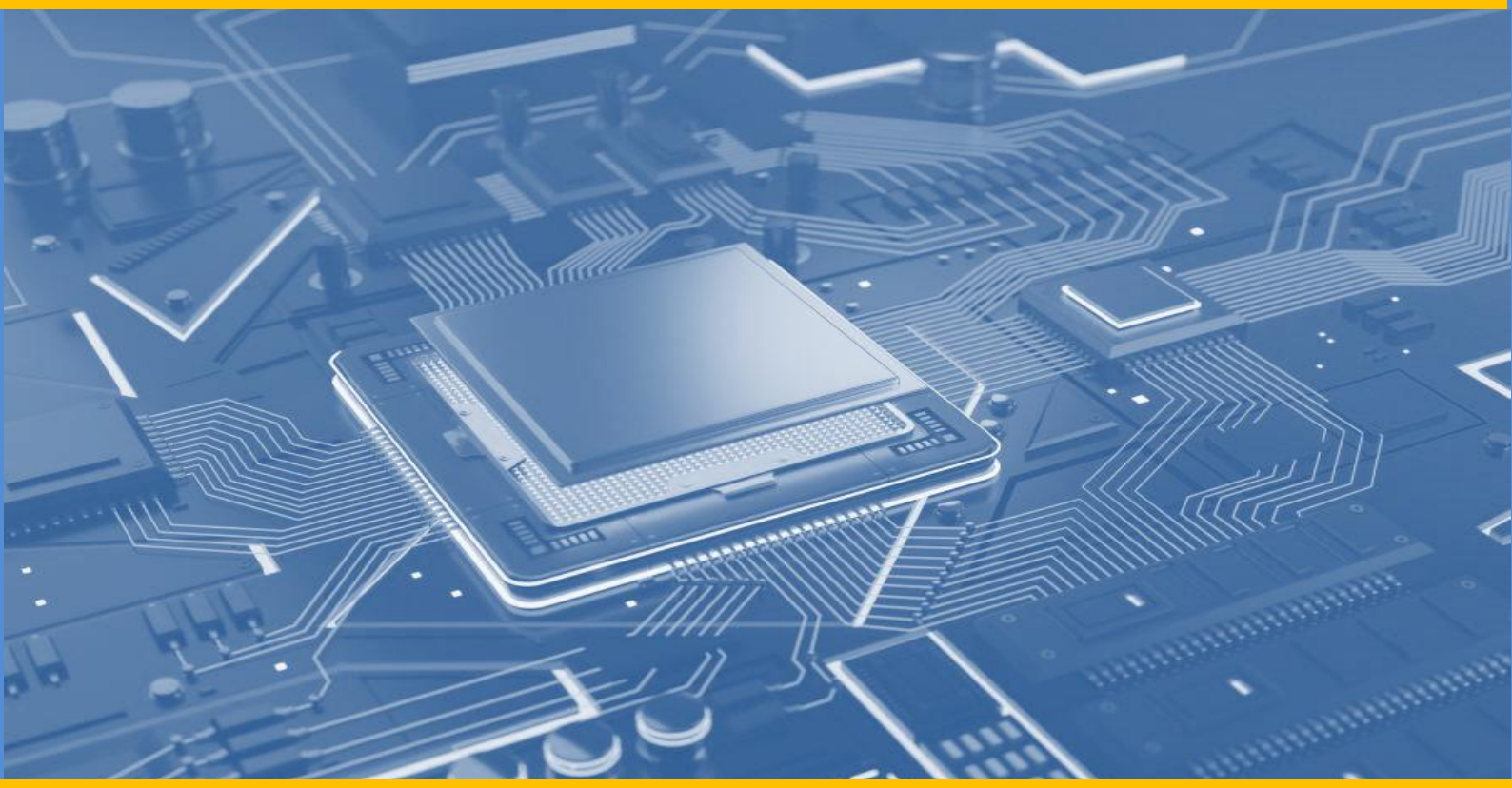
M.I.E.T. ENGINEERING COLLEGE

(Autonomous)

Tiruchirappalli-620007

Curriculum & Syllabus

(Regulations 2024)



B.E. Electronics and Communication Engineering

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 ELECTRONICS AND COMMUNICATION ENGINEERING

CURRICULUM AND SYLLABUS

B.E. ELECTRONICS AND COMMUNICATION ENGINEERING
(Regulations 2024)

Vision

To be a top-class technical hub in imparting knowledge in cutting edge areas of Electronics and Communication Engineering, providing pleasant learning environment, nurturing scholars of excellent proficiency to meet the global and socio-economic challenges of the country.

Mission

- ❖ To provide remarkable teaching and research environment through state-of-the-art facilities.
- ❖ To strengthen the soft as well as hard skills of students to achieve technical and academic excellence.
- ❖ To raise the students to become responsible citizens with good human values and encourage them to work for the well-being of society.
- ❖ To develop the skills of lifelong learning and professional growth of students through utilization of the high-standard infrastructure facilities.

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.
10. **Communication:** Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
11. **Project management and finance:** Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
12. **Life-long learning:** Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

Program Specific Outcomes (PSOs)

1. Able to develop and execute projects in the field of applied electronics to meet growing needs in the field of signal processing and IC Design.
2. Upskilled to identify and analyze communication engineering problems and solutions for for challenges faced in wireless and satellite communication.

Program Educational Objectives (PEOs)

1. To impart knowledge and prepare students to face professional and personal challenges and solve them technically and ethically
2. To encourage students to apply their skills in finding solutions for problems in the society.
3. To teach ethical and moral values in STEM Education.

Mapping of PEOs with POs & PSOs

PEOs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
PEO1	3	3	2	2	2	2	-	-	-	-	-	3	3	2
PEO2	3	3	3	3	2	-	-	-	2	1	2	3	3	3
PEO3	3	2	3	3	3	-	-	-	2	2	-	3	3	3

1 - Low, 2 - Medium, 3 – High

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.	24EE2102	Circuit Analysis	PCC	3	0	2	5	4
7.	24GE2103	Tamils and Technology தமிழரும் தொழில்நுட்பமும்	HSMC	1	0	0	1	1
8.	24GE2201	Engineering Practice Laboratory	ESC	0	0	4	4	2
			Total	**18**	**1**	**12**	**31**	**25**

SEMESTER III

S. NO.	COURSE CODE	COURSE TITLE	CATE GORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS PER WEEK	CREDITS
				L	T	P		
1.	24MU3103	Random Processes and Linear Algebra	BSC	3	1	0	4	4
2.	24EC3101	Data Structures and C ++	ESC	3	0	2	5	4
3.	24EC3102	Signals and Systems	PCC	3	0	2	5	4
4.	24EC3103	Electronic Devices and Circuits	PCC	3	0	0	3	3
5.	24EC3104	Digital Systems Design	PCC	3	0	0	3	3
6.	24ECPEXX	Professional Elective I	PEC	3	0	0	3	3
7.	24MC31XX	Mandatory Course I	MC	1	0	0	1	0
8.	24EC3201	Electronic Devices and Circuits Laboratory	PCC	0	0	3	3	1.5
9.	24EC3202	Digital Systems 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.	24EC4101	Linear Integrated Circuits	PCC	3	0	0	3	3
2.	24EC4102	Analog Communication	PCC	3	0	0	3	3
3.	24EC4103	Electromagnetic Field Theory	PCC	3	0	2	5	4
4.	24EC4104	Control System	PCC	3	0	2	5	4
5.	24CY4101	Environmental Science	BSC	2	0	0	2	2
6.	24ECPEXX	Professional Elective II	PEC	3	0	0	3	3
7.	24EC4201	Analog Communication Laboratory	PCC	0	0	3	3	1.5
8.	24EC4202	Linear Integrated Circuits Laboratory	PCC	0	0	3	3	1.5
9.	24GE4201	Technical Seminar	EEC	0	0	2	2	1
			Total	**17**	**0**	**12**	**29**	**23**

SEMESTER V

S. NO.	COURSE CODE	COURSE TITLE	CATEGORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS PER WEEK	CREDITS
				L	T	P		
1.	24EC5101	Digital Communication	PCC	3	0	0	3	3
2.	24EC5102	Transmission Lines and Wave Guides	PCC	3	0	2	5	4
3.	24EC5103	Digital Signal Processing	PCC	3	0	2	5	4
4.	24EC5104	Microprocessors and Microcontrollers	PCC	3	0	0	3	3
5.	24ECPEXX	Professional Elective III	PEC	3	0	0	3	3
6.	24ECPEXX	Professional Elective IV	PEC	3	0	0	3	3
7.	24MC51XX	Mandatory Course II	MC	1	0	0	1	0
8.	24EC5201	Digital Communication Laboratory	PCC	0	0	3	3	1.5
9.	24EC5202	Microprocessor and Microcontroller 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.	24EC6101	Antenna and Microwave	PCC	3	0	0	3	3
2.	24EC6102	VLSI and Chip Design	PCC	3	0	0	3	3
3.	24ECPEXX	Professional Elective V	PEC	3	0	0	3	3
4.	24ECPEXX	Professional Elective VI	PEC	3	0	0	3	3
5.	24ECPEXX	Professional Elective VII	PEC	3	0	2	5	4
6.	24OXXXXX	Open Elective I	OEC	3	0	2	5	4
8.	24EC6201	VLSI Laboratory	PCC	0	0	3	3	1.5
9.	24EC6202	Antenna and Microwave Laboratory	PCC	0	0	3	3	1.5
10.	24PD6201	NCC/NSS/NSO*#	-	2	0	0	2	2*#
			Total	**18**	**0**	**10**	**28**	**23**

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

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.	24EC7101	Embedded Systems Design	PEC	3	0	2	5	4
3.	24ECPEXX	Professional Elective VIII	PEC	3	0	2	5	4
4.	24OXXXXX	Open elective II	OEC	3	0	0	3	3
5.	24OXXXXX	Open elective III	OEC	3	0	0	3	3
6.	24EC7501	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.	24EC8501	Project Work	EEC	0	0	20	20	10
			Total	**0**	**0**	**20**	**20**	**10**

BASIC SCIENCE COURSE (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.	24MU3103	Random Processes and Linear Algebra	BSC	3	1	0	4	4
7.	24CY4101	Environmental Science	BSC	2	0	0	2	2
							Total	**25**

ENGINEERING SCIENCE COURSES (ESC)

S. NO.	COURSE CODE	COURSE TITLE	CATEGORY	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.	24EC3101	Data Structures and C++	ESC	3	0	2	5	4
							Total	**20**

HUMANITIES, SOCIAL SCIENCES AND MANAGEMENT COURSES (HSMC)

S. NO.	COURSE CODE	COURSE TITLE	CATEGORY	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 தொழில்நுட்பமும்	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	CATEGORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS PER WEEK	CREDITS
				L	T	P		
1.	24GE4201	Technical Seminar	EEC	0	0	2	2	1
2.	24EC7501	Mini Project	EEC	0	0	4	4	2
3.	24IS7201	Internship	EEC	-	-	-	-	1
4.	24CA7201	Case Study	EEC	-	-	-	-	1
5.	24EC8501	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.	24EE2102	Circuit Analysis	PCC	3	0	2	5	4
2.	24EC3102	Signals and Systems	PCC	3	0	2	5	4
3.	24EC3103	Electronic Devices and Circuits	PCC	3	0	0	3	3
4.	24EC3104	Digital Systems Design	PCC	3	0	0	3	3
5.	24EC3201	Electronic Devices and Circuits Laboratory	PCC	0	0	3	3	1.5
6.	24EC3202	Digital Systems Laboratory	PCC	0	0	3	3	1.5
7.	24EC4101	Linear Integrated Circuits	PCC	3	0	0	3	3
8.	24EC4102	Analog Communication	PCC	3	0	0	3	3
9.	24EC4103	Electromagnetic Field Theory	PCC	3	0	2	5	4
10.	24EC4104	Control System	PCC	3	0	2	5	4
11.	24EC4201	Analog Communication Laboratory	PCC	0	0	3	3	1.5
12.	24EC4202	Linear Integrated Circuits Laboratory	PCC	0	0	3	3	1.5
13.	24EC5101	Digital Communication	PCC	3	0	0	3	3
14.	24EC5102	Transmission Lines and Wave Guides	PCC	3	0	2	5	4
15.	24EC5103	Digital Signal Processing	PCC	3	0	2	5	4
16.	24EC5104	Microprocessors and Microcontrollers	PCC	3	0	0	3	3
17.	24EC5201	Digital Communication Laboratory	PCC	0	0	3	3	1.5
18.	24EC5202	Microprocessor and Microcontroller Laboratory	PCC	0	0	3	3	1.5
19.	24EC6101	Antenna and Microwave	PCC	3	0	0	3	3
20.	24EC6102	VLSI and Chip Design	PCC	3	0	0	3	3
21.	24EC6201	VLSI Laboratory	PCC	0	0	3	3	1.5
22.	24EC6202	Antenna and Microwave Laboratory	PCC	0	0	3	3	1.5
23.	24EC7101	Embedded Systems Design	PCC	3	0	2	5	4
							Total	**64**

PROFESSIONAL ELECTIVES COURSES (PEC)

SEMESTER III & IV, PROFESSIONAL ELECTIVE I & II
DEVICES AND NETWORKS

S. NO.	COURSE CODE	COURSE TITLE	CATE GORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS PER WEEK	CREDITS
				L	T	P		
1.	24ECPE01	Solid State Devices	PEC	3	0	0	3	3
2.	24ECPE02	Network Analysis and Synthesis	PEC	3	0	0	3	3
3.	24ECPE03	Wide Bandgap Devices	PEC	3	0	0	3	3
4.	24ECPE04	Sensors and Actuators	PEC	3	0	0	3	3
5.	24ECPE05	Applications of Linear Integrated Circuits	PEC	3	0	0	3	3
6.	24ECPE06	Network Security	PEC	3	0	0	3	3
7.	24ECPE07	Nano Electronics	PEC	3	0	0	3	3
8.	24ECPE08	EMI/EMC Testing	PEC	3	0	0	3	3

SEMESTER V, PROFESSIONAL ELECTIVE III & IV
RF TECHNOLOGIES AND COMMUNICATION SYSTEMS

S. NO.	COURSE CODE	COURSE TITLE	CATE GORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS PER WEEK	CREDITS
				L	T	P		
1.	24ECPE09	Wireless Communication	PEC	3	0	0	3	3
2.	24ECPE10	Optical Communication	PEC	3	0	0	3	3
3.	24ECPE11	Satellite Communication	PEC	3	0	0	3	3
4.	24ECPE12	Smart Antennas	PEC	3	0	0	3	3
5.	24ECPE13	RF Devices and Active Circuits	PEC	3	0	0	3	3
6.	24ECPE14	Artificial Intelligence and Machine Learning	PEC	3	0	0	3	3
7.	24ECPE15	Information Theory	PEC	3	0	0	3	3
8.	24ECPE16	Machine Learning in Communication Systems	PEC	3	0	0	3	3

SEMESTER VI, PROFESSIONAL ELECTIVE V & VI
SIGNAL PROCESSING AND TESTING ARCHITECHTURES

S. NO.	COURSE CODE	COURSE TITLE	CATE GORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS PERWEEK	CREDITS
				L	T	P		
1.	24ECPE17	Digital Speech Processing	PEC	3	0	0	3	3
2.	24ECPE18	Digital Image Processing	PEC	3	0	0	3	3
3.	24ECPE19	Biomedical Signal Processing	PEC	3	0	0	3	3
4.	24ECPE20	Digital Signal Processing for Wireless Communication	PEC	3	0	0	3	3
5.	24ECPE21	Computer Architecture and Organization	PEC	3	0	0	3	3
6.	24ECPE22	Electronic Systems: Essentials of SoCs	PEC	3	0	0	3	3
7.	24ECPE23	Pattern Recognition	PEC	3	0	0	3	3
8.	24ECPE24	VLSI Testing	PEC	3	0	0	3	3

SEMESTER VI & VII, PROFESSIONAL ELECTIVE VII & VIII
CHIP DESIGN TESTING AND IOT CONCEPTS

S. NO.	COURSE CODE	COURSE TITLE	CATE GORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS PER WEEK	CREDITS
				L	T	P		
1.	24ECPE25	Mixed Signal IC Design Testing	PEC	3	0	2	5	4
2.	24ECPE26	Low Power VLSI Design	PEC	3	0	2	5	4
3.	24ECPE27	Analog IC Design	PEC	3	0	2	5	4
4.	24ECPE28	MEMS and NEMS	PEC	3	0	2	5	4
5.	24ECPE29	IoT Processors	PEC	3	0	2	5	4
6.	24ECPE30	Software Defined Networks	PEC	3	0	2	5	4
7.	24ECPE31	Industrial IoT and Industry 4.0	PEC	3	0	2	5	4
8.	24ECPE32	RFID System Design and Testing	PEC	3	0	2	5	4

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

OPEN ELECTIVE COURSES (OEC)

OPEN ELECTIVES 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.	24OAI101	Web technology	OEC	3	0	2	5	4
6.	24OAI102	Object Oriented Programming	OEC	3	0	2	5	4
7.	24OAI103	Computational Data Analytics	OEC	3	0	2	5	4
8.	24OAI104	Networking concepts	OEC	3	0	2	5	4
9.	24OEI101	Control System Engineering	OEC	3	0	2	5	4
10.	24OEI102	Power Electronics and Drives	OEC	3	0	2	5	4
11.	24OEI103	PLC Programming	OEC	3	0	2	5	4
12.	24OEI104	Electronic Devices and Power Amplifier	OEC	3	0	2	5	4
13.	24OMI101	Internal Combustion Engines	OEC	3	0	2	5	4
14.	24OMI102	Testing of Engineering Materials	OEC	3	0	2	5	4
15.	24OMI103	Industrial Layout Design and Safety	OEC	3	0	2	5	4
16.	24OMI104	Product Design and Process Development	OEC	3	0	2	5	4

OPEN ELECTIVES 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.	24OAT201	Principles of programming languages	OEC	3	0	0	3	3
8.	24OAT202	Information security management	OEC	3	0	0	3	3
9.	24OAT203	Human computer interaction	OEC	3	0	0	3	3
10.	24OAT204	Computer application in agricultures	OEC	3	0	0	3	3

11.	24OAT205	Mobile computing	OEC	3	0	0	3	3
12.	24OAT206	Object oriented analysis and design	OEC	3	0	0	3	3
13.	24OET101	Electrical Vehicle Technologies	OEC	3	0	0	3	3
14.	24OET102	Power System	OEC	3	0	0	3	3
15.	24OET103	Circuit Theory	OEC	3	0	0	3	3
16.	24OET104	Advanced Electrical Machines	OEC	3	0	0	3	3
17.	24OET105	Hybrid Renewable Power Generation	OEC	3	0	0	3	3
18.	24OET106	Electrical Maintenance and Safety	OEC	3	0	0	3	3
19.	24OMT201	Bioenergy Conversion Technologies	OEC	3	0	0	3	3
20.	24OMT202	Automotive Materials, Components, Design and Testing	OEC	3	0	0	3	3
21.	24OMT203	Green Manufacturing Design and Practices	OEC	3	0	0	3	3
22.	24OMT204	Semiconductor Manufacturing	OEC	3	0	0	3	3
23.	24OMT205	Future Energy Resources and Mobility	OEC	3	0	0	3	3
24.	24OMT206	Failure Analysis and NDT Techniques	OEC	3	0	0	3	3

SUMMARY

S. No.	Subject Area	Credits Per Semester								Total Credit
		I	II	III	IV	V	VI	VII	VIII	
1.	Basic Science Course (BSC)	12	7	4	2	-	-	-	-	**25**
2.	Professional Core Courses (PCC)	-	4	13	17	17	9	4	-	**64**
3.	Professional Elective Courses (PEC)	-	-	3	3	6	10	4	-	**26**
4.	Open Elective Courses (OEC)	-	-	-	-	-	4	6	-	**10**
5.	Employability Enhancement Courses (EEC)	-	-	-	1	-	-	4	10	**15**
6.	Engineering Science Courses (ESC)	6	10	4	-	-	-	-	-	**20**
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

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

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: Understand 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.

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 & 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 & 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.

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: Understand 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 & 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.

Mapping of COs with POs & PSOs

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	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 PROGRAMS

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 merge sort.
8. Program to print n prime numbers.
9. Find multiplication of two matrix.
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: De compose 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.
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 & PSOs

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	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

24GE1101 தமிழர் மரபு **L T P C**

1 0 0 1

பாடத்தின் நோக்கங்கள்

- மாணவர்கள் மொழி மற்றும் இலக்கியம் பற்றி கற்றறிதல்.
- தமிழர்களின் பாரம்பரிய மரபு மற்றும் நாட்டுப்புற கலைகளை அறிந்து கொள்ளுதல்.
- தமிழர்களின் திணைக்கோட்பாடுகள் மற்றும் இந்திய பண்பாட்டிற்குத் தமிழர்களின் பங்களிப்பு பற்றி அறிந்து கொள்ளுதல்.

அலகு I மொழி மற்றும் இலக்கியம் 3

இந்திய மொழிக் குடும்பங்கள் - திராவிட மொழிகள் - தமிழ் ஒரு செம்மொழி - தமிழ் செவ்விலக்கியங்கள் - சங்க இலக்கியத்தின் சமயச் சார்பற்ற தன்மை – சங்க இலக்கியத்தில் பகிர்தல் அறம் - திருக்குறளில் மேலாண்மைக் கருத்துக்கள் - தமிழ்க் காப்பியங்கள் - தமிழகத்தில் சமண பௌத்த சமயங்களின் தாக்கம் - பக்தி இலக்கியம், ஆழ்வார்கள் மற்றும் நாயன்மார்கள் -சிற்றிலக்கியங்கள் - தமிழில் நவீன இலக்கியத்தின் வளர்ச்சி - தமிழ் இலக்கிய வரலாற்றில் பாரதியார் மற்றும் பாரதிதாசன் ஆகியோரின் பங்களிப்பு.

அலகு II மரபு -பாறை ஓவியங்கள் முதல் நவீன ஓவியங்கள் வரை சிற்பக்கலை 3

நடுகல் முதல் நவீன சிற்பங்கள் வரை - ஐம்பொன் சிலைகள் - பழங்குடியினர் மற்றும் அவர்கள் தயாரிக்கும் கைவினைப் பொருட்கள், பொம்மைகள் - தேர் செய்யும் கலை - சுடுமண் சிற்பங்கள் - நாட்டுப்புறத் தெய்வங்கள் - குமரி முனையில் திருவள்ளுவர் சிலை - இசைக் கருவிகள் – மிருதங்கம், பறை, வீணை, யாழ், நாதஸ்வரம் - தமிழர்களின் சமூக பொருளாதார வாழ்வில் கோவில்களின் பங்கு.

அலகு III நாட்டுப்புறக் கலைகள் மற்றும் வீரவிளையாட்டுகள் 3

தெருக்கூத்து, கரகாட்டம், வில்லுப்பாட்டு, கணியான் கூத்து, ஒயிலாட்டம், தோல்பாவைக் கூத்து, சிலம்பாட்டம், வளரி, புலியாட்டம், தமிழர்களின் விளையாட்டுகள்.

அலகு IV தமிழர்களின் திணைக்கோட்பாடு 3

தமிழகத்தின் தாவரங்களும் விலங்குகளும் - தொல்காப்பியம் மற்றும் சங்க இலக்கியத்தில் அகம் மற்றும் புறக்கோட்பாடுகள் – தமிழர்கள் போற்றிய அறக்கோட்பாடு - சங்க காலத்தில் தமிழகத்தில் எழுத்தறிவும், கல்வியும் - சங்க கால நகரங்களும் துறைமுகங்களும் - சங்க காலத்தில் ஏற்றுமதி மற்றும் இறக்குமதி - கடல்கடந்த நாடுகளில் சோழர்களின் வெற்றி.

அலகு V இந்திய தேசிய இயக்கம் மற்றும் இந்திய பண்பாட்டிற்குத் தமிழர்களின் பங்களிப்பு 3

இந்திய விடுதலைப் போரில் தமிழர்களின் பங்கு - இந்தியாவின் பிறப்பகுதிகளில் தமிழ்ப் பண்பாட்டின் தாக்கம் - சுயமரியாதை இயக்கம் - இந்திய மருத்துவத்தில், சித்த மருத்துவத்தின் பங்கு - கல்வெட்டுகள், கையெழுத்துப் படிகள் - தமிழ்ப் புத்தகங்களின் அச்சு வரலாறு.

TOTAL: 15 PERIODS

பாடநெறி முடிவுகள்

பாடதிட்டத்தை முடித்த பிறகு, மாணவர்கள் செய்ய கூடியவை:

CO1: செம்மொழி மற்றும் சமகால படைப்புகளில் கவனம் செலுத்தி, மொழிப்புலமை மற்றும் இலக்கிய பகுப்பாய்வின் முக்கியத்துவத்தை கற்றறிந்தனர்.

CO2: தமிழ் இலக்கியத்தின் பாரம்பரிய மரபு கலைகளை மாணவர்கள் அறிந்து கொண்டனர்.

CO3: சங்ககால இலக்கியங்களையும் இக்கால இலக்கிய கவிஞர்களின் தமிழையும் மாணவர்கள் அறிந்து கொண்டனர்.

CO4: தமிழ் இலக்கியத்தின் கலாச்சார மற்றும் சமூக தாக்கங்களை அறிந்து கொண்டனர்.

CO5: பண்டைக்கால மக்களின் தமிழ் அடையாளம் மற்றும் கலாச்சார பாரம்பரியத்தைப் பற்றி கற்றறிந்தனர்.

பாட புத்தகங்கள்

1. கே கே பிள்ளை "தமிழக வரலாறு - மக்களும் பண்பாடும்" தமிழ்நாடு பாடநூல் மற்றும் கல்வியியல் கழகம், 2004.
2. முனைவர் இல சுந்தரம், "கணினித் தமிழ்" , விகடன் பிரசுரம், 2015.
3. டாக்டர். எஸ் வி சுப்ரமணியன், டாக்டர். கே டி திருநாவுக்கரசு, "தமிழர்களின் வரலாற்றுப் பாரம்பரியம்", சர்வதேச தமிழாய்வு நிறுவனம்.

குறிப்பு புத்தகங்கள்

1. டாக்டர். சிங்காரவேலு, "தமிழர்களின் சமூக வாழ்க்கை", சர்வதேச தமிழாய்வு நிறுவனம்.
2. கீழடி "வைகை ஆற்றின் கரையில் உள்ள சங்க நகர நாகரிகம் கூட்டு" தொல்லியல் துறை, தமிழ்நாடு பாடநூல் மற்றும் கல்வி சேவைகள் கழகம், தமிழ்நாடு, 2015.
3. டாக்டர். கே கே பிள்ளை, "இந்திய வரலாறு" வெளியீடு ஆசிரியர்.
4. "பொருணை நாகரிகம்", தொல்லியல்துறை & தமிழ்நாடு பாடநூல் மற்றும் கல்வி சேவைகள் கழகம்.
5. ஆர் பாலகிருஷ்ணன், "வைகை, சிந்து நாகரிகத்தின் பயணம்" வெளியீடு – EMRL.

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	-
CO2	-	-	-	-	-	2	-	2	-	-	-	-	2	-
CO3	-	-	-	-	-	2	-	2	-	-	-	-	2	-
CO4	-	-	-	-	-	2	-	2	-	-	-	-	2	-
CO5	-	-	-	-	-	2	-	2	-	-	-	-	2	-
AVG	-	-	-	-	-	**2**	-	**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.

MS WORD **15**

1. Create and format a document.
2. Working with tables.
3. Working with Bullets and Lists.
4. Working with styles, shapes, smart art, charts.
5. Inserting objects, charts and importing objects from other office tools.
6. Creating and Using document templates.
7. Inserting equations, symbols and special characters.
8. Working with Table of contents and References, citations.
9. Insert and review comments.
10. Create bookmarks, hyperlinks, endnotes footnote.
11. Viewing document in different modes.
12. Working with document protection and security.
13. Inspect document for accessibility.

MS EXCEL **15**

1. Create worksheets, insert and format data.
2. Work with different types of data: text, currency, date, numeric etc.
3. Split, validate, consolidate, Convert data.

4. Sort and filter data.
5. Perform calculations and use functions: (Statistical, Logical, Mathematical, date, Time etc.,).
6. Work with Lookup and reference formulae.
7. Create and Work with different types of charts.
8. Use pivot tables to summarize and analysis data.
9. Perform data analysis using own formulae and functions.
10. Combine data from multiple worksheets using own formulae and built-in functions to generate results.
11. Export data and sheets to other file formats.
12. Working with macros.
13. Protecting data and Securing the workbook.

MS POWERPOINT **15**

1. Select slide templates, layout and themes.
2. Formatting slide content and using bullets and numbering.
3. Insert and format images, smart art, tables, charts.
4. Using Slide master, notes and handout master.
5. Working with animation and transitions.
6. Organize and Group slides.
7. Import or create and use media objects: audio, video, animation.
8. 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 & 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 2nd 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" (Updated version 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.

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	-	-	-	-	-	-	-	-	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

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.

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.

Mapping of COs with POs & PSOs

	POs												PSOs	
COs	**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 MATERIALS 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 CONDUCTINGMATERIALS **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 SEMICONDUCTINGMATERIALS **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 – 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 & 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) **6+12**

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: Understand the orthographic, isometric and perspective projections of simple solids.
CO4: Understand the development of section of solids and development of surfaces.
CO5: Understand 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 & 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 **9**

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 **9**

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 ENGINEERING 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: Understand 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: Understand the refrigeration, air conditioning systems, and psychrometric processes.

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 & 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

24EE2102 CIRCUIT ANALYSIS **L T P C**
3 0 2 4

COURSE OBJECTIVES

- To impart knowledge on solving circuits using network theorems.
- To introduce the concepts of resonance and transient response in circuits.
- To analyze the three phase AC circuits.

UNIT I BASIC CIRCUITS ANALYSIS **9**

Fundamentals concepts of R, L and C Elements-Energy Sources- Ohm's Law -Kirchhoff 's Laws – DC Circuits – Resistors in series and parallel circuits - A.C Circuits – Average and RMS Value -Mesh current and node voltage methods of analysis D.C and A.C Circuits. Network reduction: voltage and current division, source transformation – star-delta conversion.

UNIT II NETWORK REDUCTION AND THEOREMS **9**

Network Theorems – Superposition, Thevenin's and Norton's Theorem – Maximum power transfer theorem – Reciprocity Theorem – Millman's theorem.

UNIT III TRANSIENT RESPONSE ANALYSIS **9**

Introduction – Laplace transforms and inverse Laplace transforms- standard test signals – Transient response of RL, RC and RLC circuits using Laplace transform for Source free, Step input and Sinusoidal input.

UNIT IV RESONANCE AND COUPLED CIRCUITS **9**

Series and parallel resonance –frequency response – Quality factor and Bandwidth – Self and mutual inductance – Coefficient of coupling – Dot rule-Analysis of coupled circuits– Single Tuned circuits.

UNIT V THREE PHASE CIRCUITS **9**

Analysis of three phase 3-wire and 4-wire circuits with star and delta connected loads, balanced and unbalanced – phasor diagram of voltages and currents – power measurement in three phase circuits– Power Factor Calculations.

TOTAL: 45 PERIODS

LIST OF EXPERIMENTS

1. Simulation and experimental verification of finding equivalent resistance.
2. Simulation and experimental verification of DC electrical circuit problems using Kirchoff's law.
3. Simulation and experimental verification of AC electrical circuit problems using Kirchoff's law.
4. Simulation and experimental verification of electrical circuit problems using Thevenin's theorem.
5. Simulation and experimental verification of electrical circuit problems using Norton's theorem.
6. Simulation and experimental verification of electrical circuit problems using Superposition theorem.
7. Simulation and experimental verification of electrical circuit problems using Reciprocity theorem.
8. Simulation and experimental verification of electrical circuit problems using Maximum Power transfer theorem.
9. Simulation and Experimental validation of transient response of RLC circuits.
10. Simulation and Experimental validation of frequency response of RLC circuits.
11. Simulation and experimental verification of three phase balanced and unbalanced star connected circuits.
12. Simulation and experimental verification of three phase balanced and unbalanced delta connected circuits.

TOTAL: 30 PERIODS

COURSE OUTCOMES

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

CO1: Analyze the circuit parameters using circuit laws.
CO2: Apply network theorems for solving simple DC and AC circuits.
CO3: Analyze the transient behavior of RLC circuits.
CO4: Analyze the frequency response of series and parallel RLC circuits.
CO5: Compute power, line/phase voltage and currents of the given three phase circuits.

TEXT BOOKS

1. Sudhakar A and Shyam Mohan SP, "Circuits and Networks Analysis and Synthesis", McGraHill, 2015.
2. Chakrabarti A, "Circuits Theory (Analysis and synthesis), Dhanpat Rai & Sons, New Delhi, 2020.
3. Charles K. Alexander, Mathew N.O. Sadiku, "Fundamentals of Electric Circuits", 2nd Edition, McGraw Hill, 2019.

REFERENCE BOOKS

1. William H. HaytJr, Jack E. Kemmerly and Steven M. Durbin, "Engineering Circuits Analysis", McGraw Hill publishers, 9th edition, New Delhi, 2020.
2. Joseph A. Edminister, Mahmood Nahvi, "Electric circuits", Schaum's series, McGraw- Hill, First Edition, 2019.
3. M E Van Valkenburg, "Network Analysis", Prentice-Hall of India Pvt Ltd, New Delhi, 2015.
4. Richard C. Dorf and James A. Svoboda, "Introduction to Electric Circuits", 7th Edition, John Wiley Sons, Inc. 2018.
5. Allan H. Robbins, Wilhelm C. Miller, "Circuit Analysis Theory and Practice", Cengage Learning India, 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	3	3	2	3	-	-	-	-	-	-	-	3	-
CO2	2	3	3	2	3	-	-	-	-	-	-	-	3	-
CO3	2	3	3	2	3	-	-	-	-	-	-	-	3	-
CO4	2	3	3	2	3	-	-	-	-	-	-	-	3	-
CO5	2	3	3	2	3	-	-	-	-	-	-	-	3	-
AVG	**2**	**3**	**3**	**2**	**3**	-	-	-	-	-	-	-	**3**	-

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

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

பாடத்தின் நோக்கங்கள்

- மாணவர்கள் நெசவு மற்றும் பானைத் தொழில்நுட்பத்தைக் கற்றறிதல்.
- கட்டிட மற்றும் உற்பத்தித் தொழில்நுட்பத்தை அறிந்து கொள்ளுதல்.
- வேளாண்மை, நீர்பாசனம் மற்றும் அறிவியல் தமிழ், கணினித் தமிழ் தொழில்நுட்பத்தை அறிந்து கொள்ளுதல்.த

அலகு I நெசவு மற்றும் பானைத் தொழில்நுட்பம் 3

சங்க காலத்தில் நெசவுத் தொழில் - பானைத் தொழில்நுட்பம் - கருப்பு சிவப்பு பாண்டங்கள் - பாண்டங்களில் கீறல் குறியீடுகள்.

அலகு II வடிவமைப்பு மற்றும் கட்டிடத் தொழில்நுட்பம் 3

சங்க காலத்தில் வடிவமைப்பு மற்றும் கட்டுமானங்கள் - சங்க காலத்தில் வீட்டுப்பொருட்களில் வடிவமைப்பு - சங்க காலத்தில் கட்டுமானப் பொருட்களும் நடுகல்லும் - சிலப்பதிகாரத்தில் மேடை அமைப்பு பற்றிய விவரங்கள் - மாமல்லப்புரச் சிற்பங்களும்

கோயில்களும் - சோழர் காலத்துப் பெருங்கோயில்கள் மற்றும் பிற வழிபட்டுத் தலங்கள்- நாயக்கர் காலக் கோயில்கள் - மாதிரி கட்டமைப்புகள் பற்றி அறிதல் -மதுரை மீனாட்சி அம்மன் ஆலயம் மற்றும் திருமலை நாயக்கர் மஹால் - செட்டிநாட்டு வீடுகள் - பிரிட்டிஷ் காலத்தில் சென்னையில் இந்தோ - சரோசெனிக் கட்டிடக்கலை.

அலகு III உற்பத்தித் தொழில்நுட்பம் 3

கப்பல் கட்டும் கலை - உலோகவியல் - இரும்புத் தொழிற்சாலை - இரும்பை உருக்குதல் - எஃகு - வரலாற்றுச் சான்றுகளாக செம்பு மற்றும் தங்க நாணயங்கள் - நாணயங்கள் அச்சடித்தல் - மணி உருவாக்கும் தொழிற்சாலைகள் - கல்மணிகள், கண்ணாடி மணிகள் - சுடுமண் மணிகள் - சங்கு மணிகள் - எலும்புத் துண்டுகள் - தொல்லியல் சான்றுகள் - சிலப்பதிகாரத்தில் மணிகளின் வகைகள்.

