-High, '-'- No correlation

24AI7501 MINI PROJECT **L T P C**
0 0 4 2

COURSE OBJECTIVES

- Identifying problem and developing the structured methodology to solve the identified problem in the industry or research problem at research Institution or college.
- Conducting experiments, analyze and discuss the test results, and make conclusions
- Preparing project reports and presentation

The students shall individually / or as group work on a specific topic approved by the Department. The student can select any topic which is relevant to his/her specialization of the programme. The student should continue the work on the selected topic as per the formulated methodology. At the end of the semester, after completing the work to the satisfaction of the supervisor and review committee, a detailed report which contains clear definition of the identified problem, detailed literature review related to the area of work and methodology for carrying out the work, results and discussion, conclusion and references should be prepared as per the format prescribed by the University and submitted to the Head of the department. The students will be evaluated based on the report and viva-voce examination by a panel of examiners as per the Regulations.

TOTAL: 60 PERIODS

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COURSE OUTCOMES

On successful completion of this course, the student will be able to

CO1: Formulate a problem / create a new product/ process.

CO2: Analyze the identified problem.

CO3: Design and conduct experiments to find solution.

CO4: Analyze the results and provide solution for the identified problem.

CO5: Preparing of project report and presentation.

Mapping of COs with POs and PSOs

COs	POs												PSOs	
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
CO1	2	2	2	2	3	1	-	1	3	2	2	1	1	1
CO2	2	2	2	2	3	1	-	1	3	2	2	1	1	1
CO3	2	2	2	2	3	1	-	1	3	2	2	1	1	1
CO4	2	2	2	2	3	1	-	1	3	2	2	1	1	1
CO5	2	2	2	2	3	1	-	1	3	2	2	1	1	1
AVG	**2**	**2**	**2**	**2**	**3**	**1**	**-**	**1**	**3**	**2**	**2**	**1**	**1**	**1**

1-Low, 2-Medium, 3-High, '-'- No correlation

24IS7201 INTERNSHIP **L T P C**

0 0 0 1

COURSE OBJECTIVES

- Students acquire practical knowledge through hands-on experience in an area of modern industries
- Gain real-world experience in the profession and enables correlation of classroom learning
- To experience the career development goals involve exploring the duties and qualifications of different careers.

COURSE DESCRIPTION

The purpose of the Internship Education Program is to provide each student practical experience in a standard work environment. An internship is an integral part of engineering education. It provides real-world experience in the profession; enables correlation of classroom learning with applications in industry; broadens understanding of the types of employment available in the field; helps the student discover individual interests; builds resume credentials; and develops relationships with industrial companies.

MONITORING OF INTERNSHIP

Documents required after the internship

1. Final report with full details of internship activities and contents learned during the entire period of internship.
2. Students shall maintain a day-to-day record of their engagement for the period of training. This will be recorded in an authorized diary to be counter signed by the

concern authority at each day and the same diary shall be submitted to the internship co-ordinator.

3. At the end of the training period, a student shall produce a certificate of satisfactory completion of training.

The final report should address the following:

- Projects and duties performed during the Internship.
- Learning that occurred as a result of the internship, in regard to
- The engineering profession.
- The particular industry.
- The organization/company.
- The technical skills developed.
- The individual interests and preferences discovered.
- Suggestions.
- Goals and plans regarding future professional development.

EVALUATION PROCEDURE

The weightage as follows

1. Internship final report : 30%
2. Authorized diary : 30%
3. Oral presentation through PPT : 40%

COURSE OUTCOMES

On successful completion of this course, the student will be able to

CO1: Apply appropriate workplace behaviors in a professional setting.

CO2: Demonstrate content knowledge appropriate to job assignment.

CO3: Exhibit evidence of increased content knowledge gained through practical experience.

CO4: Evaluate the internship experience in terms of their personal, educational and career needs.

CO5: Refine and clarify professional and career goals through critical analysis of the internship experience.

Mapping of COs with POs & PSOs

COs	POs												PSOs	
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
CO1	3	2	2	2	3	-	-	-	-	2	-	-	-	-
CO2	3	2	2	2	3	-	-	-	-	2	-	-	-	-
CO3	3	2	2	2	3	-	-	-	-	2	-	-	-	-
CO4	3	2	2	2	3	-	-	-	-	2	-	-	-	-
CO5	3	2	2	2	3	-	-	-	-	2	-	-	-	-
AVG	**3**	**2**	**2**	**2**	**3**	**-**	**-**	**-**	**-**	**2**	**-**	**-**	**-**	**-**

1-Low, 2-Medium, 3-High, '-'- No correlation

24CA7201 CASE STUDY **L T P C**

0 0 0 1

COURSE OBJECTIVES

- To gain hands on industrial experience.
- To introduce industry problem solving skill.
- To familiarize the industrial operations.

The students should study at least two case studies during 6th Semester vacation and submit a details report not less than 20 pages with a copy of case study completion certificate from the Industry.

Part A: Case study on Industry Operation

The students should undergo case study on Industrial Operations.

- They should understand the company's structure, operational workflow, safety norms, and business model.
- Learn the specific department such as production, quality control, logistics, human recourses, turn-over and other major tools and softwares used by the industry.
- Students interact with industry experts, gather background information relevant to the industry.
- The students have to collect data, gather real-time processes, and analyze the challenges faced by the industry by using standard tools such as Fishbone diagrams, Pareto charts, or SWOT analysis.

Part B: Case study on Completed Project

The students should identify and select case study 2 as previously completed project relevant to their domain.

- Students should follow the work flow structure such as interacting with team leader or manager, identify and understand the problem, collect relevant data, analyze roots & methodology employed to complete the project and should understand the final outcome of the project.
- Students consolidate their findings and prepare a comprehensive report.

At the end of study,

The students should prepare a report not less than 20 pages and should include the copy of case study completion certificate in the report.

COURSE OUTCOMES

On successful completion of this course, the students will be able to

CO1: Understand the industry operations.

CO2: Analyze and interpret industrial data.

CO3: Apply engineering principles to industry real time problems.

CO4: Collaborate effectively with industry experts and teams.

CO5: Communicate technical information clearly and professionally.

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Mapping of COs with POs & PSOs

COs	POs												PSOs	
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
CO1	3	3	2	3	-	-	-	-	2	2	2	2	-	-
CO2	3	3	2	3	3	-	-	-	2	2	2	2	-	-
CO3	3	3	2	3	3	-	-	-	2	2	2	2	-	-
CO4	2	2	-	-	-	-	-	-	2	2	2	2	-	-
CO5	2	2	-	-	3	-	-	-	2	2	2	2	-	-
AVG	**2.6**	**2.6**	**2**	**3**	**3**	**-**	**-**	**-**	**2**	**2**	**2**	**2**	**-**	**-**

1-Low, 2-Medium, 3-High, '-'- No correlation

24AI8501 PROJECT WORK **L T P C**

0 0 20 10

COURSE OBJECTIVES

- To train the students for gaining domain knowledge and technical skills to solve Potential business / research problems.
- To work in small teams and understand the processes and practices in the industry.
- To implement, Test and deploy solutions for target platforms. Preparing project reports and presentation.

The students shall individually / or as group work on business/research domains and related problems approved by the Department / organization that offered the internship / project.
The student can select any topic which is relevant to his / her specialization of the programme.
The student should continue the work on the selected topic as per the formulated methodology.
At the end of the semester, after completing the work to the satisfaction of the supervisor and review committee, a detailed report which contains clear definition of the identified problem, detailed literature review related to the area of work and methodology for carrying out the work, results and discussion, conclusion and references should be prepared as per the format prescribed by the University and submitted to the Head of the department. The students will be evaluated based on the report and viva-voce examination by a panel of examiners as per the Regulations.

TOTAL: 300 PERIODS

COURSE OUTCOMES

On successful completion of this course, students will be able to

CO1: Identify, analyse and formulate real-world problems in business or research domains aligned with their area of specialization.

CO2: Apply domain-specific knowledge, research methodologies and technical skills to design and implement effective solutions.

CO3: Enhance student's abilities in conducting a detailed literature review, problem definition and structured project planning.

CO4: Develop professional competencies in report writing, documentation and presentation of project outcomes as per academic standards.

CO5: Improve communication skills, teamwork and the ability to defend technical work through viva-voce and peer evaluation.

Mapping of COs with POs & PSOs

Cos	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	3	3	3	2	2	1	1	1	2	2	1	2	3	2
CO2	3	3	3	3	3	2	2	1	2	2	2	3	3	2
CO3	2	3	2	3	3	2	2	1	2	2	2	2	3	3
CO4	2	2	2	2	2	2	1	1	2	3	2	2	2	3
CO5	2	2	2	2	2	2	2	2	3	3	3	3	2	3
AVG	2.4	2.6	2.4	2.4	2.4	1.8	1.6	1.2	2.2	2.4	2	2.4	2.6	2.6

1-Low, 2-Medium, 3-High, '-'- No correlation

24ITPE01 NETWORK SECURITY **L T P C**
3 0 2 4

COURSE OBJECTIVES

- To learn the fundamentals of cryptography.
- To learn the key management techniques and authentication approaches.
- To explore the network and transport layer security techniques.

UNIT I INTRODUCTION **9**

Basics of cryptography, conventional and public-key cryptography, hash functions, authentication, and digital signatures.

UNIT II KEY MANAGEMENT AND AUTHENTICATION **9**

Key Management and Distribution: Symmetric Key Distribution, Distribution of Public Keys, X.509 Certificates, Public-Key Infrastructure. User Authentication: Remote User-Authentication Principles, Remote User-Authentication Using Symmetric Encryption, Kerberos Systems, Remote User Authentication Using Asymmetric Encryption.

UNIT III ACCESS CONTROL AND SECURITY **9**

Network Access Control: Network Access Control, Extensible Authentication Protocol, IEEE 802.1X Port-Based Network Access Control - IP Security - Internet Key Exchange (IKE). Transport-Level Security: Web Security Considerations, Secure Sockets Layer, Transport Layer Security, HTTPS standard, Secure Shell (SSH) application.

UNIT IV APPLICATION LAYER SECURITY **9**

Electronic Mail Security: Pretty Good Privacy, S/MIME, DomainKeys Identified Mail. Wireless Network Security: Mobile Device Security.

UNIT V SECURITY PRACTICES **9**

Firewalls and Intrusion Detection Systems: Intrusion Detection Password Management, Firewall Characteristics Types of Firewalls, Firewall Basing, Firewall Location and Configurations. Blockchains, Cloud Security and IoT security.

TOTAL:45 PERIODS

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LIST OF EXPERIMENTS

1. Implement symmetric key algorithms.
2. Implement asymmetric key algorithms and key exchange algorithms.
3. Implement digital signature schemes.
4. Check message integrity and confidentiality using SSL.
5. Experiment Eavesdropping, Dictionary attacks, MITM attacks.
6. Experiment with Sniff Traffic using ARP Poisoning.
7. Demonstrate intrusion detection system using any tool.
8. Explore network monitoring tools.

TOTAL:30 PERIODS

COURSE OUTCOMES

On successful completion of this course, the students will be able to

CO1: Classify the encryption techniques
CO2: Illustrate the key management technique and authentication.
CO3: Evaluate the security techniques applied to network and transport layer.
CO4: Discuss the application layer security standards.
CO5**:** Apply security practices for real time applications.

TEXT BOOKS

1. William Stallings, "Cryptography and Network Security: Principles and Practice", 6th Edition ,Pearson,2014.
2. NordLayer ,"Essential Network Security Books: Beginner to Expert", 6th Edition, Pearson,2016.
3. William Stallings ,"Network Security Essentials: Applications and Standards", 6th Edition, Pearson,2017.

REFERENCE BOOKS

1. M. Speciner, R. Perlman, C. Kaufman,"Network Security: Private Communications in a Public World", 2nd Edition, Prentice Hall, 2002.
2. Jon Erickson," Hacking: The Art of Exploitation",1st Edition, No Starch Press,2003.
3. Michael Rash,"Linux Firewalls",1st Edition, No Starch Press, October 2007.
4. J. Michael Stewart,"Network Security, Firewalls and VPNs", 2nd Edition, Jones & Bartlett Learning, 2013.
5. Michael Gregg,"The Network Security Test Lab: A Step-By-Step Guide", 1st Edition Wiley Press, 2015.

Mapping of COs with POs & PSOs

COs	POs												PSOs	
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
CO1	3	3	2	2	2	-	-	-	2	1	2	1	2	3
CO2	1	1	3	2	2	-	-	-	2	2	1	1	3	1
CO3	1	2	1	1	2	-	-	-	3	3	1	3	2	1
CO4	2	2	3	2	3	-	-	-	3	3	2	1	2	1
CO5	2	1	3	2	2	-	-	-	2	1	1	3	2	1
AVG	**1.8**	**1.8**	**2.4**	**1.8**	**2.2**	**-**	**-**	**-**	**2.4**	**2**	**1.4**	**1.8**	**2.2**	**1.4**

1-Low, 2-Medium, 3-High, '-'- No correlation

24ITPE02 DIGITAL AND MOBILE FORENSICS **L T P C**
3 0 2 4

COURSE OBJECTIVES

- To understand basic digital forensics and techniques.
- To understand digital crime and investigation.
- To understand how to be prepared for digital forensic readiness.

UNIT I INTRODUCTION TO DIGITAL FORENSICS **9**

Forensic Science – Digital Forensics – Digital Evidence – The Digital Forensics Process – Introduction – The Identification Phase – The Collection Phase – The Examination Phase – The Analysis Phase – The Presentation Phase.

UNIT II DIGITAL CRIME AND INVESTIGATION **9**

Digital Crime – Substantive Criminal Law – General Conditions – Offenses – Investigation Methods for Collecting Digital Evidence – International Cooperation to Collect Digital Evidence.

UNIT III DIGITAL FORENSIC READINESS **9**

Introduction – Law Enforcement versus Enterprise Digital Forensic Readiness – Rationale for Digital Forensic Readiness – Frameworks, Standards and Methodologies – Enterprise Digital Forensic Readiness – Challenges in Digital Forensics.

UNIT IV IOS FORENSICS **9**

Mobile Hardware and Operating Systems - iOS Fundamentals – Jailbreaking – File System – Hardware – iPhone Security – iOS Forensics – Procedures and Processes – Tools – Oxygen Forensics – MobilEdit – iCloud.

UNIT V ANDROID FORENSICS **9**

Android basics – Key Codes – ADB – Rooting Android – Boot Process – File Systems – Security – Tools – Android Forensics – Forensic Procedures – ADB – Android Only Tools – Dual Use Tools – Oxygen Forensics – MobilEdit – Android App Decompiling.

TOTAL:45 PERIODS

LIST OF EXPERIMENTS

1. Installation of Sleuth Kit on Linux. List all data blocks. Analyze allocated as well as unallocated blocks of a disk image.
2. Data extraction from call logs using Sleuth Kit.
3. Data extraction from SMS and contacts using Sleuth Kit.
4. Install Mobile Verification Toolkit or MVT and decrypt encrypted iOS backups.
5. Process and parse records from the iOS system.
6. Extract installed applications from Android devices.
7. Extract diagnostic information from Android devices through the adb protocol.
8. Generate a unified chronological timeline of extracted records.

TOTAL:30 PERIODS

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COURSE OUTCOMES

On successful completion of this course, the students will be able to

CO1: Have knowledge on digital forensics.

CO2: Know about digital crime and investigations.

CO3: Be forensic ready.

CO4: Investigate, identify and extract digital evidence from iOS devices.

CO5: Investigate, identify and extract digital evidence from Android devices.

TEXT BOOKS

1. Andre Arnes, "Digital Forensics", Wiley, 2018.
2. Chuck Easttom, "An In-depth Guide to Mobile Device Forensics", First Edition, CRC Press, 2022.
3. Practical Mobile Forensics (4th Edition) by Rohit Tamma, Oleg Skulkin, Heather Mahalik, Satish Bommisetty.

REFERENCE BOOKS

1. Vacca, J, Computer Forensics, Computer Crime Scene Investigation, 2nd Ed, Charles River Media, 2005, ISBN: 1-58450-389.
2. An In-Depth Guide to Mobile Device Forensics by Chuck Easttom.
3. Practical Mobile Forensics (4th Edition) by Satish Bommisetty, Rohit Tamma, Heather Mahalik, and Oleg Skulkin.
4. Mobile Forensics – The File Format Handbook by Christian Hummert and Dirk.
5. Mastering Mobile Forensics by Sufyan bin Uzayr.

Mapping of COs with POs & PSOs

COs	POs												PSOs	
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
CO1	3	1	3	2	1	-	-	-	1	1	3	3	1	3
CO2	3	3	3	3	3	-	-	-	2	2	1	2	1	3
CO3	3	3	2	3	1	-	-	-	3	2	1	1	3	2
CO4	3	1	2	2	3	-	-	-	1	3	3	2	1	3
CO5	1	3	2	3	2	-	-	-	2	3	2	3	1	2
AVG	**2.6**	**2.2**	**2.4**	**2.6**	**2**	**-**	**-**	**-**	**1.8**	**2.2**	**2**	**2.2**	**1.4**	**2.6**

1-Low, 2-Medium, 3-High, '-'- No correlation

24ITPE03 SOCIAL NETWORK SECURITY **L T P C**

3 0 2 4

COURSE OBJECTIVES

- To develop semantic web related simple applications.
- To explain Privacy and Security issues in Social Networking.
- To explain the data extraction and mining of social networks.

UNIT I FUNDAMENTALS OF SOCIAL NETWORKING **9**

Introduction to Semantic Web, Limitations of current Web, Development of Semantic Web, Emergence of the Social Web, Social Network analysis, Development of Social Network Analysis, Key concepts and measures in network analysis, Historical overview of privacy and security, Major paradigms, for understanding privacy and security.

UNIT II SECURITY ISSUES IN SOCIAL NETWORKS **9**

The evolution of privacy and security concerns with networked technologies, Contextual influences on privacy attitudes and behaviors, Anonymity in a networked world.

UNIT III EXTRACTION AND MINING IN SOCIAL NETWORKING DATA **9**

Extracting evolution of Web Community from a Series of Web Archive, Detecting communities in social networks, Definition of community, Evaluating communities, Methods for community detection and mining, Applications of community mining algorithms, Tools for detecting Communities social network infrastructures and communities, Big data and Privacy.

UNIT IV PREDICTING HUMAN BEHAVIOR AND PRIVACY ISSUES **9**

Understanding and predicting human behavior for social communities, User data Management, Inference and Distribution, enabling new human experiences, Reality mining, Context, Awareness, Privacy in online social networks, Trust in online environment, what is Neo4j, Nodes, Relationships, Properties.

UNIT V ACCESS CONTROL, PRIVACY AND IDENTITY MANAGEMENT **9**

Understand the access control requirements for Social Network, Enforcing Access Control Strategies, Authentication and Authorization, Roles-based Access Control, Host, storage and network access control options, Firewalls, Authentication, and Authorization in Social Network, Identity & Access Management, Single Sign-on, Identity Federation, Identity providers and service consumers, The role of Identity provisioning.

TOTAL:45 PERIODS

LIST OF EXPERIMENTS

1. Design own social media application.
2. Create a Network model using Neo4j.
3. Read and write Data from Graph Database.
4. Find “Friend of Friends” using Neo4j.
5. Implement secure search in social media.
6. Create a simple Security & Privacy detector.
7. Behavior Prediction using Reality Mining Dataset.
8. Role-Based Access Control (RBAC) Simulation.

TOTAL:30 PERIODS

COURSE OUTCOMES

On successful completion of this course, the students will be able to

CO1: Develop semantic web related simple applications.

CO2: Address Privacy and Security issues in Social Networking.

CO3: Explain the data extraction and mining of social networks.
CO4: Discuss the prediction of human behavior in social communities.
CO5: Describe the applications of social networks.

TEXT BOOKS

1. Peter Mika, "Social Networks and the Semantic Web, 1st Edition, Springer 2007.
2. Borko Furht, "Handbook of Social Network Technologies and Application", 1st Edition, Springer, 2010.
3. Brij B. Gupta, Somya Ranjan Sahoo," Online Social Networks Security: Principles, Algorithms, Applications, and Perspectives", CRC Press,2021.

REFERENCE BOOKS

1. Easley D. Kleinberg J., "Networks, Crowds, and Markets – Reasoning about a Highly Connected World",1st Edition, Cambridge University Press, 2010.
2. Jackson, Matthew O., "Social and Economic Networks", 1st Edition, Princeton University Press, 2008.
3. GuandongXu ,Yanchun Zhang and Lin Li, "Web Mining and Social Networking – Techniques and applications", 1st Edition, Springer, 2011.
4. Dion Goh and Schubert Foo, "Social information Retrieval Systems: Emerging Technologies and Applications for Searching the Web Effectively",1st Edition, IGI Global Snippet, 2008.
5. Max Chevalier, Christine Julien and Chantal Soulé - Dupuy, "Collaborative and Social Information Retrieval and Access: Techniques for Improved user Modeling", 1st Edition, IGI Global Snippet, 2009.

Mapping of COs with POs & PSOs

COs	POs												PSOs	
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
CO1	3	1	2	3	2	-	-	-	3	2	1	2	3	3
CO2	2	2	2	3	3	-	-	-	1	2	2	3	3	3
CO3	2	1	1	3	2	-	-	-	1	2	1	1	1	3
CO4	3	3	3	3	2	-	-	-	1	1	1	1	2	1
CO5	1	3	2	2	2	-	-	-	1	1	3	1	2	3
AVG	**2.2**	**2**	**2**	**2.8**	**2.2**	**-**	**-**	**-**	**1.4**	**1.6**	**1.6**	**1.6**	**2.2**	**2.6**

1-Low, 2-Medium, 3-High, '-'- No correlation

24ITPE04 MODERN CRYPTOGRAPHY **L T P C**

3 0 2 4

COURSE OBJECTIVES

- To learn about Modern Cryptography.
- To focus on how cryptographic algorithms and protocols work and how to use them.
- To build a pseudorandom permutation.

UNIT I INTRODUCTION **9**

Basics of Symmetric Key Cryptography, Basics of Asymmetric Key Cryptography, Hardness of Functions. Notions of Semantic Security (SS) and Message Indistinguishability (MI): Proof of Equivalence of SS and MI, Hard Core Predicate, Trap-door permutation, Goldwasser-Micali Encryption. Goldreich-Levin Theorem: Relation between Hardcore Predicates and Trap-door permutations.

UNIT II FORMAL NOTIONS OF ATTACKS **9**

Attacks under Message Indistinguishability: Chosen Plaintext Attack (IND-CPA), Chosen Ciphertext Attacks (IND-CCA1 and IND-CCA2), Attacks under Message Non-malleability: NM-CPA and NM- CCA2, Inter-relations among the attack model.

UNIT III RANDOM ORACLES **9**

Provable Security and asymmetric cryptography, hash functions. One-way functions: Weak and Strong one-way functions. Pseudo-random Generators (PRG): Blum-Micali-Yao Construction, Construction of more powerful PRG, Relation between One-way functions and PRG, Pseudo- random Functions (PRF).

UNIT IV BUILDING A PSEUDORANDOM PERMUTATION **9**

The LubyRackoff Construction: Formal Definition, Application of the LubyRackoff Construction to the construction of Block Ciphers, The DES in the light of LubyRackoff Construction.

UNIT V MESSAGE AUTHENTICATION CODES **9**

Left or Right Security (LOR). Formal Definition of Weak and Strong MACs, Using a PRF as a MAC, Variable length MAC. Public Key Signature Schemes: Formal Definitions, Signing and Verification, Formal Proofs of Security of Full Domain Hashing. Assumptions for Public Key Signature Schemes: One-way functions Imply Secure One-time Signatures. Shamir's Secret Sharing Scheme. Formally Analyzing Cryptographic Protocols. Zero Knowledge Proofs and Protocols.

TOTAL:45 PERIODS

LIST OF EXPERIMENTS

1. Implement Feige-Fiat-Shamir identification protocol.
2. Implement GQ identification protocol.
3. Implement Schnorr identification protocol.
4. Implement Rabin one-time signature scheme.
5. Implement Merkle one-time signature scheme.
6. Implement Authentication trees and one-time signatures.
7. Implement GMR one-time signature scheme.
8. Implement Left or Right Security (LOR) Experiment.

TOTAL:30 PERIODS

COURSE OUTCOMES

On successful completion of this course, the students will be able to

CO1: Interpret the basic principles of cryptography and general cryptanalysis.

CO2: Determine the concepts of symmetric encryption and authentication.

CO3: Identify the use of public key encryption, digital signatures, and key establishment.

CO4: Articulate the cryptographic algorithms to compose build and analyze simple cryptographic Solutions.

CO5: Express the use of Message Authentication Codes.

TEXT BOOKS

1. Hans Delfs and Helmut Knebl, "Introduction to Cryptography: Principles and Applications", 1st Edition, Springer Verlag,2006.
2. Wenbo Mao "Modern Cryptography, Theory and Practice", 1st Edition, Prentice Hall,2003.
3. Christ of Paar & Jan Pelzl "Understanding Cryptography: A Textbook for Students and Practitioners**"**, 1st edition, Springer 2010.

REFERENCE BOOKS

1. Shaffi Gold wasser and Mihir Bellare, "Advances in Cryptology – CRYPTO'88: Proceedings",1st Ed, Springer, 1990.
2. Oded Goldreich, "Foundations of Cryptography", CUP press, 2024.
3. William Stallings, "Cryptography and Network Security: Principles and Practice",3rd Edition,Pearson India,2013.
4. Dan Boneh & Victor Shoup,"A Graduate Course in Applied Cryptography",5th Edition, Stanford University,2020.
5. William Stallings,"Cryptography and Network Security: Principles and Practice" **,** 8th Edition, Pearson Education Limited,2022.

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Mapping of COs with POs & PSOs

COs	POs												PSOs	
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
CO1	3	3	3	3	1	-	-	-	2	1	1	2	2	1
CO2	1	3	2	1	2	-	-	-	3	2	2	2	2	1
CO3	1	1	2	3	2	-	-	-	1	1	1	3	1	1
CO4	3	1	2	1	3	-	-	-	3	2	1	2	3	2
CO5	2	3	3	3	3	-	-	-	3	1	1	1	2	1
AVG	**2**	**2.2**	**2.4**	**2.2**	**2.2**	**-**	**-**	**-**	**2.4**	**1.4**	**1.2**	**2**	**2**	**1.2**

1-Low, 2-Medium, 3-High, '-'- No correlation

24ITPE05 DIGITAL MARKETING **L T P C**
3 0 2 4

COURSE OBJECTIVES

- The primary objective of this module is to examine and explore the role and importance of digital marketing in today's rapidly changing business environment.
- It also focuses on how digital marketing can be utilized by organizations and how its effectiveness can be measured.
- Analyze digital consumer behavior and how it influences online buying decisions and brand engagement.

UNIT I INTRODUCTION TO ONLINE MARKET **9**

Online Market space- Digital Marketing Strategy- Components - Opportunities for building Brand Website - Planning and Creation - Content Marketing.

UNIT II SEARCH ENGINE OPTIMISATION **9**

Search Engine optimization - Keyword Strategy- SEO Strategy - SEO success factors -On-Page Techniques - Off-Page Techniques. Search Engine Marketing- How Search Engine works- SEM components- PPC advertising -Display Advertisement

UNIT III E- MAIL MARKETING **9**

E- Mail Marketing - Types of E- Mail Marketing - Email Automation - Lead Generation - Integrating Email with Social Media and Mobile- Measuring and maximizing email campaign effectiveness. Mobile Marketing- Mobile Inventory/channels- Location based; Context based; Coupons and offers, Mobile Apps, Mobile Commerce, SMS Campaigns-Profiling and targeting

UNIT IV SOCIAL MEDIA MARKETING **9**

Social Media Marketing - Social Media Channels- Leveraging Social media for brand conversations and buzz - Successful benchmark Social media campaigns, Engagement Marketing- Building Customer relationships - Creating Loyalty drivers - Influencer Marketing.

UNIT V DIGITAL TRANSFORMATION **9**

Digital Transformation & Channel Attribution- Analytics- Ad-words, Email, Mobile, Social Media, Web Analytics - Changing your strategy based on analysis- Recent trends in Digital marketing.

TOTAL:45 PERIODS

LIST OF EXPERIMENTS

1. Create a Digital Marketing Strategy.
2. Design and launch an email marketing campaign.
3. Analyze digital marketing performance and generate a report.
4. Implement on-page SEO techniques to improve website rankings.
5. Creating a Landing Page for Lead Generation.
6. Creating and Launching a Google Ads PPC Campaign.

7. Digital Marketing Channels used case study.
8. Digital Marketing Case Study Analysis

TOTAL:30 PERIODS

COURSE OUTCOMES

On successful completion of this course, the students will be able to

CO1: To examine and explore the role and importance of digital marketing in today's rapidly changing business environment.

CO2: To focuses on how digital marketing can be utilized by organizations.

CO3: To know the key elements of a digital marketing strategy.

CO4: To study how the effectiveness of a digital marketing campaign can be measured.

CO5: To demonstrate advanced practical skills in common digital marketing tools such as SEO, SEM, Social media and Blogs.

TEXT BOOKS

1. Puneet Singh Bhatia ,"Fundamentals of Digital Marketing", 1st Edition, Pearson, July 2017.
2. Vandana Ahuja, "Digital Marketing by Vandana Ahuja",1st Edition, Oxford University Press, 2015.
3. Dave Chaffey,Fiona Ellis,"Digitial Marketing", 8th edition,Pearson,2022.

REFERENCE BOOKS

1. Willey, Philip Kotler,"Marketing 4.0: Moving from Traditional to Digital" ,1st Edition,April 2016.
2. Ryan. D,"Understanding Digital Marketing: Marketing Strategies for engaging the Digital Generation", 3rd edition; Kogan Page Limited,2012.
3. Barker, Barker, Bormann and Neher, "Social Media Marketing: A StrategicApproach", 2nd Edition, South-Western College Publishing,2012.
4. Kim Millucci,"Beginner's Guide to Digital Marketing , 1st Edition, Emakim Ltd,2020.
5. Simon Kingsnorth ,"Digital Marketing Strategy: An Integrated Approach to Online Marketing",2nd Edition, Kogan page,2019.

Mapping of COs with POs & PSOs

COs	POs												PSOs		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
1	3	3	2	1	3	-	-	-	1	2	3	3	3	3	3
2	2	2	2	1	3	-	-	-	1	2	3	3	3	3	3
3	1	1	1	2	2	-	-	-	1	2	1	1	3	2	1
4	3	2	2	3	1	-	-	-	1	3	2	3	2	3	2
5	2	3	1	3	3	-	-	-	2	3	1	2	1	2	1
AVG	**2.2**	**2.2**	**1.6**	**2**	**2.4**	**-**	**-**	**-**	**1.2**	**2.4**	**2**	**2.4**	**2.4**	**2.6**	**2**

1-Low, 2-Medium, 3-High, '-'- No correlation

24ITPE06 CYBER SECURITY **L T P C**
3 0 2 4

COURSE OBJECTIVES

- To learn cybercrime and cyber law.
- To understand the cyber-attacks and tools for mitigating them.
- To understand information gathering.

UNIT I INTRODUCTION **9**

Cyber Security – History of Internet – Impact of Internet – CIA Triad; Reason for Cyber Crime – Need for Cyber Security – History of Cyber Crime; Cybercriminals – Classification of Cybercrimes – A Global Perspective on Cyber Crimes; Cyber Laws – The Indian IT Act – Cybercrime and Punishment.

UNIT II ATTACKS AND COUNTERMEASURES **9**

OSWAP; Malicious Attack Threats and Vulnerabilities: Scope of Cyber-Attacks – Security Breach – Types of Malicious Attacks – Malicious Software – Common Attack Vectors – Social engineering Attack – Wireless Network Attack – Web Application Attack – Attack Tools – Countermeasures.

UNIT III RECONNAISSANCE **9**

Harvester – Whois – Netcraft – Host – Extracting Information from DNS – Extracting Information from E-mail Servers – Social Engineering Reconnaissance; Scanning – Port Scanning – Network Scanning and Vulnerability Scanning – Scanning Methodology – Ping Sweer Techniques – Nmap Command Switches – SYN – Stealth – XMAS – NULL – IDLE – FIN Scans – Banner Grabbing and OS Finger printing Techniques.

UNIT IV INTRUSION DETECTION **9**

Host -Based Intrusion Detection – Network -Based Intrusion Detection – Distributed or Hybrid Intrusion Detection – Intrusion Detection Exchange Format – Honeypots – Example System Snort.

UNIT V INTRUSION PREVENTION **9**

Firewalls and Intrusion Prevention Systems: Need for Firewalls – Firewall Characteristics and Access Policy – Types of Firewalls – Firewall Basing – Firewall Location and Configurations – Intrusion Prevention Systems – Example Unified Threat Management Products.

TOTAL:45 PERIODS

LIST OF EXPERIMENTS

1. Install Kali Linux on Virtual box.
2. Explore Kali Linux and bash scripting.
3. Perform open source intelligence gathering using Netcraft, Whois Lookups, DNS Reconnaissance, Harvester and Maltego.
4. Understand the nmap command d and scan a target using nmap.

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5. Install metasploitable on the virtual box and search for unpatched vulnerabilities.
6. Use Metasploit to exploit an unpatched vulnerability.
7. Install Linus server on the virtual box and install ssh.
8. Launch brute-force attacks on the Linux server using Hydra.

TOTAL:30 PERIODS

COURSE OUTCOMES

On successful completion of this course, the student will be able to

CO1: Explain the basics of cyber security, cyber crime and cyber law (K2).

CO2: Classify various types of attacks and learn the tools to launch the attacks (K2).

CO3: Apply various tools to perform information gathering (K3).

CO4: Apply intrusion techniques to detect intrusion (K3).

CO5: Apply intrusion prevention techniques to prevent intrusion (K3).

TEXT BOOKS

1. William Stallings, "Cryptography and Network Security: Principles and Practice", 8th Edition, Pearson Education India,2023.
2. William Stallings and Lawrie Brown, "Computer Security: Principles and Practice",5th Edition, Pearson Education,2023.
3. Charles J. Brooks, Christopher Grow, Philip Craig, Donald Short, "Cyber Security Essentials", CRC press,2017.

REFERENCE BOOKS

1. David Kim, Michael G. Solomon, "Fundamentals of Information Systems Security",2nd Edition, Jones & Bartlett Learning Publishers, 2013.
2. Patrick Engebretson, "The Basics of Hacking and Penetration Testing: Ethical Hacking and Penetration Testing Made easy",1st Edition, Elsevier, 2011.
3. Kimberly Graves,"CEH Official Certified Ethical hacker Review Guide", 1st edition, Wiley Publishers, 2007.
4. William Stallings, Lawrie Brown, "Computer Security Principles and Practice", 3rd Edition, Pearson Education, 2015.
5. Georgia Weidman, "Penetration Testing: A Hands-On Introduction to Hacking", 1st Edition, No Starch Press, 2014.

Mapping of COs with POs & PSOs

	POs												PSOs	
COs	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
CO1	3	3	1	2	2	-	-	-	1	1	3	2	1	3
CO2	2	1	2	2	2	-	-	-	3	2	2	1	1	2
CO3	1	1	1	3	3	-	-	-	1	2	1	1	3	3
CO4	1	1	1	2	2	-	-	-	2	3	3	3	3	1
CO5	3	1	3	1	3	-	-	-	3	1	2	2	2	2
AVG	**2**	**1.4**	**1.6**	**2**	**2.4**	**-**	**-**	**-**	**2**	**1.8**	**2.2**	**1.8**	**2**	**2.2**

1-Low, 2-Medium, 3-High, '-'- No correlation

24ITPE07 ETHICAL HACKING **L T P C**
3 0 2 4

COURSE OBJECTIVES

- To understand the basics of computer based vulnerabilities.
- To explore different foot printing, reconnaissance and scanning methods.
- To expose the enumeration and vulnerability analysis methods.

UNIT I INTRODUCTION **9**

Ethical Hacking Overview - Role of Security and Penetration Testers .- Penetration-Testing Methodologies- Laws of the Land - Overview of TCP/IP- The Application Layer - The Transport Layer - The Internet Layer - IP Addressing .- Network and Computer Attacks - Malware - Protecting Against Malware Attacks.- Intruder Attacks - Addressing Physical Security.

UNIT II FOOT PRINTING, RECONNAISSANCE AND SCANNING NETWORKS 9

Foot printing Concepts - Foot printing through Search Engines, Web Services, Social Networking Sites, Website, Email - Competitive Intelligence - Foot printing through Social Engineering -Foot printing Tools - Network Scanning Concepts - Port-Scanning Tools - Scanning Techniques - Scanning beyond IDS and Firewall.

UNIT III ENUMERATION AND VULNERABILITY ANALYSIS **9**

Enumeration Concepts - NetBIOS Enumeration – SNMP, LDAP, NTP, SMTP and DNS Enumeration - Vulnerability Assessment Concepts - Desktop and Server OS Vulnerabilities - Windows OS Vulnerabilities - Tools for Identifying Vulnerabilities in Windows- Linux OS Vulnerabilities- Vulnerabilities of Embedded Oss.

UNIT IV SYSTEM HACKING **9**

Hacking Web Servers - Web Application Components- Vulnerabilities - Tools for Web Attackers and Security Testers Hacking Wireless Networks - Components of a Wireless Network – Wardriving- Wireless Hacking - Tools of the Trade.

UNIT V NETWORK PROTECTION SYSTEMS **9**

Access Control Lists. - Cisco Adaptive Security Appliance Firewall - Configuration and Risk Analysis Tools for Firewalls and Routers - Intrusion Detection and Prevention Systems - Network-Based and Host-Based IDSs and IPSs - Web Filtering - Security Incident Response Teams – Honey pot.

TOTAL:45 PERIODS

LIST OF EXPERIMENTS

1. Install Kali or Backtrack Linux / Metasploitable/ Windows XP.
2. Practice the basics of reconnaissance.
3. Using FOCA Search Diggity tools, extract metadata and expanding the target list.
4. Aggregates information from public databases using online free tools like Paterva's Maltego.

5. Information gathering using tools like Robtex.
6. Scan the target using tools like Nessus.
7. View and capture network traffic using Wireshark.
8. Cisco ASA Firewall Simulation.

TOTAL:30 PERIODS

COURSE OUTCOMES

On successful completion of this course, the students will be able to

CO1: To express knowledge on basics of computer based vulnerabilities.

CO2: To gain understanding on different foot printing, reconnaissance and scanning methods.

CO3: To demonstrate the enumeration and vulnerability analysis methods.

CO4: To gain knowledge on hacking options available in Web and wireless applications.

CO5: To acquire knowledge on the options for network protection.

TEXT BOOKS

1. Rob S. Wilson, Michael T. Simpson, Nicholas D. Antill, "Hands-On Ethical Hacking and Network Defense",4th Edition, Cengage Learning,2022.
2. Patrick Engebretson, "The Basics of Hacking and Penetration Testing" , 2nd Edition, Syngress,2013.
3. Dafydd Stuttard and Marcus Pinto,"The Web Application Hacker's Handbook: Finding and Exploiting Security Flaws", 2nd Edition, John Wiley & Sons,2011.

REFERENCE BOOKS

1. Justin Seitz,"Black Hat Python: Python Programming for Hackers and Pentesters", 1st Edition Ed, No Starch Press,2014.
2. Jon Erickson,"Hacking: The Art of Exploitation",2nd Edition,No Starch Press,2008.
3. Georgia Weidman, "Penetration Testing: A Hands-On Introduction to Hacking" ,1st Edition, No Starch Press,2014.
4. David Kennedy," Metasploit: The Penetration Tester's Guide",2nd Edition, No Starch Press,2024.
5. Patrick Engebretson, "The Basics of Hacking and Penetration Testing", 2nd Edition, Syngress Publishing,2013.

Mapping of COs with POs & PSOs

COs	POs												PSOs	
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
CO1	2	2	3	2	1	-	-	-	1	2	2	1	1	2
CO2	1	2	1	2	1	-	-	-	2	2	1	1	1	2
CO3	2	2	3	3	1	-	-	-	1	2	1	2	2	3
CO4	2	1	1	2	1	-	-	-	1	3	3	3	3	2
CO5	2	3	1	1	2	-	-	-	2	1	1	1	1	1
AVG	**1.8**	**2**	**1.8**	**2**	**1.2**	**-**	**-**	**-**	**1.4**	**2**	**1.6**	**1.6**	**1.6**	**2**

1-Low, 2-Medium, 3-High, '-'- No correlation

24ITPE08 WEB APPLICATION SECURITY **L T P C**
3 0 2 4

COURSE OBJECTIVES

- To focus on wide aspects of secure development and deployment of web applications.
- To learn how to build secure APIs.
- To learn the basics of vulnerability assessment and penetration testing.

UNIT I FUNDAMENTALS OF WEB APPLICATION SECURITY **9**

The history of Software Security-Recognizing Web Application Security Threats, Web Application Security, Authentication and Authorization, Secure Socket layer, Transport layer Security, Session Management-Input Validation.

UNIT II SECURE DEVELOPMENT AND DEPLOYMENT **9**

Web Applications Security - Security Testing, Security Incident Response Planning, The Microsoft Security Development Lifecycle (SDL), OWASP Comprehensive Lightweight Application Security Process (CLASP), The Software Assurance Maturity Model (SAMM).

UNIT III SECURE API DEVELOPMENT **9**

API Security- Session Cookies, Token Based Authentication, Securing Natter APIs: Addressing threats with Security Controls, Rate Limiting for Availability, Encryption, Audit logging, Securing service-to-service APIs: API Keys , OAuth2, Securing Microservice APIs: Service Mesh, Locking Down Network Connections, Securing Incoming Requests.

UNIT IV VULNERABILITY ASSESSMENT AND PENETRATION TESTING **9**

Vulnerability Assessment Lifecycle, Vulnerability Assessment Tools: Cloud-based vulnerability scanners, Host-based vulnerability scanners, Network-based vulnerability scanners, Database- based vulnerability scanners, Types of Penetration Tests: External Testing, Web Application Testing, Internal Penetration Testing, SSID or Wireless Testing, Mobile Application Testing.

UNIT V HACKING TECHNIQUES AND TOOLS **9**

Social Engineering, Injection, Cross-Site Scripting(XSS), Broken Authentication and Session Management, Cross-Site Request Forgery, Security Misconfiguration, Insecure Cryptographic Storage, Failure to Restrict URL Access, Tools: Comodo, OpenVAS, Nexpose, Nikto, Burp Suite, etc.

TOTAL:45 PERIODS

LIST OF EXPERIMENTS

1. Install wireshark and explore the various protocols and analyze the difference between HTTP vs HTTPS.
2. Install wireshark and explore the various protocols and analyze the various security mechanisms embedded with different protocols.
3. Identify the vulnerabilities using OWASP ZAP tool.

