MIET
Mohamed Institute of Education & Technology
INSTITUTIONS
Since 1984

M.I.E.T. ENGINEERING COLLEGE

(Autonomous)

Tiruchirappalli-620007

Curriculum & Syllabus

(Regulations 2024)

B.E. Civil 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 CIVIL ENGINEERING

CURRICULUM AND SYLLABUS

B.E. CIVIL ENGINEERING
(Regulations 2024)

Vision

A knowledge hub in Civil Engineering sciences, contributing to the progress of humanity through innovative thinking, domain expertise and high ethical values.

Mission

- To provide quality education through industry based value-added trainings and develop skilled Civil Engineers.
- To nurture competent professionals trained in designing and implementing Civil Engineering systems and to perform professionally and ethically.
- To provide a conducive environment that fosters aptitude for research, higher education, entrepreneurship skills, leadership quality, and lifelong learning.

Programme 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.

Programme Specific Outcomes (PSO's)

1 Capability of using knowledge in various domains of Civil Engineering with ethical and social responsibility.

2 Competency in professional areas by way of research-based knowledge, modern Civil Engineering tools and lifelong self-learning ability.

Program Educational Objectives (PEOs)

1 To inculcate skills and talents to develop professional Civil Engineers and thus to enhance entrepreneurship and employability skills.

2 To promote lifelong self-learning abilities for gaining multidisciplinary knowledge through projects, research and industrial training.

3 To sensitize students towards social issues and to introduce them to professional ethics and practices.

Mapping of PEOs with POs and PSOs

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

CHOICE BASED CREDIT SYSTEM

CURRICULUM AND SYLLABI 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.	24PH2102	Material Physics	BSC	3	0	0	3	3
4.	24GE2101	Engineering Graphics	ESC	2	0	4	6	4
5.	24EE2101	Fundamentals of Electrical and Electronics Engineering	ESC	3	0	2	5	4
6.	24ME2101	Engineering Mechanics	ESC	3	1	0	4	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**	**2**	**10**	**30**	**25**

SEMESTER III

S. NO.	COURSE CODE	COURSE TITLE	CATEGORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS PER WEEK	CREDITS
				L	T	P		
1.	24MU3101	Transforms and Partial Differential Equations	BSC	3	1	0	4	4
2.	24CE3101	Strength of Materials I	PCC	3	0	2	5	4
3.	24CE3102	Fluid Mechanics	PCC	3	0	2	5	4
4.	24CE3103	Surveying	PCC	3	0	0	3	3
5.	24CEPEXX	Professional Elective I	PEC	3	0	0	3	3
6.	24MC31XX	Mandatory Course I	MC	1	0	0	1	0
7.	24CE3201	Computer Aided Building Planning and Drawing	PCC	0	0	3	3	1.5
8.	24CE3202	Surveying and Levelling Laboratory	PCC	0	0	3	3	1.5
			Total	**16**	**1**	**10**	**27**	**21**

SEMESTER IV

S. NO.	COURSE CODE	COURSE TITLE	CATEGORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS PER WEEK	CREDITS
				L	T	P		
1.	24CE4101	Strength of Materials II	PCC	3	0	2	5	4
2.	24CE4102	Applied Hydraulic Engineering	PCC	3	0	0	3	3
3.	24CE4103	Transportation Engineering	PCC	3	0	2	5	4
4.	24CE4104	Soil Mechanics	PCC	3	0	0	3	3
5.	24CY4101	Environmental Science	BSC	2	0	0	2	2
6.	24CEPEXX	Professional Elective II	PEC	3	0	0	3	3
7.	24CE4201	Hydraulic Engineering Laboratory	PCC	0	0	3	3	1.5
8.	24CE4202	Soil Mechanics 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.	24CE5101	Design of Reinforced Concrete Elements	PCC	3	0	2	5	4
2.	24CE5102	Structural Analysis I	PCC	3	0	2	5	4
3.	24CE5103	Water Supply and waste water Engineering	PCC	3	0	0	3	3
4.	24CE5104	Foundation Engineering	PCC	3	0	0	3	3
5.	24CE5105	Concrete Technology	PCC	3	0	0	3	3
6.	24CEPEXX	Professional Elective III	PEC	3	0	0	3	3
7.	24MC51XX	Mandatory Course II	MC	1	0	0	1	0
8.	24CE5201	Concrete Laboratory	PCC	0	0	3	3	1.5
9.	24CE5202	Water and waste water analysis Laboratory	PCC	0	0	3	3	1.5
10.	24CE5203	Survey Camp**	PCC	-	-	-	-	1
			Total	**19**	**0**	**10**	**29**	**24**

****Survey Camp to be conducted for a period of 2 weeks during 4th Semester vacation.**

SEMESTER VI

S. NO.	COURSE CODE	COURSE TITLE	CATEGORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS PER WEEK	CREDITS
				L	T	P		
1.	24CE6101	Design of Steel Structures	PCC	3	0	2	5	4
2.	24CE6102	Structural Analysis II	PCC	3	0	0	3	3
3.	24CE6103	Water resources and Irrigation Engineering	PCC	3	0	0	3	3
4.	24CEPEXX	Professional Elective IV	PEC	3	0	0	3	3
5.	24CEPEXX	Professional Elective V	PEC	3	0	0	3	3
6.	24OXXXXX	Open Elective I	OEC	3	0	2	5	4
7.	24CE6201	Building Information Modeling (BIM) lab	PCC	0	0	3	3	1.5
8.	24CE6202	Structural Analysis using computer software	PCC	0	0	3	3	1.5
9.	24PD6201	NCC/NSS/NSO*#	-	2	0	0	2	2
			Total	**18**	**0**	**10**	**28**	**23**

***# Guidelines for evaluation is provided in detail in the regulation/syllabus. The grades earned by the 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.	24CEPEXX	Professional Elective VI	PEC	3	0	0	3	3
3.	24CEPEXX	Professional Elective VII	PEC	3	0	2	5	4
4.	24CEPEXX	Professional Elective VIII	PEC	3	0	2	5	4
5.	24OXXXXX	Open Elective II	OEC	3	0	0	3	3
6.	24OXXXXX	Open Elective III	OEC	3	0	0	3	3
7.	24CE7501	Design Project	EEC	0	0	4	4	2
8.	24IS7201	Internship##	EEC	-	-	-	-	1
9.	24CA7201	Case Study***	EEC	-	-	-	-	1
			Total	**17**	**0**	**8**	**26**	**23**

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.	24CE8501	Project Work	EEC	0	0	20	20	10
			Total	**0**	**0**	**20**	**20**	**10**

TOTAL CREDITS:124

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.	24PH2102	Material Physics	BSC	3	0	0	3	3
6.	24MU3101	Transforms and Partial Differential Equations	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.	24EE2101	Fundamentals of Electrical and Electronics Engineering	ESC	3	0	2	5	4
5.	24ME2101	Engineering Mechanics	ESC	3	1	0	4	4
6.	24GE2201	Engineering Practice Laboratory	ESC	0	0	4	4	2
							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.	24CE7501	Design Project	EEC	0	0	4	4	2
3.	24IS7201	Internship##	EEC	-	-	-	-	1
4.	24CA7201	Case Study***	EEC	-	-	-	-	1
5.	24CE8501	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.	24CE3101	Strength of Materials I	PCC	3	0	2	5	4
2.	24CE3102	Fluid Mechanics	PCC	3	0	2	5	4
3.	24CE3103	Surveying	PCC	3	0	0	3	3
4.	24CE3201	Computer Aided Building Planning and Drawing	PCC	0	0	3	3	1.5
5.	24CE3202	Surveying and Levelling Laboratory	PCC	0	0	3	3	1.5
6.	24CE4101	Strength of Materials II	PCC	3	0	2	5	4
7.	24CE4102	Applied Hydraulic Engineering	PCC	3	0	0	3	3

8.	24CE4103	Transportation Engineering	PCC	3	0	2	5	4
9.	24CE4104	Soil Mechanics	PCC	3	0	0	3	3
10.	24CE4201	Hydraulic Engineering Laboratory	PCC	0	0	3	3	1.5
11.	24CE4202	Soil Mechanics Laboratory	PCC	0	0	3	3	1.5
12.	24CE5101	Design of Reinforced Concrete Elements	PCC	3	0	2	5	4
13.	24CE5102	Structural Analysis I	PCC	3	0	2	5	4
14.	24CE5103	Water Supply and waste water Engineering	PCC	3	0	0	3	3
15.	24CE5104	Foundation Engineering	PCC	3	0	0	3	3
16.	24CE5105	Concrete Technology	PCC	3	0	0	3	3
17.	24CE5201	Concrete Laboratory	PCC	0	0	3	3	1.5
18.	24CE5202	Water and waste water analysis Laboratory	PCC	0	0	3	3	1.5
19.	24CE5203	Survey Camp**	PCC	-	-	-	-	1
20.	24CE6101	Design of Steel Structures	PCC	3	0	2	5	4
21.	24CE6102	Structural Analysis II	PCC	3	0	0	3	3
22.	24CE6103	Water resources and Irrigation Engineering	PCC	3	0	0	3	3
23.	24CE6201	Building Information Modeling (BIM) lab	PCC	0	0	3	3	1.5
24.	24CE6202	Structural Analysis using computer software	PCC	0	0	3	3	1.5
							Total	**65**

PROFESSIONAL ELECTIVE COURSES (PEC)
SEMESTER III & IV, PROFESSIONAL ELECTIVE I & II
SUSTAINABLE ENVIRONMENTAL ENGINEERING

S. NO.	COURSE CODE	COURSE TITLE	CATE GORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS PER WEEK	CREDITS
				L	T	P		
1.	24CEPE01	Engineering Geology	PEC	3	0	0	3	3
2.	24CEPE02	Air and Noise Pollution	PEC	3	0	0	3	3
3.	24CEPE03	Remote Sensing and GIS	PEC	3	0	0	3	3
4.	24CEPE04	Climate Change	PEC	3	0	0	3	3
5.	24CEPE05	Environment, Health and Safety	PEC	3	0	0	3	3
6.	24CEPE06	Construction Materials for sustainable future	PEC	3	0	0	3	3
7.	24CEPE07	Rainwater Harvesting	PEC	3	0	0	3	3
8.	24CEPE08	Ground Water Engineering	PEC	3	0	0	3	3

SEMESTER V & VI, PROFESSIONAL ELECTIVE III & IV
URBAN INFRASTRUCTURE ENGINEERING AND MANAGEMENT

S. NO.	COURSE CODE	COURSE TITLE	CATE GORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS PER WEEK	CREDITS
				L	T	P		
1.	24CEPE09	Urban Planning and Development	PEC	3	0	0	3	3
2.	24CEPE10	Urban Water Infrastructure	PEC	3	0	0	3	3
3.	24CEPE11	Smart City	PEC	3	0	0	3	3
4.	24CEPE12	Intelligent Transport System	PEC	3	0	0	3	3
5.	24CEPE13	Principle of Building Planning and approval procedures	PEC	3	0	0	3	3
6.	24CEPE14	Construction Planning, Scheduling and Control	PEC	3	0	0	3	3
7.	24CEPE15	Contract Laws and Regulation	PEC	3	0	0	3	3
8.	24CEPE16	Energy Efficient Green Building	PEC	3	0	0	3	3

SEMESTER VI &VII, PROFESSIONAL ELECTIVE V & VI
GEOENVIRONMENTAL ENGINEERING

S. NO.	COURSE CODE	COURSE TITLE	CATE GORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS PER WEEK	CREDITS
				L	T	P		
1.	24CEPE17	Ground Improvement Techniques	PEC	3	0	0	3	3
2.	24CEPE18	Analysis and Design of Deep Foundation	PEC	3	0	0	3	3
3.	24CEPE19	Earth and Earth Retaining Structures	PEC	3	0	0	3	3
4.	24CEPE20	Advanced Construction Techniques	PEC	3	0	0	3	3
5.	24CEPE21	Water Quality Management	PEC	3	0	0	3	3
6.	24CEPE22	Watershed Conservation and Engineering	PEC	3	0	0	3	3
7.	24CEPE23	Municipal solid Waste management	PEC	3	0	0	3	3
8.	24CEPE24	Maintenance Repair and Rehabilitation of structures	PEC	3	0	0	3	3

SEMESTER VII, PROFESSIONAL ELECTIVE VII & VIII
STRUCTURAL ENGINEERING

S. NO.	COURSE CODE	COURSE TITLE	CATEGORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS PER WEEK	CREDITS
				L	T	P		
1.	24CEPE25	Prestressed concrete Structures	PEC	3	0	2	5	4
2.	24CEPE26	Prefabricated Structures	PEC	3	0	2	5	4
3.	24CEPE27	Finite Element Analysis	PEC	3	0	2	5	4
4.	24CEPE28	Modern Approaches to Industrial Structure Design	PEC	3	0	2	5	4
5.	24CEPE29	Bridge Structures	PEC	3	0	2	5	4
6.	24CEPE30	Advanced Design of Concrete Structures	PEC	3	0	2	5	4
7.	24CEPE31	Estimation, Costing and Valuation Engineering	PEC	3	0	2	5	4
8.	24CEPE32	Dynamic and Earthquake Resistant Structure	PEC	3	0	2	5	4