அலகு VI வேளாண்மை மற்றும் நீர்பாசனத் தொழில்நுட்பம் 3

அணை, ஏரி, குளம், மதகு - சோழர்காலக் குமிழித் தூம்பின் முக்கியத்துவம் - கால்நடை பராமரிப்பு - கால்நடைகளுக்காக வடிவமைக்கப்பட்ட கிணறுகள் - வேளாண்மை மற்றும் வேளாண்மைச் சார்ந்த செயல்பாடுகள் - கடல்சார் அறிவு - மீன்வளம் - முத்து மற்றும் முத்துக்குளித்தல் - பெருங்கடல் குறித்த பண்டைய அறிவு - அறிவு சார் சமூகம்.

அலகு V அறிவியல் தமிழ் மற்றும் கணித்தமிழ் 3

அறிவியல் தமிழின் வளர்ச்சி - கணித்தமிழ் வளர்ச்சி - தமிழ் நூல்களை மின்பதிப்பு செய்தல் - தமிழ் மென்பொருட்கள் உருவாக்கம் - தமிழ் இணையக் கல்விக்கழகம் - தமிழ் மின் நூலகம் - இணையத்தில் தமிழ் அகராதிகள் - சொற்குவைத் திட்டம்.

TOTAL: 15 PERIODS

பாடநெறி முடிவுகள்

பாடதிட்டத்தை முடித்த பிறகு, மாணவர்கள் செய்ய கூடியவை

CO1: மாணவர்கள் நெசவு மற்றும் பானைத் தொழில்நுட்பத்தைக் கற்றறிந்தனர்.

CO2: கட்டிடத் தொழில்நுட்ப முக்கியத்துவத்தை அறிந்து கொண்டனர்.

CO3: உற்பத்தித் தொழில்நுட்பத்தை கற்றறிந்தனர்.

CO4: வேளாண்மை மற்றும் நீர்பாசனம் தொழில்நுட்பங்களை தெரிந்துகொண்டனர்.

CO5: அறிவியல் தமிழ் மற்றும் கணித் தமிழ் தொழில்நுட்பத்தை அறிந்துகொண்டனர்.

பாட புத்தகங்கள்

1. கே கே பிள்ளை "தமிழக வரலாறு - மக்களும் பண்பாடும்", தமிழ்நாடு பாடநூல் மற்றும் கல்வியியல் கழகம், 2004.
2. முனைவர் இல சுந்தரம், "கணினித் தமிழ்", விகடன் பிரசுரம், 2015.
3. டாக்டர். எஸ் வி சுப்ரமணியன், டாக்டர். கே டி திருநாவுக்கரசு, "தமிழர்களின் வரலாற்றுப் பாரம்பரியம்", சர்வதேச தமிழாய்வு நிறுவனம்.

குறிப்பு புத்தகங்கள்

1. டாக்டர் சிங்காரவேலு, "தமிழர்களின் சமூக வாழ்க்கை", சர்வதேச தமிழாய்வு நிறுவனம்.
2. கீழடி - "வைகை ஆற்றின் கரையில் உள்ள சங்க நகர நாகரிகம் கூட்டு" தொல்லியல் துறை & தமிழ்நாடு பாடநூல் மற்றும் கல்வி சேவைகள் கழகம், தமிழ்நாடு, 2015.
3. டாக்டர். கே கே பிள்ளை, "இந்திய வரலாறு" வெளியீடு ஆசிரியர்.
4. "பொருணை நாகரிகம்", தொல்லியல் துறை, தமிழ்நாடு பாடநூல் மற்றும் கல்வி சேவைகள் கழகம்.
5. ஆர். பாலகிருஷ்ணன், "வைகை, சிந்து நாகரிகத்தின் பயணம்" வெளியீடு (EMRL).

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	-
CO2	-	-	-	-	-	2	-	2	-	-	-	-	2	-
CO3	-	-	-	-	-	2	-	2	-	-	-	-	2	-
CO4	-	-	-	-	-	2	-	2	-	-	-	-	2	-
CO5	-	-	-	-	-	2	-	2	-	-	-	-	2	-
AVG	-	-	-	-	-	**2**	-	**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 & 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

24MU3103 RANDOM PROCESSES AND LINEAR ALGEBRA **L T P C**
3 1 0 4

COURSE OBJECTIVES

- To understand the basic concepts of probability, one and two dimensional random variables and to introduce some standard distributions applicable to engineering which can describe real life phenomenon.
- To provide necessary basics in probability that are relevant in applications such as random signals, linear systems in communication engineering..
- To understand the concepts of vector space, linear transformations, inner product spaces and orthogonalization.

UNIT I PROBABILITY AND RANDOM VARIABLES **9+3**

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+3**

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 RANDOM PROCESSES **9+3**

Classification – Stationary process – Markov process – Poisson process – Discrete parameter, Markov chain – Chapman Kolmogorov equations (Statement only) – Limiting distributions – Auto Correlation – Properties.

UNIT IV VECTOR SPACES **9+3**

Vector spaces – Subspaces – Linear combinations and linear system of equations – Linear independence and linear dependence – Bases and dimensions.

UNIT V LINEAR TRANSFORMATION AND INNER PRODUCT SPACES **9+3**

Linear transformation – Null spaces and ranges – Dimension theorem – Matrix representation of linear transformations – Inner product – Norms – Gram Schmidt orthogonalization process – Adjoint of linear operations – Least square approximation.

TOTAL:45 PERIODS

COURSE OUTCOMES

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

CO1: Solve the probability and random variable problems.

CO2:Apply the one-dimensional random variable techniques for engineering applications.

CO3: Apply the random process techniques for solving correlation problems.

CO4: Apply the vector space method to solve the linear system of equation.

CO5: Apply the linear transformation for orthogonal problems.

TEXT BOOKS

1. Gross, D., Shortle, J.F, Thompson, J.M and Harris. C.M., "Fundamentals of Queueing Theory", Wiley Student 4th Edition, 2014.
2. Ibe, O.C., "Fundamentals of Applied Probability and Random Processes", Elsevier,1st Indian Reprint, 2007.
3. Friedberg. A.H., Insel. A.J. and Spence. L., "Linear Algebra", Prentice Hall of India, New Delhi,4th Edition, 2004.

REFERENCE BOOKS

1. Hsu, "Schaum's Outline of Theory and Problems of Probability, Random Variables and Random Processes", Tata McGraw Hill Edition, New Delhi, 2004.
2. Trivedi, K.S., "Probability and Statistics with Reliability, Queueing and Computer Science Applications", 2nd Edition, John Wiley and Sons, 2002.
3. Yates, R.D. and Goodman. D. J., "Probability and Stochastic Processes", 2nd Edition, Wiley India Pvt. Ltd., Bangalore, 2014.
4. Kolman. B. Hill. D.R., "Introductory Linear Algebra", Pearson Education, New Delhi, First Reprint, 2009.
5. Kumerasan.S, "Linear Algebra - A Geometric Approach", Prentice - Hall of India, New Delhi, Reprint, 2010.

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	-	-
CO2	3	3	-	-	-	-	-	-	3	-	-	2	-	-
CO3	3	3	-	-	-	-	-	-	3	-	-	2	-	-
CO4	3	3	-	-	-	-	-	-	3	-	-	2	-	-
CO5	3	3	-	-	-	-	-	-	3	-	-	2	-	-
AVG	**3**	**3**	-	-	-	-	-	-	**3**	-	-	**2**	-	-

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

24EC3101 DATA STRUCTURES AND C++ **L T P C**
3 0 2 4

COURSE OBJECTIVES

- To introduce the basics of C programming language.
- To introduce the concepts of advanced features of C.
- To understand the concepts of ADTs and linear data structures.

UNIT I C PROGRAMMING FUNDAMENTALS **9**

Data Types – Variables – Operations – Expressions and Statements – Conditional Statements – Functions – Recursive Functions – Arrays – Single and Multi-Dimensional Arrays.

UNIT II C PROGRAMMING - ADVANCED FEATURES USING 9

Structures – Union – Enumerated Data Types – Pointers: Pointers to Variables, Arrays and Functions – File Handling – Preprocessor Directives.

UNIT III LINEAR AND NON-LINEAR DATA STRUCTURES USING C++ 9

Abstract Data Types (ADTs) – List ADT – Array-Based Implementation – Linked List – DoublyLinked Lists – Circular Linked List – Stack ADT – Implementation of Stack – Applications – Queue ADT – Trees – Binary Trees – Tree Traversals –Binary Search Tree – Hashing - Hash Functions – Separate Chaining – Open Addressing – Linear Probing– Quadratic Probing.

UNIT IV SORTING AND SEARCHING TECHNIQUES USING C++ 9

Insertion Sort – Quick Sort – Heap Sort – Merge Sort –Linear Search – Binary Search.

UNIT V APPLICATIONS OF DATA STRUCTURES USING C++ 9

Stack: Postfix, Prefix, Infix expressions evaluation and conversion. Queue: Job Scheduling Problems - Graphs and Trees: Dijstra's Algorithm for shortest path - Prim's algorithm for Minimum spanning Trees - Searching and Indexing in Databases - Hash file organization.

TOTAL:45 PERIODS

LIST OF EXPERIMENTS

Using C

1. Array implementation of Stack, Queue and Circular Queue ADTs.
2. Implementation of Singly Linked List.
3. Linked list implementation of Stack and Linear Queue ADTs.

Using C++

1. Implementation of Evaluating Postfix Expressions, Infix to Postfix conversion.
2. Implementation of Dijkstra's Algorithm and Prim's Algorithm.
3. Implementation of Linear Search and Binary Search.
4. Implementation of Insertion Sort, Merge Sort and Selection Sort.
5. Implementation of Open Addressing (Linear Probing and Quadratic Probing).

TOTAL:30 PERIODS

COURSE OUTCOMES

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

CO1: Develop C programs for any real world/technical application.

CO2: Apply advanced features of C in solving problems.

CO3: Implement linear and non–linear data structure operations.

CO4: Develop suggest and use appropriate linear/non–linear data structure operations for solving a given problem.

CO5: Apply appropriate hash functions that result in a collision free scenario for data storage and retrieval.

TEXT BOOKS

1. Mark Allen Weiss, "Data Structures and Algorithm Analysis in C", Second Edition, Pearson Education, 2023.
2. ReemaThareja, "Programming in C", 2nd Edition, Oxford University Press, 2016.
3. Pradip Dey and Manas Ghosh, Programming in C, 2nd Ed., Oxford University Press, 2011.

REFERENCE BOOKS

1. Brian W. Kernighan, Rob Pike, "The Practice of Programming", Pearson Education, 2022.
2. Paul J. Deitel, Harvey Deitel, "C How to Program", Seventh Edition, Pearson Education, 2013.
3. Santosh Kumar Mishra, "The Art of Data Structures and Algorithms : The Ultimate Quick Reference Guide", Kindle Edition,2023.
4. Ellis Horowitz, SartajSahni and Susan Anderson, "Fundamentals of Data Structures", Galgotia, 2008.
5. Jean-Paul Tremblay and Paul G. Sorenson, ―An Introduction to Data Structures with Applications, Second Edition, Tata McGraw-Hill, 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	2	3	1	2	2	1	1	-	1	2	1	3	2	3
CO2	1	2	1	2	2	-	-	-	1	1	1	2	2	2
CO3	2	3	1	2	3	-	-	-	1	1	1	2	2	2
CO4	2	1	-	1	1	-	-	-	2	1	1	2	2	1
CO5	1	2	1	2	2	1	1	-	1	2	1	3	2	3
AVG	**2**	**2**	**1**	**2**	**2**	**1**	**1**	-	**1**	**1**	**1**	**2**	**2**	**2**

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

24EC3102 SIGNALS AND SYSTEMS **L T P C**

3 0 2 4

COURSE OBJECTIVES

- To introduce the basic properties of signal & systems.
- To introduce the methods of characterization of LTI systems in time domain.
- To analyze continuous time signals and system in the Fourier and Laplace domain.

UNIT I CLASSIFICATION OF SIGNALS AND SYSTEMS **9**

Standard signals- Step, Ramp, Pulse, Impulse, Real and complex exponentials and Sinusoids_Classification of signals – Continuous time (CT) and Discrete Time (DT) signals, Periodic & Aperiodic signals, Deterministic & Random signals, Energy & Power signals - Classification of systems - CT systems and DT systems – Linear & Nonlinear, Time-variant & Time-invariant,Causal & Non-causal, Stable & Unstable.

UNIT II ANALYSIS OF CONTINUOUS TIME SIGNALS **9**

Fourier transform of aperiodic signals, standard signals and periodic signals - Properties of Fourier transforms - Hilbert transform and its properties - Laplace transforms - Region of Conversion and its properties - Inverse Laplace transform.

UNIT III LINEAR TIME INVARIANT CONTINUOUS TIME SYSTEMS **9**

Continuous-time Systems and its properties - Impulse response - convolution integrals- Differential Equation- Fourier and Laplace transforms in Analysis of CT systems - Systems connected in series / parallel.

UNIT IV ANALYSIS OF DISCRETE TIME SIGNALS **9**

Baseband and Pass band signal Sampling– Fourier Transform of discrete time signals (DTFT)– Properties of DTFT - Z Transform & Properties - Analysis of LSI systems using Z – transform Sampling and reconstruction of band limited signals. Low pass and band pass sampling theorems. Aliasing - Anti-aliasing filter - Practical Sampling-aperture effect.

UNIT V LINEAR TIME INVARIANT-DISCRETE TIME SYSTEMS **9**

Impulse response–Difference equations-Convolution sum- Discrete Fourier Transform and Z Transform Analysis of Recursive & Non-Recursive systems - DT systems connected in series and parallel.

TOTAL:45 PERIODS

LIST OF EXPERIMENTS

1. Realization of correlation of two discrete signals.
2. Realization of convolution.
3. SNR and Power spectral density estimation of signals
4. Removal of noise by Autocorrelation / Cross correlation
5. Finding the Fourier Transform of a given signal and plotting its magnitude and phase spectrum.
6. Waveform synthesis using Laplace Transform.
7. Extraction of Periodic Signal masked by noise using Correlation.
8. Finding the even and odd parts of Signals/Sequence and Real and Imaginary parts of signal.

TOTAL:30 PERIODS

COURSE OUTCOMES

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

CO1: Determine if a given system is linear/causal/stable.

CO2: Determine the frequency components present in a deterministic signal.

CO3: Characterize continuous LTI systems in the time domain and frequency domains.

CO4: Characterize discrete LTI systems in the time domain and frequency domains.

CO5: Compute the output of an LTI system in the time and frequency domains.

TEXT BOOKS

1. Oppenheim, Willsky and Hamid, "Signals and Systems", 2nd Edition, Pearson Education, New Delhi, 2015.
2. Simon Haykin, Barry Van Veen, "Signals and Systems", 2nd Edition, Wiley, 2002.
3. M.Mandal and A.Asif, "Continuous and Discrete Time Signals and Systems, Cambridge, 2007.

REFERENCE BOOKS

1. B. P. Lathi, "Principles of Linear Systems and Signals", 2nd Edition, Oxford, 2009.
2. M. J. Roberts, "Signals and Systems Analysis using Transform methods and MATLAB", McGraw- Hill Education, 2018.
3. John Alan Stuller, "An Introduction to Signals and Systems", Thomson, 2007.
4. D.C.Lay, "Linear Algebra and its Applications (2/e)", Pearson, 2008.
5. S.S.Soliman & M.D.Srinath, "Continuous and Discrete Signals and Systems", Prentice- Hall, 2019.

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	-	-
CO2	3	-	3	-	-	2	-	-	-	-	-	3	-	3
CO3	3	3	-	-	3	2	-	-	-	-	-	3	2	-
CO4	3	3	-	-	3	2	-	-	-	-	-	3	-	3
CO5	3	3	-	3	3	2	-	-	-	-	-	3	-	3
AVG	3	3	3	3	3	2	-	-	-	-	-	3	2	3

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

24EC3103 ELECTRONIC DEVICES AND CIRCUITS **L T P C**
3 0 0 3

COURSE OBJECTIVES

- To introduce to give a comprehensive exposure to all types of devices and circuits constructed with discrete components.
- To introduce to analyze the frequency response of small signal amplifiers.
- To design and analyze single stage and multistage amplifier circuits

UNIT I SEMICONDUCTOR DEVICES **9**

PN junction diode, Zener diode, BJT, MOSFET, UJT –structure, operation and V-I characteristics, diffusion and transition capacitance - Rectifiers – Half Wave and Full Wave Rectifier, Zener as regulator.

UNIT II AMPLIFIERS **9**

Load line, operating point, biasing methods for BJT and MOSFET, BJT small signal model – Analysis of CE, CB, CC amplifiers- Gain and frequency response –MOSFET small signal model–Analysis of CS, CG and Source follower – Gain and frequency response.

UNIT III MULTISTAGE AMPLIFIERS AND DIFFERENTIAL AMPLIFIER 9

Cascode amplifier, Differential amplifier – Common mode and Difference mode analysis – MOSFET input stages – tuned amplifiers – Gain and frequency response.

UNIT IV FEEDBACK AMPLIFIERS AND OSCILLATORS 9

Advantages of negative feedback – Voltage / Current, Series , Shunt feedback Amplifiers – positive feedback–Condition for oscillations, RC phase shift , Wien bridge, Hartley, Colpitts and Crystal oscillators.

UNIT V POWER AMPLIFIERS AND DC/DC CONVERTERS 9

Power amplifiers - Class A-Class B-Class AB-Class C- Class AB - DC/DC convertors – Buck, Boost, Buck-Boost analysis and design.

TOTAL:45 PERIODS

COURSE OUTCOMES

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

CO1: Explain the structure and working operation of basic electronic devices.
CO2: Explore to design and analyze the amplifiers.
CO3: Analyze frequency response of BJT and MOSFET amplifiers.
CO4: Design and analyze feedback amplifiers and oscillator principles.
CO5: Analyze power amplifiers and supply circuits.

TEXT BOOKS

1. David A. Bell, "Electronic Devices and Circuits", Oxford Higher Education press, 5 th Edition, 2010.
2. Robert L. Boylestad and Louis Nasheresky, “Electronic Devices and Circuit Theory”, 10th Edition, Pearson Education / PHI, 2008.
3. Adel .S. Sedra, Kenneth C. Smith, "Micro Electronic Circuits", Oxford University Press, 7th Edition, 2014.

REFERENCE BOOKS

1. Donald.A. Neamen, "Electronic Circuit Analysis and Design", Tata McGraw Hill, 3rd Edition, 2010.
2. D.Schilling and C.Belove, "Electronic Circuits: Discrete & Integrated", McGraw Hill, 3rd Edition, 2002.
3. Muhammad H.Rashid, "Power Electronics", Pearson Education / PHI , 2004.
4. L.Macdonald & A.C.Lowe, Display Systems, Wiley, 2003Robert Pierret, “Semiconductor Device Fundamentals,” Pearson Education, 2006.
5. J.Millman and C.C.Halkias: Millman's Electronic devices and Circuits, McGraw Hill, 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	3	3	2	1	-	-	-	-	-	1	2	1
CO2	3	2	2	3	2	2	-	-	-	-	-	1	2	1
CO3	3	3	3	2	1	2	-	-	-	-	-	1	2	1
CO4	3	3	3	3	2	2	-	-	-	-	-	1	2	1
CO5	3	2	2	2	2	1	-	-	-	-	-	1	2	1
AVG	**3**	**3**	**3**	**3**	**2**	**2**	-	-	-	-	-	**1**	**2**	**1**

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

24EC3104 DIGITAL SYSTEMS DESIGN **L T P C**
3 0 0 3

COURSE OBJECTIVES

- To introduce the fundamentals of digital circuits and simplification methods.
- To introduce the design of various combinational digital circuits using logic gates.
- To analysis and design procedures for synchronous and asynchronous sequential circuits.

UNIT I BASIC CONCEPTS **9**

Review of number systems - representation - conversions, Review of Boolean algebra-theorems, sum of product and product of sum simplification, canonical forms min term and max term, Simplification of Boolean expressions - Karnaugh map, Implementation of Boolean expressions using universal gates.

UNIT II COMBINATIONAL LOGIC CIRCUITS **9**

Problem formulation and design of combinational circuits - Code-Converters, Half and Full Adders, Binary Parallel Adder – Carry look ahead Adder, BCD Adder, Magnitude Comparator, Decoder, Encoder, Priority Encoder, Mux/Demux.

Case study: Digital trans-receiver / 8 bit Arithmetic and logic unit, Parity Generator/Checker, Seven Segment display decoder.

UNIT III SYNCHRONOUS SEQUENTIAL CIRCUITS **9**

Latches, Flip flops – SR, JK, T, D, Master/Slave FF, Triggering of FF, Analysis and design of clocked sequential circuits – Design - Moore/Mealy models, state minimization, state assignment - Counters, Ripple Counters, Ring Counters, Shift registers, Universal Shift Register.

UNIT IV ASYNCHRONOUS SEQUENTIAL CIRCUITS **9**

Stable and Unstable states, output specifications, cycles and races, state reduction, race free assignments, Hazards, Essential Hazards, Fundamental and Pulse mode sequential circuits.

UNIT V LOGIC FAMILIES AND PROGRAMMABLE LOGIC DEVICES 9

Logic families - Propagation Delay, Fan - In and Fan - Out - Noise Margin - RTL, TTL, ECL, CMOS - Comparison of Logic families - Implementation of combinational logic/sequential logic design using standard ICs, PROM, PLA and PAL, basic memory, static ROM, PROM, EPROM, EEPROM, EAPROM.

TOTAL:45 PERIODS

COURSE OUTCOMES

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

CO1: Determine and use Boolean algebra and simplification procedures relevant to digital logic.

CO2: Explain and design the various combinational digital circuits using logic gates.

CO3: Analyse and design synchronous sequential circuits.

CO4: Analyse and design asynchronous sequential circuits.

CO5: Build logic gates and use programmable devices.

TEXT BOOKS

1. M. Morris Mano and Michael D. Ciletti, 'Digital Design', Pearson, 5th Edition, 2013.
2. M.J.S.Smith, "Application Specific Integrated Circuits", Pearson, 2008.
3. S.Sutherland, S. Davidmann, P. Flake, "System Verilog for Design", (2/e), Springer, 2006.

REFERENCE BOOKS

1. Charles H. Roth, Jr, 'Fundamentals of Logic Design', Jaico Books, 4th Edition, 2002.
2. William I. Fletcher, "An Engineering Approach to Digital Design", Prentice- Hall of India, 2015.
3. Floyd T.L., "Digital Fundamentals", Charles E. Merril publishing company,1982.
4. John. F. Wakerly, "Digital Design Principles and Practices", Pearson Education, 4th Edition,2007.
5. H.Gerez, "Algorithms for VLSI Design Automation", John Wiley, 2006.

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	-	-	-	-	3	3	3	3
CO2	-	-	-	-	-	-	-	-	-	-	2	1	2	3
CO3	-	3	3	2	-	2	-	-	-	-	2	2	3	3
CO4	-	-	-	-	-	-	-	-	-	-	3	2	2	3
CO5	-	3	3	3	-	-	-	-	-	-	2	2	3	3
AVG	**3**	**2.6**	**2.6**	**2.3**	**-**	**2**	**-**	**-**	**-**	**-**	**2**	**2**	**3**	**3**

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

24EC3201 ELECTRONIC DEVICES AND CIRCUITS LABORATORY **L T P C**
0 0 3 1.5

COURSE OBJECTIVES

- To learn the characteristics of PN Junction diode and Zener diode.
- To understand the operation of rectifiers and filters.
- To design and analyze the characteristics of amplifier.

LIST OF EXPERIMENTS

1. Characteristics of PN Junction Diode and Zener diode.
2. Full Wave Rectifier with Filters.
3. Design of Zener diode Regulator.
4. Common Emitter input-output Characteristics.
5. MOSFET Drain current and Transfer Characteristics.
6. Frequency response of CE and CS amplifiers.
7. Frequency response of CB and CC amplifiers.
8. Frequency response of Cascode Amplifier.
9. CMRR measurement of Differential Amplifier.
10. Analysis of Wein Bridge Oscillator,RC Phase shift oscillator using Spice.
11. Analysis of power amplifier using Spice.
12. Analysis of Hartley and Colpitts oscillator using Spice.

COURSE OUTCOMES

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

CO1: Explain the characteristics of PN Junction Diode and Zener diode.
CO2: Design and Testing of BJT and MOSFET amplifiers.
CO3: Analyze the Operation of differential amplifiers.
CO4: Design and analyze feedback amplifiers and oscillator principles.
CO5: Design and analyze power amplifiers and supply circuits.

TOTAL:45 PERIODS

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	3	2	1	-	-	-	-	1	3	2	1
CO2	2	2	3	3	2	1	-	-	-	-	1	1	2	1
CO3	2	-	2	3	1	1	-	-	-	-	1	2	2	1
CO4	-	-	-	-	3	1	-	-	-	-	1	2	2	1
CO5	-	-	-	-	2	1	-	-	-	-	1	2	2	1
AVG	**2**	**2**	**2.6**	**3**	**2**	**1**	**-**	**-**	**-**	**-**	**1**	**2**	**2**	**1**

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

24EC3202 DIGITAL SYSTEMS LABORATORY **L T P C**
0 0 3 1.5

COURSE OBJECTIVES

- To learn the to design and implement the sequential logic circuits.
- To introduce the fundamentals of digital circuits and simplification methods.
- To introduce the design of various combinational digital circuits using logic gates.

LIST OF EXPERIMENTS

1. Study of Logic gates and implementation of Boolean Functions.
2. Parity generator and parity checking.
3. Design and implementation of code converters using logic gates(i) BCD to excess-3 code and vice versa (ii) Binary to gray and vice-versa.
4. Design and implementation of 4 bit binary Adder/ Subtractor and BCD adder.
5. Design and implementation of Multiplexer and De-multiplexer using logic gates.
6. Design and implementation of encoder and decoder using logic gates.
7. Construction and verification of 4 bit ripple counter.
8. Design and implementation of 3-bit synchronous up/down counter.
9. Design of Magnitude Comparators.
10. Shift Registers: Design and implementation of 4-bit shift registers in SISO, SIPO, PISO, PIPO modes using suitability IC's.
11. Coding combinational circuits using HDL.
12. Coding sequential circuits using HDL.

COURSE OUTCOMES

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

CO1: Determine and use Boolean algebra and simplification procedures relevant to digital logic.

CO2: Explain and design the various combinational digital circuits using logic gates.

CO3: Analyse and design synchronous sequential circuits like registers.

CO4: Analyse and design Implement sequential circuits like counters.

CO5: Simulate combinational and sequential circuits using HDL.

TOTAL:45 PERIODS

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	-	-	-	-	3	3	3	3
CO2	-	-	-	-	-	-	-	-	-	-	2	1	2	3
CO3	-	3	3	2	-	2	-	-	-	-	2	2	3	3
CO4	-	-	-	-	-	-	-	-	-	-	3	2	2	3
CO5	-	3	3	3	-	-	-	-	-	-	2	2	3	3
AVG	**3**	**2.6**	**2.6**	**2.3**	**-**	**2**	**-**	**-**	**-**	**-**	**2**	**2**	**3**	**3**

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

24EC4101 LINEAR INTEGRATED CIRCUITS **L T P C**
3 0 0 3

COURSE OBJECTIVES

- To learn the linear and non-linear applications of operational amplifiers.
- To introduce the theory and applications of analog multipliers and PLL.
- To introduce the concepts of waveform generation and introduce some special function ICs.

UNIT I BASICS OF OPERATIONAL AMPLIFIERS **9**

Current mirror and current sources, BJT Differential amplifier with active loads, Basic information about op-amps – Ideal Operational Amplifier - General operational amplifier stages - and internal circuit diagrams of IC 741, DC and AC performance characteristics, slew rate, Open and closed loop configurations.

UNIT II APPLICATIONS OF OPERATIONAL AMPLIFIERS **9**

Sign Changer, Scale Changer, Voltage Follower, V-to-I and I-to-V converters, adder, subtractor, Instrumentation amplifier, Integrator, Differentiator, Logarithmic amplifier, Antilogarithmic amplifier, Comparators, Schmitt trigger, clipper and clamper, Low-pass, high-pass and band-pass Butterworth filters.

UNIT III ANALOG MULTIPLIER AND PLL **9**

Analog Multiplier using Emitter Coupled Transistor Pair - Gilbert Multiplier cell – Variable transconductance technique, analog multiplier ICs and their applications, Operation of the basic PLL, Voltage controlled oscillator, application of PLL for AM detection, FM detection, FSK modulation and demodulation and Frequency synthesizing and clock synchronization.

UNIT IV ANALOG TO DIGITAL AND DIGITAL TO ANALOG CONVERTERS **9**

Analog and Digital Data Conversions, D/A converter – specifications - weighted resistor type, R- 2R Ladder type, Voltage Mode and Current-Mode R - 2R Ladder types - A/D Converters – specifications - Flash type - Successive Approximation type - Single Slope type – Dual Slope type - A/D Converter using Voltage-to-Time Conversion.

UNIT V WAVEFORM GENERATORS AND SPECIAL FUNCTION ICS **9**

Sine-wave generators, Multivibrators and Triangular wave generator, Saw-tooth wave generator, ICL8038 function generator, Timer IC 555, IC Voltage regulators – IC 723 general purpose regulator - Monolithic switching regulator.

TOTAL:45 PERIODS

COURSE OUTCOMES

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

CO1: Design linear and non linear applications of OP – AMPS.
CO2: Design applications using analog multiplier and PLL.
CO3: Design ADC and DAC using OP – AMPS.
CO4: Generate waveforms using OP – AMP Circuits.
CO5: Analyze special function ICs.

TEXT BOOKS

1. D.Roy Choudhry, Shail Jain, "Linear Integrated Circuits", New Age International Pvt. Ltd., 2018, Fifth Edition.
2. Sergio Franco, "Design with Operational Amplifiers and Analog Integrated Circuits", 4th Edition, Tata Mc Graw-Hill, 2016
3. Coughlin, Robert F. Operational amplifiers and linear integrated circuits. 4th ed. Englewood Cliffs, N.J: Prentice Hall, 1991.

REFERENCE BOOKS

1. Ramakant A. Gayakwad, "OP-AMP and Linear ICs", 4th Edition, Prentice Hall / Pearson Education, 2015.
2. Robert F.Coughlin, Frederick F.Driscoll, "Operational Amplifiers and Linear Integrated Circuits", Sixth Edition, PHI, 2001.
3. B.S.Sonde, "System design using Integrated Circuits" , 2nd Edition, New Age Pub, 2001. Gray and Meyer, "Analysis and Design of Analog Integrated Circuits", Wiley International,5th Edition, 2009.
4. S.Salivahanan & V.S. Kanchana Bhaskaran, "Linear Integrated Circuits", TMH,2nd Edition, 4th Reprint, 2016.
5. Gray and Meyer, ―Analysis and Design of Analog Integrated Circuits‖, Wiley International,5th Edition, 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	3	3	2	-	-	-	-	2	-	-	3	2	2
CO2	3	3	3	3	-	-	-	-	3	-	-	3	3	2
CO3	3	3	3	2	-	-	-	-	2	-	-	3	3	3
CO4	3	3	3	3	-	-	-	-	3	-	-	3	3	2
CO5	3	3	3	3	-	-	-	-	3	-	-	3	3	3
AVG	3	3	3	2.6	-	-	-	-	2.6	-	-	3	2.8	2.4

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

24EC4102 ANALOG COMMUNICATION **L T P C**

3 0 0 3

COURSE OBJECTIVES

- To introduce Analog Modulation Schemes
- To introduce Angle and Pulse Modulation Schemes
- To study about various coding techniques used in information theory

UNIT I AMPLITUDE MODULATION **9**

Basic blocks of Communication System. Amplitude (Linear) Modulation – AM, DSB-SC, SSB-SC and VSB-SC. Methods of generation and detection. FDM, TDM. Super Heterodyne Receivers - Noise figure and Noise Temperature, Noise in cascaded systems, Noise performance in AM.

UNIT II ANGLE MODULATION **9**

Angle modulation and demodulation: Narrow band, Wideband FM - Spectral analysis of modulated signal, Frequency Discriminator, Noise performance in FM.

UNIT III PULSE MODULATION **9**

Schematic of digital communication systems, Sampling - Quantization – Uniform and non-uniform quantization – Quantization noise– Companding laws of speech signals, Speech Coders:, PCM, DPCM, ADPCM, DM, ADM.

UNIT IV INFORMATION THEORY **9**

Measure of information – Entropy – Source coding theorem – Discrete memoryless channels – lossless, deterministic, noiseless, BEC, BSC – Mutual information – Channel capacity – Statement of Shannon Hartley law - Source Coding: Shannon-Fano coding, Huffman Coding.

UNIT V RANDOM PROCESS & SAMPLING **9**

Review of probability and random process. Gaussian and white noise characteristics, Noise in amplitude modulation systems, Noise in Frequency modulation systems. Pre-emphasis and Deemphasis, Threshold effect in angle modulation. Low pass sampling – Aliasing- Signal Reconstruction-Quantization - Uniform & non-uniform quantization - quantization noise - Nyquist criterion- Logarithmic Companding –PAM, PPM, PWM, PCM – TDM, FDM.

TOTAL:45 PERIODS

COURSE OUTCOMES

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

CO1: D evelop and analyse amplitude modulation system.
CO2: Analyse angle modulation system.
CO3: Analyze pulse modulation schemes.
CO4: Explain the basics of Information Theory and source coding schemes.
CO5: Explore and analyze random process and sampling techniques

TEXT BOOKS

1. S. Haykin, "Communication Systems", John Wiley, 4th Edition, 2007.
2. J.G. Proakis, M. Salehi, "Fundamentals of Communication Systems", Pearson Education 2006.
3. Siman Haykin, “Digital Communication”, Wiley standard Edition, 2006.

REFERENCE BOOKS

1. HP Hsu, Schaum Outline Series, "Analog and Digital Communications", TMH 2006.
2. B. P. Lathi, "Modern Digital and Analog Communication Systems", Oxford University Press, 3rd Edition, 2007.
3. B. Sklar, "Digital Communications Fundamentals and Applications", Pearson Education 2nd Edition,2007.
4. D.Roody.J. Coolen,"ElectronicCommunications", PHI, 4th Edition, 2006.
5. V. Chandra Sekar, "Analog Communication", Oxford University Press, 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	3	3	3	2	3	-	-	-	-	3	-	3	2	3
CO2	3	3	3	3	3	-	-	-	-	3	-	3	3	3
CO3	3	3	3	3	3	-	-	-	-	3	-	3	3	3
CO4	3	3	3	2	3	-	-	-	-	3	-	3	2	3
CO5	3	3	3	3	3	-	-	-	-	3	-	3	3	3
AVG	3	3	3	2.6	3	-	-	-	-	3	-	3	2.6	3

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

24EC4103 ELECTROMAGNETIC FIELD THEORY **L T P C**

3 0 2 4

COURSE OBJECTIVES

- To impart knowledge on the basics of static electric field and the associated laws
- To impart knowledge on the basics of static magnetic field and the associated laws, Faraday's law, displacement current and Maxwell's equations
- To gain the behaviour of the propagation of EM waves and time varying fields.

UNIT I INTRODUCTION **9**

Electromagnetic model, Units and constants, Review of vector algebra, Rectangular, cylindrical and spherical coordinate systems, Line, surface and volume integrals, Gradient of a scalar field, Divergence of a vector field, Divergence theorem, Curl of a vector field, Stoke's theorem, Null identities.

UNIT II ELECTROSTATICS **9**

Electric field, Coulomb's law, Gauss's law and applications, Electric potential, Conductors in static electric field, Dielectrics in static electric field, Electric flux density and dielectric constant, Boundary conditions, Capacitance of a parallel plates, Electrostatic energy, Poisson's and Laplace's equations, Uniqueness of electrostatic solutions, Current density and Ohm's law.

UNIT III MAGNETOSTATICS **9**

Lorentz force equation, Ampere's law, Vector magnetic potential, Biot-Savart law and applications, Magnetic field intensity and idea of relative permeability, Behaviour of magnetic materials, Boundary conditions, Inductance and inductors, Magnetic forces and torques.

UNIT IV TIME-VARYING FIELDS AND MAXWELL's EQUATIONS **9**

Faraday's law, Displacement current and Maxwell-Ampere law, Maxwell's equations, Potential functions, Electromagnetic boundary conditions, Wave equations and solutions, Time-harmonic fields.