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4. Create simple REST API using python for following operation.
    a. GET
    b. PUSH
5. Create simple REST API using python for following operation.
    c. POST
    d. DELETE
6. Install Burp Suite to do SQL injection Vulnerability
7. Install Burp Suite to do cross site scripting (XSS) vulnerability.
8. Attack the website using Social Engineering method.

TOTAL:30 PERIODS

COURSE OUTCOMES

On successful completion of this course, the students will be able to

CO1: Explain the basic concepts of web application security and the need for it.

CO2: Be acquainted with the process for secure development and deployment of web applications.

CO3: Acquire the skill to design and develop Secure Web Applications that use Secure APIs.

CO4: Be able to get the importance of carrying out vulnerability assessment and penetration testing.

CO5: Acquire the skill to think like a hacker and to use hackers tool sets.

TEXT BOOKS

1. Andrew Hoffman,"Web Application Security: Exploitation and Countermeasures for Modern Web Applications",1st Edition, O'Reilly Media Inc,2020.
2. Bryan Sullivan, Vincent Liu, "Web Application Security: A Beginners Guide", 1st edition, The McGraw- Hill Companies, 2012.
3. Neil Madden, "API Security in Action", 1st Edition, Manning Publications,2020.

REFERENCE BOOKS

1. Michael Cross, "Developer's Guide to Web Application Security", 1st Edition Syngress Publishing, Inc,2007.
2. Ravi Das and Greg Johnson, "Testing and Securing Web Applications", 1st edition, Taylor & Francis Group, LLC,2021.
3. Prabath Siriwardena, "Advanced API Security", 2nd edition, Apress Media,2020.
4. Malcom McDonald, "Web Security for Developers, 1st Edition, No Starch Press,2020.
5. Allen Harper, Shon Harris, Jonathan Ness, Chris Eagle, Gideon Lenkey, and Terron Williams Grey Hat ,"Hacking: The Ethical Hacker's Handbook", 3rd Edition , The McGraw-Hill Companies, 2011.

Mapping of COs with POs & PSOs

COs	POs												PSOs	
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
CO1	1	2	2	1	3	-	-	-	-	-	-	1	-	-
CO2	2	1	2	1	3	-	-	-	-	-	-	-	-	-
CO3	1	1	1	2	3	-	-	-	-	-	-	1	-	-
CO4	1	2	1	1	2	-	-	-	-	-	-	-	-	-
CO5	1	2	2	2	2	-	-	-	-	-	-	1	-	-
AVG	**1.2**	**1.6**	**1.6**	**1.4**	**2.6**	**-**	**-**	**-**	**-**	**-**	**-**	**1**	**-**	**-**

1-Low, 2-Medium, 3-High, '-'- No correlation

24AIPE09 NEURAL NETWORKS AND DEEP LEARNING **L T P C**
3 0 0 3

COURSE OBJECTIVES

- To understand the basics in deep neural networks.
- To understand the basics of associative memory and unsupervised learning networks.
- To analyze the key computations underlying deep learning, then use them to build and train deep neural networks for various tasks.

UNIT I INTRODUCTION **9**

Neural Networks-Application Scope of Neural Networks-Artificial Neural Network: An Introduction- Evolution of Neural Networks-Basic Models of Artificial Neural Network-Important Terminologies of ANNs-Supervised Learning Network.

UNIT II ASSOCIATIVE MEMORY AND UNSUPERVISED LEARNING NETWORKS **9**

Training Algorithms for Pattern Association-Auto Associative Memory Network-Hetero Associative Memory Network-Bidirectional Associative Memory (BAM)-Hopfield Networks-Iterative Auto Associative Memory Networks-Temporal Associative Memory Network-Fixed Weight Competitive Nets-Kohonen Self-Organizing Feature Maps-Learning Vector Quantization-Counter Propagation Networks-Adaptive Resonance Theory Network.

UNIT III THIRD-GENERATION NEURAL NETWORKS **9**

Spiking Neural Networks-Convolutional Neural Networks-Deep Learning Neural Networks-Extreme Learning Machine Model-Convolutional Neural Networks: The Convolution Operation – Motivation – Pooling – Variants of the basic Convolution Function – Structured Outputs – Data Types – Efficient Convolution Algorithms – Neuroscientific Basis – Applications: Computer Vision, Image Generation, Image Compression.

UNIT IV DEEP FEEDFORWARD NETWORKS **9**

History of Deep Learning- A Probabilistic Theory of Deep Learning- Gradient Learning – Chain Rule and Backpropagation - Regularization: Dataset Augmentation – Noise Robustness -Early Stopping, Bagging and Dropout - batch normalization- VC Dimension and Neural Nets.

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UNIT V RECURRENT NEURAL NETWORKS **9**

Recurrent Neural Networks: Introduction – Recursive Neural Networks – Bidirectional RNNs – Deep Recurrent Networks – Applications: Image Generation, Image Compression, Natural Language Processing. Complete Auto encoder, Regularized Autoencoder, Stochastic Encoders and Decoders.

TOTAL: 45 PERIODS

COURSE OUTCOMES

On successful completion of this course, the students will be able to

CO1: Apply Convolution Neural Network for image processing.
CO2: Analyze the basics of associative memory and unsupervised learning networks.
CO3: Apply CNN and its variants for suitable applications.
CO4: Analyze the key computations underlying deep learning.
CO5: Apply auto encoders and generative models for suitable applications.

TEXT BOOKS

1. Ian Goodfellow, Yoshua Bengio, Aaron Courville, "Deep Learning",1st edition, MIT Press, 2016.
2. Francois Chollet, "Deep Learning with Python", 2nd Edition, Manning Publications, 2021.
3. Santanu Pattanayak, "Pro Deep Learning with Tensor Flow", 1st Edition, Apress, 2017.

REFERENCE BOOKS

1. Aurélien Géron, "Hands-On Machine Learning with Scikit-Learn and TensorFlow", 1st edition, O'Reilly, 2018.
2. Josh Patterson, Adam Gibson, "Deep Learning: A Practitioner's Approach", 1st edition , O'Reilly Media, 2017.
3. Charu C. Aggarwal, "Neural Networks and Deep Learning: A Textbook" 1st Edition, Springer International Publishing, 2018.
4. Jojo Moolayil, "Learn Keras for Deep Neural Networks", 1st Edition, Apress, 2018.
5. François Chollet, "Deep Learning with Python", 1st edition, Manning shelter island, 2017.

Mapping of COs with POs & PSOs

COs	POs												PSOs	
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
1	3	2	3	2	3	1	-	-	2	1	-	-	2	2
2	3	1	2	1	-	-	-	-	-	1	2	2	-	1
3	3	3	3	3	3	1	-	-	2	1	-	-	2	2
4	3	3	3	3	3	-	-	-	2	-	2	3	2	2
5	1	1	3	2	3	-	-	-	2	-	-	-	1	1
AVG	**2.6**	**2**	**2.8**	**2.2**	**2.4**	**0.4**	**0**	**0**	**1.6**	**0.6**	**0.8**	**1**	**1.4**	**1.6**

1-Low, 2-Medium, 3-High, '-'- No correlation

24AIPE10 ETHICS AND AI **L T P C**
3 0 0 3

COURSE OBJECTIVES

- Study the morality and ethics in AI.
- Learn about the Ethical initiatives in the field of artificial intelligence.
- Study about social and ethical issues of Robot Ethics.

UNIT I INTRODUCTION **9**

Definition of morality and ethics in AI-Impact on society-Impact on human psychology-Impact on the legal system-Impact on the environment and the planet-Impact on trust.

UNIT II ETHICAL INITIATIVES IN AI **9**

International ethical initiatives-Ethical harms and concerns-Case study: healthcare robots, Autonomous Vehicles, Warfare and weaponization.

UNIT III AI STANDARDS AND REGULATION **9**

Model Process for Addressing Ethical Concerns During System Design - Transparency of Autonomous Systems-Data Privacy Process- Algorithmic Bias Considerations - Ontological Standard for Ethically Driven Robotics and Automation Systems.

UNIT IV ROBOETHICS: SOCIAL AND ETHICAL IMPLICATION OF ROBOTICS 9

Robot-Robotics- Ethics and Morality- Moral Theories-Ethics in Science and Technology - Ethical Issues in an ICT Society- Harmonization of Principles- Ethics and Professional Responsibility- Robotics Taxonomy.

UNIT V AI AND ETHICS- CHALLENGES AND OPPORTUNITIES **9**

Challenges - Opportunities- ethical issues in artificial intelligence- Societal Issues Concerning the Application of Artificial Intelligence in Medicine- decision-making role in industries- National and International Strategies on AI.

TOTAL: 45 PERIODS

COURSE OUTCOMES

On successful completion of this course, the students will be able to

CO1: Learn about morality and ethics in AI.

CO2: Acquire the knowledge of real time application ethics, issues and its challenges.

CO3: Explore the ethical harms and ethical initiatives in AI.

CO4: Learn about AI standards and Regulations like AI Agent, Safe Design of Autonomous and Semi-Autonomous Systems.

CO5: Learn about the societal issues in AI with National and International Strategies on AI.

TEXT BOOKS

1. Y. Eleanor Bird, Jasmin Fox-Skelly, Nicola Jenner, Ruth Larbey, Emma Weitkamp and Alan Winfield , "The ethics of artificial intelligence: Issues and initiatives", 1st Edition, EPRS European Parliamentary Research Service, March 2020.
2. Patrick Lin, Keith Abney, George A Bekey, "Robot Ethics: The Ethical and Social Implications of Robotics", 1st Edition, The MIT Press- January 2014.
3. Mark Coeckelbergh, "AI Ethics", 1st Edition, The MIT Press,2016.

REFERENCE BOOKS

1. Luciano Floridi, "The Ethics of Artificial Intelligence",1st edition, Oxford University Press,November 2023.
2. Dan Hendrycks ,"Introduction to AI Safety, Ethics, and Society",1st edition,CRC Press, 2024.
3. Christoph Bartneck, Christoph Lütge, Alan Wagner, Sean Welsh ," An Introduction to Ethics in Robotics and AI",1st edition,Springer,2021.
4. S. Matthew Liao,"The Ethics of Artificial Intelligence",1st edition, Oxford University Press,2020.
5. Animesh Mukherjee," AI and Ethics: A Computational Perspective",1st edition, IOP Publishing,2023.
   PE 634.452 – March 2020.

Mapping of COs with POs & PSOs

COs	POs												PSOs	
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
CO1	3	2	3	2	3	1	-	-	2	1	-	-	2	2
CO2	3	1	2	1	-	-	-	-	-	1	2	2	-	1
CO3	3	3	3	3	3	1	-	-	2	1	-	-	2	2
CO4	3	3	3	3	3	-	-	-	2	-	2	3	2	2
CO5	1	1	3	2	3	-	-	-	2	-	-	-	1	1
AVG	**2.6**	**2**	**2.8**	**2.2**	**2.4**	**0.4**	**0**	**0**	**1.6**	**1**	**2**	**2.5**	**1.75**	**1.6**

1-Low, 2-Medium, 3-High, '-'- No correlation

24ITPE11 UI AND UX DESIGN **L T P C**

3 0 0 3

COURSE OBJECTIVES

- To provide a sound knowledge in UI & UX.
- To understand the need for UI and UX.
- To understand the various Research Methods used in Design.

UNIT I FOUNDATIONS OF DESIGN **9**

UI vs. UX Design - Core Stages of Design Thinking - Divergent and Convergent Thinking - Brainstorming and Game storming - Observational Empathy.

UNIT II FOUNDATIONS OF UI DESIGN **9**

Visual and UI Principles - UI Elements and Patterns - Interaction Behaviors and Principles – Branding - Style Guides.

UNIT III FOUNDATIONS OF UX DESIGN **9**

Introduction to User Experience - Why You Should Care about User Experience - Understanding User Experience - Defining the UX Design Process and its Methodology - Research in User Experience Design - Tools and Method used for Research - User Needs and its Goals - Know about Business Goals.

UNIT IV WIREFRAMING, PROTOTYPING AND TESTING **9**

Sketching Principles - Sketching Red Routes - Responsive Design – Wire framing - Creating Wire flows - Building a Prototype - Building High-Fidelity Mockups - Designing Efficiently with Tools - Interaction Patterns - Conducting Usability Tests - Other Evaluative User Research Methods - Synthesizing Test Findings - Prototype Iteration.

UNIT V RESEARCH, DESIGNING, IDEATING, & INFORMATION ARCHITECTURE **9**

Identifying and Writing Problem Statements - Identifying Appropriate Research Methods - Creating Personas - Solution Ideation - Creating User Stories - Creating Scenarios - Flow Diagrams - Flow Mapping - Information Architecture.

TOTAL: 45 PERIODS

COURSE OUTCOMES

On successful completion of this course, the students will be able to

CO1: Build UI for user Applications.

CO2: Evaluate UX design of any product or application.

CO3: Demonstrate UX Skills in product development.

CO4: Implement Sketching principles.

CO5: Create Wireframe and Prototype.

TEXT BOOKS

1. Joel Marsh, "UX for Beginners", 1st edition, A Book Apart, 2018.
2. Jon Yablonski, "Laws of UX using Psychology to Design Better Product & Services",2nd edition, O'Reilly Media,2024.
3. Jeff Gothelf,"Lean UX: Applying Lean Principles to Improve User Experience,1st edition, O'Reilly Media, March 8, 2013.

REFERENCE BOOKS

1. Jenifer Tidwell, Charles Brewer, Aynne Valencia, "Designing Interface",3rd Edition, O'Reilly Media, 2020.
2. Steve Schoger, Adam Wathan "Refactoring UI", 1st edition, Refactoring UI 2018.

3. Steve Krug, "Don't Make Me Think, Revisited: A Commonsense Approach to Web & Mobile", 3rd Edition, New Riders ,2014.
4. Alan Cooper, Robert Reimann, David Cronin, Christopher Noessel, "About Face: The Essentials of Interaction Design", 4th Edition, John Wiley & Sons, September 2, 2014.
5. Jeff Gothelf, Josh Seiden,"Lean UX: Designing Great Products with Agile Teams", 3rd edition, O'Reilly Media, October 26, 2021.

Mapping of COs with POs & PSOs

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	3	1	1	3	1	-	-	-	3	3	2	1	3	3
2	2	3	1	3	2	-	-	-	1	2	2	2	1	2
3	1	3	3	2	2	-	-	-	2	3	1	2	1	3
4	1	2	3	3	1	-	-	-	3	2	1	3	3	3
5	1	2	3	2	1	-	-	-	2	1	1	1	3	2
AVG	1.6	2.2	2.2	2.6	1.4	-	-	-	2.2	2.2	1.4	1.8	2.2	2.6

1-Low, 2-Medium, 3-High, '-'- No correlation

24ITPE12 INFORMATION RETRIEVAL TECHNIQUES

L T P C
3 0 0 3

COURSE OBJECTIVES

- To understand fundamental topics in retrieval optimization techniques
- To Learn the collective systems such as ACO, PSO, and BCO
- To develop skills in biologically inspired algorithm design with an emphasis on solving real world problems.

UNIT I INTRODUCTION 9

Optimization Techniques: Introduction to Optimization Problems – Single and Muti- objective Optimization – Classical Techniques – Overview of various Optimization methods – Evolutionary Computing: Genetic Algorithm and Genetic Programming: Basic concept – encoding – representation – fitness function – Reproduction – differences between GA and Traditional optimization methods – Applications – Bio- inspired Computing (BIC): Motivation – Overview of BIC – usage of BIC – merits and demerits of BIC.

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UNIT II SWARM INTELLIGENCE 9

Introduction – Biological foundations of Swarm Intelligence – Swarm Intelligence in Optimization – Ant Colonies: Ant Foraging Behavior – Towards Artificial Ants – Ant Colony Optimization (ACO) – S- ACO – Ant Colony Optimization Metaheuristic: Combinatorial Optimization – ACO Metaheuristic – Problem solving using ACO – Other Metaheuristics – Simulated annealing – Tabu Search – Local search methods – Scope of ACO algorithms.

UNIT III NATURAL TO ARTIFICIAL SYSTEMS **9**

Biological Nervous Systems – artificial neural networks – architecture – Learning Paradigms – unsupervised learning – supervised learning – reinforcement learning – evolution of neural networks – hybrid neural systems – Biological Inspirations in problem solving – Behavior of Social Insects: Foraging –Division of Labor – Task Allocation – Cemetery Organization and Brood Sorting – Nest Building – Cooperative transport.

UNIT IV SWARM ROBOTICS **9**

Foraging for food – Clustering of objects – Collective Prey retrieval – Scope of Swarm Robotics – Social Adaptation of Knowledge: Particle Swarm – Particle Swarm Optimization (PSO) – Particle Swarms for Dynamic Optimization Problems – Artificial Bee Colony (ABC) Optimization biologically inspired algorithms in engineering.

UNIT V CASE STUDIES **9**

Other Swarm Intelligence algorithms: Fish Swarm – Bacteria foraging – Intelligent Water Drop Algorithms – Applications of biologically inspired algorithms in engineering. Case Studies: ACO and PSO for NP-hard problems – Routing problems – Assignment problems – Scheduling problems – Subset problems – Machine Learning Problems – Travelling Salesman problem.

TOTAL: 45 PERIODS

COURSE OUTCOMES

On successful completion of this course, the students will be able to

CO1: Familiarity with the basics of several biologically inspired optimization techniques.

CO2: Familiarity with the basics of several biologically inspired computing paradigms.

CO3: Ability to select an appropriate bio-inspired computing method and implement for any application and data set.

CO4: Theoretical understanding of the differences between the major bio-inspired computing methods.

CO5: Learn Other Swarm Intelligence algorithms and implement the Bio-inspired technique with other traditional algorithms.

TEXT BOOKS

1. A.E. Elben and J. E. Smith, "Introduction to Evolutionary Computing", 2nd Edition, Springer,2015.
2. Floreano D. and Mattiussi C.,"Bio-Inspired Artificial Intelligence:Theories, Methods, and Technologies", 2nd Edition,The MIT Press, 2013.
3. Leandro Nunes de Castro, "Fundamentals of Natural Computing, Basic Concepts, Algorithms and Applications",1st Edition, CRC Press, June 2, 2006.

REFERENCE BOOKS

1. Eric Bonabeau, Marco Dorigo, Guy Theraulaz, "Swarm Intelligence: From Natural to Artificial Systems", 1st Edition,Oxford University press, October 21, 1999.
2. Christian Blum, Daniel Merkle (Eds.), "Swarm Intelligence: Introduction and Applications", 1st Edtion,Springer, 2008.

3. Leandro N De Castro, Fernando J Von Zuben, "Recent Developments in Biologically Inspired Computing", 1st Edition,Idea Group Inc., 2005.
4. Albert Y.Zomaya, "Handbook of Nature-Inspired and Innovative Computing", 1st Edition Springer, January 10, 2006.
5. Ricardo Baeza-Yates, Berthier Ribeiro-Neto," Modern Information Retrieval: The Concepts and Technology behind Search,2nd edition, Pearson,2011.

Mapping of COs with POs & PSOs

COs	POs												PSOs	
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
1	3	2	1	3	1	-	-	-	3	1	1	3	2	1
2	2	3	2	3	2	-	-	-	2	2	2	1	2	3
3	1	1	1	1	3	-	-	-	1	3	1	2	3	3
4	3	2	1	2	2	-	-	-	2	3	3	3	3	1
5	2	2	3	1	2	-	-	-	1	1	3	1	1	1
AVG	**2.2**	**2**	**1.6**	**2**	**2**	**-**	**-**	**-**	**1.8**	**2**	**2**	**2**	**2.2**	**1.8**

1-Low, 2-Medium, 3-High, '-'- No correlation

24ITPE13 COMPUTER VISION **L T P C**
3 0 0 3

COURSE OBJECTIVES

- To understand the fundamental concepts related to Image formation and processing.
- To become familiar with feature based alignment and motion estimation.
- To understand image based rendering and recognition.

UNIT I INTRODUCTION TO IMAGE FORMATION AND PROCESSING **9**

Computer Vision - Geometric primitives and transformations - Photometric image formation - The digital camera - Point operators - Linear filtering - More neighborhood operators - Fourier transforms - Pyramids and wavelets - Geometric transformations - Global optimization.

UNIT II FEATURE DETECTION, MATCHING AND SEGMENTATION **9**

Points and patches - Edges - Lines - Segmentation - Active contours - Split and merge - Mean shift and mode finding - Normalized cuts - Graph cuts and energy-based methods.

UNIT III FEATURE-BASED ALIGNMENT & MOTION ESTIMATION **9**

2D and 3D feature-based alignment - Pose estimation - Geometric intrinsic calibration – Triangulation - Two-frame structure from motion - Factorization - Bundle adjustment - Constrained structure and motion - Translational alignment - Parametric motion - Spline-based motion - Optical flow - Layered motion.

UNIT IV 3D RECONSTRUCTION **9**

Shape from X - Active range finding - Surface representations - Point-based representations- Volumetric representations - Model-based reconstruction - Recovering texture maps and albedosos.

UNIT V IMAGE-BASED RENDERING AND RECOGNITION **9**

View interpolation Layered depth images - Light fields and Lumigraphs - Environment mattes - Video- based rendering-Object detection - Face recognition - Instance recognition - Category recognition - Context and scene understanding- Recognition databases and test sets.

TOTAL: 45 PERIODS

COURSE OUTCOMES

On successful completion of this course, the students will be able to

CO1: Use basic knowledge, theories and methods in image processing and Computer vision.

CO2: Implement basic and some advanced image processing techniques in OpenCV.

CO3: Apply 2D a feature-based based image alignment, segmentation and motion estimations.

CO4: Apply 3D image reconstruction techniques.

CO5**:** Design and Develop innovative image processing and computer vision applications.

TEXT BOOKS

1. Richard Szeliski, "Computer Vision: Algorithms and Applications", 2nd Edition Springer, 2022.
2. D. A. Forsyth, J. Ponce ,"Computer Vision: A Modern Approach" , 1st Edition, Pearson, 2002.
3. Richard Szeliski,"Computer Vision: Algorithms and Applications" ,2nd Edition, Springer, 2022.

REFERENCE BOOKS

1. Richard Hartley and Andrew Zisserman, "Multiple View Geometry in Computer Vision", 2nd Edition, Cambridge University Press, March 2004.
2. Christopher M. Bishop, " Pattern Recognition and Machine Learning",1st Edition, Springer, 2006.
3. E. R. Davies, "Computer and Machine Vision", 4th Edition, Academic Press, 2012.
4. David A. Forsyth "Computer Vision: A Modern Approach" ,2nd Edition,Pearson,2011.
5. Richard Hartley, Andrew Zisserman,"Multiple View Geometry in Computer Vision", 2nd Edition, Cambridge University Press,2004.

Mapping of COs with POs & PSOs

COs	Pos												PSOs	
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
CO1	3	1	1	1	1	-	-	-	2	1	3	2	2	1
CO2	3	3	3	2	3	-	1	-	2	1	2	2	3	1
CO3	3	3	2	2	3	-	-	-	1	1	2	2	3	2
CO4	2	3	3	2	3	-	-	-	2	1	2	3	2	2
CO5	2	3	3	2	2	2	-	-	3	1	2	3	3	3
AVG	**2.6**	**2.6**	**2.4**	**1.8**	**2.4**	**0.4**	**0.25**	**0**	**2**	**1**	**2.2**	**2.4**	**2.6**	**1.8**

1-Low, 2-Medium, 3-High, '-'- No correlation

24AIPE14 OPEN SOURCE TECHNOLOGY **L T P C**
3 0 0 3

COURSE OBJECTIVES

- To understand open-source concepts, benefits, and successful projects.
- To gain practical skills in using open-source tools for various tasks.
- To learn collaboration techniques using GitHub and contribute to opensource projects.

UNIT I INTRODUCTION **9**

Need for Free and Open Source Software – Overview of Linux – Distributions – Licensing Schemes – Versions – Collaborative Version Control Systems – Shell Commands

UNIT II PROCEDURAL PROGRAMMING **9**

Object Oriented Programming in Python - Bank account simulations - Problems with procedural implementation - Building software with Classes, Objects and Instantiation

UNIT III WEB DEVELOPMENT WITH PYTHON **9**

HTML – CSS – Bootstrap – Introduction to Flask – Templates – Models – Forms – Modules.

UNIT IV WORKING WITH DATABASES **9**

Introduction to Document Databases – Working – Relational Database versus NoSQL – Modeling – Mapping Classes to MongoDB – Building Data layer with Mongo Engine.

UNIT V WORKING WITH CONTAINERS **9**

Running software in containers - Installing Dockers - Working with databases such as Redis - Building Docker images - Deployment of applications with Docker.

TOTAL: 45 PERIODS

COURSE OUTCOMES

On successful completion of this course, the students will be able to

CO1: Use shell commands for executing programs and applications.

CO2: Use Git for collaboration and maintaining different versions.

CO3: Develop a web application using the Flask framework.

CO4: Work with NoSQL Databases.

CO5: Develop a server side web application using Python**.**

TEXT BOOKS

1. Jesus M. Gonzalez Barahona, Joaquin Seoane Pascual, Gregorio Robles, “Introduction to Free Software”, 3rd Edition, Free Technology Academy, 2009.
2. Steven F. Lott, “Object-Oriented Python”,1st Edition, Addison-Wesley Professional, 2014.
3. Lawrance Roshan,“Open Source Licensing; Software Freedom and Intellectual Property law”,1st Edition,Prentice Hall,2004.

REFERENCE BOOKS

1. Allen B. Downey, Jeffrey Elkner, Chris Meyers, "How to Think Like a Computer Scientist", 2nd edition, Green Tea Press, 2012.
2. Scott Chacon, Ben Straub, "Pro Git", 2nd Edition, Apress, 2014.
3. Miguel Grinberg, "Flask Web Development Developing Web Applications with Python", 2nd Edition,O'Reilly Media , 2014.
4. Karl Seguin, "The Little Mongo DB Book",1st Edition Pearson Publications, March 28, 2011.
5. Jeff Nickoloff and Stephen Kuenzli, "Docker in Action", 2nd Edition, Manning Publications, March 2016.

Mapping of COs with POs & PSOs

COs	POs												PSOs	
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
CO1	3	3	2	1	3	-	-	-	1	2	3	3	3	3
CO2	2	2	2	1	3	-	-	-	1	2	3	3	3	3
CO3	1	1	1	2	2	-	-	-	1	2	1	1	3	2
CO4	3	2	2	3	1	-	-	-	1	3	2	3	2	3
CO5	2	3	1	3	3	-	-	-	2	3	1	2	1	2
AVG	**2.2**	**2.2**	**1.6**	**2**	**2.4**	**-**	**-**	**-**	**1.2**	**2.4**	**2**	**2.4**	**2.4**	**2.6**

1-Low, 2-Medium, 3-High, '-'- No correlation

24AIPE15 REINFORCEMENT LEARNING **L T P C**
3 0 0 3

COURSE OBJECTIVE

- Introduce the fundamental concepts, elements, and scope of reinforcement learning, including the agent-environment interaction and classical problems such as the n-armed bandit.
- Provide a strong mathematical foundation through the study of the Bellman equation, and dynamic programming techniques for optimal decision making.
- Develop practical understanding of model-free learning approaches.

UNIT I INTRODUCTION TO REINFORCEMENT LEARNING **9**

Introduction to Reinforcement Learning–Elements of Reinforcement Learning–Limitations and Scope – History of Reinforcement Learning– The Agent-Environment Interface - An-Armed Bandit Problem.

UNIT II MARKOV DECISION PROCESS AND DYNAMIC PROGRAMMING **9**

Markov Decision Process – Action Space – Policy – Episode – Return and Discount Factor - The Markov Property – Markov Decision Processes – Bellman Equation – Dynamic Programming – Value Iteration and Policy Iteration.

UNIT III MONTE CARLO METHODS AND TEMPORAL METHODS **9**

Understanding Monte Carlo Method – Prediction and Control Tasks – Monte Carlo Prediction – First and Every Visit – Monte Carlo Control – Understanding Temporal Difference Learning – TD Prediction – On-Policy TD Control – SARSA – Off-Policy TD Control – Q-Learning.

UNIT IV DEEP Q NETWORKS AND ITS VARIANTS **9**

DQN – replay Buffer – Loss functions – Target Function – Architecture of DQN – Double DQN – DQN with prioritized Experience replay – Dueling DQN – Deep Recurrent Method.

UNIT V FUNCTION APPROXIMATION **9**

Getting Started with Policy Gradient Methods – Policy Gradient Intuition – Variance Reduction Methods – Actor – Citic Methods – A2C , A3C , A3C – Deep Gradient Policy Gradient – Twin Delayed DDPG – Trust Region Policy Approximation – TRPO -Proximal Policy Optimization.

TOTAL: 45 PERIODS

COURSE OUTCOMES

On successful completion of this course, the students will be able to

CO1: Explain the different terminologies of RL and Concepts of Probability.

CO2: Illustrate Markov Decision Process and Bellman Equation for learning.

CO3: Apply dynamic programming techniques on Markov decision process and Monte Carlo methods.

CO4: Implement Time difference learning for real world problems.

CO5: Apply Approximation methods of learning and Q-Learning Technique.

TEXT BOOKS

1. Richard **S.** Sutton & Andrew G. Barto. "Reinforcement Learning: An Introduction",2nd Edition, MIT Press,2018.
2. Aske Plaat ,"Deep Reinforcement Learning: A Textbook", Springer Nature,2021.
3. Csaba Szepesvári, "Reinforcement Learning: Theory and Algorithm", 1st Edition, Springer,2020.

REFERENCE BOOKS

1. Richard S.Sutton and Andrew G.Barto, "Reinforcement learning: An introduction", 2nd Edition, MIT Press, 2019.
2. Sudharsan Ravichandiran, "Deep Reinforcement Learning with Python" , 2nd Edition, Packet Publishing, 2020.
3. Kevin P Murphy, "Machine Learning: A Probabilistic Perspective", 2nd Edition,MIT Press, 2022.
4. Csaba Szepesvari, "Algorithms for Reinforcement Learning (Synthesis Lectures on Artificial Intelligence & Machine Learning)", Morgan & Claypool Publishers, 2010.
5. Laura Graesser and Wah Loon Keng, "Foundations of Deep Reinforcement learning: theory", Cambridge University Press,2018.

Mapping of COs with POs & PSOs

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	3	3	2	1	3	-	-	-	1	2	3	3	3	3
CO2	2	2	2	1	3	-	-	-	1	2	3	3	3	3
CO3	1	1	1	2	2	-	-	-	1	2	1	1	3	2
CO4	3	2	2	3	1	-	-	-	1	3	2	3	2	3
CO5	2	3	1	3	3	-	-	-	2	3	1	2	1	2
AVG	2.2	2.2	1.6	2	2.4	-	-	-	1.2	2.4	2	2.4	2.4	2.6

1-Low, 2-Medium, 3-High, '-'- No correlation

24ITPE16 SOFT COMPUTING **L T P C**

3 0 0 3

COURSE OBJECTIVES

- To introduce the ideas of fuzzy sets, fuzzy logic and use of heuristics based on human experience.
- To provide the mathematical background for carrying out the optimization associated with neural network learning.

UNIT I INTRODUCTION TO SOFT COMPUTING AND FUZZY LOGIC **9**

Introduction - Fuzzy Logic - Fuzzy Sets, Fuzzy Membership Functions, Operations on Fuzzy Sets, Fuzzy Relations, Operations on Fuzzy Relations, Fuzzy Rules and Fuzzy Reasoning, Fuzzy Inference Systems.

UNIT II NEURAL NETWORKS **9**

Supervised Learning Neural Networks – Perceptrons - Backpropagation -Multilayer Perceptrons – Unsupervised Learning Neural Networks – Kohonen Self-Organizing Networks

UNIT III GENETIC ALGORITHMS **9**

Chromosome Encoding Schemes -Population initialization and selection methods - Evaluation function - Genetic operators- Cross over – Mutation - Fitness Function – Maximizing function.

UNIT IV NEURO FUZZY MODELING **9**

ANFIS architecture – hybrid learning – ANFIS as universal approximator – Coactive Neuro fuzzy modeling – Framework – Neuron functions for adaptive networks – Neuro fuzzy spectrum - Analysis of Adaptive Learning Capability

UNIT V APPLICATIONS **9**

Modeling a two input sine function - Printed Character Recognition – Fuzzy filtered neural networks – Plasma Spectrum Analysis – Hand written neural recognition - Soft Computing for Color Recipe Prediction.

TOTAL:45 PERIODS

COURSE OUTCOMES

On successful completion of this course, the students will be able to

CO1: Explain the fuzzy logic operators and inference mechanisms.

CO2: Apply neural network architecture for AI applications such as classification and Clustering.

CO3: Learn the functionality of Genetic Algorithms in Optimization problems.

CO4: Use hybrid techniques involving Neural networks and Fuzzy logic.

CO5: Apply soft computing techniques in real world applications.

TEXT BOOKS

1. Jyh-Shing Roger Jang, Chuen-Tsai Sun, Eiji Mizutani "Neuro-fuzzy and soft computing: A computational approach to learning and machine intelligence", Pearson Education India,1997.
2. Fakhreddine O. Karray & Clarence De Silva, "Soft Computing and Intelligent Systems: Theory and Applications" ,1st Edition, Academic Press,1999.
3. S. N. Sivanandam, S. N. Deepa, "Principles of Soft computing" , 3rd Edition, Wiley India,2018.

REFERENCE BOOKS

1. Roj Kaushik and Sunita Tiwari, "Soft Computing-Fundamentals Techniques and Applications", 1st Edition, McGraw Hill, 2018.
2. S. Rajasekaran and G.A.V.Pai, "Neural Networks, Fuzzy Logic and Genetic Algorithms", PHI, 2003.
3. Samir Roy, Udit Chakraborthy, "Introduction to Soft Computing, Neuro Fuzzy and Genetic Algorithms", Pearson Education, 2013.
4. S.N. Sivanandam, S.N. Deepa, "Principles of Soft Computing",3rd Edition, Wiley India Pvt Ltd, 2019.
5. R.Eberhart, P.Simpson and R.Dobbins, "Computational Intelligence – PC Tools", AP Professional, Boston, 1996.

Mapping of COs with POs & PSOs

COs	POs												PSOs	
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
CO1	3	2	3	3	3	-	-	-	3	1	3	2	3	1
CO2	2	3	3	2	3	-	-	-	3	2	3	2	2	1
CO3	1	3	2	2	1	-	-	-	3	1	1	2	1	3
CO4	1	2	1	3	2	-	-	-	3	3	1	1	2	1
CO5	2	3	1	2	1	-	-	-	3	3	3	2	1	2
AVG	**1.8**	**2.6**	**2**	**2.4**	**2**	**-**	**-**	**-**	**3**	**2**	**2.2**	**1.8**	**1.8**	**1.6**

1-Low, 2-Medium, 3-High, '-'- No correlation

24AIPE17 CLOUD COMPUTING **L T P C**
3 0 0 3

COURSE OBJECTIVES

- To understand the principles of cloud architecture, models and infrastructure.
- To understand the concepts of virtualization and virtual machines.
- To gain knowledge about virtualization Infrastructure.

UNIT I CLOUD ARCHITECTURE MODELS AND INFRASTRUCTURE 9

Cloud Architecture: System Models for Distributed and Cloud Computing – NIST Cloud Computing Reference Architecture – Cloud deployment models – Cloud service models; Cloud Infrastructure: Architectural Design of Compute and Storage Clouds – Design Challenges.

UNIT II VIRTUALIZATION BASICS 9

Virtual Machine Basics – Taxonomy of Virtual Machines – Hypervisor – Key Concepts – Virtualization structure – Implementation levels of virtualization – Virtualization Types: Full Virtualization – Para Virtualization – Hardware Virtualization – Virtualization of CPU, Memory and I/O devices.

UNIT III VIRTUALIZATION INFRASTRUCTURE AND DOCKER 9

Desktop Virtualization – Network Virtualization – Storage Virtualization – System-level of Operating Virtualization – Application Virtualization – Virtual clusters and Resource Management – Containers vs. Virtual Machines – Introduction to Docker – Docker Components – Docker Container – Docker Images and Repositories.

UNIT IV CLOUD DEPLOYMENT ENVIRONMENT 9

Google App Engine – Amazon AWS – Microsoft Azure; Cloud Software Environments – Eucalyptus – OpenStack.

UNIT V CLOUD SECURITY 9

Virtualization System-Specific Attacks: Guest hopping – VM migration attack – hyperjacking. Data Security and Storage; Identity and Access Management (IAM) - IAM Challenges - IAM Architecture and Practice.

TOTAL:45 PERIODS

COURSE OUTCOMES

On successful completion of this course, the students will be able to

CO1: Explain the design challenges in the cloud.

CO2: Apply the concept of virtualization and its types.

CO3: Experiment with virtualization of hardware resources and Docker.

CO4: Develop and deploy services on the cloud and set up a cloud environment.

CO5: Explain security challenges in the cloud environment.

TEXT BOOKS

1. Kai Hwang, Geoffrey C Fox, Jack G Dongarra, "Distributed and Cloud Computing, From Parallel Processing to the Internet of Things", Morgan Kaufmann Publishers, 2011.
2. James Turnbull, "The Docker Book",Turnbull Press , 2014.
3. Krutz, R. L., Vines, R. D, "Cloud security. A Comprehensive Guide to Secure Cloud Computing", Wiley Publishing, 2010.

REFERENCE BOOKS

1. James E. Smith, Ravi Nair, "Virtual Machines: Versatile Platforms for Systems and Processes", Elsevier/Morgan Kaufmann, 2005.
2. Tim Mather, Subra Kumaraswamy, and Shahed Latif, "Cloud Security and Privacy: enterprise perspective on risks and compliance", O'Reilly Media, Inc., 2009.
3. Thomas Erl, Ricardo Puttini, Zaigham Mahmood,"Cloud Computing: Concepts, Technology & Architecture**",** 1st Edition, Pearson, 2013.
4. Thomas Erl, Eric Barceló Monroy,"Cloud Computing: Concepts, Technology, Security, and Architecture",2nd Edition,Pearson, 2023.
5. Rajkumar Buyya, James Broberg, Andrzej Goscinski."Cloud Computing: Principles and Paradigms", 1st Edition,Wiley,2011.

Mapping of COs with POs & PSOs

COs	POs												PSOs	
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
CO1	3	2	1	1	1	-	-	-	2	3	1	3	2	1
CO2	3	1	2	2	1	-	-	-	1	2	1	3	2	2
CO3	2	3	2	3	1	-	-	-	3	1	1	3	1	1
CO4	1	2	3	3	3	-	-	-	3	3	1	2	1	3
CO5	2	3	3	1	3	-	-	-	2	2	1	2	2	2
AVG	**2.2**	**2.2**	**2.2**	**2**	**1.8**	**-**	**-**	**-**	**2.2**	**2.2**	**1**	**2.6**	**1.6**	**1.8**

1-Low, 2-Medium, 3-High, '-'- No correlation

24AIPE18 VIRTUALIZATION **L T P C**

3 0 0 3

COURSE OBJECTIVES

- To learn the basics and types of Virtualization.
- To understand the Hypervisors and its types.
- To Explore the Virtualization Solutions

UNIT I INTRODUCTION TO VIRTUALIZATION **9**

Virtualization and cloud computing - Need of virtualization – cost, administration, fast deployment, reduce infrastructure cost – limitations- Types of hardware virtualization: Full virtualization - partial virtualization - Paravirtualization-Types of Hypervisors.

UNIT II SERVER AND DESKTOP VIRTUALIZATION **9**

Virtual machine basics- Types of virtual machines- Understanding Server Virtualization- types of server virtualization- Business Cases for Server Virtualization – Uses of Virtual Server Consolidation – Selecting Server Virtualization Platform-Desktop Virtualization-Types of Desktop Virtualization.

UNIT III NETWORK VIRTUALIZATION **9**

Introduction to Network Virtualization-Advantages- Functions-Tools for Network Virtualization-VLAN- WAN Architecture-WAN Virtualization.

UNIT IV STORAGE VIRTUALIZATION **9**

Memory Virtualization-Types of Storage Virtualization-Block, File-Address space Remapping-Risks of Storage Virtualization-SAN-NAS-RAID.

UNIT V VIRTUALIZATION TOOLS **9**

VMWare-Amazon AWS-Microsoft HyperV- Oracle VM Virtual Box - IBM PowerVM-Google Virtualization- Case study.

TOTAL: 45 PERIODS

COURSE OUTCOMES

On successful completion of this course, the students will be able to

CO1: Analyze the virtualization concepts and Hypervisor.

CO2: Apply the Virtualization for real-world applications.

CO3: Install & Configure the different VM platforms.

CO4: Experiment with the VM with various software.

CO5: Evaluate the performance, benefits, and limitations of virtualization technologies in enterprise and cloud environments.

TEXT BOOKS

1. Anthony T.Velte , Toby J. Velte Robert Elsenpeter “Cloud computing a practical approach” -TATA McGraw- Hill , New Delhi – 2010.
2. James Broberg, Andrzej Goscinski, “Cloud Computing (Principles and Paradigms)”, John Wiley & Sons, Inc. 2011.
3. David Marshall, Wade A. Reynolds, Advanced Server Virtualization: VMware and Microsoft Platform in the Virtual Data Center, Auerbach.

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REFERENCE BOOKS

1. Chris Wolf, Erick M. Halter, "Virtualization: From the Desktop to the Enterprise", A Press, 2005.
2. James E. Smith, Ravi Nair, "Virtual Machines: Versatile Platforms for Systems and Processes", Elsevier/Morgan Kaufmann, 2005.
3. David Marshall, Wade A. Reynolds, "Advanced Server Virtualization: VMware and Microsoft Platform in the Virtual Data Center", Auerbach Publications, 2006.
4. Virtualization Essentials (3rd Edition) by Matthew Portnoy.
5. Virtualization: A Manager's Guide by Dan Kusnetzky.

Mapping of COs with POs & PSOs

COs	POs												PSOs	
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
CO1	1	3	1	3	2	-	-	-	1	1	3	1	2	3
CO2	3	2	2	1	2	-	-	-	1	2	2	3	3	2
CO3	3	2	1	3	1	-	-	-	2	2	1	3	3	3
CO4	1	1	2	3	3	-	-	-	3	3	1	1	3	2
CO5	1	3	2	3	1	-	-	-	2	1	3	3	1	1
AVG	**1.8**	**2.2**	**1.6**	**2.6**	**1.8**	**-**	**-**	**-**	**1.8**	**1.8**	**2**	**2.2**	**2.4**	**2.2**

1-Low, 2-Medium, 3-High, '-'- No correlation

24AIPE19 CLOUD SERVICES MANAGEMENT **L T P C**
3 0 0 3

COURSE OBJECTIVES

- Introduce Cloud Service Management terminology, definition & concepts.
- Compare and contrast cloud service management with traditional IT service management.
- Identify strategies to reduce risk and eliminate issues associated with adoption of cloud Services.