MANDATORY COURSES (MC)
MANDATORY COURSE 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
							Total	**0**

MANDATORY COURSE 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	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
							Total	**0**

OPEN ELECTIVE I

S. NO.	COURSE CODE	COURSE TITLE	CATEGORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS PER WEEK	CREDITS
				L	T	P		
1.	24OAI101	Web technology	OEC	3	0	2	5	4
2.	24OAI102	Object oriented programming	OEC	3	0	2	5	4
3.	24OAI103	Computational data analytics	OEC	3	0	2	5	4
4.	24OAI104	Networking concepts	OEC	3	0	2	5	4
5.	24OEI101	Control System Engineering	OEC	3	0	2	5	4
6.	24OEI102	Power Electronics and Drives	OEC	3	0	2	5	4
7.	24OEI103	PLC Programming	OEC	3	0	2	5	4
8.	24OEI104	Fundamentals of Electronic Devices and Circuits	OEC	3	0	2	5	4
9.	24OMI101	Internal Combustion Engines	OEC	3	0	2	5	4
10.	24OMI102	Testing of Engineering Materials	OEC	3	0	2	5	4
11.	24OMI103	Industrial Layout Design and Safety	OEC	3	0	2	5	4
12.	24OMI104	Product Design and Process Development	OEC	3	0	2	5	4
13.	24OBI101	Introduction to Digital Signal Processing	OEC	3	0	2	5	4
14.	24OBI102	IoT and Sensors Types	OEC	3	0	2	5	4
15.	24OBI103	Medical Diagnostic and Therapeutic Equipment	OEC	3	0	2	5	4
16.	24OBI104	Biomedical Instrument and Design	OEC	3	0	2	5	4

OPEN ELECTIVE II & III

S. NO.	COURSE CODE	COURSE TITLE	CATE GORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS PER WEEK	CREDITS
				L	T	P		
1.	24OAT201	Principles of Programming Languages	OEC	3	0	0	3	3
2.	24OAT202	Information Security Management	OEC	3	0	0	3	3
3.	24OAT203	Human Computer Interaction	OEC	3	0	0	3	3
4.	24OAT204	Computer Application in Agricultures	OEC	3	0	0	3	3
5.	24OAT205	Mobile Computing	OEC	3	0	0	3	3
6.	24OAT206	Object Oriented Analysis and Design	OEC	3	0	0	3	3
7.	24OET101	Electrical Vehicle Technologies	OEC	3	0	0	3	3
8.	24OET102	Power System	OEC	3	0	0	3	3
9.	24OET103	Circuit Theory	OEC	3	0	0	3	3
10.	24OET104	Advanced Electrical Machines	OEC	3	0	0	3	3
11.	24OET105	Hybrid Renewable Power Generation	OEC	3	0	0	3	3
12.	24OET106	Electrical Maintenance and Safety	OEC	3	0	0	3	3
13.	24OMT201	Bioenergy Conversion Technologies	OEC	3	0	0	3	3
14.	24OMT202	Automotive Materials, Components, Design and Testing	OEC	3	0	0	3	3
15.	24OMT203	Green Manufacturing Design and Practices	OEC	3	0	0	3	3
16.	24OMT204	Semiconductor Manufacturing	OEC	3	0	0	3	3
17.	24OMT205	Future Energy Resources and Mobility	OEC	3	0	0	3	3
18.	24OMT206	Failure Analysis and NDT Techniques	OEC	3	0	0	3	3
19.	24OBT201	Hospital Management	OEC	3	0	0	3	3
20.	24OBT202	Assist Devices	OEC	3	0	0	3	3
21.	24OBT203	Robotics in Medicine	OEC	3	0	0	3	3
22.	24OBT204	DSP Architecture	OEC	3	0	0	3	3
23.	24OBT205	Image Processing Techniques	OEC	3	0	0	3	3
24.	24OBT206	Wireless Sensor Networks	OEC	3	0	0	3	3

Summary

S.No.	Subject Area	Credits per Semester								Credits Total
		I	II	III	IV	V	VI	VII	VIII	
1.	Basic Science Course (BSC)	12	7	4	2	-	-	-	-	25
2.	Professional core courses (PCC)	-	-	14	17	21	13	-	-	65
3.	Professional elective courses (PEC)	-	-	3	3	3	6	11	-	26
4.	Open Elective Courses (OEC)	-	-	-	-	-	4	6	-	10
5.	Employability Enhancement Courses (EEC)	-	-	-	1	-	0	4	10	15
6.	Engineering Science Courses (ESC)	6	14	-	-	-	-	-	-	20
7	Mandatory Courses (MC)	-	-	-	-	-	-	-	-	-
8	Humanities, Social Sciences and Management Courses (HSMC)	5	4	-	-	-	-	2	-	11
	Total Credit	**23**	**25**	**21**	**23**	**24**	**23**	**23**	**10**	**172**

TOTAL CREDITS TO BE EARNED FOR THE AWARD OF THE DEGREE =172

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: Identify and use basic grammatical structures appropriately in various contexts.
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 and PSOs

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

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

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

3 1 0 4

COURSE OBJECTIVES

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

UNIT I MATRICES **9+3**

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

UNIT II DIFFERENTIAL CALCULUS **9+3**

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

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

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

UNIT IV INTEGRAL CALCULUS **9+3**

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

UNIT V MULTIPLE INTEGRALS **9+3**

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

TOTAL: 60 PERIODS

COURSE OUTCOMES

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

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

TEXT BOOKS

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

REFERENCE BOOKS

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

Mapping of Cos with POs and PSOs

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

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

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

COURSE OBJECTIVES

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

UNIT I PROPERTIES OF MATTER **9**

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

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

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

UNIT III LASERS **9**

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

UNIT IV FIBER OPTICS **9**

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

UNIT V QUANTUM PHYSICS **9**

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

TOTAL: 45 PERIODS

LIST OF EXPERIMENTS

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

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: Explain the fundamental concepts of quantum physics.

TEXT BOOKS

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

REFERENCE BOOKS

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

Mapping of Cos with POs and PSOs

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

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

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

COURSE OBJECTIVES

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

UNIT I WATER TECHNOLOGY **9**

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

UNIT II ENERGY STORAGE **9**

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

UNIT III ENGINEERING MATERIALS **9**

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

UNIT IV NANOCHEMISTRY **9**

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

UNIT V FUELS **9**

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

TOTAL: 45 PERIODS

LIST OF EXPERIMENTS

1. Estimation of total, temporary and permanent Hardness of the sample water by EDTA method.
2. Estimation of strength of given Hydrochloric acid using pH meter.
3. Estimation of strength of given Hydrochloric acid using conductivity meter.
4. Determination of strength of acids in a mixture of acids using conductivity meter.
5. Estimation of amount of BaCl2 present in the given solution using Std.Na2SO4 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 Na2CO3 as the primary standard.
9. Prepare Na2CO3 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 and PSOs

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

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

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

COURSE OBJECTIVES

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

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

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

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

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

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

Conditionals: Boolean values and operators, conditional (if), alternative (if – else), chained conditional (if el if – else); Iteration: state, while, for, break, continue, pass; Fruitful functions: return values, parameters, local and global scope, function composition, recursion; Strings: string slices, immutability, string functions and methods, string module; Lists as arrays. Illustrative programs: square root, gcd, exponentiation, sum an array of numbers, linear search, binary search.

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

Lists: list operations, list slices, list methods, list loop, mutability, aliasing, cloning lists, list parameters; Tuples: tuple assignment, tuple as return value; Dictionaries: operations and methods; advanced list processing - list comprehension; Illustrative programs: simple sorting, histogram, Students marks statement, Retail bill preparation.

UNIT V 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 mergesort.
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: Decompose a Python program into functions.

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

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

TEXT BOOKS

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

REFERENCE BOOKS

1. Paul Deitel and Harvey Deitel, "Python for Programmers, Pearson Education", 1st Edition, 2021.
2. G Venkatesh and Madhavan Mukund,"" Computational Thinking: A Primer for Programmers and Data Scientists", 1st Edition, Notion Press, 2021.
3. John V Guttag, "Introduction to Computation and Programming Using Python: With Applications to Computational Modeling and Understanding Data", Third Edition, MIT Press, 2021.
4. Eric Matthes, "Python Crash Course, A Hands – on Project Based Introduction to Programming", 2nd Edition, No Starch Press, 2019.
5. Martin C Brown, " Python: The Complete Reference", 4th Edition, Mc-Graw Hill, 2018.

Mapping of Cos with POs and PSOs

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

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

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 and 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**

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

MS EXCEL **15**

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

MSPOWERPOINT **15**

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

TOTAL: 45 PERIODS

COURSE OUTCOMES

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

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

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

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

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

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

Mapping of Cos with POs and PSOs

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

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

24HS2101 WRITING SKILLS FOR PROFESSIONALS **L T P C**
3 0 0 3

COURSE OBJECTIVES

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

UNIT I SELF EXPRESSION **9**

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

UNIT II FORMAL EXPRESSION **9**

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

UNIT III CREATIVE EXPRESSION **9**

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

UNIT IV EXPRESSION OF IDEAS **9**

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

UNIT V PROFESSIONAL EXPRESSIONS **9**

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

TOTAL: 45 PERIODS

COURSE OUTCOMES

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

CO1: Enhance their grammatical competency for flawless writing.

CO2: Write reports, emails meeting professional expectations.

CO3: Use grammar to form correct sentences with maximum accuracy.

CO4: Present their ideas and opinions in a planned and logical manner.

CO5: Write essays on various topics.

TEXT BOOKS

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

REFERENCE BOOKS

1. William Zinsser Paperback, "On Writing Well", Harper Perennial Publishers, 2016.
2. D S Paul, "Advanced Writing Skills", Good will Publishing House, 2022.
3. Matthew T Zakaria, "Successful Writing Skills", Commonwealth Publishers, 2022.
4. G S Hook, "Effective Communication" (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 and PSOs

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

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

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

3 1 0 4

COURSE OBJECTIVES

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

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

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

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

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

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

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

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

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

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 and PSOs

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

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

24PH2102 MATERIAL PHYSICS **L T P C**

3 0 0 3

COURSE OBJECTIVES

- To make the students to understand the various types of crystal structures and semiconducting materials.
- To gain knowledge on properties of magnetic and dielectric materials.
- To get knowledge of advanced engineering materials.

UNIT I CRYSTAL PHYSICS **9**

Lattice – Unit cell – Bravais lattice – Calculation of number of atoms per unit cell – Atomic radius –Coordination number – Characteristics of SC, BCC, FCC and HCP structures – Lattice

planes –Miller indices – d spacing in cubic lattice – Crystal defects – point, line and surface defects – Burger vector.

UNIT II SEMICONDUCTING MATERIALS **9**

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

UNIT III MAGNETIC MATERIALS **9**

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

UNIT IV DIELECTRIC MATERIALS **9**

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

UNIT V ADVANCED ENGINEERING MATERIALS **9**

Metallic glasses – Properties, preparations and its applications – Shape memory alloys (SMA): Characteristics, properties of Ni-Ti alloy and its applications – Carbon nano tubes – Types of CNT – Nanomaterials synthesis – chemical vapour deposition – electro deposition – ball milling – properties and applications.

TOTAL: 45 PERIODS

COURSE OUTCOMES

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

CO1: Know the basics of crystallography and its importance.

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

CO3: Get the necessary explaining of magnetic materials and its types.

CO4: Gain knowledge on dielectric properties of materials.

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

TEXT BOOKS

1. V.Raghavan. "Materials Science and Engineering: A First Course", Prentice Hall India Learning Private Limited, 2015.
2. Bhattacharya, D.K. & Poonam, T. "Engineering Physics". Oxford University Press, 2015.
3. S.O. Kasap, "Principles of Electronic Materials and Devices", Mc-Graw Hill, 2018.

REFERENCE BOOKS

1. R. Balasubramaniam, Callister's "Materials Science and Engineering". Wiley (Indian Edition), 2014.
2. Wendelin Wright and Donald Askeland, "Essentials of Materials Science and Engineering", CL Engineering, 2013.
3. Charles Kittel, "Introduction to Solid State Physics", Wiley India Edition, 2019.
4. Parag K. Lala, "Quantum Computing: A Beginner's Introduction", McGraw-Hill Education Indian Edition, 2020.
5. G.W.Hanson." Fundamentals of Nano electronics. Pearson Education", Indian Edition, 2019.