UNIT V PLANE ELECTROMAGNETIC WAVES **9**

Plane waves in lossless media, Plane waves in lossy media (low-loss dielectrics and good conductors), Group velocity, Electromagnetic power flow and Poynting vector, Normal incidence at a plane conducting boundary, Normal incidence at a plane dielectric boundary.

TOTAL:45 PERIODS

LIST OF EXPERIMENTS

1. Electric Field pattern between two circular electrodes.
2. Electric Field between Parallel Conductors.
3. Electric Filed and Potential Inside the parallel plate capacitor.
4. Measurement of Magnetic Field of coils.
5. Verification of Electromagnetic Induction.
6. Generation of EM-Wave.
7. Measurement of Magnetic field force on a current carrying conductor.
8. Determination of Di-electric constant of a given Di-electric material.

TOTAL:30 PERIODS

COURSE OUTCOMES

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

CO1: Relate the fundamentals of vector, coordinate system to electromagnetic concepts.

CO2: Analyze the characteristics of Electrostatic field.

CO3: Interpret the concepts of Electric field in material space and solve the boundary conditions.

CO4: Explain the concepts and characteristics of Magneto Static field in material space and solve boundary conditions.

CO5: Determine the significance of time varying fields.

TEXT BOOKS

1. D.K. Cheng, Field and wave electromagnetics, 2nd ed., Pearson (India), 2002.
2. M.N.O.Sadiku and S.V. Kulkarni, Principles of electromagnetics, 6th ed., Oxford(Asian Edition), 2015.
3. Sedki M. Riad, Iman M. Salama, "Electromagnetic Fields & Waves", 1st Edition, Mc Graw Hill, October 9, 2021.

REFERENCE BOOKS

1. Edward C. Jordan & Keith G. Balmain,Electromagnetic waves and Radiating Systems, Second Edition, Prentice-Hall Electrical Engineering Series, 2012.
2. W.H. Hayt and J.A. Buck, Engineering electromagnetics, 7th ed., McGraw-Hill (India), 2006.
3. B.M. Notaros, Electromagnetics, Pearson: New Jersey, 2011.
4. Dr. Gulzar Ahmad, "Electromagnetic Field Theory", First edition, 2020, ISBN 978-969-23460-0-9.
5. N. Narayana Rao,"Elements of Engineering Electromagnetics", Pearson, 6th Ed, 2006.

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	3	2
CO2	3	3	3	3	3	-	-	-	-	3	-	2	3	3
CO3	3	3	3	2	3	-	-	-	-	2	-	2	3	2
CO4	3	3	3	3	3	-	-	-	-	2	-	3	3	3
CO5	3	3	3	3	3	-	-	-	-	3	-	3	3	3
AVG	3	3	3	2.6	3	-	-	-	-	2.4	-	2.6	3	2.6

1-Low, 2-Medi-um, 3-High, '-'- No Correlation

24EC4104 CONTROL SYSTEM **L T P C**

3 0 2 4

COURSE OBJECTIVES

- To introduce the components and their representation of control systems
- To learn various methods for analyzing the time response, frequency response and stability of the systems.
- To learn the various approach for the state variable analysis.

UNIT I SYSTEMS COMPONENTS AND THEIR REPRESENTATION **9**

Control System: Terminology and Basic Structure-Feed forward and Feedback control theory- Electrical and Mechanical Transfer Function Models-Block diagram Models-Signal flow graphs models.

UNIT II TIME RESPONSE ANALYSIS **9**

Transient response-steady state response-Measures of performance of the standard first order and second order system-effect on an additional zero and an additional pole-steady error constant and system- type number-PID control-Analytical design for PD, PI,PID control systems.

UNIT III FREQUENCY RESPONSE AND SYSTEM ANALYSIS **9**

Closed loop frequency response-Performance specification in frequency domain-Frequency response of standard second order system- Bode Plot - Polar Plot- Nyquist plots-Design of compensators using Bode plots.

UNIT IV CONCEPTS OF STABILITY ANALYSIS **9**

Concept of stability-Bounded - Input Bounded - Output stability-Routh stability criterion-Relative stability-Root locus concept-Guidelines for sketching root locus-Nyquist stability criterion.

UNIT V CONTROL SYSTEM ANALYSIS USING STATE VARIABLE METHODS 9

State variable representation-Conversion of state variable models to transfer functions-Conversion of transfer functions to state variable models-Solution of state equations-Concepts of Controllability and Observability-Stability of linear systems.

TOTAL:45 PERIODS

LIST OF EXPERIMENTS

1. Stability analysis using Pole zero maps and Routh Hurwitz Criterion in simulation platform.
2. Root Locus-based analysis in simulation platform.
3. Determination of transfer functions of a physical system using frequency response and Bode's asymptotes.
4. Test of controllability and observability in continuous and discrete domain in simulation platform.
5. DC position control system.
6. Design of Lag and Lead compensator.
7. To study synchro Transmitter –Receiver.
8. Determination of transfer function of DC generator.

TOTAL:30 PERIODS

COURSE OUTCOMES

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

CO1: Compute the transfer function of different physical systems.

CO2: Analyse the time domain specification and calculate the steady state error.

CO3: Illustrate the frequency response characteristics of open loop and closed loop system response.

CO4: Analyse the stability using Routh and root locus techniques.

CO5: Illustrate the state space model of a physical system and discuss the concepts of sampled data control system.

TEXT BOOKS

1. M.Gopal,"Control System – Principles and Design", Tata McGraw Hill, 4th Edition, 2012.
2. Prof. Vishwajit K. Barbudhe, Control System Engineering Universe Win Publication house, 2020.
3. Norman S. Nise, "Nise's Control Systems Engineering", Wiley India Ed, January 2018.

REFERENCE BOOKS

1. J.Nagrath and M.Gopal, "Control System Engineering", New Age International Publishers, 5th Edition, 2007.
2. K.Ogata, "Modern Control Engineering", PHI, 5th Edition, 2012.
3. S.K.Bhattacharya, "Control System Engineering", Pearson, 3rd Edition, 2013.
4. Benjamin.C.Kuo, "Automatic Control Systems", Prentice Hall of India, 7th Edition,1995.
5. Malgorzata Zywno, "Introduction to Control Systems", Ryerson University.

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	2	-	-	-	-	2	3	3	3
CO2	3	3	3	3	2	3	-	-	-	-	2	2	3	3
CO3	3	2	3	3	2	2	-	-	-	-	2	3	3	2
CO4	3	3	3	2	2	2	-	-	-	-	2	2	3	3
CO5	2	2	3	3	2	3	-	-	-	-	2	3	2	2
AVG	3	3	3	3	2	2	-	-	-	-	2	3	3	3

1-Low, 2-Medi-um, 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 facilitate the understanding of global and Indian scenario of renewable and nonrenewable resources, causes of their degradation and measures to preserve them.
- To inculcate and embrace sustainability practices and develop a broader understanding on green materials, energy cycles and analyze the role of sustainable urbanization.

UNIT I ENVRONMENT 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.

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:45 PERIODS

COURSE OUTCOMES

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

CO1: Recognize and understand the functions of environment, ecosystems and biodiversity.

CO2: Examine the relationship between living organisms and their environment.

CO3: Identify the causes, effects of environmental pollution.

CO4: Identify and apply the understanding of renewable.

CO5: Recognize the different goals 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, 'Handbook of EnvironmentalLaws, 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 Crisis to 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**
CO1	2	1	-	-	-	2	3	-	-	-	-	2	-	3
CO2	3	2	-	-	-	3	3	-	-	-	-	2	-	3
CO3	3	-	1	-	-	2	2	-	-	-	-	2	-	3
CO4	3	2	1	1	-	2	2	-	-	-	-	2	-	3
CO5	3	2	1	-	-	2	2	-	-	-	-	1	-	3
AVG	2.8	1.8	1	1	-	2.2	2.4	-	-	-	-	1.8	-	**3**

Low, 2-Medium, 3-High, '-'- No Correlation

24EC4201 ANALOG COMMUNICATION LABORATORY **L T P C**

0 0 3 1.5

COURSE OBJECTIVES

- To introduce Amplitude and Frequency modulation and demodulation
- To introduce time and frequency division multiplexing
- To introduce pulse amplitude, width and position modulation and demodulation.

LIST OF EXPERIMENTS

Using Kit

1. Amplitude, Frequency modulation and demodulation.
2. Pre-emphasis & de-emphasis.
3. Time Division Multiplexing and Demultiplexing.
4. Pulse Amplitude Modulation & Demodulation.
5. Pulse Width Modulation & Demodulation.
6. Pulse Position modulation & Demodulation.
7. Signal Sampling.

Using Matlab

1. FM Modulation.
2. SSB –SC Modulator and detector.
3. PLL.
4. DSB –SC Modulator and detector.
5. Frequency Division Multiplexing and Demultiplexing.

COURSE OUTCOMES

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

CO1: Design AM & FM Modulators for specific applications.
CO2: Compute the sampling frequency for analog modulation.
CO3: Simulate & validate the time and frequency division multiplexing and demultiplexing modules of Analog Communication System.
CO4: Simulate SSB AND DSB Modulator and Detector.
CO5: Apply various Pulse coding schemes & demonstrate their capabilities towards the improvement of the noise performance of Analog Communication System.

TOTAL:45 PERIODS

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	3	-	-	-	-	3	-	2	2	3
CO2	3	3	2	3	3	-	-	-	-	3	-	2	3	3
CO3	3	3	3	2	3	-	-	-	-	3	-	3	2	3
CO4	3	3	2	2	3	-	-	-	-	3	-	3	3	3
CO5	3	3	3	3	3	-	-	-	-	3	-	3	3	3
AVG	3	3	2.6	2.6	3	-	-	-	-	3	-	2.6	2.6	3

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

24EC4202 LINEAR INTEGRATED CIRCUITS LABORATORY **L T P C**

0 0 3 1.5

COURSE OBJECTIVES

- To understand the basics of linear integrated circuits and available ICs .
- To understand the characteristics of the operational amplifier.
- To acquire the basic knowledge of special function IC.

LIST OF EXPERIMENTS

Circuit Design

1. Series and Shunt feedback amplifiers-Frequency response, Input and output impedance.
2. RC Phase shift oscillator and Wien Bridge Oscillator.
3. Hartley Oscillator and Colpitts Oscillator.
4. RC Integrator and Differentiator circuits using Op-Amp.
5. Clippers and Clampers.
6. Active low-pass, High pass & Band pass filters.

Simulation Using Spice (Using Transistor)

1. Tuned Collector Oscillator.
2. Twin -T Oscillator / Wein Bridge Oscillator.
3. Double and Stagger tuned Amplifiers.
4. Bistable Multivibrator.
5. Schmitt Trigger circuit with Predictable hysteresis.
6. Analysis of power amplifier.

COURSE OUTCOMES

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

CO1: Design amplifiers, oscillators, D-A converters using operational amplifiers.

CO2: Design filters using op-amp and performs an experiment on frequency response.

CO3: Analyze the working of PLL and describe its application as a frequencies.

CO4: Design DC power supply using ICs.

CO5: Analyze the performance of filters, multivibrators, A/D converter.

TOTAL:45 PERIODS

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	3	2
CO2	3	3	3	3	3	-	-	-	-	2	-	3	3	3
CO3	3	3	3	2	3	-	-	-	-	3	-	3	3	2
CO4	3	3	3	3	3	-	-	-	-	2	-	3	3	3
CO5	3	3	3	2	3	-	-	-	-	3	-	3	3	3
AVG	3	3	3	2.4	3	-	-	-	-	2.4	-	3	3	2.6

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

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

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.

TOTAL:30 PERIODS

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

24EC5101 DIGITALCOMMUNICATION **L T P C**

3 0 0 3

COURSE OBJECTIVES

- To know the principles of sampling & quantization.
- To study the various waveform coding schemes.
- To understand the various Band pass signaling schemes

UNIT I SAMPLING & QUANTIZATION **9**

Low pass sampling – Aliasing- Signal Reconstruction-Quantization - Uniform & non-uniform quantization - quantization noise - Logarithmic Companding of speech signal- PCM - TDM

UNIT II WAVEFORM CODING **9**

Prediction filtering and DPCM - Delta Modulation - ADPCM & ADM principles-Linear Predictive Coding, Digital Multiplexers.

UNIT III BASEBAND TRANSMISSION **9**

Properties of Line codes- Power Spectral Density of Unipolar / Polar RZ & NRZ – Bipolar NRZ - Manchester- ISI – Nyquist criterion for distortionless transmission – Pulse shaping – Correlative coding - Mary schemes – Eye pattern - Equalization

UNIT IV DIGITAL MODULATION & DEMODULATION SCHEME **9**

Geometric Representation of signals - Generation, detection, PSD & BER of Coherent BPSK, BFSK & QPSK - QAM - Carrier Synchronization - Structure of Non-coherent Receivers - Principle of DPSK, Elements of Detection Theory, Optimum detection of signals in noise - Probability of Error evaluations. Baseband Pulse Transmission - Optimum demodulation of digital signals over band-limited channels

UNIT V ERROR CONTROL CODING **9**

Channel coding theorem - Linear Block codes - Hamming codes - Cyclic codes - Convolutional codes - Viterbi Decoder.

TOTAL:45 PERIODS

COURSE OUTCOMES

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

CO1: Design PCM systems.
CO2: Design and implement band pass signaling schemes.
CO3: Design and implement band pass signaling schemes.
CO4: Analyze the spectral characteristics of band pass signaling schemes and their noise performance.
CO5: Design error control coding schemes.

TEXT BOOKS

1. S. Haykin, “Digital Communications”, John Wiley, 2005.
2. Digital Communications: Fundamentals and Applications by Bernard Sklar.
3. Cover, Thomas M., and Joy A. Thomas. Elements of Information Theory. 2nd ed. New York, NY: Wiley Interscience, 2006.

REFERENCE BOOKS

1. B. Sklar, "Digital Communication Fundamentals and Applications", 2nd Edition, Pearson Education, 2009.
2. B.P.Lathi, "Modern Digital and Analog Communication Systems" 3rd Edition, Oxford University Press 2007.
3. H P Hsu, Schaum Outline Series - "Analog and Digital Communications", TMH 2006.
4. J.G Proakis, "Digital Communication", 4th Ed., Tata McGraw Hill Company, 2001.
5. Proakis, John G. Digital Communications. 4th ed. New York, NY: McGraw-Hill, 2000.

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	2	1	1	-	-	-	1	1	3	2
CO2	3	3	3	3	2	1	1	-	-	-	1	1	3	3
CO3	3	3	3	3	3	1	1	-	-	-	1	1	3	2
CO4	3	3	3	3	3	1	1	-	-	-	1	1	3	3
CO5	3	3	3	3	2	1	1	-	-	-	1	1	3	2
Avg	**3**	**3**	**3**	**3**	**2.5**	**1**	**1**	**-**	**-**	**-**	**1**	**1**	**3**	**2.5**

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

24EC5102 TRANSMISSION LINES AND WAVE GUIDES **L T P C**
3 0 2 4

COURSE OBJECTIVES

- To introduce the various types of transmission lines and to discuss the losses.
- To give thorough understanding about impedance transformation and matching.
- To use the Smith chart in problem solving.

UNIT I TRANSMISSION LINE THEORY **9**

General theory of Transmission lines - the transmission line - general solution - The infinite line - Wavelength, velocity of propagation - Waveform distortion - the distortion-less line - Loading and different methods of loading - Line not terminated in Z0 - Reflection coefficient - calculation of current, voltage, power delivered and efficiency of transmission - Input and transfer impedance - Open and short circuited lines - reflection factor and reflection loss.

UNIT II HIGH FREQUENCY TRANSMISSION LINES **9**

Transmission line equations at radio frequencies - Line of Zero dissipation - Voltage and current on the dissipation-less line, Standing Waves, Nodes, Standing Wave Ratio - Input impedance of the dissipation-less line - Open and short circuited lines - Power and impedance measurement on lines - Reflection losses - Measurement of VSWR and wavelength

UNIT III IMPEDANCE MATCHING IN HIGH FREQUENCY LINES **9**

Impedance matching: Quarter wave transformer - Impedance matching by stubs - Single stub and double stub matching - Smith chart - Solutions of problems using Smith chart - Single and double stub matching using Smith chart

UNIT IV PASSIVE FILTERS **9**

Characteristic impedance of symmetrical networks - filter fundamentals, Design of filters: Constant K - Low Pass, High Pass, Band Pass, Band Elimination, m- derived sections - low pass, high pass composite filters.

UNIT V WAVEGUIDES **9**

General Wave behaviours along uniform Guiding structures, Transverse Electromagnetic waves, Transverse Magnetic waves, Transverse Electric waves, TM and TE waves between parallel plates, TM and TE waves in Rectangular wave guides, Bessel's differential equation and Bessel function, TM and TE waves in Circular wave guides, Rectangular and circular cavity Resonators.

TOTAL:45 PERIODS

LIST OF EXPERIMENTS

1. Determination of primary and secondary constants of a coaxial line.
2. Measurement of attenuation in a co-axial line.
3. Measurement of cut off frequency of a co-axial line.
4. Design and simulation of constant k, m-derived and composite filters using Circuit maker.
5. Study of waveguide components.
6. Calculation of phase and group velocity calculation at 9GHz.
7. Propagation of wave in Rectangular Waveguide.
8. Impedance Matching using Smith Chart.

TOTAL:30 PERIODS

COURSE OUTCOMES

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

CO1: Discuss the propagation of signals through transmission lines.
CO2: Analyze signal propagation at Radio frequencies.
CO3: Explain radio propagation in guided
CO4: Utilize cavity resonators
CO5: Comprehend the characteristics of TE and TM waves

TEXT BOOKS

1. John D Ryder, "Networks, lines and fields", 2nd Edition, Prentice Hall India, 2010.
2. Mathew M. Radmanesh, "Radio Frequency &Microwave Electronics", Pearson Education, Asia, Second Edition,2002. (UNIT V)
3. Annapurna Das, Sisir K. Das, "Microwave Engineering", McGraw Hill Education (India) private limited, Third edition,2000.(Unit – V)

REFERENCE BOOKS

1. E.C.Jordan and K.G. Balmain, "Electromagnetic Waves and Radiating Systems", Prentice Hall of India, 2006.
2. G.S.N Raju "Electromagnetic Field Theory and Transmission Lines" , Pearson Education, First edition 2005.
3. Reinhold Ludwig and Powel Bretchko, "RF Circuit Design" – Theory and Applications", Pearson Education Asia, First Edition, 2001.
4. Richard Chi-Hsi Li - , "RF Circuit Design" – A John Wiley & Sons, Inc, Publications.
5. D. K. Misra, "Radio Frequency and Microwave Communication Circuits"- Analysis and Design, John Wiley & Sons, 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	3	3	3	2	1	-	-	-	1	-	1	2	1
CO2	3	2	2	3	2	1	-	-	-	1	-	1	2	1
CO3	3	3	3	2	1	2	-	-	-	1	-	1	2	1
CO4	3	3	2	3	2	1	-	-	-	1	-	1	2	1
CO5	3	2	3	2	2	1	-	-	-	1	-	1	2	1
AVG	**3**	**3**	**3**	**3**	**2**	**1**	-	-	-	**1**	-	**1**	**2**	**1**

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

24EC5103 DIGITAL SIGNAL PROCESSING **L T P C**

3 0 0 3

COURSE OBJECTIVES

- To learn discrete fourier transform, properties of DFT and its application to linear filtering.
- To understand the characteristics of digital filters, design digital IIR and FIR filters and apply these filters to filter undesirable signals in various frequency bands.
- To understand the effects of finite precision representation on digital filters.

UNIT I DISCRETE FOURIER TRANSFORM **9**

Sampling Theorem, concept of frequency in discrete-time signals, Discrete Fourier transform (DFT) - deriving DFT from DTFT, properties of DFT - periodicity, symmetry, circular convolution. Filtering long data sequences - overlap save and overlap add method. Fast computation of DFT - Radix-2 Decimation-in-time (DIT) Fast Fourier transform (FFT), Decimation-in-frequency (DIF) Fast Fourier transform (FFT).

UNIT II INFINITE IMPULSE RESPONSE FILTERS **9**

Characteristics of practical frequency selective filters. characteristics of commonly used analog filters - Butterworth filters, Chebyshev filters. Design of IIR filters from analog filters (LPF, HPF, BPF, BRF) - Approximation of derivatives, Impulse invariance method, Bilinear transformation. Frequency transformation in the analog domain. Structure of IIR filter - direct form I, direct form II, Cascade, parallel realizations

UNIT III FINITE IMPULSE RESPONSE FILTERS **9**

Design of FIR filters - symmetric and Anti-symmetric FIR filters - design of linear phase FIR filters using Fourier series method - FIR filter design using windows (Rectangular, Hamming and Hanning window). FIR filter structures - linear phase structure, direct form realizations.

UNIT IV FINITE WORD LENGTH EFFECTS **9**

Fixed point and floating point number representation - ADC - quantization - truncation and rounding - quantization noise - input / output quantization - coefficient quantization error - product quantization error - overflow error - limit cycle oscillations due to product quantization and summation - scaling to prevent overflow.

UNIT V DSP APPLICATIONS **9**

Multirate signal processing: Decimation, Interpolation, Sampling rate conversion by a rational factor – Adaptive Filters: Introduction, Applications of adaptive filtering to equalization - DSP Architecture- Fixed and Floating point architecture principles.

TOTAL:45 PERIODS

LIST OF EXPERIMENTS

1. Generation of elementary Discrete-Time sequences.
2. Linear and Circular convolutions.
3. Auto correlation and Cross Correlation.
4. Frequency Analysis using DFT.
5. Design of FIR filters (LPF/HPF/BPF/BSF) and demonstrates the filtering operation.
6. Study of architecture of Digital Signal Processor.
7. Perform MAC operation using various addressing modes.
8. Generation of various signals and random noise.

TOTAL:30 PERIODS

COURSE OUTCOMES

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

CO1: Apply DFT for the analysis of digital signals and systems.
CO2: Design IIR and FIR filters.
CO3: Characterize the effects of finite precision representation on digital filters.
CO4: Design multirate filters.
CO5: Apply adaptive filters appropriately in communication systems.

TEXT BOOKS

1. John G. Proakis and Dimitris G.Manolakis, Digital Signal Processing – Principles, Algorithms and Applications, 4th Ed., Pearson Education / Prentice Hall, 2007.
2. A. V. Oppenheim, R.W. Schafer and J.R. Buck, Discrete-Time Signal Processing", 8th Indian Reprint, Pearson, 2004.
3. M.Mandal, Continuous and Discrete Time Signals and Systems, Cambridge, 2007.

REFERENCE BOOKS

1. Emmanuel C. Ifeachor& Barrie. W. Jervis, "Digital Signal Processing", Second Edition, Pearson Education / Prentice Hall, 2002.
2. Sanjit K. Mitra, "Digital Signal Processing – A Computer Based Approach", Tata Mc Graw Hill, 2007.
3. Andreas Antoniou, "Digital Signal Processing", Tata Mc Graw Hill, 2006.
4. D.C.Lay, "Linear Algebra and its Applications (2/e)", Pearson, 2008.
5. S.S.Soliman & M.D.Srinath, "Continuous and Discrete Signals and Systems", Prentice- Hall, 1990.

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	2	2	-	-	-	-	1	1	3	3
CO2	3	3	3	3	2	2	-	-	-	-	1	1	2	2
CO3	3	3	**2**	2	2	2	-	-	-	-	1	1	1	2
CO4	3	3	2	2	3	1	-	-	-	-	1	1	2	2
CO5	3	2	2	2	3	2	-	-	-	-	1	1	2	2
AVG	**3**	**3**	**2**	**2**	**2**	**2**	**-**	**-**	**-**	**-**	**1**	**1**	**2**	**2**

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

24EC5104 MICROPROCESSORS AND MICROCONTROLLERS **L T P C**
3 0 0 3

COURSE OBJECTIVES

- To understand the Architecture of 8086 microprocessor.
- To learn the design aspects of I/O and Memory Interfacing circuits.
- To study and design the Architecture of 8051 microcontroller.

UNIT I INTRODUCTION OF 8086 MICROPROCESSOR **9**

Introduction to 8086 – Microprocessor architecture – Addressing modes - Instruction set and assembler directives – Assembly language programming – Modular Programming - Linking and Relocation - Stacks - Procedures – Macros – Interrupts and interrupt service routines – Byte and String Manipulation.

UNIT II 8086 SYSTEM BUS STRUCTURE **9**

8086 signals – Basic configurations – System bus timing –System design using 8086 – I/O programming – Introduction to Multiprogramming – System Bus Structure –Multiprocessor configurations – Coprocessor, Closely coupled and loosely Coupled configurations – Introduction to advanced processors.

UNIT III I/O INTERFACING **9**

Memory Interfacing and I/O interfacing - Parallel communication interface – Serial communication interface – D/A and A/D Interface - Timer – Keyboard /display controller – Interrupt controller – DMA controller – Programming and applications Case studies: Traffic Light control, LED display , LCD display, Keyboard display interface and Alarm Controller

UNIT IV MICROCONTROLLER **9**

Architecture of 8051 – Special Function Registers(SFRs) - I/O Pins Ports and Circuits – Instruction set - Addressing modes - Assembly language programming.

UNIT V INTERFACING MICROCONTROLLER **9**

Programming 8051 Timers - Serial Port Programming - Interrupts Programming – LCD & Keyboard Interfacing - ADC, DAC & Sensor Interfacing - External Memory Interface- Stepper Motor and Waveform generation - Comparison of Microprocessor and Microcontroller.

TOTAL:45 PERIODS

COURSE OUTCOMES

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

CO1: Explain and execute programs based on 8086 microprocessor.
CO2: Design Memory Interfacing circuits.
CO3: Design and interface I/O circuits.
CO4: Design and implement 8051 microcontroller based systems.
CO5: Design 8051 microcontroller with interfacing circuits.

TEXT BOOKS

1. Yu-Cheng Liu, Glenn A.Gibson, “Microcomputer Systems: The 8086 / 8088 Family Architecture, Programming and Design”, Second Edition, Prentice Hall of India, 2007.
2. Mohamed Ali Mazidi, Janice Gillispie Mazidi, Rolin McKinlay, “The 8051 Microcontroller and Embedded Systems: Using Assembly and C”, Second Edition, Pearson education, 2011.
3. R. Gaonkar - Microprocessor Architecture, Programming and Applications with the 8086.

REFERENCE BOOKS

1. Doughlas V.Hall, “Microprocessors and Interfacing, Programming and Hardware”,TMH,2012.
2. A.K.Ray,K.M.Bhurchandi, "Advanced Microprocessors and Peripherals" 3rd edition, Tata McGrawHill, 2012.
3. Advanced Microprocessors and Peripherals – A. K. Ray and K.M. Bhurchandani, TMH, 2nd Edition 2006.
4. S. Furber, “ARM system On Chip Architecture”, 2nd ED, Pearson, 2015.
5. A. Sloss, D. Symes, C. Wright, “ARM System Developer's Guide: Designing and Optimizing System Software”, First Edition, Elsevier, 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	3	2	2	-	-	-	-	-	-	-	2	2	3
CO2	3	3	3	-	-	-	-	-	-	-	-	2	2	2
CO3	3	3	3	-	-	-	-	-	-	-	-	2	2	2
CO4	3	3	2	2	-	-	-	-	-	-	-	2	2	3
CO5	3	3	3	-	-	-	-	-	-	-	-	2	2	3
AVG	**3**	**3**	**2.6**	**2**	-	-	-	-	-	-	-	**2**	**2.5**	**2.6**

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

24EC5201 DIGITAL COMMUNICATION LABORATORY **L T P C**

0 0 3 1.5

COURSE OBJECTIVES

- To understand the basics of linear integrated circuits and available ICs .
- To understand the characteristics of the operational amplifier.
- To acquire the basic knowledge of special function IC.

LIST OF EXPERIMENTS

1. Pulse Code Modulation and Demodulation
2. Delta Modulation and Demodulation
3. Line Coding Schemes
4. ASK, FSK, and PSK generation using kit
5. Study of PCM modulation, and demodulation using Hardware.
6. Simulation of ASK, FSK, and BPSK generation schemes.
7. Simulation of DPSK and QPSK generation schemes
8. Simulation of QAM generation schemes
9. Simulation of signal constellations of BPSK, QPSK and QAM
10. Simulation of ASK, FSK and BPSK detection schemes
11. Simulation of Linear Block and Cyclic error control coding schemes.
12. Implementation Of Huffman Coding Using MatLab

COURSE OUTCOMES

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

CO1: Simulate & validate the various functional modules of a communication system

CO2: Demonstrate their knowledge in base band signaling schemes.

CO3: Apply various channel coding schemes & demonstrate their capabilities towards the improvement of the noise performance of communication system

CO4: Simulate end-to-end communication Link.

CO5: Evaluate the performance of the digital communication system.

TOTAL:45 PERIODS

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	3	3	-	-	-	1	1	1	3	1
CO2	3	3	3	3	3	2	-	-	-	1	1	1	3	1
CO3	3	3	3	3	3	2	-	-	-	1	1	1	3	1
CO4	3	3	3	3	3	3	-	-	-	1	1	1	3	1
CO5	3	3	3	3	3	2	-	-	-	1	1	1	3	1
AVG	3	3	3	3	3	2.5	-	-	-	1	1	1	3	1

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

24EC5202 MICROPROCESSORS AND MICROCONTROLLERS LABORATORY **L T P C 0 0 3 1.5**

COURSE OBJECTIVES

- To Introduce ALP concepts, features and Coding methods
- Write ALP for arithmetic and logical operations in 8086 and 8051.
- Interface different I/Os with Microprocessors.

LIST OF EXPERIMENTS

8086 Programs using kits

1. Basic arithmetic and Logical operations.
2. Move a data block without overlap.
3. Code conversion, decimal arithmetic and Matrix operations.
4. Floating point operations, string manipulations, sorting and searching.

Peripherals and Interfacing Experiments

1. Traffic light controller.
2. Stepper motor control.
3. Key board and Display.
4. Serial interface and Parallel interface.
5. A/D and D/A interface and Waveform Generation.

8051 Experiments using Kit and Keil Sofware

1. Basic arithmetic and Logical operations.
2. Square and Cube program, Find 2's complement of a number.
3. Unpacked BCD to ASCII.

COURSE OUTCOMES

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

CO1: Write ALP Programmes for fixed and Floating Point and Arithmetic operations.
CO2: Interface different I/Os with processor.
CO3: Generate waveforms using Microprocessors.
CO4: Execute Programs in 8051.
CO5: Explain the difference between simulator and Emulator.

TOTAL:45 PERIODS

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
CO2	3	3	1	1	-	-	-	-	-	-	-	-	2	1
CO3	1	2	2	2	-	-	-	-	-	-	1	1	2	2
CO4	-	1	3	3	1	-	-	-	-	-	1	1	2	2
CO5	3	3	3	3	1	-	-	-	-	-	1	1	2	2
AVG	2.2	2.2	2.2	2.2	1	-	-	-	-	-	1	1	2	2

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

24EC6101 ANTENNA AND MICROWAVE **L T P C**

3 0 0 3

COURSE OBJECTIVES

- To enable the student to understand the basic principles in antenna and microwave system design.
- To enhance the student knowledge in the area of various antenna designs.
- To enhance the student knowledge in the area of microwave components and antenna for practical applications.

UNIT I INTRODUCTION TO MICROWAVE SYSTEMS AND ANTENNAS

Microwave frequency bands, Physical concept of radiation, Near- and far-field regions, Fields and Power Radiated by an Antenna, Antenna Pattern Characteristics, Antenna Gain and Efficiency, Aperture Efficiency and Effective Area, Antenna Noise Temperature and G/T, Impedance matching, Friis transmission equation, Link budget and link margin, Noise Characterization of a microwave receiver.

UNIT II RADIATION MECHANISMS AND DESIGN ASPECTS **9**

Radiation Mechanisms of Linear Wire and Loop antennas, Aperture antennas, Reflector antennas, Microstrip antennas and Frequency independent antennas, Design considerations and applications.

UNIT III ANTENNA ARRAYS AND APPLICATIONS **9**

Two-element array, Array factor, Pattern multiplication, Uniformly spaced arrays with uniform and non-uniform excitation amplitudes, Smart antennas.

UNIT IV PASSIVE AND ACTIVE MICROWAVE DEVICES **9**

Microwave Passive components: Directional Coupler, Power Divider, Magic Tee, attenuator, resonator, Principles of Microwave Semiconductor Devices: Gunn Diodes, IMPATT diodes, Schottky Barrier diodes, PIN diodes, Microwave tubes: Klystron, TWT, Magnetron.

UNIT V MICROWAVE DESIGN PRINCIPLES **9**

Impedance transformation, Impedance Matching, Microwave Filter Design, RF and Microwave Amplifier Design, Microwave Power amplifier Design, Low Noise Amplifier Design, Microwave Mixer Design, Microwave Oscillator Design.

TOTAL:45 PERIODS

COURSE OUTCOMES

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

CO1: Apply the basic principles and evaluate antenna parameters and link power budgets.

CO2: Design and assess the performance of various antennas.

CO3: Design a microwave system given the application specifications.

CO4: Design the Microwave devices.

CO5: Evaluate the requirements for the design and implementation of amplifiers and oscillators.

TEXT BOOKS

1. John D Krauss, Ronald J Marhefka and Ahmad S. Khan, "Antennas and Wave Propagation: Fourth Edition, Tata McGraw-Hill, 2006.
2. David M. Pozar, "Microwave Engineering", Fourth Edition, Wiley India, 2012.
3. R.Janaswamy, Radio Wave Propagation and Smart Antennas for Wireless Communication, Kluwer, 2001.

REFERENCE BOOKS

1. Constantine A.Balanis, ―Antenna Theory Analysis and Design‖, Third edition, John Wiley India Pvt Ltd., 2005.
2. R.E.Collin, "Foundations for Microwave Engineering", Second edition, IEEE Press, 2001.
3. Lamont V. Blake and Maurice W. Long, Fundamentals and measurement 3rd Ed., 2009.
4. W.L. Stutzman & G.A. Thiele : Antenna Theory and Design, Wiley,2007.
5. J.R. James et al, Microstrip Antenna Theory and Design, IEE, 1981.

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	3	-	-	-	-	3	-	3	3	3
CO2	3	3	3	3	3	-	-	-	-	3	-	3	3	2
CO3	3	3	3	3	3	-	-	-	-	3	-	3	2	2
CO4	3	3	3	3	3	-	-	-	-	3	-	3	3	3
CO5	3	3	3	3	3	-	-	-	-	3	-	3	3	3
AVG	3	3	3	3	3	-	-	-	-	3	-	3	2.8	2.6

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

24EC6102 VLSI AND CHIP DESIGN **L T P C**

3 0 0 3

COURSE OBJECTIVES

- Understand the fundamentals of IC technology components and their characteristics.
- Understand combinational logic circuits and design principles.
- Understand ASIC Design functioning, memory architecture, building blocks and design.

UNIT I MOS TRANSISTOR PRINCIPLES **9**

MOS logic families (NMOS and CMOS), Ideal and Non Ideal IV Characteristics, CMOS devices. MOS(FET) Transistor Characteristic under Static and Dynamic Conditions, Technology Scaling, power consumption.

UNIT II COMBINATIONAL LOGIC CIRCUITS **9**

Propagation Delays, stick diagram, Layout diagrams, Examples of combinational logic design, Elmore's constant, Static Logic Gates,Dynamic Logic Gates, Pass Transistor Logic, Power Dissipation, Low Power Design principles.

UNIT III SEQUENTIAL LOGIC CIRCUITS AND CLOCKING STRATEGIES **9**

Static Latches and Registers, Dynamic Latches and Registers, Pipelines, Nonbistable Sequential Circuits.Timing classification of Digital Systems, Synchronous Design, Self-Timed Circuit Design.

UNIT IV MEMORY ARCHITECHTURES **9**

Interconnect Parameters – Capacitance, Resistance, and Inductance, Electrical WireModels, Sequential digital circuits: adders - multipliers - comparators - shift registers. Logic Implementation using Programmable Devices (ROM, PLA, FPGA), Memory Architecture and Building Blocks,Memory Core and Memory Peripherals Circuitry.

UNIT V ASIC DESIGN AND TESTING **9**

Introduction to wafer to chip fabrication process flow. Microchip design process & issues in test and verification of complex chips, embedded cores and SOCs, Fault models, Test coding. ASIC Design Flow, Introduction to ASICs, Introduction to test benches, Writing test benches in Verilog HDL, Automatic test pattern generation, Design for testability, Scan design: Test interface and boundary scan.