UNIT I CLOUD SERVICE MANAGEMENT FUNDAMENTALS **9**

cloud Ecosystem, The Essential Characteristics, Basics of Information Technology Service Management and Cloud Service Management, Service Perspectives, Cloud Service Models, Cloud Service Deployment Models.

UNIT II CLOUD SERVICES STRATEGY **9**

Cloud Strategy Fundamentals, Cloud Strategy Management Framework, Cloud Policy, Key Driver for Adoption, Risk Management, IT Capacity and Utilization, Demand and Capacity matching, Demand Queueing, Change Management, Cloud Service Architecture.

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UNIT III CLOUD SERVICE MANAGEMENT **9**

Cloud Service Reference Model, Cloud Service LifeCycle, Basics of Cloud Service Design, Dealing with Legacy Systems and Services, Benchmarking of Cloud Services, Cloud Service Capacity Planning, Cloud Service Deployment and Migration, Cloud Marketplace, Cloud Service Operations Management.

UNIT IV CLOUD SERVICE ECONOMICS **9**

Pricing models for Cloud Services, Freemium, Pay Per Reservation, Pay per User, Subscription based Charging, Procurement of Cloud-based Services, Capex vs Opex Shift, Cloud service Charging, Cloud Cost Models.

UNIT V CLOUD SERVICE GOVERNANCE & VALUE **9**

IT Governance Definition, Cloud Governance Definition, Cloud Governance Framework, Cloud Governance Structure, Cloud Governance Considerations, Cloud Service Model Risk Matrix, Understanding Value of Cloud Services, Measuring the value of Cloud Services, Balanced Scorecard, Total Cost of Ownership

TOTAL: 45 PERIODS

COURSE OUTCOMES

On successful completion of this course, the students will be able to

CO1: Exhibit cloud-design skills to build and automate business solutions using cloud technologies.

CO2: Possess Strong theoretical foundation leading to excellence and excitement towards adoption of Cloud-based services.

CO3: Solve the real world problems using Cloud services and technologies.

CO4: Explain the processes and lifecycle of cloud service management, including service design, Service transition, service operation and continuous improvement.

CO5: Evaluate cloud service providers and make informed decisions based on factors such as Cost, performance, security, and compliance.

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TEXT BOOKS

1. Enamul Haque, "Cloud Service Management and Governance: Smart Service Management in Cloud Era" , Lulu Press, 2020.
2. Thomas Erl, Ricardo Puttini, Zaigham Mahmood, "Cloud Computing: Concepts, Technology & Architecture", Pearson Education,2013.
3. Thomas Erl, Robert Cope, Amin Naserpour ,"Cloud Computing Design Patterns", Pearson Education,2015.

REFERENCE BOOKS

1. Bill Williams,"Economics of Cloud Computing", 1st Edition, Cisco Press,2012.
2. Rajkumar Buyya, Christian Vechhiola, S. Thamarai Selvi. "Mastering Cloud Computing Foundations and Applications Programming",1st Edition, Morgan Kaufmann,2013.
3. Talal H. Noor, Quan Z. Sheng, Athman Bouguettaya."Trust Management in Cloud Services" ,1st Edition, : Springer International Publishing,2014.

4. Imad M. Abbadi. "Cloud Management and Security", 1st Edition, John Wiley & Sons,2014.
5. Yongkui Liu, Lin Zhang, "Service Management and Scheduling in Cloud Manufacturing",1st Edition, De Gruyter,2022.

Mapping of COs with POs & PSOs

COs	POs												PSOs	
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
CO1	3	3	1	1	1	-	-	-	2	1	3	2	2	1
CO2	3	1	2	3	2	-	-	-	1	2	3	1	2	2
CO3	1	1	3	1	3	-	-	-	3	3	1	1	3	2
CO4	1	1	1	2	3	-	-	-	2	3	3	1	1	1
CO5	1	3	3	2	2	-	-	-	1	3	1	2	1	3
AVG	**1.8**	**1.8**	**2**	**1.8**	**2.2**	**-**	**-**	**-**	**1.8**	**2.4**	**2.2**	**1.4**	**1.8**	**1.8**

1-Low, 2-Medium, 3-High, '-'- No correlation

24AIPE20 QUANTUM COMPUTING **L T P C**
3 0 0 3

COURSEOBJECTIVES

- To know the background of classical computing and quantum computing.
- To learn the fundamenta lconcepts behind quantum computation.
- To study the details of quantum mechanics and its relation to Computer Science.

UNIT I QUANTUM COMPUTING BASIC CONCEPTS **9**

Complex Numbers – Linear Algebra – Matrices and Operators -Global Perspectives Postulates of Quantum Mechanics – Quantum Bits - Representations of Qubits – Superposition's.

UNIT II QUANTUMGATESANDCIRCUITS **9**

Universal logicgates–Basic single qubitgates – Multiple qubitgates – Circuit development-Quantum error correction.

UNIT III QUANTUM ALGORITHMS **9**

Quantum parallelism - Deutsch'salgorithm–The Deutsch – Jozsa algorithm–Quantum Fourier transform and its applications - Quantum Search Algorithms: Grover's Algorithm.

UNIT IV QUANTUM INFORMATION THEORY **9**

Data compression - Shannon's noiseless channel coding theorem - Schumacher's quantum noiseless channel coding theorem – Classical information over noisy quantum channels.

UNIT V QUANTUM CRYPTOGRAPHY **9**

Classical cryptography basic concepts-Private key cryptography - Shor's Factoring Algorithm-Quantum Key Distribution - BB84 - Ekart 91.

TOTAL: 45 PERIODS

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COURSE OUTCOMES

On successful completion of this course, the students will be able to

CO1: Explain the basics of quantum computing.

CO2: Analyze the background of Quantum Mechanics.

CO3: Analyze the computation models.

CO4: Model the circuits using quantum computation environments and frameworks.

CO5: Expolre the quantum operations such as noise and error-correction.

TEXT BOOKS

1. Parag K. Lala, "Quantum Computing: A Beginner's Introduction", 1st Edition, McGraw Hill Education,1 November 2020.
2. Michael A. Nielsen, IsaacL. Chuang, "Quantum Computation and Quantum Information",10th Edition, Cambridge University Press, 2010.
3. Chris Bernhardt, "Quantum Computing for Everyone", Reprint Edition, The MIT Press, 8 September 2020.

REFERENCE BOOKS

1. Scott Aaronson, "Quantum Computing Since Democritus", Cambridge University Press, 2013.
2. N. David Mermin, "Quantum Computer Science: An Introduction", Cambridge University Press, 2007.
3. Jack D. Hidary, " Quantum Computing: An Applied Approach", Second Edition, Springer, 2021.
4. Michael A. Nielsen, Isaac L. Chuang, "Quantum Computation and Quantum Information",10th Edition, Cambridge University Press, 2007.
5. Eleanor G. Rieffel, Wolfgang H. Polak," Quantum Computing: A Gentle Introduction",MIT Press,2011.

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Mapping of COs with POs & PSOs

COs	POs												PSOs	
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
CO1	3	2	2	2	-	-	-	-	2	-	-	-	2	3
CO2	3	2	2	2	-	-	-	-	2	-	-	-	2	3
CO3	3	3	3	3	2	-	-	-	3	-	-	-	3	2
CO4	3	3	3	3	3	-	-	-	3	-	-	-	1	3
CO5	3	3	2	3	-	-	-	-	2	-	-	-	1	3
AVG	**3**	**2.6**	**2.4**	**2.6**	**1**	**-**	**-**	**-**	**2.4**	**-**	**-**	**-**	**1.8**	**2.8**

1-Low, 2-Medium, 3-High, '-'- No correlation

24AIPE21 DATA WAREHOUSING **L T P C**
3 0 0 3

COURSE OBJECTIVES

- To know the details of data warehouse Architecture.
- To understand the OLAP Technology.
- To understand the roles of process manager & system manager.

UNIT I INTRODUCTION TO DATA WAREHOUSE **9**

Data warehouse Introduction - Data warehouse components- operational database Vs data warehouse – Data warehouse Architecture – Three-tier Data Warehouse Architecture - Autonomous Data Warehouse- Autonomous Data Warehouse Vs Snowflake - Modern Data Warehouse.

UNIT II ETL AND OLAP TECHNOLOGY **9**

What is ETL – ETL Vs ELT – Types of Data warehouses - Data warehouse Design and Modeling - Delivery Process - Online Analytical Processing (OLAP) - Characteristics of OLAP - Online Transaction Processing (OLTP) Vs OLAP - OLAP operations- Types of OLAP- ROLAP Vs MOLAP Vs HOLAP.

UNIT III META DATA, DATA MART AND PARTITION STRATEGY **9**

Meta Data – Categories of Metadata – Role of Metadata – Metadata Repository – Challenges for Meta Management - Data Mart – Need of Data Mart- Cost Effective Data Mart- Designing Data Marts- Cost of Data Marts- Partitioning Strategy – Vertical partition – Normalization – Row Splitting – Horizontal Partition.

UNIT IV DIMENSIONAL MODELING AND SCHEMA **9**

Dimensional Modeling- Multi-Dimensional Data Modeling – Data Cube- Star Schema- Snowflake schema- Star Vs Snowflake schema- Fact constellation Schema- Schema Definition - Process Architecture- Types of Data Base Parallelism – Data warehouse Tools.

UNIT V SYSTEM & PROCESS MANAGERS **9**

Data Warehousing System Managers: System Configuration Manager- System Scheduling Manager - System Event Manager - System Database Manager - System Backup Recovery Manager - Data Warehousing Process Managers: Load Manager – Warehouse Manager- Query Manager – Tuning – Testing.

TOTAL: 45 PERIODS

COURSE OUTCOMES

On successful completion of this course, the students will be able to

CO1: Design data warehouse architecture for various Problems.

CO2: Apply the OLAP Technology.

CO3: Analyze the partitioning strategy.

CO4: Critically analyze the differentiation of various schema for given problem.

CO5: Frame roles of process manager & system manager.

TEXT BOOKS

1. Alex Berson and Stephen J. Smith "Data Warehousing, Data Mining & OLAP", 3rd Edition, McGraw – Hill Education, 2017..
2. Ralph Kimball, "The Data Warehouse Toolkit: The Complete Guide to Dimensional Modeling", 3rd edition, Wiley,2013.
3. Sam Anahory and Dennis Murray "Data Warehousing in the Real World: A Practical Guide for Building Decision Support Systems" , Addison-Wesley,1997.

REFERENCE BOOKS

1. Paul Raj Ponniah, "Data warehousing fundamentals for IT Professionals", 2nd Edition,Wiley,2010.
2. K.P. Soman, ShyamDiwakar and V. Ajay ,"Insight into Data mining Theory and Practice", 1st Edition, Prentice Hall of India, 2006.
3. W.H. Inmon ,"Building the Data Warehouse",4th Edition,Wiley,2005 .
4. Matthias Jarke, Maurizio Lenzerini, Yannis Vassiliou, Panos Vassiliadis, "Fundamentals of Data Warehouses", Springer,2013.
5. Ralph Kimball and Margy Ross, "The Data Warehouse Toolkit: The Definitive Guide to Dimensional Modeling",3rd Edition,Wiley,2013.

Mapping of COs with POs & PSOs

COs	POs												PSOs	
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
CO1	3	3	3	2	2	-	-	-	3	-	-	3	2	3
CO2	3	2	2	2	3	-	-	-	2	-	2	2	2	3
CO3	3	3	3	3	-	-	-	-	-	-	-	3	3	2
CO4	3	3	3	3	-	-	-	-	-	-	-	3	1	3
CO5	3	2	2	2	-	2	-	-	-	-	2	2	1	3
AVG	**3**	**2.6**	**2.6**	**1.2**	**2.5**	**1**	**-**	**-**	**2.5**	**-**	**2**	**2.6**	**1.8**	**2.8**

1-Low, 2-Medium, 3-High, '-'- No correlation

24AIPE22 STORAGE TECHNOLOGIES **L T P C**

3 0 0 3

COURSE OBJECTIVES

- Characterize the functionalities of logical and physical components of storage.
- Describe various storage networking technologies.
- Understand common storage management activities and solutions.

UNIT I STORAGE SYSTEMS **9**

Introduction to Information Storage: Digital data and its types, Information storage, Key characteristics of data center and Evolution of computing platforms. Information Lifecycle Management. Third Platform Technologies: Cloud computing and its essential characteristics, Cloud services and cloud deployment models, Big data analytics, Social networking and mobile computing, Characteristics of third platform infrastructure and Imperatives for third platform transformation. Data Center Environment: Building blocks of a data center, Compute systems and compute virtualization and Software-defined data center.

UNIT II INTELLIGENT STORAGE SYSTEMS AND RAID **9**

Components of an intelligent storage system, Components, addressing, and performance of hard disk drives and solid-state drives, RAID, Types of intelligent storage systems, Scale-up and scale- out storage Architecture**.**

UNIT III STORAGE NETWORKING TECHNOLOGIES AND VIRTUALIZATION 9

Block-Based Storage System, File-Based Storage System, Object-Based and Unified Storage. Fibre Channel SAN: Software-defined networking, FC SAN components and architecture, FC SAN topologies, link aggregation, and zoning, Virtualization in FC SAN environment. Internet Protocol SAN: iSCSI protocol, network components, and connectivity, Link aggregation, switch aggregation, and VLAN, FCIP protocol, connectivity, and configuration. Fibre Channel over Ethernet SAN: Components of FCoE SAN, FCoE SAN connectivity, Converged Enhanced Ethernet, FCoE architecture.

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UNIT IV BACKUP, ARCHIVE AND REPLICATION **9**

Introduction to Business Continuity, Backup architecture, Backup targets and methods, Data deduplication, Cloud-based and mobile device backup, Data archive, Uses of replication and its characteristics, Compute based, storage-based, and network-based replication, Data migration, Disaster Recovery as a Service (DRaaS)**.**

UNIT V SECURING STORAGE INFRASTRUCTURE **9**

Information security goals, Storage security domains, Threats to a storage infrastructure, Security controls to protect a storage infrastructure, Governance, risk, and compliance, Storage infrastructure management functions, Storage infrastructure management processes.

TOTAL: 45 PERIODS

COURSE OUTCOMES

On successful completion of this course, the students will be able to

CO1: Demonstrate the fundamentals of information storage management and various models of Cloud infrastructure services and deployment.

CO2: Illustrate the usage of advanced intelligent storage systems and RAID.

CO3: Interpret various storage networking architectures - SAN, including storage Sub systems and Virtualization.

CO4: Examine the different role in providing disaster recovery and remote replication Technologies.

CO5: Infer the security needs and security measures to be employed in information storage Management.

TEXT BOOKS

1. EMC Corporation, "Information Storage and Management", 2nd Edition,Wiley, 2012.
2. Jon Tate, Pall Beck, Hector Hugo Ibarra, Shanmuganathan Kumaravel and Libor Miklas, "Introduction to Storage Area Networks", 9th Edition, IBM - Redbooks, December 2017.
3. Ulf Troppens, Rainer Erkens, Wolfgang Mueller-Friedt, Rainer Wolafka, Nils Haustein," Storage Networks Explained", 2nd Edition, Wiley, 2009.

REFERENCE BOOKS

1. Richard Barker, Paul Massiglia," The Complete Guide to Storage Area Networks",1st Edition, Addison-Wesley,2001.
2. Marc Farley,"Storage Networking Fundamentals: An Introduction to Storage Devices,Subsystems, Applications, Management, and File Systems" ,CISCO Press,2005.
3. Tom Clark,"Designing Storage Area Networks: A Practical Guide to SANs and NAS",2nd Edition,Addison-Wesley,2003.
4. Troppens, Rainer Erkens, Wolfgang Müller-Friedt,"Storage Networks Explained: Basics and Application of Fibre Channel SAN",2nd Edition,Wiley,2011.
5. Roland Hughes,"The Complete Guide to Data Storage Technologies for Networked Enterprise Environments",2nd Edition,Wiley, 2012.

.Mapping of COs with POs & PSOs

COs	POs												PSOs	
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
CO1	1	2	1	3	3	-	-	-	1	1	1	3	1	2
CO2	3	1	2	3	3	-	-	-	3	2	3	2	2	3
CO3	1	1	3	2	2	-	-	-	3	1	1	2	2	3
CO4	3	2	1	2	2	-	-	-	1	1	3	1	3	2
CO5	1	3	2	1	2	-	-	-	1	2	3	1	3	2
AVG	**1.8**	**1.8**	**1.8**	**2.2**	**2.4**	**-**	**-**	**-**	**1.8**	**1.4**	**2.2**	**1.8**	**2.2**	**2.4**

1-Low, 2-Medium, 3-High, '-'- No correlation

24AIPE23 ENGINEERING SECURE SOFTWARE SYSTEMS **L T P C**
3 0 0 3

COURSE OBJECTIVES

- Know the importance and need for software security.
- Understand risk management in secure software development.
- Know the working of tools related to software security.

UNIT I NEED OF SOFTWARE SECURITY AND LOW-LEVEL ATTACKS 9

Software Assurance and Software Security - Threats to software security - Sources of software insecurity - Benefits of Detecting Software Security - Properties of Secure Software – Memory-Based Attacks: Low-Level Attacks against Heap and Stack - Defense Against Memory-Based Attacks.

UNIT II SECURE SOFTWARE DESIGN 9

Requirements engineering for secure software - SQUARE process Model - Requirements elicitation and prioritization- Isolating the Effects of Untrusted Executable Content - Stack Inspection – Policy Specification Languages – Vulnerability Trends – Buffer Overflow – Code Injection - Session Hijacking. Secure Design - Threat Modeling and Security Design Principles.

UINT III SECURITY RISK MANAGEMENT 9

Risk Management Life Cycle – Risk Profiling – Risk Exposure Factors – Risk Evaluation and Mitigation – Risk Assessment Techniques – Threat and Vulnerability Management.

UNIT IV SECURITY TESTING 9

Traditional Software Testing - Comparison - Secure Software Development Life Cycle - Risk Based Security Testing - Prioritizing Security Testing With Threat Modeling - Penetration Testing - Planning and Scoping – Enumeration - Remote Exploitation - Web Application - Exploits and Client Side Attacks – Post Exploitation - Bypassing Firewalls and Avoiding Detection - Tools for Penetration Testing.

UNIT V SECURE PROJECT MANAGEMENT 9

Governance and security - Adopting an enterprise software security framework - Security and project management - Maturity of Practice

TOTAL: 45 PERIODS

COURSE OUTCOMES

On successful completion of this course, the students will be able:

CO1: Identify various vulnerabilities related to memory attacks.
CO2: Apply security principles in software development.
CO3: Evaluate the extent of risks.
CO4: Involve selection of testing techniques related to software security in the testing p hase of software development.
CO5: Use tools for securing software.

TEXT BOOKS

1. Julia H. Allen, “Software Security Engineering”, Addison-Wesley Professional , 2008.
2. Evan Wheeler, “Security Risk Management: Building an Information Security Risk Management Program from the Ground Up”, 1st edition, Syngress Publishing, 2011.

3. Chris Wysopal, Lucas Nelson, Dino Dai Zovi, and Elfriede Dustin, "The Art of Software Security Testing: Identifying Software Security Flaws (Symantec Press)", Addison Wesley Professional, 2006.

REFERENCE BOOKS

1. Robert C. Seacord, "Secure Coding in C and C++ (SEI Series in Software Engineering)", Addison-Wesley Professional, 2005.
2. Jon Erickson, "Hacking: The Art of Exploitation", 2nd Edition, No Starch Press, 2008.
3. Mike Shema, "Hacking Web Apps: Detecting and Preventing Web Application Security Problems", 1st edition, Syngress Publishing, 2012.
4. Bryan Sullivan and Vincent Liu, "Web Application Security, A Beginner's Guide", 1st Edition, McGraw Hill, 2011.
5. Lee Allen, "Advanced Penetration Testing for Highly-Secured Environments: The Ultimate Security Guide (Open Source: Community Experience Distilled)", 2nd Edition, Packet Publishing, 2012.

Mapping of COs with POs & PSOs

COs	POs												PSOs	
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
CO1	2	3	2	3	2	-	-	-	2	1	2	2	2	2
CO2	2	2	2	3	3	-	-	-	2	1	2	2	1	2
CO3	1	2	2	2	1	-	-	-	1	1	2	1	2	2
CO4	2	3	2	2	2	-	-	-	2	1	2	2	2	2
CO5	2	1	2	2	3	-	-	-	2	1	1	2	2	1
AVG	**1.8**	**2.2**	**2**	**2.4**	**2.2**	**-**	**-**	**-**	**1.8**	**1**	**1.8**	**1.8**	**1.8**	**1.8**

1-Low, 2-Medium, 3-High, '-'- No correlation

24AIPE24 CLOUD DEPLOYMENT AND MANAGEMENT **L T P C**

3 0 0 3

COURSE OBJECTIVES

- This course aims to provide students with a comprehensive understanding of cloud computing, foundational concepts, service models, deployment strategies, and operational practices.
- Through theoretical knowledge and practical experience, students will gain proficiency in utilizing cloud platforms, implementing virtualization and containerization technologies.
- It also emphasizes the importance of security, compliance, and cost optimization in cloud environments.

UNIT I INTRODUCTION TO CLOUD COMPUTING **9**

Overview of Cloud Computing: Concepts, history, characteristics-Cloud Service Models: IaaS, PaaS, SaaS – definitions and use cases - Cloud Deployment Models: Public, Private, Hybrid, Multi – cloud - Benefits and Challenges of Cloud Adoption.

UNIT II CLOUD SERVICE PROVIDERS **9**

Amazon Web Services (AWS): EC2, S3, IAM, VPC-Microsoft Azure: VMs, Azure Blob Storage, Azure AD-Google Cloud Platform: Compute Engine, Cloud Storage, IAM-Comparing key services and pricing models.

UNIT III VIRTUALIZATION AND CONTAINERIZATION **9**

Virtual Machines vs. Containers - Docker: Architecture, Installation, Docker files, Hub, Volumes - Kubernetes Basics: Pods, Services, Deployments-Orchestration, Scaling, and Container Lifecycle Management

UNIT IV CLOUD DEPLOYMENT TECHNIQUES **9**

Infrastructure as Code: Terraform, AWS Cloud Formation-CI/CD Pipelines: Jenkins, GitHub Actions, GitLab CI-Configuration and Deployment Automation: Ansible, Chef, Puppet-Deployment Strategies: Blue-Green, Canary, Rolling

UNIT V CLOUD MONITORING, SECURITY, AND COST MANAGEMENT **9**

Monitoring Tools: Prometheus, Grafana, AWS Cloud Watch, Azure Monitor-Logging: ELK Stack (Elasticsearch, Logstash, Kibana) - Security: IAM, Encryption (at-rest/in-transit), VPC, Firewalls-Compliance: GDPR, HIPAA, ISO/IEC 27001-Cost Optimization: Billing Models, Cost Management Tools, Resource Optimization.

TOTAL: 45 PERIODS

COURSE OUTCOMES

On successful completion of this course, the students will be able to

CO1: Explain the fundamentals, service, and deployment models of cloud computing.
CO2: Explore services provided by major cloud providers like AWS, Azure, and GCP.
CO3: Implement containerized and virtualized applications using Docker and Kubernetes.
CO4: Apply deployment techniques using IaC, CI/CD tools, and orchestration platforms.
CO5: Utilize monitoring, security, compliance, and cost optimization tools in the cloud.

TEXT BOOKS

1. Thomas Erl, Zaigham Mahmood, Ricardo Puttini,"Cloud Computing: Concepts, Technology & Architecture**",** 1st Edition,Pearson / Prentice Hall,2013**.**
2. Rajkumar Buyya, James Broberg, Andrzej Goscinski," Cloud Computing: Principles and Paradigms",Wiley,2011.
3. Arshdeep Bahga and Vijay Madisetti,"Cloud Computing: A Hands-On Approach",1st Edition, CreateSpace Independent Publishing Platform,2013.

REFERENCE BOOKS

1. John Arundel, Justin Domingus ,"Cloud Native DevOps with Kubernetes",1st Edition, O'Reilly Media,2019.
2. Yevgeniy Brikman."Terraform: Up & Running – Writing Infrastructure as Code",3rd Edition, O'Reilly Media,2022.
3. Martin Kleppmann ,"Designing Data-Intensive Applications",1st Edition, O'Reilly Media,2017.
4. Imad M. Abbadi ,"Cloud Management and Security**"**,1st Edition, Wiley & Sons,2014.
5. Michael J. Kavis ,"Architecting the Cloud: Design Decisions for Cloud Computing Service Models**"**,1st Edition, John Wiley & Sons,2014.

Mapping of COs with POs & PSOs

COs	POs												PSOs	
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
CO1	2	2	1	1	1	1	1	1	1	1	1	1	1	1
CO2	2	2	2	1	1	1	1	1	1	1	1	1	1	1
CO3	2	2	2	1	1	1	1	1	1	1	1	1	1	1
CO4	2	2	2	2	2	2	2	2	2	2	2	2	2	2
CO5	2	2	2	2	2	2	2	2	2	2	2	2	2	2
AVG	**2**	**2**	**2**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**

1-Low, 2-Medium, 3-High, '-'- No correlation

24ITPE25 DEVOPS **L T P C**

3 0 2 4

COURSE OBJECTIVES

- To introduce DevOps terminology, definition & concepts.
- To understand the different Version control tools like Git, Mercurial.
- To understand the concepts of Continuous Integration/ Continuous Testing/ Continuous Deployment).

UNIT I INTRODUCTION TO DEVOPS **9**

Devops Essentials - Introduction to AWS, GCP, Azure - Version control systems: Git and Github.

UNIT II COMPILE AND BUILD USING MAVEN & GRADLE **9**

Introduction, Installation of Maven, POM files, Maven Build lifecycle, Build phases (compile build, test, package) Maven Profiles, Maven repositories (local, central, global), Maven plugins, Maven create and build Artificats, Dependency management, Installation of Gradle, understand build using Gradle.

UNIT III CONTINUOUS INTEGRATION USING JENKINS **9**

Install & Configure Jenkins, Jenkins Architecture Overview, creating a Jenkins Job, configuring a Jenkins job, Introduction to Plugins, Adding Plugins to Jenkins, commonly used

plugins (Git Plugin, Parameter Plugin, HTML Publisher, Copy Artifact and Extended choice parameters). Configuring Jenkins to work with java, Git and Maven, Creating a Jenkins Build and Jenkins workspace.

UNIT IV CONFIGURATION MANAGEMENT USING ANSIBLE **9**

Ansible Introduction, Installation, Ansible master/slave configuration, YAML basics, Ansible modules, Ansible Inventory files, Ansible playbooks, Ansible Roles, adhoc commands in ansible.

UNIT V BUILDING DEVOPS PIPELINES USING AZURE **9**

Create Github Account, Create Repository, Create Azure Organization, create a new pipeline, build a sample code, Modify azure-pipelines. yaml file.

TOTAL: 45 PERIODS

LIST OF EXPERIMENTS

1. Create Maven Build pipeline in Azure.
2. Run regression tests using Maven Build pipeline in Azure.
3. Install Jenkins in Cloud.
4. Create CI pipeline using Jenkins.
5. Create a CD pipeline in Jenkins and deploy in Cloud.
6. Create an Ansible playbook for a simple web application infrastructure.
7. Build a simple application using Gradle.
8. Install Ansible and configure ansible roles and to write playbooks.

TOTAL: 30 PERIODS

COURSE OUTCOMES

On successful completion of this course, the students will be able to

CO1: Anlyze different actions performed through Version control tools like Git.

CO2: Perform Continuous Integration and Continuous Testing and Continuous Deployment using Jenkins by building and automating test cases.

CO3: Ability to Perform Automated Continuous Deployment.

CO4: Ability to do configuration management using Ansible.

CO5**:** Use to leverage Cloud-based DevOps tools using Azure DevOps.

TEXT BOOKS

1. Roberto Vormittag, "A Practical Guide to Git and GitHub for Windows Users: From Beginner to Expert in Easy Step-By-Step Exercises", 2nd Edition, 2016.
2. Jason Cannon, "Linux for Beginners: An Introduction to the Linux Operating System and Command Line", 1st Edition,2019.
3. Mikael Krief, "Learning DevOps: Continuously Deliver Better Software", Packt Publishing, 2nd Edition ,2016.

REFERENCE BOOKS

1. Joakim Verona, Michael Duffy, Paul," Learning DevOps: Continuously Deliver Better Software", Packt Publishing, 2016.
2. Mitesh Soni ,"CI/CD Implementation for DevOps and Microsoft Azure", BPB Publications,2020.

3. Jeff Geerling, "Ansible for DevOps: Server and configuration management for humans",13th Edition, Midwestern Mac, LLC,2020.
4. David Johnson, "Ansible for DevOps: Everything You Need to Know to Use Ansible for DevOps", 2nd Edition, Midwestern Mac, LLC, 2018.
5. Daniel Rowell, "A Comprehensive Guide to Version Control, Project Management, and Teamwork for the New Developer", 2nd Edition ,Apress, 2021.

Mapping of COs with POs & PSOs

COs	POs												PSOs	
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
CO1	3	1	1	1	3	-	-	-	1	3	1	3	3	3
CO2	3	1	2	1	2	-	-	-	1	2	2	1	2	3
CO3	2	2	1	2	3	-	-	-	2	1	1	3	2	1
CO4	2	3	3	1	1	-	-	-	2	2	2	2	1	2
CO5	1	2	1	3	1	-	-	-	3	2	1	3	3	3
AVG	**2.2**	**1.8**	**1.6**	**1.6**	**2**	**-**	**-**	**-**	**1.8**	**2**	**1.4**	**2.4**	**2.2**	**2.4**

1-Low, 2-Medium, 3-High, '-'- No correlation

24AIPE26 EXPLORATORY DATA ANALYSIS **L T P C**
3 0 2 4

COURSE OBJECTIVES:

- This course aims to provide in-depth knowledge and practical skills in performing.
- Exploratory Data Analysis (EDA), using statistical and graphical techniques.

UNITI INTRODUCTION **9**

Purpose and goals of EDA - Mindset for effective data exploration -Significance of EDA in the data science lifecycle - Types of data and quality issues -EDA vs. Classical and Bayesian approaches - Tools and libraries for EDA - Visual techniques for initial insights.

UNIT II DATA WRANGLING **9**

Importing, loading, and cleaning datasets - Merging, reshaping, and pivoting data - Handling missing values and outliers - Renaming, deduplication, discretization, and binning - Permutation and random sampling - Challenges in realworld data preprocessing.

UNIT III MULTIVARIATE ANALYSIS, RELATIONSHIP EXPLORATION AND CAUSAL INFERENCE **9**

Univariate, Bivariate, and Multivariate Analysis - Interpreting relationships and Simpson's Paradox - Multicollinearity and correlation pitfalls - Visualizing multivariate data using pair plots and heatmaps - Causal inference in data science: correlation vs. causation, confounding variables.

UNIT IV STATISTICAL TESTING FOR INSIGHTS **9**

Hypothesis Testing: Null vs. Alternative, Type I & II Errors - Statistical tests: t-tests, p-values using scipy and statsmodels - Interpreting test results in the context of EDA.

UNIT V FROM EDA TO MODEL DEPLOYMENT **9**

Supervised vs. unsupervised models - Simple and Multiple Linear Regression -Train/Test Split, Cross-validation - Evaluation metrics: MAE, RMSE, R^2, Accuracy, F1-score - Saving models using pickle or joblib - Basic deployment using Flask for local predictions.

TOTAL: 45 PERIODS

LIST OF EXPERIMENTS

1. Load a real-world dataset in CSV/JSON format into a Pandas DataFrame and inspect its structure using head(), info(), shape, and describe().
2. Perform exploratory data analysis and create a data story using 3–5 visualizations to identify trends, patterns, and anomalies.
3. Identify and handle missing values, duplicate records, and inconsistent data in a dataset using Pandas functions.
4. Perform data cleaning and preprocessing by renaming columns, converting data types, and applying equal-width and equal-frequency binning to continuous variables.
5. Construct and analyze a correlation matrix to identify strongly positive and negative relationships among numerical variables.
6. Create and interpret a Seaborn pair plot using numerical variables and a categorical hue to analyze relationships and grouped patterns.
7. Perform time-series resampling using Pandas to down-sample and up-sample data, applying suitable aggregation and filling methods.
8. Calculate rolling mean and standard deviation for time-series data and visualize trends, fluctuations, and anomalies.
9. Perform statistical hypothesis testing using SciPy, including t-tests, and interpret test statistics, p-values, and significance levels.
10. Implement simple linear regression using Scikit-learn, split the dataset into training and testing sets, and evaluate model performance using MAE, RMSE, and R^2.

TOTAL: 30 PERIODS

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COURSE OUTCOMES

On successful completion of this course, the students will be able to

CO1: Describe the importance of exploratory data analysis in understanding and summarizing datasets.
CO2: Analyze datasets identify patterns, trends, anomalies, and relationships among variables.
CO3: Evaluate data quality and extract meaningful insights for decision-making.
CO4: Design effective exploratory data analysis workflows for real-world datasets.
CO5: Recognize the importance of continuous learning by adapting to emerging tools and evolving data-driven.

TEXT BOOKS

1. Mukhiya, S. K., & Ahmed, U. (2020). Hands-On Exploratory Data Analysis with Python. Packt Publishing.
2. Wes McKinney (2022), Python for Data Analysis, O'Reilly Media (3rd Edition).

REFERENCE BOOKS

1. Grus, J. (2019). Data science from scratch: First principles with Python. O'Reilly Media.
2. Sandhya Arora and Latesh Malik, (2023) Data Science and Analytics with Python, Universities Press.
3. Kyla Mcmullen, Elizabeth Matthews, Programming with Python with MindTap, Cengage, 1st Edition, (2023).

Mapping of COs with POs & PSOs

COs	POs												PSOs	
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
CO1	3	3	2	2	2	1	–	–	–	–	–	2	2	2
CO2	3	3	2	2	3	1	–	–	–	–	–	2	3	2
CO3	3	3	3	3	2	1	–	–	–	–	–	2	3	3
CO4	2	3	2	3	2	1	–	–	–	–	–	2	2	2
CO5	3	3	3	3	3	1	–	–	–	2	2	3	3	3
AVG	**2.8**	**3.0**	**2.4**	**2.6**	**2.4**	**1.0**	**–**	**–**	**–**	**2.0**	**2.0**	**2.2**	**2.6**	**2.4**

1-Low, 2-Medium, 3-High, '-'- No correlation

24AIPE27 OPTIMIZATION TECHNIQUES **L T P C**
3 0 2 4

COURSE OBJECTIVES:

- Formulate and solve linear programming problems(LPP)
- Evaluate Integer Programming Problems, Transportation and Assignment Problems.
- Obtain a solution to network problems using CPM and PERT techniques.

UNIT I LINEAR MODELS **6**

Introduction of Operations Research-mathematical formulation of LPP-Graphical Methods to solve LPP-Simplex Method- Two-Phase method

UNIT II INTEGER PROGRAMMING AND TRANSPORTATION PROBLEMS **6**

Integer programming: Branch and bound method- Transportation and Assignment problems - Traveling salesman problem.

UNIT III PROJECT SCHEDULING **6**

Project network -Diagram representation – Floats - Critical path method (CPM) – PERT- Cost considerations in PERT and CPM.

UNIT IV CLASSICAL OPTIMIZATION THEORY **6**

Unconstrained problems – necessary and sufficient conditions -Newton-Raphson method, constrained problems – equality constraints – inequality constraints -Kuhn-Tucker conditions.

UNITV QUEUING MODEL **6**

Introduction, Queuing Theory, Operating characteristics of a Queuing system, Constituents of a Queuing system, Service facility, Queue discipline, Single channel models, multiple service channels.

TOTAL: 30 PERIODS

LIST OF EXPERIMENTS

1. Solving simplex maximum &minimum problems using R programming.
2. Solving transportation problems using R.
3. Solving assignment problems using R.
4. Solving optimization problems using LINGO.
5. Studying Primal-Dual relationships in LP using TORA.
6. Solving shortest route problems using optimization software
7. Testing random numbers and random variates for their uniformity.
8. Solve single server queuing model using simulation software package.

TOTAL: 30 PERIODS

COURSE OUTCOMES:

On successful completion of this course, the student will able to

CO1: Formulate and solve linear programming problems (LPP)
CO2: Evaluate Integer Programming Problems, Transportation and Assignment Problems.
CO3: Obtain a solution to network problems using CPM and PERT techniques
CO4: Able to optimize the function subject to the constraints.
CO5: Identify and solve problems under Markovian queuing models.

TEXTBOOK:

1. HamdyATaha, Operations Research: AnIntroduction, Pearson, 10thEdition, 2017.

REFERENCES:

1. ND Vohra, Quantitative Techniques in Management, TataMcGrawHill, 4thEdition, 2011.
2. J.K.Sharma, Operations Research Theory and Applications, Macmillan, 5thEdition, 2012.
3. Hiller F.S, Liberman G.J, Introduction to Operations Research, 10th Edition McGrawHill, 2017.
4. Jit. S. Chandran, MahendranP.Kawatra, KiHoKim, Essentials of Linear Programming, Vikas Publishing House Pvt.Ltd. New Delhi, 1994.
5. Ravindran.A. Philip D.T., and Solberg J.J., Operations Research, John Wiley, 2nd Edition, 2007.

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MAPPING of CO's with PO's & PSO's

CO's	PO's												PSO's		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	3	2	1	1	-	-	-	2	1	1	2	3	3	3
CO2	3	1	2	2	3	-	-	-	3	2	3	1	2	1	1
CO3	2	3	3	2	2	-	-	-	3	3	1	3	1	3	1
CO4	2	2	1	1	3	-	-	-	2	1	3	1	2	1	2
CO5	2	1	1	3	2	-	-	-	3	3	1	3	3	2	1
AVg.	2.4	2	1.8	1.8	2.2	-	-	-	2.6	2	1.8	2	2.2	2	1.6

1- Low, 2 - Medium, 3-high, '-' -No correlation

24AIPE28 APPLIED DATA SCIENCE WITH PYTHON SPECIALIZATION **L T P C**
3 0 2 4

COURSE OBJECTIVES

- To understand the python libraries for data science.
- To understand the basic Statistical and Probability measures for data science.
- To present and interpret data using visualization packages in Python.

UNIT I PYTHON FUNDAMENTALS **9**

Introduction to Programming – Problem Solving - Basics of Python – Python Block Structure - Data types – Operators and Operations – Input/Output Statements – Decision Structures and Looping Statements.

UNIT II INTRODUCTION TO FUNCTIONS **9**

Introduction to Functions – Types of Functions – Void and Fruitful Functions – Lists – Built-in Functions and methods – Tuples – Indexing and Slicing – Operations – Sets and Dictionary – Basic set Operations - Dictionary – Basic Dictionary – Strings – Built-in Methods, Built-in functions for Strings.

UNIT III MODULES AND PACKAGES **9**

Creation of a module – Importing modules – Standard modules in Python – Packages – Errors and Exceptions – Multiple and Exception handling – User defined exceptions – File handling – Types of Files – Handling text files – Handling binary files – Pickle – File handling of Excel Files – Python Context Manager.

UNIT IV PYTHON PACKAGES FOR DATA SCIENCE **9**

The Basics of NumPy Arrays – Creation – Properties – Indexing and Slicing Operations – Arithmetic operations – Data analysis – Pandas – Series – Indexing – Data Frames – Data Manipulation – Data visualization using Pandas and Matplotlib – Data Manipulation and Scikit-Learn

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UNIT V DATA SCIENCE USING PYTHON **9**

Introduction to Data Science –Data Science Process – Data Acquisition - Big data: Definition, Risks of Big Data, Structure of Big Data - Web Data: Exploratory Data analysis – Data Analytics – Hypothesis Testing - Analysis vs Reporting - Core Analytics versus Advanced Analytics - Modern Data Analytic Tools – Data Visualization.

TOTAL: 45 PERIODS

LIST OF EXPERIMENTS

1. Download, install and explore the features of NumPy, SciPy, Jupyter, Statsmodels and Pandas packages.
2. Working with Numpy arrays.
3. Working with Pandas data frames.
4. Reading data from text files, Excel and the web and exploring various commands for doing descriptive analytics on the Iris data set.
5. Use the diabetes data set from UCI and Pima Indians Diabetes data set for performing the following:
   a. Univariate analysis: Frequency, Mean, Median, Mode, Variance, Standard Deviation, Skewness and Kurtosis.
   b. Bivariate analysis: Linear and logistic regression modeling.
6. Multiple Regression analysis and Also compare the results of the above analysis for the two data sets.
7. Apply and explore various plotting functions on UCI data sets.
   a. Normal curves.
   b. Density and contour plots.
8. Correlation and scatter plots.

TOTAL: 30 PERIODS

COURSE OUTCOMES

On successful completion of this course, the student will able to

CO1: Know the Basics of Python decision and looping structures.

CO2: Utilyze the basics of function writing.

CO3: Learn to create user-defined modules and packages.

CO4: Explore Python Ecosystem for Data Science.

CO5: Explain the needs for Big Data and applications.

TEXT BOOKS

1. Jake Vander Plas, " Python Data Science Handbook",2nd Edition, O'Reilly Media,2023.
2. Kyran Dale, "Data Visualization with Python and JavaScript" O'Reilly Media, 2016.
3. Aurélien Géron,"Hands-On Machine Learning with Scikit-Learn, Keras, and TensorFlow",3rd Edition, O'Reilly Media,2022

REFERENCE BOOKS

1. Sridhar S, Indumathi J, Hariharan V.M, "Python Programming",1st Edition, Pearson Education, 2023.
2. Jake VanderPlas, "Python Data Science Handbook",1st Edition, O'Reilly, , 2016.
3. Joel Grus, "Data Science from Scratch – First principles with Python", 2nd Edition, O'Reilly, 2019.
4. Bill Franks, "Taming the Big Data Tidal Wave: Finding Opportunities in Huge Data

Streams with Advanced Analytics", 1st Edition, John Wiley & sons, 2012.
5. Rémy Cointet, "Applied Social Network Analysis in Python-Network Science", Packt Publishing, 2018.

Mapping of COs with POs & PSOs

COs	Pos												PSOs	
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
CO1	1	3	2	1	1	-	-	-	-	1	3	3	3	-
CO2	2	3	2	2	3	1	-	-	-	3	1	3	2	-
CO3	3	3	2	1	3	1	-	-	-	2	1	1	1	-
CO4	4	2	3	1	3	-	-	-	-	2	3	2	3	-
CO5	5	1	2	3	1	1	-	-	-	2	1	3	1	-
AVG	**2**	**2**	**2**	**2**	**1**	**-**	**-**	**-**	**-**	**2**	**2**	**2**	**2**	**-**

1-Low, 2-Medium, 3-High, '-'- No correlation

24ITPE29 IMAGE AND VIDEO ANALYTICS

L T P C
3 0 2 4

COURSE OBJECTIVES

- To understand the basics of image processing techniques for computer vision.
- To learn the techniques used for image pre-processing.
- To elaborate on the video analytics techniques.