Mapping of Cos with POs and PSOs

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

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

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

COURSE OBJECTIVES

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

CONCEPTS AND CONVENTIONS (Not for Examination)

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

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

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

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

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

UNIT III PROJECTION OF SOLIDS 6+12

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

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

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

UNIT V ISOMETRIC AND PERSPECTIVE PROJECTIONS 6+12

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

TOTAL: 90 PERIODS

COURSE OUTCOMES

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

CO1: Construct the conic curves, involutes and cycloid.
CO2: Solve practical problems involving projection of line and plane surfaces.
CO3: Explain the orthographic, isometric and perspective projections of simple solids
CO4: Compare the development of section of solids and development of surfaces.
CO5: Identify the isometric and perspective projections.

Publication of Bureau of Indian Standards

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

TEXT BOOKS

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

REFERENCE BOOKS

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

Mapping of Cos with POs and PSOs

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

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

24EE2101 FUNDAMENTALS OF ELECTRICAL AND ELECTRONICS ENGINEERING **L T P C 3 0 2 4**

COURSE OBJECTIVES

- To impart knowledge in electric circuits and electrical machines.
- To educate the fundamental concepts of Analog and digital electronics.
- To gain the knowledge on principle and working of measuring instruments.

UNIT I ELECTRICAL CIRCUITS **9**

DC Circuits – Ohm's Law - Kirchhoff's Laws – Nodal Analysis, Mesh analysis with independent sources only (Steady state) Introduction to AC Circuits and Parameters:

Waveforms, Average value, RMS Value – Steady state analysis of RLC circuits (Simple problems only)

UNIT II MACHINES AND TRANFORMER **9**

Construction and Working principle- DC Separately and Self excited Generators, EMF equation, Types and Applications. Working Principle of DC motors, Torque Equation, Types and Applications, Construction and Working principle – Three Phase Induction motor, Construction, Working principle and Applications of Transformer.

UNIT III ANALOG ELECTRONICS **9**

Semiconductor Materials: Silicon &Germanium – PN Junction Diodes, Zener Diode – Characteristics, Applications – Bipolar Junction Transistor-Principle of transistor, SCR, MOSFET, IGBT – Types, I-V Characteristics and Applications, Rectifier and Inverters.

UNIT IV DIGITAL ELECTRONICS **9**

Review of number systems – Basic Gates – Universal gates – Combinational logic circuit – representation of logic functions – SOP and POS forms – Minimization of Boolean function using K maps (Simple Problems only)**.**

UNIT V MEASUREMENTS AND INSTRUMENTATION **9**

Functional elements of an instrument, Standards and calibration, Operating Principle, types – Moving Coil and Moving Iron meters, Energy Meter, Instrument Transformers – CT and PT, DSO – Block diagram.

TOTAL: 45 PERIODS

LIST OF EXPERIMENTS

1. Verification of ohms Law.
2. Verification of Kirchhoff's Laws.
3. Load test on DC Shunt Motor.
4. Load test on Induction motor.
5. Load test on Single-phase Transformer.
6. Characteristics of PN Junction diode.
7. Characteristics of Zener diode.
8. Characteristics of SCR.
9. Characteristics of MIOSFET.
10. Characteristics of IGBT.
11. Verification of Logic Gates.
12. Verification of Boolean function.

TOTAL: 30 PERIODS

COURSE OUTCOMES

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

CO1: Compute the electric circuit parameters for simple problems.

CO2: Explain the working principle and applications of electrical machines.

CO3: Analyses the characteristics of analogy electronic devices.
CO4: Explain the basic concepts of digital electronics.
CO5: Explain the operating principles of measuring instruments

TEXT BOOKS

1. A Sudhakar Shya mohan S Palli, "Electrical Circuit Analysis -I", TataMcGraw Hill Education, 2015.
2. Kothari D P and I J Nagrath, "Basic Electrical and Electronics Engineering", Second Edition, McGraw Hill Education, 2020.
3. A K Sawhney, Puneet Sawhney "A Course in Electrical & Electronic Measurements & Instrumentation", Dhanpat Rai and Co, 2015.

REFERENCE BOOKS

1. Kothari D P and I J Nagrath, "Basic Electrical Engineering", Fourth Edition, McGraw Hill Education, 2019.
2. Thomas L Floyd, "Digital Fundamentals", 11th Edition, Pearson Education, 2017.
3. Albert Malvino, David Bates, 'Electronic Principles, McGraw Hill Education; 7th edition, 2017.
4. Sedha R S, "A textbook book of Applied Electronics", S. Chand & Co, 2008.
5. S K Bhattacharya, "Basic Electrical and Electronics Engineering", Pearson Education, Second Edition, 2017.

Mapping of Cos with POs and PSOs

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

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

24EM2101 ENGINEERING MECHANICS **L T P C**
3 1 0 4

COURSE OBJECTIVES

- To familiarize the effect of forces in statics of particles and rigid bodies.
- To determine the properties of surfaces and solids.
- To gain knowledge on frictional and dynamics related problems

UNIT I BASICS AND STATICS OF PARTICLES **12**

Introduction – Units and Dimensions – Laws of Mechanics – Lami's theorem, Parallelogram and triangular Law of forces – Vectorial representation of forces – Vector operations of forces

- additions, subtraction, dot product, cross product – Coplanar Forces – rectangular components – Equilibrium of a particle – Forces in space – Equilibrium of a particle in space – Equivalent systems of forces – Principle of transmissibility.

UNIT II EQUILIBRIUM OF RIGID BODIES **12**

Free body diagram – Types of supports –Action and reaction forces – stable equilibrium – Moments and Couples – Moment of a force about a point and about an axis – Vectorial representation of moments and couples – Scalar components of a moment – Varignon's theorem– Single equivalent force -Equilibrium of Rigid bodies in two dimensions – Equilibrium of Rigid bodies in three dimensions

UNIT III PROPERTIES OF SURFACES AND SOLIDS **12**

Centroids and centre of mass – Centroids of lines and areas – Rectangular, circular, triangular areas by integration – T section – I section – Angle section – Hollow section by using standard formula – Theorems of Pappus – Area moments of inertia of plane areas – Rectangular, circular, triangular areas by integration – T section, I section, Angle section, Hollow section by using standard formula – Parallel axis theorem and perpendicular axis theorem – Principal moments of inertia of plane areas – Principal axes of inertia.

UNIT IV DYNAMICS OF PARTICLES **12**

Displacements – Velocity and acceleration – their relationship – Relative motion – Curvilinear motion – Newton's laws of motion – Work Energy Equation – Impulse and Momentum – Impact of elastic bodies.

UNIT V FRICTION **12**

The Laws of Dry Friction – Coefficients of Friction – Angles of Friction – Wedge friction, Wheel Friction – Rolling Resistance – Ladder friction.

TOTAL: 60 PERIODS

COURSE OUTCOMES

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

CO1: Apply the equilibrium equation for solving the statics of the particle
CO2: Apply the equilibrium equation to solve the problem of rigid body.
CO3: Determine the geometrical and Inertial properties of surfaces and solids
CO4: Solve the problems related to Friction
CO5: Solve the dynamic problems.

TEXT BOOKS

1. Beer F P and Johnston Jr E R, "Vector Mechanics for Engineers (In SI Units): Statics and Dynamics", 8th Edition, Tata McGraw-Hill Publishing company, New Delhi 2004.
2. Dr N Kottiswaran, "Engineering Mechanics", Sri Balaji Publications, Coimbatore 2017.

3. Bhavikatti S S and Rajashekarappa K G, “Engineering Mechanics”, New Age International (P) Limited Publishers, 1998.

REFERENCE BOOKS

1. Hibbeller R C and Ashok Gupta, “Engineering Mechanics: Statics and Dynamics”, 11th Edition, Pearson Education 2010.
2. Irving H Shames and Krishna Mohana Rao G, “Engineering Mechanics – Statics and Dynamics”, 4th Edition, Pearson Education 2006.
3. Meriam J L and Kraige L G, “Engineering Mechanics- Statics - Volume 1, Dynamics-Volume 2”, Third Edition, John Wiley & Sons, 1993.
4. Rajasekaran S and Sankara Subramanian G, “Engineering Mechanics Statics and Dynamics”, 3rd Edition, Vikas Publishing House Pvt. Ltd., 2005.
5. Kumar K L, “Engineering Mechanics”, 3rd Revised Edition, Tata McGraw-Hill Publishing company, New Delhi, 2008.

Mapping of Cos with POs and PSOs

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

1-Low, 2-Medium, 3-High, “-” – No correlation

24GE2101 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.

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 and 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: 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 explaining of electronic assembly and testing procedures.

Mapping of Cos with POs and PSOs

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

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

24MU3101 TRANSFORMS AND PARTIAL DIFFERENTIAL EQUATIONS **L T P C 3 1 0 4**

COURSE OBJECTIVES

- To introduce the basic concepts of PDE for solving standard partial differential equations.
- To learn the Fourier series analysis which is central to many applications in engineering.
- To familiarize the Fourier and Z - transforms techniques used in wide variety of situations.

UNIT I FOURIER SERIES **9+3**

Dirichlet's conditions – General Fourier series – Odd and even functions – Half range sine series –Half range cosine series – Complex form of Fourier series – Parseval's identity – Harmonic analysis.

UNIT II FOURIER TRANSFORMS **9+3**

Statement of Fourier integral theorem – Fourier transform pair – Fourier sine and cosine transforms – Properties – Transforms of simple functions – Convolution theorem – Parseval's identity.

UNIT III Z - TRANSFORMS AND DIFFERENCE EQUATIONS **9+3**

Z- Transforms - Elementary properties – Inverse Z - transform (using partial fraction and residues) –Convolution theorem - Formation of difference equations – Solution of difference equations using Z –Transform.

UNIT IV PARTIAL DIFFERENTIAL EQUATIONS **9+3**

Formation of partial differential equations – Singular integrals -Solutions of standard types of first order partial differential equations - Lagrange's linear equation - Linear partial differential equations of second and higher order with constant coefficients of both homogeneous and non-homogeneous types.

UNIT V APPLICATIONS OF PARTIAL DIFFERENTIAL EQUATIONS 9+3

Classification of PDE – Method of separation of variables - Solutions of one dimensional wave equation – One dimensional equation of heat conduction – Steady state solution of two dimensional equation of heat conduction (excluding insulated edges).

TOTAL: 60 PERIODS

COURSE OUTCOMES

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

CO1: Solve Fourier series techniques for heat flow problems and wave equations.
CO2: Apply the Fourier transform techniques for engineering applications.
CO3: Analyze the discrete time systems using Z- Transform and differential equations.
CO4: Apply the PDE to solve the linear equations.
CO5: Apply the PDE to solve the boundary value problems.

TEXT BOOKS

1. Erwin Kreyszig, "Advanced Engineering Mathematics", 11th Edition, Wiley India, 2020.
2. Grewal. B.S., "Higher Engineering Mathematics", 45th Edition, Khanna Publishers, Delhi, 2020.
3. Ramana.B.V, "Higher Engineering Mathematics", Tata McGraw Hill Education Pvt. Ltd., New Delhi, 2018.

REFERENCE BOOKS

1. Narayanan.S., Manicavachagom Pillay T.K and Ramanaiah.G "Advanced Mathematics for Engineering Students," Vol.II & III, S.Viswanathan Publishers Pvt. Ltd, Chennai, 2019.
2. Manish Goyal, N.P. Bali – "Transforms and Partial Differential Equations" 2nd Edition, Laxmi Publications
3. Ray Wylie.C and Barrett.L.C, "Advanced Engineering Mathematics" Tata Mc Graw Hill Education Pvt Ltd, Sixth Edition, New Delhi, 2017.
4. Glyn James, "Advanced Modern Engineering Mathematics", 5th Edition, Pearson Education, 2017.
5. Veerarajan. T., "Transforms and Partial Differential Equations", Tata McGraw Hill Education Pvt. Ltd., New Delhi, Second reprint, 2016.

Mapping of COs with POs and PSOs

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

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

24CE3101 STRENGTH OF MATERIALS I **L T P C**
3 0 2 4

COURSE OBJECTIVES

- To understand the basic concepts of stress, strain, and how materials behave under different loads.
- To learn how to analyze beams, bending, and shear forces in structural elements.
- To study columns, cylinders, and shafts under various loading conditions including torsion.

UNIT I STRESS AND STRAIN **9**

Stress and strain at a point – Tension, Compression, Shear Stress – Hooke's Law – Relationship among elastic constants – Stress Strain Diagram for Mild Steel, TOR steel, Concrete – Ultimate Stress – Yield Stress – Factor of Safety – Thermal Stresses –Stresses due to impact and suddenly applied load - Compound bars.

UNIT II SHEAR FORCE AND BENDING MOMENT **9**

Beams and Bending- Types of loads, supports – Shear Force and Bending Moment Diagrams for statically determinate beam with concentrated load, UDL, uniformly varying load.

UNIT III THEORY OF SIMPLE BENDING **9**

Theory of Simple Bending – assumptions - Analysis of Beams for Stresses – Stress Distribution at a cross Section - bending stresses in symmetrical and unsymmetrical sections – Shear stress distribution for different sections.