TOTAL:45 PERIODS

COURSE OUTCOMES

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

CO1: In depth knowledge of MOS technology
CO2: Explain and design Combinational Logic Circuits and Design Principles
CO3: Explain and design Sequential Logic Circuits and Clocking Strategies
CO4: Explore Memory architecture and building blocks
CO5: Analyse the ASIC Design Process and Testing.

TEXT BOOKS

1. Jan D Rabaey, Anantha Chandrakasan, " Digital Integrated Circuits: A Design Perspective", PHI, 2016.
2. Neil H E Weste, Kamran Eshranghian, " Principles of CMOS VLSI Design: A System Perspective," Addison Wesley, 2009..
3. Michael J Smith ," Application Specific Integrated Circuits, Addison Wesley, 2015 .

REFERENCE BOOKS

1. D.A. Hodges and H.G. Jackson, Analysis and Design of Digital Integrated Circuits, International Student Edition, McGraw Hill 1983.
2. P. Rashinkar, Paterson and L. Singh, "System-on-a-Chip Verification-Methodology and Techniques", Kluwer Academic Publishers,2001.
3. SamihaMourad and YervantZorian, “Principles of Testing Electronic Systems”, Wiley 2000.
4. M. Bushnell and V. D. Agarwal, "Essentials of Electronic Testing for Digital, Memory and Mixed-Signal VLSI Circuits", Kluwer Academic Publishers,2000.
5. Parag K.Lala,” Digital Circuit Testing and Testability”, Academic Press, 1997.

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	-	-	-	-	-	-	-	-	-	-	3	3
CO2	3	2	3	2	-	-	-	-	-	-	-	1	3	3
CO3	2	3	2	3	1	1	-	-	-	-	-	2	3	2
CO4	-	-	1	1	-	-	-	-	-	-	-	3	3	3
CO5	-	-	-	-	-	2	-	-	-	-	1	-	3	2
AVG	**2**	**2**	**2**	**2**	**1**	**1.5**	-	-	-	-	**1**	**2**	**3**	**3**

1-Low, 2-Medium, 3-High, ‘-’- No Correlation

24EC6201 VLSI LABORATORY **L T P C**

0 0 3 1.5

COURSE OBJECTIVES

- To learn Hardware Descriptive Language (Verilog/VHDL).
- To learn the fundamental principles of Digital System Desing using HDL and FPGA.
- To learn the fundamental principles of VLSI circuit design in digital domain.

LIST OF EXPERIMENTS

1. Design of basic combinational and sequential (Flip-flops) circuits using HDL. Simulate it using Xilinx/Altera Software and implement by Xilinx/Altera FPGA.
2. Design an Adder ; Multiplier (Min 8 Bit) using HDL. Simulate it using Xilinx/Altera Software and implement by Xilinx/Altera FPGA.
3. Design and implement Universal Shift Register using HDL. Simulate it using Xilinx/Altera Software.
4. Design Memories using HDL. Simulate it using Xilinx/Altera Software and implement by Xilinx/Altera FPGA.
5. Design Finite State Machine (Moore/Mealy) using HDL. Simulate it using Xilinx/Altera Software and implement by Xilinx/Altera FPGA.
6. Design 3-bit synchronous up/down counter using HDL. Simulate it using Xilinx/Altera Software and implement by Xilinx/Altera FPGA.
7. Design 4-bit Asynchronous up/down counter using HDL. Simulate it using Xilinx/Altera Software and implement by Xilinx/Altera FPGA.

8. Design and simulate a CMOS Basic Gates & Flip-Flops. Generate Manual/Automatic Layout.
9. Design and simulate a 4-bit synchronous counter using a Flip-Flops. Generate Manual/Automatic Layout.
10. Design and Simulate a CMOS Inverting Amplifier.
11. Design and Simulate basic Common Source, Common Gate and Common Drain Amplifiers.
12. Design and simulate simple 5 transistor differential amplifier.

COURSE OUTCOMES

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

CO1: Write HDL code for basic as well as advanced digital integrated circuit.

CO2: Import the logic modules into FPGA Boards.

CO3: Synthesize Place and Route the digital Ips.

CO4: Design, Simulate and Extract the layouts of Digital & Analog IC Blocks using EDA tools.

CO5: Test and Verification of IC design.

TOTAL:45 PERIODS

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
CO2	3	3	1	1	-	-	-	-	-	-	-	-	2	1
CO3	1	2	2	2	-	-	-	-	-	-	1	1	2	2
CO4	-	1	3	3	1	-	-	-	-	-	1	1	2	2
CO5	3	3	3	3	1	-	-	-	-	-	1	1	2	2
AVG	**2.2**	**2.2**	**2.2**	**2.2**	**1**	-	-	-	-	-	**1**	**1**	**2**	**2**

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

24EC6202 ANTENNA AND MICROWAVE LABORATORY **L T P C**

0 0 3 1.5

COURSE OBJECTIVES

- To perform the basic operations such as arrays,various antennas in MATLAB.
- To implement the characteristics of measurements and impedance matching.
- To gain practical hands-on experience the students are exposed to various microwave components.

LIST OF EXPERIMENTS

1. Plot of Radiation pattern of Uniform Linear Array.
2. Plot of Radiation pattern of dipole antenna.
3. Plot of Radiation pattern of monopole antenna.
4. Characteristics of Gunn diode.

5. Characteristics of the reflex klystron tube.
6. Attenuation measurement.
7. Frequency measurement.
8. VSWR and Impedance Measurement and Impedance Matching.
9. Characterization of Directional Couplers, Isolators, Circulators.
10. Microwave IC – Filter Characteristics.
11. Determination of standing wave ratio and reflection coefficient.
12. Study of magic tee.

COURSE OUTCOMES

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

CO1: Analyze the performance of various antenna.

CO2: Analyze the characteristics of Gunn diode and klystron tube.

CO3: Design the characteristics of attenuation and frequency measurement.

CO4: Design and implement the VSWR and impedance matching.

CO5: Explain the intricacies in Microwave System design.

TOTAL:45 PERIODS

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	2	2	-	-	-	-	1	1	3	3
CO2	3	3	3	3	2	2	-	-	-	-	1	1	2	2
CO3	3	3	**2**	2	2	2	-	-	-	-	1	1	1	2
CO4	3	3	2	2	3	1	-	-	-	-	1	1	2	2
CO5	3	2	2	2	3	2	-	-	-	-	1	1	2	2
AVG	**3**	**3**	**2**	**2**	**2**	**2**	**-**	**-**	**-**	**-**	**1**	**1**	**2**	**2**

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

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

2 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 students 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.

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
CO1	-	-	-	-	-	-	2	-	3	3	-	3	-	-
CO2	-	-	-	-	-	-	2	-	3	3	-	3	-	-
CO3	-	-	-	-	-	-	2	2	3	3	-	3	-	-
CO4	-	-	-	-	-	-	2	2	3	3	-	3	-	-
CO5	-	-	-	-	-	-	2	2	3	3	-	3	-	-
AVG	-	-	-	-	-	-	2	2	3	3	-	3	-	-

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

24EC7101 EMBEDDED SYSTEMS DESIGN **L T P C**

3 0 2 4

COURSE OBJECTIVES

- Understand the concepts of embedded system design and analysis.
- Learn the architecture and programming of ARM processor.
- Learn the architecture design flow and Build an IoT based system.

UNIT I INTRODUCTION TO EMBEDDED SYSTEM DESIGN **9**

Complex systems and micro processors– Embedded system design process –Design example: Model train controller- Design methodologies- Design flows - Requirement Analysis – Specifications-System analysis and architecture design – Quality Assurance techniques - Designing with computing platforms – consumer electronics architecture – platform-level performance analysis.

UNIT II ARM PROCESSOR AND PERIPHERALS **9**

ARM Architecture Versions – ARM Architecture – Instruction Set – Stacks and Subroutines – Features of the LPC 214X Family – Peripherals – The Timer Unit – Pulse Width Modulation Unit – UART – Block Diagram of ARM9 and ARM Cortex M3 MCU

UNIT III EMBEDDED PROGRAMMING **9**

Components for embedded programs- Models of programs- Assembly, linking and loading – compilation techniques- Program level performance analysis – Software performance optimization – Program level energy and power analysis and optimization – Analysis and optimization of program size- Program validation and testing.

UNIT IV REAL TIME SYSTEMS **9**

Structure of a Real Time System — Estimating program run times – Task Assignment and Scheduling – Fault Tolerance Techniques – Reliability, Evaluation – Clock Synchronisation

UNIT V PROCESSES AND OPERATING SYSTEMS **9**

Introduction – Multiple tasks and multiple processes – Multirate systems- Preemptive realtime operating systems- Priority based scheduling- Interprocess communication mechanisms – Evaluating operating system performance- power optimization strategies for processes – Example Real time operating systems-POSIX-Windows CE. - Distributed embedded systems – MPSoCs and shared memory multiprocessors. – Design Example - Audio player, Engine control unit – Video accelerator.

TOTAL:45 PERIODS

LIST OF EXPERIMENTS

1. Study of ARM evaluation system and Interfacing ADC & DAC.
2. Interfacing LED and PWM.
3. Interfacing real time clock and serial port.
4. Interfacing keyboard and LCD.
5. Interfacing EPROM and interrupt.
6. Flashing of LEDS.
7. Interfacing stepper motor and temperature sensor.
8. Implementing zigbee protocol with ARM

TOTAL:30 PERIODS

COURSE OUTCOMES

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

CO1: Develop a model of an embedded system.
CO2: Describe the architecture and programming of ARM processor.
CO3: List the concepts of real time operating systems.
CO4: Learn the architecture and protocols of IoT.
CO5: Design an IoT based system for any application.

TEXT BOOKS

1. Mohammed Ali Mazidi, Janice Gillispie Mazidi, Rolin D.McKinlay, The 8051 Microcontroller and Embedded Systems Using Assembly and C, Second Edition, Pearson Education, 2008.(Unit – I)
2. Marilyn Wolf, Computers as Components – Principles of Embedded Computing System Design, Third Edition, Morgan Kaufmann, 2012.(Unit – II,III)
3. Arshdeep Bahga, Vijay Madisetti, Internet – of- Things – A Hands on Approach, Universities Press, 2015.(Unit – IV,V).

REFERENCE BOOKS

1. Mayur Ramgir, Internet – of – Things, Architecture, Implementation and Security, First Edition, Pearson Education, 2020.
2. Lyla B.Das, Embedded Systems: An Integrated Approach, Pearson Education 2013.
3. Jane.W.S .Liu, Real – Time Systems, Pearson Education, 2003.
4. Raymond J.A. Buhr, Donald L.Bailey, "An Introduction to Real-Time Systems-From Design to Networking with C/C++", Prentice Hall, 1999.
5. C.M. Krishna, Kang G. Shin, "Real-Time Systems", International Editions, Mc Graw Hill 1997.

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	2
CO2	3	3	3	2	2	-	-	-	-	-	-	-	3	2
CO3	3	3	2	2	2	-	-	-	-	-	-	-	2	1
CO4	3	3	2	2	2	-	-	-	-	-	-	-	3	3
CO5	3	3	3	3	3	-	-	-	-	-	-	-	3	3
AVG	**3**	**3**	**2.6**	**2.2**	**2.2**	-	-	-	-	-	-	-	**2.8**	**2.2**

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

24EC7501 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

COURSE OUTCOMES

On successful completion of this course, the students 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 & PSOs

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

No. of Weeks: 02

COURSE OUTCOMES

On successful completion of this course, the students 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, or logistics, total employees, turn-over and major tools and software etc are 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 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 are 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.

TOTAL: 30 PERIODS

COURSE OUTCOMES

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

CO1: Explore 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.

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

24EC8501 PROJECT WORK **L T P C**
0 0 20 10

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: 300 PERIODS

COURSE OUTCOMES

On successful completion of this course, the students 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 & 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	2
CO2	3	3	3	2	2	-	-	-	-	-	-	-	3	2
CO3	3	3	2	2	2	-	-	-	-	-	-	-	2	1
CO4	3	3	2	2	2	-	-	-	-	-	-	-	3	3
CO5	3	3	3	3	3	-	-	-	-	-	-	-	3	3
AVG	3	3	2.6	2.2	2.2	-	-	-	-	-	-	-	2.8	2.2

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

24ECPE01 SOLID STATE DEVICES **L T P C**
3 0 0 3

COURSE OBJECTIVES

- To introduce the basics of semiconductors and insulators.
- Develop strong background in semiconductor physics.
- To understand the operation of basic two-terminal and three-terminal semiconductor devices.

UNIT I BASICS OF SEMICONDUCTORS **9**

Energy bands: metals, semiconductors and insulators, direct and indirect semiconductors, Charge carriers in semiconductors: electrons and holes, intrinsic and extrinsic material: n- material and p-material, carrier concentration: fermi level, electron and hole concentrations at equilibrium, temperature dependence.

UNIT II CARRIER TRANSPORT IN SEMICONDUCTORS **9**

Conductivity and mobility: drift and resistance, effect of temperature and doping on mobility, high field effects, Generation and Recombination mechanisms of excess carriers: direct and indirect recombination, steady state carrier generation, quasi Fermi levels, Diffusion of carriers: diffusion processes, Einstein relations.

UNIT III PN JUNCTIONS **9**

PN junctions: formation of junction, contact potential, electrical field, potential and charge density at the junction, space charge at a junction, energy band diagram, Ideal diode equation, electron and hole component of current in forward biased p-n junction, Reverse bias breakdown in p-n junctions: zener and avalanche break down.

UNIT IV BIPOLAR JUNCTION TRANSISTORS **9**

Bipolar transistor action: Basic principle of operation, modes of operation, amplification with bipolar transistors, minority carrier distributions: forward active mode, other modes of operation.

UNIT V METAL INSULATOR SEMICONDUCTOR DEVICES AND MOSFET **9**

Metal Insulator semiconductor devices: The ideal MOS capacitor, band diagrams at equilibrium, accumulation, depletion and inversion, surface potential, CV characteristics.

TOTAL:45 PERIODS

COURSE OUTCOMES

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

CO1: Explain the crystal structures of elements used for fabrication of semiconductor devices.

CO2: Explore fermi levels, movement of charge carriers, Diffusion current and Drift current.

CO3: Fabrication of different semiconductor devices, Varactor diode, Zener diode, Schottky diode, BJT, MOSFET, etc.

CO4: Comprehend VI Characteristics of devices and its limitations in factors like current, power frequency.

CO5: Summarize the learn high frequency and high power devices.

TEXT BOOKS

1. Ben. G. Streetman & Sanjay Banerjee, Solid State Electronic Devices, 7th Edition, Global Edition, 2015.
2. Donald A. Neaman, Semiconductor Physics and Devices, 4th Edition, TMH, 2012.
3. Yannis Tsividis, Operation & Modeling of MOS Transistor, 2nd Edition, Oxford University Press, 2003.

REFERENCE BOOKS

1. Solid state electronic devices by Streetman, Ben G. Contributor(s): Banerjee, Sanjay Kumar. Publication details: Noida Pearson Education 2022.
2. Introduction to Semiconductor Materials and Devices: by M. S. Tyagi,Oxford University Press, 2nd Edition, 2009.
3. D.K. Bhattacharya & Rajinish Sharma, Solid State Electronic Devices, Oxford University Press, 2007.
4. Nandita Das Gupta & Aamitava Das Gupta, Semiconductor Devices Modeling a Technology, PHI, 2004.
5. Semiconductor Devices Fundamentals: by Robert F. Pierret.,Pearson 1st edition1996.

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	-	-	-	-	-	-	-	-	-	-	-	1	1
CO2	3	3	-	-	-	-	-	-	-	-	-	-	1	1
CO3	3	2	-	-	-	-	-	-	-	-	-	-	1	1
CO4	2	-	-	-	-	-	-	-	-	-	-	-	1	1
CO5	3	3	-	-	-	-	-	-	-	-	-	-	1	1
AVG	2.6	2.6	-	-	-	-	-	-	-	-	-	-	1	1

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

24ECPE02 NETWORK ANALYSIS AND SYNTHESIS **L T P C**
3 0 0 3

COURSE OBJECTIVES

- To make the students capable of analyzing any given electrical network.
- To make the students learn how to synthesize an electrical network from a given impedance/admittance function.
- To introduce two-port networks and network parameters.

UNIT I GRAPH THEORY **9**

Importance of Graph Theory in Network Analysis, Graph of a network, Definitions, planar & Non Planar Graphs, Isomorphism, Tree, Co Tree, Link, basic loop and basic cutset, Incidence matrix, Cut set matrix, Tie set matrix, Duality, Loop and Nodal methods of analysis.

UNITII NETWORK THEOREMS **9**

Superposition theorem, Thevenin's theorem, Norton's theorem, Maximum power transfer theorem, Reciprocity theorem. Millman's theorem, Compensation theorem, Tellegen's Theorem.

UNIT III TRANSIENT CIRCUIT ANALYSIS **9**

Natural response and forced response, Transient response and steady state response for arbitrary inputs (DC and AC), Evaluation of time response both through classical and Laplace methods.

UNIT IV NETWORK FUNCTIONS **9**

Concept of complex frequency, Transform impedances network functions of one port and two port networks, Concept of poles and zeros, Properties of driving point and transfer functions. Two Port Networks- Ladder and Lattice networks: T & Π representation, terminated two Port networks, Image Impedance.

UNIT V NETWORK SYNTHESIS **9**

Positive real function; definition and properties, Properties of LC, RC and RL driving point functions, Synthesis of LC, RC and RL driving point immittance functions using Foster and Cauer first and second forms. Filters- Image parameters and characteristics impedance, Passive and active filter fundamentals, Low pass filters, High pass (constant K type) filters, Introduction to active filters.

TOTAL:45 PERIODS

COURSE OUTCOMES

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

CO1: Apply network topology concepts in the formulation and solution of electric network problems.

CO2: Apply two-port network analysis in the design and analysis of filter and attenuator networks.

CO3: Identify the properties and characteristics of network functions, and verify the mathematical constraints for their physical realisation.

CO4: Synthesize passive one-port networks using standard Foster and Cauer forms.

CO5: Synthesize passive and active the low pass filters.

TEXT BOOKS

1. ME Van Valkenburg, "Network Analysis", Prentice Hall of India,3rd Edition, 2019.
2. Alexander, Sadiku, "Fundamentals of Electric Circuits", McGraw Hill, 7th Edition, 2022.
3. D Roy Choudhary, "Networks and Systems", Wiley Eastern Ltd, 2nd Edition,2014.

REFERENCE BOOKS

1. CL Wadhwa, "Network Analysis and Synthesis", New Age International Publishers, 3rd Edition,2018.
2. A. Chakrabarti, "Circuit Theory", Dhanpat Rai & Co. 1. Hayt, Kimmerly, Durbin, "Engineering Circuit Analysis", McGraw Hill. 8th edition, 2013.
3. Donald E. Scott, "An Introduction to Circuit analysis: A System Approach", McGraw Hill, 2022 .
4. ME Van Valkenburg, "An Introduction to Modern Network Synthesis", Wiley Eastern Ltd, 2021.
5. Samarjit Ghosh, " Network Theory: Analysis & Synthesis" Prentice Hall India, 1st Edition, 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	2	1	1	-	-	-	1		1	-	-	1	1
CO2	3	3	2	2	-	-	-	1		1	-	-	1	1
CO3	3	3	3	3	-	-	-	1		1	-	-	1	1
CO4	3	3	3	3	-	-	-	1		1	-	-	1	1
CO5	3	3	3	2	-	-	-	1		1	-	-	1	1
AVG	**3**	**3**	**3**	**2**	**-**	**-**	**-**	**1**		**1**	**-**	**-**	**1**	**1**

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

24ECPE03 WIDE BANDGAP DEVICES **L T P C**
3 0 0 3

COURSE OBJECTIVES

- Introduce the concept of wide band gap (WBG) devices and its application in real world Advantages and disadvantages of WBG devices.
- Provide an introduction to basic operation of WBG power devices.
- Learn Design principles of modern power devices.

UNIT I WBG DEVICES AND THEIR APPLICATION IN REAL WORLD **9**

Review of semiconductor basics, Operation and characteristics of the SiC Schottky Barrier Diode, SiC DMOSFET and GaN HEMT, Review of Wide bandgap semiconductor technology -Advantages and disadvantages.

UNIT II SWITCHING CHARACTERIZATION OF WBG **9**

Turn-on and Turn-off characteristics of the device, Hard switching loss analysis, Double pulse test set-up.

UNIT III DRIVERS FOR WIDE BAND GAP DEVICES **9**

Gate driver, Impact of gate resistance, Gate drivers for wide bandgap power devices , Transient immunity integrated gate drivers.

UNIT IV HIGH FREQUENCY DESIGN COMPLEXITY AND PCB DESIGNING **9**

Effects of parasitic inductance, Effects of parasitic capacitance , EMI filter design for high frequency power converters High frequency PCB design, Conventional power loop design, High frequency power loop optimization, Separation of power from signal PCB.

UNIT V APPLICATIONS OF WIDE BANDGAP DEVICES **9**

Consumer electronics applications, Wireless power transfer applications, Electric vehicle applications , Renewable energy sources applications.

TOTAL:45 PERIODS

COURSE OUTCOMES

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

CO1: Explore master design principles of power devices.
CO2: Students become familiar with reliability issues and testing methods.
CO3: An ability to design and conduct experiments, as well as to analyze and interpret
CO4: Student to get real life experience and to know practical applications of WBG.
CO5: In depth knowledge on practical usage of this technology.

TEXT BOOKS

1. A. Lidow, J. Strydom, M. D. Rooij, D. Reusch, GaN Transistors for Efficient Power Convertion, Wiley, 2014, ISBN-13: 978-1118844762.
2. G. Meneghesso, “Gallium Nitride-enabled High Frequency and High Efficiency Power Conversion,” Springer International Publishing, 2018.
3. Wide Bandgap Semiconductor Power Devices (Elsevier), 2022.

REFERENCE BOOKS

1. F. Wang, Z. Zhang and E. A. Jones, Characterization of Wide Bandgap Power Semiconductor Devices,2018.
2. B.J.Baliga, “Gallium Nitride and Silicon Carbide Power Devices,” World Scientific Publishing Company (3 Feb. 2017).
3. L. Corradini, D. Maksimovic, P. Mattavelli, R. Zane, “Digital Control of HighFrequency Switched-Mode Power Converters”, Wiley,1st Edition,2015.
4. "Wide Bandgap Semiconductors for Power Electronics" , Chen, 2nd Edition, 2021.
5. Wide Gap. Semiconductors, Optical and Electron Devices, published in by Morikita,March 2006.

Mapping of COs with POs & PSOs

COs	POs												PSOs	
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**PSO1**	**PSO2**
CO1	3	3	2	3	2	-	-	-	-	-	-	-	1	1
CO2	3	3	3	2	2	-	-	-	-	-	-	-	1	1
CO3	3	3	2	2	2	-	-	-	-	-	-		2	2
CO4	3	3	3	3	2	-	-	-	-	-	-	-	3	2
CO5	3	2	3	3	2	-	-	-	-	-	-	-	2	2
AVG	**3**	**3**	**2.6**	**2.6**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**2**	**2**

1-Low, 2-Medium, 3-High, ‘-’- No Correlation

24ECPE04 SENSORS AND ACTUATORS **L T P C**
3 0 0 3

COURSE OBJECTIVES

- The objective of this course is to make the students to list common types of sensor and actuators used in automotive vehicles.
- To study of aircraft instrumentation of all the flight, gyroscopic and power plant instruments.
- To learn and rectify the problems occurring in the aircraft.

UNIT I INTRODUCTION TO MEASUREMENTS AND SENSORS **9**

Sensors: Functions- Classifications- Main technical requirement and trends Units and standards-Calibration methods- Classification of errors- Error analysis- Limiting error-Probable error-Propagation of error- Odds and uncertainty- principle of transduction-Classification. Static characteristics- mathematical model of transducers- Zero, First and Second order transducers-Dynamic characteristics of first and second order transducers for standard test inputs.

UNIT II VARIABLE RESISTANCE AND INDUTANCE SENSORS VARIABLE RESISTANCE AND INDUTANCE SENSORS **9**

Principle of operation- Construction details- Characteristics and applications of resistive potentiometer- Strain gauges- Resistive thermometers- Thermistors- Piezoresistive sensors Inductive potentiometer- Variable reluctance transducers:- EI pick up and LVDT.

UNIT III VARIABLE AND OTHER SPECIAL SENSORS **9**

Variable air gap type, variable area type and variable permittivity type- capacitor microphone Piezoelectric, Magnetostrictive, Hall Effect, semiconductor sensor- digital transducers- Humidity Sensor. Rain sensor, climatic condition sensor, solar, light sensor, antiglare sensor.

UNIT IV AUTOMOTIVE ACTUATORS **9**

Electro mechanical actuators- Fluid-mechanical actuators- Electrical machines- Direct-current machines- Three-phase machines- Single-phase alternating-current Machines - Duty-type ratings for electrical machines. Working principles, construction and location of actuators viz. Solenoid, relay, stepper motor etc.

UNIT V AUTOMATIC TEMPERATURE CONTROL ACTUATORS **9**

Different types of actuators used in automatic temperature control- Fixed and variable displacement temperature control- Semi Automatic- Controller design for Fixed and variable displacement type air conditioning system.

TOTAL: 45 PERIODS

COURSE OUTCOMES

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

CO1: List common types of sensor and actuators used in vehicles.

CO2: Design measuring equipment's for the measurement of pressure force, temperature and flow.

CO3: Generate new ideas in designing the sensors and actuators for automotive Application.

CO4: Explain the operation of sensors, actuators and electronic control.

CO5: Design temperature control actuators for vehicles.

TEXT BOOKS

1. Doebelin's Measurement Systems: 7th Edition (SIE),Ernest O. Doebelin DhaneshN.Manik McGraw Hill Publishers, 2019.
2. Robert Brandy, " Automotive Electronics and Computer System", Prentice Hall,2000.
3. William Kimberley," Bosch Automotive Handbook", 6th Edition, Robert Bosch GmbH, 2004.

REFERENCE BOOKS

1. James D Halderman, " Automotive Electrical and Electronics" , Prentice Hall, USA, 2013.
2. Tom Denton, "Automotive Electrical and Electronics Systems," Third Edition, 2004, SAE International.
3. Patranabis.D, " Sensors and Transducers", 2nd Edition, Prentice Hall India Ltd,2003.
4. William Ribbens, "Understanding Automotive Electronics -An Engineering Perspective," 7th Edition, Elsevier Butterworth-Heinemann Publishers, 2012.
5. Bosch Automotive Electrics and Automotive Electronic Systems and Components, Networking and Hybrid Drive, 5th Edition, 2007, ISBN No: 978-3-658-01783-5.

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	-	-	-	-	-	-	-	-	1	1
CO2	3	3	2	1	-	-	-	-	-	-	-	-	1	1
CO3	3	3	2	1	-	-	-	-	-	-	-	-	1	1
CO4	3	3	3	2	-	-	-	-	-	-	-	-	1	1
CO5	3	3	3	2	-	-	-	-	-	-	-	-	1	1
AVG	**3**	**3**	**2**	**1**	-	-	-	-	-	-	-	-	**1**	1

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

24ECPE05 APPLICATIONS OF LINEAR INTEGRATED CIRCUITS L T P C
3 0 0 3

COURSE OBJECTIVES

- To discuss and learn the IC fabrication and characteristics of Op-Amp.
- To interpret the internal functional blocks and the applications of special ICs.
- To illustrate the operation of application ICs.

UNIT I INTRODUCTION TO LINEAR INTEGRATED CIRCUITS 9

Basics of Integrated Circuits (ICs): Definition, types, and classification, Comparison between linear and digital ICs,Overview of the IC manufacturing process (Bipolar, CMOS, BiCMOS),Linear ICs: Features and applications, Characteristics of Op-Amps.

UNIT II OPERATIONAL AMPLIFIERS AND THEIR APPLICATIONS 9

Common Op-Amp configurations: Inverting, non-inverting, differential amplifiers, Applications: Signal amplification, voltage followers, integration and differentiation, comparator circuits, Instrumentation amplifiers, summing amplifiers, differentiators, integrators, active filters, Schmitt triggers.

UNIT III VOLTAGE REGULATORS AND POWER SUPPLY DESIGN 9

Principles of voltage regulation: Linear vs. switching regulators, Fixed and adjustable voltage regulators (78xx, 79xx series, LM317), Power supply design using linear ICs: Smoothing filters, ripple rejection, and thermal considerations, Power management and distribution in electronic circuits.

UNIT IV ACTIVE FILTERS AND OSCILLATORS 9

Frequency response of linear systems,Design of first and second-order active filters: Low-pass, high-pass, band-pass, and band-stop filters using Op-Amps,Applications of active filters in audio processing, communication systems, and signal conditioning,Oscillator circuits: Phase-shift oscillators, Wien bridge oscillators, and RC oscillators using Op-Amps,Practical applications of oscillators in signal generation, frequency synthesis, and clock generation.

UNIT V SPECIALIZED APPLICATIONS OF LINEAR ICS 9

Precision rectifiers and peak detectors: Design and applications in signal processing, Temperature sensors and instrumentation using linear ICs (e.g., LM35, thermocouples, and thermostats),Applications in medical instrumentation and industrial automation, Linear ICs in audio processing: Op-Amp based audio amplifiers.

TOTAL:45 PERIODS

COURSE OUTCOMES

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

CO1: Explain the fundamental principles and characteristics of Linear ICs.
CO2: Design the circuits using operational amplifiers (Op-Amps) and other linear ICs.
CO3: Apply linear ICs in real-world applications.
CO4: Solve practical problems related to power supply design.
CO5: Prototype and test circuits with linear ICs.

TEXT BOOKS

1. D.Roy Choudhry, Shail Jain, "Linear Integrated Circuits", New Age International Pvt. Ltd., 2018, Fifth Edition,2018.
2. Sergio Franco, "Design with Operational Amplifiers and Analog Integrated Circuits", 4th Edition, Tata Mc Graw-Hill, 2016.
3. Coughlin, Robert F. Operational amplifiers and linear integrated circuits. 4th ed. Englewood Cliffs, N.J: Prentice Hall, 1991.

REFERENCE BOOKS

1. Roy Choudhury and Shail Jain, "Linear Integrated Circuits", 2nd Edition, New Age International Publishers, 2003.
2. S.Salivahanan and V.S. Kanchana Bhaaskaran, "Linear Integrated Circuits", 6th Edition, Tata McGraw-Hill, 2011.
3. Ramakant A.Gayakwad, "Op-Amps and Linear Integrated Circuits", 4th Edition, Prentice Hall, 2000.
4. Robert F. Coughlin, Frederick F. Driscoll, "Operational-Amplifiers and Linear Integrated Circuits", 6th Edition, Prentice Hall, 2001.
5. Sergio Franco, "Design with operational amplifier and analog integrated circuits", McGraw Hill, 1997.

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	-	-	-	-	-	-	-	-	-	1	-	2	1
CO2	2	3	3	2	-	-	-	-	-	-	-	-	2	1
CO3	1	-	-	2	-		-	-	-	-	-	-	2	1
CO4	1	-	-	2	-	-	-	-	-	-	-	-	2	1
CO5	1	2	3	3	-	-	-	-	-	-	-	3	2	1
AVG	**1.4**	**2.5**	**3**	**2.2**	-	-	-	-	-	-	**1**	**3**	**2**	**1**

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

24ECPE06 NETWORK SECURITY **L T P C**
3 0 0 3

COURSE OBJECTIVES

- Understand network security concepts, services, attacks, and mechanisms.
- Comprehend and apply authentication services and algorithms.
- Understand and implement security protocols at the network, transport, and application layers.

UNIT I NETWORK MODELS AND DATALINK LAYER **9**

Overview of Networks and its Attributes – Network Models – OSI, TCP/IP, Addressing – Introduction to Datalink Layer – Error Detection and Correction – Ethernet(802.3)- Wireless LAN – IEEE 802.11, Bluetooth – Flow and Error Control Protocols – HDLC – PPP.

UNIT II NETWORK LAYER PROTOCOLS **9**

Network Layer – IPv4 Addressing – Network Layer Protocols(IP,ICMP and Mobile IP) Unicast and Multicast Routing – Intradomain and Interdomain Routing Protocols – IPv6 Addresses – IPv6 – Datagram Format - Transition from IPv4 to IPv6.

UNIT III TRANSPORT AND APPLICATION LAYERS **9**

Transport Layer Protocols – UDP and TCP Connection and State Transition Diagram - Congestion Control and Avoidance(DEC bit, RED)- QoS - Application Layer Paradigms – Client – Server Programming – Domain Name System – World Wide Web, HTTP, Electronic Mail.

UNIT IV NETWORK SECURITY **9**

OSI Security Architecture – Attacks – Security Services and Mechanisms – Encryption – Advanced Encryption Standard – Public Key Cryptosystems – RSA Algorithm – Hash Functions – Secure Hash Algorithm – Digital Signature Algorithm.

UNIT V HARDWARE SECURITY **9**

Introduction to hardware security, Hardware Trojans, Side – Channel Attacks – Physical Attacks and Countermeasures – Design for Security. Introduction to Blockchain Technology.

TOTAL:45 PERIODS

COURSE OUTCOMES

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

CO1: Explain the Network Models, layers and functions.
CO2: Categorize and classify the routing protocols.
CO3: List the functions of the transport and application layer.
CO4: Evaluate and choose the network security mechanisms.
CO5: Discuss the hardware security attacks and countermeasures.

TEXT BOOKS

1. Behrouz.A.Forouzan, Data Communication and Networking, Fifth Edition, TMH, 2017.
2. William Stallings, Cryptography and Network Security, Seventh Edition, Pearson Education, 2017.
3. Bhunia Swarup, Hardware Security –A Hands On Approach,Morgan Kaufmann, First edition, 2018.

REFERENCE BOOKS

1. James.F.Kurose and Keith.W.Ross, Computer Networking – A Top – Down Approach, Sixth Edition, Pearson, 2017.
2. Doughlas .E.Comer, Computer Networks and Internets with Internet Applications, Fourth Edition, Pearson Education, 2008.
3. William Stallings and Lawrie Brown, "Computer Security: Principles and Practice", Pearson Education, 2014.
4. Mark Ciampa "Security + Guide to Network Security Fundamentals/" Cengage Learning publisher, ISBN-10: 1428340661, ISBN-13: 978-1428340664, 3rd Edition,2008.
5. Saadat Malik, Saadat Malik. "Network Security Principles and Practices (CCIE Professional Development)". Pearson Education. 2002. (ISBN: 1587050250).

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
CO2	3	3	3	-	-	-	-	-	-	-	-	-	2	3
CO3	3	3	3	2	-	-	-	-	-	-	-	-	2	3
CO4	3	3	3	2	-	-	-	-	-	-	-	-	3	3
CO5	3	3	3	2	-	-	-	-	-	-	-	-	3	3
AVG	**3**	**3**	**3**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**2.4**	**2.8**

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

24ECPE07 NANO ELECTRONICS **L T P C**
3 0 0 3

COURSE OBJECTIVES

- To understand the concepts of nano electronics and quantum electronics.
- To understand the concepts of nano electronic devices, transistors, tunneling devices and superconducting devices.
- To understand the basics of nanotube devices.

UNIT I INTRODUCTION TO NANO ELECTRONICS **9**

Scaling to nano - Light as a wave and particle- Electrons as waves and particles- origin of quantum mechanics - General postulates of quantum mechanics - Time independent Schrodinger wave equation- Electron confinement - Quantum dots, wires and well-Spin and angular momentum.

UNIT II QUANTUM ELECTRONICS **9**

Quantum electronic devices - Short channel MOS transistor - Split gate transistor - Electron wave transistor - Electron wave transistor - Electron spin transistor - Quantum cellular automata Quantum dot array, Quantum memory.

UNIT III NANO ELECTRONIC TRANSISTORS **9**

Coulomb blockade - Coulomb blockade in Nano capacitors - Coulomb blockade in tunnel junctions - Single electron transistors, Semiconductor nanowire FETs and SETs, Molecular SETs and molecular electronics - Memory cell.

UNIT IV NANO ELECTRONIC TUNNELING AND SUPER CONDUCTING DEVICES **9**

Tunnel effect -Tunneling element -Tunneling diode - Resonant tunneling diode - Three terminal resonant tunneling devices- Superconducting switching devices- Cryotron-Josephson tunneling device.

UNIT V NANOTUBES AND NANOSTRUCTURE DEVICES **9**

Carbon Nanotube - Fullerenes - Types of nanotubes – Formation of nanotubes –Assemblies – Purification of carbon nanotubes – Electronic properties – Synthesis of carbon nanotubes – Carbon nanotube interconnects – Carbon nanotube FETs and SETs –Nanotube for memory applications- Nano structures and nano structured devices.