UNIT I INTRODUCTION **9**

Computer Vision – Image representation and image analysis tasks - Image representations – digitization – properties – color images – Data structures for Image Analysis - Levels of image data representation - Traditional and Hierarchical image data structures.

UNIT II IMAGE PRE-PROCESSING **9**

Local pre-processing - Image smoothing - Edge detectors - Zero-crossings of the second derivative - Scale in image processing - Canny edge detection - Parametric edge models - Edges in multi- speralct images - Local pre-processing in the frequency domain - Line detection by local pre- processing operators - Image restoration.

UNIT III OBJECT DETECTION USING MACHINE LEARNING **9**

Object detection– Object detection methods – Deep Learning framework for Object detection– bounding box approach-Intersection over Union (IoU) –Deep Learning Architectures-R-CNN-Faster R-CNN-You Only Look Once(YOLO)-Salient features-Loss Functions-YOLO architectures.

UNIT IV FACE RECOGNITION AND GESTURE RECOGNITION **9**

Face Recognition-Introduction-Applications of Face Recognition-Process of Face Recognition- DeepFace solution by Facebook-FaceNet for Face Recognition- Implementation using FaceNet- Gesture Recognition.

UNIT V VIDEO ANALYTICS **9**

Video Processing – use cases of video analytics-Vanishing Gradient and exploding gradient problem - RestNet architecture-Rest Net and skip connections-Inception Network - GoogleNet architecture- Improvement in Inception v2-Video analytics - RestNet and Inception v3.

TOTAL: 45 PERIODS

LIST OF EXPERIMENTS

1. Write a program that computes the T-pyramid of an image.
2. Write a program that derives the quad tree representation of an image using the Homogeneity criterion of equal intensity.
3. Develop programs for the following geometric transforms: (a) Rotation (b) Change of scale.
4. Skewing and Affine transform calculated from three pairs of corresponding points (e) Bilinear transform calculated from four pairs of corresponding points.
5. Develop a program to implement Object Detection and Recognition
6. Develop a program for motion analysis using moving edges, and apply it to your Image sequences.
7. Develop a program for Facial Detection and Recognition.
8. Write a program for event detection in video surveillance system.

TOTAL: 30 PERIODS

COURSE OUTCOMES

On successful completion of this course, the student will able to

CO1: Analyze the basics of image processing techniques for computer vision and video analysis.

CO2: Explain the techniques used for image pre-processing.

CO3: Develop various object detection techniques.

CO4: Use the various face recognition mechanisms.

CO5: Elaborate on deep learning-based video analytics

TEXT BOOKS

1. Milan Sonka, Vaclav Hlavac, Roger Boyle, "Image Processing, Analysis, and Machine Vision", 4th edition, Thomson Learning, 2013.
2. Vaibhav Verdhan, "Computer Vision Using Deep Learning Neural Network Architectures with Python and Keras", 1st Edition, Apress 2021.
3. Richard Szeliski, "Computer Vision: Algorithms and Applications",2nd Edition,2022.

REFERENCE BOOKS

1. Richard Szeliski, "Computer Vision: Algorithms and Applications", 2nd Edition, Springer, 2022.
2. Caifeng Shan, FatihPorikli, Tao Xiang, Shaogang Gong, "Video Analytics for Business Intelligence",1st Edition, Springer, 2012.
3. D. A. Forsyth, J. Ponce, "Computer Vision: A Modern Approach", Pearson Education, 2011.
4. E. R. Davies, "Computer & Machine Vision", 4th Edition, Academic Press, 2012.
5. Lawrence Rabiner & Biing-Hwang Juang,"Fundamentals of Speech Recognition", Prentice Hall,1993.

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Mapping of COs with POs & PSOs

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	3	1	2	2	2	-	-	-	3	3	2	1	2	1
CO2	2	2	3	3	3	-	-	-	3	2	1	1	2	2
CO3	1	2	2	2	3	-	-	-	1	2	1	2	1	1
CO4	1	2	3	2	3	-	-	-	2	2	2	3	2	2
CO5	3	2	1	3	2	-	-	-	2	1	1	3	3	2
AVG	2	1.8	2.2	2.4	2.6	-	-	-	2.2	2	1.4	2	2	1.6

1-Low, 2-Medium, 3-High, '-'- No correlation

24ITPE30 MULTIMEDIA DATA COMPRESSION AND STORAGE **L T P C**

3 0 2 4

COURSE OBJECTIVES

- To understand the basics of compression techniques
- To understand the categories of compression for text, image and video
- To explore the modalities of text, image and video compression algorithms

UNIT I BASICS OF DATA COMPRESSION **9**

Introduction —Lossless and Lossy Compression– Basics of Huffmann coding- Arithmetic coding- Dictionary techniques- Context based compression – Applications.

UNIT II IMAGE COMPRESSION **9**

Lossless Image compression – JPEG-CALIC-JPEG LS-Prediction using conditional averages – Progressive Image Transmission – Lossless Image compression formats – Applications - Facsimile encoding.

UNIT III VIDEO COMPRESSION **9**

Introduction – Motion Compensation – Video Signal Representation – H.261 – MPEG-1- MPEG-2- H.263.

UNIT IV DATA PLACEMENT ON DISKS **9**

Statistical placement on Disks – Striping on Disks – Replication Placement on Disks – Constraint allocation on Disks – Tertiary storage Devices – Continuous Placement on Hierarchical storage system – Statistical placement on Hierarchical storage systems – Constraint allocation on Hierarchical storage system.

UNIT V DISK SCHEDULING METHODS **9**

Scheduling methods for disk requests – Feasibility conditions of concurrent streams– Scheduling methods for request streams.

TOTAL: 45 PERIODS

LIST OF EXPERIMENTS

1. Construct Huffman codes for given symbol probabilities.
2. Encode run lengths with fixed-length code.
3. Write a shell script, which converts all images in the current directory in JPEG.
4. Write a program to split images from a video without using any primitives.
5. Create a photo album of a trip by applying appropriate image dimensions and format.
6. Write the code for identifying the popularity of content retrieval from media server.
7. Write the code for ensuring data availability in disks using strip based method.
8. Program for scheduling requests for data streams.

TOTAL: 30 PERIODS

COURSE OUTCOMES

On successful completion of this course, the student will able to

CO1: Explain the basics of text, Image and Video compression.

CO2: Analyze the various compression algorithms for multimedia content.

CO3: Explore the applications of various compression techniques.

CO4: Explore knowledge on multimedia storage on disks.

CO5: Use scheduling methods for request streams.

TEXT BOOKS

1. Khalid Sayood, “Introduction to Data Compression”, 5th Edition, Morgan Kaufmann 2018.
2. Philip K.C.Tse, “Multimedia Information Storage and Retrieval: Techniques and Technologies”, 1st Edition, IGI Global, 2008.
3. Khalid Sayood, “Introduction to Data Compression”, 5th Edition, Morgan Kaufmann, 2017.

REFERENCE BOOKS

1. David Salomon, "A concise introduction to data compression", Springer, 2008.
2. Lenald Best, "Best's Guide to Live Stream Video Broadcasting", CreateSpace Independent Publishing Platform, 2017.
3. Yun-Qing Shi, "Image and Video Compression For Multimedia Engineering Fundamentals Algorithms And Standards", CRC Press, 2009.
4. Irina Bocharova, "Compression for Multimedia",1st Edition, Cambridge University Press,2009.
5. Ralf Steinmetz and Klara Nahrstedt,"Multimedia Systems",1st Edition, 1995.

Mapping of COs with POs & PSOs

COs	POs												PSOs	
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
CO1	3	1	1	1	2	-	-	-	2	3	1	1	3	1
CO2	2	2	2	2	1	-	-	-	1	2	1	3	3	2
CO3	2	2	2	1	2	-	-	-	2	2	1	2	1	3
CO4	3	1	3	2	1	-	-	-	1	1	2	3	3	1
CO5	2	3	2	3	1	-	-	-	1	3	2	2	2	3
AVG	**2.4**	**1.8**	**2**	**1.8**	**1.4**	**-**	**-**	**-**	**1.4**	**2.2**	**1.4**	**2.2**	**2.4**	**2**

1-Low, 2-Medium, 3-High, '-'- No correlation

24ITPE31 NATURAL LANGUAGE PROCESSING **L T P C**
3 0 2 4

COURSE OBJECTIVE

- To understand the steps involved in Natural language processing.
- To learn about the lexical, syntactic and semantic analysis of natural language processing.
- To explore the various parsing techniques and the various applications involved in Natural language processing.

UNIT I LEXICAL ANALYSIS **9**

Lexical Analysis - Regular expression and Automata for string matching - Words and Word Forms - Morphology fundamentals - Morphological Diversity of Indian Languages - Morphology Paradigms - Finite State Machine / Transducers Based Morphology - Automatic Morphology Learning - Parts of Speech - N-gram Models - Hidden Markov Models.

UNIT II SPEECH PROCESSING **9**

Biology of Speech Processing - Place and Manner of Articulation - Word Boundary Detection - Argmax based computations - HMM and Speech Recognition - Text to Speech Synthesis - Rule Based-Concatenative based approach.

UNIT III PARSING **9**

Theories of Parsing - Parsing Algorithms – Earley Parser - CYK Parser - Probabilistic Parsing - CYK - Resolving attachment and structural ambiguity - Shallow Parsing - Dependency

Parsing - Named Entity Recognition - Maximum Entropy Models - Conditional Random Fields.

UNIT IV LEXICAL KNOWLEDGE NETWORKS **9**

Meaning: Lexical Knowledge Networks - Wordnet Theory - Indian Language Wordnets and Multilingual Dictionaries - Semantic Roles - Word Sense Disambiguation - WSD and Multilingualism - Metaphors - Coreference and Anaphora Resolution.

UNIT V APPLICATIONS **9**

Applications: Sentiment Analysis - Text Entailment - Machine Translation - Question Answering System - Information Retrieval - Information Extraction - Cross Lingual Information Retrieval (CLIR).

TOTAL: 45 PERIODS

LIST OF EXPERIMENTS

1. Implement string matching algorithms using regular expressions and finite automata.
2. Implement a basic speech recognition system using Hidden Markov Models (HMM).
3. Implement a basic text-to-speech (TTS) synthesis system.
4. Detect word boundaries in continuous speech using segmentation algorithms.
5. Implement the Early parser, an efficient chart parser for context-free grammars.
6. Create a multilingual WorldNet or integrate Indian language Word Nets.
7. Implement a Semantic Role Labeling (SRL) system that assigns roles to words based on their meaning in a sentence.
8. Understand finite state transducers (FSTs) and their application in morphological analysis.

TOTAL: 30 PERIODS

COURSE OUTCOMES

On successful completion of this course, the student will able to

CO1: Suggest appropriate lexical and parsing techniques for a given natural language.

CO2: Apply appropriate statistical models for a given natural language application.

CO3: Modify existing algorithms to suit any natural language for processing.

CO4: Suggest appropriate pre-processing steps essential for the various applications involving natural language processing.

CO5: Develop speech processing systems, including speech recognition, feature extraction (MFCCs), and text-to-speech synthesis.

TEXT BOOKS

1. Jurafsky Daniel, Martin James, “Speech and Language Processing”, 2nd Edition, Pearson Education, 2018.
2. Steven Bird, Ewan Klein, Edward Loper, “Natural Language Processing with Python”, 1st Edition, O’Reilly Media publication, 2009.
3. Christopher Manning, Schutze Heinrich, “Foundations of Statistical Natural Language Processing”, 1st Edition, MIT Press, 1999.

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REFERENCE BOOKS

1. Allen James, "Natural Language Understanding", 2nd Edition, Pearson,1994. .
2. Charniack Eugene, "Statistical Language Learning",1st Edition, MIT Press, 1993.
3. "Foundations of Statistical Natural Language Processing", 1st Edition,The MIT Press Cambridge, 1999.
4. Subhendu Kumar Pati, "Speech Processing: A Dynamic and Optimization-Oriented Approach", 1st Edition, CRC press,2003.
5. Yoav Goldberg, "Neural Network Methods for Natural Language Processing",1st Edition, Morgan & Claypool Publishers,2017.

Mapping of COs with POs & PSOs

COs	POs												PSOs	
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
CO1	1	1	1	-	1	-	1	1	1	-	-	-	1	-
CO2	1	1	1	1	1	1	1	-	1	-	-	-	1	1
CO3	1	1	1	1	1	1	1	1	-	-	1	-	1	1
CO4	1	1	1	-	1	1	1	1	1	-	-	-	1	1
CO5	1	1	1	1	-	-	1	1	1	-	-	1	1	1
AVG	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**-**	**-**	**-**	**1**	**1**

1-Low, 2-Medium, 3-High, '-'- No correlation

24AIPE32 COGNITIVE SCIENCE **L T P C**
3 0 2 4

COURSE OBJECTIVES

- To know the theoretical background of cognition.
- To understand the link between cognition and computational intelligence.
- To explore probabilistic programming language.

UNIT I PHILOSOPHY, PSYCHOLOGY AND NEUROSCIENCE **9**

Philosophy: Mental-physical Relation – From Materialism to Mental Science – Logic and the Sciences of the Mind – Psychology: Place of Psychology within Cognitive Science – Science of Information Processing –Cognitive Neuroscience – Perception – Decision – Learning and Memory – Language Understanding and Processing.

UNIT II COMPUTATIONAL INTELLIGENCE **9**

Machines and Cognition – Artificial Intelligence – Architectures of Cognition – Knowledge Based Systems – Logical Representation and Reasoning – Logical Decision Making –Learning – Language – Vision.

UNIT III PROBABILISTIC PROGRAMMING LANGUAGE **9**

WebPPL Language – Syntax – Using Javascript Libraries – Manipulating probability types and distributions – Finding Inference – Exploring random computation – Coroutines: Functions that receive continuations –Enumeration

UNIT IV INFERENCE MODELS OF COGNITION **9**

Generative Models – Conditioning – Causal and statistical dependence – Conditional dependence – Data Analysis – Algorithms for Inference.

UNIT V LEARNING MODELS OF COGNITION **9**

Learning as Conditional Inference – Learning with a Language of Thought – Hierarchical Models– Learning (Deep) Continuous Functions – Mixture Models.

TOTAL: 45 PERIODS

LIST OF EXPERIMENTS

1. Demonstration of Mathematical functions using WebPPL.
2. Implementation of reasoning algorithms.
3. Developing an Application system using generative model.
4. Developing an Application using conditional inference learning model.
5. Application development using hierarchical model.
6. Application development using Mixture model.
7. Modeling random computation and probabilistic webPPL.
8. Simulating cognition task using online tools.

TOTAL: 30 PERIODS

COURSE OUTCOMES

On successful completion of this course, the student will able to

CO1: Explain the underlying theory behind cognition.

CO2: Connect to the cognition elements computationally.

CO3: Implement mathematical functions through WebPPL.

CO4: Develop applications using cognitive inference model.

CO5: Develop applications using cognitive learning model.

TEXT BOOKS

1. Vijay V Raghavan, Venkat N.Gudivada, Venu Govindaraju, C.R. Rao, "Cognitive Computing: Theory and Applications", Elsevier publications, 2016.
2. Judith Hurwitz, Marcia Kaufman, Adrian Bowles, "Cognitive Computing and Big Data Analytics", 1st Edition, Wiley Publications, 2015.
3. Robert A. Wilson, Frank C. Keil, "The MIT Encyclopedia of the Cognitive Sciences", The MIT Press, 1999.

REFERENCE BOOKS

1. Noah D. Goodman, Andreas Stuhlmuller, "The Design and Implementation of Probabilistic Programming Languages", MIT press, 2014.
2. Jose Luis Bermúdez, "Cognitive Science -An Introduction to the Science of the Mind",4th Edition, SAGE Publications,2021.
3. Noah D.Goodman, Joshua B. Tenenbaum, The ProbMods Contributors, "Probabilistic Models of Cognition", 2nd Edition, Pearson Education, 2016.

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4. Jay Friedenberg & Gordon Silverman,"Cognitive Science: An Introduction to the Study of Mind", 3rd Edition, SAGE Publications,2019.
5. Paul Thagard ,"Mind: Introduction to Cognitive Science",2nd Edition,MIT Press,2005.

Mapping of COs with POs & PSOs

COs	POs												PSOs	
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
CO1	3	1	3	2	2	-	-	-	1	1	2	2	1	2
CO2	2	2	1	1	2	-	-	-	3	2	3	1	2	3
CO3	1	3	1	3	3	-	-	-	1	3	1	3	3	1
CO4	2	1	1	2	3	-	-	-	1	2	3	1	3	3
CO5	1	2	3	2	2	-	-	-	1	2	2	2	2	2
AVG	**1.8**	**1.8**	**1.8**	**2**	**2.4**	**-**	**-**	**-**	**1.4**	**2**	**2.2**	**1.8**	**2.2**	**2.2**

1-Low, 2-Medium, 3-High, '-'- No correlation

24MC3101 LEGAL SYSTEM OF INDIA **L T P C**
3 0 0 0

COURSE OBJECTIVES

- To introduce the basic concepts necessity of law among engineers.
- To introduce Indian legal system.
- To familiarize taxations and basic laws.

UNIT I INTRODUCTION TO INDIAN LEGAL SYSTEM **9**

Constitution of India, Sources of Law and Judicial system.

UNIT II CONTRACTS AND ITS ELEMENTS **9**

Employment contracts, Contract Interpretation, Service Contract, Contract of Indemnity, Law of Agency. Employment agreement.

UNIT III LEGAL DOCUMENTATION **9**

Drafting of legal documents including Non-Disclosure Agreements (NDA), Request for Proposal (RFP), collaboration agreements, joint venture agreements, tendering and subcontracting

UNIT IV CYBER AND LABOUR LAWS **9**

E-Commerce and E-Governance. Provident Fund, ESIC, Gratuity, Bonus, Perquisites, Contract labour Health, Safety and welfare of construction workers.

UNIT V TAXATION **9**

Income Tax, Service Tax, VAT, Excise Duty, GST. Alternate Dispute Resolution (ADR) in Domestic and International dealings, Code of Conduct and Ethics for engineering professionals

TOTAL: 45 PERIODS

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COURSE OUTCOMES

On successful completion of this course, the students will be able to

CO1: Explore the Indian Legal System.

CO2: Explain the basics of different laws.

CO3: Acquire practical insight of legal system and its application in engineering profession.

CO4: Analyze the cyber and labour law.

CO5: Use the tax system.

TEXT BOOKS

1. Karnika Seth, Computer Internet and New Technology Laws, Lexisnexis, First Edition 2013.
2. Prafulla C Pant, The Arbitration and Conciliation Act, 1996, Butterworths India, New Delhi.
3. Joseph Minattur, Indian Legal System, Indian Law Institute, New Delhi.

REFERENCE BOOKS

1. J. Beatson, Anson's Law of Contract, Oxford University Press.
2. V. S. Datey , Indirect Taxes: Law and Practice, Taxmann Publications (P) Ltd.
3. Dr. Vinod K. Singhania and Dr. Monica Singhania, Student's Guide To Income Tax, Taxmann Publications (P) Ltd.
4. S.C. Srivastava, Industrial Relations and Labour Laws, Vikas Publishing House Pvt. Ltd.
5. Singh, M. P., & Kumar, N, The Indian legal system: An enquiry. Oxford University Press, 2019.

24MC3102 IPR AND PATENT DRAFTING **L T P C**
3 0 0 0

COURSE OBJECTIVES

- To introduce the basic concepts intellectual property.
- To familiarize the importance of patent copyrights and trademarks.
- To train the students for drafting of patent.

UNIT I BASICS OF IPR **9**

Introduction – Invention and Creativity – Intellectual Property (IP) – Importance – Protection of IPR – Basic types of property (Movable Property, Immovable Property and Intellectual Property).

UNIT II PATENT, COPYRIGHTS AND TRADEMARKS **9**

IP – Patents – Copyrights and related rights – Trade Marks and rights arising from Trademark registration – Definitions – Industrial Designs and Integrated circuits – Protection of Geographical Indications at national and International levels – Application Procedures.

UNIT III INTERNATIONAL PATENT FILING **9**

International convention relating to Intellectual Property – Establishment of WIPO – Mission and Activities – History – General Agreement.

UNIT IV DRAFT OF PATENT **9**

Pre-drafting requirement, Types of specifications, Drafting of Provisional specifications, drafting of complete specifications, Drafting of claims, Filing procedure for Ordinary application, Convention application, PCT International Phase application, PCT National Phase application, Patent of addition, Divisional application, Publication of paten, First Examination Report, Time limit for different phase of prosecution, Pre Grant opposition, Post Grant opposition.

UNIT V INFRINGEMENT OF PATENTS AND CASE STUDIES 9

Infringement & remedies, Literal Infringement, Case Studies on – Patents, Copyright and related rights – Trade Marks – Industrial design and Integrated circuits – Geographic indications – Protection against unfair competition.

TOTAL: 45 PERIODS

COURSE OUTCOMES

On successful completion of this course, the students will be able to

CO1: Explain the basics of IPR.
CO2: Explore the importance of Patenting.
CO3: Discuss the method of international patent filing.
CO4: Draft of patent application.
CO5: Explain the importance of patent infringement.

TEXT BOOKS

1. Kompal Bansal, Parikshit Bansal, Fundamentals of Intellectual Property for Engineers, BS Publications 2013.
2. Pmbuddha Ganguli, Inrelletul property right - Unleasbing the knowledge economy, Tata Mccraw HiU Publishing Company Ltd.
3. Deborah Bouchoux, Intellectual Property: The Law of Trademarks, Copyrights, Patents, and Trade Secrets Delmar Cengage Learning; 5th Edition.

REFERENCE BOOKS

1. N.K Acharya, Intellectual property rights, Asia Law House, 9th Edition.
2. Jeffrey G. Sheldon, How to Write a Patent Application, Third Edition, Practising Law Institute, 2016.
3. WIPO Intellectual Prcpeny Handbook. Policy, Law and Use, 2nd Edition.
4. Dr. R. Ashok Raj, Dr. K. Panneer Selvam, and V. Sivaganesan “Introduction to Intellectual Property Rights and Patent Drafting, JBR TRY SEA Publishers, 2024.
5. The American Society of International law, Electronic resource guide, ERC publication.

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24MC3103 LITERARY FORMS AND TECHNIQUES **L T P C**
3 0 0 0

COURSE OBJECTIVES

- To make the students aware about the finer sensibilities of human existence through an art form.
- The students will learn to appreciate different forms of literature as suitable modes of expressing human experience.
- To gain knowledge in modern tools for visualization.

UNIT I INTRODUCTION TO ELEMENTS OF LITERATURE **9**

Relevance of literature, Enhances Reading, thinking, discussing and writing skills. Develops finer sensibility for better human relationship. Increases understanding of the problem of humanity without bias. Providing space to reconcile and get a cathartic effect.

UNIT II ELEMENTS OF FICTION **9**

Fiction, fact and literary truth. Fictional modes and patterns. Plot character and perspective.

UNIT III ELEMENTS OF POETRY **9**

Emotions and imaginations. Figurative language. Simile, metaphor, conceit, symbol, pun and irony). Personification and animation. Rhetoric and trend.

UNIT IV ELEMENTS OF DRAMA **9**

Drama as representational art. Content mode and elements. Theatrical performance. Drama as narration, mediation and persuasion. Features of tragedy, comedy and satire.

UNIT V MODERN TOOLS FOR VISUALIZATION **9**

Plot Diagram Infographic, Theme Video Tone & Mood, Visual Set, Setting Diorama or 3D Model Soundtrack for a Story, Symbolism Poster, Book Trailer.

TOTAL: 45 PERIODS

COURSE OUTCOMES

On successful completion of this course, the students will be able to

CO1: Explain the relevance of literature in human life.

CO2: Explore the relevance various aspects in developing finer sensibilities.

CO3: Explain the essence of poetry.

CO4: Enumerate the essence of drama.

CO5: Use the modern tools for visualization.

TEXT BOOKS

1. W.H. Hudson, An Introduction to the Study of English Literature, Atlantic, 2007.
2. Mario Klarer, Routledge, An Introduction to Literary Studies, 2013.
3. The Experience of Poetry, Graham Mode, Open college of Arts with Open Unv Press, 1991.

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REFERENCE BOOKS

1. Wolfstuff, The Elements of Fiction: A Survey, Ulf Wolf (ed), 2014
2. The Elements of Drama, J.L.Styan, Literary Licensing, 2011.
3. WIPO Intellectual Prcpeny Handbook. Policy, Law and Us.
4. Kelly J. Mays, "The nrton introduction to Literature", W.W.Norton &Company,15th 2024.
5. Eleclronic resource guide ERc published online by the American Society of International law.

24MC3104 DISASTER RISK REDUCTION AND MANAGEMENT **L T P C**
3 0 0 0

COURSE OBJECTIVES

- To impart knowledge on concepts related to disaster management.
- To acquaint with the skills for planning and organizing disaster response.
- To impart knowledge on concepts related to disaster, disaster risk reduction.

UNIT I HAZRADS, VULNERABILITY AND DISASTER RISKS **9**

Definition: Disaster, Hazard, Vulnerability, Resilience, Risks – Types of Disasters: Natural, Human induced, Climate change induced –Earthquake, Landslide, Flood, Drought, Fire etc – Technological disasters- Structural collapse, Industrial accidents, oil spills -Causes, Impacts including social, Economic, political, environmental, health, psychosocial, etc.- Disaster vulnerability profile of India and Tamil Nadu - Global trends in disasters: urban disasters, pandemics, Complex emergencies,-Inter relations between Disasters and Sustainable development Goals.

UNIT II DISASTER RISK REDUCTION (DRR) **9**

Sendai Framework for Disaster Risk Reduction, Disaster cycle - Phases, Culture of safety, prevention, mitigation and preparedness community Based DRR, Structural- nonstructural measures, Roles and responsibilities of- community, Panchayati Raj Institutions / Urban Local Bodies (PRIs/ULBs), States, Centre, and other stakeholders- Early Warning System – Advisories from Appropriate Agencies. - Relevance of indigenous Knowledge, appropriate technology and Local resources.

UNIT III DISASTER MANAGEMENT **9**

Components of Disaster Management – Preparedness of rescue and relief, mitigation, rehabilitation and reconstruction- Disaster Risk Management and post disaster management – Compensation and Insurance- Disaster Management Act (2005) and Policy - Other related policies, plans, programmers and legislation - Institutional Processes and Framework at State and Central Level- (NDMA –SDMA-DDMA-NRDF- Civic Volunteers).

UNIT IV TOOLS AND TECHNOLOGY FOR DISASTER MANAGEMENT **9**

Early warning systems -Components of Disaster Relief: Water, Food, Sanitation, Shelter, Health, Waste Management, Institutional arrangements (Mitigation, Response and Preparedness, – Role of GIS and Information Technology Components in Preparedness, Risk

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Assessment, Response and Recovery Phases of Disaster – Disaster Damage Assessment. - Elements of Climate Resilient Development –Standard operation Procedure for disaster response – Financial planning for disaster Management.

UNIT V DISASTER MANAGEMENT: CASE STUDIES **9**

Discussion on selected case studies to analyse the potential impacts and actions in the contest of disasters-Landslide Hazard Zonation: Earthquake Vulnerability Assessment of Buildings and Infrastructure: Case Studies, Drought Assessment: Case Studies, Coastal Flooding: Storm Surge Assessment, Floods: Fluvial and Pluvial Flooding: Case Studies; Forest Fire: Case Studies, Man Made disasters: Case Studies, Space Based Inputs for Disaster Mitigation and Management and field works related to disaster management.- Field work-Mock drill.

TOTAL: 45 PERIODS

COURSE OUTCOMES

On successful completion of this course, the students will be able to

CO1: Use the concepts of Disaster, Vulnerability and Disaster Risk reduction.

CO2: Explore on Hazards, Vulnerability and Disaster Risk Assessment prevention and risk reduction.

CO3: Develop disaster response skills by adopting relevant tools and technology.

CO4: Enhance awareness of institutional processes for Disaster response in the country.

CO5: Develop rudimentary ability to respond to their surroundings with potential.

TEXT BOOKS

1. Taimpo, Disaster Management and Preparedness, CRC Publications, 2016.
2. Singh R, Disaster Management Guidelines for earthquakes, Landslides, Avalanches and tsunami, Horizon Press Publications, 2017.
3. Tushar Bhattacharya, "Disaster Science and Management", McGraw Hill India Education Pvt. Ltd., 2012.

REFERENCE BOOKS

1. Singhal J.P. "Disaster Management", Laxmi Publications, 2010.
2. Govt. of India: Disaster Management Act, Government of India, New Delhi, 2005.
3. Government of India, National Disaster Management Policy, 2009.
4. Shaw R., Community based Disaster risk reduction, Oxford University Press, 2016.
5. Madu, C. N., Kuei, C.-H., Madu, I. E., Ozumba, B. C., Nnadi, V. E., Odinkonigbo, U. L., & Ezeasor, I. C. (Eds.), Handbook of disaster risk reduction & management: Climate change and natural disasters. World Scientific Publishing Co, 2017.

24MC3105 FILM APPRECIATION **L T P C**

3 0 0 0

COURSE OBJECTIVES

- To gain knowledge on concepts film.
- To acquaint the skills on film language.
- To know the developments in films.

Theme - A: The Component of Films

A-1: The material and equipment

A-2: The story, screenplay and script

A-3: The actors, crew members, and the director

A-4: The process of film making… structure of a film

Theme - B: Evolution of Film Language

B-1: Film language, form, movement etc.

B-2: Early cinema… silent film (Particularly French)

B-3: The emergence of feature films: Birth of a Nation

B-4: Talkies

Theme - C: Film Theories and Criticism/Appreciation

C-1: Realist theory; Auteurists

C-2: Psychoanalytic, Ideological, Feminists

C-3: How to read films?

C-4: Film Criticism / Appreciation

Theme – D: Development of Films

D-1: Representative Soviet films

D-2: Representative Japanese films

D-3: Representative Italian films

D-4: Representative Hollywood film and the studio system

Theme - E: Indian Films

E-1: The early era

E-2: The important films made by the directors

E-3: The regional films

E-4: The documentaries in India

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READING:

A Reader containing important articles on films will be prepared and given to the students. The students must read them and present in the class and have discussion on these.

TOTAL: 45 PERIODS

COURSE OUTCOMES

On successful completion of this course, the students will be able to

CO1: Explore the components of film.

CO2: Utilze the development of film languages.

CO3: Explain the film theories.

CO4: Discuss the latest developments in film.

CO5: List the latest developments in Indian film.

TEXT BOOKS

1. Jim Piper, The Film Appreciation Book: The Film Course You Always Wanted to Take, Allworth Pr, 2014.
2. Monaco, How to read a film, Oxford University Press, 2000.
3. Bordwell, D., & Thompson, K., Film art: An introduction, 12th Edition, McGraw-Hill Education., 2020.

REFERENCE BOOKS

1. Nichols, B., Engaging cinema: An introduction to film studies. W. W. Norton & Company, 2017.
2. Cook, D. A., A history of narrative film (4th ed.). W. W. Norton & Company, 2004.
3. Giannetti, L., Understanding movies (14th ed.). Pearson, 2020.
4. Boggs, J. M., & Petrie, D. W., The art of watching films (9th ed.). McGraw-Hill Education, 2017.
5. Hayward, S. (2013). Cinema studies: The key concepts (4th ed.). Routledge.

24MC3106 WOMEN AND GENDER STUDIES **L T P C**
3 0 0 0

COURSE OBJECTIVES

- To gain knowledge in feminism and its theory's.
- To know the woman's global, national and locals movements.
- To understand the gender and representations.

UNIT I CONCEPTS **9**

Sex vs. Gender, masculinity, femininity, socialization, patriarchy, public/ private, essentialism, binaryism, power, hegemony, hierarchy, stereotype, gender roles, gender relation, deconstruction, resistance, sexual division of labour.

UNIT II FEMINIST THEORY **9**

Liberal, Marxist, Socialist, Radical, Psychoanalytic, postmodernist, ecofeminist.

UNIT III WOMEN'S MOVEMENTS: GLOBAL, NATIONAL AND LOCAL **9**

Rise of Feminism in Europe and America. Women's Movement in India.

UNIT IV GENDER AND LANGUAGE **9**

Linguistic Forms and Gender. Gender and narratives.

UNIT V GENDER AND REPRESENTATION **9**

Advertising and popular visual media. Gender and Representation in Alternative Media. Gender and social media.

TOTAL: 45 PERIODS

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COURSE OUTCOMES

On successful completion of this course, the students will be able to

CO1: Distinguish between key concepts related to sex, gender, patriarchy, and gender roles.

CO2: Analyze various feminist theories, including liberal, Marxist, socialist, radical, and postmodernist perspectives.

CO3: Examine the development of women's movements globally, nationally (India), and locally.

CO4: Interpret the relationship between gender and language, including narrative forms and linguistic structures.

CO5: Evaluate the representation of gender in mainstream, alternative, and social media platforms.

TEXT BOOKS

1. Madhu Nagla, Women and Gender Studies: A Textbook, Rawat Publications; First Edition, 2025.
2. Mary S Evans, Kathy Davis and Judith Lorber, Handbook of Gender and Women's Studies, Sage Publications, 2006.
3. Gillis, M. J., & Jacobs, A. T. Introduction to women's and gender studies: An interdisciplinary approach (2nd ed.). Oxford University Press, 2019.

REFERENCE BOOKS

1. Launius, C., & Hassel, H., Threshold concepts in women's and gender studies (2nd ed.). Routledge, 2018.
2. Hunter College Women's and Gender Studies Collective. Women's realities, women's choices: An introduction to women's and gender studies. Oxford University Press, 2014.
3. Saraswati, L. A., Shaw, B., & Rellihan, H. (2017). Introduction to women's, gender, and sexuality studies. Oxford University Press
4. Clemens, C. L.Introduction to women's & gender studies. The Pennsylvania Alliance for Design of Open Textbooks (PA-ADOPT), 2023.

24MC5101 FOOD AND NUTRITION **L T P C**

3 0 0 0

COURSE OBJECTIVES

- Obtain knowledge of different food groups, their composition and role in diet.
- To gain knowledge of different plant and animal derived foods and their nutritive values and properties.
- To gain knowledge in different methods of processing and cooking.

UNIT I FOOD GROUPS **9**

Basic 4, 5&7 food groups. Functional food groups-energy yielding, body building and protective foods (only sources and not properties and functions). Food Pyramid, My Plate. Study of various cooking methods - Boiling, steaming, stewing, frying, baking, roasting,

broiling, cooking under pressure. Cereals - composition of rice, wheat, effects of cooking on parboiled and raw rice, principles of starch cookery, gelatinization.

UNIT II PULSES AND GRAMS **9**

Varieties of pulses & grams, composition, nutritive value, cooking quality of pulses, germination and its effect. Vegetables - Classification, composition, nutritive value, selection and preparation for cooking, methods and principles involved in cooking. Fruits - Composition, nutritive value, changes during ripening, methods and effects of cooking, enzymatic browning.

UNIT III BEVERAGES **9**

Classification, nutritive value, Milk based beverages- methods of preparing tea and coffee, fruit based beverages and preparation of carbonated non – alcoholic beverages. Spices and Condiments - Uses and abuses. Fats and Oils - Types of oils, function of fats and oils, shortening effects of oil, smoking point of oil, factors affecting absorption of oil. Sugar cookery- Stages of sugar cookery, crystallization and factors affecting crystallization.

UNIT IV MILK **9**

Composition, nutritive value, kinds of milk, pasteurization and homogenization of milk, changes in milk during heat processing, preparation of cheese and milk powder Egg - Structure, composition, classification, nutritive value, uses of egg in cookery, methods of cooking, foam formation and factors affecting foam formation.

UNIT V MEAT **9**

Structure, composition, nutritive value, selection of meat, post mortem changes in meat, aging, tenderness, methods of cooking meat and their effects. Poultry – types, composition, nutritive value, selection, methods of cooking. Fish - Structure, composition, nutritive value, selection of fish, methods of cooking and effects

TOTAL: 45 PERIODS

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COURSE OUTCOMES

On successful completion of this course, the students will be able to

CO1: Explain the food groups.
CO2: Explore properties of pulses and grams.
CO3: Apply the properties of beverages.
CO4: Use the properties of milk.
CO5: Utilize properties of meats.

TEXT BOOKS

1. M. Swaminathan. Food science, Chemistry and Experimental foods, International Book House Publication
2. Norman. N. Potter, Food Science, New York: Chapman & HalI, 1995
3. Griswold R.M, Experimental study of Foods, John Wiely & Sons, INC, New York, 1962.

REFERENCE BOOKS

1. Helen Charley, Food Science, Macmillan, 1982
2. A.G. Peckam, Foundation of Food Preparation, Collier Macmillan Ltd, 1969.
3. Modern Cookery for teaching and trade, volume I&II ,Thangam Philip. Orient Longmans Ltd.
4. Food Fundamentals by MacWiliams, John Willy and son‟s, New York.
5. Food Facts & Principles by Shakunthala manay & Shadakhraswamy.

24MC5102 DESIGN THINKING **L T P C**

3 0 0 0

COURSE OBJECTIVES

- To learn design thinking concepts and principles.
- To use design thinking methods in every stage of the problem.
- To learn the different phases of design thinking.

UNIT I INTRODUCTION **9**

Why Design? - Four Questions, Ten Tools - Principles of Design Thinking - The process of Design Thinking - How to plan a Design Thinking project.

UNIT II UNDERSTAND, OBSERVE AND DEFINE THE PROBLEM **9**

Search field determination - Problem clarification - Understanding of the problem - Problem, analysis - Reformulation of the problem - Observation Phase - Empathetic design - Tips for observing - Methods for Empathetic Design - Point-of-View Phase - Characterization of the target group - Description of customer needs.

UNIT III IDEATION AND PROTOTYPING **9**

Ideate Phase - The creative process and creative principles - Creativity techniques - Evaluation of ideas - Prototype Phase - Lean Startup Method for Prototype Development - Visualization and presentation techniques.

UNIT IV TESTING AND IMPLEMENTATION **9**

Test Phase - Tips for interviews - Tips for surveys - Kano Model - Desirability Testing - How to conduct workshops - Requirements for the space - Material requirements - Agility for Design Thinking.

UNIT V FUTURE **9**

Design Thinking meets the corporation – The New Social Contract – Design Activism – Designing tomorrow**.**

TOTAL: 45 PERIODS

COURSE OUTCOMES

On successful completion of this course, the students will be able to

CO1: Explain the principles of design thinking.

CO2: Define the problems.

CO3: Create prototype.

CO4: Test the product.
CO5: Implement the product in the market sale.

TEXT BOOKS

1. Christian Mueller-Roterberg, Handbook of Design Thinking - Tips & Tools for how to design thinking.
2. Jeanne Liedtka and Tim Ogilvie, Designing for Growth: a design thinking tool kit for managers.
3. Tim Brown, Change by Design: How Design Thinking Transforms Organizations and Inspires Innovation.

REFERENCE BOOKS

1. Johnny Schneider, "Understanding Design Thinking, Lean and Agile", O'Reilly Media, 2017.
2. Roger Martin, "The Design of Business: Why Design Thinking is the Next Competitive Advantage", Harvard Business Press, 2009.
3. Hasso Plattner, Christoph Meinel and Larry Leifer (eds), "Design Thinking: Understand – Improve – Apply", Springer, 2011
4. http://ajjuliani.com/design-thinking-activities/\
5. https://venturewell.org/class-exercices.

24MC5103 HISTORY OF SCIENCE AND TECHNOLOGY IN INDIA **L T P C**
3 0 0 0

COURSE OBJECTIVES

- To know the contributions of sciences.
- To gain knowledge astronomy, mathematics and Ayurveda.
- To gain knowledge on technological development of India.

UNIT I INTRODUCTION **9**

Logic and methodology of Indian sciences. An overview of Indian contributions to sciences. An overview of Indian contributions to technology.

UNIT II ASTRONOMY **9**

Development of astronomy in India. Pancanga: Indian calendrical computations. The distinct features of Indian planetary models. Computation of eclipses: Its simplicity, elegance and efficiency. Observational astronomy in India.

UNIT III MATHEMATICS **9**

An overview of the development of mathematics in India. Mathematics contained in Sulbasutras. Combinatorial aspects of the Chandassastra. Solutions to the first and second order indeterminate equations. Weaving mathematics into beautiful poetry: Bhaskaracarya. The evolution of sine function in India. The discovery of calculus by Kerala astronomers

UNIT IV AYURVEDA **9**

History of Ayurveda, Rational foundations of Ayurveda, Textual sources in Ayurveda, Ayurveda and allied disciplines, Approach to health and disease in Ayurveda – 2 lectures, Approach to diet and nutrition in Ayurveda. Modern medicine, Ayurveda and Yoga.

UNIT V TECHNOLOGICAL DEVELOPMENT IN INDIA **9**

Agriculture- Origin, development, and Ancient crops, Water management- Overview, Harappan water management, other case studies, Medieval Water structures, Pottery-technical aspects, Silpasastra: Architecture and Construction- An introduction to Silpasastra and Construction Technology.

TOTAL: 45 PERIODS

COURSE OUTCOMES

On successful completion of this course, the students will be able to

CO1: Explain the Indian science.
CO2: Explore essence of Indian astronomy.
CO3: Enumerate the development of Indian mathematics
CO4: Discuss the sources of Ayurveda.
CO5: Explain the technological development of India.

TEXT BOOKS

1. Soni, S., India's glorious scientific tradition: Exploration of ancient knowledge and modern insights. Prabhat Prakashan.2020.
2. Joseph, G. G, A passage to infinity: Medieval Indian mathematics from Kerala and its impact. SAGE Publications, 2009.
3. Mohan, K., Science and technology in colonial India. Routledge, 2023.

REFERENCE BOOKS

1. Sarma, K. V. A history of the Kerala school of Hindu astronomy. Vishveshvarananda Institute of Sanskrit and Indological Studies, 1972.
2. Seshadri, C. S. (Ed.). Studies in the history of Indian mathematics. Hindustan Book Agency, 2010.
3. Datta, B., & Singh, A. N. History of Hindu mathematics: A source book. Asia Publishing House, 1962.
4. Kashyapa, K., Kashyapa Samhita. Chaukhambha Orientalia, 2007.
5. https://onlinecourses.swayam2.ac.in/arp19_ap87/preview.

24MC5104 POLITICAL AND ECONOMIC THOUGHT FOR A HUMANE SOCIETY

L	T	P	C
3	0	0	0

COURSE OBJECTIVES

- To know the human society and system.
- To understand the capitalism, fascism and communism.
- To gain knowledge in human welfare and essential elements in Indian civilization.