UNIT IV COLUMNS AND CYLINDER **9**

Euler's theory of long columns – critical loads for prismatic columns with different end conditions; Rankine-Gordon formula for eccentrically loaded columns – Eccentrically loaded short columns – middle third rule – core section – Thin and thick cylinders

UNIT V TORSION **9**

Torsion of Circular and Hollow Shafts – Elastic Theory of Torsion – Stresses and Deflection in Circular Solid and Hollow Shafts – combined bending moment and torsion of shafts - strain energy due to torsion - Modulus of Rupture – Power transmitted to shaft – Shaft in series and parallel.

TOTAL: 45 PERIODS

COURSE OUTCOMES

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

CO1: Explain basic concepts of stress, strain, and material behavior under different loads.

CO2: Draw and interpret shear force and bending moment diagrams for statically determinate beams under various loading conditions.

CO3: Calculate bending and shear stresses in different types of beam sections.

CO4: Analyze columns and cylinders under axial and eccentric loads.

CO5: Analyze circular shafts under torsion and determine stress, strain energy, and power transmitted.

TEXT BOOKS

1. Rajput. R.K. “Strength of Materials”, S.Chand and Co, New Delhi, 2007.
2. Bansal. R.K. A Textbook of Strength of Materials, Laxmi Publications, New Delhi, 2007.
3. Bhavikatti. S., "Solid Mechanics", Vikas publishing house Pvt. Ltd, New Delhi, 2010.

REFERENCE BOOKS

1. Gambhir. M.L., "Fundamentals of Solid Mechanics", PHI Learning Private Limited., New Delhi, 2009.
2. Timoshenko.S.B. and Gere.J.M, “Mechanics of Materials”, Van Nos Reinbhold, New Delhi 1995.
3. Vazirani.V.N and Ratwani.M.M, “Analysis of Structures”, Vol I Khanna Publishers, New Delhi,1995.
4. Junnarkar.S.B. and Shah.H.J, “Mechanics of Structures”, Vol I, Charotar Publishing House, New Delhi 1997.
5. Ugural. A.C., "Mechanics of Materials", Wiley India Pvt. Ltd., New Delhi, 2013.

LIST OF EXPERIMENTS

1. Izod Impact test on metal specimen.
2. Charpy Impact test on metal specimen.
3. Rockwell Hardness test on metal.
4. Brinell Hardness test on metal.
5. Compression test on helical spring.
6. Deflection test on carriage spring.

7. Tension test on steel rod.
8. Torsion test on mild steel rod.

TOTAL: 30 PERIODS

Mapping of COs with POs and PSOs

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

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

24CE3102 FLUID MECHANICS **L T P C**
3 0 2 4

COURSE OBJECTIVES

- To analysis fluid properties and static conditions.
- To apply control volume analysis to fluid flow problems.
- To design and analysis hydraulic systems and pipe flow.

UNIT I FLUIDS PROPERTIES AND FLUID STATICS **10**

Scope of fluid mechanics – Definitions of a fluid – Methods of analysis – Continuum hypothesis – System and Control volume approach – Reynold's transportation theorem – Fluid properties – Fluid statics – Manometry – Forces on plane and curved surfaces.

UNIT II BASIC CONCEPTS OF INCOMPRESSIBLE FLUID **10**

Kinematics: Classification of flows – Streamline, streak-line and path-lines – Stream function and velocity potentials – Flow nets; Dynamics: Application of control volume to continuity, energy and momentum – Euler's equation of motion along a stream line – Bernoulli's equation – Moment of momentum equation.

UNIT III INCOMPRESSIBLE VISCOUS FLOW **10**

Reynolds experiment – Laminar flow in pipes and between parallel plates – Development of laminar and turbulent flows in pipes – Darcy-Weisbach equation – Moody diagram – Major and minor losses of flow in pipes – Total energy line – Hydraulic grade line – Pipes in series and parallel – Equivalent pipes.

UNIT IV BOUNDARY LAYERS **8**

Definition of boundary layers – Laminar and turbulent boundary layers – Displacement, momentum and energy thickness – Momentum integral equation – Applications – Separation of boundary layer – Drag and Lift forces.

UNIT V DIMENSIONAL ANALYSIS AND MODEL STUDIES **7**

Fundamental dimensions – Dimensional homogeneity – Rayleigh's method and Buckingham Pi theorem – Dimensionless parameters – Similitude and model studies – Distorted and undistorted models.

TOTAL: 45 PERIODS

COURSE OUTCOMES

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

CO1: Demonstrate the difference between solid and fluid, its properties and behaviour in static conditions.

CO2: Apply the conservation laws applicable to fluids and its application through fluid kinematics and dynamics.

CO3: Explain the concept of boundary layer and its application to find the drag force excreted by the fluid on the flat solid surface.

CO4: Estimate the losses in pipelines for both laminar and turbulent conditions and analysis of pipes connected in series and parallel.

CO5: Formulate the relationship among the parameters involved in the given fluid phenomenon and to predict the performance of prototypes by model studies.

TEXT BOOKS

1. Modi P.N and Seth Hydraulics and Fluid Mechanics including Hydraulic Machines Standard Book House New Delhi. 2015.
2. Streeter, V.L. Wylie, E. B. and Bedford K.W, Fluid Mechanics. (9 th Ed.) Tata McGraw Hill, New Delhi, 1998.
3. R.K. Bansal, Laxmi Publication Pvt Ltd , Fluid Mechanics and Hydraulilc Machines, 2023.

REFERENCE BOOKS

1. S K Som; Gautam Biswas and S Chakraborty, Introduction to Fluid Mechanics and Fluid Machines, Tata McGraw Hill Education Pvt. Ltd., 2012.
2. Pani B S, Fluid Mechanics: A Concise Introduction, Prentice Hall of India Private Ltd, 2016.
3. Jain A. K. Fluid Mechanics including Hydraulic Machines, Khanna Publishers, New Delhi, 2014.
4. Narayana Pillai N. Principles of Fluid Mechanics and Fluid Machines, (3rd Ed.) University Press (India) Pvt. Ltd. 2009.
5. Manish Kumar Goyal, PHI learning Private Limited, Fluid Mechanics and Hydraulic machines, 2015.

LIST OF EXPERIMENTS

1. Calibration of Rotameter.
2. Determination of coefficient of discharge for small orifice by constant head method.
3. Determination of Co-efficient of discharge for the Orifice Meter.
4. Determination of Co-efficient of Discharge for the Venturi meter.
5. Determination of flow through triangular Notch.
6. Determination of flow through rectangular Notch.
7. Determination of flow through mouthpiece.
8. Bernoulli's apparatus to verify Bernoulli's theorem.

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

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

24CE3103 SURVEYING **L T P C**
3 0 0 3

COURSE OBJECTIVES

- To introduce the basics of plane surveying and geodetic principles to Civil Engineers.
- To learn the various methods of plane and geodetic surveying to solve the real world problems.
- To introduce the concepts of Control Surveying and basics of modern Surveying instruments.

UNIT I FUNDAMENTALS OF CONVENTIONAL SURVEYING **9**

Definition – Classifications – Basic principles – Equipment and accessories for ranging and chaining – Methods of ranging – Well conditioned triangles – Chain traversing – Compass – Basic principles – Types – Bearing – System and conversions – Sources of errors and Local attraction – Magnetic declination – Dip – compass traversing – Plane table and its accessories – Merits and demerits – Radiation – Intersection – Resection – Plane table traversing.

UNIT II LEVELLING **9**

Level line – Horizontal line – Datum – Benchmarks – Levels and staves – Temporary and permanent adjustments – Methods of leveling – Fly leveling – Check leveling – Procedure in leveling – Booking – Reduction – Curvature and refraction – Reciprocal leveling – Precise leveling - Contouring.

UNIT III THEODOLITE SURVEYING **9**

Horizontal and vertical angle measurements – Temporary and permanent adjustments – Heights and distances – Tacheometric surveying – Stadia Tacheometry – Tangential Tacheometry – Trigonometric leveling – Single Plane method – Double Plane method.

UNIT IV CONTROL SURVEYING AND ADJUSTMENT **9**

Horizontal and vertical control – Methods – Triangulation – Traversing – Gale 's table – Trilateration – Concepts of measurements and errors – Error propagation and Linearization – Adjustment methods - Least square methods – Angles, lengths and levelling network.

UNIT V MODERN SURVEYING **9**

Total Station: Digital Theodolite, EDM, Electronic field book – Advantages – Parts and accessories – Working principle – Observables – Errors - COGO functions – Field procedure and applications. GPS: Advantages – System components – Signal structure – Selective availability and ant spoofing receiver components and antenna – Planning and data acquisition – Data processing – Errors in GPS – Field procedure and applications.

TOTAL: 45 PERIODS

COURSE OUTCOMES

On Successful completion of this course, the student will able to

CO1: Demonstrate the various surveying methods and its principles.
CO2: Explain the methods of level computation for terrain and surface features.
CO3: Utilize the principles of Theodolite Surveying in performing surveying tasks.
CO4: Comprehend the methodology involved in Traversing and Trilateration techniques.
CO5: Acquire knowledge on the application of modern surveying instruments.

TEXT BOOKS

1. B. C. Punmia, Ashok K. Jain and Arun K Jain, Surveying Vol. I & II, Lakshmi publications Pvt Ltd, New Delhi, Sixteenth Edition, 2016.
2. R.Subramanian, Surveying and Levelling, Oxford University Press, Second Edition, 2012.
3. T. P. Kanetkar and S. V. Kulkarni, Surveying and Levelling, Parts 1 & 2, Pune vidyarthi Griha Prakashan, Pune, 2008.

REFERENCE BOOKS

1. James M. Anderson and Edward M. Mikhail, Surveying, Theory and Practice, Seventh Edition, Mc Graw Hill 2001.
2. Bannister and S. Raymond, Surveying, Seventh Edition, Longman 2004.
3. S. K. Roy, Fundamentals of Surveying, Second Edition, Prentice Hall of India 2010.
4. K. R. Arora, Surveying Vol I & II, Standard Book house, Twelfth Edition 2013.
5. C. Venkatramaiah, Textbook of Surveying, Universities Press, Second Edition,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	2	3	2	2	2	2	-	-	-	-	-	2	2	2
CO2	3	2	3	2	2	2	-	-	-	-	-	3	2	2
CO3	2	3	2	2	2	3	-	-	-	-	-	2	2	2
CO4	3	3	3	2	2	2	-	-	-	-	-	3	2	2
CO5	2	3	2	2	2	3	-	-	-	-	-	2	2	2
AVG	**2**	**3**	**2**	**2**	**2**	**2**	**-**	**-**	**-**	**-**	**-**	**2**	**2**	**2**

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

24CE3201 COMPUTER AIDED BUILDING PLANNING AND DRAWING

L T P C
0 0 3 1.5

COURSE OBJECTIVES

- To provide a strong foundation in the use of AutoCAD software for 2D drafting and 3D modeling in architectural and structural design.
- To introduce the principles of architectural planning, including building orientation, joinery detailing, and application of Vaastu Shastra.
- To develop practical skills in preparing building plans, structural layouts, and 3D visualizations for residential, commercial, and industrial structures.

LIST OF EXPERIMENTS

1. Study of AutoCAD Software and Commands used for Drafting and Modeling.
2. Drawing of a Title Block with necessary text and projection symbol.
3. Principles of planning, orientation and complete joinery details (Paneled and Glazed Doors).
4. Principles of planning, orientation and complete joinery details (Paneled and Glazed Windows).
5. Planning of Residential building using Vaastu sastra.
6. A Residential Building with Load Bearing Walls.
7. Outline marking and column marking for Building Construction.
8. A Double Bed Room House using framed structural system.
9. A Commercial Building using framed structural system.
10. Residential Building with sloped roof.
11. Industrial Building – North light roof truss.
12. Residential Building - 3D View.

TOTAL: 45 PERIODS

COURSE OUTCOMES

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

CO1: Efficiently use AutoCAD software for creating accurate architectural and structural drawings.

CO2: Design and draft title blocks, projection symbols, and incorporate relevant annotations in construction drawings.

CO3: Apply planning principles and detail joinery elements such as paneled and glazed doors and windows.

CO4: Prepare comprehensive building plans for various structural systems including load bearing walls, framed structures, and truss roofing.

CO5: Perform site layout procedures such as outline and column marking, and generate 3D views for residential buildings.

TEXT BOOKS

1. Sikka V. B., A Course in Civil Engineering Drawing, 4th Edition, S.K. Kataria and Sons, 1998.
2. George Omura, "Mastering in AUTOCAD 2002", BPB Publications, 2002.
3. Lal, R., "Civil Engineering Drawing", CBS Publishers & Distributors, 2011.