TOTAL:45 PERIODS

COURSE OUTCOMES

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

CO1: Explain the basics of nano electronics including quantum wire dots and wells.

CO2: Analyse and Use the mechanism behind quantum electronic devices.

CO3: Explore the fundamental concepts and Analyze the key performance aspects of tunneling and superconducting nano electronic devices.

CO4: Apply the knowledge in the development of nanotubes and nanostructure devices.

CO5: Demonstrate accurate and efficient use of understand the basics of nanotube devices.

TEXT BOOKS

1. Hanson, Fundamentals of Nanoelectronics, Pearson education, 2009.
2. Ibe, O.C., “Fundamentals of Applied Probability and Random Processes", Elsevier,1st Indian Reprint, 2007.
3. Friedberg. A.H., Insel. A.J. and Spence. L., “Linear Algebra”, Prentice Hall of India, New Delhi,4th Edition, 2004.

REFERENCE BOOKS

1. Jan Dienstuhl, Karl Goser, and Peter Glösekötter, Nanoelectronics and Nanosystems: From Transistors to Molecular and Quantum Devices, Springer-Verlag, 2004.
2. Mircea Dragoman and Daniela Dragoman, Nanoelectronics: Principles and Devices, Artech House, 2009.
3. Robert Puers, Livio Baldi, Marcel Van de Voorde and Sebastiaan E. Van Nooten, Nanoelectronics: Materials, Devices, Applications, Wiley, 2017.
4. Brajesh Kumar Kaushik, Nanoelectronics: Devices, Circuits and Systems, Elsevier science, 2018.
5. Hassan Raza, Nanoelectronics Fundamentals Materials, Devices and Systems, Spiringer, 2019.

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
CO2	3	2	-	-	-	-	-	-	2	-	-	-	2	2
CO3	3	2	-	-	-	-	-	-	2	-	-	-	2	2
CO4	3	2	-	-	-	-	-	-	2	-	-	-	2	2
CO5	3	2	-	-	-	-	-	-	2	-	-	-	2	2
AVG	**3**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**2**	**-**	**-**	**-**	**2**	**2**

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

24ECPE08 EMI/EMC TESTING **L T P C**

3 0 0 3

COURSE OBJECTIVES

- To define EMI Environment, Coupling principles, Different sources of EMI and Mitigation Techniques.
- To describe Electromagnetic emissions and distinguish EMI radiation and conduction coupling.
- To describe the Characteristics of EMI filters and components for EMI/EMC standards.

UNIT I INTRODUCTION **9**

Classification of electromagnetic interference sources - Natural sources - Man-made sources- Surveys of the electromagnetic environment.

UNIT II COUPLING MECHANISMS **9**

Propagation and Cross talk – Basic Principles – Representation of EM Coupling from External Fields – Determination of EM field generated by Transmission Lines – Electromagnetic Coupling between Systems – Penetration and Coupling – Propagation and Cross Talk.

UNIT III INTERFERENCE CONTROL TECHNIQUES **9**

Shielding Theory – Shielding Effectiveness - Equipment screening - Cable screening - grounding - Power-line filters - Isolation - Balancing - Signal-line filters - Nonlinear protective Devices.

UNIT IV EMC STANDARDS, MEASUREMENTS AND TESTING **9**

Need for standards - The international framework - FCC – Military Standard MIL-STD-461DEMC measurement techniques – Measurement tools – Test environments – Transient EMI test wave simulators.

UNIT V EMC IN WIRELESS TECHNOLOGIES AND ELECTRIC VEHICLES **9**

Efficient use of the frequency spectrum – EMC, Interoperability, and Coexistence – Transmission of high frequency signals over telephone and power networks - EMC Problems of Electric Vehicles - EMC Problems of Wireless Charging System, EMC Problems of Battery Management System, Vehicle EMC Requirements.

TOTAL:45 PERIODS

COURSE OUTCOMES

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

CO1: Explain the various parameters in EMI and compatibility.
CO2: Summarize electromagnetic field coupling mechanisms.
CO3: Analyze various interference control techniques.
CO4: Appreciate the need for various standards and measurement procedures.
CO5: Explore the impact of EMI on wireless technologies and Electric vehicles.

TEXT BOOKS

1. Dr. V.P. Kodali, Engineering Electromagnetic Compatibility, IEEE Printed in India by S. Chand & Co. Ltd., New Delhi, 2000. Publication,
2. Henry W. Ott, Electromagnetic Compatibility Engineering, John Wiley & Sons Inc, New York, 2009
3. Clayton R.Paul, Introduction to electromagnetic compatibility, John Wiley and Sons, Inc. 1991.

REFERENCE BOOKS

1. Daryl Gerke and William Kimmel, EDN's Designer's Guide to Electromagnetic Compatibility, Elsevier Science & Technology Books, 2002.
2. Dr Kenneth L Kaiser, The Electromagnetic Compatibility Handbook, CRC Press, 2005.
3. Bernhard Keiser, Principles of Electromagnetic Compatibility, 3rd Edition, Artech house, 1986.
4. Christos Christopoulos, Principles and Techniques of Electromagnetic Compatibility, CRC Press, Third Edition, 2023.
5. Li Zhai, Electromagnetic Compatibility of Electric Vehicle, 1st Ed., Springer 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	3	3	3	3	-	-	-	-	3	-	3	3	3
CO2	3	3	3	3	3	-	-	-	-	3	-	3	3	3
CO3	3	3	3	3	3	-	-	-	-	3	-	3	2	3
CO4	3	3	3	3	3	-	-	-	-	3	-	3	3	2
CO5	3	3	3	3	3	-	-	-	-	3	-	3	3	2
AVG	**3**	**3**	**3**	**3**	**3**	**-**	**-**	**-**	**-**	**3**	**-**	**3**	**2.8**	**2.6**

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

24ECPE09 WIRELESS COMMUNICATION **L T P C**
3 0 0 3

COURSE OBJECTIVES

- To study and understand the concepts and design of a Cellular System.
- To Study And Understand Mobile Radio Propagation And Various Digital Modulation Techniques.
- To Understand The Concepts Of Multiple Access Techniques And Wireless Networks.

UNIT I THE CELLULAR CONCEPT-SYSTEM DESIGN FUNDAMENTALS 9

Introduction-FrequencyReuse-Channel Assignment Strategies-Handoff Strategies:Prioritizing Handoffs, Practical Handoff Considerations. Interference And System Capacity: Co-Channel Interference And System Capacity-Channel Planning For Wireless Systems, Adjacent Channel Interference, Power Control For Reducing Interference, Trunking And Grade Of Service. Improving Coverage And Capacity In Cellular Systems: Cell Splitting, Sectoring.

UNIT II MOBILE RADIO PROPAGATION 9

Large Scale Path Loss: Introduction To Radio Wave Propagation - Free Space Propagation Model – Three Basic Propagation Mechanism: Reflection – Brewster Angle- Diffraction-Scattering.Small Scale Fading And Multipath: Small Scale Multipath Propagation, Factors Influencing Small-Scale Fading, Doppler Shift, Coherence Bandwidth, Doppler Spread And Coherence Time. Types Of Small- Scale Fading: Fading Effects Due To Multipath Time Delay Spread, Fading Effects Due To Doppler Spread.

UNITI III MODULATION TECHNIQUES, EQUALIZATION AND DIVERSITY 9

Digital Modulation – An Overview: Factors That Influence The Choice Of Digital Modulation, Linear Modulation Techniques: Minimum Shift Keying (MSK), Gaussian Minimum Shift Keying(GMSK), Spread Spectrum Modulation Techniques: Pseudo- Noise (PN) Sequences, Direct Sequence Spread Spectrum (DS-SS)- Modulation Performance In Fading And Multipath 91 Channels- Equalization, Diversity And Channel Coding: Introduction-Fundamentals Of Equalization- Diversity Techniques: Practical Space Diversity Considerations, Polarization Diversity, Frequency Diversity, Time Diversity.

UNIT IV MULTIPLE ACCESS TECHNIQUES 9

Introduction: Introduction To Multiple Access- Frequency Division Multiple Access(FDMA)- Time Division Multiple Access(TDMA)- Spread Spectrum Multiple Access-Code Division Multiple Access(CDMA)- Space Division Multiple Access(SDMA)-Capacity Of Cellular Systems: Capacity Of Cellular CDMA, Capacity Of CDMA With Multiple Cells.

UNIT V WIRELESS NETWORKING 9

Introduction: Difference Between Wireless And Fixed Telephone Networks, The Public Switched Telephone Network(PSTN), Development Of Wireless Networks: First Generation Wireless Networks, Second Generation Wireless Networks, Third Generation Wireless Networks, Fixed Network Transmission Hierarchy, Traffic Routing In Wireless Networks: Circuit Switching, Packet Switching.

TOTAL:45 PERIODS

COURSE OUTCOMES

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

CO1: Explain Mobile Radio Propagation And Various Digital Modulation Techniques.
CO2: Perceive the concepts of Multiple Access Techniques.
CO3: Characterize a wireless channel and evolve the system design specifications.
CO4: Design a cellular system based on resource availability and traffic demands.
CO5: Explore the signal processing approach for wireless communication.

TEXT BOOKS

1. Rappaport,T.S.,-Wireless communications", Pearson Education, 2nd Ed., 2010.
2. Wireless Communication –Andrea Goldsmith, Cambridge University Press, 2011.
3. Van Nee, R. and Ramji Prasad, ―OFDM for wireless multimedia communications, Artech House, 2000.

REFERENCE BOOKS

1. David Tse and Pramod Viswanath, ―Fundamentals of Wireless Communication, Cambridge University Press, 2005.
2. Upena Dalal, ―Wireless Communication", Oxford University Press, 2009.
3. Andreas.F. Molisch, ―Wireless Communications", John Wiley – India, 2006.
4. Sophoncles J. Orfanidis, "Optimum Signal Processing ", McGraw Hill, 2000.
5. A Monson H. Hayes, "Statistical digital signal processing and modeling", John Wiley and Sons Inc. New York, Indian reprint 2008.

Mapping of COs with POs & PSOs

COs	POs							PSOs						
	1	2	3	4	5	6	7	8	9	10	11	12	PSO1	PSO2
CO1	3	2	2	3	3	1	-	-	-	-	-	1	1	1
CO2	3	3	2	1	3	2	-	-	-	-	-	-	1	2
CO3	3	3	3	3	2	2	-	-	-	-	-	1	1	2
CO4	2	3	2	2	2	2	-	-	-	-	-	1	1	1
CO5	2	-	3	3	2	1	-	-	-	-	-	1	2	2
AVG	3	3	2	2	2	2	-	-	-	-	-	1	1	2

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

24ECPE10 OPTICAL COMMUNICATION **L T P C**
3 0 0 3

COURSE OBJECTIVES

- To learn fundamentals of optical communication and optical fiber working principles.
- To study various types of connectors and splicing techniques and also various misalignment losses.
- To understand the concepts of power launching, power coupling and also receiver operation.

UNIT I OVERVIEW OF OPTICAL FIBER COMMUNICATION **9**

Historical development, The general system, advantages of optical fiber communications. Optical fiber wave guides- Introduction, Ray theory transmission, Total Internal Reflection, Acceptance angle, Numerical Aperture, Skew rays, Cylindrical fibers Modes, V-number, Mode coupling, Step Index fibers, Graded Index fibers, Single mode fibers- Cut off wavelength, Mode Field Diameter, Effective Refractive Index, Related problems.

UNIT II MATERIALS IN OPTICAL FIBER FABRICATION **9**

Fiber materials:- Glass, Halide, Active glass, Chalgenide glass, Plastic optical fibers. Signal distortion in optical fibers-Attenuation, Absorption, Scattering and Bending losses, Core and Cladding losses, Information capacity determination, Group delay, Types of Dispersion:- Material dispersion, Wave-guide dispersion, Polarization-Mode dispersion, Intermodal dispersion, Pulse broadening in Graded index fiber, Related problems.

UNIT III CONNECTORS, SPLICING AND MISALIGNMENT LOSSES **9**

Optical fiber Connectors-Connector types, Single mode fiber connectors, Connector return loss, Fiber Splicing -Splicing techniques, Splicing single mode fibers, Fiber alignment and joint loss- Multimode fiber joints, single mode fiber joints.

UNIT IV OPTICAL SOURCES AND DETECTORS **9**

Optical sources- LEDs, Structures, Materials, Quantum efficiency, Power, Modulation, Power bandwidth product. Injection Laser Diodes- Modes, Threshold conditions, External quantum efficiency, Laser diode rate equations, Resonant frequencies, Reliability of LED&ILD, Optical detectors-Physical principles of PIN and APD, Detector response time, Temperature effect on Avalanche gain, Comparison of Photo detectors, Related problems.

UNIT V POWER LAUNCHING AND COUPLING IN RECEIVERS **9**

Source to fiber power launching - Output patterns, Power coupling, Power launching, Equilibrium Numerical Aperture, Laser diode to fiber coupling, Optical receiver operation-Fundamental receiver operation, Digital signal transmission, error sources, Receiver configuration, Digital receiver performance, Probability of Error, Quantum limit, Analog receivers.

TOTAL:45 PERIODS

COURSE OUTCOMES

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

CO1: Choose necessary components required in modern optical communications Systems.

CO2: Design and build optical fiber experiments in the laboratory.

CO3: Use different types of photo detectors and optical test equipment.

CO4: Choose the optical cables for better communication with minimum losses.

CO5: Design build and demonstrate optical fiber experiments in the laboratory.

TEXT BOOKS

1. Optical Fiber Communications – Gerd Keiser, Mc Graw-Hill International edition, 3rd Edition, 2000.
2. Optical Fiber Communications – John M. Senior, PHI, 2nd Edition, 2002.
3. W.L. Stutzman & G.A. Thiele : Antenna Theory and Design, Wiley,3rd Edition,2012.

REFERENCE BOOKS

1. Fiber Optic Communications – D.K. Mynbaev , S.C. Gupta and Lowell L. Scheiner, Pearson Education,2005.
2. Text Book on Optical Fiber Communication and its Applications – S.C.Gupta, PHI, 2005.
3. Fiber Optic Communication Systems – Govind P. Agarwal , John Wiley, 3rd Edition, 2004.
4. Fiber Optic Communications – Joseph C. Palais, 4th Edition, Pearson Education, 2004.
5. Optical Communication Networks – Biswajit Mukherjee, TMH, 1998.

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	3	-	-	-	-	3	-	3	3	3
CO2	3	3	3	3	3	-	-	-	-	3	-	3	3	3
CO3	3	3	3	3	3	-	-	-	-	3	-	3	2	1
CO4	3	3	3	3	3	-	-	-	-	3	-	3	3	3
CO5	3	3	3	3	3	-	-	-	-	3	-	3	3	3
AVG	3	3	3	3	3	-	-	-	-	3	-	3	2.8	2.6

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

24ECPE11 SATELLITE COMMUNICATION **L T P C**
3 0 0 3

COURSE OBJECTIVES

- To become familiar with satellites and satellite services.
- To study the satellite orbits and launching.
- To study the satellite access by various users.

UNIT I SATELLITE ORBITS **9**

Kepler's Laws, Newton's law, orbital parameters, orbital perturbations, station keeping, geo stationary and non Geo-stationary orbits – Look Angle Determination- Limits of visibility – eclipseSub satellite point –Sun transit outage-Launching Procedures - launch vehicles and propulsion.

UNIT II SPACE SEGMENT **9**

Spacecraft Technology- Structure, Primary power, Attitude and Orbit control, Thermal control and Propulsion, communication Payload and supporting subsystems, Telemetry, Tracking and command-Transponders Antenna Subsystem.

UNIT III SATELLITE LINK DESIGN **9**

Basic link analysis, Uplink and Downlink Design equation, Free space loss-Atmospheric effects, Ionospheric scintillation, Rain induced attenuation and interference, system noise temperature, Link Design with and without frequency reuse.

UNIT IV SATELLITE ACCESS AND CODING TECHNIQUES **9**

Modulation and Multiplexing: Voice, Data, Video, Analog – digital transmission system, Digital video Broadcast, multiple access: FDMA, TDMA, CDMA, PAMA and DAMA Assignment Methods, compression – encryption, Coding Schemes.

UNIT V SATELLITE APPLICATIONS **9**

INTELSAT Series, INSAT, VSAT, Mobile satellite services: GSM, GPS, LEO, MEO, Satellite Navigational System. GPS-Position Location Principles, Differential GPS, Direct Broadcast satellites (DBS/DTH).

TOTAL:45 PERIODS

COURSE OUTCOMES

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

CO1: Ability to understand about satellite orbits, trajectories and their parameters.
CO2: Knowledge on electronic subsystem associated with the satellite and earth station.
CO3: Ability to compute the satellite link parameters under various conditions.
CO4: Ability to understand about multiple access techniques.
CO5: Ability to understand about satellite applications.

TEXT BOOKS

1. Dennis Roddy, "Satellite Communication", 4th Edition, Mc Graw Hill International, 2017.
2. Timothy Publications,2021Anil K. Maina, Varsha Agrawal, "Satellite Communications", Wiley India Pvt Ltd, 2015, ISBN: 978-81-265-2071-8.
3. Pratt, Charles, W.Bostain, Jeremy E.Allnutt, "Satellite Communication", 3rd Edition, Wiley Publications,2021,

REFERENCE BOOKS

1. W.L.Pritchard, H G Suyderhoud and R A Nelson, "Satellite Communication System Engineering", Prentice Hall, 2nd Edition, 1993.
2. Tri. T. Ha, "Digital Satellite Communications', McGraw Hill, 2nd Edition, 1990.
3. B.N.Agarwal, "Design of Geosynchronous Space Craft", Prentice Hall, 1986.
4. M. Richharia, "Satellite Systems for Personal Applications", John Wiley, 2010.
5. Wilbur L. Pritchard, Hendri G. Suyderhoud, Robert A. Nelson, "Satellite Communication Systems Engineering", Prentice Hall/Pearson, 2007.

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	3	-	-	-	-	3	-	3	3	2
CO2	3	3	3	3	3	-	-	-	-	3	-	3	3	2
CO3	3	3	3	3	3	-	-	-	-	3	-	3	2	3
CO4	3	3	3	3	3	-	-	-	-	3	-	3	3	3
CO5	3	3	3	3	3	-	-	-	-	3	-	3	3	3
AVG	3	3	3	3	3	-	-	-	-	3	-	3	2.8	2.8

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

24ECPE12 SMART ANTENNAS **L T P C**
3 0 0 3

COURSE OBJECTIVES

- To provide the basic knowledge of smart antennas and their radiation characteristics.
- To provide the knowledge of broad band antennas and their applications.
- To develop the students understanding of various Microstrip antenna for smart antenna applications.

UNIT I RADIATION AND POLARIZATION **9**

Physical concept of radiation, Radiation pattern, near- and far-field regions, reciprocity, directivity and gain, effective aperture, input impedance, efficiency. Polarization, Friis transmission equation, radiation integrals and auxiliary potential functions.

UNIT II INTRODUCTION TO SMART ANTENNAS **9**

Need for smart antennas, standards for smart antennas, types of smart antennas, features and benefits ,architecture, advantages and disadvantages of smart antennas, introduction to orthogonal signals, signal propagation: multipath and co-channel Interference. Concept and benefits of smart antennas, fixed weight beam forming basics. Adaptive beam forming. Switched beam systems, spatial division multiple access.

UNIT III RADIATION FROM WIRES AND APERTURE ANTENNAS **9**

Infinitesimal dipole, finite-length dipole, linear elements near conductors, dipoles for mobile communication, small circular loop. Huygens' Principle, radiation from rectangular and circular apertures, design considerations, Babinet's principle, Radiation from sectoral and pyramidal horns, design concepts.

UNIT IV MICROSTRIP ANTENNAS

Basic characteristics of microstrip antennas, feeding methods, methods of analysis. Design of rectangular and circular patch antennas and their field expressions.

UNIT V BROADBAND ANTENNAS **9**

Broadband concept, Biconical antenna, radiated fields and input impedance, Log-periodic antennas, Planer and wire surfaces, Dipole array and feed networks, frequency independent antennas, equiangular spiral antennas, Planner spiral, and conical spiral.

TOTAL:45 PERIODS

COURSE OUTCOMES

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

CO1: Explain the various antenna parameters.
CO2: Demonstrate basic understanding of smart antennas for broad frequency range.
CO3: Demonstrate basic understanding of wire and aperture antennas.
CO4: Analyze the broadband antennas for different applications.
CO5: Interpret the different microstrip antennas for smart antenna applications.

TEXT BOOKS

1. C.A.Balanis - Antenna Theory and Design, 3rd Ed., John Wiley & Sons., 2005.
2. F.B.Gross - Smart Antennas for Wireless Communications, McGraw-Hill., 2005.
3. J.D.Kraus and Ronald J Marhefka - Antennas For all Applications, TMH, 2003.

REFERENCE BOOKS

1. R. E. Collin - Antennas and Radio Wave Propagation, McGraw-Hill., 1985.
2. R. S. Elliot - Antenna Theory and Design, Revised edition, Wiley-IEEE Press., 2003.
3. Praveen Kumar Malik, Pradeep Kumar, Sachin Kumar, Dushyant Kumar Singh, "Smart Antennas: Recent Trends in Design and Applications", Bentham Books,2021.
4. Praveen Kumar Malik , Joan Lu, B T P Madhav, Wei Xiang, "Latest Trends in Design and Application", Springer, 2023.
5. T. K. Sarkar, Michael C. Wicks, Magdalena Salazar-Palma, Robert J. Bonneau, "Smart Antennas", Wiley-IEEE 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	3	3	3	2	1	-	-	-	1	-	2	3	2
CO2	3	2	2	2	2	1	-	-	-	1	-	2	3	2
CO3	3	3	2	2	1	2	-	-	-	1	-	2	3	2
CO4	3	3	2	3	2	1	-	-	-	1	-	2	3	2
CO5	3	2	3	2	2	1	-	-	-	1	-	2	3	2
AVG	**3**	**3**	**2**	**2**	**2**	**1**	**-**	**-**	**-**	**1**	**-**	**2**	**3**	**2**

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

24ECPE13 RF DEVICES AND ACTIVE CIRCUITS **L T P C**
3 0 0 3

COURSE OBJECTIVES:

- To impart knowledge on the design considerations for RF active circuits.
- To analyze the characteristics of RF diodes and transistors.
- To enhance the the design RF active circuits for given specifications.

UNIT I ACTIVE RF DEVICES AND COMPONENTS **9**

Semiconductor properties-RF diodes- PIN-Schotky-Varactor-Gunn diode-applications of diodes- switch-modulator-attenuator-phase shifter-detector BJTs, FETs-MOSFETS, Director-Circulator-Couplers.

UNIT II MICROWAVE AMPLIFIER PARAMETERS **9**

Bandwidth, Power gain, input and output VSWR, Inter modulation distortion, two tone measurements technique, Harmonic power, Power added Efficiency, Peak to Average Ratio, Noise Characterization, Dynamic Range, Multistage amplifier characteristics, Stability and gain analysis. Amplifier types.

UNIT III RF AMPLIFIERS **9**

BJT and FET Biasing, Impedance matching, Small Signal Amplifier Design, Large signal amplifier design, Multistage amplifier design.

UNIT IV MIXERS **9**

Mixer characteristics: Image frequency, conversion loss, noise figure; Devices for mixers: p-n junctions, Schottky barrier diode, FETs; Diode mixers: Small-signal characteristics of diode, single-ended mixer, large-signal model, switching model; FET Mixers: Single-ended mixer, other FET mixers; Balanced mixers; Image reject mixers.

UNIT V OSCILLATORS AND FREQUENCY SYNTHESIZERS **9**

General analysis of RF oscillators, transistor oscillators, voltage-controlled oscillators, dielectric resonator oscillators, frequency synthesis methods, analysis of first and second order phase-locked loop, oscillator noise and its effect on receiver performance.

TOTAL:45 PERIODS

COURSE OUTCOMES

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

CO1: Apply the basic knowledge of RF active circuits.
CO2: Explore the methods used for amplification of the microwave power.
CO3: Analyze the performance of RF devices and circuits.
CO4: Learn the basics of parameters and use them in describing the components.
CO5: Expose to the Oscillators and their frequency synthesizers.

TEXT BOOKS

1. Les Besser, Rowan Gilmore, "Practical RF Circuit Design for Modern Wireless Systems, Volume 2: Active Circuits", Wiley, 2003.
2. S.Y.Liao, "Microwave Devices and Circuits (3/e)", PHI, 2005.
3. Michael Steer, "Fundamentals of Microwave and RF Design", North Carolina State University Libraries, 2019.

REFERENCE BOOKS

1. Christopher Bowick, "RF Circuit Design", Elsevier, 2nd Edition, 2008.
2. Bahl I and Bhartia P, "Microwave Solid State Circuit Design", John Wiley & Sons, 2nd Edition, 2003.
3. Chang K, Bahl I and Nair V, "RF and Microwave Circuit and Component Design for Wireless Systems", Wiley Inter science. 2002.
4. Inder J Bahl, " Fundamentals of RF and Microwave Transistor Amplifiers", John Wiley & Sons Inc, 2009.
5. Hong and Lancaster, "Microstrip Filters for RF Microwave Applications", 3rd edition,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	3	3	2	2	-	-	-	-	-	-	-	3	2
CO2	3	3	3	2	2	-	-	-	-	-	-	-	3	2
CO3	3	3	2	2	2	-	-	-	-	-	-	-	2	1
CO4	3	3	2	2	2	-	-	-	-	-	-	-	3	3
CO5	3	3	3	3	3	-	-	-	-	-	-	-	3	3
AVG	3	3	2.6	2.2	2.2	-	-	-	-	-	-	-	2.8	2.2

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

24ECPE14 ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING L T P C
3 0 0 3

COURSE OBJECTIVES

- Learn techniques for reasoning under uncertainty.
- Introduce Machine Learning and supervised learning algorithms.
- Study about ensembling and unsupervised learning algorithms.

UNIT I PROBLEM SOLVING **9**

Introduction to AI - AI Applications - Problem solving agents – search algorithms – uninformed search strategies – Heuristic search strategies – Local search and optimization problems – adversarial search – constraint satisfaction problems (CSP).

UNIT II 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.

UNIT III SUPERVISED LEARNING **9**

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

UNIT IV 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 V NEURAL NETWORKS **9**

Perceptron - 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.

TOTAL:45 PERIODS

COURSE OUTCOMES

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

CO1: Use appropriate search algorithms for problem solving.
CO2: Apply reasoning under uncertainty.
CO3: Build supervised learning models.
CO4: Build ensembling and unsupervised models.
CO5: Build deep learning neural network models.

TEXT BOOKS

1. Stuart Russell and Peter Norvig, "Artificial Intelligence – A Modern Approach", Fourth Edition, Pearson Education, 2021.
2. Ethem Alpaydin, "Introduction to Machine Learning", MIT Press, Fourth Charu Edition, 2020.
3. C. Aggarwal, "Data Classification Algorithms and Applications", CRC Press, 2014.

REFERENCE BOOKS

1. Dan W. Patterson, "Introduction to AI and ES", Pearson Education,2007.
2. Kevin Night, Elaine Rich, and Nair B., "Artificial Intelligence", McGraw Hill, 2008.
3. Patrick H. Winston, "Artificial Intelligence", Third Edition, Pearson Education, 2006.
4. Deepak Khemani, "Artificial Intelligence", Tata McGraw Hill Education, 2013 (http://nptel.ac.in/).
5. Christopher M. Bishop, "Pattern Recognition and Machine Learning", Springer, 2006.

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	3	1	3	2	-	-	-	-	1	3	3
CO2	3	2	2	3	1	3	2	-	-	-	-	1	3	3
CO3	1	2	1	3	2	3	2	-	-	-	-	1	3	3
CO4	1	2	3	1	3	3	2	-	-	-	-	1	3	3
CO5	2	2	2	-	3	3	2	-	-	-	-	1	3	3
AVG	2	2	2	2	2	3	2	-	-	-	-	1	3	3

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

24ECPE15 INFORMATION THEORY **L T P C**
3 0 0 3

COURSE OBJECTIVES

- To introduce the basic concepts of information theory, including the measurement of information and the principles of entropy and data compression.
- To understand the fundamentals of source coding, channel coding, and their applications in communication systems.
- To explore modern applications of information theory, including wireless communication, cryptography, and data compression.

UNIT I INTRODUCTION TO INFORMATION THEORY **9**

Definition of Information and Entropy, Shannon's Information Measure (Entropy, Joint and Conditional Entropy), Mutual Information and its Properties, Data Processing Inequality, Channel Models and Noisy Channels, Applications of Information Theory in Communication Systems.

UNIT II SOURCE CODING THEOREM AND TECHNIQUES **9**

Source Coding Theorem,Shannon-Fano Coding,Huffman Coding (Optimality of Huffman Codes),Arithmetic Coding,Lossless Data Compression (LZW, LZ77),Minimum Average Code Length and Redundancy.

UNIT III CHANNEL CODING THEOREM AND TECHNIQUES **9**

Noisy Channel and Channel Capacity,Shannon-Hartley Theorem,Linear Block Codes, Cyclic Codes,Hamming Codes and Hamming Distance,Error Detection and Correction Codes,Maximum Likelihood Decoding.

UNIT IV RATE-DISTORTION THEORY AND APPLICATIONS **9**

Rate-Distortion Function and its Derivation,Distortion Measures in Source Coding,Applications in Image and Video Compression (JPEG, MPEG),Practical Examples of Rate-Distortion in Data Compression.

UNIT V MODERN APPLICATIONS OF INFORMATION THEORY **9**

Applications in Wireless Communications (MIMO, Channel Capacity),Error Correction in Wireless Systems (Turbo Codes, LDPC),Information Theory in Cryptography (One-Time Pad, Information-Theoretic Security),Data Compression Techniques in Multimedia (MP3, JPEG, MPEG),Network Coding and its Application in Data Networks.

TOTAL:45 PERIODS

COURSE OUTCOMES

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

CO1: Explain Information Measures: Compute and interpret entropy.
CO2: Source Coding: Apply different source coding techniques.
CO3: Explore and implement error detection and correction techniques.
CO4: Design systems to maximize channel capacity using information-theoretic Principles.
CO5: Apply information theory concepts to real-world systems like data compression.

TEXT BOOKS

1. Thomas M. Cover and Joy A. Thomas, " Elements of Information Theory", Wiley-Interscience, 2004.
2. David J.C. MacKay, "Information Theory, Inference and Learning Algorithms," Cambridge University Press, Illustrated Edition, 2003.
3. Roberto Togneri and Christopher J.S. deSilva, "Fundamentals of Information Theory and Coding Design", Chapman & Hall/CRC, 2012.

REFERENCE BOOKS

1. Raymond W. Yeung, A First Course in Information Theory, Springer, 2013.
2. Robert G. Gallager, "Information Theory and Reliable Communication," Wiley 2017.
3. Norman Abramson, "Information Theory and Coding", McGraw-Hill.,1963.
4. Shu Lin and Daniel Castello, "Error Control Coding – Fundamentals and Applications", second edition 2004.
5. Thomas M Cover, Joy Thomas, "Elements of Information Theory", MGH 2006.

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	-	-	-	-	-	-	-	-	1	-
CO2	3	3	2	3	-	-	-	-	-	-	-	-	1	-
CO3	3	3	2	3	-	-	-	-	-	-	-	1	1	-
CO4	3	3	3	2	-	-	-	-	-	-	-	1	1	-
CO5	3	3	3	2	-	-	-	-	-	-	-	1	1	-
AVG	3	3	2	1	-	-	-	-	-	-	-	1	1	-

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

24ECPE16 MACHINE LEARNING IN COMMUNICATION SYSTEMS L T P C
3 0 0 3

COURSE OBJECTIVES

- To introduce the fundamental principles of machine learning (ML) and how they can be applied in communication systems.
- To understand the use of supervised and unsupervised learning techniques for signal detection, modulation classification, and channel estimation.
- To explore modern applications of information theory, including wireless communication, cryptography, and data compression.

UNIT I INTRODUCTION TO MACHINE LEARNING AND COMMUNICATION SYSTEMS **9**

Overview of Communication Systems: Channels, Modulation, and Signal Processing,Basic Machine Learning Concepts: Supervised vs Unsupervised Learning, Regression, Classification,ML Workflow: Data Collection, Feature Engineering, Model Training, Testing, and Evaluation,ML Algorithms Overview: Linear Regression, K-Nearest Neighbors, Decision Trees, Support Vector Machines (SVMs),Challenges in Communication Systems: Noise, Interference, Channel Estimation.

UNIT II SUPERVISED LEARNING IN COMMUNICATION SYSTEMS **9**

Modulation Classification: Identifying modulation types using supervised learning (e.g., SVM, Random Forests),Signal Detection and Estimation: ML-based techniques for detecting signals in noisy environments,Channel Estimation and Equalization: Application of regression models for channel estimation in wireless communication.

UNIT III UNSUPERVISED LEARNING AND REINFORCEMENT LEARNING IN COMMUNICATIONS **9**

Clustering Techniques for Traffic Classification: K-means, DBSCAN for network traffic analysis,Reinforcement Learning (RL) for Resource Allocation: Multi-agent systems for network optimization (e.g., dynamic spectrum access, network slicing),Bandwidth Allocation and Interference Management using RL.

UNIT IV DEEP LEARNING FOR SIGNAL PROCESSING 9

Deep Learning Fundamentals: Neural Networks, CNNs, RNNs, Autoencoders,Application of Convolutional Neural Networks (CNNs) for Signal Detection and Classification,Recurrent Neural Networks (RNNs) and Long Short-Term Memory (LSTM) for Time-Series Prediction (e.g., channel state prediction),Deep Learning for MIMO and OFDM Systems: End-to-End Training for Communication Systems,Neural Networks for Interference Cancellation and Error Correction.

UNIT V APPLICATIONS OF ML IN MODERN COMMUNICATION SYSTEMS 9

Cognitive Radio and Spectrum Management: ML for dynamic spectrum allocation and frequency hopping,Machine Learning in 5G and Beyond: Network slicing, beamforming, and dynamic resource allocation in 5G networks using ML,ML for Massive MIMO and Adaptive Beamforming: Application of ML for optimizing antenna selection and beamforming,Intelligent Transportation Systems: Use of ML for communication between autonomous vehicles (V2X communication),Future Trends in ML and Communication: AI-driven 6G networks and beyond.

TOTAL:45 PERIODS

COURSE OUTCOMES

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

CO1: Explain and apply basic ML techniques.
CO2: Design and implement ML-based solutions.
CO3: Optimization using ML models for network optimization.
CO4: Deep learning for communication systems.
CO5: Analyze and process real-world data from communication networks.

TEXT BOOKS

1. Kevin P. Murphy, Machine Learning: A Probabilistic Perspective, MIT Press, 2014.
2. Ian Goodfellow, Yoshua Bengio, and Aaron Courville, “Deep Learning,” MIT Press, 2016.
3. Andrea Goldsmith, “Wireless Communications”, Cambridge University Press, 2005.

REFERENCE BOOKS

1. John D. Kelleher, Brian Mac Namee, Aoife D'Arcy, Fundamentals of Machine Learning for Predictive Data Analytics, MIT Press,2015.
2. Fa-Long Luo, Charlie Zhang, “Machine Learning for Future Wireless Communications,” Wiley-IEEE Press, 2020.
3. Alexander M. Wyglinski, Maziar Nekovee, Thomas Hou, “Machine Learning for Future Wireless Communications”, Wiley-IEEE Press.
4. Murphy, Kevin P, “Machine learning: a probabilistic perspective”, First edition, MIT press, 2012.
5. Ruisi He, Z Ding, “Applications of Machine Learning in Wireless Communications”, First edition, IET Telecommunication series 81, 2019.

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	0.6	0.8	1	1.4	1.6

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

24ECPE17 DIGITAL SPEECH PROCESSING **L T P C**
3 0 0 3

COURSE OBJECTIVES

- To introduce speech production and related parameters of speech.
- To show the computation and use of techniques such as short time Fourier transform, linear predictive coefficients and other coefficients in the analysis of speech.
- To understand different speech modeling procedures such as Markov and their implementation issues.

UNIT I INTRODUCTION TO SPEECH PRODUCTION MODEL AND REPRESENTATION OF SPEECH **9**

Speech production model-1D sound waves-functional block of the Vocal tract model –Linear predictive co- efficients (LPC) -Auto-correlation method-Levinson-Durbin algorithm-Auto-covariance method-Lattice structure-Computation of Lattice co-efficient from LPC-Phonetic Representation of speech-Perception of Loudness - Critical bands – Pitch perception – Auditory masking.