UNIT I HUMAN SOCIETY AND SYSYTEM **9**

Considerations for humane society, holistic thought, human being's desires, harmony in self, harmony in relationships, society, and nature, societal systems.

UNIT II CAPITALISM **9**

Capitalism – Free markets, demand-supply, perfect competition, laissez-faire, monopolies, Imperialism. Liberal democracy.

UNIT III FASCISM AND COMMUNISM **9**

Fascism and totalitarianism. World War I and II. Cold war. Communism – Mode of production, theory of labour, surplus value, class struggle, dialectical Materialism, historical materialism, Russian and Chinese models.

UNIT IV HUMAN WELFARE **9**

Welfare state. Relation with human desires. Empowered human beings, satisfaction. Gandhian thought. Swaraj, Decentralized economy & polity, Community. Control over one's lives, Relationship with nature.

UNIT V ESSENTIAL ELEMENTS OF INDIAN CIVILIZATION **9**

Essential elements of Indian civilization, Technology as driver of society, Role of education in shaping of society. Future directions.

COURSE OUTCOMES

On successful completion of this course, the students will be able to

CO1: Explore the human society and system.
CO2: Explain principles of capitalism.
CO3: Discuss the fascism and communism.
CO4: Explore the importance of Human Welfare.
CO5: List the essential elements of Indian civilization.

TEXT BOOKS

1. Capra, F, The Turning Point: Science, Society, and the Rising Culture (Revised ed.). HarperOne,2023.
2. Marx, K., & Engels, F. The Communist Manifesto. Penguin Classics. 2022.
3. Paxton, R. O. The Anatomy of Fascism. Vintage, 2022.

REFERENCES BOOKS

1. Kumar, S.,The Song of the Earth. Green Books, 2022.
2. Stiglitz, J. E, Globalization and Its Discontents Revisited: Anti-Globalization in the Era of Trump. Penguin UK, 2017.
3. Lenin, V. I., The State and Revolution. Penguin Random House 2024.
4. Sen, A., Development as Freedom. Oxford University Press.2022.
5. Capra, F., & Luisi, P. L., The Systems View of Life: A Unifying Vision. Cambridge University Press, 2022.

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24MC5105 STATE, NATION BUILDING AND POLITICS IN INDIA **L T P C**
3 0 0 0

COURSE OBJECTIVE

- To gain knowledge in need and role of state and politics.
- To gain knowledge in Indian national movements.
- To gain knowledge in national politics and constitution.

UNIT I INTRODUCTION **9**

Understanding the need and role of State and politics. Development of Nation-State, sovereignty, sovereignty in a globalized world.

UNIT II STATE POLITICS **9**

Organs of State – Executive, Legislature, Judiciary. Separation of powers, forms of government unitary-federal, Presidential-Parliamentary.

UNIT III INDIAN NATIONAL MOVEMENTS **9**

The idea of India. 1857 and the national awakening. 1885 Indian National Congress and development of national movement – its legacies.

UNIT IV CONSTITUTION OF INDIA **9**

Constitution making and the Constitution of India. Goals, objective and philosophy.

UNIT V NATIONAL POLITICS **9**

National integration and nation-building. Challenges of nation-building – State against democracy (Kothari) New social movements. The changing nature of Indian Political System, the future scenario.

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COURSE OUTCOMES

On successful completion of this course, the students will be able to

CO1: Explore the needs of politics.
CO2: Explain the organs of state politics.
CO3: Explain the history of Indian national movements.
CO4: Discuss the constitution of India.
CO5: Discuss the roles of national politics.

TEXT BOOKS

1. Sunil Khilnani, The Idea of India. Penguin India Ltd., New Delhi.
2. Madhav Khosla, The Indian Constitution, Oxford University Press. New Delhi, 2012.
3. Chatterjee, P. (Ed.). State and politics in India. Oxford University Press, 1997.

REFERENCE BOOKS

1. Sumantra Bose, Transforming India: Challenges to the World's Largest Democracy, Picador India, 2013.
2. V. Atul Kohli, Democracy and Discontent: India's Growing Crisis of Governability, Cambridge University Press, Cambridge, U. K., 1991.
3. M. P. Singh and Rekha Saxena, Indian Politics: Contemporary Issues and Concerns, PHI, New Delhi, 2008, latest edition.
4. Rajni Kothari, Rethinking Democracy, Orient Longman, New Delhi, 2005.
5. Brij Kishore Sharma, Introduction to the Indian Constitution, PHI, New Delhi, latest edition.

24MC5106 INDUSTRIAL SAFETY **L T P C**

3 0 0 0

COURSE OBJECTIVES

- To Understand the Introduction and basic Terminologies safety.
- To enable the students to learn about the Important Statutory Regulations and standards.
- To enable students to Conduct and participate the various Safety activities in the Industry.

UNIT I SAFETY TERMINOLOGIES **9**

Hazard-Types of Hazard- Risk-Hierarchy of Hazards Control Measures-Lead indicators- lag Indicators-Flammability- Toxicity Time-weighted Average (TWA) - Threshold Limit Value (TLV) - Short Term Exposure Limit (STEL)- Immediately dangerous to life or health (IDLH)- acute and chronic Effects- Routes of Chemical Entry-Personnel Protective Equipment- Health and Safety Policy-Material Safety Data Sheet MSDS.

UNIT II STANDARDS AND REGULATIONS **9**

Indian Factories Act-1948- Health- Safety- Hazardous materials and Welfare- ISO 45001:2018 occupational health and safety (OH&S) - Occupational Safety and Health Audit IS14489:1998- Hazard Identification and Risk Analysis- code of practice IS 15656:2006.

UNIT III SAFETY ACTIVITIES **9**

Toolbox Talk- Role of safety Committee- Responsibilities of Safety Officers and Safety Representatives- Safety Training and Safety Incentives- Mock Drills- On-site Emergency Action Plan- Off-site Emergency Action Plan- Safety poster and Display- Human Error Assessment.

UNIT IV WORKPLACE HEALTH AND SAFETY **9**

Noise hazard- Particulate matter- musculoskeletal disorder improper sitting poster and lifting Ergonomics RULE & REBA- Unsafe act & Unsafe Condition- Electrical Hazards- Crane SafetyToxic gas Release.

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UNIT V HAZARD IDENTIFICATION TECHNIQUES **9**

Job Safety Analysis-Preliminary Hazard Analysis-Failure mode and Effects Analysis- Hazard and Operability- Fault Tree Analysis- Event Tree Analysis Qualitative and Quantitative Risk Assessment Checklist Analysis- Root cause analysis- What-If Analysis- and Hazard Identification and Risk Assessment.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

Course outcomes on completion of this course the student will be able:

CO1: Explain the basic concept of safety.
CO2: Obtain knowledge of Statutory Regulations and standards.
CO3: Know about the safety Activities of the Working Place.
CO4: Analyze on the impact of Occupational Exposures and their Remedies
CO5: Obtain knowledge of Risk Assessment Techniques.

TEXT BOOKS

1. R.K. Jain and Prof. Sunil S. Rao Industrial Safety, Health and Environment Management Systems KHANNA PUBLISHER
2. L. M. Deshmukh Industrial Safety Management: Hazard Identification and Risk Control McGraw-Hill Education.
3. Asfahl, C. R., & Rieske, D. W., Industrial safety and health management (7th ed.). Pearson 2018.

REFERENCE BOOKS

1. Frank Lees, 'Lees' Loss Prevention in Process Industries. Butterworth-Heinemann publications, UK, 4th Edition., 2012.
2. John Ridley & John Channing, Safety at Work: Routledge, 7th Edition., 2008.
3. Dan Petersen, Techniques of Safety Management: A System Approach, 2003
4. Alan Waring, Safety management system: Chapman & Hall, England 5. Society of Safety Engineers, USA, 1996
5. Ferris, R. W., & Murphy, D, Workplace safety: Establishing an effective violence prevention program. Butterworth-Heinemann.

24OCI101 ESTIMATION AND COSTING OF BUILDING **L T P C**

3 0 2 4

COURSE OBJECTIVES

- To understand methods for estimating quantities in a range of construction projects, including buildings, roads, and infrastructure.
- To acquire knowledge in rate analysis and cost estimation for construction activities.
- To build proficiency in drafting construction specifications, technical reports, and tender documents.

UNIT I ESTIMATION OF QUANTITIES **9**

Philosophy – Purpose – Methods of estimation – Centre line method – Long and short wall method – Types of estimates – Approximate estimates – Detailed estimate – Estimation of quantities for buildings, bituminous and cement concrete roads, septic tank, soak pit.

UNIT II COSTING AND RATE ANALYSIS **9**

Standard Data – Observed Data – Schedule of rates – Market rates – Materials and Labour – Standard Data for Man Hours and Machineries for common civil works.

UNIT III CONSTRUCTION SPECIFICATIONS AND DOCUMENTATION **9**

Specifications – Detailed and general specifications – Constructions – Sources – Types of specifications – Principles for report preparation – report on estimate of residential building – Culvert – Roads.

UNIT IV TYPES OF CONTRACTS **9**

Contract – Types of contracts – BOT – Types - Formation of contract – Contract conditions – Contract for labour, material, design, construction.

UNIT V PROPERTY VALUATION **9**

Definitions – Various types of valuations – Valuation methods - Necessity –Year's purchase-sinking fund- Capitalised value – Depreciation – Escalation – Valuation of land – Buildings – Calculation of Standard rent.

TOTAL:45 PERIODS

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LIST OF EXPERIMENTS (Using MS Excel Software)

1. Deriving an approximate estimate for a multistoried building by approximate methods.
2. Detailed estimate for the following with the required material survey for the same.
3. Derive an estimate for Ground plus three storied RCC Framed structure with blockwork walls.
4. Prepare the detailed estimate for the bridge with minimum 2 spans.
5. Detailed estimate for the factory building.
6. Detailed estimate for the road work cross drainage work.
7. Derive an estimate for Ground plus three storied building with load-bearing walls.
8. Preparation of valuation report in standard Government form.

TOTAL:30 PERIODS

COURSE OUTCOMES

On Successful completion of this course, the student will able to

CO1: Estimate quantities for construction projects using standard methods and software.

CO2: Analyze rates and create cost estimates for different construction works.

CO3: Gain skills in preparing construction specifications, reports, and tenders.

CO4: Analyze the different types of construction contracts, their formation, and how disputes are resolved.

CO5: Value the properties such as land, buildings, mortgages, and leases.

TEXT BOOKS

1. B.N Dutta 'Estimating and Costing in Civil Engineering', CBS Publishers & Distributors (P) Ltd, Twenty eighth revised edition, 2020.
2. B.S.Patil, 'Civil Engineering Contracts and Estimates', 7th edition, University Press, 2015.
3. D.N. Banerjee, 'Principles and Practices of Valuation', V Edition, Eastern Law House, 2015.

REFERENCE BOOKS

1. Hand Book of Consolidated Data – 8/2000, Vol.1, TNPWD.
2. Tamil Nadu Transparencies in Tenders Act, 1998 and rules 2000.
3. Arbitration and Conciliation Act, 1996.
4. Standard Bid Evaluation Form, Procurement of Good or Works, The World Bank, April 1996.
5. Standard Data Book for Analysis and Rates, IRC, New Delhi, 2019.

Mapping of COs with POs

Cos	POs												PSO	
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
CO1	2	3	3	2	3	2	3	3	3	2	3	3	2	2
CO2	2	3	3	2	3	2	3	3	3	2	3	3	2	2
CO3	2	3	3	2	3	2	3	3	3	2	3	3	2	2
CO4	2	3	3	2	3	2	3	3	3	2	3	3	2	1
CO5	2	3	3	2	3	2	3	3	3	2	3	3	2	1
AVG	**2**	**3**	**3**	**2**	**3**	**2**	**3**	**3**	**3**	**2**	**3**	**3**	**2**	**1.6**

1-Low, 2-Medium, 3-High, "-" – No correlation

24OCI102 QUALITY ASSESSMENT OF BUILDING MATERIALS **L T P C**

3 0 2 4

COURSE OBJECTIVES

- To learn the importance of quality control and testing standards for building materials.
- To understand the methods for testing materials like cement, concrete, aggregates, bricks, and steel.
- To gain hands-on experience in testing the quality of building materials in the laboratory.

UNIT I INTRODUCTION TO QUALITY ASSESSMENT AND TESTING STANDARDS **9**

Importance of quality control in construction - Properties of building materials - physical, chemical, and mechanical properties - Quality assurance vs. quality control - IS codes for material testing (cement, aggregates, steel, etc.) - Sampling techniques and procedures - Acceptance criteria and reporting.

UNIT II CEMENT AND CONCRETE **9**

Types and grades of cement - Testing of cement: fineness, consistency, setting time, strength - Concrete mix design (brief introduction) – Grades of Concrete - Workability and durability tests - Compressive, tensile, and flexural strength of concrete - Nondestructive testing (NDT) - rebound hammer, ultrasonic pulse velocity. Types and roles of admixtures - Quality assessment of chemical and mineral admixtures.

UNIT III AGGREGATES **9**

Types of aggregates - fine and coarse - Tests on aggregates - sieve analysis, specific gravity, water absorption, impact value, crushing value - Bulking of sand - Alkali-aggregate reaction - IS codes relevant to aggregate testing.

UNIT IV BRICKS, BLOCKS, AND MASONRY UNITS **9**

Classification and properties of bricks and blocks - Water absorption, compressive strength, efflorescence of bricks - Testing of solid and hollow concrete blocks - Masonry mortar: types and tests - Quality standards for masonry units relevant to IS codes.

UNIT V STEEL, TIMBER, AND OTHER MATERIALS **9**

Types of steel used in construction – mild steel, HYSD, TMT - Tensile and bend tests for steel – Timber - defects, moisture content, and strength grading - Quality control for paints, plastics, and glass - Modern materials - Geosynthetics, Graphine infused materials, Fiber reinforced polymers, Phase change materials (PCMs), Recycled and sustainable materials, Geopolymer, Advanced composite materials and Nano materials.

TOTAL: 45 PERIODS

LIST OF EXPERIMENTS

1. Fineness and consistency test on cement.
2. Compressive strength test on cement mortar cubes and concrete cubes.
3. Workability test on fresh concrete using slump cone and compaction factor.
4. Compressive and flexural strength test on hardened concrete.
5. Sieve analysis and specific gravity test on aggregates.
6. Impact and crushing value test on coarse aggregates.
7. Water absorption and compressive strength test on bricks.
8. Non-Destructive test on concrete specimens.

TOTAL: 30 PERIODS

COURSE OUTCOMES

On Successful completion of this course, the students will be able to

CO1: Demonstrate the use of quality control techniques to verify building material standards.

CO2: Evaluate the properties of cement, concrete, and admixtures using standard methods and non-destructive testing.

CO3: Perform tests on different types of aggregates to evaluate their properties and compliance with relevant IS codes.

CO4: Analyze the quality of bricks and blocks to ensure they meet construction requirements.

CO5: Perform testing on steel, timber, and modern materials to determine their construction suitability.

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TEXT BOOKS

1. Shetty, M.S., Concrete Technology (Theory and Practice), S. Chand and Company Ltd., 2008.
2. Gambhir, M.L., Concrete Technology, Tata McGraw Hill Education, 5th Edition, 2013.
3. Varghese, P.C., Quality Control and Testing of Construction Materials, PHI Learning Pvt. Ltd., 2007.

REFERENCE BOOKS

1. Duggal, S.K., Building Materials, New Age International Publishers, 4th Edition, 2008.
2. IS 456:2000 – Plain and Reinforced Concrete – Code of Practice, Bureau of Indian Standards, New Delhi.
3. IS 383:2016 – Specification for Coarse and Fine Aggregates for Concrete, Bureau of Indian Standards, New Delhi.
4. IS 516:2018 – Method of Tests for Strength of Concrete, Bureau of Indian Standards, New Delhi.
5. IS 3495 (Parts 1 to 4):1992 – Methods of Tests of Burnt Clay Building Bricks, Bureau of Indian Standards, New Delhi.

Mapping of COs with POs

COs	POs												PSO	
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
CO1	2	3	3	2	3	2	3	3	3	2	3	3	1	2
CO2	2	3	3	2	3	2	3	3	3	2	3	3	2	2
CO3	2	3	3	2	3	2	3	3	3	2	3	3	2	2
CO4	2	3	3	2	3	2	3	3	3	2	3	3	2	2
CO5	2	3	3	2	3	2	3	3	3	2	3	3	1	2
AVG	**2**	**3**	**3**	**2**	**3**	**2**	**3**	**3**	**3**	**2**	**3**	**3**	2.6	2

1-Low, 2-Medium, 3-High, "-" – No correlation

24OCI103 PROJECT MANAGEMENT **L T P C**

3 0 2 4

COURSE OBJECTIVES

- To study and understand the formulation, scheduling and various safety concepts and its requirements applied to construction projects.
- To study the various management techniques for successful completion of construction projects.
- To study the effect of management for project organization, workers, material and equipment utilization, and cost estimation.

UNIT I GENERAL OVERVIEW AND PROJECT ORGANIZATION **9**

Introduction - Interdisciplinary nature of modern construction projects – execution of project – evaluation of bits – resource management.

UNIT II ESTIMATION OF PROJECT COST & ECONOMICS **9**

Estimating quantities – description of items – estimation of project cost – running account bills – decision making in construction projects – depreciation of construction equipment – case study.

UNIT III PLANNING AND SCHEDULING **9**

Introduction – project scheduling – uncertainties in duration of activities using PERT – Project monitoring and control system – resource levelling and allocation – crashing of network.

UNIT IV SAFETY DURING CONSTRUCTION **9**

Basic terminology in safety - types of injuries - safety pyramid - Accident patterns - Planning for safety budget, safety culture - Introduction to OSHA regulations - Site safety programs - Job hazardanalysis, accident investigation & accident indices-violation, penalty.

UNIT V SAFE OPERATING PROCEDURES **9**

Safety during alteration, demolition works – Earthwork, steel construction, temporary structures,masonry & concrete construction, cutting & welding - Construction equipment, materials handling- disposal & hand tools - Other hazards – fire, confined spaces, electrical safety - Linear Programming, PERT/CPM, Transportation problems, Assignment problems, Learning Curve Theory.

TOTAL: 45 PERIODS

LIST OF EXPERIMENTS

1. Introduction to various construction management software.
2. Planning and creating new project.
3. Scheduling and constraints using PRIMAVERA.
4. Project cost management using PRIMAVERA.
5. Construction project safety management using BIM.
6. Gantt Chart and Network Diagram Creation.
7. Critical Path Method (CPM) & PERT Analysis.
8. Risk Management Simulation.

TOTAL: 30 PERIODS

COURSE OUTCOMES

On successful completion of this course, the students will be able to

CO1: Perform formulations of projects.

CO2: Analyze project costing.

CO3: Identify and estimate the activity in the construction.

CO4: Develop the knowledge on accidents and their causes.

CO5: Plan, assess, analyze and manage the construction project sites using CPM/PERT.

TEXT BOOKS

1. Chitkara, K.K. Construction Project Management: Planning, Scheduling and Control, Tata McGraw-Hill Publishing Company, New Delhi, 1998.
2. Choudhury S, Project Management, McGraw-Hill Publishing Company, New Delhi, 1988.

3. Chris Hendrickson and Tung Au, Project Management for Construction – Fundamental Concepts for Owners, Engineers, Architects and Builders, Prentice Hall, Pittsburgh, 2000.

REFERENCE BOOKS

1. Barcus, S.W. and Wilkinson. J. W., Hand Book of Management Consulting Services, McGraw Hill,New York, 1986.
2. Joy P.K., Total Project Management - The Indian Context, New Delhi, Macmillan India Ltd., 1992.
3. Albert Lester, Project Management, Planning and Control, 7th Edition, Butterworth-Heinemann, USA, 2017.
4. Patrick X.W. Zou, Riza Yosia Sunindijo, Strategic Safety Management in Construction andEngineering John Wiley & Sons, Ltd 2015.
5. Frederick E. Gould, Construction Project Management, Wentworth Institute of Technology, Vary E. Joyce, Massachusetts Institute of Technology, 2000.

Mapping of COs with POs

COs	POs												PSO	
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
CO1	2	3	3	2	3	2	3	3	3	2	3	3	3	2
CO2	2	3	3	2	3	2	3	3	3	2	3	3	3	2
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CO4	2	3	3	2	3	2	3	3	3	2	3	3	3	2
CO5	2	3	3	2	3	2	3	3	3	2	3	3	3	2
AVG	**2**	**3**	**3**	**2**	**3**	**2**	**3**	**3**	**3**	**2**	**3**	**3**	**3**	**2**

1-Low, 2-Medium, 3-High, "-" – No correlation

24OCI104 BUILDING PLANNING USING VAASTU SASTRA **L T P C**

3 0 2 4

COURSE OBJECTIVES

- To introduce the principles of Vaasthu Shastra and its role in modern building planning.
- To equip students with the knowledge of guidelines for residential and commercial spaces.
- To develop the skills to apply principles in planning spaces for maximum comfort, energy flow, and harmony.

UNIT I INTRODUCTION TO VAASTHU SHASTRA **9**

Introduction to traditional Indian building orientation concepts including Vaasthu Shastra: overview, historical context, and philosophical background. Introduction to the five elements (Pancha Bhootas), cardinal directions, and their relevance in spatial organization. Role of energy flow and psychological comfort in building planning.

UNIT II GUIDELINES FOR RESIDENTIAL BUILDINGS **9**

General Vaasthu planning guidelines for residential buildings with functional and spatial arrangements. Orientation and zoning for daylight, ventilation, and thermal comfort. Introduction to structural load considerations as per IS 875 – Part 1: Dead Loads and IS 875 – Part 2: Imposed Loads. Importance of safety, utility, and aesthetic harmony in layout design.

UNIT III PLANNING OF COMMERCIAL AND PUBLIC BUILDINGS **9**

Design principles for commercial and public buildings such as offices, retail spaces, educational institutions, and hospitals. Functional requirements, circulation, and service zoning. Application of planning standards and integration with IS 875 loading codes and IS 456: Plain and Reinforced Concrete – Code of Practice.

UNIT IV CLIMATIC DESIGN & ENVIRONMENTAL INTEGRATION **9**

Importance of site context, solar orientation, prevailing winds, and daylighting in building design. Incorporating passive design strategies for thermal comfort and sustainability. Overview of IS SP 41: Guidelines for Climatic Design and ECBC (Energy Conservation Building Code) basics.

UNIT V COMMON DEFECTS AND SOLUTIONS **9**

Common functional and structural design issues in residential and commercial buildings. Remedial measures as per structural codes and basic planning principles. Introduction to basic concepts of defect rectification through both engineering practices and traditional approaches. Real-life examples and mini-case studies.

TOTAL:45 PERIODS

LIST OF EXPERIMENTS

1. Vaasthu analysis of an existing residential floor plan.
2. Designing room layouts based on Vaasthu principles.
3. Vaasthu compliant commercial building layout planning.
4. Identifying and correcting Vaasthu defects in a building plan.
5. Vaasthu guidelines for entrance and exit planning.
6. Selecting a construction site based on Vaasthu considerations.
7. Kitchen layout design following Vaasthu principles.
8. Optimizing solar and wind orientation in building design using Vaasthu.

TOTAL:30 PERIODS

COURSE OUTCOMES

On Successful completion of this course, the student will able to

CO1: Explain the key principles of Vaasthu Shastra.

CO2: Apply guidelines in the design of residential and commercial buildings.

CO3: Plan spaces that promote balance, energy flow, and harmony.

CO4: Design buildings that respond to climate and environment using passive strategies and relevant IS codes.

CO5: Identify and rectify common defects in existing buildings.

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TEXT BOOKS

1. Narayan, S. Vastu Shastra: For a better living. Rupa Publications, 2005.
2. Vasudevan, R. Vastu: Transcending time, tradition, and modernity. Orient BlackSwan, 2011.
3. Sastry, B. K. Vastu Shastra: The ancient Indian science of architecture. TBS Publishers, 2002.

REFERENCE BOOKS

1. Bhat, S. Vastu for modern living. New Age International,2009.
2. Chakraborty, P. The art of Vastu Shastra. Allied Publishers, 2010.
3. Nambiar, S. M. Vastu Shastra for home and office. Srishti Publishers, 2013.
4. Kumar, P. Vastu for health, wealth, and happiness. Orient Longman, 2016.
5. Sharma, A. Practical Vastu Shastra for the home. Sterling Publishers Pvt. Ltd, 2008.

Mapping of COs with POs

COs	POs												PSO	
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CO3	2	3	3	2	3	2	3	3	3	2	3	3	3	3
CO4	2	3	3	2	3	2	3	3	3	2	3	3	2	3
CO5	2	3	3	2	3	2	3	3	3	2	3	3	2	3
AVG	2	3	3	2	3	2	3	3	3	2	3	3	2.2	2.8

1-Low, 2-Medium, 3-High, "-" – No correlation

24OEI101 CONTROL SYSTEMS ENGINEERING **L T P C**
3 0 2 4

COURSE OBJECTIVES

- To understand the use of transfer function models for analysis physical systems and introduce the control system components.
- To provide adequate knowledge in the time response of systems and steady state error analysis.
- To accord basic knowledge in obtaining the open loop and closed–loop frequency responses of systems.

UNIT I MATHEMATICAL MODELS OF PHYSICALSYSTEMS **9**

Definition & classification of system – terminology & structure of feedback control theory – Analogous systems - Physical system representation by Differential equations – Block diagram reduction–Signal flow graphs.

UNIT II TIME RESPONSE ANALYSIS **9**

Standard test signals – Steady state error & error constants – Time Response of I and II order system.

UNIT III FREQUENCY RESPONSE ANALYSIS **9**

Correlation between Time & Frequency response – Polar plots – Bode Plots – Determination of Transfer Function from Bode plot.

UNIT IV STABILITY CONCEPTS & ANALYSIS **9**

Concept of stability – Necessary condition – RH criterion – Relative stability – Nyquist stability criterion – Stability from Bode plot – Relative stability from Nyquist & Bode – Closed loop frequency response.

UNIT V STATE VARIABLE ANALYSIS **9**

Concept of state – State Variable & State Model – State models for linear & continuous time systems–Solution of state & output equation–controllability & observability.

TOTAL: 45 PERIODS

LIST OF EXPERIMENTS

1. Mathematical modelling and analysis of Mechanical and Electrical systems using transfer function approach.
2. Time domain analysis of second order system.
3. Study of stability using Routh Hurwitz criterion.
4. Root locus technique based stability analysis.
5. Frequency response and stability analysis using Bode plot.
6. Frequency response and stability analysis using Polar plot.
7. Mathematical modelling and analysis of Mechanical and Electrical systems using state space approach.
8. Test of controllability and observability of a state space model.

TOTAL: 30 PERIODS

COURSE OUTCOMES

On successful completion of this course, the student will be able to

CO1: Design the basic mathematical model of physical System.
CO2: Analyze the time response analysis and techniques.
CO3: Analyze the transfer function from different plots.
CO4: Apply the stability concept in various criterion.
CO5: Assess the state models for linear and continuous Systems.

TEXT BOOKS

1. Farid Golnarghi, Benjamin C. Kuo, Automatic Control Systems Paper back, McGraw Hill Education, 2018.
2. Katsuhiko Ogata, ‘Modern Control Engineering’, Pearson, 5th Edition2015.
3. J. Nagrath and M. Gopal, Control Systems Engineering (Multi Colour Edition), New Age International, 2018.

REFERENCE BOOKS

1. Richard C. Dorf and Robert H. Bishop, Modern Control Systems, Pearson Education, 2010.
2. Control System Dynamics" by Robert Clark, Cambridge University Press, 1996

3. John J. D'Azzo, Constantine H. Houpis and Stuart N. Sheldon, Linear Control System AnalysisandDesign, 5th Edition, CRC PRESS, 2003.
4. S . Palani, Control System Engineering, McGraw-Hill Education Private Limited, 2009.
5. Yaduvir Singh and S.Janardhanan, Modern Control, Cengage Learning, First mpression, 2010.

Mapping of COs with POs

COs	POs												PSO	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	3	3	3	2	2	1	-	-	-	-	-	1	2	1
CO2	3	3	2	3	1	1	-	-	-	-	-	1	2	1
CO3	3	3	3	2	2	2	-	-	-	-	-	1	2	1
CO4	3	3	3	2	2	1	-	-	-	-	-	1	2	1
CO5	3	3	3	1	1	1	-	-	-	-	-	1	2	1
AVG	3	3	2.8	2	1.6	1.2	-	-	-	-	-	1	2	1

1 - Low, 2 - Medium, 3 – High, '-' No correlation

24OEI102 POWER ELECTRONICS AND DRIVES **L T P C**
3 0 2 4

COURSE OBJECTIVES

- Different types of power semiconductor devices and their switching.
- Operation, characteristics and performance parameters of controlled rectifiers and switched mode power supplies.
- Operation of AC voltage controller and various configurations.

UNIT I SINGLE PHASE RECTIFIERS **9**

Power Diode – half wave rectifier – mid-point secondary transformer based full wave rectifier – bridge rectifier - distortion factor - LC filters – SCR-Two transistor analogy based turn- ON, Controlled converters (1 pulse, 2 pulse) displacement factor – ripple and harmonic factor effect of source inductance, inverter angle limit.

UNIT II THREE PHASE RECTIFIERS **9**

Three phase diode rectifiers – Concern for power quality, Controlled converters (3 pulse, 6 pulse) Computation of performance parameters.

UNIT III SWITCHING POWER SUPPLIES **9**

IGBT, MOSFET: dynamic behaviour - driver and snubber circuits -low power high switching frequency switching Power supplies, buck, boost, buck-boost converters – Isolated topologies – resonant converters switching loss calculations and thermal design.

UNIT IV AC PHASE CONTROLLERS **9**

TRIAC triggering concept with positive and negative gate pulse triggering, TRIAC based phase controllers various configurations for SCR based single and three phase controllers.

UNIT V DRIVE CHARACTERISTICS **9**

Electric drive – Equations governing motor load dynamics – steady state stability – multi quadrant Dynamics: acceleration, deceleration, starting & stopping – typical load torque characteristics – Selection of motor.

TOTAL: 45 PERIODS

LIST OF EXPERIMENTS

1. Characteristics of PN junction diode,
2. Experimental verification of transfer characteristics of AC Phase Controllers.
3. Characteristics of SCR,
4. Simulation of Single Phase Rectifiers.
5. Experimental verification of transfer characteristic of AC to DC half controlled Converter,
6. Experimental verification of transfer characteristic of AC to DC fully controlled Converter,
7. Simulation of Three Phase Rectifiers.
8. Characteristics of MOSFET and IGBT.

TOTAL: 30 PERIODS

COURSE OUTCOMES

On successful completion of this course, the student will be able to

CO1: Explain the operation of semiconductor devices, its dynamic characteristics and

CO2: Design low power SMPS.

CO3: Analyze the various uncontrolled rectifiers and design suitable filter circuits.

CO4: Analyze the operation of the n-pulse converters and evaluate the performance parameters.

CO5: Apply voltage control and harmonic Elimination methods to inverter circuits.

TEXT BOOKS

1. Ned Mohan, T.M.Undeland, W.P.Robbins, "Power Electronics: Converters, applications and design", John Wiley and Sons, 3rd Edition (reprint), 2009
2. Rashid M.H., Power Electronics Circuits, Devices and Applications, Prentice Hall India, 3 rd Edition, New Delhi, 2004.
3. Bimal.K.Bose "Modern Power Electronics and AC Drives", Pearson Education, Second Edition, 2003.

REFERENCE BOOKS

1. Cyril.W.Lander, Power Electronics, McGraw Hill International, Third Edition, 1993.
2. P.S.Bimbhra, Power Electronics, Khanna Publishers, Third Edition 2003.
3. PhilipT.Krein, Elements of Power Electronics, Oxford University Press, 2013.
4. P.C.Sen, Power Electronics, Tata McGraw-Hill, 30th reprint, 2008.
5. Bin Wu, Mehdi Narimani, "High-Power Converters and AC Drives", Wiley, 2nd Edition, 2017.

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Mapping of COs with POs

COs	POs												PSO	
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
CO1	3	2	2	-	2	-	-	2	2	1	-	1	1	1
CO2	3	2	2	1	2	-	-	2	2	1	-	1	1	1
CO3	3	2	2	1	2	1	-	2	2	1	-	1	1	1
CO4	3	2	2	-	2	1	-	2	2	1	-	1	1	1
CO5	3	2	2	-	2	1	-	2	2	1	-	1	1	1
AVG	**3**	**2**	**2**	**1**	**2**	**1**	**-**	**2**	**2**	**1**	**-**	**1**	**1**	**1**

1 - Low, 2 - Medium, 3 – High, '-' No correlation

24OEI103 PLC PROGRAMMING **L T P C**
3 0 2 4

COURSE OBJECTIVES

- To understand the fundamental concepts and architecture of Programmable Logic Controllers (PLCs).
- To identify and analyze the hardware components and interfacing devices used in PLC systems.
- To develop proficiency in PLC programming techniques and logic fundamentals for automation applications**.**

UNIT I PLC BASICS **9**

Programmable Logic Controllers (PLCs): Introduction; definition & history of the PLC; Principles of Operation; Various Parts of a PLC: CPU & programmer/monitors; PLC input & output modules; Solid state memory; the processor; I/O modules; power supplies. PLC advantage & disadvantage; PLC versus Computers, PLC Application.

UNIT II PLC HARDWARE COMPONENTS **9**

The I/O section, Discrete I/O Modules, Analog I/O Modules, Special I/O Modules,I/O specifications, The CPU, Memory design, Memory Types, Programming Devices, Selection of wire types and size.

UNIT III FUNDAMENTALS OF LOGIC **9**

The Binary Concept, AND, OR and NOT functions, Boolean Algebra, Developing circuits from Boolean Expression expressions, Producing the Boolean equation from given circuit, Hardwired logic versus programmed logic, Programming word level logic instructions. Converting Relay schematics and Boolean equation into PLC Ladder Programs,

UNIT IV VARIOUS INPUT /OUTPUT DEVICES AND ITS INTERFACING WITH PLC **9**

Different types of Input devices : Switches: Push button Switches, Toggle Switches, Proximity switches, Photo switches, Temperature Switch, Pressure Switch, and Level Switch, Flow Switches, manually operated switches, Motor starters, Transducers and sensors, Transmitters etc. Their working, specification and interfacing with PLC.

UNIT V BASICS OF PLC PROGRAMMING **9**

Processor Memory Organization, Program Scan, PLC Programming languages, Relay type Instructions, Instruction addressing, Branch Instructions, Internal Relay Instructions, Programming Examine if Closed and examine If Open instructions, Entering the ladder diagram, Modes of operation. Creating Ladder Diagrams from Process Control Descriptions.

TOTAL: 45 PERIODS

LIST OF EXPERIMENTS

1. Introduction to ladder programming& to implement basic logic gates.
2. Develop, Simulate and Test Ladder diagram for Bottle Filling system.
3. Develop, Simulate and Test Ladder diagram for Traffic Light Control System.
4. Develop, Simulate and Test Ladder diagram for Car Parking system.
5. Develop Simulate and Test Ladder diagram for an alarm enunciator system.
6. Develop, Simulate and Test Ladder diagram for Batch Mixer.
7. Develop and test PLC program for three phase motor in both directions.
8. Develop, Simulate and Test Ladder diagram for stepper motor control in forward and reverse direction.

TOTAL: 30 PERIODS

COURSE OUTCOMES

On successful completion of this course, the student will be able to

CO1: Compare conventional sequential control with programmable logic control system

CO2: Develop programs using different PLC programming languages for sequential and continuous process.

CO3: Interface analog and digital input/ output devices with PLC using different communication protocol

CO4: Test the PLC based system and troubleshoot the errors associated with it.

CO5: Develop the fundamentals of logic application.

TEXT BOOKS

1. Frank D. Petruzella, “Programmable Logic Controllers”, 5th Edition, McGraw- Hill, New York,2019.
2. Stuart Boyer A, “SCADA: Supervisory control and data Acquisition”, Fourth Edition, ISA- The Instrumentation, Systems, and Automation Society,2010.
3. Programmable Logic Controllers- Principles and Applications by John W. Webb and Ronald A. Reiss, Fifth Edition, PHI.

REFERENCE BOOKS

1. Bolton. W, “Programmble Logic Controllers”, Elsevier Newnes, 6th Edition 2015.
2. https://nptel.ac.in/courses/108105062.
3. Programmable Logic Controllers- Programming Method and Applications by
4. JR.Hackworth and F.D Hackworth Jr., Pearson, 2004.
5. Embedded Systems- An integrated approach - Lyla b das, Pearson education 2012. Computers as Components –Wayne Wolf, Morgan Kaufmann (second edition).

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Mapping of COs with POs

COs	POs												PSO	
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
CO1	3	2	2	-	2	-	-	2	2	1	-	1	2	1
CO2	3	2	2	1	2	-	-	2	2	1	-	1	1	1
CO3	3	2	2	1	2	1	-	2	2	1	-	1	2	1
CO4	3	2	2	-	2	1	-	2	2	1	-	1	1	1
CO5	3	2	2	-	2	1	-	2	2	1	-	1	2	1
AVG	**3**	**2**	**2**	**1**	**2**	**1**	**-**	**2**	**2**	**1**	**-**	**1**	**1.6**	1

1 - Low, 2 - Medium, 3 – High, '-' No correlation

24OEI104 ELECRONIC DEVICES AND POWER AMPLIFIER **L T P C**
3 0 2 4

COURSE OBJECTIVES

- To introduce the fundamentals of analysis of electronic circuits.
- To provide basic understanding of semiconductor devices and analog integrated circuits.
- To explain the design and implementation of OP-AMP circuits.

UNIT I DIODES **9**

The Ideal Diode - Terminal Characteristics of Junction Diodes - Physical Operation of Diodes - Analysis of Diode Circuits - Small Signal Model and Its Application - Operation in the Reverse Breakdown Region - Zener Diodes.

UNIT II BIPOLAR JUNCTION TRANSISTOR **9**

Operation of the NPN transistor in the Active mode – Transistor Characteristics – Transistor as an Amplifier – Basic single Stage BJT Amplifier Configurations-Transistor as a Switch.

UNIT III FIELD EFFECT TRANISITOR **9**

Structure and Physical operation of Enhancement – Type MOSFET – Current Voltage Characteristics of Enhancement – Type MOSFT- The depletion type MOSFET – MOSFET as an Amplifier.

UNIT IV OUTPUT STAGES AND POWER AMPLIFIERS **9**

Classification of output Stages – Class A Output Stage – Class B Output Stage – Biasing the Class AB Stage – Power BJT Tuned Amplifiers – Push Pull Stages.

UNIT V SIGNAL GENERATOR AND WAVEFORM SHAPING CIRCUITS **9**

Basic Principles of Sinusoidal Oscillator – Op Amp- RC Oscillator Circuits – LC And Crystal Oscillators – Multivibrators – Unregulated Power Supply – Integrated Circuit Timers.

TOTAL: 45 PERIODS

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LIST OF EXPERIMENTS

1. Characteristics of PN junction diode.
2. Characteristics of BJT – CB, CE, CC.
3. Op-Amp based amplifier circuits Inverting and Non-inverting amplifier.
4. Op-Amp based Differential amplifier/Instrumentation amplifier.
5. Design of Adder-subtractor circuits using Op-Amp.
6. Square wave and Tri-angular wave oscillator.
7. Op-Amp based Wien bridge and RC oscillator.
8. 555 – timer IC based astable multi-vibrator.

TOTAL: 30 PERIODS

COURSE OUTCOMES

On successful completion of this course, the student will be able to

CO1: Explain the structure and underlying semiconductor physics concepts.

CO2: Design circuits employing electronic devices.

CO3: Explore the characteristics of OPAMP and its internal components.

CO4: Analyze, design and implement analog electronic circuits involving OP-AMP.

CO5: Analyze, design and implement analog electronic circuits involving timer 555.

TEXT BOOKS

1. David A bell, " Electronic circuits", Oxford University Press, 2011.
2. Ramakant A Gayakwad, " Opamps and Linear Integrated Circuits", IV edition, Pearson Education/PHI, 2009.
3. D. Roy Choudary, S.B. Jain, " Linear Integrated Circuits", Third edition, New Age publishers,2014.

REFERENCE BOOKS

1. Millman and Halkias, "Integrated Electronics", McGraw Hill Publications, 2010.
2. Muhammad H. Rashid, "Linear Integrated Circuits", Cengage Learning, 2014.
3. Donald A Neamen, "Electronic Circuits", McGraw Hill, edition, 2007.
4. Sergio Franco, "Design with Operational Amplifiers and Analog Integrated Circuits", McGraw Hill,
5. Floyd, Buchla, "Fundamentals of Analog Circuits", Pearson, 2013.

Mapping of COs with POs

COs	POs												PSO	
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
CO1	2	1	2	3	3	1	-	-	2	-	-	1	3	2
CO2	2	1	2	3	3	1	-	-	2	-	-	1	3	2
CO3	2	1	2	3	3	1	-	-	2	-	-	1	3	2
CO4	2	1	2	3	3	1	-	-	2	-	-	1	3	2
CO5	2	1	2	3	3	1	-	-	2	-	-	1	3	2
AVG	**2**	**1**	**2**	**3**	**3**	**1**	**-**	**-**	**2**	**-**	**-**	**1**	**3**	**2**

1 - Low, 2 - Medium, 3 – High, '-' No correlation

24OMI101 INTERNAL COMBUSTION ENGINES **L T P C**
3 0 2 4

COURSE OBJECTIVES

- To impart the basic fundamental knowledge on IC engines and its working along with some of the recent trends in IC engine.
- To impart knowledge on cooling and lubrication.
- To study the modern engine technologies.

UNIT I INTRODUCTION IC ENGINES **9**

Introduction, Types of IC engines, Constructional details IC engine, working, principles – 2 & 4 stroke engines, Cycles – Air standard cycles, Fuel air cycles and actual cycles, Actual Indicator diagram for four stroke and two stroke engines, General fuel properties, ignition properties –octane and cetane rating, Materials for engine components.

UNIT II PETROL ENGINES **9**

Working and constructional details of petrol engines, Carburetor – constructional and working, types of carburetors, additional features in modern carburetor, A/F ratio calculation, Petrol Injection - introduction, Ignition – introduction and requirements, Battery and magneto coil ignition system, Electronic ignition system, Stages of combustion in petrol engines, Combustion chambers for petrol engine, formation of knock in petrol engine.

UNIT III DIESEL ENGINES **9**

Working and constructional details of diesel engines, fuel injection – requirements, types of injection systems – inline, distributor pumps, unit injector, Mechanical and pneumatic governors. Fuel injector, Types of injection nozzles, Spray characteristics. Injection timing, Split and multiple injection, Stages of combustion in Diesel engines, direct and indirect combustion chambers for diesel engine, knocking in diesel engine, Introduction on supercharging and turbocharging.