REFERENCE BOOKS

1. Shah.M.G., Kale. C.M. and Patki. S.Y., "Building Drawing with an Integrated Approach to Build Environment", Tata McGraw Hill Publishers Limited, 2007.
2. Verma.B.P., "Civil Engineering Drawing and House Planning", Khanna Publishers, 1989.
3. Marimuthu V.M., Murugesan R. and Padmini S., "Civil Engineering Drawing-I", Pratheeba Publishers, 2008.
4. Chuck Eastman, Paul Teicholz, Rafael Sacks, Kathleen Liston, BIM Handbook: A Guide to building information modeling for Owners, Managers, Designers, Engineers, and Contractors, John Wiley and Sons. Inc.,2011.
5. Madsen, D.A., and Madsen, D.P., "Engineering Drawing and Design", Cengage Learning, 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	3	-	-	-	3	3	-	2	3	2
CO2	3	3	3	2	3	-	-	-	3	3	-	2	3	2
CO3	3	3	3	2	3	-	-	-	3	3	-	2	3	2
CO4	3	3	3	2	3	-	-	-	3	3	-	2	3	2
CO5	3	3	3	2	3	-	-	-	3	3	-	2	3	2
AVG	**3**	**3**	**3**	**2**	**3**	**-**	**-**	**-**	**3**	**3**	**-**	**2**	**3**	**2**

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

24CE3202 SURVEYING AND LEVELLING LABORATORY **L T P C**
0 0 3 1.5

COURSE OBJECTIVES

- To acquire knowledge of survey field techniques.
- To train students in the proper use of surveying equipments.
- To foster independent learning and real problem-solving abilities in different field conditions and prepare maps.

LIST OF EXPERIMENTS

Chain Survey

1. Study of chains and its accessories, Aligning, Ranging, Chaining and Marking Perpendicular offset.
2. Setting out works – Foundation marking using tapes single Room and Double Room.

Compass Survey

3. Compass Traversing – Measuring Bearings & arriving included angles.

Levelling - Study of levels and levelling staff

4. Fly levelling using Dumpy level &Tilting level.
5. Check levelling.

Theodolite - Study of Theodolite

6. Measurements of horizontal angles by reiteration and repetition and vertical angles.
7. Determination of elevation of an object using single plane method when base is Accessible/inaccessible.

Tacheometry – Tangential system – Stadia system

8. Determination of Tacheometric Constants.
9. Heights and distances by stadia Tacheometry.
10. Heights and distances by Tangential Tacheometry.

Total Station - Study of Total Station, Measuring Horizontal and vertical angles

11. Traverse using Total station and Area of Traverse.
12. Determination of distance and difference in elevation between two inaccessible points using Total station.

TOTAL: 45 PERIODS

COURSE OUTCOMES

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

CO1: Gain knowledge on the usage of basic surveying instruments like chain/tape, compass and levelling instruments.
CO2: Use levelling instruments effectively for surveying tasks.
CO3: Apply the theodolite instrument for various surveying operations.
CO4: Carry out necessary surveys for social infrastructures.
CO5: Prepare planimetric maps.

TEXT BOOKS

1. T. P. Kanetkar and S. V. Kulkarni, Surveying and Levelling, Parts 1 & 2, Pune Vidyarthi Griha Prakashan, Pune, 24th Reprint, 2015.
2. Dr. B. C. Punmia, Ashok K. Jainand Arun K Jain, Surveying Vol. I & II, Lakshmi Publications Pvt Ltd, New Delhi, 17th Edition, 2016.
3. James M. Anderson and Edward M. Mikhail, Surveying, Theory and Practice, Seventh Edition, McGraw Hill, 2001

REFERENCE BOOKS

1. Bannister and S. Raymond, Surveying, Seventh Edition, Longman 2004.
2. David Clark and James Clendinning, Plane and Geodetic Surveying for Engineers Volume II, Constable and Company Ltd, London, CBS, 6th Edition, 2004.
3. S. K. Roy, Fundamentals of Surveying, Second Edition, Prentice Hall of India, 2004
4. K. R. Arora, Surveying Vol. I & II, Standard Book house, Eleventh Edition, 2013.
5. C. Venkatramaiah, Textbook of Surveying, Universities Press, Second Edition, 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	2	3	2	2	2	2	-		-	3	2	-	2	2
CO2	3	2	3	2	2	2	-		-	3	2	-	3	2
CO3	2	3	2	2	2	3	-		-	3	2	-	2	2
CO4	3	3	3	2	2	2	-		-	3	2	-	3	2
CO5	2	3	2	2	2	3	-		-	3	2	-	2	2
AVG	2	3	2	2	2	2	-		-	3	2	-	2	2

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

24CE4101 STRENGTH OF MATERIALS II **L T P C**
3 0 2 4

COURSE OBJECTIVES

- To understand and analyze two-dimensional stress and strain states, including principal stresses and Mohr's circle.
- To apply energy principles and various methods to calculate deflections and slopes in beams and structures.
- To analyze determinate and indeterminate beams, including advanced bending topics such as unsymmetrical and curved beam behavior.

UNIT I PRINCIPLAL STRESSES AND STRAINS **9**

2 D State of Stress – 2 D Normal and Shear Stresses on any plane – Principal Planes and and Principal Stresses – analytical method for determining stresses on oblique plane - Mohr's circle – Strain on Oblique plane.

UNIT II ENERGY PRINCIPLES **9**

Strain energy and strain energy density – strain energy due to axial load, shear, flexure and torsion – Castigliano's theorems – Maxwell's reciprocal theorems - Principle of virtual work – application of energy theorems for computing deflections in beams and trusses - Williot Mohr's Diagram.

UNIT III DEFLECTION **9**

Double integration method - Macaulay's methods - Area moment method - conjugate beam method for computation of slopes and deflections of determinant beams.

UNIT IV INDETERMINATE BEAMS **9**

Concept of Analysis - Propped cantilever and fixed beams-fixed end moments and reactions – Theorem of three moments – analysis of continuous beams – shear force and bending moment diagrams.

UNIT V ADVANCED TOPICS IN BENDING OF BEAMS **9**

Unsymmetrical bending of beams of symmetrical and unsymmetrical sections – Shear Centre -curved beams – Winkler Bach formula**.**

TOTAL: 45 PERIODS

COURSE OUTCOMES

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

CO1: Analyze principal stresses and strains in two-dimensional stress systems using analytical methods and Mohr's circle.

CO2: Apply energy principles to calculate deflections in beams and trusses accurately.

CO3: Determine slopes and deflections of beams using established analytical methods.

CO4: Perform analysis of statically indeterminate beams to find bending moments and support reactions.

CO5: Evaluate advanced bending behaviors including unsymmetrical bending and curved beam effects.

TEXT BOOKS

1. Rajput.R.K. "Strength of Materials", S.Chand and Co, New Delhi, 2018.
2. Timoshenko, S. and Young, D. H., "Elements of Strength of Materials", DVNC, New York, USA.
3. Bhavikatti. S., "Solid Mechanics", Vikas publishing house Pvt. Ltd, New Delhi, 2022.

REFERENCE BOOKS

1. Gambhir. M.L., "Fundamentals of Solid Mechanics", PHI Learning Private Limited., New Delhi, 2009.
2. Bansal, R.K. A Textbook of Strength of Materials. Laxmi Publications, New Delhi, 2007.

3. Vazirani.V.N and Ratwani.M.M, “Analysis of Structures”, Vol I Khanna Publishers, New Delhi,1995.
4. Junnarkar.S.B. and Shah.H.J, “Mechanics of Structures”, Vol I, Charotar Publishing House, New Delhi 1997.
5. Ugural. A.C., "Mechanics of Materials", Wiley India Pvt. Ltd., New Delhi, 2013.

LIST OF EXPERIMENTS

1. Deflection test on metal beam
2. Double shear test on metal
3. Determination of Compression test on wood
4. Application of Macaulay’s theorem
5. Compression test on Column
6. Non Destructive Testing – Rebound Hammer
7. Measurement of Strain in a Concrete Beam Using Strain Gauges and Data Logger
8. Measurement of Deflection using advanced sensors.

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

1-Low, 2-Medium, 3-High, “-” – No correlation

24CE4102 APPLIED HYDRAULICS ENGINEERING **L T P C**
3 0 0 3

COURSE OBJECTIVES

- To Understand and analysis uniform, gradually varied, and rapidly varied flows.
- To Gain knowledge about the working principles of hydraulic machines like Pelton wheel, Francis, and Kaplan turbines.
- To Analysis centrifugal and reciprocating pumps along with various types of turbines.

UNIT I UNIFORM FLOW **9**

Definition and differences between pipe flow and open channel flow - Types of Flow - Properties of open channel - Fundamental equations - Sub-critical, Super-critical and Critical flow - Velocity distribution in open channel - Steady uniform flow: Chezy’s equation, Manning equation - Best hydraulic sections for uniform flow - Computation in Uniform Flow - Specific energy and specific force.

UNIT II VARIED FLOWS **9**

Dynamic equations of gradually varied - Water surface flow profile classifications: Hydraulic Slope, Hydraulic Curve - Profile determination by Numerical method: Direct step method and Standard step method – Change in Grades

.

UNIT III RAPIDLY VARIED FLOWS **9**

Application of the momentum equation for RVF - Hydraulic jumps - Types - Energy dissipation – Positive and Negative surges.

UNIT IV TURBINES **9**

Turbines - Classification - Impulse turbine – Pelton wheel - Reaction turbines - Francis turbine - Kaplan turbine - Draft tube - Cavitation - Performance of turbine - Specific speed - Runaway speed – Minimum Speed to start the pump.

UNIT V PUMPS **9**

Centrifugal pumps - Minimum speed to start the pump - NPSH - Cavitation's in pumps - Operating characteristics - Multistage pumps - Reciprocating pumps - Negative slip - Indicator diagrams and its variations - Air vessels - Savings in work done.

TOTAL: 45 PERIODS

COURSE OUTCOMES

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

CO1: Apply their knowledge of fluid mechanics in addressing problems in open channels.
CO2: Identify an effective section for flow in different cross sections.
CO3: Solve problems in uniform, gradually and rapidly varied flows in steady state conditions.
CO4: Design turbines and explain the working principle.
CO5: Differentiate pumps and explain the working principle.

TEXT BOOKS

1. Jain. A.K., Fluid Mechanics, Khanna Publishers, Delhi,2010.
2. Chandramouli P N, Applied Hydraulic Engineering, Yes Dee Publisher, 2017
3. R. K. Bansal, Fluid Mechanics and Hydraulic machine, Laxmi Publications. 2023.

REFERENCE BOOKS

1. Ven Te Chow, Open Channel Hydraulics, McGraw Hill, New York, 2009.
2. Modi P.N. and Seth S.M., Hydraulics and Fluid Mechanics, Standard Book House, New Delhi, 19th edition, 2013.
3. Mays L. W., Water Resources Engineering, John Wiley and Sons (WSE), New York, 2019.
4. Subramanya K., Flow in open channels, Tata McGraw Hill, New Delhi, 2019.
5. D. S. Kumar, Heat and Mass Transfer, S K Kataria& Sons,2016.

Mapping of COs with POs & PSOs

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

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

4CE4103 TRANSPORTATION ENGINEERING **L T P C**
3 0 2 4

COURSE OBJECTIVES

- To understand the planning and construction of highways, railways, airports, and harbours.
- To develop skills for designing and maintaining transportation infrastructure.
- To learn about environmental and regulatory factors in infrastructure development.

UNIT I HIGHWAY ENGINEERING AND DESIGN OF HIGHWAY ELEMENTS **8**

Classification of highways – Institutions for Highway planning, design and construction at different levels – factors influencing highway alignment –Typical cross sections of Urban and Rural roads - Conventional and Modern Method-Cross sectional elements – Horizontal curves, super elevation, transition curves, widening of curves – Sight distances – Vertical curves, gradients.

UNIT II HIGHWAY CONSTRUCTION AND MAINTENANCE **7**

Pavement components and their role - Design practice for flexible and rigid pavements (IRC methods only). Highway construction materials, properties, testing methods – Construction practice of flexible and concrete pavement- Highway drainage – Evaluation and Maintenance of pavements

UNIT III RAILWAY PLANNING AND CONSTRUCTION **10**

Elements of permanent way – Rails, Sleepers, Ballast, rail fixtures and fastenings, Selection of gauges - Track Stress, coning of wheels, creep in rails, defects in rails – Route alignment surveys, conventional and modern methods-Geometric design of railway, gradient, super elevation, widening of gauge on curves (Problems)-Railway drainage- Level Crossings-Signaling.

UNIT IV AIRPORT ENGINEERING **10**

Air transport characteristics-airport classification-airport planning: objectives, components, layout characteristics, criteria for airport site selection and ICAO stipulations, Typical airport

layouts, Parking and circulation area. Runway Design: Orientation, Wind Rose Diagram - Runway length - Problems on basic and Actual Length, Geometric design of runways, Configuration and Pavement Design Principles –Elements of Taxiway Design – Airport Zones – Runway and Taxiway Markings and lighting.