UNIT II FEATURE EXTRACTION OF THE SPEECH SIGNAL **9**

Feature extraction of the speech signal: Endpoint detection-Dynamic time warping- Pitch frequency estimation: Autocorrelation approach- Homomorphic approach-Formant frequency estimation using vocal tract model and Homomorphic approach-Linear predictive co-efficient -Poles of the vocal tract Reflection co-efficient-Log Area ratio.

UNIT III FUNCTIONAL BLOCKS OF THE SPEECH TRANSFORMATION **9**

Cepstrum- Line spectral frequencies- Functional blocks of the ear- Mel frequency cepstral coefficient- Spectrogram-Time resolution versus frequency resolution-Discrete wavelet transformation.

UNIT IV PATTERN RECOGNITION FOR SPEECH DETECTION **9**

Pattern recognition for speech detection: Back-propagation Neural Network-Support Vector MachineHidden Markov Model (HMM)-Gaussian Mixture Model(GMM) -Unsupervised Learning system: KMeans and Fuzzy K-means clustering - Kohonen self-organizing map-Dimensionality reduction techniques: Principle component analysis (PCA), Linear discriminate analysis (LDA), Kernel-LDA (KLDA), Independent component analysis(ICA).

UNIT V QUANTIZATION AND SPEECH SYNTHESIS SYSTEMS **9**

Non-uniform quantization for Gaussian distributed data- Adaptive quantization-Differential pulse code modulation- Code Exited Linear prediction (CELP)-Quality assessment of the compressed speech signal Text to Speech (TTS) analysis –Evolution of speech synthesis systems-Unit selection methods - TTS Applications.

TOTAL:45 PERIODS

COURSE OUTCOMES

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

CO1: Illustrate how the speech production is modeled
CO2: Summarize the various techniques involved in collecting the features.
CO3: Summarize the functional blocks of the ear .
CO4: Compare the various pattern recognition techniques.
CO5: Summarize the various speech compression techniques.

TEXT BOOKS

1. L.R.Rabiner and R.W.Schafer, ”Introduction to Digital speech processing”, now publishers USA,2007.
2. E.S.Gopi, ”Digital speech processing using matlab”, Springer, 2014.
3. Frederick Jelinek, “Statistical Methods of Speech Recognition”, MIT Press, 1997.

REFERENCE BOOKS

1. L.R.Rabiner and R.W.Schafer, ”Digital processing of speech signals”, PrenticeHall,1978.
2. T.F.Quatieri,”Discrete-time Speech Signal Processing”, Prentice-Hall, PTR,2001.
3. L.Hanzaetal, “Voice Compression and Communications”, Wiley/ IEEE, 2001.
4. Ben Gold and Nelson Morgan, “Speech and Audio Signal Processing, Processing and Perception of Speech and Music”, Wiley- India Edition, 2006.
5. Thomas F Quatieri, “Discrete-Time Speech Signal Processing – Principles and Practice”, Pearson Education, 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	1	2	1	1	2	1	-	-	-	-	-	2	3	3
CO2	1	2	1	1	2	1	-	-	-	-	-	2	2	2
CO3	1	2	1	1	2	1	-	-	-	-	-	1	1	2
CO4	3	-	3	3	-	3	-	-	-	-	-	2	2	3
CO5	3	-	3	3	-	3	-	-	-	-	-	2	2	2
AVG	**1.8**	**2**	**1.8**	**1.8**	**2**	**1.8**	-	-	-	-	-	**1.8**	**2**	**2.4**

1-Low, 2-Medium, 3-High, ‘-’- No Correlation

24ECPE18 DIGITAL IMAGE PROCESSING **L T P C**
3 0 0 3

COURSE OBJECTIVES

- To Learn digital image fundamentals.
- To be exposed to simple image processing, compression and segmentation techniques.
- To Learn to represent image in form of features.

UNIT I DISCRETE IMAGES AND IMAGE TRANSFORMS **9**

Linearity and space-invariance. PSF, Discrete images and image transforms, 2-D sampling and reconstruction, Image quantization, 2-D transforms and properties.

UNIT II IMAGE ENHANCEMENT METHODS **9**

Image enhancement-Histogram modeling, equalization and modification. Image smoothing, Spatial filtering, Generalized cepstrum and homomorphic filtering.

UNIT III IMAGE RESTORATION METHODS **9**

Image restoration-image observation models. Inverse and Wiener filtering. Filtering using image transforms. Constrained least-squares restoration.

UNIT IV IMAGE ANALYSIS AND APPLICATIONS **9**

Image analysis-applications, Spatial and transform features. Edge detection, boundary extraction, Moments as features.

UNIT V IMAGE SEGMENTATION **9**

Morphological operations and transforms. Texture. Scene matching and detection. Segmentation and classification.

TOTAL:45 PERIODS

COURSE OUTCOMES

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

CO1: Analyze the need for image transforms, types and their properties.

CO2: To enhance the different techniques of images both in spatial and frequency domain.

CO3: Explore causes for image degradation and to teach various restoration techniques.

CO4: Evaluate the image compression techniques in spatial and frequency domain.

CO5: Gain knowledge of feature extraction techniques for image analysis and recognition.

TEXT BOOKS

1. A.K. Jain, “Fundamentals of Digital Image Processing”, PHI, 1995.
2. R.C.Gonzalez& R.E. Woods,” Digital Image Processing”, (2/e), Pearson, 2002.
3. Rafael C. Gonzales, Richard E. Woods, “Digital Image Processing”, Third Edition, Pearson Education, 2010.

REFERENCE BOOKS

1. J.C. Russ, “The Image Processing Handbook”, (5/e), CRC, 2006.
2. E.S.Gopi, "Digital Image processing using Matlab", Scitech publications, 2006.
3. Anil Jain K. “Fundamentals of Digital Image Processing”, PHI Learning Pvt. Ltd., 2011.
4. Willliam K Pratt, “Digital Image Processing”, John Willey, 2002.
5. Malay K. Pakhira, “Digital Image Processing and Pattern Recognition”, First Edition, PHI Learning Pvt. Ltd., 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	3	3	2	2	2	-	-	-	-	-	3	2	3
CO2	3	3	3	2	2	2	-	-	-	-	-	2	2	3
CO3	3	3	2	2	2	2	-	-	-	-	-	2	2	2
CO4	3	3	3	2	2	2	-	-	-	-	-	2	2	2
CO5	3	3	3	3	2	2	-	-	-	-	-	2	2	2
AVG	3	3	3	2	2	2	-	-	-	-	-	2	2	2

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

24ECPE19 BIO MEDICAL SIGNAL PROCESSING **L T P C**
3 0 0 3

COURSE OBJECTIVES

- To Make Students Understand the Sources, Types & Characteristics of Different Noises and Artifacts Present in Biomedical Signals.
- To Make Students Able to Design Time Domain and Frequency Domain Filters for Noise and Artifact Removal from Biomedical signals.
- To Make Students Able to Understand and Apply Various Methods for Analyzing Biomedical Signal Characteristics.

UNIT I INTRODUCTION TO BIOMEDICAL SIGNAL PROCESSING **9**

Acquisition, Generation of Bio-signals-Origin of bio-signals-Types of bio-signals-Study of diagnostically significant bio-signal parameters.

UNIT II ELECTRODES FOR BIO-PHYSIOLOGICAL SENSING AND CONDITIONING **9**

Electrode-electrolyte interface-polarization-electrode skin interface and motion artefact-biomaterial used for electrode- Types of electrodes (body surface, internal, array of electrodes, microelectrodes)-Practical aspects of using electrodes-Acquisition of bio-signals (signal conditioning) and Signal conversion (ADC's DAC's) Processing.

UNIT III TRANSFORM TECHNIQUES **9**

Biomedical signal processing by Fourier analysis-Biomedical signal processing by wavelet (time frequency) analysis-Analysis (Computation of signal parameters that are diagnostically significant)-Classification of signals and noise-Spectral analysis of deterministic-stationary random signals and non-stationary signals.

UNIT IV DIMENSIONALITY REDUCTION TECHNIQUES **9**

Principal component analysis-Correlation and regression-Analysis of chaotic signals Application areas of Bio–Signals analysis Multi resolution analysis(MRA) and wavelets-Principal component analysis(PCA)-Independent component analysis(ICA).

UNIT V PATTERN CLASSIFICATION **9**

supervised and unsupervised classification, Neural networks, Support vector Machines, Hidden Markov models. Examples of biomedical signal classification examples.

TOTAL:45 PERIODS

COURSE OUTCOMES

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

CO1: Explain different types of biomedical signals.
CO2: Explore the acquisition of various biomedical signals.
CO3: Analyze the non-stationary biomedical signals.
CO4: Analyze the chaotic signals using various orthogonal transformation techniques.
CO5: Classify biomedical signal using pattern recognition techniques.

TEXT BOOKS

1. R.M. Rangayyan Biomedical Signal analysis: A Case study approach, IEEE press, John Wiley & Sons. Inc, 2002.
2. C. Raja Rao, SK Guha, Principles of Medical Electronics and Biomedical instrumentation, Universities Press, 2001.
3. Reddy, D.C., Biomedical signal processing: principles and techniques. McGraw-Hill, 2005.

REFERENCE BOOKS

1. W. J. Tompkins, Biomedical Digital Signal Processing, Prentice Hall, 1993.
2. Eugene N Bruce, Biomedical Signal Processing and Signal Modeling, John Wiley & Son's publication, 2001.
3. D C Reddy, Biomedical Signal Processing, McGraw Hill, 2005.
4. Duda, R. O. and Stork, D.G., Pattern classification, JohnWiley & sons, 2012.
5. Sörnmo, L. and Laguna, P., Bioelectrical signal processing in cardiac and neurological applications (Vol. 8). Academic 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	3	3	3	3	-	-	-	-	3	-	3	3	2
CO2	3	3	3	3	3	-	-	-	-	3	-	3	3	2
CO3	3	3	3	3	3	-	-	-	-	3	-	3	2	3
CO4	3	3	3	3	3	-	-	-	-	3	-	3	3	3
CO5	3	3	3	3	3	-	-	-	-	3	-	3	3	3
AVG	**3**	**3**	**3**	**3**	**3**	**-**	**-**	**-**	**-**	**3**	**-**	**3**	**2.8**	**2.6**

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

24ECPE20 DIGITAL SIGNAL PROCESSING FOR WIRELES COMMUNICATION **L T P C 3 0 0 3**

COURSE OBJECTIVES

- The subject aims to make the students to understand the signal processing approach for wireless communication.
- To introduce the describe the Coherence time, Coherence frequency, Doppler spread and Delay spread.
- To analyze describe various multiple access techniques and diversity techniques.

UNIT I MATHEMATICAL MODEL OF THE TIME-VARYING WIRELESS CHANNEL **9**

Multi-path model, Coherence time and Doppler spread, Coherence frequency and Delay spread. Relationship between the time- varying impulse response of the Base band and Bandpass Transmission. Discrete Complex Base band time varying channel model for wireless communication. Computation of probability of error for Flat fading Rayleigh channel, Flat fading Rician model and single tap channel with known filter coefficient.

UNIT II AUTOCORRELATION AND DENSITY COMPUTATION OF BASE BAND AND THE BAND PASS SIGNAL **9**

Sampling and reconstruction of W.S.S. random process. Spectral density computation for PSK, QPSK, FSKand MSK. Relationship between Base band and band pass random process using Hilbert transformation. Periodogram, Barlett method, Welch, Blackman and Tuckey methods of estimating spectrum of the modulated signal.

UNIT III MULTIPLE INPUT MULTIPLE OUTPUT (MIMO) SYSTEM MODEL **9**

Matched filter receiver. Optimal precoding and combining, Spatial multiplexing using Decoupling of MIMO system. Massive MIMO, Power scaling, Orthogonality, Multi-cell Multi user MIMO, Pilot contamination and Rate scaling. OFDM, MCM, MCM transmission/Received signal, MCM-IFFT/FFT Processing, MCM-Cyclic prefix, Spectrum of OFDM transmission, MIMO-OFDM System model, BER of OFDM and MIMO-OFDM.

UNIT IV MULTIPLE ACCESS TECHNIQUES **9**

Introduction: Introduction To Multiple Access- Frequency Division Multiple Access(FDMA)- Time Division Multiple Access(TDMA)- Spread Spectrum Multiple Access-Code Division Multiple Access(CDMA)- Space Division Multiple Access(SDMA)- Capacity Of Cellular Systems: Capacity Of Cellular CDMA, Capacity Of CDMA With Multiple Cells.

UNIT V 5G TECHNOLOGY **9**

Non-orthgonal multiple access, Spatial Modulation, Filter bank multi-carrier systems (FBMC), FBMC-OQAM System model, MIMO-FBMC Signal processing, Full Duplex Estimation Radio, Self-interference, Hybrid cancellation, mm wave MIMO Channel Modeling and Estimation.

TOTAL:45 PERIODS

COURSE OUTCOMES

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

CO1: Explain Mobile Radio Propagation and Various Digital Modulation Techniques.
CO2: Explore The Concepts Of Multiple Access Techniques.
CO3: Characterize a wireless channel and evolve the system design specifications.
CO4: Design a cellular system based on resource availability and traffic demands.
CO5: Explore the signal processing approach for wireless communication.

TEXT BOOKS

1. Rappaport,T.S.,-Wireless communications", Pearson Education, 2nd Ed., 2010.
2. Wireless Communication –Andrea Goldsmith, Cambridge University Press, 2011.
3. Van Nee, R. and Ramji Prasad, ―OFDM for wireless multimedia communications, Artech House, 2000.

REFERENCE BOOKS

1. David Tse and Pramod Viswanath, ―Fundamentals of Wireless Communication, Cambridge University Press, 2005.
2. Upena Dalal, ―Wireless Communication", Oxford University Press, 2009.
3. Andreas.F. Molisch, ―Wireless Communications", John Wiley – India, 2006.
4. Sophoncles J. Orfanidis, "Optimum Signal Processing ", McGraw Hill, 2000.
5. A Monson H. Hayes, "Statistical digital signal processing and modeling", John Wiley and Sons Inc. New York, Indian reprint 2008.

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	3	3	1	-	-	-	-	-	1	1	1
CO2	3	3	2	1	3	2	-	-	-	-	-	-	1	2
CO3	3	3	3	3	2	2	-	-	-	-	-	1	1	2
CO4	2	3	2	2	2	2	-	-	-	-	-	1	1	1
CO5	2	-	3	3	2	1	-	-	-	-	-	1	2	2
AVG	3	3	2	2	2	2	-	-	-	-	-	1	1	2

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

24ECPE21 COMPUTER ARCHITECTURE AND ORGANIZATION **L T P C**
3 0 0 3

COURSE OBJECTIVES

- To make students understand the basic structure and operation of digital computer.
- To study the design of data path unit and control unit for processor.
- To introduce the parallel processing technique.

UNIT I COMPUTER ORGANIZATION & INSTRUCTIONS **9**

Basics of a computer system: Evolution, Ideas, Technology, Performance, Power wall, Uniprocessors to Multiprocessors. Addressing and addressing modes. Instructions: Operations and Operands, Representing instructions, Logical operations, control operations.

UNITII ARITHMETIC OPERATIONS **9**

Fixed point Addition, Subtraction, Multiplication and Division. Floating Point arithmetic, High performance arithmetic, Subword parallelism.

UNIT III THE PROCESSOR **9**

Introduction, Logic Design Conventions, Building a Datapath - A Simple Implementation scheme - An Overview of Pipelining - Pipelined Datapath and Control. Data Hazards: Forwarding versus Stalling, Control Hazards, Exceptions, Parallelism via Instructions.

UNIT IV MEMORY AND I/O ORGANIZATION **9**

Memory hierarchy, Memory Chip Organization, Cache memory, Virtual memory.
Parallel Bus Architectures, Internal Communication Methodologies, Serial Bus Architectures, Mass storage, Input and Output Devices.

UNIT V ADVANCED COMPUTER ARCHITECTURE **9**

Parallel processing architectures and challenges, Hardware multithreading, Multicore and shared memory multiprocessors, Introduction to Graphics Processing Units, Clusters and Warehouse scale computers - Introduction to Multiprocessor network topologies.

TOTAL:45 PERIODS

COURSE OUTCOMES

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

CO1: Describe data representation, instruction formats and the operation.
CO2: Illustrate the fixed point and floating-point arithmetic for ALU operation.
CO3: Discuss about implementation schemes of control unit and pipeline performance.
CO4: Explain the concept of various memories, interfacing and organization.
CO5: Discuss parallel processing technique and unconventional architectures.

TEXT BOOKS

1. David A. Patterson and John L. Hennessey, ―Computer Organization and Design‖, Fifth edition, Morgan Kauffman / Elsevier, 2014. (UNIT I-V).
2. Miles J. Murdocca and Vincent P. Heuring, ―Computer Architecture and Organization: An Integrated approach‖, Second edition, Wiley India Pvt Ltd, 2015 (UNIT IV,V).
3. Mano M Morris, “Computer System Architecture”, Pearson,2017.

REFERENCE BOOKS

1. V. Carl Hamacher, Zvonko G. Varanesic and Safat G. Zaky, ―Computer Organization―, Fifth edition, Mc Graw-Hill Education India Pvt Ltd, 2014.
2. William Stallings ―Computer Organization and Architecture‖, Seventh Edition, Pearson Education, 2006.
3. Govindarajalu, ―Computer Architecture and Organization, Design Principles and Applications", Second edition, McGraw-Hill Education India Pvt Ltd, 2014.
4. Smruti R Sarangi, “Advanced Computer Architecture”, Mc Graw Hill, 2021.
5. Carl Hamacher, Safwat Zaky, Zvonko Vranesic, Computer Organization, published in 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	3	3	-	-	-	-	-	-	-	-	-	2	2
CO2	3	3	3	-	-	-	-	-	-	-	-	-	2	3
CO3	3	3	3	2	-	-	-	-	-	-	-	-	2	3
CO4	3	3	3	2	-	-	-	-	-	-	-	-	3	3
CO5	3	3	3	2	-	-	-	-	-	-	-	-	3	3
AVG	3	3	3	2	-	-	-	-	-	-	-	-	2.4	2.8

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

24ECPE22 ELECTRONIC SYSTEMS:ESSENTIALS OF SoCs L T P C
3 0 0 3

COURSE OBJECTIVES

- To give the student an understanding of basics of System on Chip.
- To introduce the Ability to Build logic gates and use programmable devices.
- To Gain awareness of the System-on-Chip (SoC) design flow and current semiconductor technologies.

UNIT I BASIC CONCEPTS OF SoC **9**

Introduction to SoC Architecture & Design: Basic SoC VLSI design flow – Specifications - Architecture – High/Low Level design – RTL Coding(+Lint) – Block Verification - SoC Integration & Testing – Synthesis & Scan Insertion – Formal Verification – Layout & STA – Tapeout. Different SoC Processors and its Selection.

UNIT II MEMORY **9**

Memory Design, Interconnect Architectures and Bus protocols: APB, AHB, I2C, SPI & UART (opensource bus protocol manuals from internet to be used as study material).

UNIT III LOW POWER METHODS **9**

Introduction to Low Power methods, Power switch basics, Isolation, Level shifters, Clock gating, an example showing the need for Isolation in a SoC Design.

UNIT IV CLOCK DOMAIN **9**

Clock Domain Crossing & STA : Clock Domain Crossing, Reset Domain Crossing, Toggle synchronizers, Double Synchronizers, Reset Synchronizers, MTBF.

UNIT V CELL BASISCS AND SoCS APPLICATIONS **9**

Standard cell basics, how .lib modelling is done for std cell delay & power. STA concepts, Timing verification, Configuring STA environment,SoCS Applications.

TOTAL:45 PERIODS

COURSE OUTCOMES

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

CO1: Gain awareness of the System-on-Chip (SoC) design flow and current semiconductor technologies.

CO2: Demonstrate proficiency in RTL coding for SPI Protocol and employ System Verilog/UVM for thorough design verification.

CO3: Identify signals necessitating low-power cells (e.g., Level shifters, isolators) in RTL designs with Always-ON and power-gated SPI controller blocks. Conduct Design Verification to prevent "X" propagation from OFF to ON domains.

CO4: To detect and resolve setup/hold time violations effectively during Design Verification simulations, ensuring robust SoC designs.

CO5: Ability to Build logic gates and use programmable devices.

TEXT BOOKS

1. Static Timing Analysis for Nanometer Designs : A Practical Approach by J. Bhasker and Rakesh Chadha, 2009.
2. Neil H. E. Weste and David Money Harris,"CMOS VLSI Design: A Circuits and Systems Perspective", 2015.
3. Jan M. Rabaey, Anantha Chandrakasan, and Borivoje Nikolic", Digital Integrated Circuits: A Design Perspective" , 2002.

REFERENCE BOOKS

1. Low Power Methodology Manual for System-on-Chip Design by David Flynn, Rob Aitken, Alan Gibbons and Kaijian Shi, 2011.
2. William I. Fletcher, "An Engineering Approach to Digital Design", Prentice-Hall of India, 1980.
3. H.Gerez, "Algorithms for VLSI Design Automation", John Wiley, 1999.
4. Jan.M.Rabaey et al, "Digital Integrated Circuit Design Perspective", 2nd Edition, PHI 2003.
5. David A.Hodges, "Analysis and Design of Digital Integrated Circuits", 3rd Edition, MGH 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	2	1	3	-	-	-	-	-	-	-	2	3	3
CO2	3	3	1	2	-	-	-	-	-	-	-	2	3	3
CO3	3	2	1	3	-	-	-	-	-	-	-	2	3	3
CO4	3	-	1	3	-	-	-	-	-	-	-	2	3	3
CO5	3	-	1	3	-	-	-	-	-	-	-	2	3	3
AVG	**3**	**2.6**	**1**	**3**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**2**	**3**	**3**

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

24ECPE23 PATTERN RECOGNITION **L T P C**
3 0 0 3

COURSE OBJECTIVES

- To subject aims to make the students to understand the mathematical approach for pattern recognition.
- To become familiar with feature based alignment and motion estimation.
- To study the signal processing methods used in neural networks.

UNIT I POLYNOMIAL CURVE FITTING METHODS **9**

Polynomial curve fitting – The curse of dimensionality - Decision theory - Information theory - The beta distribution - Dirichlet distribution-Gaussian distribution-The exponent family: Maximum likelihood and sufficient statistics -Non-parametric method: kernel-density estimators - Nearest neighbour methods.

UNIT II LINEAR MODELS FOR REGRESSION AND CLASSIFICATION **9**

Linear models for regression and classification: Linear basis function models for regression - Bias variance decomposition-Bayesian linear regression-Discriminant functions - Fisher's linear discriminant analysis (LDA) - Principal Component Analysis (PCA) - Probabilistic generative model - Probabilistic discriminative model.

UNIT III KERNEL METHODS AND DUAL REPRESENTATIONS **9**

Kernel methods: Dual representations-Constructing kernels-Radial basis function networks-Gaussian process-Maximum margin classifier (Support Vector Machine) –Relevance Vector Machines-KernelPCA, Kernel-LDA.

UNIT IV MIXTURE MODELS AND LINEAR DYNAMICAL SYSTEMS **9**

Mixture models: K-means clustering - Mixtures of Gaussian - Expectation-Maximization algorithm Sequential models: Markov model, Hidden-Markov Model (HMM) - Linear Dynamical Systems(LDS).

UNIT V NEURAL NETWORKS AND ALGORITHMS **9**

Neural networks: Feed- forward Network functions-Network training - Error Back propagation - The Hessian Matrix - Regularization in Neural Network - Mixture density networks – Bayesian Neural Networks.

TOTAL:45 PERIODS

COURSE OUTCOMES

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

CO1: Summarize the various techniques involved in pattern recognition.
CO2: Identify the suitable pattern recognition techniques for the particular applications.
CO3: Categorize the various pattern recognition techniques into supervised & unsupervised.
CO4: Summarize the mixture models based pattern recognition techniques.
CO5: Summarize the artificial neural network based pattern recognition techniques.

TEXT BOOKS

1. C.M.Bishop,"Pattern recognition and machinelearning",Springer,2006.
2. E.S.Gopi, "Pattern recognition, Springer, 2019.
3. David G. Stork,"Pattern Classification", Springer, 2008.

REFERENCE BOOKS

1. Sergious Thedorodis ,Konstantinos Koutroumbas, Pattern recognition, Elsevier, Fourth edition,2009.
2. Richard O.Duda, Peter.E.Hart, David G.Stork, “Pattern classification”, Wiley, Second edition,2016.
3. Christopher M. Bishop, "Pattern Recognition and Machine Learning", Springer, 2006.
4. Geoffrey J. McLachlan Discriminant Analysis and Statistical Pattern Recognition.,1992.
5. Kevin P. Murphy, "Machine Learning: A Probabilistic Perspective". Illustrated,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	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

24ECPE24 VLSI TESTING **L T P C**
3 0 0 3

COURSE OBJECTIVES

- To introduce the concept of VLSI testing.
- To introduce logic and fault simulation and testability measures.
- To study the test generation for combinational and sequential circuits.

UNIT I INTRODUCTION TO VLSI TESTING **9**

Testing of VLSI Circuits– Fault Modeling – Equivalence and Dominance - Logic and Fault Simulation –Testability Measures – Combinational Circuit Test Generation – Redundancy Identification.

UNIT II LOGIC & FAULT SIMULATION & TESTABILITY MEASURES **9**

Simulation for Design Verification and Test Evaluation – Modeling Circuits for Simulation – Algorithms for True Value and Fault Simulation – Scoap Controllability and Observability.

UNIT III TEST GENERATION FOR COMBINATIONAL AND SEQUENTIAL CIRCUITS **9**

Testable Combinational Logic Circuit Design – Design of Testable Sequential Circuits– BIST Architectures –Random Logic Bist –Test-Per-Clock – Test-Per-Scan - BIST Systems – Memory BIST –At-speed Testing– Boundary Scan Architecture – JTAG Standards.

UNIT IV DESIGN FOR TESTABILITY **9**

Design for Testability Basics – Testability Analysis - Scan Cell Designs – Scan Architecture –DFT for Other Test Objectives.

UNIT V CASE STUDY ON TESTING **9**

Combinational Logic Circuit Design- Sequential Circuits design-Real time application.

TOTAL:45 PERIODS

COURSE OUTCOMES

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

CO1: Identify the various IC fabrication methods.
CO2: Express the Layout of simple MOS circuit using true value and fault simulation.
CO3: Apply the BIST Architectures design rules for subsystem design.
CO4: Differentiate various FPGA,scan architectures.
CO5: Design an real time application using VLSI testing.

TEXT BOOKS

1. M. L. Bushnell and V.D. Agrawal, Essentials of Electronic Testing for Digital Memory and Mixed Signal VLSI Circuits, Springer, 2005.
2. H. Fujiwara, Logic Testing and Design for Testability, MIT Press, 1985.
3. M. Abramovici, M. Breuer, and A. Friedman, Digital System Testing and Testable Design, IEEE Press, 1994.

REFERENCE BOOKS

1. M. Huth and M. Ryan, Logic in Computer Science, Cambridge Univ. Press, 2004.
2. T. Kropf, Introduction to Formal Hardware Verification, Springer Verlag, 2000.
3. D. Baik, K. K. Saluja and S. Kajihara, `Random Access Scan: a solution to test power, test data volume and test time`, International Conference on VLSI Design, Jan. 2004.
4. H. Fujiwara, `A new class of sequential circuits with combinational test generation complexity`, IEEE Trans. on Computers, Vol. 49, No. 5, Sep 2000, pp. 895-905.
5. S. Ohtake, T. Masuzawa, and H. Fujiwara, `A non-scan DfT method for controllers to achieve complete fault efficiency`, Proc. of the IEEE Asian Test Symposium (ATS) 1998, pp. 204-211.

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	-	-	-	-	-	-	-	-	-	-	3	3
CO2	3	2	3	2	-	-	-	-	-	-	-	1	3	3
CO3	2	3	2	3	1	1	-	-	-	-	-	2	3	2
CO4	-	-	1	1	-	-	-	-	-	-	-	3	3	3
CO5	-	-	-	-	-	2	-	-	-	-	1	-	3	2
AVG	**2**	**2**	**2**	**2**	**1**	**1.5**	-	-	-	-	**1**	**2**	**3**	**3**

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

24ECPE25 MIXED SIGNAL IC DESIGN TESTING **L T P C**
3 0 2 4

COURSE OBJECTIVES

- To know about mixed-signal devices and the need for testing these devices.
- To study and learn the various techniques for testing such as ADC and DAC.
- To understand the Clock and Serial Data Communications Channels.

UNIT I MIXED – SIGNAL TESTING **9**

Common Types of Analog and Mixed- Signal Circuits – Applications of Mixed-Signal Circuits - Post- Silicon Production Flow - Test and Packing – Characterization versus Production Testing - Test and Diagnostic Equipment - Automated Test Equipments – Wafer Probers – Handlers – E-Beam Probers – Focused Ion Beam Equipments – Forced – Temperature.

UNIT II YIELD, MEASUREMENT ACCURACY, AND TEST TIME **9**

Yield - Measurement Terminology - Repeatability, Bias, and Accuracy - Calibrations and Checkers - Tester Specifications - Reducing Measurement Error with Greater Measurement Time – Guardbands - Effects of Measurement Variability on Test Yield - Effects of Reproducibilty and Process Variation on Yield - Statistical Process Control.

UNIT III DAC TESTING **9**

Basics of Data Converters -Principles of DAC and ADC Conversion, Data Formats, Comparison of DACs and ADCs, DAC Failure Mechanisms - Basic DC Tests - Transfer Curve Tests - Dynamic DAC Tests - Tests for Common DAC Applications.

UNIT IV ADC TESTING **9**

ADC Testing Versus DAC Testing - ADC Code Edge Measurements - Edge Code Testing Versus Center Code Testing, Step Search and Binary Search Methods, Servo Method, Linear Ramp Histogram Method, Histograms to Code Edge Transfer Curves, Rising Ramps Versus Falling Ramps, Sinusoidal Histogram Method - DC Tests and Transfer Curve Tests - Dynamic ADC Tests - Tests for Common ADC Applications.

UNIT V CLOCK AND SERIAL DATA COMMUNICATIONS CHANNEL MEASUREMENT **9**

Synchronous and Asynchronous Communications - Time-Domain Attributes of a Clock Signal - Frequency-Domain Attributes of a Clock Signal - Communicating Serially Over a Channel - Bit Error Rate Measurement - Methods to Speed Up BER Tests in Production - Deterministic Jitter Decomposition - Jitter Transmission Tests.

TOTAL:45 PERIODS

LIST OF EXPERIMENTS

1. PLL characteristics
2. Implementation of PLL as Frequency Multiplier.
3. Implementation of PLL for Clock synchronization.
4. R-2R Ladder Type and Flash Type ADC.
5. DC power supply using LM317 and LM723.
6. Design of asynchronous counter.
7. Design of synchronous counter.
8. Implementation and Testing of RS Latch and Flip-flops.

TOTAL:30 PERIODS

COURSE OUTCOMES

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

CO1: Learn the fundamentals of mixed signal circuits.
CO2: Define the various measurement terminologies.
CO3: Acquire knowledge of Analog to Digital Converters.
CO4: Learn testing of Analog to Digital Converters.
CO5: Comprehend the attributes of a clock signal.

TEXT BOOKS

1. Gordon W.Roberts, Friedrich Taenzler, Mark Burns, "An Introduction to Mixed signal IC Test and Measurement" Oxford University Press, Inc.2012.
2. M.L.Bushnell and V.D.Agrawal, "Essentials of Electronic Testing for Digital, Memory and Mixed-Signal VLSI Circuits", Kluwer Academic Publishers, 2002.
3. BapirajuVinnakota, "Analog and mixed-signal test", Prentice Hall,1998.

REFERENCE BOOKS

1. Digital and Analogue Instrumentation: Testing and Measurement by Nihal Kularatna,Illustrated 2002.
2. D.A. Hodges and H.G. Jackson, Analysis and Design of Digital Integrated Circuits, International Student Edition, McGraw Hill 1983.
3. P. Rashinkar, Paterson and L. Singh, "System-on-a-Chip Verification-Methodology and Techniques", Kluwer Academic Publishers,2001.
4. Neil H E Weste, Kamran Eshranghian, " Principles of CMOS VLSI Design: A System Perspective," Addison Wesley, 2009.
5. Michael J Smith ," Application Specific Integrated Circuits, Addison Wesley.1st 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
CO1	3	3	3	2	2	-	-	-	-	-	-	-	3	2
CO2	3	3	3	2	2	-	-	-	-	-	-	-	3	2
CO3	3	3	2	2	2	-	-	-	-	-	-	-	2	1
CO4	3	3	2	2	2	-	-	-	-	-	-	-	3	3
CO5	3	3	3	3	3	-	-	-	-	-	-	-	3	3
AVG	3	3	2.6	2.2	2.2	-	-	-	-	-	-	-	2.8	2.2

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

24ECPE26 LOW POWER VLSI DESIGN **L T P C**
3 0 2 4

COURSE OBJECTIVES

- To learn the fundamentals of low power low voltage VLSI design.
- To understand the impact of power on system performances.
- To develop the low power low voltage memories.

UNIT I FUNDAMENTALS OF LOW POWER CIRCUITS **9**

Need for Low Power Circuit Design, Sources of Power Dissipation – Switching Power Dissipation, Short Circuit Power Dissipation, Leakage Power Dissipation, Glitching Power Dissipation, Short Channel Effects –Drain Induced Barrier Lowering and Punch Through, Surface Scattering, Velocity Saturation, Impact Ionization, Hot Electron Effect.

UNIT II LOW-POWER DESIGN APPROACHES **9**

Propagation Delays, stick diagram, Layout diagrams, Examples of combinational logic design, Elmore's constant, Static Logic Gates,Dynamic Logic Gates, Pass Transistor Logic, Power Dissipation, Low Power Design principles.

UNIT III LOW-VOLTAGE LOW-POWER ADDERS **9**

Introduction, Standard Adder Cells, CMOS Adder's Architectures – Ripple Carry Adders, Carry Look-Ahead Adders, Carry Select Adders, Carry Save Adders, LowVoltage Low Power Design Techniques –Trends of Technology and Power Supply Voltage, LowVoltage Low-Power Logic Styles.

UNIT IV LOW-VOLTAGE LOW-POWER MULTIPLIERS **9**

Introduction, Overview of Multiplication, Types of Multiplier Architectures, Braun Multiplier, Baugh- Wooley Multiplier, Booth Multiplier, Introduction to Wallace Tree Multiplier.

UNIT V LOW-VOLTAGE LOW-POWER MEMORIES **9**

Basics of ROM, Low-Power ROM Technology, Future Trend and Development of ROMs, Basics of SRAM, Memory Cell, Precharge and Equalization Circuit, LowPower SRAM Technologies, Basics of DRAM, Self-Refres Circuit, Future Trend and Development of DRAM.

TOTAL:45 PERIODS

LIST OF EXPERIMENTS

1. Modeling and sources of power consumption.
2. Power estimation at circuit level.
3. Power estimation at transistor level.
4. Power estimation at gate level.
5. Power optimization for combinational circuits.
6. Power optimization for sequential circuits.
7. Power optimization for RT levels.
8. Power optimization for algorithmic levels.

TOTAL:30 PERIODS

COURSE OUTCOMES

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

CO1: Explain the fundamentals of Low power circuit design.
CO2: Attain the knowledge of architectural approaches.
CO3: Analyze and design Low-Voltage Low-Power combinational circuits.
CO4: Learn the design of Low-Voltage Low-Power Memories.
CO5: Design and develop Low Power, Low Voltage Circuits.

TEXT BOOKS

1. J Sung-Mo Kang, Yusuf Leblebici, "CMOS Digital Integrated Circuits – Analysis and Design", TMH, 2011.
2. Kiat-Seng Yeo, Kaushik Roy, "Low-Voltage, Low-Power VLSI Subsystems", TMH Professional Engineering, 2004.
3. Ming-BO Lin, "Introduction to VLSI Systems: A Logic, Circuit and System Perspective", CRC Press, 2012.

REFERENCE BOOKS

1. Anantha Chandrakasan, "Low Power CMOS Design", IEEE Press, /Wiley International, 1998.
2. Kaushik Roy, Sharat C. Prasad, "Low Power CMOS VLSI Circuit Design", John Wiley, & Sons, 2000.
3. Gary K. Yeap, "Practical Low Power Digital VLSI Design", Kluwer Academic Press, 2002.
4. Bellamour, M. I. Elamasri, "Low Power CMOS VLSI Circuit Design", A Kluwer Academic Press, 1995.
5. Siva G. Narendran, Anatha Chandrakasan, "Leakage in Nanometer CMOS Technologies", Springer, 2005.