UNIT IV COOLING AND LUBRICATION **9**

Requirements, Types- Air cooling and liquid cooling systems, forced circulation cooling system, pressure and Evaporative cooling systems, properties of coolants for IC engine. Need of lubrication, Lubricants for IC engines - Properties of lubricants, Types of lubrication – Mist, Wet and dry sump lubrication systems.

UNIT V MODERN TECHNOLOGIES IN IC ENGINES **9**

HCCI Engines – construction and working, CRDi injection system, GDI Technology, E - Turbocharger, Variable compression ratio engines, variable valve timing technology, Fuel cell, Hybrid Electric Technology.

TOTAL: 45 PERIODS

LIST OF EXPERIMENTS

1. Valve Timing Diagram of a Four-Stroke Engine.
2. Port Timing Diagram of a Two-Stroke Engine.
3. Actual Pressure-Volume (P–V) Diagrams of Internal Combustion Engines.
4. Performance Test on a Four-Stroke Diesel Engine.
5. Heat Balance Test on a Four-Stroke Diesel Engine.

6. Morse Test on a Multi-Cylinder Petrol Engine.
7. Retardation Test on a Diesel Engine.
8. Viscosity Measurement Using a Redwood Viscometer.

TOTAL: 30 PERIODS

COURSE OUTCOMES

On successful completion of this course, the student will be able to

CO1: Analyze air standard cycles, engine components.

CO2: Understand SI engine fundamentals.

CO3: Express concept of CI engines.

CO4: Understand the purpose of cooling and lubrication.

CO5: Remember the recent trends in IC engines.

TEXT BOOKS

1. Ganesan.V., Internal Combustion Engines, Tata McGraw Hill Publishing Co., New York,1994.
2. Ramalingam. K. K., Internal Combustion Engines, Scitech publications, Chennai, 200352 Internal Combustion Engines.
3. John B.Heywood, "IC Engines fundamentals", 2nd Edition, New York: McGraw-Hill, 2018.

REFERENCE BOOKS

1. Gupta H.N, "Fundamentals of Internal Combustion Engines", 2nd Edition Prentice Hall of India, 2013.
2. R.B. Mathur and R.P. Sharma, Internal Combustion Engines., Dhanpat Rai & Sons 2007.
3. Duffy Smith, Auto Fuel Systems, The Good Heart Willcox Company, Inc., 1987.
4. Rajput. R. K., "Internal Combustion Engines" Laxmi Publications, 2017.
5. Eric Chowenitz, Automobile Electronics, SAE Publications, 1995.

Mapping of COs with POs

COs	POs												PSO	
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CO1	3	2	2	-	-	-	-	-	-	-	-	-	2	2
CO2	3	3	3	-	-	-	-	-	-	-	-	-	2	2
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CO4	3	3	3	-	-	-	-	-	-	-	-	-	3	2
CO5	3	3	3	-	-	-	-	-	-	-	-	-	3	2
AVG	3	2.8	2.8	-	-	-	-	-	-	-	-	-	2.4	2

1-Low,2 -Medium, 3– High, '-' No correlation

24OMI102 TESTING OF ENGINEERING MATERIALS **L T P C**
3 0 2 4

COURSE OBJECTIVES

- To gain and understanding of the response of various metals under the application of stress and temperature.
- To build necessary theoretical back ground of the role of lattice defects in governing both elastic and plastic properties of metals will be discussed.
- Obtain a working knowledge of various hardness testing machines BHN, VHN, RHN.

UNIT I INTRODUCTION **9**

Introduction, Importance of testing Hardness Test: Methods of hardness testing – Brinell, Vickers, Rockwell hardness tests. The Impact Test: Notched bar impact test and its significance, Charpy and Izod Tests, fracture toughness testing - COD and CTOD tests, significance of transition temperature curve.

UNIT II TENSILE TESTING **9**

Engineering stress-strain and True stress-strain curves. Tensile properties, conditions for necking. Stress-Strain diagrams for steel, Aluminum and cast iron.

UNIT III FATIGUE TESTING **9**

Introduction, Stress cycles, S-N Curve, Effect of mean stress, Mechanism of fatigue failure, Effect of stress concentration, size, surface condition and environments on fatigue.

UNIT IV CREEP AND STRESS RUPTURE **9**

Introduction, The creep curve, Stress-rupture test, Structural changes during creep, Mechanism of creep deformation, theories of creep. Fracture at elevated temperature.

UNIT V NON DESTRUCTIVE TESTING **9**

Principle, Operation, Advantages and Limitations of Liquid Penetrant, Magnetic Particle, Radiography and Ultrasonic tests.

TOTAL: 45 PERIODS

LIST OF EXPERIMENTS

1. Tension test on mild steel rod.
2. Torsion test on mild steel rod.
3. Hardness test on metal beam (Rockwell and Brinell Hardness Tests).
4. Compression test on helical spring.
5. Deflection test on carriage spring.
6. Impact Testing on mild steel rod.
7. Deflection of a cantilever wooden and steel beam.
8. Determine the deflection of a simply supported wooden and steel beam

TOTAL: 30 PERIODS

COURSE OUTCOMES

On successful completion of this course, the student will be able to

CO1: Classify mechanical testing of ferrous and non-ferrous metals and alloys.

CO2: Recognize the importance of crystal defects including dislocations in plastic deformation.

CO3: Solve the 2D vector variable problems using Finite Element technique.
CO4: Identify the testing methods for obtaining strength and hardness.
CO5: Examine the mechanisms of materials failure through fatigue and creep.

TEXT BOOKS

1. Mechanical Metallurgy – G. E. Dieter, Third edition, published by New York Mc GrawHill,1986.
2. J. Wulff,".Mechanical behavior", John Wiley & Sons Inc; Trans-ed edition.
3. Baldev Raj, T.Jayakumar, M.Thavasimuthu "Practical Non-Destructive Testing", Narosa Publishing House, 2009.

REFERENCE BOOKS

1. Mechanical Metallurgy – White & Lemay.
2. Testing of Metallic Materials - A.V.K. Suryanarayana
3. Metals Handbook: Mechanical testing, (Volume 8) ASM Handbook Committee, 9th Edition, American Society for Metals, 1978.
4. Brandon D.G., "Modern Techniques in Metallography", Von Nostrand Inc. NJ, USA, 1986.
5. ASM Metals Handbook, "Non-Destructive Evaluation and Quality Control", American Society of Metals, Metals Park, Ohio, USA.

Mapping of COs with POs

COs	POs												PSO	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	3	3	-	2	-	-	-	-	-	-	-	-	2	1
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CO3	3	3	-	2	-	-	-	-	-	-	-	-	2	1
CO4	3	3	-	2	-	-	-	-	-	-	-	-	2	1
CO5	3	3	-	2	-	-	-	-	-	-	-	-	2	1
AVG	3	3	-	2	-	-	-	-	-	-	-	-	2	1

1-Low, 2-Medium, 3-High, '-'- No correlation

24OMI103 INDUSTRIAL LAYOUT DESIGN AND SAFETY **L T P C**
3 0 2 4

COURSE OBJECTIVES

- To introduce the industrial layout design principles, process and material flow analysis and product and equipment analysis.
- To impart knowledge layout design and algorithms.
- To study the safety planning and management.

UNIT I INTRODUCTION **9**

Industrial Facility Layout: Definition, Types of Layout Problems, Engineering Design Problem Approach – Product Analysis, Equipment Selection, Personnel Requirement Analysis, Space Requirement and Availability – Process and Material Flow Analysis, Data Requirement for Layout Decisions, Tools for Presenting Layout Designs.

UNIT II FACILITIES LAYOUT DESIGN & ALGORITHMS 9

Traditional Approaches to Facility Layout, Systematic Layout Planning, Special Considerations in Office Layout, Engineering Design Problem Approach, Code Compliance, OSHA, ADA Regulations, and Other Considerations in Facility Design – Algorithms for the Layout Problem, Construction Algorithms, Improvement Algorithms, Hybrid Algorithms, Layout Software (CRAFT, BLOCPLAN, PFAST, Layout-iQ, VIP- PLANOPT, Factory CAD, Factory FLOW, Plant Simulation).

UNIT III FACILITIES LAYOUT PROBLEM MODELS & ALGORITHMS 9

Models for the Layout Problem, Generic Modeling Tools, Models for the Single-Row Layout Problem, Models for the Multi row Layout Problem with Departments of Equal and Unequal Area – Material Handling, Principles, Types, Models for Material- Handling System Design – Storage and Warehousing, Warehouse Functions, Warehouse Design and Operation.

UNIT IV SAFETY PLANNING & MANAGEMENT 9

Introduction: Elements of Safety Programming, Safety Management. Upgrading Safety Developmental Programs: Safety Procedures, Arrangements and Performance Measures, Education, Training and Development in Safety. Safety Performance: An Overview of an Accident, Occupational Health and Industrial Hygiene. Understanding the Risks: Prevention of Accidents Involving Hazardous Substances. Indian Factories Act 1948 for Health and Safety.

UNIT V APPROACHES IN SAFETY MANAGEMENT 9

Safeguarding against Common Potential Hazards: Trips, Slips and Falls, Preventing Electrocution, Static Electricity, Hazardous Energy Control. Specific Hazard Control Measures: Forklift Hazard Control, Tractor Hazard Control. Safe Handling and Storage: Material Handling, Compressed Gas Cylinders, Corrosive Substances, Hydrocarbons, Waste Drums and Containers.

TOTAL: 45 PERIODS

LIST OF EXPERIMENTS

1. Simulation of Manufacturing Shop
2. Simulation of Batch Production System
3. Simulation of Multi Machine Assignment System
4. Simulation of Manufacturing and Material Handling Systems
5. Simulation of a Shop Floor
6. Simulation of Material Handling Systems
7. Write an algorithm for plant layout
8. Write an algorithm for storage and warehouse.

TOTAL: 30 PERIODS

COURSE OUTCOMES

On successful completion of this course, the student will be able to

CO1: Explain the industrial facility layout design principles, process and material flow analysis and product and equipment analysis.

CO2: Discuss the facilities layout design algorithms and selecting appropriate software.

CO3: Describe the facilities layout problem modeling tools and algorithms for production, warehouse and material handling.
CO4: Explain the safety planning and management principles in industries.
CO5: Illustrate the various safety management approaches in industries.

TEXT BOOKS

1. Sunderesh S. Heragu, "Facilities Design", 3rd Edition, CRC Press Taylor & Francis Group, 2008.
2. L. M. Deshmukh, "Industrial Safety Management: Hazard Identification and Risk Control", Tata McGraw-Hill Publishing Co. Ltd., 2005.
3. Eric Teicholz, "Facility Design and Management Handbook", Tata McGraw-Hill Publishing Co. Ltd., 2001.

REFERENCE BOOKS

1. James A. Tompkins, John A. White, Yavuz A. Bozer, and J. M. A. Tanchoco, "Facilities Planning", 4th Edition, John Wiley & Sons, 2010.
2. Matthew P. Stevens and Fred E. Meyers, "Manufacturing Facilities Design and Material Handling", 5th Edition, Purdue University Press, 2013.
3. Charles D.Reese, Occupational Health and Safety Management: A Practical Approach, CRC Press, 2003.
4. J Maiti, Pradip Kumar Ray, Industrial Safety Management: 21st Century Perspectives of Asia, 2017.
5. Industrial Hazard and Safety Handbook: (Revised impressionby Ralph W King and John Magid, 2013.

Mapping of COs with POs

COs	POs												PSO	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	2	1	-	-	-	-	-	-	-	-	-	-	1	1
CO2	2	2	-	-	-	-	-	-	-	-	-	-	1	1
CO3	3	3	2	-	-	-	-	-	-	-	-	-	1	1
CO4	3	3	3	2	-	-	-	-	-	-	-	-	1	0
CO5	3	3	3	2	-	-	-	-	-	-	-	-	1	0
AVG	2.6	2.4	2.67	2	-	-	-	-	-	-	-	-	1	1

1-Low, 2-Medium, 3-High, '-'- No correlation

24OMI104 PRODUCT DESIGN AND PROCESS DEVELOPMENT **L T P C**
3 0 2 4

COURSE OBJECTIVES

- Applying the principles of generic development process; and understanding the organization structure for new product design and development.
- Identifying opportunity and planning for new product design and development.
- Conducting customer need analysis; and setting product specification for new product design and development.

UNIT I INTRODUCTION **9**

Introduction – Characteristics of Successful Product Development – People involved in Product Design and Development - Duration and Cost of Product Development - The Challenges of Product Development - The Product Development Process - Concept Development: The Front- End Process - Adapting the Generic Product Development Process - Product Development Process Flows - Product Development Organizations.

UNIT II OPPORTUNITY DENTIFICATION & PRODUCT PLANNING **9**

Opportunity Identification: Definition - Types of Opportunities - Tournament Structure of Opportunity Identification - Effective Opportunity Tournaments – Opportunity densification Process - Product Planning: Four Types of Product Development Projects – The Process of Product Planning.

UNIT III IDENTIFYING CUSTOMER NEEDS & PRODUCT SPECIFICATIONS **9**

Identifying Customer Needs: The Importance of Latent Needs - The Process of Identifying Customer Needs. Product Specifications: Definition - Time of Specifications Establishment - Establishing Target Specifications - Setting the Final Specifications.

UNIT IV CONCEPT GENERATION & SELECTION **9**

Concept Generation: Activity of Concept Generation - Structured Approach - Five step method of Concept Generation. Concept Selection: Methodology - Concept Screening and Concepts Scoring.

UNIT V CONCEPT TESTING & PROTOTYPING **9**

Concept Testing: Seven Step activities of concept testing. Prototyping – Principles of Prototyping – Prototyping Technologies – Planning for Prototypes

TOTAL: 45 PERIODS

LIST OF EXPERIMENTS

1. Identifying the customer needs for a selected product.
2. Plan for the Design Process.
3. Develop Engineering Specification.
4. Generate a concept for a product.
5. Develop a clay model for a new product.
6. Perform a design calculation.
7. Fabricate a prototype model of the new product as per the design.
8. Perform economic analysis for the new product.

TOTAL: 30 PERIODS

COURSE OUTCOMES

On successful completion of this course, the student will be able to

CO1: Apply the principles of generic development process; and understand the organization structure for new p1roduct design and development.

CO2: Identify opportunity and plan for new product design and development.

CO3: Conduct customer need analysis; and set product specification for new product design and development.

CO4: Generate, select, and screen the concepts for new product design and development.

CO5: Test and prototype the concepts to design and develop new products.

TEXT BOOKS

1. Ulrich K.T., Eppinger S. D. and Anita Goyal, "Product Design and Development" McGraw-Hill Education; 7th edition, 2020.
2. Fabio Giudice, Guido La Rosa, Product Design for the environment-A life cycle approach, Taylor & Francis 2006
3. Saaksvuori Antti, ImmonenAnselmie, product Life Cycle Management Springer, Dreamtech, 3-540-25731-4.

REFERENCE BOOKS

1. Belz A., 36-Hour Course: "Product Development" McGraw-Hill, 2010.
2. Rosenthal S., "Effective Product Design and Development", Business One Orwin, Home Wood, 1992, ISBN 1-55623-603-4.
3. Stuart Pugh., "Total Design –Integrated Methods for Successful Product Engineering" Addison Wesley Publishing, 1991, ISBN 0-202-41639-5.
4. Chitale, A. K. and Gupta, R. C., Product Design and Manufacturing, PHI Learning, 2013.
5. Jamnia, A., Introduction to Product Design and Development for Engineers, CRC Press 2018.

Mapping of COs with POs

COs	POs												PSO	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	3	2	2	-	-	-	-	-	-	-	-	-	2	1
CO2	2	-	2	-	-	-	-	-	-	-	-	-	2	1
CO3	-	-	2	-	-	-	-	-	-	-	-	-	2	1
CO4	2	2	2	-	-	-	-	-	-	-	-	-	2	1
CO5	-	-	2	-	-	-	-	-	-	-	-	-	2	1
AVG	2.33	2	2	-	-	-	-	-	-	-	-	-	2	1

1-Low, 2 -Medium, 3– High, '-' No correlation

24OBI101 DIGITAL SIGNAL PROCESSING **L T P C**

3 0 2 4

COURSE OBJECTIVES

- To introduce the concepts of discrete time random signal processing.
- To introduce about multirate signal processing and its applications.
- To understand the spectrum estimation techniques.

UNIT I MULTIRATE SIGNAL PROCESSING **9**

Review of Convolution, DFT and ZT, Multirate Signal Processing - Decimation, Interpolation, Sampling Rate Conversion by a rational factor – digital filter banks, sub band coding, Quadrature Mirror Filter.

UNIT II DISCRETE TIME RANDOM PROCESSES **9**

Stationary random processes, Autocorrelation, Rational Power Spectra, Filters for generating random Processes from white noise and inverse filter – AR, MA and ARMA processes – relationship between autocorrelation and the filter parameters.

UNIT III LINEAR PREDICTION AND FILTERING **9**

Linear Prediction – Forward and Backward - Wiener filters for filtering and prediction – FIR Wiener Filter – IIR Wiener Filter – Kalman Filter.

UNIT IV ADAPTIVE FILTERING **9**

FIR adaptive filters – adaptive filters based on steepest descent method – LMS algorithm – Variants of LMS algorithm – adaptive echo cancellation – adaptive channel equalization – RLS Algorithm.

UNIT V SPECTRUM ESTIMATION **9**

Estimation of power spectra from finite duration observations of signals – Non parametric methods of spectrum estimation – the Bartlett and the Welch method – Parametric spectrum estimation – AR MA and ARMA.

TOTAL:45 PERIODS

LIST OF EXPERIMENTS

1. Study of autocorrelation and Cross Correlation of random signals.
2. Design and Implementation of Multirate Systems.
3. Design and Implementation of Wiener Filter.
4. Design and Implementation of FIR Linear Predictor.
5. Design of adaptive filters using LMS algorithm.
6. Spectrum Estimation using Bartlett and Welch Methods.
7. Design and Implementation of IIR .
8. Design of adaptive filters using RLS algorithm.

TOTAL:30 PERIODS

COURSE OUTCOMES

On successful completion of this course, the students will be able to

CO1: Comprehend multirate signal processing and demonstrate its applications.

CO2: Demonstrate an understanding of the power spectral density and apply to discrete random signals and systems.

CO3: Apply linear prediction and filtering techniques to discrete random signals for signal detection and estimation.

CO4: Analyze adaptive filtering problems and demonstrate its application.

CO5: Apply power spectrum estimation techniques to random signals.

TEXT BOOKS

1. John G. Proakis & Dimitris G.Manolakis, —Digital Signal Processing – Principles, Algorithms & Applications, Fourth Edition, Pearson Education / Prentice Hall, 2007.
2. P. Vaidyanathan, "Multirate systems and filter banks", Prentice Hall Inc. 1993.

3. A. V. Oppenheim, R.W. Schafer and J.R. Buck, —Discrete-Time Signal Processing", 8th Indian Reprint, Pearson, 2004.

REFERENCE BOOKS

1. Monson H. Hayes, "Statistical digital signal processing and modeling", John Wiley and Sons Inc. New York, Indian reprint 2008.
2. Haykin, Adaptive Filter Theory, 4th Edition, Pearson Education, New Delhi, 2006.
3. Sophoncles J. Orfanidis, "Optimum Signal Processing ", McGraw Hill, 2000.
4. Emmanuel C. Ifeachor& Barrie. W. Jervis, "Digital Signal Processing", Second Edition, Pearson Education / Prentice Hall, 2002.
5. Sanjit K. Mitra, "Digital Signal Processing – A Computer Based Approach", Tata Mc Graw Hill, 2007.

Mapping of COs with POs

COs	POs												PSO	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	2	3	-	-	-	-	-	-	-	-	-	-	2	1
CO2	2	3	-	-	-	-	-	-	-	-	-	-	2	1
CO3	2	3	-	-	-	-	-	-	-	-	-	-	2	1
CO4	2	3	-	-	-	-	-	-	-	-	-	-	2	1
CO5	2	3	-	-	-	-	-	-	-	-	-	-	1	1
AVG	**2**	**3**	-	-	-	-	-	-	-	-	-	-	**2**	**1**

1-Low, 2-Medium, 3-High, '-'- No correlation

24OBI102 IOT AND SENSORS TYPES **L T P C**

3 0 2 4

COURSE OBJECTIVES

- To understand the fundamental concepts related to IoT and sensors types.
- To understand basics of an IOT System, IoT hardware and communication protocols, data storage, data analysis and use them for real time IoT enabled domains.
- To become familiar with sensor types and its functions.

UNIT I INTRODUCTION TO IOT AND IOT LEVELS **9**

Functional blocks of an IoT system (Sensors, Data Ingress, Data Aggregation Point Communication point back to the cloud, Analysis, Decision making, Actuation) Basic of Physical and logical design of IoT (IoT protocols, communication models) IoT enabled domains (Home automation, Smart cities, environment monitoring, renewable energy, agriculture, industry, healthcare, marketing and management) M2M, Difference between IoT, Embedded Systems and M2M, Industry 4.0 concepts.

UNIT II IOT SENSORS AND HARDWARE **9**

Passive and active sensors, differences, Different kinds of sensors (Temperature, humidity, pressure, obstacle, water flow, accelerometer, colour, gyro, load cell, finger print, motion, ultrasonic distance, magnetic vibration, eye blink, hear beat, PPG, glucose, body position, blood pressure), Multi-sensors, Pre-processing (sampling, filtering, ADC, size of data, local

memory, compression), IoT front end hardware (Raspberry Pi, Arduino, Galileo, beagle bone equivalent platforms).

UNIT III INTRODUCTION TO IOT PROTOCOLS 9

Infrastructure (6LowPAN, IPv4/IPv6, RPL), Identification (EPC, uCode, IPv6, URIs), Communication/ Transport (Wi-Fi, Bluetooth, ZigBee, LPWAN), Data Protocols (MQTT, CoAP, AMQP, Websocket, Node).

UNIT IV IOT CLOUD AND DATA ANALYTICS 9

Collecting data from sensors, Data Ingress, Cloud storage, IoT cloud platforms (Amazon AWS, Microsoft Azure, Google APIs), Data analytics for IoT, Software and management tool for IoT, Dashboard design.

UNIT V IOT ARCHITECTURES WITH CASE STUDIES 9

Business models for IoT, smart cities, agriculture, healthcare, industry. Case studies/Mini projectsfor the real time IoT applications.

TOTAL:45 PERIODS

LIST OF EXPERIMENTS

1. Introduction to Arduino platform and programming.
2. Explore different communication methods with IoT devices (Zigbee, GSM, Bluetooth)
3. Introduction to Raspberry PI platform and python programming.
4. Interfacing sensors with Raspberry PI.
5. Communicate between Arduino and Raspberry PI using any wireless medium.
6. Setup a cloud platform to log the data.
7. Log Data using Raspberry PI and upload to the cloud platform.
8. Design an IOT based system.

TOTAL:30 PERIODS

COURSE OUTCOMES

On successful completion of this course, the students will be able to

CO1: Enumerate basic premise of an IOT System.
CO2: Implement basic and to be familiar with the sensors available for IoT applications.
CO3: Learn the front-end hardware platforms and communication protocols for IoT.
CO4: Explore the cloud storage, data analysis and management.
CO5: Design and develop the usage for real time IoT enabled domains.

TEXT BOOKS

1. Arshdeep Bahga, Vijay Madisetti, “Internet of Things – A hands-on approach”, Universities Press, 2015.
2. Mayur Ramgir, Internet – of – Things, Architecture, Implementation and Security, First Edition, Pearson Education, 2020.
3. Robert Barton, Patrick Grossetete, David Hanes, Jerome Henry, Gonzalo Salgueiro, “IoT Fundamentals: Networking Technologies, Protocols, and Use Cases for the Internet of Things”, CISCO Press, 2017.

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REFERENCE BOOKS

1. Raj kamal, Internet of Things, Architecture and Design Principles, McGraw-Hill, 2017.
2. Manoel Carlos Ramon, "Intel® Galileo and Intel® Galileo Gen 2: API Features and Arduino Projects for Linux Programmers", Apress, 2014.H.Gerez, "Algorithms for VLSI Design Automation", John Wiley, 1999.
3. Marco Schwartz, "Internet of Things with the Arduino Yun", Packt Publishing, 2014.
4. Perry Lea, "Internet of things for architects", Packt, 2018.
5. Olivier Hersent, David Boswarthick, Omar Elloumi, "The Internet of Things – Key applications and Protocols", Wiley, 2012.

Mapping of COs with POs

COs	POs												PSO	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	3	3	3	-	-	-	-	-	-	-	-	-	2	1
CO2	3	3	3	-	-	-	-	-	-	-	-	-	2	1
CO3	3	3	3	-	-	-	-	-	-	-	-	-	2	1
CO4	3	3	3	-	-	-	-	-	-	-	-	-	3	1
CO5	3	3	3	-	-	-	-	-	-	-	-	-	3	1
AVG	**3**	**3**	**3**	-	-	-	-	-	-	-	-	-	2.4	1

1-Low, 2-Medium, 3-High, '-'- No correlation

24OBI103 MEDICAL DIAGNOSTIC AND THERAPEUTIC EQUIPMENTS L T P C

3 0 2 4

COURSE OBJECTIVES

- To understand the working of the devices for measurement of parameters related to ECG, EEG and EMG.
- To explain diagnostic and therapeutic devices related to respiratory parameters.
- To understand the various sensory measurements that hold clinical importance.

UNIT I CARDIAC EQUIPMENT **9**

Electrocardiograph, Normal and Abnormal Waves, Heart rate monitor- Holter Monitor, Phonocardiography, Cardiac Pacemaker-Internal and External Pacemaker, AC and DC Defibrillator- Internal and External.

UNIT II NEUROLOGICALEQUIPMENT **9**

Clinical significance of EEG, Multi-channel EEG recording system, Evoked Potential– Visual, Auditory and Somatosensory, MEG (Magneto Encephalo Graph), EEG Bio Feedback Instrumentation.

UNIT III MUSCULAR AND BIOMECHANICAL EQUIPMENT **9**

Clinical significance of EEG, Multi-channel EEG recording system, Evoked Potential– Visual, Auditory and Somatosensory, MEG (Magneto Encephalo Graph), EEG Bio Feedback Instrumentation.

UNIT IV RESPIRATORY MEASUREMENT AND ASSIST SYSTEM 9

Instrumentation for measuring the mechanics of breathing – Spiro meter, Lung Volume and vital capacity, measurements of residual volume, Pneumotacho meter, Whole body Plethysmo graph, Apnoea Monitor.

UNIT V SENSORY DIAGNOSTIC EQUIPMENT 9

Psycho physiological Measurements – polygraph, basal skin resistance (BSR), galvanic skin resistance (GSR), Sensory responses - Audiometer-Pure tone, Speech, Eye Tonometer, auto refractometer.

TOTAL: 45 PERIODS

LIST OF EXPERIMENTS

1. Measurement of visually and auditory evoked potential.
2. Galvanic skin resistance (GSR) measurement.
3. Measurement of output intensity from short wave and ultra sonic diathermy.
4. Electrical safety measurements.
5. Measurement of stimulation current wave forms used in medical stimulator.
6. Recording of Audiogram.
7. Study the working of Defibrillator and pacemakers.
8. Study of ECG, EEG and EMG electrodes.

TOTAL:30 PERIODS

COURSE OUTCOMES

On successful completion of this course, the students will be able to

CO1: Describe the working and recording setup of all basic cardiac equipment.
CO2: Utilize the working and recording of all basic neurological equipment's.
CO3: Discuss the recording of diagnostic and therapeutic equipment's related to EMG.
CO4: Explain about measurements of parameters related to respiratory system.
CO5: Describe the measurement techniques of sensory responses.

TEXT BOOKS

1. John G.Webster," Medical Instrumentation Application and Design",4th edition, Wiley India Pvt Ltd, New Delhi, 2015.
2. Joseph J. Carrand John M. Brown," Introduction to Biomedical Equipment Technology", Pearson education, 2012.
3. Khandpur. R.S., "Handbook of Biomedical Instrumentation". Second Edition. Tata Mc-Graw Hill Pub. Co., Ltd. 2003.

REFERENCE BOOKS

1. L.A Geddes and L.E.Baker, "Principles of Applied Biomedical Instrumentation", 3rd Edition, 2008.
2. Khandpur. R.S., "Handbook of Biomedical Instrumentation". Second Edition. Tata Mc Graw Hill Pub. Co., Ltd. 2003.
3. Antony Y. K. Chan, "Biomedical Device Technology, Principles and design", Charles Thomas Publisher Ltd, Illinois, USA, 2008.

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4. Leslie Cromwell, "Biomedical Instrumentation and Measurement", Pearson Education, New Delhi, 2007.
5. Shakti Chatterjee, Aubert Miller, "Bio medical Instrumentation Systems" 2010 1st edition, Delmar Cencage Learning, Clifton Park, New York.

Mapping of COs with POs

COs	POs												PSO	
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
CO1	3	2	1	-	1	-	-	-	-	-	-	1	3	2
CO2	3	2	1	-	1	-	-	-	-	-	-	1	3	2
CO3	3	2	1	-	1	-	-	-	-	-	-	1	3	2
CO4	3	2	1	-	1	-	-	-	-	-	-	1	3	2
CO5	3	2	1	-	1	-	-	-	-	-	-	1	3	2
AVG	**3**	**2**	**1**	**-**	**1**	**-**	**-**	**-**	**-**	**-**	**-**	**1**	**3**	**2**

1-Low, 2-Medium, 3-High, '-'- No correlation

24OBI104 BIOMEDICAL INSTRUMENT AND DESIGN **L T P C**
3 0 2 4

COURSE OBJECTIVES

- To understand the origin of various biological signals and electrode configurations specific to bio-potential measurements.
- To understand the characteristics of Bio signals and the design of bio amplifiers.
- To explain the different techniques used for measurement of non-electrical bio-parameters.

UNIT I ELECTRODE CONFIGURATIONS **9**

Bio signals characteristics – Origin of bio potential and its propagation, Frequency and amplitude ranges, Electrode configurations: Electrode-electrolyte interface, electrode–skin interface impedance, Unipolar and bipolar configuration, classification of electrodes.

UNIT II BIO SIGNAL CHARACTERISTICS **9**

Bio signals characteristics – ECG-frequency and amplitude ranges, Einthoven's triangle, standard 12 lead system. EEG – 10-20 electrode system, unipolar, bipolar and average mode. EMG– unipolar and bipolar mode. EMG - Electrode configuration -unipolar and bipolar mode.

UNIT III BIO AMPLIFIERS **9**

Infrastructure (6LowPAN, IPv4/IPv6, RPL), Identification (EPC, uCode, IPv6, URIs), Communication/ Transport (Wi-Fi, Bluetooth, ZigBee, LPWAN), Data Protocols (MQTT, CoAP, AMQP, Websocket, Node).

UNIT IV MEASUREMENT OF BIO SIGNALS **9**

Temperature, respiration rate and pulse rate measurements. Blood Pressure - indirect methods and direct methods, Blood flow and cardiac output measurement- Indicator dilution and thermal dilution, Electromagnetic and ultrasound blood flow measurements.

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UNIT V BIO CHEMICAL MEASUREMENTS **9**

Biochemical sensors - pH, pO2 and pCO2, Blood gas analyzers, colorimeter, flame photometer, spectrophotometer, blood cell counter, auto analyzer.

TOTAL:45 PERIODS

LIST OF EXPERIMENTS

1. Design of ECG Amplifiers.
2. Design of EMG amplifier.
3. Design of frontal EEG amplifier.
4. Design a Multiplexer and Demultiplexer for any two bio signals.
5. Measurement of body Temperature.
6. Measurement of pulse-rate using Photo transducer.
7. Measurement of pH and conductivity.
8. Measurement of blood pressure using sphygmomanometer.

TOTAL:30 PERIODS

COURSE OUTCOMES

On successful completion of this course, the students will be able to

CO1: Illustrate the origin of various biological signals and their characteristics.

CO2: Gain knowledge on characteristics of bio signals.

CO3: Gain knowledge on various amplifiers involved in monitoring and transmission of bio signals.

CO4: Explain the different measurement techniques for non-electrical bio-parameters.

CO5: Explain the biochemical measurement techniques as applicable for diagnosis and further treatment.

TEXT BOOKS

1. Leslie Cromwell," Biomedical Instrumentation and measurement", 2nd edition, prentice hall of India, New Delhi, 2015.
2. John G.Webster, "Medical Instrumentation Application and Design", 4th edition, Wiley India Pvt Ltd, New Delhi, 2015.
3. Khandpur R. S, "Handbook of Biomedical Instrumentation", Tata Mc Graw Hill, New Delhi, 2003.

REFERENCE BOOKS

1. John Enderle, Susan Blanchard,Joseph Bronzino, "Introduction to Biomedical Engineering", second edition, Academic Press,2005.
2. Joseph J. Carrand John M.Brown, "Introduction to Biomedical Equipment Technology", Pearson Education, 2004.
3. L. A. Geddas and L. E. Baker, "Principles of Applied Biomedical Instrumentation",2004.
4. John G. Webster, "Bioinstrumentation", John Willey and sons, New York, 2004.
5. Myer Kutz, "Standard Handbook of Biomedical Engineering & Design", McGraw-Hill Publisher, 2003.

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Mapping of COs with POs

COs	POs												PSO	
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
CO1	3	2	1	1	-	-	-	-	-	-	-	-	2	1
CO2	3	2	1	1	-	-	-	-	-	-	-	-	2	1
CO3	3	2	1	1	-	-	-	-	-	-	-	-	2	1
CO4	3	2	1	2	-	-	-	-	-	-	1	-	2	1
CO5	3	2	1	1	-	-	-	-	-	-	1	-	2	1
AVG	**3**	**2**	**1**	**1.2**	**-**	**-**	**-**	**-**	**-**	**-**	**0.4**	**-**	**2**	**1**

Low, 2-Medium, 3-High, '-'- No correlation

24OCT201 BUILDING PLANNING AND APPROVAL **L T P C**

3 0 0 3

COURSE OBJECTIVES

- To understand the principles of building planning, including utility, economy, aesthetics, and circulation.
- To learn the process of site selection, building orientation, and compliance with legal building regulations.
- To explore sustainable building concepts and smart technologies integrated into modern planning practices.

UNIT I FUNDAMENTALS OF BUILDING PLANNING **9**

Covers basic principles of building planning such as utility, economy, aesthetics, and circulation. Introduces types of buildings, their classification, and key components like walls, doors, windows, and stairs.

UNIT II SITE SELECTION AND ORIENTATION **9**

Explains factors affecting site selection including topography, soil, climate, and access. Emphasizes proper building orientation based on sun path, wind direction, and site features for energy efficiency and comfort.

UNIT III BUILDING RULES AND DEVELOPMENT CONTROL **9**

Introduces building byelaws and development regulations including FAR, setbacks, height limits, and open spaces. Discusses provisions of the National Building Code (NBC) and local municipal norms.

UNIT IV BUILDING APPROVAL PROCESS AND DOCUMENTATION **9**

Covers the step-by-step procedure for obtaining building permissions. Includes preparation of site plans, working drawings, and required documents. Introduces online approval systems and key authorities.

UNIT V SUSTAINABLE AND SMART BUILDING CONCEPTS **9**

Highlights eco-friendly planning and green building features. Discusses energy-efficient design, rainwater harvesting, and green certifications (GRIHA, IGBC, LEED). Introduces smart building technologies.

TOTAL:45 PERIODS

COURSE OUTCOMES

On Successful completion of this course, the student will able to

CO1: Use planning principles to design practical buildings.

CO2: Follow building rules and codes.

CO3: Choose the right site for building.

CO4: Prepare the required documents for approval.

CO5: Apply green and smart technologies in building designs.

TEXT BOOKS

1. Bindra, S. P., & Arora, S. P. Building construction: Planning techniques and methods. Dhanpat Rai Publishing Company, 2013.
2. Shah, M. G., Kale, C. M., & Patki, S. Y. Building drawing. Tata McGraw-Hill Education, 2010.
3. Bureau of Indian Standards. National building code of India (NBC). Bureau of Indian Standards, 2016.

REFERENCE BOOKS

1. Varghese, P. C. Building construction. PHI Learning Pvt. Ltd,2007 Rai Publications, 2013.
2. Rangwala, S. C. Building construction. Charotar Publishing House, 2014.
3. Gopi, S. Building drawing and detailing. Pearson Education, 2010.
4. Ching, F. D. K. Architecture: Form, space, and order. Wiley,2015.
5. Birdie, G. S., & Birdie, J. S. Building design and drawing. Dhanpat Rai Publishing Company, 2004.

Mapping of COs with POs

COs	POs												PSO	
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
CO1	2	-	3	2	-	2	3	3	-	3	3	3	3	1
CO2	2	-	3	2	-	2	3	3	-	3	3	3	3	1
CO3	2	-	3	2	-	2	3	3	-	3	3	3	3	1
CO4	2	-	3	2	-	2	3	3	-	3	3	3	3	1
CO5	2	-	3	2	-	2	3	3	-	3	3	3	3	1
AVG	**2**	**-**	**3**	**2**	**-**	**2**	**3**	**3**	**-**	**3**	**3**	**3**	**3**	**1**

1-Low, 2-Medium, 3-High, "-" – No correlation

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24OCT202 ENERGY EFFICIENT BUILDING **L T P C**
3 0 0 3

COURSE OBJECTIVES

- To understand climate-responsive design principles and their impact on building performance.
- To learn passive strategies for heating, cooling, ventilation, and daylighting in buildings.
- To apply energy-efficient design techniques for different climatic zones using relevant tools and case studies.

UNIT I INTRODUCTION **9**

Climate adapted and climate rejecting buildings – Heat Transfer – Measuring Conduction – Thermal Storage – Measurement of Radiation – The Greenhouse Effect – Convection – Measuring latent and sensible heat – Psychrometry Chart – Thermal Comfort – Microclimate, Site Planning and Development – Temperature – Humidity – Wind – Optimum Site Locations – Sun Path Diagrams – Sun Protection – Types of Shading Devices – Design responses to energy conservation strategies.

UNIT II PASSIVE SOLAR HEATING AND COOLING **9**

General Principles of passive Solar Heating – Key Design Elements – Sunspace – Direct gain – Trombe Walls, Water Walls – Convective Air loops – Concepts – Case Studies – General Principles of Passive Cooling – Ventilation – Principles – Case studies – Courtyards – Roof Ponds– Cool Pools – Predicting ventilation in buildings – Window Ventilation Calculations – Room Organization Strategies for Cross and Stack Ventilation – Radiation – Evaporation and dehumidification – Wind Catchers – Mass Effect – Zoning – Load Control – Air Filtration and odor removal.

UNIT III DAYLIGHTING AND ELECTRICAL LIGHTING **9**

Materials, components and details – Insulation – Optical materials – Radiant Barriers – Glazing materials – Glazing Spectral Response – Day lighting – Sources and concepts –Building Design Strategies – Case Studies – Daylight apertures – Light Shelves – Codal requirements – Day lighting design – Electric Lighting – Light Distribution – Electric Lighting control for day lighted buildings – Switching controls – Coefficient of utilization – Electric Task Lighting – Electric Light Zones – Power Adjustment Factors.

UNIT IV HEAT CONTROL AND VENTILATION **9**

Hourly Solar radiation – Heat insulation – Terminology – Requirements – Heat transmission through building sections – Thermal performance of Building sections – Orientation of buildings – Building characteristics for various climates – Thermal Design of buildings – Influence of Design Parameters – Mechanical controls – Examples. Ventilation – Requirements – Minimum standards for ventilation – Ventilation Design – Energy Conservation in Ventilating systems – Design for Natural Ventilation – Calculation of probable indoor wind speed.

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UNIT V DESIGN FOR CLIMATIC ZONES **9**

Energy efficiency – An Overview of Design Concepts and Architectural Interventions – Embodied Energy – Low Embodied Energy Materials – Passive Downdraft Evaporative Cooling – Design of Energy Efficient Buildings for Various Zones – Cold and cloudy – Cold and sunny – Composite – Hot and dry – Moderate – Warm and humid – Case studies of residences, office buildings and other buildings in each zones – Commonly used software packages in energy efficient building analysis and design - Energy Audit – Certification.

TOTAL: 45 PERIODS

COURSE OUTCOMES

On successful completion of this course, the student will be able to

CO1: Analze heat transfer, thermal comfort, and site-specific microclimate factors.

CO2: Apply passive heating and cooling strategies, including solar design elements and natural ventilation techniques.

CO3: Design effective daylighting systems using optical materials and integrate electrical lighting controls for energy efficiency.

CO4: Evaluate thermal performance and ventilation requirements for various building orientations and climate types.

CO5: Develop energy-efficient design solutions for diverse climatic zones using case studies, tools, and energy audit methods.

TEXT BOOKS

1. Jagadish, K.S., Venkatarama Reddy, B.V., Alternative Building Materials and Technologies, New Age International, 2005.
2. Majumdar, M (Ed), Energy - Efficient Buildings in India, Tata Energy Research Institute, Ministry of Non-Conventional Energy Sources, 2009.
3. Residential Energy: Cost Savings and Comfort for Existing Buildings by John Krigger and Chris Dorsi, Published by Saturn Resource Management, 2013.

REFERENCE BOOKS

1. Energy Conservation Building Code, cau of Energy Efficiency, New Delhi, 2018.
2. Handbook on Functional Requirements of Buildings Part 1 to 4 SP: 41 1995.
3. Brown, G.Z. and DeKay, M., Sun, Wind and Light - Architectural Design Strategies, John Wiley and Sons Inc,3rd Edition, 2014.
4. Marian Keeler and Prasad Vaidya, Fundamentals of Integrated Design for Sustainable Building, John Wiley & Sons, 2016.
5. Sustainable Building Design Manual. Vol 1 and 2, Teri, New Delhi, 2004.

Mapping of COs with POs

COs	POs												PSO	
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
CO1	2	-	2	2	-	2	3	3	-	-	3	3	2	1
CO2	2	-	2	2	-	2	3	3	-	-	3	3	2	1
CO3	2	-	2	2	-	2	3	3	-	-	3	3	2	1
CO4	2	-	2	2	-	2	3	3	-	-	3	3	2	1
CO5	2	-	2	2	-	2	3	3	-	-	3	3	2	1
AVG	**2**	**-**	**2**	**2**	**-**	**2**	**3**	**3**	**-**	**-**	**3**	**3**	**2**	**1**

1-Low, 2-Medium, 3-High, "-" – No correlation

24OCT203 ENVIRONMENTAL IMPACT ASSESSMENT **L T P C**
3 0 0 3

COURSE OBJECTIVES

- To expose the students to the need, methodology, documentation and usefulness of environmental impact assessment.
- To develop the skill to prepare environmental management plan.
- To Gain working knowledge of environmental and human-health risk assessment methods and the strategies used to manage identified risks.