UNIT V HARBOUR ENGINEERING **10**

Definition of Basic Terms: Harbor, Port, Satellite Port, Docks, Waves and Tides – Planning and Design of Harbours: Requirements, Classification, Location and Design Principles – Harbour Layout and Terminal Facilities – Coastal Structures: Piers, Break waters, Wharves, Jetties, Quays, Spring Fenders, Dolphins and Floating Landing Stage – Inland Water Transport – Wave action on Coastal Structures and Coastal Protection Works – Environmental concern of Port Operations –Coastal Regulation Zone, 2011.

TOTAL: 45 PERIODS

COURSE OUTCOMES

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

CO1: Learn about highway planning, classification, design and examine the material used in them.

CO2: Learn road construction methods, maintenance and to evaluate material characteristics through experiments.

CO3: Explain railway components and track design.

CO4: Explain airport layout and runway design.

CO5: Learn harbour planning and coastal protection.

TEXT BOOKS

1. Khanna.S. K., Justo.C.E.G and Veeraragavan A. "Highway Engineering", Nemchand Publishers, 2014.
2. Subramanian K.P., “Highways, Railways, Airport and Harbour Engineering”, Scitech Publications (India), Chennai,.2010.
3. C. Venkatramaiah., Transportation Engineering-Vol.2 Railways, Airports, Docks and Harbours, Bridges and Tunnels., Universities Press (India) Private Limited, Hyderabad, 2015.

REFERENCE BOOKS

1. Kadiyali.L.R. "Principles and Practice of Highway Engineering", Khanna Technical Publications,6th edition Delhi, 2015.
2. Bindra S P, "A Course in Docks and Harbour Engineering", Dhanpat Rai and Sons, New Delhi, 2013.
3. Satish Chandra and Agarwal M.M, "Railway Engineering", 2nd Edition, Oxford UniversityPress, New Delhi, 2013.
4. Yang H. Huang, "Pavement Analysis and Design", Pearson Education Inc, Nineth Impression, South Asia, 2012.
5. Saxena Subhash, C. and Satyapal Arora, A Course in Railway Engineering, Dhanapat Rai and Sons, Delhi, 1998.

LIST OF EXPERIMENTS

1. Specific gravity and water absorption capacity of the coarse aggregate sample.
2. Determination of abrasion value of the coarse aggregate sample.
3. Specific gravity determination of the bitumen/asphalt sample.
4. Viscosity determination of bituminous binder.
5. Determination of softening point of the asphalt/bitumen sample.
6. Determination of ductility value of the bitumen sample.
7. Estimation of loss of bitumen on heating.
8. Determination of optimum binder content by Marshall method.

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

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

24CE4104 SOIL MECHANICS **L T P C**
3 0 0 3

COURSE OBJECTIVES

- To impart knowledge on soil classification based on the index properties and to assess their engineering properties.
- To familiarize the students about the fundamental concepts of compaction, flow through soil, stress transformation, stress distribution, consolidation and shear strength of soils.
- To impart knowledge on design of both finite and infinite slopes.

UNIT I SOIL CLASSIFICATION AND COMPACTION **9**

Formation of soil - Soil description – Particle – Size shape and colour – Composition of gravel, sand, silt, clay particles – Particle behaviour – Soil structure – Phase relationship – Index properties – Significance – BIS classification system – Unified classification system – Compaction of soils – Theory, Laboratory and field tests – Field Compaction methods – Factors influencing compaction of soils.

UNIT II EFFECTIVE STRESS AND PERMEABILITY **9**

Soil - water – Static pressure in water - Effective stress concepts in soils – Capillary phenomena Permeability interaction – Hydraulic conductivity – Darcy's law – Determination of Hydraulic Conductivity – Laboratory Determination (Constant head and falling head methods) and field

measurement pumping out in unconfined and confined aquifer – Factors influencing permeability of soils – Seepage - Two dimensional flow – Laplace's equation – Introduction to flow nets – Simple problems. (Sheet pile and weir).

UNIT III STRESS DISTRIBUTION AND SETTLEMENT **9**

Stress distribution in homogeneous and isotropic medium – Boussinesq theory – (Point land, Line land and udl) Use of New marks influence chart –Components of settlement — Immediate and consolidation settlement – Terzaghi's one dimensional consolidation theory – Computation of rate of settlement. - √t and log t methods– e-log p relationship.

UNIT IV SHEAR STRENGTH **9**

Shear strength of cohesive and cohesion less soils – Mohr-Coulomb failure theory – Measurement of shear strength - Direct shear, Triaxial compression, UCC and Vane shear tests – Pore pressure parameters – Cyclic mobility – Liquefaction.

UNIT V SLOPE STABILITY **9**

Stability Analysis - Infinite slopes and finite slopes – Total stress analysis for saturated clay – Friction circle method – Use of stability number – Method of slices – Fellenious and Bishop's method - Slope protection measures.

TOTAL: 45 PERIODS

COURSE OUTCOMES

On Successful completion of this course, the student will able to

CO1: Demonstrate an ability to identify various types of soils and its properties, formulate and solve engineering Problems

CO2: Show the basic of flow through soil medium and its impact of engineering Solution.

CO3: Explain the basic concept of stress distribution in loaded soil medium and soil settlement due to consolidation.

CO4: Show the shear strength of soils and its impact of engineering solutions to the loaded soil medium.

CO5: Demonstrate an ability to design both finite and infinite slopes.

TEXT BOOKS

1. Murthy, V.N.S., "Soil Mechanics and Foundation Engineering", CBS Publishers Distribution Ltd., New Delhi. 2015
2. Gopal Ranjan and Rao, A.S.R., "Basic and Applied Soil Mechanics", New Age Ltd. International Publisher, New Delhi (India) 2006.
3. R. Subramanian, Surveying and Levelling, Oxford University Press, Second Edition, 2012.

REFERENCE BOOKS

1. McCarthy, D.F., "Essentials of Soil Mechanics and Foundations". Prentice-Hall, 2006.
2. Coduto, D.P., "Geotechnical Engineering – Principles and Practices", Prentice Hall of India Pvt.Ltd. New Delhi, 2010.
3. Das, B.M., "Principles of Geotechnical Engineering". Brooks / Coles / Thompson Learning Singapore, 8th Edition, 2013.
4. Punmia, B.C., "Soil Mechanics and Foundations", Laxmi Publications Pvt. Ltd. New Delhi, 2023.
5. Kaniraj, S.R. "Design aids in Soil Mechanics and Foundation Engineering", Tata McGraw Hill publishing company Ltd., New Delhi, 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	3	2	2	-	-	2	-	-	-	-	2	2	2
CO2	3	3	2	2	-	-	2	-	-	-	-	2	2	2
CO3	3	3	2	2	-	-	2	-	-	-	-	2	2	2
CO4	3	3	2	2	-	-	2	-	-	-	-	2	2	2
CO5	3	3	2	2	-	-	2	-	-	-	-	2	2	2
AVG	3	3	2	2	-	-	2	-	-	-	-	2	2	2

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

24CY4101 ENVIRONMENTAL SCIENCE AND ENGINEERING **L T P C**
2 0 0 2

COURSE OBJECTIVES

- To introduce the fundamental ideas of environment and interrelationship between living organism.
- To impart knowledge on pollution and perspectives on renewable resources.
- To inculcate and embrace sustainability practices and develop a broader understanding on green materials.

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: 30 PERIODS

COURSE OUTCOMES

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

CO1: Recognize and undersand 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: Apply the concepts of renewable energy in practical situations.
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 Environmental Laws, Rules, Guidelines, Compliances and Standards', Vol. I and II, Enviro Media. 38th 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	2	-	-	-	-	2	-	-
CO2	3	1	-	-	-	2	2	-	-	-	-	1	-	-
CO3	3	-	1	-	-	2	2	-	-	-	-	1	-	-
CO4	3	2	1	-	-	2	2	-	-	-	-	2	-	-
CO5	3	2	2	-	-	2	3	-	-	-	-	2	-	-
AVG	**2.8**	**1.2**	**0.8**	**-**	**-**	**2**	**2.2**	**-**	**-**	**-**	**-**	**1.6**	**-**	**-**

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

24CE4201 HYDRAULIC ENGINEERING LABORATORY

L T P C
0 0 3 1.5

COURSE OBJECTIVES

- To understand the basic principles of fluid flow and energy losses in pipe systems.
- To provide hands-on experience in testing the performance of pumps and turbines.
- To learn important hydraulic phenomena like the hydraulic jump and flow through different fittings.

LIST OF EXPERIMENTS

1. Experimental Analysis of Friction Loss in a Sudden Contraction Pipe.
2. Experimental Analysis of Friction Loss in a Sudden Enlargement Pipe.
3. Determination of Head Loss in a Pipe Bend.
4. Determination of friction factor in Elbow pipe.
5. Performance Evaluation of a Centrifugal Pump.
6. Performance Study of a Reciprocating Pump
7. Performance Characteristics of a Gear Pump
8. Efficiency Testing of a Submersible pump
9. Characteristics of Pelton wheel turbine.
10. Efficiency Evaluation of a Francis Turbine
11. Characteristics of Kaplan turbine.
12. Determination of metacentric height of floating bodies.

TOTAL: 45 PERIODS

COURSE OUTCOMES

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

CO1: Explain water flow in different pipes and calculate energy losses.
CO2: Determine the friction factor in pipes using real-time experiments.

CO3: Test different pumps and measure the perform in various conditions.
CO4: Explain the working of water turbines and measure their efficiency.
CO5: Analyze the stability of floating bodies with respect to buoyancy and fluid equilibrium.

TEXT BOOKS

1. Dilip Kumar Majumdar, "Irrigation Water Management", Prentice-Hall of India, New Delhi, 2008.
2. Punima B.C; Irrigation and water power Engineering, Laxmi Publications, 16th Edition, New Delhi, 2009.
3. Garg S. K., "Irrigation Engineering and Hydraulic structures", Khanna Publishers, 23rd Revised Edition, New Delhi, 2009.

REFERENCE BOOKS

1. Duggal, K.N. and Soni, J.P., "Elements of Water Resources Engineering", New Age International Publishers, 2005.
2. Linsley R.K. and Franzini J.B, "Water Resources Engineering", McGraw-Hill Inc, 2000.
3. Chaturvedi M.C., "Water Resources Systems Planning and Management", Tata McGraw Hill Inc., New Delhi, 1997.
4. Sharma R.K. "Irrigation Engineering", S.Chand & Co. 2007.
5. Michael A.M., Irrigation Theory and Practice, 2nd Edition, Vikas Publishing House Pvt. Ltd., Noida, Up, 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	3	2	-	-	-	3	-	3	3	-	2	3	2
CO2	3	3	2	-	-	-	3	-	3	3	-	2	3	2
CO3	3	3	2	-	-	-	3	-	3	3	-	2	3	2
CO4	3	3	2	-	-	-	3	-	3	3	-	2	3	2
CO5	3	3	2	-	-	-	3	-	3	3	-	2	3	2
AVG	3	3	2	-	-	-	3	-	3	3	-	2	3	2

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

24CE4202 SOIL MECHANICS LABORATORY **L T P C**
0 0 3 1.5

COURSE OBJECTIVES

- To enhance the knowledge on various index properties of soil.
- To gain knowledge about the compaction characteristics of soil.
- To learn about the shearing properties and bearing capacity of soil.

LIST OF EXPERIMENTS

1. **DETERMINATION OF INDEX PROPERTIES**
    a. Specific gravity of soil solids.
    b. Grain size distribution – Sieve analysis.
    c. Grain size distribution - Hydrometer analysis.
    d. Liquid limit and Plastic limit tests.
    e. Shrinkage limit.
2. **DETERMINATION OF INSITU DENSITY AND COMPACTION CHARACTERISTICS**
    a. Field density Test (Sand replacement method).
    b. Determination of moisture – density relationship using standard proctor compaction test.
    c. Determine the in-situ dry density of soil using Core Cutter Method.
    d. Determination of Field Vane Shear Test.
3. **DETERMINATION OF ENGINEERING PROPERTIES**
    a. Permeability determination (constant head and falling head methods).
    b. One dimensional consolidation test (Determination of co-efficient of consolidation).
    c. Direct shear test in cohesion less soil.
    d. Unconfined compression test in cohesive soil.
    e. Laboratory vane shear test in cohesive soil.
    f. Tri-axial compression test in cohesion less soil.
    g. California Bearing Ratio Test.

TOTAL :45 PERIODS

COURSE OUTCOMES

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

CO1: Conduct tests to determine the index properties of soils.
CO2: Determine in-situ density and compaction characteristics.
CO3: Conduct tests to determine the compressibility and permeability of soils.
CO4: Determine the shear strength parameters of soil.
CO5: Determine the Consolidation properties of soil and interpret settlement behavior.

TEXT BOOKS

1. Lambe T.W., “Soil Testing for Engineers”, John Wiley and Sons, New York, 1951. Digitized2008.
2. Braja M.Das., “Soil Mechanics: Laboratory Manual”, Oxford University Press, eighth edition, 2012.
3. Soil Engineering Laboratory Instruction Manual” published by Engineering College Co- operative Society, Anna University, Chennai, 2010.