Mapping of COs with POs & PSOs

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	PSO1	PSO2
CO1	1	1	-	-	-	-	-	-	-	-	-	-	3	3
CO2	3	2	3	2	-	-	-	-	-	-	-	1	3	3
CO3	2	3	2	3	1	1	-	-	-	-	-	2	3	2
CO4	-	-	1	1	-	-	-	-	-	-	-	3	3	3
CO5	-	-	-	-	-	2	-	-	-	-	1	-	3	2
AVG	2	2	2	2	1	1.5	-	-	-	-	1	2	3	3

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

24ECPE27 ANALOG IC DESIGN **L T P C**
3 0 2 4

COURSE OBJECTIVES

- To study the basics of MOS Circuits.
- To analyse the noise characteristics of amplifiers.
- To understand the detection and testing of faults.

UNIT I SINGLE STAGE AMPLIFIERS **9**

Basic MOS physics and equivalent circuits and models, CS, CG and Source Follower, differential amplifier with active load, Cascode and Folded Cascode configurations with active load, design of Differential and Cascode Amplifiers – to meet specified SR, noise, gain, BW, ICMR and power dissipation, voltage swing, high gain amplifier structures.

UNITII HIGH FREQUENCY AND NOISE CHARACTERISTICS OFAMPLIFIERS 9

Miller effect, association of poles with nodes, frequency response of CS, CG and Source Follower, Cascode and Differential Amplifier stages, statistical characteristics of noise, noise in Single Stage amplifiers, noise in Differential Amplifiers.

UNIT III FEEDBACK AND SINGLE STAGE OPERATIONAL AMPLIFIERS 9

Properties and types of negative feedback circuits, effect of loading in feedback networks, operational amplifier performance parameters, single stage Op Amps, two-stage Op Amps, input range limitations, gain boosting, slew rate, power supply rejection, noise in Op Amps.

UNIT IV STABILITY , FREQUENCY COMPENSATION 9

Multipole Systems, Phase Margin, Frequency Compensation, Compensation Of Two Stage Op Amps, Slewing In Two Stage Op Amps, Other Compensation Techniques.

UNIT V LOGIC CIRCUIT TESTING 9

Faults in Logic Circuits- Basic Concepts of Fault Detection- Design for Testability- Ad Hoc Techniques, Level-Sensitive Scan Design, Partial Scan, Built-in Self-Test.

TOTAL:45 PERIODS

LIST OF EXPERIMENTS

1. Design a CMOS inverter and analyze its characteristics.
2. Design a Common source amplifier and analyze its performance.
3. Design a Common drain amplifier and analyze its performance.
4. Design a Common gate amplifier and analyze its performance.
5. Design a differential amplifier with resistive load using transistors.
6. Design a differential amplifier with active load using transistors.
7. Design three stage ring oscillator circuit.
8. Design five stage ring oscillator circuit.

TOTAL:30 PERIODS

COURSE OUTCOMES

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

CO1: Design amplifiers to meet user specifications.
CO2: Analyse the frequency and noise performance of amplifiers.
CO3: Design and analyse feedback amplifiers and one stage op amps .
CO4: Analyse stability of op amp.
CO5: Discuss about various logic testing methods.

TEXT BOOKS

1. Behzad Razavi, “Design Of Analog Cmos Integrated Circuits”, Tata Mcgraw Hill, 2001.
2. Parag K.Lala, “An Introduction to Logic Circuit Testing”,Morgan & Claypool Publishers,2009.
3. Willey M.C. Sansen, “Analog Design Essentials”, Springer, 2006.

REFERENCE BOOKS

1. JGrebene, "Bipolar And Mos Analog Integrated Circuit Design", John Wiley & Sons,Inc.,2003.
2. Phillip E.Allen, Douglas R .Holberg, "Cmos Analog Circuit Design", Oxford University Press, 2nd Edition, 2002. Recorded Lecture Available at http://www.ee.iitm.ac.in/vlsi/courses/ee5320_2021/start.
3. Jacob Baker "CMOS: Circuit Design, Layout, And Simulation, Wiley IEEE Press, 3rd Edition, 2010.
4. M.L.Bushnell and V.D.Agrawal, "Essentials of Electronic Testing for Digital, Memory and Mixed-Signal VLSI Circuits", Kluwer Academic Publishers, 2002.
5. BapirajuVinnakota, "Analog and mixed-signal test", Prentice Hall, 1998.

Mapping of COs with POs & PSOs

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	PSO1	PSO2
CO1	3	3	3	3	2	2	-	-	-	-	-	2	3	3
CO2	3	3	2	2	1	2	-	-	-	-	-	2	3	2
CO3	3	3	2	2	2	2	-	-	-	-	-	2	3	2
CO4	3	3	3	2	2	1	-	-	-	-	-	2	1	2
CO5	3	3	3	2	2	2	-	-	-	-	-	3	2	1
AVG	3	3	2.6	2.2	1.8	1.8	-	-	-	-	-	2.2	2.4	2

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

24ECPE28 MEMS AND NEMS **L T P C**
3 0 2 4

COURSE OBJECTIVES

- To introduce the concepts of Micro Electro Mechanical devices.
- To know the fabrication process of microsystems.
- To familiarize concepts of Quantum Mechanics and Nano systems.

UNIT I OVERVIEW OF MEMS AND NEMS **9**

New trends in Engineering and Science: Micro and Nanoscale systems, introduction to design of MEMS and NEMS, MEMS and NEMS – applications, devices and structures. Materials for MEMS: Silicon, Silicon compounds, polymers, metals.

UNIT II MEMS FABRICATION TECHNOLOGIES **9**

Microsystem Fabrication Processes: Photolithography, Ion Implantation, Diffusion, Oxidation. Thin Film Depositions: LPCVD, Sputtering, Evaporation, Electroplating; Etching Techniques: Dry and Wet Etching, Electrochemical Etching; Micromachining: Bulk Micromachining, Surface Micromachining, High Aspect- Ratio (LIGA and LIGA-Like) Technology; Packaging: Microsystems Packaging, Essential Packaging Technologies, Selection of Packaging Materials.

UNIT III MICRO SENSORS **9**

MEMS Sensors: Design of Acoustic Wave Sensors, Resonant Sensor, Vibratory Gyroscope, Capacitive and Piezo Resistive Pressure Sensors- Engineering Mechanics Behind These Microsensors. Case Study: Piezo-Resistive Pressure Sensor.

UNIT IV MICRO ACTUATORS **9**

Design of Actuators: Actuation Using Thermal Forces, Actuation Using Shape Memory Alloys, Actuation Using Piezoelectric Crystals, Actuation using Electrostatic Forces (Parallel Plate, Torsion Bar, Comb Drive Actuators), Micromechanical Motors and Pumps. Case Study: Comb Drive Actuators.

UNIT V NANOSYSTEMS AND QUANTUM MECHANICS **9**

Atomic Structures and Quantum Mechanics, Molecular and Nanostructure Dynamics: Schrodinger Equation and Wave Function Theory, Density Functional Theory, Nanostructures and Molecular Dynamics, Electromagnetic Fields and their Quantization, Molecular Wires and Molecular Circuits.

TOTAL:45 PERIODS

LIST OF EXPERIMENTS

1. Simulation of cantilever.
2. Simulation of micro machined structures.
3. Simulation of accelerometers.
4. Simulation of micromirror.
5. Simulation MEMS structures using sacrificial layer method.
6. Simulation of MEMS sensors.
7. Simulation study of integration of circuits and MEMS.
8. Design and simulation of thermo couples.

TOTAL:30 PERIODS

COURSE OUTCOMES

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

CO1: Discuss micro sensors.
CO2: Explain micro actuators.
CO3: Outline nanosystems and Quantum mechanics.
CO4: Design micro actuators for different applications.
CO5: Analyze atomic structures.

TEXT BOOKS

1. Chang Liu, “Foundations of MEMS”, Pearson education India limited, 2006.
2. Murty B.S, Shankar P, Raj B, Rath, B.B, Murday J, Textbook of Nanoscience and Nanotechnology, Springer publishing, 2013.
3. Sergey Edward Lyshevski, “MEMS and NEMS: Systems, Devices, and Structures”, CRC Press, 2002.

REFERENCE BOOKS

1. Tai Ran Hsu, MEMS and Microsystems Design and Manufacture, Tata Mcgraw Hill, 2002.
2. Vinod Kumar Khanna Nanosensors: Physical, Chemical, and Biological, CRC press, 2012.
3. Stephen D. Senturia," Micro System Design", Kluwer Academic Publishers,2001
4. Sergey Edward Lyshevski, "MEMS and NEMS: Systems, Devices, and Structures" CRC Press, 2002.
5. Tai Ran Hsu ,"MEMS and Microsystems Design and Manufacture" ,Tata Mcraw Hill, 2002.

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	3	2
CO2	3	3	3	2	2	2	-	-	-	-	-	2	3	2
CO3	3	3	3	2	2	2	-	-	-	-	-	2	3	2
CO4	3	3	3	2	2	2	-	-	-	-	-	2	3	2
CO5	3	3	3	2	2	2	-	-	-	-	-	2	3	2
AVG	**3**	**3**	2.8	2	2	2	**-**	**-**	-	**-**	**-**	**1.8**	**3**	**2**

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

24ECPE29 IOT PROCESSORS **L T P C**
3 0 2 4

COURSE OBJECTIVES

- Learn the architecture and features of ARM interrupts in CORTEX M3.
- Learn the architecture of STM 32L15XXX ARM CORTEX M3/M4 microcontroller.
- Understand the concepts of System – On – Chip(SoC).

UNIT I OVERVIEW OF ARM AND CORTEX-M3 **9**

ARM Architecture – Versions, Instruction Set Development, Thumb 2 and Instruction Set Architecture, Cortex M3 Basics: Registers, Stack Pointer, Link Register, Program Counter, Special Registers, Operation Mode, Exceptions and Interrupts, Vector Tables, Stack Memory Operations, Reset Sequence , CORTEX M3 Instruction Sets: Assembly Basics, Instruction List, Instruction Descriptions, CORTEX M3 – Implementation Overview: Pipeline, Block Diagram. Bus Interfaces, I – Code Bus, D – Code Bus, System Bus- External PPB and DAP Bus.

UNIT II CORTEX EXCEPTION HANDLING AND INTERRUPTS **9**

Exception Types, Priority, Vector Tables, Interrupt Inputs and Pending behaviour, Fault Exceptions, Supervisor Call and Pendable Service Call, NVIC: Nested Vector Interrupt Controller, Overview, Basic Interrupts, SYSTICK Time, Interrupt Behaviourm Interrupt/Exception Sequences, Exception Exits, Nested Interrupts, Tail – Chaining Interrupts, Late Arrivals and Interrupt Latency.

UNIT III CORTEX M3/M4 PROGRAMMING **9**

Cortex M3/M4 Programming: Overview, Typical Development Flow, Using C, CMSIS Using Assembly, Exception Programming Using Interrupts, Exception/Interrupt Handlers, Software Interrupts, Vector Table Relocation, Memory Protection Unit and other CORTEX M3 Features, MPU Registers, Setting up the MPU, Power Management, Multiprocessor Configuration.

UNIT IV STM32L15XXX ARMCORTEX M3/M4 MICROCONTROLLER **9**

STM32L15XXX ARM CORTEX M3/M4 Microcontroller: Memory and Bus Architecture, Power Control, Reset and Clock Control, STM32L15XXX Peripherals: GPIOs, System Configuration Controller, NVIC, ADC, Comparators, GP Timers, USART Development and Debugging Tools: Software and Hardware tools like Cross Assemblerm Compiler, Debugger, Simulator, In – Circuit Emulator(ICE), Logic Analyser.

UNIT V INTRODUCTION TO SYSTEM – ON – CHIP **9**

System Architecture: An Overview, Components of the System Processors, Memories and Interconnects, Processor Architectures, Memory and Addressing, System Level Interconnection – An Approach for SOC Design – Chip basics – Cycle Time – Die Area – Power and Cost – Area, Power and Time Trade – Offs in Processor Design – Reliability and Configurability – SOC Design Approach – Application Studies – AES, 3D Graphics Processor. Image Compression and Video Compression.

TOTAL:45 PERIODS

LIST OF EXPERIMENTS

ARM Assembly Programming

1. Write a program to add two 32-bit numbers stored in r0 and r1 registers and write the result to r2. The result is stored to a memory location. Run the program with breakpoint and verify the result .
2. Write a program to subtract two 32-bit numbers stored in r0 and r1 registers and write the result to r2. Run the program with stepping and verify the content of registers at each stage.
3. Write ARM assembly to perform the function of division. Registers r1 and r2 contain the dividend and divisor, r3 contains the quotient, and r5 contains the remainder.
4. Write ARM assembly to perform the function of multiplication. Registers r1 and r2 contain the multiplier and multiplicand, r3 contains the product.

Embedded C Programming on ARM Cortex M3/M4 Microcontroller

1. Write a program to turn on green LED (Port B.6) and Blue LED (Port B.7) on STM32L- Discovery by configuring GPIO.
2. Transmit a string “Programming with ARM Cortex” to PC by configuring the registers of USART2. Use polling method.

ARM Cortex M3/M4 Programming with CMSIS

1. Write a program to toggle the LEDs at the rate of 1 sec using standard peripheral library. Use Timer 3 for Delay.
2. Transmit a string “Programming with ARM Cortex” to PC by using standard peripheral library with the help of USART3. Use polling method.

TOTAL:30 PERIODS

COURSE OUTCOMES

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

CO1: Explain the architecture and features of ARM.
CO2: List the concepts of exception handling.
CO3: Write a program using ARM CORTEX M3/M4.
CO4: Learn the architecture of STM32L15XXX ARM CORTEX M3/M4.
CO5: Design an SoC for any application.

TEXT BOOKS

1. Joseph Yiu, The Definitive Guide to the ARM CORTEX M3/M4, Second Edition, Elsevier, 2010.(Unit – I, II).
2. Andrew N Sloss, Dominic Symes, Chris Wright, ARM System Developers Guide Designing and Optimising System Software, Elsevier, 2006 (Unit – III, IV).
3. Michael J Flynn and Wayne Luk, Computer System Design, System On Chip, Wiley India 2011.(Unit – V).

REFERENCE BOOKS

1. Steve Furber, ARM System – on – Chip Architecture, 2nd Edition, Pearson, 2015.
2. CORTEX M Series ARM Reference Manual.
3. CORTEX M3 Technical Reference Manual.
4. STM32L152XX ARM CORTEX M3 Microcontroller Reference Manual 5/97.
5. Nader. F. Mir," Computer and Communication Networks", Pearson Prentice Hall Publishers, 2nd Edition, 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	3	3	3	2	2	2	-	-	-	-	-	3	3	3
CO2	3	3	3	3	2	2	-	-	-	-	-	2	3	3
CO3	3	3	3	3	2	2	-	-	-	-	-	2	2	2
CO4	3	3	2	2	2	2	-	-	-	-	-	2	2	2
CO5	3	3	2	2	2	1	-	-	-	-	-	3	3	2
AVG	3	3	2.6	2.4	2	1.8	-	-	-	-	-	2.4	2.6	2.4

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

24ECPE30 SOFTWARE DEFINED NETWORKS **L T P C**
3 0 2 4

COURSE OBJECTIVES

- To introduce the principles of software defined networks (SDN).
- To introduce modern software defined networking standards and practices.
- To enable the appreciation for the strengths and limitations of various techniques and protocols in SDN.

UNIT I SDN BACKGROUND AND MOTIVATION **9**

Evolving network requirements-The SDN Approach: Requirements, SDN Architecture, Characteristics of Software-Defined Networking, SDN and NFV-Related Standards: Standards-Developing Organizations, Industry Consortia, Open Development Initiatives.

UNIT II SDN DATA PLANE AND OPENFLOW **9**

SDN data plane: Data plane Functions, Data plane protocols, Open flow logical network Device: Flow table Structure, Flow Table Pipeline, The Use of Multiple Tables, Group Table-Open Flow Protocol.

UNIT III SDN CONTROL PLANE **9**

SDN Control Plane Architecture: Control Plane Functions, Southbound Interface, Northbound Interface, Routing, ITU-T Model- Open Daylight-REST- Cooperation and Coordination among Controllers.

UNIT IV SDN APPLICATION PLANE **9**

SDN Application Plane Architecture: Northbound Interface, Network Applications, User Interface- Network Services Abstraction Layer: Abstractions in SDN, Frenetic- Traffic Engineering Measurement and Monitoring- Security- Data Center Networking- Mobility and Wireless.

UNIT V NETWORK FUNCTIONS VIRTUALIZATION **9**

Background and Motivation for NFV- Virtual Machines- NFV Concepts: Simple Example of the Use of NFV, NFV Principles, High-Level NFV Framework, NFV Benefits and Requirements.

TOTAL:45 PERIODS

LIST OF EXPERIMENTS

1. Network Topology creation and REST API introduction.
2. Create a network and run a simple performance test.
3. Dynamically change the forwarding rules.
4. Mininet Random Topology Generator.
5. Influencing flows via c URL commands.
6. Use ―ovs-vsctl command to directly control open v switch.
7. Dynamically change the network parameters-link delay analysis.
8. Building a SDN based application.

TOTAL:30 PERIODS

COURSE OUTCOMES

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

CO1: Explain the key benefits of SDN by the separation of data and control planes.

CO2: Outline the concepts of SDN data plane devices and Open flow Protocols.

CO3: Relate the SDN control plane with different controllers.

CO4: Summarize the Network services and applications in SDN.

CO5: Interpret the Network Functions Virtualization components and their roles in SDN.

TEXT BOOKS

1. William Stallings, Foundations of Modern Networking, Pearson Ltd., 2016.
2. Paul Goransson and Chuck Black, "Software Defined Networks: A Comprehensive Approach" , Morgan Kaufmann Publications, 2014.
3. Oswald Coker, Siamak Azodolmolky, "Software-Defined Networking with OpenFlow", 2nd Edition, O'Reilly Media, 2017.

REFERENCE BOOKS

1. Gray K, Nadeau TD, Amsterdam Boston Heidelberg, Morgan Kaufmann, "Network Function Virtualization" 2016.
2. Nadeau TD, Gray K. SDN: "Software Defined Networks: [an Authoritative Review of Network Programmability, Technologies", O'Reilly; 2013.
3. Feamster, Nick, Jennifer Rexford, and Ellen Zegura. "The road to SDN: an intellectual history of programmable networks." ACM SIGCOMM Computer Communication Review 44.2 : 87-98., 2014.
4. Kreutz, Diegoetal. "Software-defined networking: A comprehensive survey." Proceedings of the IEEE 103.1 : 14-76, 2015.
5. Thomas D. Nadeau & Ken Gray, O'Reilly, "SDN- Software Defined Networks" , 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	3	3	2	-	-	-	-	-	3	3	3
CO2	3	3	3	2	2	2	-	-	-	-	-	3	3	2
CO3	3	3	3	3	1	2	-	-	-	-	-	3	2	3
CO4	2	3	3	2	2	1	-	-	-	-	-	2	2	1
CO5	3	3	2	2	2	1	-	-	-	-	-	2	2	2
AVG	**3**	**3**	**3**	**2**	**2**	**2**	**-**	**-**	**-**	**-**	**-**	**2**	**2**	**2**

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

24ECPE31 INDUSTRIAL IOT AND INDUSTRY 4.0 **L T P C**
3 0 2 4

COURSE OBJECTIVES

- Explain IoT Nodes, Sensors, Gateways & Cloud Systems.
- To introduce modern IoT Cloud Dashboards.
- To enable the challenges in Iot system Design of Hardware & Software.

UNIT I UNDERSTANDING IOT CONCEPT AND DEVELOPMENT PLATFORM 9

IOT Definition, Importance of IoT, Applications of IOT, IoT architecture, Understanding working of Sensors, Actuators, Sensor calibration, Study of Different sensors and their characteristics.

UNIT II ANALYZING & DECODING OF COMMUNICATION PROTOCOL 9

UART Communication Protocol, I2C Protocol device interfacing and decoding of signal, SPI Protocol device interfacing and decoding of signal, WIFI and Router interfacing, Ethernet Configuration, Bluetooth study and analysis of data flow, Zigbee Interfacing and study of signal flow .

UNIT III IOT PHYSICAL DEVICES AND SENSORS 9

IoT Physical Devices and Endpoints- Introduction to Arduino and Raspberry Pi- Installation, Interfaces (serial, SPI, I2C), Python Programming. Sensors- Light sensor, temperature sensor with thermistor, voltage sensor, ADC and DAC, Temperature and Humidity Sensor DHT11, Motion Detection Sensors, Wireless Bluetooth Sensors.

UNITIV CLOUD SERVICES USED IN IOT DEVELOPMENT PLATFORM 9

Configuration of the cloud platform, Sending data from the IOT nodes to the gateways using different communication options; Transferring data from gateway to the cloud; Exploring the web services like mail, Messaging (SMS) and Twitter etc.;Tracking of cloud data as per the requirement; Google Cloud service architect; AWS clod Services architect; Microsoft Azure cloud services Architect; OEN source Cloud Services; Initial State Iot Dashboard & Cloud Services.

UNIT V CHALLENGES IN IOT SYSTEM DESIGN – HARDWARE & SOFTWARE 9

Antenna design and placement, Chip-package system development, Power electronics, electromagnetic interference/compatibility (EMI/EMC), Electronics reliability; Battery simulation.

TOTAL:45 PERIODS

LIST OF EXPERIMENTS

Study and Program different Sensors for IoT applications

1. LDR sensor & IR sensor,
2. Temperature Sensor, Ultrasound Sensor & Gas sensor.
3. Write a program using IR sensor for working morning alarm and night lamp.
4. Write a program using Temperature sensor for detecting heat / fire.

Designing and debugging complex mixed signal devices.

1. Write a program to interface Bluetooth and implement DC Motor.
2. Write a program to control LEDs using Alexa Echo Dot.
3. Write a program to control Buzzer using Alexa Echo Dot.
4. Write a program to control DC motor using Google Assistance**.**

TOTAL:30 PERIODS

COURSE OUTCOMES

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

CO1: Explain the building blocks of IoT and explore of IoT applications.
CO2: Use processors & peripherals to design & build IoT hardware.
CO3: Assess, select and customize technologies for IoT applications.
CO4: Connect numerous IOT applications with the physical world of humans.
CO5: Design and implement IOT applications that manage big data.

TEXT BOOKS

1. Arshdeep Bahga and Vijay Madisetti, “Internet of Things - A Hands-on Approach”, Universities Press, 2015, ISBN: 9788173719547.
2. Matt Richardson & Shawn Wallace, “Getting Started with Raspberry Pi”, O'Reilly (SPD), 2014, ISBN: 9789350239759.
3. Honbo Zhou, “Internet of Things in the cloud”, CRC press, 2012.

REFERENCE BOOKS

1. Simon Monk, “Raspberry Pi Cookbook, Software and Hardware Problems and solutions”, O'Reilly (SPD), 2016, ISBN 7989352133895.
2. N. Ida, Sensors, Actuators and Their Interfaces, SciTech Publishers, 2014. 3. Peter Waher, 'Learning Internet of Things', Packt Publishing, 2015.
3. Editors Ovidiu Vermesan Kreutz, Diegoetal. "Software-defined networking: A comprehensive survey." Proceedings of the IEEE 103.1 : 14-76, 2015.
4. Pethuru Raj and Anupama C. Raman, "The Internet of Things: Enabling Technologies, Platforms, and Use Cases", CRC Press, 2017.
5. Constandinos X. Mavromoustakis, George Mastorakis, Jordi MongayBatalla, “Internet of Things (IoT) in 5G Mobile Technologies” Springer International Publishing Switzerland 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	2	2	2	1	2	-	-	-	-	-	2	3	2
CO2	3	2	2	2	1	2	-	-	-	-	-	2	3	3
CO3	3	2	2	2	2	2	-	-	-	-	-	2	3	3
CO4	3	2	3	2	3	2	-	-	-	-	-	2	3	3
CO5	3	3	3	3	3	3	-	-	-	-	-	1	3	2
AVG	**3**	**2.25**	**2.4**	**2.2**	**2**	**2.2**	**-**	**-**	**-**	**-**	**-**	**1.8**	**3**	**2.6**

1-Low, 2-Medium, 3-High, ‘-’- No Correlation

24ECPE32 RFID SYSTEM DESIGN AND TESTING L T P C

3 0 2 4

COURSE OBJECTIVES

- To discuss the fundamentals of near field and far field RFID communications.
- To articulate the standards and protocols used in RFID systems.
- To introduce the security aspects, system architecture, industrial and scientific applications of RFID systems.

UNIT I INTRODUCTION **9**

RFID Principles: Near-field based RFID – Properties of Magnetic field – Far-field based RFID – Properties of Backscatter RF Systems – Modulation techniques – Frequency based property comparison of RFID Systems.

UNIT II RFID STANDARDS AND PROTOCOLS **9**

RFID Industry standards: EPC global – ISO15693 Vicinity cards and RFID – ISO14443 Proximity cards and RFID – The NFC forum – Reading collocated RFID tags: Query Tree protocol – Query Slot protocol.

UNIT III OPERATING PRINCIPLES **9**

RFID Tag components: RFID tag types – the 1-Bit Transponder and Chipless Tags – RFID readers and middleware component – Communication fundamentals: Coupling, Data encoding, multi-path effect – Tag, Reader and sensor communication.

UNIT IV DATA INTEGRITY AND SECURITY **9**

The checksum procedure – Multiaccess procedures – Attacks on RFID Systems – Protection by Cryptographic measures.

UNIT V RFID ENABLED SENSORS AND APPLICATIONS **9**

RFID enabled Sensors: Antenna design challenges – IC design – Integration of sensors and RFID – Power consumption and Link budget. 133 Applications: Contactless smart cards – Access control – Electronic passport – Industrial Automation – Medical applications – Challenges and opportunities.

TOTAL:45 PERIODS

LIST OF EXPERIMENTS

1. Design of a passive RFID Tag Antenna.
2. Design of an RFID reader antenna.
3. Determination of read range of the RFID tag at UHF frequencies.
4. Determination of read range of the RFID tag at Microwave frequencies.
5. Determination of RFID tag performance for different standards.
6. Design of an RFID Industry standards.
7. Design Query Tree protocol.
8. Design Query Slot protocol.

TOTAL:30 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. 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. Klaus Finkenzeller, RFID Handbook, 3rd Edition, Wiley, 2010.
2. Syed Ahson, Mohammad Ilyas, RFID Handbook, CRC Press, 2008.
3. Paris Kitsos, Security in RFID and Sensor Networks, CRC Press, 2016.
4. Steven Shepard, "Radio Frequency Identification", 1st Ed., McGraw Hill, 2011.
5. Harvey Lehpamer, "RFID Design Principles", 2nd Ed., 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	3	3	3	2	2	3	1	-	-	1	-	3	2	3
CO2	3	2	3	2	2	2	1	-	-	1	-	3	3	2
CO3	3	3	3	2	3	2	1	-	-	1	-	3	2	3
CO4	3	3	3	2	2	2	1	-	-	1	-	2	3	2
CO5	3	3	2	2	2	2	2	-	-	1	-	3	2	2
AVG	3	3	3	2	3	3	1	-	-	1	-	2	3	3

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

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.

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.

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 Norton introduction to Literature,W.W.Norton &Company,Fifteenth Edition,2025.
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 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

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

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.
5. Judith Lorber,Gender Inequality:Feminist Theories and Politics,Oxford University Press,Third Edition,2010.

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

COURSE OUTCOMES

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

CO1: Explore the food groups.
CO2: Explore properties of pulses and grams.
CO3: Explore properties of beverages.
CO4: Explore properties of milk.
CO5: Explore 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: Explore 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 the 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 the 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.

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.

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.

UNIT V HAZARD IDENTIFICATION TECHNIQUES **9**

Job Safety Analysis-Preliminary Hazard Analysis-Failure mode and Effects Analysis-Hazardand 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

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

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

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', Vth 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 & PSOs

COs	POs												PSOs	
	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	-	-
CO2	2	3	3	2	3	2	3	3	3	2	3	3	-	-
CO3	2	3	3	2	3	2	3	3	3	2	3	3	-	-
CO4	2	3	3	2	3	2	3	3	3	2	3	3	-	-
CO5	2	3	3	2	3	2	3	3	3	2	3	3	-	-
AVG	**2**	**3**	**3**	**2**	**3**	**2**	**3**	**3**	**3**	**2**	**3**	**3**	-	-

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.

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 Ed., 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 Ed., 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 & PSOs

COs	POs												PSOs	
	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	-	-
CO2	2	3	3	2	3	2	3	3	3	2	3	3	-	-
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CO4	2	3	3	2	3	2	3	3	3	2	3	3	-	-
CO5	2	3	3	2	3	2	3	3	3	2	3	3	-	-
AVG	**2**	**3**	**3**	**2**	**3**	**2**	**3**	**3**	**3**	**2**	**3**	**3**	-	-

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 & PSOs

COs	POs												PSOs	
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CO2	2	3	3	2	3	2	3	3	3	2	3	3	-	-
CO3	2	3	3	2	3	2	3	3	3	2	3	3	-	-
CO4	2	3	3	2	3	2	3	3	3	2	3	3	1	-
CO5	2	3	3	2	3	2	3	3	3	2	3	3	-	-
AVG	**2**	**3**	**3**	**2**	**3**	**2**	**3**	**3**	**3**	**2**	**3**	**3**	1	-

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.

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 & PSOs

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CO2	2	3	3	2	3	2	3	3	3	2	3	3	-	-
CO3	2	3	3	2	3	2	3	3	3	2	3	3	-	-
CO4	2	3	3	2	3	2	3	3	3	2	3	3	-	-
CO5	2	3	3	2	3	2	3	3	3	2	3	3	-	-
AVG	2	3	3	2	3	2	3	3	3	2	3	3	-	-

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

24OAI101 WEB TECHNOLOGY **L T P C**
3 0 2 4

COURSE OBJECTIVES

- To understand different Internet Technologies.
- To learn java-specific web services architecture.
- To develop web applications using frameworks.

UNIT I WEB SITE BASICS, HTML5, CSS3, WEB2.0 **9**

Web Essentials**:** Clients, Servers and Communication – The Internet – World Wide Web – HTTP Request Message – HTTP Response Message – Web Clients – Web Servers – HTML5 – Tables – Lists – Image – HTML5 Control Elements – Drag and Drop – Audio – Video Controls – CSS3 – Inline, Embedded and External Style Sheets – Rule Cascading – Inheritance – Backgrounds – Border Images – Colors – Shadows – Text – Transformations – Transitions – Animations – Bootstrap Framework.

UNIT II CLIENT-SIDE PROGRAMMING **9**

Java Script: An introduction to JavaScript–JavaScript DOM Model-Exception Handling-Validation- Built-in objects-Event Handling- DHTML with JavaScript- JSON introduction – Syntax – Function Files.

UNIT III SERVER-SIDE PROGRAMMING **9**

Servlets: Java Servlet Architecture- Servlet Life Cycle- Form GET and POST actions-Session Handling- Understanding Cookies- DATABASE CONNECTIVITY: JDBC.

UNIT IV PHP AND XML **9**

An introduction to PHP: PHP- Using PHP- Variables- Program control- Built -in functions-Form Validation. XML: Basic XML -Document Type Definition - XML Schema, XML Parsers and Validation, XSL.

UNIT V INTRODUCTION TO ANGULAR AND WEB APPLICATIONS FRAME WORKS **9**

Introduction to AngularJS, MVC Architecture, Understanding ng attributes, Expressions and data binding, Conditional Directives, Style Directives, Controllers, Filters, Forms, Routers, Modules, Services; Web Applications Frameworks and Tools – Firebase- Docker- Node JS- React- Django- UI & UX.

TOTAL: 45 PERIODS

LIST OF EXPERIMENTS

1. Create a webpage with the following using HTML
   a) To embed an image map in a webpage.
   b) To fix the hotspots.
   c) Show all the related information when the hotspots are clicked.
2. Create a webpage with all types of Cascading Style Sheets.
3. Client-side scripts for validating web form controls using DHTML.
4. Installation of Apache Tomcat web server.
5. Write programs in Java using Servlets:
   a) To invoke servlets from HTML forms.
   b) Session tracking.
6. Write programs in Java to create three-tier applications using JSP and Databases:
   a) For conducting online examination.
   b) For displaying student mark list. Assume that student information is available in a database which has been stored in a database server.
7. Programs using XML – Schema – XSLT/XSL.
8. Write a program to design a simple calculator using (a) JavaScript (b) PHP (c) Servlet and (d) JSP.

TOTAL: 30 PERIODS

COURSE OUTCOMES

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

CO1: Construct a basic website using HTML and Cascading Style Sheets.

CO2: Build dynamic web page with validation using JavaScript objects and by applying different event handling mechanisms.

CO3: Develop server-side programs using Servlets and JSP.

CO4: Construct simple web pages in PHP and to represent data in XML format.

CO5: Develop interactive web applications.

TEXT BOOKS

1. Deitel and Deitel and Nieto, Internet and World Wide Web - How to Program, Prentice Hall,5th Edition, 2011.
2. Jeffrey C and Jackson, Web Technologies: A Computer Science Perspective, Pearson Education, 2011.
3. Angular 6 for Enterprise-Ready Web Applications, Doguhan Uluca, 1st Edition, Publishing.

REFERENCE BOOKS

1. Stephen Wynkoop and John Burke, Running a Perfect Website, QUE, 2nd Edition, 1999.
2. Chris Bates, Web Programming – Building Intranet Applications, 3rd Edition, Wiley p, 2009.
3. Gopalan N. P. and Akilandeswari J., Web Technology, Prentice Hall of India, 2011.
4. Uttam K. Roy, Web Technologies, Oxford University Press, 2011.
5. Angular: Up and Running – Learning Angular, Step by Step, Shyam Seshadri, 1st Edition, O′Reilly.

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	–	2	-	-
CO2	3	2	3	–	3	–	–	–	–	–	–	3	-	-
CO3	3	2	3	–	3	–	–	–	–	–	–	3	-	-
CO4	3	2	2	–	3	–	–	–	–	–	–	3	-	-
CO5	3	3	3	2	3	2	2	–	2	2	2	3	-	-
AVG	**3**	**2.3**	**2.6**	**2**	**3**	**2**	**2**	**-**	**2**	**2**	**2**	**2.8**	-	-

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

24OAI102 OBJECT ORIENTED PROGRAMMING **L T P C**
3 0 2 4

COURSE OBJECTIVES

- To understand Object Oriented Programming concepts and basics of Java programming Language.
- To know the principles of packages, inheritance and interfaces.
- To develop a Java application with threads and generics classes.

UNIT I INTRODUCTION TO OOP AND JAVA **9**

Overview of OOP – Object oriented programming paradigms – Features of Object Oriented Programming – Java Buzzwords – Overview of Java – Data Types, Variables and Arrays – Operators – Control Statements –Programming Structures in Java – Defining classes in Java – Constructors-Methods -Access specifiers - Static members-Java Doc comments

UNIT II INHERITANCE PACKAGES AND INTERFACES **9**

Overloading Methods – Objects as Parameters – Returning Objects –Static, Nested and Inner Classes. Inheritance: Basics–Types of Inheritance –Super keyword –Method Overriding – Dynamic Method Dispatch –Abstract Classes –final with Inheritance. Packages and Interfaces: Packages – Packages and Member Access – Importing Packages – Interfaces.

UNIT III EXCEPTION HANDLING AND MULTI THREADING **9**

Exception Handling basics – Multiple catch Clauses – Nested try Statements – Java's Built-in Exceptions–User defined Exception. Multithreaded Programming: Java Thread Model–Creating a Thread and Multiple Threads – Priorities – Synchronization – Inter Thread Communication- Suspending –Resuming, and Stopping Threads –Multithreading. Wrappers – Auto boxing.

UNIT IV I/O, GENERICS, STRING HANDLING **9**

I/O Basics – Reading and Writing Console I/O – Reading and Writing Files. Generics: Generic Programming – Generic classes – Generic Methods – Bounded Types – Restrictions and Limitations. Strings: Basic String class, methods and String Buffer Class.

UNIT V JAVAFX EVENT HANDLING, CONTROLS AND COMPONENT **9**

JAVAFX Events and Controls: Event Basics – Handling Key and Mouse Events. Controls:Checkbox, Toggle Button – Radio Buttons – List View – Combo Box – Choice Box – Text Controls – ScrollPane.Layouts–FlowPane–HBoxandVBox–BorderPane–StackPane–GridPane.Menus – Basics – Menu – Menu bars – Menu Item.