UNIT I INTRODUCTION **9**

Historical development of Environmental Impact Assessment (EIA), Environmental Clearance- EIA in project cycle, legal and regulatory aspects in India – types and limitations of EIA –EIA process screening – scoping - terms of reference in EIA- setting – analysis – mitigation. Cross sectoral issues –public hearing in EIA- EIA consultant accreditation.

UNIT II IMPACT INDENTIFICATION AND PREDICTION **10**

Matrices – networks – checklists – cost benefit analysis – analysis of alternatives – expert systems in EIA. prediction tools for EIA – mathematical modelling for impact prediction – assessment of impacts – air – water – soil – noise – biological — cumulative impact assessment

UNIT III SOCIO-ECONOMIC IMPACT ASSESSMENT **8**

Socio-economic impact assessment - relationship between social impacts and change in community and institutional arrangements. factors and methodologies- individual and family level impacts. communities in transition-rehabilitation.

UNIT IV EIA DOCUMENTATION AND ENVIRONMENTAL MANAGEMENT PLAN **9**

Environmental management plan - preparation, implementation and review – mitigation and rehabilitation plans – policy and guidelines for planning and monitoring programmes – post project audit – documentation of EIA findings – ethical and quality aspects of environmental impact assessment.

UNIT V CASE STUDIES **9**

Mining, power plants, cement plants, highways, petroleum refining industry, storage & handling of hazardous chemicals, common hazardous waste facilities, CETPs, CMSWMF, building and construction projects.

TOTAL: 45 PERIODS

COURSE OUTCOMES

On successful completion of this course, the student will be able to

CO1: Carry out scoping and screening of developmental projects for environmental and social assessments.

CO2: Explain different methodologies for environmental impact prediction and assessment.

CO3: Asses socio-economic investigation of the environment in a project.

CO4: Plan environmental impact assessments and environmental management plans.

CO5: Gain Knowledge to prepare environmental impact assessment reports for various projects.

TEXT BOOKS

1. Canter, L.W., "Environmental Impact Assessment", McGraw Hill, New York. 1996.
2. Lawrence, D.P., "Environmental Impact Assessment – Practical solutions to recurrent problems", Wiley-Inter science, New Jersey. 2003.
3. World Bank –Source book on EIA.

REFERENCE BOOKS

1. Cutter, S.L., "Environmental Risk and Hazards", Prentice-Hall of India Pvt. Ltd., New Delhi, 1999.
2. Kolluru Rao, Bartell Steven, Pitblado R and Stricoff "Risk Assessment and Management Handbook", McGraw Hill Inc., New York, 1996.
3. K. V. Raghavan and A A. Khan, "Methodologies in Hazard Identification and Risk Assessment", Manual by CLRI, 1990.
4. Sam Mannan, Lees' Loss Prevention in the Process Industries, Hazard Identification, Assessment and Control, 4th Edition, Butterworth Heineman, 2012.
5. Westman, Walter E., "Ecology, Impact Assessment and Environment Planning" John Wiley and Sons, Canada, 1985.

Mapping of COs with POs

COs	POs												PSO	
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
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CO4	2	-	2	2	-	2	3	3	-	-	3	3	2	1
CO5	2	-	2	2	-	2	3	3	-	-	3	3	2	1
AVG	**2**	**-**	**2**	**2**	**-**	**2**	**3**	**3**	**-**	**-**	**3**	**3**	**2**	**1**

1-Low, 2-Medium, 3-High, "-" – No correlation

24OCT204 REHABILITATION OF STRUCTURES **L T P C**

3 0 0 3

COURSE OBJECTIVES

- To acquire the knowledge on maintenance aspects and causes of deterioration.
- To gain an understanding of concrete quality, durability characteristics and testing techniques.
- To impart knowledge on strengthening techniques and safe demolition procedures.

UNIT I MAINTENANCE AND REPAIR STRATIGES **9**

Maintenance, Repair and Rehabilitation - Facets of Maintenance - Importance of Maintenance - Various aspects of Inspection - Assessment procedure for evaluating a damaged structure - causes of deterioration.

UNIT II STRENGTH AND DURABILITY OF CONCRETE **9**

Quality assurance for concrete – Strength and Durability of concrete - Cracks, different types, causes-Effects due to climate, temperature, Sustained elevated Temperature, Corrosion.

UNIT III TESTING TECHNIQUES AND PROTECTION METHODS **9**

Non-destructive Testing Techniques, Epoxy injection, Shoring, Underpinning, Corrosion protection techniques – Corrosion inhibitors, Corrosion resistant steels, Coatings to reinforcement, cathodic protection.

UNIT IV STRENGTHENING AND REPAIR OF STRUCTURES **9**

Strengthening of Structural elements, Repair of structures distressed due to corrosion, fire, leakage and earthquake - Restoration of Heritage structures- Case studies.

UNIT V DEMOLITION **9**

Demolition Techniques, Demolition by Machines, Demolition by Explosives, Advanced techniques using Robotic Machines, Demolition Sequence, Dismantling Techniques, Safety precaution in Demolition and Dismantling.

TOTAL: 45 PERIODS

COURSE OUTCOMES

On successful completion of this course, the student will be able to

CO1: Discuss the importance of inspection and maintenance.

CO2: Study the Impacts of cracks, corrosion and climate on structures.

CO3: Explain about various testing techniques.

CO4: Classify the strengthening techniques and repair strategies.

CO5: Explore the safe demolition techniques.

TEXT BOOKS

1. Shetty,M.S. Jain A K., Concrete Technology - Theory and Practice, S.Chand and Company, Eighth Edition, 2019.
2. B.Vidivelli, Rehabilitation of Concrete Structures Standard Publishes Distribution.1st edition 2009.
3. Peter H.Emmons, “Concrete repair and maintenance illustrated”, Galgotia Publications Pvt. Ltd., 2001.

REFERENCE BOOKS

1. Hand book on Seismic Retrofit of Buildings, CPWD and Indian Buildings Congress, Narosa Publishers, 2008.
2. Hand Book on “Repair and Rehabilitation of RCC Buildings” – Director General works CPWD, Govt of India, New Delhi – 2002.
3. P.C.Varghese, Maintenance Repair and Rehabilitation & Minor works of building, Prentice Hall India Pvt Ltd, 2014.

4. Dodge Woodson, Concrete Structures, Protection, Repair and Rehabilitation, Butterworth-Heinemann, Elsevier, New Delhi 2012.
5. Ravishankar.K., and Krishnamoorthy.T.S, " Structural Health Monitoring, Repair and Rehabilitation of Concrete Structures", Allied Publishers, 2004.

Mapping of COs with POs

COs	POs												PSO	
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
CO1	2	3	3	2	-	2	3	3	-	-	3	3	2	1
CO2	2	3	3	2	-	2	3	3	-	-	3	3	2	1
CO3	2	3	3	2	-	2	3	3	-	-	3	3	2	1
CO4	2	3	3	2	-	2	3	3	-	-	3	3	2	1
CO5	2	3	3	2	-	2	3	3	-	-	3	3	2	1
AVG	**2**	**3**	**3**	**2**	**-**	**2**	**3**	**3**	**-**	**-**	**3**	**3**	**2**	**1**

1-Low, 2-Medium, 3-High, "-" – No correlation

24OCT205 DRINKING WATER SUPPLY AND TREATMENT **L T P C**

3 0 0 3

COURSE OBJECTIVES

- To provide a basic understanding of water sources, quality, and supply system planning.
- To introduce the design and operation of water conveyance and treatment systems.
- To explain the components of water distribution systems and plumbing in buildings.

UNIT I SOURCES OF WATER **9**

Public water supply system – Planning, Objectives, Design period, Population forecasting; Water demand – Sources of water and their characteristics, Surface and Groundwater – Impounding Reservoir – Development and selection of source – Source Water quality – Characterization -Significance – Drinking Water quality standards.

UNIT II CONVEYANCE FROM THE SOURCE **9**

Water supply – intake structures – Functions; Pipes and conduits for water – Pipe materials - Hydraulics of flow in pipes – Transmission main design – Laying, jointing and testing of pipes -appurtenances – Types and capacity of pumps – Selection of pumps and pipe materials.

UNIT III WATER TREATMENT **9**

Objectives – Unit operations and processes – Principles, functions, and design of water treatment plant units, aerators of flash mixers, Coagulation and flocculation sand filters – Disinfection -Construction, Operation and Maintenance aspects.

UNIT IV ADVANCED WATER TREATMENT **9**

Water softening – Desalination- R.O. Plant – demineralization – Adsorption – Ion exchange Membrane Systems – Iron and Manganese removal – Defluoridation – Construction and Operation and Maintenance aspects.

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UNIT V WATER DISTRIBUTION AND SUPPLY **9**

Requirements of water distribution – Components – Selection of pipe material – Service reservoirs - Functions – Network design – Economics – Computer applications – Appurtenances – Leak detection – Principles of design of water supply in buildings – House service connection - Fixtures and fittings, systems of plumbing and types of plumbing.

TOTAL:45 PERIODS

COURSE OUTCOMES

On Successful completion of this course, the students will be able to

CO1: Identify different sources of water and assess their suitability for supply.

CO2: Design of intake structures, pipes, and pumps used in water conveyance.

CO3: Explain the processes involved in water treatment and apply them in plant design.

CO4: Describe advanced treatment methods like softening, desalination, and removal of contaminants.

CO5: Design water distribution systems and understand plumbing arrangements in buildings.

TEXT BOOKS

1. Garg. S.K., "Water Supply Engineering", Khanna Publishers, Delhi, September 2008.
2. Punmia B.C, Arun K.Jain, Ashok K.Jain, “Water supply Engineering” Laxmi Publications (p) LTD, New Delhi, 2016.
3. Rangwala "Water Supply and Sanitary Engineering", Charotar Publishing house Pvt.Ltd, February 2022.

REFERENCE BOOKS

1. Fair. G.M., Geyer.J.C., “Water Supply and Wastewater Disposal”, John Wiley and Sons, 1954.
2. Babbit.H.E, and Donald.J.J, “Water Supply Engineering”, McGraw Hill book Co,1984.
3. Steel. E.W.et al., “Water Supply Engineering”, Mc Graw Hill International book Co, 1984.
4. Duggal. K.N., “Elememts of public Health Engineering”, S.Chand and Company Ltd, New Delhi, 1998.
5. Birdie.G.S., "Water Supply and Sanitary Engineering", Dhanpat Rai and sons, 2018.

Mapping of COs with POs

COs	POs												PSO	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	2	2	3	2	-	3	3	2	-	-	2	3	2	3
CO2	2	2	3	2	-	3	3	2	-	-	2	3	2	3
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CO4	2	2	3	2	-	3	3	2	-	-	2	3	2	3
CO5	2	2	3	2	-	3	3	2	-	-	2	3	2	3
AVG	2	2	3	2	-	3	3	2	-	-	2	3	2	3

1-Low, 2-Medium, 3-High, “-” – No correlation

24OCT206 PROJECT SCHEDULING AND OPTIMIZATION USING CPM AND PERT TECHNIQUES **L T P C 3 0 0 3**

COURSE OBJECTIVES

- To understand fundamental project management concepts and principles.
- To learn principles and processes related to project scope management.
- To comprehend concepts and tools related to project scheduling and their applications in real-world projects.

UNIT I GENERAL OVERVIEW AND PROJECT ORGANIZATION **9**

Introduction to Projects, Types of Projects, Introduction to Construction Project Management, Project Lifecycle and its Phases, Key Activities Involved in Different Project Lifecycle Phases, Role of Various Stakeholders in Different Project Lifecycle Phases, Project Organization Structure and its Types.

UNIT II PROJECT SCOPE MANAGEMENT **9**

Gathering Project Requirements, Project Scope and Specifications, Project Scope Matrix, Project Contract Management, Work Breakdown Structure (WBS), WBS Types, Creating WBS, Scope Management Steps and Processes

UNIT II PROJECT PLANNING AND SCHEDULING **9**

Project Planning, Planning and Scheduling, Steps Involved in Project Planning, Networking and Non-Networking Techniques Scheduling Techniques, Gantt-Chart, Formulation and Applications of Critical Path Method (CPM), Program Evaluation & Review Technique (PERT) and Precedence Diagram Method (PDM), Introduction to Linear Scheduling Methods

UNIT IV PROJECT CONTROL **9**

Time-Cost Tradeoff, Earned Value Management (EVM), Crashing and Fast-tracking Projects, Resource Constrained Scheduling, Resource Levelling, Schedule Updation and Project Control.

UNIT V ADVANCED TOOLS IN PROJECT SCHEDULING **9**

Software Applications and Use of AI in Project Planning, Scheduling and Control, Data driven Decision Making

TOTAL: 45 PERIODS

COURSE OUTCOMES

On successful completion of this course, the student will be able to

CO1: Explore the fundamental project management concepts and principles.

CO2: Comprehend the principles and processes related to project scope management.

CO3: Gain the ability to apply concepts and tools related to project scheduling in real world Projects.

CO4: Comprehend the use of advanced project scheduling tools.

CO5: Assess the use of advanced technology platforms in project scheduling and control.

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TEXT BOOKS

1. Oberlender, G. D., & Oberlender, G. D. Project management for engineering and construction (Vol. 2). New York: McGraw-Hill,1993.
2. Sears, S. K., Sears, G. A., & Clough, R. H. Construction project management: A practical guide to field construction management. John Wiley & Sons,2010.
3. Callahan, M. T., Quackenbush, D. G., & Rowings, J. E. Construction project scheduling,1992.

REFERENCE BOOKS

1. Barcus, S.W. and Wilkinson.J.W., Hand Book of Management Consulting Services, McGraw Hill, New York, 1986.
2. Joy P.K., Total Project Management - The Indian Context, New Delhi, Macmillan India Ltd., 1992.
3. Albert Lester, Project Management, Planning and Control, 7th Edition, Butterworth-Heinemann, USA , 2017.
4. Guide, P. M. B. O. K. A guide to the project management body of knowledge,2008.
5. Mubarak, S. A. Construction project scheduling and control. John Wiley & Sons,2015.

Mapping of COs with POs

COs	POs												PSO	
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
CO1	2	1	2	3	3	1	-	-	2	-	-	1	2	1
CO2	2	1	2	3	3	1	-	-	2	-	-	1	2	1
CO3	2	1	2	3	3	1	-	-	2	-	-	1	2	1
CO4	2	1	2	3	3	1	-	-	2	-	-	1	2	1
CO5	2	1	2	3	3	1	-	-	2	-	-	1	2	1
AVG	**2**	**1**	**2**	**3**	**3**	**1**	**-**	**-**	**2**	**-**	**-**	**1**	**2**	**1**

1-Low, 2-Medium, 3-High, "-" – No correlation

24OET101 ELECTRICAL VEHICLE TECHNOLOGIES **L T P C**
3 0 0 3

COURSE OBJECTIVES

- To understand the concept and operations of electric and hybrid electric vehicles (EVs and HEVs), including their architecture.
- To explore the need for energy storage in hybrid vehicle and the technologies available for energy storage.
- To provide an overview of various energy storage technologies applicable to electric vehicles.

UNIT I ELECTRIC VEHICLES AND VEHICLE MECHANICS **9**

Electric Vehicles (EV),Hybrid Electric Vehicles (HEV), Engine ratings – Comparisons of EV with internal combustion Engine vehicles – Fundamentals of vehicle mechanics.

UNIT II ARCHITECTURE OF EV's AND POWER TRAIN COMPONENTS 9

Architecture of EV's and HEV's - Plug-n Hybrid Electric Vehicles (PHEV) – Power train components and sizing, Gears, Clutches, Transmission and Brakes.

UNIT III POWER ELECTRONICS AND MOTOR DRIVES 9

Electric drive components – Power electronic switches – four quadrant operation of DC drive – Induction motor and permanent magnet synchronous motor – based vector control operation – Switched Reluctance Motor (SRM) drives – EV motor sizing.

UNIT IV BATTERY ENERGY STORAGE SYSTEM 9

Battery Basics – Different types – Battery Parameters – Battery life and safety - Battery modeling – Design of battery for large vehicles.

UNIT V ALTERNATIVE ENERGY STORAGE SYSTEMS 9

Introduction to fuel cell – Types, operation and Characteristics – proton exchange membrane (PEM) fuel cell for E-mobility – hydrogen storage systems – Super capacitors for transportation applications.

TOTAL: 45 PERIODS

COURSE OUTCOMES

On successful completion of this course, the student will be able to

CO1: Utilize the concept of electric vehicle and energy storage systems.

CO2: Describe the working and components of Electric Vehicle and Hybrid Electric Vehicle.

CO3: Explain the principles of power converters and electrical drives.

CO4: Illustrate the operation of storage systems such as battery and super capacitor.

CO5: Analyze the various energy storage systems based on fuel cells and hydrogen storage.

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TEXT BOOKS

1. Wei Liu, 'Hybrid Electric Vehicle System Modeling and Control', Second Edition, WILEY, 2017
2. James Larminie and John Lowry, 'Electric Vehicle Technology Explained', Second Edition, Wiley,2012.
3. Paul C. Krause, Oleg Wasynczuk, Scott D. Sudhoff, Steven D. Pekarek "Analysis of Electric Machinery and Drive Systems", 3rd Edition, Wiley-IEEE Press, 2013.

REFERENCE BOOKS

1. Stephen D. Umans, "Fitzgerald & Kingsley's Electric Machinery", Tata McGraw Hill, 7th Edition, 2020.
2. Bogdan M. Wilamowski, J. David Irwin, The Industrial Electronics Handbook, Second Edition, Power Electronics and Motor Drives, CRC Press, 2011.
3. Paul C. Krause, Oleg Wasynczuk, Scott D. Sudhoff, Steven D. Pekarek "Analysis of Electric Machinery and Drive Systems", 3rd Edition, Wiley-IEEE Press, 2013.
4. Rashid M.H., "Power Electronics Circuits, Devices and Applications ", Pearson, fourth Edition, 10th Impression 2021.
5. Iqbal Husain, 'Electric and Hybrid Electric Vehicles', CRC Press, 2021.

Mapping of COs with POs

COs	POs												PSO	
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CO4	2	1	2	3	3	1	-	-	2	-	-	1	2	1
CO5	2	1	2	3	3	1	-	-	2	-	-	1	2	1
AVG	**2**	**1**	**2**	**3**	**3**	**1**	**-**	**-**	**2**	**-**	**-**	**1**	**2**	**1**

1 - Low, 2 - Medium, 3 – High, '-' No correlation

24OET102 POWER SYSTEMS **L T P C**

3 0 0 3

COURSE OBJECTVES

- To develop a comprehensive understanding of power system components, their operation, and the overall structure of electrical power systems.
- To acquire the knowledge of transmission line parameters, insulators, cables, and protective devices such as circuit breakers, enabling effective design, analysis, and maintenance of power systems.
- To familiarize students with modern control and monitoring techniques in power systems.

UNIT I INTRODUCTION **9**

Power scenario in India – Power system components – Structure of Power System – Types of Power – Substation layout components.

UNIT II TRANSMISSION LINE PARAMETERS **9**

Parameters of single and three phase transmission lines with single and double circuits - Resistance, inductance and capacitance of solid, stranded and bundled conductors, conductor types – Symmetrical and unsymmetrical spacing and transposition-application of self and mutual GMD; skin and proximity effects.

UNIT III INSULATORS AND CABLES **9**

Main components of overhead lines-Insulators-Types, voltage distribution in insulator string, improvement of string efficiency, Underground cables-Types of cables, insulation materials, Parameters of cable, Grading of cables, Capacitance of 3-core cable, heating, thermal resistance of cables.

UNIT IV COMPUTER CONTROL OF POWER SYSTEMS **9**

Need of computer control of power systems-concept of energy control centers and functions – PMU - system monitoring, data acquisition and controls - System hardware configurations - SCADA and EMS functions - state estimation problem – measurements and errors - weighted least square estimation - various operating states - state transition diagram.

UNIT V CIRCUIT BREAKERS **9**

Types of circuit breakers – air blast, air break, oil,SF6, MCBs, MCCBs and vacuum circuit breakers – comparison of different circuit breakers –Rating and selection of Circuit breakers – Relays.

TOTAL: 45 PERIODS

COURSE OUTCOMES

On successful completion of this course, the student will be able to

CO1: Explain Power System Components and Structure.

CO2: Analyze Transmission Line Parameters and Performance.

CO3: Design and Selection of Insulators and Cables.

CO4: Discuss application of Computer Control Systems in Power Systems.

CO5: Interpret the knowledge of Circuit Breakers and Protective Devices

TEXT BOOKS

1. S.N.Singh, 'Electric Power Generation ,Transmission and Distribution', Prentice Hall of India Pvt.Ltd, New Delhi, 2008.
2. B.R.Gupta,' Power System Analysis and Design', S.Chand, New Delhi, Fifth Edition2005-08.
3. J.Brian, Hardy and Colin R.Bayliss' Transmission and Distribution in Electrical Engineering', Newnes; Fourth Edition, 2012.

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1. R.K.Rajput, 'Power System Engineering' Laxmi Publications (P) Ltd, New Delhi, 2006.
2. D.P.Kothari, I.J.Nagarath, 'Power System Engineering' Tata Mc Graw -Hill Publishing Company limited, New Delhi, 2007.
3. C.L.Wadhwa, 'Electrical Power Systems', New Academic Science Ltd, 2009
4. Luces M.Fualkenberry, Walter Coffer, 'Electrical Power Distribution and Transmission', Pearson Education, 2007.
5. Hadi Saadat, 'Power System Analysis, 'PSA Publishing; Third Edition, 2010.

Mapping of COs with POs

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CO5	3	2	2	-	-	1	2	-	-	1	-	-	3	2
AVG	3	2	2	-	-	1	2	-	-	1	-	-	3	2

1 - Low, 2 - Medium, 3 – High, '-' No correlation

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24OET103 CIRCUIT THEORY **L T P C**
3 0 0 3

COURSE OBJECTIVES

- To introduce electric circuits, including their analysis, solving circuit equations using network theorems, and understanding phasor diagrams and three-phase circuit analysis.
- To explain the phenomenon of resonance in coupled circuits and its significance.
- To educate on determining the transient response of circuits and analyzing their dynamic behavior.

UNIT I BASIC CIRCUITS ANALYSIS **9**

Resistive elements - Ohm's Law Resistors in series and parallel circuits – Kirchoffs laws – Mesh current and node voltage - methods of analysis.

UNIT II NETWORK REDUCTION AND THEOREMS **9**

Network reduction: voltage and current division, source transformation – star delta conversion. Thevenins and Norton Theorems – Superposition Theorem – Maximum power transfer theorem.

UNIT III TRANSIENT RESPONSE ANALYSIS **9**

L and C elements -Transient response of RL, RC and RLC Circuits using Laplace transform for DC input and A.C. sinusoidal input.

UNIT IV THREE PHASE CIRCUITS **9**

A.C. circuits – Average and RMS value - Phasor Diagram – Power, Power Factor and Energy.- Analysis of three phase 3-wire and 4-wire circuits with star and delta connected loads, balanced & un balanced – phasor diagram of voltages and currents – power measurement in three phase circuits.

UNIT V RESONANCE AND COUPLED CIRCUITS **9**

Series and parallel resonance – their frequency response – Quality factor and Bandwidth – Self and mutual inductance – Coefficient of coupling – Tuned circuits – Single tuned circuits.

TOTAL: 45 PERIODS

COURSE OUTCOMES

On successful completion of this course, the student will be able to

CO1: Enumerate the concepts of electrical circuits, and fundamental laws.

CO2: Analyze electric circuits with theorem.

CO3: Analyze the concepts of Three phase circuits.

CO4: Analyze the concepts of resonance circuits.

CO5: Analyze the transient response of circuits.

TEXT BOOKS

1. William H. Hayt Jr, Jack E. Kemmerly and Steven M. Durbin, "Engineering Circuits Analysis", McGraw Hill publishers, edition, New Delhi, 2013.
2. Charles K. Alexander, Mathew N.O. Sadiku, "Fundamentals of Electric Circuits", Second Edition, McGraw Hill, 2013.

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3. Allan H. Robbins, Wilhelm C. Miller, “Circuit Analysis Theory and Practice”, Cengage Learning India, 2013.

REFERENCE BOOKS

1. Chakrabarti A, “Circuits Theory (Analysis and synthesis), Dhanpath Rai & Sons, New Delhi, 1999.
2. Jegatheesan, R., “Analysis of Electric Circuits,” McGraw Hill, 2015.
3. Joseph A. Edminister, Mahmood Nahri, “Electric circuits”, Schaum’s series, McGraw- Hill, New Delhi, 2010.
4. M E Van Valkenburg, “Network Analysis”,Prentice-Hall of India Pvt Ltd, New Delhi,2015.
5. Mahadevan, K., Chitra, C., “Electric Circuits Analysis,” Prentice-Hall of India Pvt Ltd., New Delhi, 2015.

Mapping of COs with POs

COs	POs												PSO	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	2	3	2	3	2	-	-	-	-	-	-	3	2	1
CO2	3	3	3	3	2	-	-	-	-	-	-	2	2	1
CO3	2	3	2	3	3	-	-	-	-	-	-	1	2	1
CO4	3	2	2	2	2	-	-	-	-	-	-	3	2	1
CO5	3	3	3	2	2	-	-	-	-	-	-	1	2	1
AVG	2.8	2.8	2.2	2.8	2.2	-	-	-	-	-	-	2	2	1

1 - Low, 2 - Medium, 3 – High, ‘-’ No correlation

24OET104 ADVANCED ELECTRICAL MACHINES **L T P C**
3 0 0 3

COURSE OBJECTIVS

- To understand the working of special machines like stepper motor, switched reluctance motor, BLDC motor & PMSM.
- To derive torque equation and study the characteristics of special machines.
- To design the controller for special machines and study the working principle of synchronous reluctance motor.

UNIT I PERMANENT MAGNET BRUSHLESS DC MOTORS **9**

Fundamentals of Permanent Magnets- Types- Principle of operation- Magnetic circuit analysis- EMF and Torque equations- Characteristics and control.

UNIT II PERMANENT MAGNET SYNCHROUNOUS MOTORS **9**

Principle of operation – EMF and torque equations - Phasor diagram - Power controllers– performance characteristics – Digital controllers – Constructional features, operating principle and characteristics of synchronous reluctance motor.

UNIT III SWITCHED RELUCTANCE MOTORS **9**

Constructional features –Principle of operation- Torque prediction –performance Characteristics-Power controllers – Control of SRM drive- Sensor less operation of SRM – Applications.

UNIT IV STEPPER MOTORS **9**

Constructional features –Principle of operation –Types – Different modes of excitation - Torque equation – Characteristics – Drive circuits – Closed loop control – Applications.

UNIT V STUDY OF OTHER SPECIAL ELECTRICAL MACHINES **9**

Principle of operation and characteristics of Hysteresis motor – Universal motor – Linear induction motor – Applications.

TOTAL: 45 PERIODS

COURSE OUTCOMES

On successful completion of this course, the student will be able to

CO1: Utilize the control and characteristics of PMBDC motors.

CO2: Optimally design magnetic required in special machines based drive systems using FEM based software tools.

CO3: Analyze the dynamic performance of special electrical machine.

CO4: Explain the operation and characteristics of other special electrical machines.

CO5: Design and conduct experiments towards research.

TEXT BOOKS

1. K.Venkataratnam, 'Special Electrical Machines', Universities Press (India) Private Limited, 2008.
2. T. Kenjo, 'Stepping Motors and their Microprocessor Controls', Clarendon Press London, 1984
3. E.G. Janardanan, 'Special electrical machines', PHI learning Private Limited, Delhi, 2014.

REFERENCE BOOKS

1. T.J.E. Miller, 'Brushless magnet and Reluctance motor drives', Clarendon press, London,1989
2. T.Kenjo, ' Stepping motors and their microprocessor controls', Oxford University press, New Delhi, 2000 Dekker 2009
3. R. Krishnan - Switched Reluctance Motor Drives Modeling, Simulation, Analysis, Design and Applications -CRC Press 2017.
4. Bilgin, Berker Emadi, Ali Jiang, James Weisheng - Switched reluctance motor drives: fundamentals to applications-CRC 2019.
5. Ramu Krishnan - Permanent Magnet Synchronous and Brushless DC Motor Drives - CRC Press, Marcel Applications -CRC Press 2009.

Mapping of COs with POs

COs	POs												PSO	
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
CO1	2	3	2	2	3	1	-	-	-	-	-	1	3	2
CO2	2	3	3	2	3	1	-	-	-	-	-	1	3	2
CO3	2	3	3	2	3	1	-	-	-	-	-	1	3	2
CO4	1	1	1	2	2	1	-	-	-	-	-	1	2	2
CO5	1	2	2	2	1	1	-	-	-	-	-	1	2	2
AVG	**1.6**	**2.4**	**2.2**	**2.2**	**3**	**1**	**-**	**-**	**-**	**-**	**-**	**1**	**2.6**	**2**

1 - Low, 2 - Medium, 3 – High, '-' No correlation

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24OET105 HYBRID RENEWABLE POWER GENERATION **L T P C**
3 0 0 3

COURSE OBJECTIVES

- To learn the working principles and integration of different renewable energy sources.
- To understand the power electronic interfaces and control strategies used in hybrid systems
- To analyze energy storage systems and battery management techniques used in hybrid technologies.

UNIT I HYDRID ENERGY SYSTEMS **9**

Need for Hybrid Energy Systems – Solar-Wind-Fuel Cell-Diesel, Wind Biomass-Diesel, Micro-Hydel-PV, Ocean and geyser energy - Classification of Hybrid Energy systems – Importance of Hybrid Energy systems – Advantages and Disadvantages - Environmental aspects of renewable energy - Impacts of renewable energy generation on the environment - Present Indian and international energy scenario of conventional and RE sources

UNIT II ENERGY STORAGE AND CONTROL SYSTEMS **9**

Energy storage systems: Batteries, flywheels, compressed air, supercapacitors, and pumped hydro- Battery management systems and charge controllers-Control strategies for hybrid systems-Load forecasting and demand-side management.

UNIT III POWER CONVERTERS AND ANALYSIS OF HYBRID SOLAR PV SYSTEMS **9**

Power converters for Solar PV systems: Line-commutated converters (inversion-mode), boost and buck-boost converter-Selection of inverters, battery sizing, and array sizing- Analysis of Solar PV systems: Block diagrams and types (stand-alone PV systems)

UNIT IV ANALYSIS OF POWER CONVERTERS FOR HYBRID ENERGY SYSTEMS **9**

Introduction to Power Converters – Stand-alone Converters -AC-DC-AC converters: uncontrolled rectifiers, PWM Inverters - Bi-Directional Converters - Grid-Interactive Inverters - Matrix converter –Merits and Limitations.

UNIT V CASE STUDIES FOR HYBRID RENEWABLE ENERGY SYSTEMS **9**

Hybrid Systems- Range and type of Hybrid systems – Performance Analysis – Cost Analysis - Case studies of Diesel-PV, Wind-PV-Fuel-cell, Micro-hydel-PV, Biomass-Diesel-Fuel-cell systems.

TOTAL: 45 PERIODS

COURSE OUTCOMES

On successful completion of this course, the student will be able to

CO1: Explain the classification, need, and benefits of hybrid energy systems.
CO2: Explain various energy storage and control mechanisms for hybrid systems
CO3: Analyze different combinations of renewable energy sources.
CO4: Design and select appropriate converters and control strategies for hybrid systems.
CO5: Interpret real-time case studies of hybrid systems.

TEXT BOOKS

1. Md. Rabiul Islam et al., Emerging Power Converters for Renewable Energy and Electric Vehicles, CRC Press, First Edition, 2021
2. G.D. Rai, SolarEnergy Utilization, Khanna Publishers, 3rd Edition, 1987
3. B.H. Khan, Non-Conventional Energy Sources, Tata McGraw-Hill Publishing Company, New Delhi, 2017, 3rd Edition.

REFERENCE BOOKS

1. S.N. Bhadra, D. Kastha, & S. Banerjee, Wind Electrical Systems, Oxford University Press, 2005.Rashid M.H., Power Electronics Handbook, Academic Press, 4th Edition, 2018.
2. G.D. Rai, Non-Conventional Energy Sources, Khanna Publishers, 6th Edition, 2017.
3. Gray L. Johnson, Wind Energy System, Prentice Hall of India, 2nd Edition, 2006
4. Wind Power Integration - Connection and System Operational Aspects, Brendan Fox, 2014, IET, 2nd Edition.
5. G.D. Rai, SolarEnergy Utilization, Khanna Publishers, 3rd Edition, 1987.

Mapping of COs with POs

COs	POs												PSO	
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
CO1	3	-	-	-	-	-	2	1	-	2	-	-	2	1
CO2	3	3	-	-	3	-	2	1	-	2	-	-	2	1
CO3	3	-	-	-	-	-	2	1	-	2	-	-	2	1
CO4	3	-	-	-	-	-	2	1	-	2	-	-	3	1
CO5	3	-	-	-	-	-	2	1	-	2	-	-	3	1
AVG	**3**	**3**	-	-	**3**	-	**2**	**1**	-	**2**	-	-	**2.4**	**1**

1 - Low, 2 - Medium, 3 – High, '-' No correlation

24OET106 ELECTRICAL MAINTENANCE AND SAFETY **L T P C**
3 0 0 3

COURSE OBJECTIVES

- To understand the fundamental principles of electrical safety, including causes and prevention of electrical shocks.
- To develop knowledge of safety protocols and best practices during the installation, testing, commissioning, operation, and maintenance of electrical systems in different settings, including hazardous areas.
- To gain awareness of fire safety measures, including the proper selection and use of fire extinguishers.

UNIT I INTRODUCTION TO ELECTRICAL SAFETY, SHOCKS AND THEIR PREVENTION **9**

Terms and definitions, objectives of safety and security measures, Hazards associated with electric current and voltage, who is exposed, principles of electrical safety, Approaches to prevent Accidents, scope of subject electrical safety. Primary and secondary electrical shocks, possibilities of getting electrical shock and its severity, medical analysis of electric shocks and

its effects, shocks due to flash/ Spark over's, prevention of shocks, safety precautions against contact shocks, flash shocks, burns, residential buildings and shop.

UNIT II ELECTRICAL SAFETY IN RESIDENTIAL, COMMERCIAL AND AGRICULTURAL INSTALLATIONS **9**

Wiring and fitting –Domestic appliances –water tap giving shock –shock from wet wall –fan firing shock –multi-storied building –Temporary installations Agricultural pump installation – Do's and Don'ts for safety in the use of domestic electrical appliances.

UNIT III ELECTRICAL SAFETY DURING INSTALLATION, TESTING AND COMMISSIONING, OPERATION AND MAINTENANCE **9**

Preliminary preparations –safe sequence –risk of plant and equipment –safety documentation –field quality and safety -personal protective equipment –safety clearance notice –safety precautions –safeguards for operators –safety.

UNIT IVELECTRICAL SAFETY IN HAZARDOUS AREAS **9**

Hazardous zones –class 0, 1 and 2 spark, flashovers and corona discharge and functional requirements Specifications of electrical plants, equipment's for hazardous locations Classification of equipment enclosure for various hazardous gases and vapours classification of equipment/enclosure for hazardous locations.

UNIT V FIRE EXTINGUISHERS **9**

Fundamentals of Fire-Initiation of Fires, Types; Extinguishing Techniques, Prevention of Fire, Types of Fire Extinguishers, Fire Detection and Alarm System, CO2 and Halogen Gas Schemes, Foam Schemes.

TOTAL: 45 PERIODS

COURSE OUTCOMES

On successful completion of this course, the student will be able to

CO1: Applying Electrical Safety Principles.
CO2: Explain Safe Electrical Installations and Maintenances.
CO3: Manage Electrical Safety in Hazardous and Special Areas.
CO4: Promote Safety During Electrical Operations and Repairs.
CO5: Implement Fire Safety and Extinguishing Measures.

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TEXT BOOKS

1. Rao, S. and Saluja, H.L., "Electrical Safety, Fire Safety Engineering and Safety Management", Khanna Publishers, 1988.
2. www.apeasternpower.com/downloads/elecact2003.pdf .
3. Gupta, B.R., Handbook of Electrical Power System and Wiring, S. Chand Publishing, 2013.

REFERENCE BOOKS

1. Cooper.W.F, "Electrical safety Engineering", Newnes-Butterworth Company, 1978.
2. John Codick, "Electrical safety hand book", McGraw Hill Inc., New Delhi, 2000.
3. Nagrath, I.J. and Kothari, D.P., "Power System Engineering", Tata McGraw Hill, 1998.

4. Wadhwa, C.L., "Electric Power Systems", New Age International, 2004.
5. Pradeep Chaturvedi, "Energy management policy, planning and utilization", Concept Publishing company, New Delhi, 1997.

Mapping of COs with POs

COs	POs												PSO	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	3	-	-	-	-	-	2	1	-	2	-	-	2	1
CO2	3	3	-	-	3	-	2	1	-	2	-	-	2	1
CO3	3	-	-	-	-	-	2	1	-	2	-	-	2	1
CO4	3	-	-	-	-	-	2	1	-	2	-	-	2	1
CO5	3	-	-	-	-	-	2	1	-	2	-	-	3	2
AVG	**3**	**3**	**-**	**-**	**3**	**-**	**2**	**1**	**-**	**2**	**-**	**-**	**2.1**	**1.2**

1 - Low, 2 - Medium, 3 – High, '-' No correlation

24OMT201 BIOENERGY CONVERSION TECHNOLOGIES **L T P C**
3 0 0 3

COURSE OBJECTIVES

- To elucidate on biomass, types, availability, and characteristics.
- To gain knowledge on gasification process.
- To gain knowledge on liquidation process.

UNIT I INTRODUCTION **9**

Biomass: types – advantages and drawbacks – typical characteristics – proximate & ultimate analysis – comparison with coal - Indian scenario - carbon neutrality – biomass assessment studies – typical conversion mechanisms - densification technologies.

UNIT II BIOMETHANATION **9**

Biomethenation process – influencing parameters – typical feed stocks – Biogas plants: types and design, Biogas appliances – burner, luminaries and power generation systems – Industrial effluent based biogas plants.

UNIT III COMBUSTION **9**

Perfect, complete and incomplete combustion – stoichiometric air requirement for biofuels - equivalence ratio – fixed Bed and fluid Bed combustion.

UNIT IV GASIFICATION, PYROLYSIS AND CARBONISATION **9**

Chemistry of gasification - types – comparison – typical application – performance evaluation –economics. Pyrolysis - Classification - process governing parameters – Typical yield rates. Carbonization – merits of carbonized fuels – techniques adopted for carbonization.

UNIT V LIQUIFIED BIOFUELS **9**

Straight Vegetable Oil (SVO) as fuel - Biodiesel production from oil seeds, waste oils and algae - Process and chemistry - Biodiesel Vs. Diesel – comparison on emission and performance fronts. Production of alcoholic fuels (methanol and ethanol) from biomass – engine modifications

TOTAL: 45 PERIODS

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COURSE OUTCOMES

On successful completion of this course, the student will be able to

CO1: Estimate the surplus biomass availability of any given area.

CO2: Design a biogas plant for a variety of biofuels.

CO3: Determine and compare the cost of steam generation from biofuels with that of coal and petroleum fuels.

CO4: Analyse the influence of process governing parameters in thermochemical conversion of biomass.

CO5: Synthesize liquid biofuels for power generation from biomass.

TEXT BOOKS

1. Biomass for Bioenergy and Biomaterials, by Nidhi Adlakha, Rakesh Bhatnagar Syed Shams Yazdani, CRC Press; 1st edition (22 October 2021).
2. Bioenergy and Biochemical Processing Technologies, by Augustine O. Ayeni, Samuel EshorameSanni , Solomon U. Oranusi, Springer (30 June 2022).
3. Mehmet Kanoglu, Yunus A. Cengel, John M. Cimbala, Fundamentals and Applications of Renewable Energy, Indian Edition, Graw Hill; First edition 2020.

REFERENCE BOOKS

1. David Boyles, Bio Energy Technology Thermodynamics and costs, Ellis Hoknood Chichester, 1984..
2. Iyer PVR et al, Thermochemical Characterization of Biomass, M N E S.
3. Khandelwal KC, Mahdi SS, Biogas Technology – A Practical Handbook, Tata McGraw Hill, 1986.
4. Mahaeswari, R.C. Bio Energy for Rural Energisation, Concepts Publication,1997
5. Tom B Reed, Biomass Gasification – Principles and Technology, Noyce Data Corporation, 1981.

Mapping of COs with POs

COs	POs												PSO	
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
CO1	3	2	-	-	-	-	-	-	-	-	-	-	3	1
CO2	3	3	2	-	-	-	-	-	-	-	-	-	3	1
CO3	3	3	2	-	-	-	-	-	-	-	-	-	3	1
CO4	3	2	2	-	-	-	-	-	-	-	-	-	3	1
CO5	3	2	2	-	-	-	-	-	-	-	-	-	3	1
AVG	**3**	**2.4**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**3**	**1**

1-Low, 2-Medium, 3-High, '-'- No correlation

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24OMT202 AUTOMOTIVE MATERIALS, COMPONENTS, DESIGN AND TESTING **L T P C 3 0 0 3**

COURSE OBJECTIVES

- To study the functional requirements of engine components and suitable materials.
- To learn to design of cylinder and piston components.
- To learn to design of connecting rod and crank shaft.

UNIT I FUNCTIONAL REQUIREMENTS OF ENGINE COMPONENTS AND SUITABLE MATERIALS **9**

Functional requirements of engine components – Piston, piston pin, cylinder liner, connecting rod, crank shaft, valves, spring, engine block, cylinder head, and flywheel. Suitable materials for engine components.

UNIT II DESIGN OF CYLINDER AND PISTON COMPONENTS **9**

Design of connecting rod – Shank design – small end design – big end design – bolts design. Design of overhang crank shaft under bending and twisting – Crank pin design – Crank web design – Shaft design.

UNIT III DESIGN OF CONNECTING ROD AND CRANK SHAFT **9**

Design of connecting rod – Shank design – small end design – big end design – bolts design. Design of overhang crank shaft under bending and twisting – Crank pin design – Crank web design – Shaft design.

UNIT IV DESIGN OF FLYWHEEL AND VALVE TRAIN **9**

Design of valve – inlet valve – exhaust valve - Valve springs – tappet – rocker arm. Determination of mass of flywheel for a given coefficient of fluctuation of speed. Design of flywheel - rim - hub - arm.

UNIT V ENGINE TESTING **9**

Engine test cycles – WLTC – WHSC – WHVC – NRTC – ISO 8178. Dynamometer – Chassis dynamometer - transient dynamometer. Emission measurement technologies and instruments - NOX – Smoke – Particulate matter – CO – CO2 - HC.-Particle counter.

TOTAL: 45 PERIODS

COURSE OUTCOMES

On successful completion of this course, the student will be able to

CO1: Discuss the requirements of engine components and select suitable materials.