REFERENCE BOOKS

1. “Saibaba Reddy, E. Ramasastri, K. “Measurement of Engineering Properties of Soils”, New ageInternational (P) limited publishers, New Delhi, 2008.

2. IS 2720 (Part 11). 1993. Methods of Test for Soils, Part 11: Determination of the Shear Strength Parameters of a Specimen Tested in Unconsolidated, Undrained Triaxial Compression Without the Measurement of Pore Water Pressure. Bureau of Indian Standards, New Delhi.
3. IS 2720 (Part 12). 1981. Methods of Test for Soils, Part 12: Determination of Shear Strength Parameters of Soil from Consolidated Undrained Triaxial Compression Test with Measurement of Pore Water Pressure. Bureau of Indian Standards, New Delhi.
4. IS 6403 (1981), Code of practice for determination of bearing capacity of shallow foundations, Bureau of Indian Standards, New Delhi.
5. IS 1888 – 1982, Indian Standard Method of Load Test on Soils, 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	2	2	3	-	-	-	3	3	-	2	3	2
CO2	2	3	2	2	3	-	-	-	3	3	-	2	3	2
CO3	2	3	2	2	3	-	-	-	3	3	-	2	3	2
CO4	2	3	2	2	3	-	-	-	3	3	-	2	3	2
CO5	2	3	2	2	3	-	-	-	3	3	-	2	3	2
AVG	**2**	**3**	**2**	**2**	**3**	**-**	**-**	**-**	**3**	**3**	**-**	**2**	**3**	**2**

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

24GE4201 TECHNICAL SEMINAR **L T P C**
0 0 2 1

COURSE OBJECTIVES

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

COURSE SUMMARY

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

GENERAL GUIDELINES

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

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

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

Evaluation pattern (Only internal evaluation)

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

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

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

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

COURSE OUTCOMES

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

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

CO3: Prepare a presentation about an academic document.

CO4: Give a presentation about an academic document.

CO5: Prepare a technical report.

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

24CE5101 DESIGN OF REINFORCED CONCRETE ELEMENTS **L T P C**
3 0 2 4

COURSE OBJECTIVES

- To introduce RCC design philosophies using IS codes.
- To develop skills to design beams, slabs, columns, and footings.
- To use Software tools for drafting reinforcement detailing of structural elements.

UNIT I INTRODUCTION **9**

Type of Loads on Structures and Load Combinations-Concept of Working Stress Method, Ultimate Load Design and Limit State Design Methods for RCC–Properties of Concrete and Reinforcing Steel-Design of Singly reinforced rectangular beams by working stress method - Limit State philosophy as detailed in IS code - Advantages of Limit State Method over other methods - Design of singly and doubly reinforced rectangular beams by Limit State Method.

UNIT II DESIGN OF BEAMS **9**

Analysis and design of Flanged beams – Use of design aids for Flexure-Behaviour of RC members in Shear, Bond and Anchorage-Design requirements as per current code-Behaviour of rectangular RC beams in shear and torsion- Design of RC members for combined Bending, Shear and Torsion.

UNIT III DESIGN OF SLABS **9**

Analysis and design of cantilever, one way simply supported and continuous slabs and supporting beams-Two-way slab- Design of simply supported and continuous slabs using IS code coefficients

UNIT IV DESIGN OF COLUMNS **9**

Types of columns –Axially Loaded columns – Design of short Rectangular Square and circular columns –Design of Slender columns- Design for Uniaxial and Biaxial bending using Column Curves

UNIT V DESIGN OF FOOTINGS **9**

Concepts of Proportioning footings and foundations based on soil properties-Design of wall footing – Design of axially and eccentrically loaded square, rectangular pad and sloped footings –Design of Combined Rectangular footing for two columns only.

TOTAL:45 PERIODS

LIST OF EXPERIMENTS

Using AutoCAD computer software, draft the Reinforcement detailing of the following design elements

1. Singly reinforced and Doubly reinforced beam
2. Tee -Beam
3. One way and two-way Slab
4. Cantilever and Continuous Slab
5. Rectangular and Circular Column
6. Composite Column
7. Rectangular Pad and Stepped Footing
8. Sloped and Combined Footing

TOTAL:30 PERIODS

COURSE OUTCOMES

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

CO1: Explain RCC Design methods, analyze RCC beams and prepare their reinforcement detailing using software.
CO2: Design flanged beams for flexure, shear, and torsion, and draft their reinforcement.
CO3: Study slab behavior, design and create detailing for different slab types.
CO4: Assess column strength under various loads and provide reinforcement details.
CO5: Design different types of footings as per soil conditions and draft its reinforcement.

TEXT BOOKS

1. Varghese, P.C., “Limit State Design of Reinforced Concrete”, Prentice Hall of India, Pvt. Ltd., New Delhi, 2016.
2. Subramanian, N., “Design of Reinforced Concrete Structures”, Oxford University Press, New Delhi, 2013.
3. Krishnaraju. N., “Design of Reinforced Concrete Structures”, CBS Publishers & Distributors Pvt. Ltd., New Delhi,2016.

REFERENCE BOOKS

1. Jain, A.K., “Limit State Design of RC Structures”, Nemchand Publications, Roorkee, 1998.
2. Unnikrishna Pillai, S., Devdas Menon, “Reinforced Concrete Design”, Tata McGraw Hill Publishing Company Ltd., 2009.
3. Punmia.B.C., Ashok Kumar Jain, Arun Kumar Jain, “Limit State Design of Reinforced Concrete”, Laxmi Publication Pvt. Ltd., New Delhi, 2016.

4. IS456:2000, Code of practice for Plain and Reinforced Concrete, Bureau of Indian Standards, New Delhi, 2000.
5. SP16, IS456:1978 "Design Aids for Reinforced Concrete to Bureau of Indian Standards, New Delhi, 1999.

Mapping of COs, POs and PSOs

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

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

24CE5102 STRUCTURAL ANALYSIS I **L T P C**
3 0 2 4

COURSE OBJECTIVES

- To analyze determinate and indeterminate trusses using classical methods.
- To apply classical methods such as Slope Deflection Method and Moment Distribution Method for structural analysis.
- To use matrix methods such as to solve indeterminate structures and assess their behavior under various loads.

UNIT I ANALYSIS OF TRUSSES **9**

Determinate and indeterminate trusses - analysis of determinate trusses - method of joints - method of sections – Method of tension co-efficient – effect of change in temperature - Application to space trusses.

UNIT II SLOPE DEFLECTION METHOD **9**

Slope deflection equations – Equilibrium conditions - Analysis of continuous beams and rigid frames - Support settlements- symmetric frames with symmetric and skew-symmetric loadings.

UNIT III MOMENT DISTRIBUTION METHOD **9**

Stiffness and carry over factors – Distribution and carryover of moments - Analysis of continuous Beams- Plane rigid frames with and without sway – Support settlement - symmetric frames with symmetric and skew-symmetric loadings.

UNIT IV FLEXIBLITY METHOD **9**

Primary structures - Compatibility conditions – Formation flexibility matrices - Analysis of indeterminate pin- jointed plane frames, continuous beams and rigid jointed plane frames by direct flexibility approach.

UNIT V STIFFNESS METHOD **9**

Restrained structure –Formation of stiffness matrices - equilibrium condition - Analysis of Continuous Beams, Pin-jointed plane frames and rigid frames by direct stiffness method.

TOTAL: 45 PERIODS

LIST OF EXPERIMENTS

Using computer software, analyse the following models:

1. Introduction to Structural Analysis software.
2. Creating structural elements using STAAD/ETABS software.
3. Analysis of Simply supported beam
4. Analysis of Cantilever, Overhanging beam and Continuous beam
5. Analysis of Portal frame with and without out sway
6. Analysis of Portal frame with sway (unequal members and skew symmetric loading)
7. Analysis of pin jointed plane frames
8. Analysis of plane truss

TOTAL: 30 PERIODS

COURSE OUTCOMES

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

CO1: Analyze determinate and indeterminate trusses using method of joints, sections and tension co-efficient.

CO2: Analyse the continuous beams and rigid frames by slope defection method.

CO3: Explain the concept of moment distribution and analysis of continuous beams and rigid frames with and without sway.

CO4: Analyse the indeterminate pin jointed plane frames, continuous beams and rigid frames using matrix flexibility method.

CO5: Explain the concept of stiffness matrix method and analysis of continuous beams, pin jointed trusses and rigid plane frames.

TEXT BOOKS

1. Vaidyanathan, R., & Perumal, P. Structural Analysis Vol. I & II (3rd ed.). Laxmi Publications, 2023.
2. Bhavikatti, S.S,Structural Analysis,Vol.1&2, Vikas Publishing House Pvt.Ltd., New Delhi-4, 2014.
3. Vazrani.V.N And Ratwani, M.M, Analysis of Structures, Vol.II, Khanna Publishers, 2015.

REFERENCE BOOKS

1. Punmia. B.C, Ashok Kumar Jain & Arun Kumar Jain, Theory of structures, Laxmi Publications, New Delhi, 2004.
2. William Weaver, Jrand James M.Gere, Matrix analysis of framed structures, CBS Publishers & Distributors, Delhi,2020.
3. Hibbeler, R.C.,Structural Analysis, VII Edition, Prentice Hall, 2012.
4. Pandit G.S.andGupta S.P.,Structural Analysis–AMatrix Approach, Tata McGraw Hill Publishing Company Ltd.,2006.
5. Rajasekaran. S, & G. Sankarasubramanian., "Computational Structural Mechanics", PHI Learning Pvt. Ltd, 2015.

Mapping of Cos with POs and PSOs

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

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

24CE5103 WATER SUPPLY AND WASTEWATER ENGINEERING **L T P C**
3 0 0 3

COURSE OBJECTIVES

- To introduce students to various components and design of water supply scheme, water treatment methods including the sources of water.
- To design of intake structures and sewerage system.
- To create awareness about the advanced technologies used in the upgrading of water and wastewater treatment plants

UNIT I WATER SUPPLY **9**

Estimation of surface and subsurface water resources - Predicting demand for water- Impurities of water and their significance - Physical, chemical and bacteriological analysis - Waterborne diseases - Standards for potable water. Intake of water: Pumping and gravity schemes.

UNIT II WATER TREATMENT **9**

Objectives - Unit operations and processes - Principles, functions, and design of water treatment plant units, aerators of flash mixers, Coagulation and flocculation – Clarifloccuator - Plate and tube settlers - Pulsator clarifier - sand filters - Disinfection - softening, removal of iron and manganese - Defluoridation - Softening - Desalination process - Residue Management - Construction, Operation and Maintenance aspects.

UNIT III WATER STORAGE AND DISTRIBUTION **9**

Storage and balancing reservoirs - types, location and capacity. Distribution system: layout, hydraulics of pipe lines, pipe fittings, valves including check and pressure reducing valves, meters, analysis of distribution systems, leak detection, maintenance of distribution systems, pumping stations and their operations - House service connections.

UNIT IV PLANNING AND DESIGN OF SEWERAGE SYSTEM **9**

Characteristics and composition of sewage - Population equivalent - Sanitary sewage flow estimation - Sewer materials - Hydraulics of flow in sanitary sewers - Sewer design - Storm drainage-Storm runoff estimation - Sewer appurtenances - Corrosion in sewers - Prevention and control – Sewage pumping-drainage in buildings - Plumbing systems for drainage.

UNIT V SEWAGE TREATMENT AND DISPOSAL **9**

Objectives - Selection of Treatment Methods - Principles, Functions, - Activated Sludge Process and Extended aeration systems - Trickling filters - Sequencing Batch Reactor (SBR) - UASB - Waste Stabilization Ponds - Other treatment methods - Reclamation and Reuse of sewage - Recent Advances in Sewage Treatment - Construction, Operation and Maintenance aspects. - Discharge standards-sludge treatment -Disposal of sludge.

TOTAL: 45 PERIODS

COURSE OUTCOMES

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

CO1: Explain the various components of water supply scheme and design of intake structure and conveyance system for water transmission

CO2: Design the various functional units in water treatment.

CO3: Design and evaluate water storage and distribution system.

CO4: Explain the concept of Planning and designing of sewerage system

CO5: Explain various treatment system of sewage and disposal methods

TEXT BOOKS

1. Garg, S.K. Environmental Engineering, Vol. I Khanna Publishers, New Delhi, 2010.
2. Modi, P.N., Water Supply Engineering, Vol. I Standard Book House, New Delhi, 2016.
3. Garg, S.K., Environmental Engineering Vol. II, Khanna Publishers, New Delhi, 2015.