TOTAL: 45 PERIODS

LIST OF EXPERIMENTS

1. Develop stack and queue data structures using classes and objects.
2. Write a Java program to create an abstract class named Shape that contains two integers and an empty method named printArea(). Provide three classes named Rectangle, Triangle, and Circle such that each one of the classes extends the class Shape. Each one of the classes contains only the method printArea() that prints the area of the given shape.
3. Solve the above problem using an interface.
4. Implement exception handling and creation of user-defined exceptions.
5. Write a Java program that implements a multi-threaded application that has three threads. First thread generates a random integer every 1 second and if the value is even, the second thread computes the square of the number and prints. If the value is odd, the third thread will print the value of the cube of the number.
6. Write a program to perform file operations.
7. Develop applications to demonstrate the features of generics classes.
8. Implement single, multilevel, and hierarchical inheritance with method overriding.

TOTAL: 30 PERIODS

COURSE OUTCOMES

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

CO1: Apply the concepts of classes and objects to solve simple problems.

CO2: Develop programs using inheritance, packages and interfaces.

CO3: Make use of exception handling mechanisms and multithreaded model to solve real- world problems.

CO4: Build Java applications with I/O packages, string classes, Collections and generics Concepts.

CO5: Integrate the concepts of event handling and JavaFX components and controls for developing GUI-based applications.

TEXT BOOKS

1. Herbert Schildt, "Java: The Complete Reference", 11th Edition, McGraw Hill Education, New Delhi, 2019.
2. Herbert Schildt, "IntroducingJavaFX8Programming",1st Edition, McGrawHill Education, New Delhi, 2015.
3. Design Patterns: Elements of Reusable Object-Oriented Software" by Erich Gamma, Richard Helm, Ralph Johnson, and John Vlissides (The Gang of Four).

REFERENCE BOOKS

1. Cay S. Horstmann, "Core Java Fundamentals", Volume 1, 11th Edition, Prentice Hall, 2018.
2. Head First Object-Oriented Analysis and Design" by Brett McLaughlin, Gary Pollice, and David West.
3. Meyer, Bertrand. Object-Oriented Software Construction 3rd Edition. Prentice Hall, 1997.
4. Phillips, Dusty. Python 3 Object-Oriented Programming 3rd Edition, Packt Publishing, 2022.
5. Lafore, Robert. Object-Oriented Programming in C++ 3rd Edition, Publishing, 2002.

Mapping of COs with POs & PSOs

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CO3	3	2	-	2	3	-	-	-	-	-	2	-	-	-
CO4	3	2	2	-	3	-	-	-	-	-	-	-	-	-
CO5	2	-	3	-	3	-	-	-	-	2	2	-	-	-
AVG	**2.8**	**2**	**2.5**	**2**	**2.4**	-	-	-	**1**	**2**	**2**	**2**	1	-

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

24OAI103 COMPUTATIONAL DATA ANALYTICS **L T P C**
3 0 2 4

COURSE OBJECTIVES

- To understand the concepts of ADTs.
- To learn linear data structures – lists, stacks, and queues.
- To understand non-linear data structures – trees and graphs.

UNIT I LISTS **9**

Abstract Data Types (ADTs) –List ADT –Array-based implementation–Linked list implementation –Singly linked lists–Circularly linked lists–Doubly-linked lists–Applications of lists–Polynomial ADT – Radix Sort – Multi lists.

UNIT II STACKS AND QUEUES **9**

Stack ADT – Operations – Applications – Balancing Symbols – Evaluating arithmetic expressions- Infix to Postfix conversion–Function Calls–Queue ADT–Operations–Circular Queue–DeQueue – Applications of Queues.

UNIT III TREES **9**

Tree ADT–Tree Traversals –Binary Tree ADT–Expression trees–Binary Search Tree ADT–AVL Trees –Priority Queue (Heaps) – Binary Heap.

UNIT IV MULTI WAY SEARCH TREES AND GRAPHS **9**

B-Tree –B+Tree – Graph Definition – Representation of Graphs – Types of Graph - Breadth-first traversal –Depth-first traversal — Bi-connectivity – Euler circuits –Topological Sort – Dijkstra's algorithm – Minimum Spanning Tree –Prim's algorithm –Kruskal's algorithm

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

Searching –Linear Search –Binary Search. Sorting –Bubble sort –Selection sort –Insertion sort – Shell sort –. Merge Sort – Hashing –Hash Functions – Separate Chaining – Open Addressing – Rehashing – Extendible Hashing.

TOTAL: 45 PERIODS

LIST OF EXPERIMENTS

1. Array implementation of Stack, Queue and Circular Queue ADTs.
2. Implementation of Singly Linked List.
3. Linked list implementation of Stack and Linear Queue ADTs.
4. Implementation of Polynomial Manipulation using Linked list.
5. Implementation of Binary Search Trees.
6. Implementation of AVL Trees.
7. Implementation of Heaps using Priority Queues.
8. A Real-world case study using LSB (Least Significant Bit) steganography in data analytics.

TOTAL: 30 PERIODS

COURSE OUTCOMES

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

CO1: Define linear and non-linear data structures.

CO2: Implement linear and non–linear data structure operations.

CO3: Use appropriate linear/non–linear data structure operations for solving a given problem.

CO4: Apply appropriate graph algorithms for graph applications.

CO5: Analyze the various searching and sorting algorithms.

TEXT BOOKS

1. Mark Allen Weiss, Data Structures and Algorithm Analysis in C, 2nd Edition, Pearson Education, 2005.
2. Kamthane, Introduction to Data Structures in C, 1st Ed., Pearson Education, 2007.
3. Data Science and Predictive Analytics: Biomedical and Health Applications using R (2nd Edition) by Ivo D. Dinov.

REFERENCE BOOKS

1. Langsam, Augenstein and Tanenbaum, Data Structures Using C and C++, 2nd Edition, Pearson Education, 2015.
2. Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest, Clifford Stein, Introduction to Algorithms, 4th Edition, McGraw Hill / MIT Press, 2022.
3. Alfred V. Aho, Jeffrey D. Ullman, John E. Hopcroft, Data Structures and Algorithms, 1st Edition, Pearson, 2002.
4. Kruse, Data Structures and Program Design in C, 2nd Ed., Pearson Education, 2006.
5. Advanced Data Science and Analytics with Python by Jesús Rogel-Salazar.

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	-	-	-	-	-	-	2	-	-
CO2	3	3	2	-	2	-	-	-	-	-	-	-	-	-
CO3	3	3	3	-	3	-	-	-	1	-	1	-	-	-
CO4	2	3	2	3	2	-	-	-	-	-	1	-	-	-
CO5	3	2	2	-	3	-	-	-	-	-	-	1	-	-
AVG	**2.8**	**2.6**	**2.3**	**3**	**2.2**	**-**	**-**	**-**	**1**	**-**	**1**	**1.5**	**-**	**-**

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

24OAI104 NETWORKING CONCEPTS **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 the 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 (DECbit, 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 DATA LINK 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

LIST OF EXPERIMENTS

1. Learn to use commands like TCP dump, net stat, if config, ns lookup, and traceroute. 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 Wireshark to capture packets and examine the packets.
6. Write 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 a simulation tool.

TOTAL: 30 PERIODS

COURSE OUTCOMES

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

CO1: Explain the basic layers and their 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. James 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.

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-Dar Lin, Ren-Hung Hwang, Fred Baker, Computer Networks: An Open Source Approach, McGraw Hill, 2012.
5. William Stallings, Network Security Essentials: Applications and Standards.

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	-	-	-	-	-	-	2	1	-
CO2	3	3	-	2	2	-	-	-	-	-	1	-	1	-
CO3	3	2	2	2	1	-	-	-	-	-	1	-	1	2
CO4	2	1	-	-	2	-	-	-	-	-	-	-	1	-
CO5	2	2	2	-	3	-	-	-	1	2	2	1	1	2
AVG	**2.6**	**2**	**2**	**2**	**1.8**	**-**	**-**	**-**	**1**	**2**	**1.3**	**1.5**	1	2

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

24OEI101 CONTROL SYSTEM 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,
2. McGraw Hill Education, 2018.
3. Katsuhiko Ogata, ‘Modern Control Engineering’, Pearson, 5th Edition2015.
4. J. Nagrath and M. Gopal, Control Systems Engineering (Multi Colour Edition),
5. 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 Engg., McGraw-Hill Education Private Limited, 2009.
5. Yaduvir Singh and S.Janardhanan, Modern Control, Cengage Learning, First impression, 2010.

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	-
CO2	3	3	2	3	1	1	-	-	-	-	-	1	-	-
CO3	3	3	3	2	2	2	-	-	-	-	-	1	-	1
CO4	3	3	3	2	2	1	-	-	-	-	-	1	-	-
CO5	3	3	3	1	1	1	-	-	-	-	-	1	-	-
AVG	3	3	2.8	2	1.6	1.2	-	-	-	-	-	1	1	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 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, 3rd 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.

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	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	-	-
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 direction.
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 JR.Hackworth and F.D Hackworth Jr., Pearson, 2004.
4. Embedded Systems- An integrated approach - Lyla b das, Pearson education 2012.
5. Computers as Components –Wayne Wolf, Morgan Kaufmann (second edition).

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	1	-	1	-	-
CO2	3	2	2	1	2	-	-	2	2	1	-	1	-	-
CO3	3	2	2	1	2	1	-	2	2	1	-	1	-	-
CO4	3	2	2	-	2	1	-	2	2	1	-	1	-	-
CO5	3	2	2	-	2	1	-	2	2	1	-	1	-	-
AVG	**3**	**2**	**2**	**1**	**2**	**1**	**-**	**2**	**2**	**1**	**-**	**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

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", 3rd Ed., 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, 2022.
5. Floyd, Buchla, "Fundamentals of Analog Circuits", Pearson, 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	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

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: Explain the working SI engine fundamentals.
CO3: Express concept of CI engines.
CO4: Explain 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 & PSOs

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

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 & PSOs

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

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, Springer, 2017.
5. Industrial Hazard and Safety Handbook: (Revised impressionby Ralph W King and John Magid 24 September 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	1	-	-	-	-	-	-	-	-	-	-	-	-
CO2	2	2	-	-	-	-	-	-	-	-	-	-	-	-
CO3	3	3	2	-	-	-	-	-	-	-	-	-	-	-
CO4	3	3	3	2	-	-	-	-	-	-	-	-	-	-
CO5	3	3	3	2	-	-	-	-	-	-	-	-	-	-
AVG	2.6	2.4	2.67	2	-	-	-	-	-	-	-	-	-	-

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 & PSOs

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	3	2	2	-	-	-	-	-	-	-	-	-	-	-
CO2	2	-	2	-	-	-	-	-	-	-	-	-	-	-
CO3	-	-	2	-	-	-	-	-	-	-	-	-	-	-
CO4	2	2	2	-	-	-	-	-	-	-	-	-	-	-
CO5	-	-	2	-	-	-	-	-	-	-	-	-	-	-
AVG	2.33	2	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 & PSOs

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

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

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.

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: Analyze 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 & PSOs 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	3	-	-	3	3	-	-
CO2	2	-	2	2	-	2	3	3	-	-	3	3	-	-
CO3	2	-	2	2	-	2	3	3	-	-	3	3	-	-
CO4	2	-	2	2	-	2	3	3	-	-	3	3	-	-
CO5	2	-	2	2	-	2	3	3	-	-	3	3	-	-
AVG	**2**	**-**	**2**	**2**	**-**	**2**	**3**	**3**	**-**	**-**	**3**	**3**	-	-

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 & PSOs

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

-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 & PSOs

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

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.

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 & PSOs

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

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 & PSOs

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

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

24OAT201 PRINCIPLES OF PROGRAMMING LANGUAGES **L T P C**

3 0 0 3

COURSE OBJECTIVES

- To understand and describe syntax and semantics of programming languages.
- To understand data, data types, and basic statements.
- To understand call-return architecture and ways of implementing them.

UNIT I SYNTAX AND SEMANTICS **9**

Evolution of programming languages – describing syntax – context-free grammars – attribute grammars – describing semantics – lexical analysis – parsing – recursive-descent – bottom up parsing.

UNIT II DATA, DATATYPES AND BASIC STATEMENTS **9**

Names–variables–binding–type checking–scope–scope rules–life time and garbage collection– primitive datatypes –strings–array types–associative arrays–record Types– union types–pointers and references–Arithmetic expressions–overloaded operators– type conversions– relational and boolean expressions– assignment statements– mixed mode assignments– control structures– selection– iterations– branching– guarded statements.

UNIT III SUBPROGRAMS AND IMPLEMENTATIONS **9**

Sub programs –design issues–local referencing–parameter passing–overloaded methods– generic methods – design issues for functions– semantics of call and return – implementing simple sub programs–stack and dynamic local variables–nested sub programs – blocks – dynamic scoping

UNIT IV OBJECT-ORIENTATION, CONCURRENCY AND EVENT HANDLING **9**

Object - orientation– design issues for OOP languages– implementation of object- oriented constructs –concurrency– semaphores – monitors –message passing – threads – statement level concurrency – exception handling – event handling

UNIT V FUNCTIONAL AND LOGIC PROGRAMMING LANGUAGES **9**

Introduction to lambda calculus – fundamentals of functional programming languages – Programming with Scheme – Programming with ML – Introduction to logic and logic programming – Programming

TOTAL:45 PERIODS

COURSE OUTCOMES

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

CO1: Describe syntax and semantics of programming languages.

CO2: Explain data, data types, and basic statements of programming languages.

CO3: Design and implement subprogram constructs.

CO4: Apply object-oriented, concurrency, and event handling programming constructs and develop programs in Scheme, ML, and Prolog.

CO5: Adopt new programming languages.

TEXT BOOKS

1. Robert W. Sebesta, “Concepts of Programming Languages”, Twelfth Edition (Global Edition), Pearson, 2022.
2. Michael L. Scott, “ProgrammingLanguagePragmatics”, Fourth Edition, Elsevier, 2018.
3. Principles of Programming Languages" by Er. Anil Panghal & Ms. Sharda Panghal.

REFERENCE BOOKS

1. R. Kent Dybvig, “The Scheme programming language”, Fourth Edition, Prentice Hall,2011.
2. Jeffrey D. Ullman, “Elements of ML programming”, Second Edition, Pearson,1997.
3. W. F. Clocksin and C. S. Mellish, “Programming in Prolog: Using the ISO Standard”, Fifth Edition, Springer, 2003.
4. Principles of Programming Languages" by Bruce J. MacLennan.
5. Essentials of Programming Languages" by Daniel P. Friedman, Mitchell Wand, and Christopher T. Haynes.

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	-	-	-	-	-	-	-	-	-
CO2	3	2	1	-	2	-	-	-	-	-	-	-	-	-
CO3	3	3	3	-	2	-	-	-	-	-	1	-	-	-
CO4	3	2	2	-	3	-	-	-	1	1	1	-	-	-
CO5	2	2	-	-	2	-	-	-	-	-	-	3	-	-
AVG	2.8	2.2	2	-	2.2	-	-	-	1	1	1	3	-	-

1-Low, 2-Medium, 3-High, ‘-’- No correlation

24OAT202 INFORMATION SECURITY MANAGEMENT **L T P C**

3 0 0 3

COURSE OBJECTIVES

- To understand the basics of Information Security
- To know the legal, ethical and professional issues in Information Security
- To know the aspects of risk management

UNIT I INTRODUCTION **9**

History - What is Information Security? - Critical Characteristics of Information - NSTISSC Security Model - Components of an Information System - Securing the Components - Balancing Security and Access - The SDLC - The Security SDLC.

UNIT II SECURITY INVESTIGATION **9**

Need for Security - Business Needs - Threats - Attacks - Legal - Ethical and Professional Issues - An Overview of Computer Security - Access Control Matrix - Policy - Security policies - Confidentiality policies - Integrity policies and Hybrid policies.

UNIT III SECURITY ANALYSIS **9**

Risk Management - Identifying and Assessing Risk - Assessing and Controlling Risk - Systems: Access Control Mechanisms - Information Flow and Confinement Problem.

UNIT IV LOGICAL DESIGN **9**

Blueprint for Security - Information Security Policy - Standards and Practices - ISO 17799/BS 7799 - NIST Models - VISA - International Security Model - Design of Security Architecture - Planning for Continuity.

UNIT V PHYSICAL DESIGN **9**

Security Technology - IDS - Scanning and Analysis Tools - Cryptography - Access Control Devices - Physical Security - Security and Personnel.

TOTAL: 45 PERIODS

COURSE OUTCOMES

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

CO1: Illustrate the legal, ethical and professional issues in information security.

CO2: Demonstrate the aspects of risk management.

CO3: Become aware of various standards in the Information Security System.

CO4: Design and implementation of Security Techniques.

CO5: Apply security technologies and practices to secure physical and logical components, including Cryptography, IDS, and physical security measures.

TEXT BOOKS

1. Michael E Whitman, Herbert J Mattord, "Principles of Information Security", Vikas Publishing House, New Delhi, 2003.
2. Information Security Management: Concepts and Practice" by Bel G. Raggad.
3. Information Security Management, 2nd Edition" by Michael Workman.

REFERENCE BOOKS

1. Micki Krause, Harold F. Tipton, "Handbook of Information Security Management", Vol. 1 3, CRC Press LLC, 2004
2. Stuart McClure, Joel Scrambray, George Kurtz, "Hacking Exposed", Tata McGraw Hill, 2003.
3. Matt Bishop, "Computer Security Art and Science", Pearson/PHI, 2002.
4. A Comprehensive Guide to Information Security Management and Audit" by Rajkumar Banoth, Gugulothu Narsimha, and Aruna Kranthi Godishala.
5. Information Security Management Handbook, Volume 7, 6th Edition" edited by Richard O'Hanley and James S. Tiller.

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	-	3	-	2	-	-	-	-
CO2	2	2	-	2	-	-	-	-	-	-	2	-	-	-
CO3	2	1	-	-	1	-	1	-	-	-	-	2	-	-
CO4	3	2	3	-	3	-	-	-	-	-	1	-	-	-
CO5	3	2	3	-	3	-	-	-	-	-	1	-	-	-
AVG	2.4	1.8	3	2	2.3	3	1	3	-	2	1.3	2	-	-

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

24OAT203 HUMAN COMPUTER INTERACTION **L T P C**
3 0 0 3

COURSE OBJECTIVES

- To understand the theoretical dimensions of human factors involved in the acceptance of computer.
- To understand the important aspects of implementation of human computer interfaces.
- To identify the various tools and techniques for interface analysis, design and evaluation.

UNIT I INTRODUCTION **9**

HCI Foundations: Input–output channels - Human memory - Thinking: reasoning and problem solving - Emotion - Individual differences - Psychology and the design of interactive systems - Text entry devices - Positioning - pointing and drawing - Display devices - Devices for virtual reality and 3D interaction - Physical controls - sensors and special devices - Paper: printing and scanning.

UNIT II INTERACTION DESIGNS **9**

Designing - Programming Interactive systems - Models of interaction - Frameworks and HCI - Ergonomics - Interaction styles - Elements of the WIMP interface - The context of the interaction - Experience - engagement and fun - Paradigms for interaction. Cantered Design and testing - Interaction design basics - The process of design - User focus - Scenarios - Navigation design - Screen design and layout, Iteration and prototyping.

UNIT III DESIGN RULES **9**

HCI in the software process - Iterative design and prototyping - Design rules - Principles to support usability - Standards and Guidelines - Golden rules and heuristics - HCI patterns. Implementation support - Elements of windowing systems - Programming the application - Using toolkits - User interface management systems.

UNIT IV ANALYSIS **9**

Evaluation techniques - Evaluation through expert analysis - Evaluation through user participation - Universal design - User support. Models and Theories - Cognitive models - Goal and task hierarchies - Linguistic models - The challenge of display-based systems - Physical and device models - Cognitive architectures.

UNIT V NOTATIONS **9**

Collaboration and communication - Face-to-face communication - Conversation - Text-based communication - Group working - Dialog design notations - Diagrammatic notations - Textual dialog notations - Dialog semantics - Dialog analysis and design Human factors and security - Groupware - Meeting and decision support systems - Shared applications and artifacts - Frameworks for groupware - Implementing synchronous groupware - Mixed - Augmented and Virtual Reality.

COURSE OUTCOMES

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

CO 1: Design and Develop processes and life cycle of Human Computer Interaction.

CO 2: Analyse product usability evaluations and testing methods.

CO 3: Apply the interface design standards/guidelines for cross cultural and disabled users.

CO 4: Categorize, Design and Develop Human Computer Interaction in proper architectural structures.

CO5: Design collaborative and communicative interfaces, incorporating human factors and security.

TEXT BOOKS

1. A Dix, Janet Finlay, G D Abowd, R Beale, "Human - Computer Interaction", Pearson Publishers, Third Edition, 2008.
2. Shneiderman, Plaisant, Cohen, Jacobs, "Designing the User Interface: Strategies for Effective Human Computer Interaction", Pearson Publishers, Fifth Edition, 2018.
3. Interaction Design: Beyond Human-Computer Interaction" (5th Edition) by Jenny Preece, Yvonne Rogers, and Helen Sharp.

REFERENCE BOOKS

1. Jonathan Lazar, "Research Methods in Human–Computer Interaction", John Wiley & Sons.
2. Human-Computer Interaction Handbook: Fundamentals, Evolving Technologies, and Emerging Applications" (3rd Edition) edited by Julie A. Jacko.
3. The Design of Everyday Things" by Don Norman. "Designing Interactions" by Bill Moggridge.
4. "The Humane Interface: New Directions for Designing Interactive Systems" by Jef Raskin.
5. Human Computer Interaction, https://onlinecourses.nptel.ac.in/noc25_cs38/preview.

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	-	3	-	2	-	-	-	-	-	1	-
CO2	2	-	2	-	2	-	3	-	-	-	-	-	-	-
CO3	3	2	3	2	3	-	2	-	-	-	2	-	-	-
CO4	2	2	2	-	2	-	2	-	-	-	-	-	-	-
CO5	2	-	-	-	2	2	2	3	-	-	-	2	-	2
AVG	**2.4**	**2**	**2.3**	**2**	**2.4**	**2**	**2.2**	**3**	**-**	**-**	**2**	**2**	1	2

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

24OAT204 COMPUTER APPLICATION IN AGRICULTURES **L T P C**
3 0 0 3

COURSE OBJECTIVES:

- To introduce the students to areas of agricultural systems in which IT and computers play a major role.
- To also expose the students to IT applications in precision farming and environmental control systems
- To also expose the students to IT applications in agricultural systems management and weather prediction models.

UNITI PRECISION FARMING **9**

Precision agriculture and agricultural management – Ground based sensors, Remote sensing, GPS, GIS and mapping software, Yield mapping systems, Crop production modeling.

UNIT II ENVIRONMENT CONTROL SYSTEMS **9**

Artificial light systems, management of crop growth in greenhouses, simulation of CO2consumption in greenhouses, on-line measurement of plant growth in the greenhouse, models of plant production and expert systems in horticulture.

UNIT III AGRICULTURAL SYSTEMS MANAGEMENT **9**

Agricultural systems - managerial overview, Reliability of agricultural systems, Simulation of crop growth and field operations, Optimizing the use of resources, Linear programming, Project scheduling, Artificial intelligence and decision support systems.

UNIT IV WEATHER PREDICTION MODELS **9**

Importance of climate variability and seasonal forecasting, Understanding and predicting world's climate system, Global climatic models and their potential for seasonal climate forecasting, General systems approach to applying seasonal climate forecasts.

UNIT V E-GOVERNANCE IN AGRICULTURAL SYSTEMS **9**

Expert systems, decision support systems, Agricultural and biological data bases, e-commerce, e- business systems & applications, Technology enhanced learning systems and solutions, e- learning, Rural development and information society.

TOTAL:45 PERIODS

COURSE OUTCOMES

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

CO1: Explore the applications of IT in remote sensing applications such as Drones, etc.

CO2: Discuss the greenhouse can be automated.

CO3: Apply IT principles and concepts for management of field operations.

CO4: Discuss about weather models, their inputs, and applications.

CO5: Use the e-governance in agriculture.

TEXT BOOKS

1. National Research Council, "Precision Agriculture in the 21st Century", National Academies Press, Canada, 1997.
2. H. Krug, Liebig, H.P. "International Symposium on Models for Plant Growth, Environmental Control and Farm Management in Protected Cultivation", 1989.
3. Computers in Agriculture" by Manish Kumar Sharma, Anil Bhat & M. Iqbal Jeelani Bhat.

REFERENCE BOOKS

1. Peart, R.M.,and Shoup,W.D.,"Agricultural Systems Management", Marcel Dekker, New York,2004.
2. Hammer,G.L., Nicholls,N.,and Mitchell,C., "Applications of Seasonal Climate", Springer, Germany,2000.
3. ICT & its Applications in Agriculture" by Golla Ravi, MD. Mubeena, Apoorva Veldandi.
4. Communication Technologies in Agriculture" by Dr. P. Jaisridhar & Mrs. Surudhi.
5. Internet and Computers for Agriculture" edited by Dimitre Dimitrov.

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	-	-	-	1	2	-	-
CO2	3	2	2	-	3	-	2	-	-	-	1	2	-	-
CO3	3	3	3	2	3	1	2	-	-	-	3	2	-	-
CO4	2	2	-	2	2	-	3	-	-	-	2	2	-	-
CO5	2	2	2	-	2	-	2	2	1	2	3	2	-	-
AVG	**2.6**	**2.4**	**2.3**	**2**	**2.6**	**1**	**2.2**	**2**	**1**	**2**	**2**	**2**	-	-

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

24OAT205 MOBILE COMPUTING

L	T	P	C
3	0	0	3

COUSE OBJECTIVES

- To understand the basic concepts of mobile computing.
- To learn the basics of mobile telecommunication system.
- To be familiar with the network layer protocols and Ad-Hoc networks.

UNIT I INTRODUCTION **9**

Introduction to Mobile Computing – Applications of Mobile Computing- Generations of Mobile Communication Technologies- Multiplexing – Spread spectrum -MAC Protocols – SDMA- TDMA- FDMA- CDMA.

UNIT II MOBILE TELECOMMUNICATION SYSTEM **9**

Introduction to Cellular Systems – GSM – Services & Architecture – Protocols – Connection Establishment – Frequency Allocation – Routing – Mobility Management – Security – GPRS- UMTS – Architecture – Handover – Security.

UNIT III MOBILE NETWORK LAYER **9**

Mobile IP – DHCP – AdHoc– Proactive protocol-DSDV, Reactive Routing Protocols – DSR, AODV , Hybrid routing –ZRP, Multicast Routing- ODMRP, Vehicular Ad Hoc networks (VANET) –MANET Vs VANET – Security.

UNIT IV MOBILE TRANSPORT AND APPLICATION LAYER **9**

Mobile TCP– WAP – Architecture – WDP – WTLS – WTP –WSP – WAE – WTA Architecture – WML.

UNIT V MOBILE PLATFORMS AND APPLICATIONS **9**

Mobile Device Operating Systems – Special Constraints & Requirements – Commercial Mobile Operating Systems – Software Development Kit: iOS, Android, BlackBerry, Windows Phone – MCommerce – Structure – Pros & Cons – Mobile Payment System – Security Issues.

TOTAL: 45 PERIODS

COURSE OUTCOMES

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

CO 1: Explain the basics of mobile telecommunication systems.

CO 2: Illustrate the generations of telecommunication systems in wireless networks.

CO 3: Determine the functionality of MAC, network layer and Identify a routing protocol for a given Ad hoc network.

CO 4: Explain the functionality of Transport and Application layers.

CO 5: Develop a mobile application using android/blackberry/ios/Windows SDK.

TEXT BOOKS

1. Jochen Schiller, ―Mobile Communications‖, PHI, Second Edition, 2003.
2. Prasant Kumar Pattnaik, Rajib Mall, ―Fundamentals of Mobile Computing‖, PHI Learning Pvt.Ltd, New Delhi – 2012
3. Mobile Computing: Concepts, Methodologies, Tools, and Applications (6 Volumes) edited by David

REFERENCE BOOKS

1. Dharma Prakash Agarval, Qing and An Zeng, ―Introduction to Wireless and Mobile systems‖,Thomson Asia Pvt Ltd, 2005.
2. Uwe Hansmann, Lothar Merk, Martin S. Nicklons and Thomas Stober, ―Principles of Mobile Computing‖, Springer, 2003.
3. William.C.Y.Lee,―Mobile Cellular Telecommunications-Analog and Digital Systems‖, Second Edition,TataMcGraw Hill Edition ,2006.
4. C.K.Toh, ―AdHoc Mobile Wireless Networks‖, First Edition, Pearson Education, 2002.
5. Mobile Computing and Wireless Networks: Concepts, Methodologies, Tools, and Applications (4 Volumes) by Information Resources Management Association.

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
CO2	3	2	-	-	2	-	-	-	-	-	-	-	-	2
CO3	3	3	3	2	3	-	-	-	-	-	-	-	-	2
CO4	2	2	-	-	2	-	-	-	-	-	-	-	-	3
CO5	2	2	3	-	3	-	-	-	1	2	2	2	-	3
AVG	2.6	2.2	3	2	2.4				1	2	2	2	-	2.4

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

24OAT206 OBJECT ORIENTED ANALYSIS AND DESIGN **L T P C**
3 0 0 3

COURSE OBJECTIVES

- To introduce the fundamentals of Object-Oriented Analysis and Design (OOAD) using the Unified Process and various UML diagrams.
- To enable students to model software systems using static and dynamic UML diagrams such as class, use-case, sequence, state, and activity diagrams.
- To develop the ability to apply GRASP principles and GoF design patterns to design robust, maintainable, and scalable object-oriented systems.

UNIT I UNIFIED PROCESS AND USE CASE DIAGRAMS **9**

Introduction to OOAD with OO Basics — Unified Process — UML diagrams — Use Case – Case study — the Next Gen POS system, Inception -Use case Modelling — Relating Use cases — include, extend and generalization — When to use Use-cases

UNIT II STATIC UML DIAGRAMS **9**

Class Diagram—- Elaboration — Domain Model — Finding conceptual classes and description classes — Associations — Attributes — Domain model refinement — Finding conceptual class Hierarchies — Aggregation and Composition — Relationship between sequence diagrams and use cases — When to use Class Diagrams

UNIT III DYNAMIC AND IMPLEMENTATION UML DIAGRAMS **9**

Dynamic Diagrams — UML interaction diagrams — System sequence diagram — Collaboration diagram — When to use Communication Diagrams — State machine diagram and Modelling –When to use State Diagrams — Activity diagram — When to use activity diagrams Implementation Diagrams — UML package diagram — When to use package diagrams — Component and Deployment Diagrams — When to use Component and Deployment diagrams

UNIT IV DESIGN PATTERNS **9**

GRASP: Designing objects with responsibilities — Creator — Information expert — Low Coupling — High Cohesion — Controller Design Patterns — creational — factory method — structural — Bridge — Adapter — behavioural — Strategy — observer –Applying GoF design patterns — Mapping design to code

UNIT V TESTING **9**

Object Oriented Methodologies — Software Quality Assurance — Impact of object orientation on Testing — Develop Test Cases and Test Plans

TOTAL: 45 PERIODS

COURSE OUTCOMES

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

CO1: Explain OOAD principles and apply the Unified Process in software development.

CO2: Create and analyze static UML diagrams such as class and domain models.

CO3: Model dynamic behaviors using sequence, state, activity, and implementation diagrams.

CO4: Apply design patterns and GRASP principles in object-oriented design.

CO5: Evaluate object-oriented systems through testing and quality assurance methods.

TEXT BOOKS

1. Booch, Grady,"Object-Oriented Analysis and Design with Applications",3rd Edition, Addison-Wesley Professional, 2007.
2. McLaughlin, Brett, Gary Pollice and David West,"Head First Object-Oriented Analysis and Design", O'Reilly Media, 2006.
3. Gamma, Erich, Richard Helm, Ralph Johnson and John Vlissides. "Design Patterns: Elements of Reusable Object-Oriented Software", Addison-Wesley Professional, 1994.

REFERENCE BOOKS

1. Booch, Grady, "Object-Oriented Analysis and Design with Applications", 3rd Edition, Addison-Wesley Professional, 2007.
2. Larman, Craig, "Applying UML and Patterns: An Introduction to Object-Oriented Analysis and Design and Iterative Development", 3rd Edition, Pearson Education, 2004.
3. Gamma, Erich; Helm, Richard; Johnson, Ralph; Vlissides, John, "Design Patterns: Elements of Reusable Object-Oriented Software", Addison-Wesley Professional, 1994.
4. Fowler, Martin, "UML Distilled: A Brief Guide to the Standard Object Modeling Language", 3rd Edition, Addison-Wesley Professional, 2003.
5. Pressman, Roger S., "Software Engineering: A Practitioner's Approach" 8th Edition, McGraw-Hill 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**
CO1	3	2	2	-	1	-	-	-	-	2	-	1	-	-
CO2	2	3	3	-	1	-	-	-	2	2	-	1	-	-
CO3	2	3	3	1	1	-	-	-	-	2	-	1	-	-
CO4	3	2	3	-	2	-	-	-	-	1	2	1	-	-
CO5	1	2	2	-	1	-	-	-	-	1	2	1	-	-
AVG	**2.2**	**2.4**	**2.6**	**1**	**1.2**	**-**	**-**	**-**	**2**	**1.6**	**2**	**1**	-	-

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

24OET101 ELECTRIC 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.

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 Ed., 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 & PSOs

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

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

24OET102 POWER SYSTEM **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 IV 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 the Power System Components and Structure.

CO2: Analyze Transmission Line Parameters and Performance.

CO3: Design and Selection of Insulators and Cables.

CO4: Discuss 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.

REFERENCE BOOKS

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 & PSOs

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

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

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.
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 & PSOs

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

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

24OT104 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: Exolain 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 & PSOs

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

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

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 systems 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 & PSOs

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CO1	3	-	-	-	-	-	2	1	-	2	-	-	-	-
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CO3	3	-	-	-	-	-	2	1	-	2	-	-	-	-
CO4	3	-	-	-	-	-	2	1	-	2	-	-	-	-
CO5	3	-	-	-	-	-	2	1	-	2	-	-	-	-
AVG	3	3	-	-	3	-	2	1	-	2	-	-	-	-

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 IV ELECTRICAL 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: Apply 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.

TEXT BOOKS

1. Rao, S. and Saluja, H.L., "Electrical Safety, Fire Safety Engineering and Safety Management", Khanna Publishers, 1988.
2. Gupta, B.R., Handbook of Electrical Power System and Wiring, S. Chand Publishing, 2013 .
3. B.V.S.Rao, "Operation and Maintenance of Electrical Equipment – Volume I & II" Media Promoters & Publishers Private Limited, Mumbai, 1st Edition, 1st Reprint 2011.

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 & PSOs

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CO2	3	3	-	-	3	-	2	1	-	2	-	-	-	-
CO3	3	-	-	-	-	-	2	1	-	2	-	-	-	-
CO4	3	-	-	-	-	-	2	1	-	2	-	-	-	-
CO5	3	-	-	-	-	-	2	1	-	2	-	-	-	-
AVG	3	3	-	-	3	-	2	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

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 & PSOs & PSOs

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

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

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.

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 & PSOs

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	3	3	2	2	-	-	-	-	-	-	-	2	-	-
CO2	3	3	3	2	-	-	-	-	-	-	-	2	-	-
CO3	3	3	2	3	-	-	-	-	-	-	-	2	-	-
CO4	3	3	3	3	-	-	-	-	-	-	-	2	-	-
CO5	3	2	2	2	-	-	-	-	-	-	-	2	-	-
AVG	3	2.8	2.4	2.4	-	-	-	-	-	-	-	2	-	-

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 ASSESSMEN **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.

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 & PSOs

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

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

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.

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: Explain the impact of high and low carbon energy resource on mobility.
CO2: Synergetic knowledge on fuel cells Battery energy sources.
CO3: Discuss on conventional and future propulsion system.
CO4: Enumerate 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
5. HCCI Diesel Engines - Nptel - https://nptel.ac.in/courses/112104033/34.

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	-	-	-	-	-	-	-	-	-	-	-	-
CO2	3	3	2	-	-	-	-	-	-	-	-	-	-	-
CO3	3	3	2	-	-	-	-	-	-	-	-	-	-	-
CO4	3	2	2	-	-	-	-	-	-	-	-	-	-	-
CO5	3	2	2	-	-	-	-	-	-	-	-	-	-	-
AVG	3	2.4	2	-	-	-	-	-	-	-	-	-	-	-

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.
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 & PSOs & PSOs

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

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


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