CO2: Apply the concept of design to cylinder and piston components and solve problems.

CO3: Apply the concept of design to Connecting rod and crank shaft and solve problems.

CO4: Apply the concept of design to flywheel and valve train and solve problems.

CO5: Discuss engine teste cycles, dynamometer and emission measurement technologies and Instruments.

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TEXT BOOKS

1. Khurmi. R.S. & Gupta. J.K., "A text book of Machine Design", Eurasia Publishing House (Pvt) Ltd, 2001.
2. Giancarlo Genta and Lorenzo Morello, The Automotive Chassis: Volume 1: Components Design (Mechanical Engineering Series) , 2019.
3. Bhandari V B, "Design of Machine Elements", 4th Edition, Tata McGraw-Hill Book Co, 2016.

REFERENCE BOOKS

1. Hiroshima Yamagata, "The science and technology of materials in automotive engines", Woodhead Publishing Limited, Cambridge, England.
2. Jain.R.K, "Machine Design", Khanna Publishers, New Delhi, 2005.
3. Lobna A. Elseify, Mohamad Midani, et al, Manufacturing Automotive Components from Sustainable Natural Fiber Composites (SpringerBriefs in Materials), 2021.
4. Andreas Öchsner and Holm Altenbach, Mechanical and Materials Engineering of Modern Structure and Component Design, 2015.
5. George C. Sih, Alberto Carpinteri, et al, Advanced Technology for Design and Fabrication of Composite Materials and Structures: Applications to the Automotive, Marine, Aerospace and Applications of Fracture Mechanics, 2010.

Mapping of COs with POs

COs	POs												PSO	
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
CO1	3	3	2	2	-	-	-	-	-	-	-	2	2	1
CO2	3	3	3	2	-	-	-	-	-	-	-	2	2	1
CO3	3	3	2	3	-	-	-	-	-	-	-	2	2	1
CO4	3	3	3	3	-	-	-	-	-	-	-	2	2	1
CO5	3	2	2	2	-	-	-	-	-	-	-	2	2	1
AVG	**3**	**2.8**	**2.4**	**2.4**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**2**	**2**	**1**

1-Low, 2-Medium, 3-High, '-'- No correlation

24OMT203 GREEN MANUFACTURING DESIGN AND PRACTICES **L T P C**

3 0 0 3

COURSE OBJECTIVES

- To introduce the concept of environmental design and industrial ecology.
- To impart knowledge about air pollution and its effects on the environment.
- To enlighten the students with knowledge about noise and its effects on the environment.

UNIT I DESIGN FOR ENVIRONMENT AND LIFE CYCLE ASSESSMENT **9**

Environmental effects of design -selection of natural friendly material - Eco design - Environmental damage Material flow and cycles – Material recycling – Emission less manufacturing- Industrial Ecology – Pollution prevention – Reduction of toxic emission – design for recycle.

UNIT II AIR POLLUTION SAMPLING **9**

Primary and Secondary Pollutants, Automobile Pollutants, Industrial Pollution, Ambient air quality Standards, Metrological aspects of air Pollution, Temperature lapse Rates and Stability-wind velocity and turbulence-Pump behavior dispersion of air Pollutants-solution to the atmosphere dispersion equation- the Gaussian Plume Model, Air pollution sampling-collection of gaseous air pollutants-collection of particulate pollutants-stock sampling, analysis of air pollutants-sulfur dioxide-nitrogen dixide, carbon monoxide, oxidants and ozone.

UNIT III NOISE POLLUTION AND CONTROL **9**

Frequency and Sound Levels, Units of Noise based power radio, contours of Loudness. Effect of human, Environment and properties, Natural and Anthrogenic Noise Sources, Measuring Instruments for frequency and Noise levels, Masking of sound, Types, Kinetics, Selection of different reactors used for waste treatment, Treatment of noise at source, Path and Reception, Sources of noise, Effects of noise- Occupational Health hazards, thermal Comforts, Heat Island Effects, Radiation Effects.

UNIT IV WATER DEMAND AND WATER QUALITY **9**

Factors affecting consumption, Variation, Contaminants in water, Nitrates, Fluorides, Detergents, taste and odour, Radio activity in water, Criteria, for different impurities in water for portable and non-portable use, Point and non-point Source of pollution, Major pollutants of Water, Water Quality Requirement for different uses, Global water crisis issues.

UNIT V GREEN CO-RATING **9**

Ecological Footprint - Need For Green Co-Rating – Green Co-Rating System – Intent – System Approach – Weightage- Assessment Process – Types Of Rating – Green Co- Benefits – Case Studies Of Green Co- Rating.

TOTAL: 45 PERIODS

COURSE OUTCOMES

On successful completion of this course, the student will be able to

CO1: Explain the environmental design and selection of eco-friendly materials.

CO2: Analyse manufacturing processes towards minimization or prevention of air pollution.

CO3: Analyse manufacturing processes towards minimization or prevention of noise pollution.

CO4: Analyse manufacturing processes towards minimization or prevention of water pollution.

CO5: Evaluate green co-rating and its benefits.

TEXT BOOKS

1. Gradel.T.E. and B.R. Allenby – Industrial Ecology – Prentice Hall – 2010.
2. Rao M.N. and Dutta A.K. "Wastewater treatment", Oxford & IBH publishing Co. Pvt. Ltd., New Delhi, Second Edition, 2006.
3. Gradel.T.E. and B.R. Allenby – Industrial Ecology – Prentice Hall – 2010.

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REFERENCE BOOKS

1. Frances Cairncross– Costing the Earth: The Challenge for Governments, the Opportunities for Business – Harvard Business School Press – 1993.
2. World Commission on Environment and Development (WCED), Our Common Future, Oxford University Press 2005.
3. Rao M.N. and Dutta A.K. "Wastewater treatment", Oxford & IBH publishing Co. Pvt. Ltd., New Delhi, Second Edition, 2006.
4. Rao CS Environmental Pollution Control Engineering-, Wiley Eastern Ltd., New Delhi, 2006.
5. Lewis H Bell and Douglas H Bell, Industrial noise control, Fundamentals and applications, Marcel Decker, 1994.

Mapping of COs with POs

COs	POs												PSO	
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
CO1	2	2	2	-	-	-	-	-	-	-	-	-	**3**	**1**
CO2	2	2	2	-	-	-	-	-	-	-	-	-	**2**	**1**
CO3	2	2	2	-	-	-	-	-	-	-	-	-	**3**	**1**
CO4	2	2	2	-	-	-	-	-	-	-	-	-	**2**	**1**
CO5	2	2	2	-	-	-	-	-	-	-	-	-	2	1
AVG	**2**	**2**	**2**	-	-	-	-	-	-	-	-	-	**2.3**	**1**

1-Low, 2-Medium, 3-High, '-'- No correlation

24OMT204 SEMICONDUCTOR MANUFACTURING **L T P C**
3 0 0 3

COURSE OBJECTIVES

- To provide the students with a comprehensive understanding of the fundamental principles of semiconductor materials, devices and technology.
- To explore the operational principles of various semiconductor devices, processes involved in the fabrication.
- Apply their knowledge in designing and analyzing basic semiconductor circuits and systems.

UNIT I INTRODUCTION TO SEMICONDUCTOR MATERIALS **9**

Definition and types, comparison with conductors and insulators; bonding and structure - crystal structure (diamond, zinc blende), covalent bonding in semiconductors; energy bands – energy band theory, conduction and valence bands, bandgap and its significance; carrier statistics – electrons and holes, effective mass, fermi level and its significance.

UNIT II SEMICONDUCTOR DEVICES AND THEIR OPERATION **9**

P-N junction – formation and properties, depletion region, forward and reverse bias characteristics; diodes – types and applications; bipolar junction transistors – structure and operation, current gain, common configurations; Field effect transistor – JFETs and MOSFETs, threshold voltage and I-V characteristics, applications.

UNIT III FABRICATION TECHNIQUES **9**

Crystal growth and wafer preparation – czochralski process, wafer slicing and polishing; oxidation – thermal oxidation process, properties of silicon dioxide; photolithography – photoresist application, exposure and development; etching and doping – wet and dry etching techniques, diffusion and ion implantation; thin film deposition – chemical vapor deposition and physical vapor deposition; fabrication for ceramic components – tapecasting, sintering, machining , challenges in processing ceramic materials, integration with semiconductor fabrication process.

UNIT IV CHARACTERIZATION AND TESTING OF SEMICONDUCTORS **9**

Electrical characteristics – I-V and C-V measurements, carrier lifetime and mobility; Optical characterization – photoluminescence and Raman spectroscopy, absorption and reflection measurements; structural characterization – x-ray diffraction, SEM, TEM; Reliability and Failure analysis – stress testing, common failure mechanisms, techniques for failure analysis; characterization of ceramic materials – mechanical testing, thermal properties, electrical properties.

UNIT V CERAMICS IN SEMICONDUCTOR TECHNOLOGY **9**

Overview of applications in semiconductor devices and fabrication processes, comparison with other materials used in semiconductors; ceramic substrates – types of substrates, properties and advantages of ceramic substrates, applications in power electronics, RF components and high frequency devices; ceramic packaging – importance of packaging in semiconductor devices, types of ceramic packaging, advantages, thermal management and reliability; ceramic s in MEMs – role of ceramics in MEMs, common materials and applications; ceramic dielectrics – types of ceramic dielectric materials, properties and applications, role of high k dielectrics for advanced semiconductor devices

TOTAL: 45 PERIODS

COURSE OUTCOMES

On successful completion of this course, the student will be able to

CO1: Apply the fundamental concepts of semiconductor physics.

CO2: Analyze and describe the operation of various semiconductor devices.

CO3: Acquire knowledge of the key processes in semiconductor device fabrication.

CO4: evaluate the properties and performance of semiconductor materials and devices.

CO5: Use of ceramics in semiconductor technology including advancements in materials and fabrication techniques.

TEXT BOOKS

1. Peter Y Yu, Manuel Cardona, “Fundamentals of Semiconductors: Physics and Material Properties”, 1995.
2. Dieter K Schroder, “Semiconductor Material and Device Characterization”, 2006.
3. Donald A Neamen, “Semiconductor Physics and Devices”, McGraw-Hill, 2002.

REFERENCE BOOKS

1. Adel S Sedra, Kenneth C Smith, “Microelectronic Circuits”, OUP USA, 2003.
2. Ben G Streetman, Sanjay Banerjee, “Solid State Electronic Devices”, Pearson Education, 2015.

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3. Stephen A Campbell, "The Science and Engineering of Microelectronic Fabrication". Oxford Univ Press, 2001.
4. Hong Xiao, "Introduction to Semiconductor Manufacturing Technology", Pearson Education, 2000.
5. C Barry Carter, M Grant Norton, " Ceramic Materials: Science and Engineering", 2019.

Mapping of COs with POs

COs	POs												PSO	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	3	2	-	3	-	-	-	-	-	-	-	-	2	1
CO2	3	2	-	3	-	-	-	-	-	-	-	-	2	1
CO3	3	2	-	3	-	-	-	-	-	-	-	-	2	1
CO4	3	2	-	3	-	-	-	-	-	-	-	-	2	1
CO5	3	2	-	3	-	-	-	-	-	-	-	-	2	1
AVG	**3**	**2**	**-**	**3**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**2**	**1**

1-Low, 2-Medium, 3-High, '-'- No correlation

24OMT205 FUTURE ENERGY RESOURCES AND MOBILITY **L T P C**
3 0 0 3

COURSE OBJECTIVES

- To expose the students to various future energy resources and mobility.
- To explore the various bio, solar, wind, fuel cell energy technologies.
- To study the various types of energy storage devices and technologies and them comparison.

UNIT I CURRENT AND FUTURISTIC ENERGY RESOURCES **9**

High Carbon Fuels - Gasoline and Diesel Fuels. Low Carbon Fuels – Ethanol, Methanol, Isobutanol, Dimethyl Ether(DME), Polyoxymethylene Dimethyl Ether (PODE), Compressed and Liquified Natural Gas (CNG & LNG). Zero Carbon Fuels – Hydrogen and Ammonia Fuels. – Physiochemical Properties – Improvements in Fuel Quality as per BS Norms – Current and Future plans on storage and distribution infrastructures.

UNIT II ALTERNATE ENERGY RESOURCES **9**

Fuel Cell stacks – Types – Working, Batteries – Types – Working – Materials, Comparison of Fuel Cell and Battery. Future scopes in Fuel Cell and Batteries.

UNIT III CURRENT AND FUTURE INTERNAL COMBUSTION ENGINES (ICE) FOR MOBILITY **9**

BSVI Qualified ICE Powered Vehicles and Technologies, Conventional Hybrid Vehicle Technologies, Advanced Combustion Mode enabled ICEs and Hybrids, Hydrogen and Ammonia Fuelled ICEs, Flexi Fuel Engines. Low Carbon Fuelled ICEs. Decarbonisation and De- fossilization.

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UNIT IV ALTERNATE ENERGY RESOURCES POWERED MOBILITY 9

Fuel Cell Powered Vehicle Technologies, Battery Powered Electric Vehicle Technologies, Requirements of fueling and charging Infrastructures, Comparison of Merits and Demerits, Life cycle analysis and Carbon credit gained between Alternate and Conventional Fuel powered mobility.

UNIT V DATA ANALYSIS OF CURRENT AND FUTURE MOBILITY APPLICATIONS 9

Case studies in present and future technologies in mobility design and its performance analysis.

TOTAL: 45 PERIODS

COURSE OUTCOMES

On successful completion of this course, the student will be able to

CO1: Knowledge on impact of high and low carbon energy resource on mobility.

CO2: Synergetic knowledge on fuel cells Battery energy sources.

CO3: Knowledge on conventional and future propulsion system.

CO4: Knowledge on alternate energy sources powered mobility.

CO5: Capability to perform data analysis of conventional and future propulsion systems.

TEXT BOOKS

1. Pundir B.P. "I.C. Engines Combustion and Emission", Narosa Publishing House, 2010.
2. Barclay F.J., "Fuel Cells, Engines and Hydrogen", Wiley, 2009.
3. Bent Sorensen (Sørensen), Hydrogen and Fuel Cells: Emerging Technologies and Applications, Elsevier, UK 2005.

REFERENCE BOOKS

1. Rakesh_Kumar_Maurya Characteristics and Control of Low Temperature Combustion Engines, Springer - ISSN 0941-5122 ISSN 2192-063X.
2. Mehrdad Ehsani, Yimi Gao, Sebastian E. Gay, Ali Emadi, Modern Electric, Hybrid Electric and Fuel Cell Vehicles: Fundamentals, Theory and Design, CRC Press, 2004.
3. Rand D.A.J, Woods, R & Dell RM Batteries for Electric vehicles, John Wiley & Sons 1998
4. HCCI and CAI Engines – Nptel - https://nptel.ac.in/courses/112104033/33 CO PO PS
5. HCCI Diesel Engines - Nptel - https://nptel.ac.in/courses/112104033/34.

Mapping of COs with POs

COs	POs												PSO	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	3	2	-	-	-	-	-	-	-	-	-	-	2	1
CO2	3	3	2	-	-	-	-	-	-	-	-	-	2	1
CO3	3	3	2	-	-	-	-	-	-	-	-	-	2	1
CO4	3	2	2	-	-	-	-	-	-	-	-	-	2	1
CO5	3	2	2	-	-	-	-	-	-	-	-	-	2	1
AVG	3	2.4	2	-	-	-	-	-	-	-	-	-	2	1

1-Low, 2-Medium, 3-High, '-'- No correlation

24OMT206 FAILURE ANALYSIS AND NDT TECHNIQUES **L T P C**
3 0 0 3

COURSE OBJECTIVES

- To understating the importance of failure analysis.
- To study the causes of failures, principles of NDT methods.
- To gain knowledge on various test methods.

UNIT I INTRODUCTION TO FAILURE ANALYSIS **9**

Need and scope of failure analysis. Engineering Disasters in history and their failure analysis. Sources of failures. Description & origin of Processing defects. Types of failures- Ductile & Brittle, Fracture Analysis, FMEA. Application of fracture mechanics concepts to design for safety. NDT for failure analysis- an overview.

UNIT II DYE PENETRANT & MAGNETIC PARTICLE INSPECTION **9**

Importance of NDT, Visual Inspection: Tools, applications and limitations, Liquid Penetrant Inspection (LPI): Principles, Requisites of a good penetrant and developer, Types of penetrants and developers, Techniques, procedures, interpretation and evaluation of penetrant test indications, advantages, and limitations, case study. Magnetic Particle Inspection (MPI): Principles, Magnetization- Methods, techniques. Continuous & Residual testing of MPI, System sensitivity, Interpretation of MPI indications, Advantages and limitations, case study.

UNIT III ULTRASONIC TESTING **9**

Principle, type of Ultrasonic waves, mode conversion in ultrasonics, Principle, UT testing methods: Contact testing and immersion testing, normal beam and straight beam testing, angle beam testing, dual crystal probe, Ultrasonic Testing Techniques: Resonance testing, Through transmission technique, Pulse echo testing technique, Instruments used in UT, Transducer types, Reference blocks with artificially created defects, Calibration of equipment, A-Scan, B-scan & C-scan, case study.

UNIT IV EDDY CURRENT TESTING & THERMOGRAPHY **9**

Eddy current Testing: Principles, Physics aspects of ECT- conductivity, permeability, resistivity, inductance, inductive reactance, impedance, Filed factor and lift-off effect, edge effect, end effect, Depth of penetration of ECT, Instrumentation, application of ECT, advantages, limitations, case study. Thermography: Principles, Contact and non-contact inspection methods, Heat sensitive paints and papers, thermally quenched phosphors, Liquid crystals, techniques for applying liquid crystals, advantage and limitations, Infrared radiation and infrared detectors, applications, case study.

UNIT V RADIOGRAPHY TESTING **9**

Principle, electromagnetic radiation sources, X-ray sources, Production of X-rays, High energy X-ray source, Gama ray source, Properties of X-rays and gamma rays, Inspection techniques, Exposure, Real-time radiography, Films and screens used in radiography, Quality of radiographic film processing, interpretation, evaluation of test results, Computed Tomography, Safety aspects required in radiography, Applications, advantages and limitations, case study.

TOTAL: 45 PERIODS

COURSE OUTCOMES

On successful completion of this course, the student will be able to

CO1: Discuss on the various failures, their analysis and their importance.

CO2: Adapt the Penetrant testing procedures for evaluating the surface defects.

CO3: Interpret the images and the results obtained from the Thermographic technique and the Eddy current testing.

CO4: Describe the testing procedure and analyze the results obtained in the Ultrasonic inspection.

CO5: Explain the techniques involved in the Radiographic testing and the various advancements in Radiography.

TEXT BOOKS

1. Paul E Mix, "Introduction to Non-destructive testing: a training guide", Wiley, 2nd edition New Jersey, 2005.
2. ASM Metals Handbook, "Non-Destructive Evaluation and Quality Control", American Society of Metals, Metals Park, Ohio, USA, 200, Volume-17, 2000.
3. Baldev Raj, T.Jayakumar, M.Thavasimuthu "Practical Non-Destructive Testing", Narosa Publishing House, 2009.

REFERENCE BOOKS

1. ASM International, ASM Handbook, Volume 17: Nondestructive Evaluation of Materials, 2018.
2. B. Hull and V. John, Non-Destructive Testing. New York, NY, USA: Springer, 2012.
3. N. Ida, C. Boller, and R. Diederichs, Eds., Handbook of Advanced Nondestructive Evaluation, 2nd ed. Cham, Switzerland: Springer, 2023.
4. Chuck Hellier, "Handbook of Nondestructive Evaluation", Mc Graw Hill, 2021.
5. G. Lacidogna, Ed., Nondestructive Testing (NDT). Basel: MDPI, 2021.

Mapping of COs with POs

COs	POs												PSO	
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
CO1	2	2	2	2	-	-	-	-	-	-	-	-	2	1
CO2	3	-	2	2	-	-	-	-	-	-	-	-	1	1
CO3	3	2	2	2	-	-	-	-	-	-	-	-	2	1
CO4	3	2	2	2	-	-	-	-	-	-	-	-	1	1
CO5	3	2	2	2	-	-	-	-	-	-	-	-	2	1
AVG	**3**	**2**	**2**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**1.6**	**1**

1-Low, 2-Medium, 3-High, '-'- No correlation

24OBT201 HOSPITAL MANAGEMENT **L T P C**

3 0 0 3

COURSE OBJECTIVES

- Understanding Health System Organization.
- To know Regulatory Requirements and Health Care Codes.
- To learn Equipment and Maintenance Management.

UNIT I HEALTH SYSTEM **9**

Health organization of the country, the state, the cities and the region, Health Financing System, Organization of Technical Section.

UNIT II HOSPITAL ORGANISATION AND MANAGEMEN **9**

Management of Hospital organization, Nursing section Medical Sector, Technical Department, Definition and Practice of Management by Objective, Transactional Analysis, Human relation in Hospital, Legal aspect in Hospital Management.

UNIT III REGULATORY REQUIREMENT AND HEAITH CARE CODES **9**

FDA Regulation, joint commission of Accreditation for Hospitals, National Fire Protection Association Standard, IRPC.

UNIT IV EQUIPMENT MAINTENANCE MANAGEMENT **9**

Organizing Maintenance Operations, Paper Work Control, Maintenance Job, Planning Maintenance Work, Measurement and Standards, Preventive Maintenance, Maintenance Budgeting and Forecasting, Maintenance Training.

UNIT V TRAINED TECHNICAL PERSONNEL **9**

Function of Clinical Engineer, Role to be performed in Hospital, Man power Market, Professional Registration, Structure in hospital.

TOTAL:45 PERIODS

COURSE OUTCOMES

On successful completion of this course, the students will be able to

CO1: Explain the principles, staffing and marketing processes, discussing their significance.

CO2: Manage their role in effective and efficient management of health care organizations.

CO3:Analyze the various regulations and standards to be followed in hospitals for safety.

CO4:Evaluate various aspects of equipment maintenance.

CO5:Apply the aspects of managing the hospital in terms of staff, marketing and the use of computers.

TEXT BOOKS

1. Cesar A. Caceresand Albert Zara,The practice of Clinical Engineering, Academic Press, 1977.
2. Webster,J.G. and Albert M.Cook, Clinical Engineering Principles and Practices, Prentice Hall Inc. Englewood Cliffs, 1979.
3. Antony Kelly, Maintenance planning and control, Butterworths London, 1984.

REFERENCE BOOKS

1. Hans P feiff,Vera Dammann (Ed.) Hospital Engineering in Developing Countries, Zreport Eschborn, 1986.
2. Jacob Kline, Handbook of Bio Medical Engineering, Academic Press, SanDiego1988.

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3. R.C.Goyal, Handbook of Hospital Personal Management, Prentice Hall of India,1993.
4. G. D. Kunders, "Hospitals–Facilities Planning and Management", TMH, New Delhi–5th edition Reprint 2007.
5. Peter Berman, "Health Sector Reforming Developing Countries", Harvard University Press, 1995.

Mapping of COs with POs

COs	POs												PSO	
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
CO1	1	2	1	-	-	1	-	1	-	1	1	-	2	1
CO2	1	2	1	-	-	1	-	1	-	1	1	-	2	1
CO3	1	2	1	-	-	1	-	1	-	1	1	-	2	1
CO4	1	2	1	-	-	1	-	1	-	1	1	-	2	1
CO5	1	2	1	-	-	1	-	1	-	1	1	-	2	1
AVG	**1**	**2**	**1**	**-**	**-**	**1**	**-**	**1**	**-**	**1**	**1**	**-**	**2**	**1**

1-Low, 2-Medium, 3-High, '-'- No correlation

24OBT202 ASSIST DEVICES **L T P C**
3 0 0 3

COURSE OBJECTIVES

- To study the role and importance of machines that takes over the functions of the heart and lungs.
- To study various mechanical techniques that helps a non-functioning heart.
- To learn the functioning of the unit which does the clearance of urea from the blood.

UNIT I HEART LUNG MACHINE AND ARTIFICIAL HEART **9**

Different types of Oxygenators, Pumps, Pulsatile and Continuous Types, Monitoring Process, Shunting, Blood Handling System, Functioning and different types of Artificial Heart.

UNIT II CARDIAC ASSIST DEVICES **9**

Assisted through Respiration, Right and left Ventricular Bypass Pump, Auxiliary ventricle, Open Chest and Closed Chest type, Intra Aortic Balloon Pumping, Prosthetic Cardiac valves.

UNIT III ARTIFICIAL KIDNEY **9**

Indication and Principle of Haemodialysis, Dialysate, types of filter and membranes, Different types of hemodialyzers, Wearable Artificial Kidney, Implanting Type.

UNIT IV RESPIRATORY AND HEARING AIDS **9**

Ventilator and its types-Intermittent positive pressure, Breathing Apparatus Operating Sequence, Electronic IPPB unit with monitoring for all respiratory parameters. Types of Deafness, Hearing Aids, SISI, masking techniques.

UNIT V RECENT TRENDS **9**

Transcutaneous electrical nerve stimulator, bio-feedback, Electrical safety Analyser, Latest use of assistive technology for health care Information technology, Future trends in assistive technology.

TOTAL: 45 PERIODS

COURSE OUTCOMES

On successful completion of this course, the students will be able to

CO1: Explain the principles and construction of artificial heart.

CO2: Discuss the various mechanical techniques that improve therapeutic technology.

CO3: Explain the functioning of the membrane or filter that cleanses the blood.

CO4: Describe the tests to assess the hearing loss and development of wearable devices for the same.

CO5: Analyze and research on electrical stimulation and bio feedback techniques in rehabilitation and physiotherapy.

TEXT BOOKS

1. Gray E Wnek, Gray L Browlin – Encyclopedia of Biomaterials and Biomedical Engineering – Marcel Dekker Inc New York 2004.
2. John.G. Webster – Bioinstrumentation – John Wiley & Sons (Asia) Pvt Ltd-2004.
3. Joseph D. Bronzino, The Biomedical Engineering Handbook, Third Edition: Three Volume Set, CRC Press, 2006.

REFERENCE BOOKS

1. Andreas.F.Vonracum, "Handbook of biomaterial evaluation", Mc-Millan publishers, 1980.
2. GrayEWnek, GrayLBrowlin, "Encyclopedia of Biomaterials and Biomedical Engineering" Marcel Dekker Inc New York 2004.
3. D.S.Sunder, "Rehabilitation Medicine", 3rdEdition, Jaypee Medical Publication, 2010.
4. Albert M.Cooka nd WebsterJ.G., Therapeutic Medical Devices, Prentice Hall Inc., New Jersey,1982.
5. KolffW.J., Artificial Organs, John Wiley and Sons, NewYork, 1979.

Mapping of COs with POs

COs	PO's												PSO	
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
CO1	3	2	1	1	-	-	-	-	-	-	-	-	2	1
CO2	3	2	1	1	-	-	-	-	-	-	-	-	2	1
CO3	3	2	1	1	-	-	-	-	-	-	-	-	2	1
CO4	3	2	1	1	-	-	-	-	-	-	-	-	2	1
CO5	3	2	1	1	-	-	-	-	-	-	-	-	2	1
AVG	**3**	**2**	**1**	**1**	-	-	-	-	-	-	-	-	2	1

1-Low, 2-Medium, 3-High, '-'- No correlation

24OBT203 ROBOTICS IN MEDICINE **L T P C**
3 0 0 3

COURSE OBJECTIVES

- To Get introduced to the fundamental of robotics and position analysis.
- Learn about Parallel robots, different types of motions and force analysis.
- Know the basics of trajectory planning, Motion control systems and actuators.

UNIT I FUNDAMENTALS AND POSITION ANALYSIS **9**

Fundamentals, Degrees of freedom, Joints, Coordinates, Reference frames, Programming modes, Collaborative robots, Position analysis – Robots as mechanisms, Conventions, Transformations, Denavit Hartenberg Representation, Degeneracy and Dextrerity, Position analysis of Articulated robot.

UNIT II PARALLEL ROBOTS, DIFFERENTIAL MOTIONS AND FORCE ANALYSIS **9**

Parallel robots, Planar and Spatial parallel robots, Differential relationships, The Jacobian, Large scale motions, Frame vs Robot, Differential motions and change, Hand frame, Operator, Jacobian and Inverse for Screw based and Parallel Robots, Differential operator, Lagarangian mechanics.

UNIT III TRAJECTORY PLANNING, MOTION CONTROL SYSTEMS AND ACTUATORS **9**

Path and Trajectory, Joint Space and Cartesian Space Descriptions and Trajectory Planning, Cartesian, Trajectory Recording, Basics, Steady state error, Root locus, Proportional, Compensators, Multiple IO systems, Characteristics of Hydraulic, Pneumatic, Electric motors, Other actuators.

UNIT IV SENSORS, IMAGE PROCESSING AND ANALYSIS WITH VISION SYSTEMS **9**

Sensor Characteristics, Micro switches, Visible and IR, Touch, Proximity, Transforms – Fourier, Hough, Resolution, Image processing, Segmentation, Region growing and splitting, Object recognition, Specialized lighting, Compression, Colour images.

UNIT V FUZZY CONTROL AND APPLICATIONS IN MEDICINE **9**

Fuzzy control - Crisp vs Fuzzy, Sets, Inference rules, Defuzzification, Simulation, Applications in Biomedical Engineering and rehabilitation, Nanobots in medicine, Cardiac and abdominal procedures with tele operated robots, Orthopedic surgery with cooperative robots

TOTAL:45 PERIODS

COURSE OUTCOMES

On successful completion of this course, the students will be able to

CO1: Describe the fundamental of robotics and position analysis.

CO2: Outline the functioning of parallel robots, different types of motions and force analysis.

CO3: Portray the basics of trajectory planning, Motion control systems and actuators.

CO4: Recognize and explain the use of various sensors and vision systems in robotics.
CO5: Employ Fuzzy control in robotics and apply it to Robotics in Medicine.

TEXT BOOKS

1. S.B. Niku, Introduction to Robotics, Analysis, Control, Applications, Pearson Education, 2020.
2. Robert Schilling, Fundamentals of Robotics-Analysis and control, Prentice Hall of India, 2003.
3. Fu Gonzales and Lee, "Robotics" , Mc Graw Hill, 1987.

REFERENCE BOOKS

1. Grover, Wiess, Nagel and Oderey, Industrial Robotics, McGraw Hill, 2012.
2. Klafter, Chmielewski and Negin, Robot Engineering, Prentice Hall Of India, 1989.
3. Mittal, Nagrath, Robotics and Control, Tata McGraw Hill publications, 2003.
4. Bijay K. Ghosh, NingXi, T.J.Tarn, Controlling Robotics and Automation Sensor – Based integration, Academic Press, 1999.
5. Mikell P. Groover, Mitchell Weiss, Industrial robotics, technology, Programming and Applications, McGraw Hill International Editions, 1986.

Mapping of COs with POs

COs	POs												PSO	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	3	2	1	1	1	-	-	-	-	-	-	-	2	1
CO2	3	2	1	1	1	-	-	-	-	-	-	-	2	1
CO3	3	2	1	1	1	-	-	-	-	-	-	-	2	1
CO4	3	2	1	1	1	-	-	-	-	-	-	-	2	2
CO5	3	2	1	1	1	-	-	-	-	-	-	-	2	1
AVG	3	2	1	1	1	-	-	-	-	-	-	-	2	1.2

1-Low, 2-Medium, 3-High, '-'- No correlation

24OBT204 DSP ARCHITECTURE **L T P C**

3 0 0 3

COURSE OBJECTIVES

- To introduce architectural features of programmable DSP Processors of TI and Analog Devices.
- To give practical examples of DSP Processor architectures for better understanding.
- To develop the programming knowledge using Instruction set of DSP Processors.

UNIT I INTRODUCTION TO DIGITAL SIGNAL PROCESSING **9**

Introduction, A Digital signal-processing system, The sampling process, Discrete time sequences. Discrete Fourier Transform (DFT) and Fast Fourier Transform (FFT), Linear time-invariant systems, Digital filters, Decimation and interpolation.

UNIT II ARCHITECTURES FOR PROGRAMMABLE DSP DEVICES 9

Basic Architectural features, DSP Computational Building Blocks, Bus Architecture and Memory, Data Addressing Capabilities, Address Generation UNIT, Programmability and Program Execution, Speed Issues, Features for External interfacing.

UNIT III PROGRAMMABLE DIGITAL SIGNAL PROCESSORS 9

Commercial Digital signal-processing Devices, Data Addressing modes of TMS320C54XX DSPs, Data Addressing modes of TMS320C54XX Processors, Memory space of TMS320C54XX Processors, Program Control, TMS320C54XX instructions and Programming.

UNIT IV ANALOG DEVICES FAMILY OF DSP DEVICES 9

Analog Devices Family of DSP Devices – ALU and MAC block diagram, Shifter Instruction, Base Architecture of ADSP 2100, ADSP-2181 high performance Processor.

UNIT V INTERFACING MEMORY 9

Memory space organization, External bus interfacing signals, Memory interface, Parallel I/O interface, Programmed I/O, Interrupts and I/O, Direct memory access (DMA).

TOTAL:45 PERIODS

COURSE OUTCOMES

On successful completion of this course, the students will be able to

CO1: Classify RFID systems based on frequency, architecture and performance.

CO2: Define standards for RFID technology.

CO3: Illustrate the operation of various components of RFID systems.

CO4: Describe the privacy and security issues in RFID Systems .

CO5: Discuss the construction and applications of RFID enabled sensor .

TEXT BOOKS

1. Digital Signal Processing – Avtar Singh and S. Srinivasan, Thomson Publications, 2004.
2. A Practical Approach to Digital Signal Processing - K Padmanabhan, R. Vijayarajeswaran, Ananthi. S, New Age International, 2006/2009.
3. Embedded Signal Processing with the Micro Signal Architecture Publisher: Woon-Seng Gan,Sen M. Kuo, Wiley-IEEE Press, 2007.

REFERENCE BOOKS

1. Digital Signal Processors, Architecture, Programming and Applications – B. Venkataramani and M. Bhaskar, 2002, TMH.
2. Digital Signal Processing – Jonatham Stein, 2005, John Wiley.
3. DSP Processor Fundamentals, Architectures & Features – Lapsley et al. 2000, S. Chand & Co.

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4. Digital Signal Processing Applications Using the ADSP-2100 Family by The Applications Engineering Staff of Analog Devices, DSP Division, Edited by Amy Mar, PHI.
5. The Scientist and Engineer's Guide to Digital Signal Processing by Steven W. Smith, Ph.D., California Technical Publishing, ISBN 0-9660176-3-3, 1997.

Mapping of COs with POs

COs	POs													PSO	
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**		**1**	**2**
CO1	3	1	1	1	-	-	-	-	2	1	2	2		2	1
CO2	3	3	1	1	-	-	-	-	2	1	2	2		2	1
CO3	3	3	1	1	-	-	-	-	2	1	2	2		2	1
CO4	3	3	1	1	-	-	-	-	2	1	2	2		2	1
CO5	3	3	1	1	-	-	-	-	2	1	2	2		2	1
AVG	**3**	**2.6**	**1**	**1**	**-**	**-**	**-**	**-**	**2**	**1**	**2**	**2**		**2**	**1**

1-Low, 2-Medium, 3-High, '-'- No correlation

24OBT205 IMAGE PROCESSING TECHNIQUES **L T P C**
3 0 0 3

COURSE OBJECTIVES

- To become familiar with digital image fundamentals.
- To get exposed to simple image enhancement techniques in Spatial and Frequency domain.
- To study the image segmentation and representation techniques.

UNIT I DIGITAL IMAGE FUNDAMENTALS **9**

Steps in Digital Image Processing – Components – Elements of Visual Perception – Image Sensing and Acquisition – Image Sampling and Quantization – Relationships between pixels - Color image fundamentals - RGB, HSI models, Two-dimensional mathematical preliminaries, 2D transforms - DFT, DCT.

UNIT II IMAGE ENHANCEMENT **9**

Spatial Domain: Gray level transformations – Histogram processing – Basics of Spatial Filtering Smoothing and Sharpening Spatial Filtering, Frequency Domain: Introduction to Fourier Transform– Smoothing and Sharpening frequency domain filters – Ideal, Butterworth and Gaussian filters, Homomorphic filtering, Color image enhancement.

UNIT III IMAGE RESTORATION **9**

Image Restoration - degradation model, Properties, Noise models – Mean Filters – Order Statistics – Adaptive filters – Band reject Filters – Band pass Filters – Notch Filters – Optimum Notch Filtering – Inverse Filtering – Wiener filtering .

UNIT IV IMAGE SEGMENTATION **9**

Edge detection, Edge linking via Hough transform – Thresholding - Region based segmentation Region growing – Region splitting and merging – Morphological processing- erosion and

dilation, Segmentation by morphological watersheds – basic concepts – Dam construction – Watershed segmentation algorithm.

UNIT V IMAGE COMPRESSION AND RECOGNITION **9**

Need for data compression, Huffman, Run Length Encoding, Shift codes, Arithmetic coding, JPEG standard, MPEG. Boundary representation, Boundary description, Fourier Descriptor, Regional Descriptors – Topological feature, Texture - Patterns and Pattern classes - Recognition based on matching.

TOTAL:45 PERIODS

COURSE OUTCOMES

On successful completion of this course, the students will be able to

CO1: Explain the basics and fundamentals of digital image processing, such as digitization, sampling, quantization, and 2D-transforms.

CO2: Operate on images using the techniques of smoothing, sharpening and enhancement.

CO3: Explore the restoration concepts and filtering techniques.

CO4: Learn the basics of segmentation, features extraction, compression and recognition methods for color models.

CO5: Comprehend image compression concepts.

TEXT BOOKS

1. Rafael C. Gonzalez, Richard E. Woods, 'Digital Image Processing', Pearson, Third Edition,2010.
2. Anil K. Jain, 'Fundamentals of Digital Image Processing', Pearson, 2002.
3. G. R. Sinha and B. C. Patel, Medical Image Processing Concepts and Applications, PHI, 2014.

REFERENCE BOOKS

1. Kenneth R. Castleman, 'Digital Image Processing', Pearson, 2006.
2. Rafael C. Gonzalez, Richard E. Woods, Steven Eddins, 'Digital Image Processing using MATLAB', Pearson Education, Inc., 2011.
3. D,E. Dudgeon and RM. Mersereau, 'Multidimensional Digital Signal Processing', Prentice Hall Professional Technical Reference, 1990.
4. William K. Pratt, 'Digital Image Processing', John Wiley, New York, 2002.
5. Milan Sonka et al 'Image processing, analysis and machine vision', Brookes/Cole, Vikas Publishing House, 2nd edition, 1999.

Mapping of COs with POs

COs	POs												PSO	
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
CO1	3	2	-	-	-	-	-	-	-	-	-	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
AVG	**3**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**2**	**3**	**2**

1-Low, 2-Medium, 3-High, '-'- No correlation

24OBT206 WIRELESS SENSOR NETWORKS **L T P C**
3 0 0 3

COURSE OBJECTIVES

- To understand the fundamentals of wireless sensor network.
- To gain knowledge on the MAC and Routing Protocols of WSN.
- To acquire knowledge on the protocols required for developing real time applications using WSN and 6LOWPAN.

UNIT I INTRODUCTION **9**

Principle of Wireless Sensor Network -Introduction to wireless sensor networks- Challenges, Comparison with ad hoc network, Node architecture and Network architecture, design principles, Service interfaces, Gateway, Short range radio communication standards-IEEE 802.15.4, Zigbee and Bluetooth. Physical layer and transceiver design considerations.

UNIT II MAC AND ROUTING PROTOCOLS **9**

MAC protocols – fundamentals, low duty cycle protocols and wakeup concepts, contention and Schedule-based protocols - SMAC, BMAC, TRAMA, Routing protocols – Requirements, Classification -SPIN, Directed Diffusion, COUGAR, ACQUIRE, LEACH, PEGASIS.

UNIT III 6LOWPAN **9**

6LoWPAN Architecture - protocol stack, Adaptation Layer, Link layers – Addressing, Routing - MeshUnder - Route-Over, Header Compression - Stateless header compression - Context-based header compression, Fragmentation and Reassembly, Mobility – types, Mobile IPv6, Proxy Home Agent, Proxy MIPv6, NEMO –Routing – MANET, ROLL, Border routing.

UNIT IV APPLICATION **9**

Design Issues, Protocol Paradigms -End-to-end, Real-time streaming and sessions, Publish/subscribe, Web service paradigms, Common Protocols -Web service protocols, MQ telemetry transport for sensor networks (MQTT-S), ZigBee compact application protocol (CAP),Service discovery, Simple network management protocol (SNMP), Real-time transport and sessions, Industry- Specific protocols.

UNIT V TOOLS **9**

TinyOS – Introduction, NesC, Interfaces, modules, configuration, Programming in TinyOS using NesC, TOSSIM, Contiki – Structure, Communication Stack, Simulation environment – Cooja simulator, Programming.

TOTAL:45 PERIODS

COURSE OUTCOMES

On successful completion of this course, the students will be able to

CO1: Design solutions for WSNs applications.

CO2: Develop efficient MAC and Routing Protocols.

CO3: Design solutions for 6LOWPAN applications.

CO4: Develop efficient layered protocols in 6LOWPAN.

CO5: Use Tiny OS and Contiki OS in WSNs and 6LOWPAN applications.

TEXT BOOKS

1. V. Daniel Hunt, Alber Puglia, Mike Puglia, "RFID: A guide for radio frequency identification", Wiley & Sons, Inc., Publication, 2011.
2. Roy Want, RFID Explained, Springer 2022.
3. Amin Rida, Li Yang, Manos M. Tentzeris, RFID Enabled Sensor Design and Applications, Artech House, 2010.

REFERENCE BOOKS

1. Holger Karl, Andreas willig, "Protocol and Architecture for Wireless Sensor Networks", John Wiley Publication, 2006.
2. Anna Forster, "Introduction to Wireless Sensor Networks", Wiley, 2017.
3. Zach Shelby Sensinode and Carsten Bormann, " 6LoWPAN: The Wireless Embedded".
4. Philip Levis, "TinyOS Programming", 2006 –www.tinyos.net.
5. The Contiki Operating System.http://www.sics.se/contiki.

Mapping of COs with POs

COs	POs												PSO	
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
CO1	3	3	2	2	2	1	-	-	-	-	2	2	2	2
CO2	3	3	2	2	2	1	-	-	-	-	-	2	2	2
CO3	3	3	3	2	2	1	-	-	-	-	-	3	2	2
CO4	3	3	3	3	2	2	-	-	-	-	-	2	2	2
CO5	2	-	1	1	3	2	-	-	-	-	-	2	2	2
AVG	**2.8**	**2.4**	**2.2**	**2**	**2.2**	**1.4**	**-**	**-**	**-**	**-**	**2**	**2.2**	**2**	**2**

1-Low, 2-Medium, 3-High, '-'- No correlation

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