REFERENCE BOOKS

1. Punmia B.C, Ashok Jain and Arun Jain, Water Supply Engineering, Laxmi Publications (P) Ltd., New Delhi 2010.
2. Manual on Water Supply and Treatment, CPHEEO, Ministry of Urban Development, Government of India, New Delhi, 1999.
3. Syed R. Qasimand Edward M. Motley Guang Zhu, Water Works Engineering Planning, Design and Operation, Prentice Hall of India Learning Private Limited, New Delhi, 2009.

4. Ministry of Urban Development, Government of India, New Delhi, 2013.
5. Metcalf and Eddy – Waste water Engineering – Treatment and Reuse, Tata Mc. Graw – Hill Company, New Delhi, 2010.

Mapping of COs, 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	-	-	-	2	3	2
CO2	3	3	3	2	-	-	3	2	-	-	-	2	3	2
CO3	3	3	3	2	-	-	3	2	-	-	-	2	3	2
CO4	3	3	3	2	-	-	3	2	-	-	-	2	3	2
CO5	3	3	3	2	-	-	3	2	-	-	-	2	3	2
AVG	3	3	3	2	-	-	3	2	-	-	-	2	3	2

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

24CE5104 FOUNDATION ENGINEERING **L T P C**
3 0 0 3

COURSE OBJECTIVES

- To learn site exploration methods and foundation selection based on soil conditions.
- To assess bearing capacity of shallow foundation.
- To design footings, rafts, piles, and retaining walls, considering load capacity, settlement, seismic effects, and stability analysis.

UNIT I SITE INVESTIGATION AND SELECTION OF FOUNDATION **9**

Scope and objectives – Methods of exploration – Auguring and boring – Wash boring and rotary drilling – Depth and spacing of bore holes – Soil samples – Representative and undisturbed – Sampling methods – Split spoon sampler, Thin wall sampler, Stationary piston sampler – Penetration tests (SPT and SCPT) – Data interpretation - Strength parameters and Evaluation of Liquefaction potential - Selection of foundation based on soil condition- Bore log report.

UNIT II BEARING CAPACITY OF SHALLOW FOUNDATION **9**

Introduction – Location and depth of foundation – Codal provisions – Bearing capacity of shallow foundation on homogeneous deposits – Terzaghi's formula and BIS formula – Factors affecting bearing capacity – Bearing capacity from in-situ tests (SPT, SCPT and plate load) – Allowable bearing pressure – Seismic considerations in bearing capacity evaluation. Determination of Settlement of foundations on granular and clay deposits – Total and differential settlement – Allowable settlements – Codal provision – Methods of minimizing total and differential settlements.

UNIT III FOOTINGS AND RAFTS **9**

Types of Isolated footing, Combined footing, Mat foundation – Contact pressure and settlement distribution – Proportioning of foundations for conventional rigid behaviour – Minimum depth

for rigid behaviour – Applications – Floating foundation – Special foundations – Seismic force consideration – Codal provision

UNIT IV PILE FOUNDATION **9**

Types of piles and their functions – Factors influencing the selection of pile – Carrying capacity of single pile in granular and cohesive soil – Static formula – Dynamic formulae (Engineering news and Hileys) – Capacity from insitu tests (SPT, SCPT) – Negative skin friction – Uplift capacity- Group capacity by different methods (Field's rule, Converse – Labarra formula and block failure criterion) – Settlement of pile groups – Interpretation of pile load test (routine test only), Under reamed piles – Capacity under compression and uplift – Codal provision.

UNIT V RETAINING WALLS **9**

Plastic equilibrium in soils – Active and passive states – Rankine's theory – Cohesionless and cohesive soil – Coulomb's wedge theory – Condition for critical failure plane – Earth pressure on retaining walls of simple configurations – Culmann's Graphical method – Pressure on the wall due to line load – Stability analysis of retaining walls – Codal provision.

TOTAL: 45 PERIODS

COURSE OUTCOMES

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

CO1: Carry out soil investigation for Civil Engineering construction
CO2: Have sufficient knowledge on bearing capacity of soils
CO3: Analyze and design the shallow foundation
CO4: Analyze and design the deep foundation
CO5: Analyze and design the earth retaining structures for any kind of soil medium

TEXT BOOKS

1. Punmia, B.C., "Soil Mechanics and Foundations", Laxmi Publications Pvt. Ltd., New Delhi, 2017.
2. Gopal Ranjan and Rao A.S.R. "Basic and Applied soil mechanics", New Age International (P) Ltd, New Delhi,2023.
3. Murthy, V.N.S., "Soil Mechanics and Foundation Engineering", CBS Publishers and Distributers Ltd., New Delhi, 2022.

REFERENCE BOOKS

1. Das, B.M. "Principles of Foundation Engineering" (Eigth edition), Thompson Asia Pvt. Ltd., Singapore, 2017.
2. Kaniraj, S.R. "Design aids in Soil Mechanics and Foundation Engineering", Tata McGraw Hill publishing company Ltd., New Delhi, 2017.
3. Varghese, P.C.,"Foundation Engineering", Prentice Hall of India Private Limited, New Delhi, 2012.
4. Bowles, J.E. Foundation Analysis and Design (5th ed.). McGraw-Hill, 1996.
5. Tomlinson, M.J. Foundation Design and Construction (7th ed.),2001.

Mapping of COs, 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	2	2
CO2	3	2	2	2	-	-	-	-	-	-	-	2	2	2
CO3	3	2	2	2	-	-	-	-	-	-	-	2	2	2
CO4	3	2	2	2	-	-	-	-	-	-	-	2	2	2
CO5	3	2	2	2	-	-	-	-	-	-	-	2	2	2
AVG	3	2	2	2	-	-	-	-	-	-	-	2	2	2

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

24CE5105 CONCRETE TECHNOLOGY **L T P C**
3 0 0 3

COURSE OBJECTIVES

- To study the properties of concrete making materials.
- To have better knowledge about the chemical and mineral admixtures in concrete with the IS method of mix design as per the latest code.
- To understand the fresh and hardened properties of concrete, importance and applications of special concretes

UNIT I CONSTITUENT MATERIALS **9**

Cement-Different types - Chemical composition and Properties -Tests on cement-IS Specifications- Aggregates-Classification-Mechanical properties and tests as per BIS Grading requirements - Quality of water for use in concrete.

UNIT II CHEMICAL AND MINERAL ADMIXTURES **9**

Accelerators-Retarders- Plasticisers- Super plasticizers- Water proofers - Mineral Admixtures likeFly Ash, Silica Fume, Ground Granulated Blast Furnace Slag and Metakaoline -Their effects on concrete properties

UNIT III PROPORTIONING OF CONCRETE MIX **9**

Principles of Mix Proportioning-Properties of concrete related to Mix Design-Physical properties of materials required for Mix Design - Design Mix and Nominal Mix-BIS Method of Mix Design - Mix Design Examples.

UNIT IV FRESH AND HARDENED PROPERTIES OF CONCRETE **9**

Workability-Tests for workability of concrete-Slump Test and Compacting factor Test-Segregationand Bleeding-Determination of Compressive and Flexural strength as per BIS - Properties of Hardened concrete- Stress-strain curve for concrete-Determination of Modulus of elasticity.

UNIT V SPECIAL CONCRETES **9**

Light weight concretes - High strength concrete - Fibre reinforced concrete – Ferrocement -

Ready mix concrete - SIFCON - Shotcrete — Polymer concrete - High performance concrete- self compacting concrete - Geopolymer Concrete.

TOTAL: 45 PERIODS

COURSE OUTCOMES

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

CO1: Explain the properties of cement, aggregates and water for concrete.
CO2: Select suitable admixtures for enhancing the properties of concrete.
CO3: Design concrete mixes as per IS method of mix design.
CO4: Determine the properties of concrete at fresh and hardened state.
CO5: Know the importance of special concretes for specific requirements.

TEXT BOOKS

1. Gambhir.M.L. "Concrete Technology", Fifth Edition, McGraw Hill Education,2017.
2. Shetty,M.S, "Concrete Technology", S.Chand and Company Ltd, New Delhi, 2003.
3. Neville, A.M; "Properties of Concrete", Pitman Publishing Limited, London,1995.

REFERENCE BOOKS

1. Job Thomas., Concrete Technology, Cencage learning India Private Ltd, New Delhi, 2015.
2. Santhakumar. A.R., "Concrete Technology", Oxford University Press India, 2006.
3. IS10262-2019 Recommended Guidelines for Concrete Mix Design, Bureau of Indian Standards, New Delhi.
4. Kumar P Mehta., Paulo J M Monterio., "Concrete- Microstructure, Properties and Materials", McGraw Hill Education (India) Private Limited, New Delhi, 2016.
5. Bhavikatti.S.S, "Concrete Technology", I.K.International Publishing House 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	3	2	2	2	-	2	2	-	-	-	-	3	2	3
CO2	3	2	2	2	-	2	2	-	-	-	-	3	2	3
CO3	3	2	2	2	-	2	2	-	-	-	-	3	2	3
CO4	3	2	2	2	-	2	2	-	-	-	-	3	2	3
CO5	3	2	2	2	-	2	2	-	-	-	-	3	2	3
AVG	3	2	2	2	-	2	2	-	-	-	-	3	2	3

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

24CE5201 CONCRETE LABORATORY **L T P C**
0 0 3 1.5

COURSE OBJECTIVES

- To familiarize students with standard material testing procedures.
- To assess the physical and mechanical properties of cement, aggregates and concrete.
- To develop practical skills in material testing for quality control.

LIST OF EXPERIMENTS

I. TESTS ON CEMENT

1. Determination of fineness and consistency of cement
2. Determination of specific gravity of cement
3. Determination of initial and final setting time of cement

II. TESTS ON FINE AGGREGATE

1. Determination of specific gravity and water absorption of fine aggregate
2. Determination of grading of fine aggregate

III. TESTS ON COARSE AGGREGATE

1. Determination of compacted and loose bulk density of coarse aggregate
2. Determination of impact value of coarse aggregate
3. Determination of elongation index and flakiness index of coarse aggregate
4. Determination of aggregate crushing value of coarse aggregate
5. Determination of specific gravity and water absorption of coarse aggregate

VI. TESTS ON CONCRETE

1. Determination of slump of concrete
2. Determination of compressive strength of concrete cube

TOTAL:30 PERIODS

COURSE OUTCOMES

On Successful completion of this course, the student will able to

CO1: Conduct tests on cement for consistency, setting time, and fineness.
CO2: Evaluate fine and coarse aggregates for specific gravity, grading, and strength properties.
CO3: Perform slump and compressive strength tests on concrete.
CO4: Analyze and interpret test results as per standards.
CO5: Apply testing knowledge for material selection and mix design.

TEXT BOOKS

1. Gambhir.M.L. “Concrete Technology”, Fifth Edition, McGraw Hill Education,2017.
2. Shetty,M.S, "Concrete Technology", S.Chand and Company Ltd, New Delhi, 2003.
3. Neville, A.M; "Properties of Concrete", Pitman Publishing Limited, London,1995.

REFERENCE BOOKS

1. Bhavikatti.S.S, "Concrete Technology", I.K.International Publishing House Pvt. Ltd., New Delhi, 2015.
2. Construction Materials Laboratory Manual, Anna University, Chennai.
3. IS 4031 (Part 1)– 1996– Indian Standard Method for determination of fineness by dry sieving.
4. IS 2386 (Part 1 to Part 6)– 1963– Indian Standard methods for test for aggregate for concrete.
5. IS 383– 1970 Indian Standard specification for coarse and fine aggregates from natural sources for concrete.

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

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

24CE5202 WATER AND WASTEWATER ANALYSIS LABORATORY **L P T C 0 0 3 1.5**

COURSE OBJECTIVES

- To analyze the physical, chemical and biological characteristics of water and wastewater.
- To quantify the dosage requirement for coagulation process.
- To study the growth of micro-organism and its quantification.

LIST OF EXPERIMENTS

ANALYSIS OF WATER SAMPLE

1. Measurement of Electrical conductivity and turbidity
2. Determination of fluoride in water by spectrophotometric method /ISE
3. Determination of iron in water
4. Determination of Sulphate in water
5. Determination of Optimum Coagulant Dosage by Jar test apparatus
6. Determination of available Chlorine in Bleaching powder and residual chlorine in water.

ANALYSIS OF WASTEWATER SAMPLE

7. Estimation of suspended, volatile and fixed solids
8. Determination of Sludge Volume Index in waste water
9. Determination of Dissolved Oxygen
10. Estimation of B.O.D.
11. Estimation of C.O.D.
12. Determination of TKN and Ammonia Nitrogen in wastewater

TOTAL: 45 PERIODS

COURSE OUTCOMES

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

CO1: Calibrate and standardize the equipment.
CO2: Collect proper sample for analysis.
CO3: Explain the sample preservation methods.
CO4: Analyze to perform field oriented testing of water and wastewater.
CO5: Determine the coliform analysis.

TEXT BOOKS

1. APHA, "Standard Methods for the Examination of Water and Waste water", 22nd Ed. Washington, 2012.
2. H.H. and Krist,H "Laboratory Manual for the Examination of water, wastewater soil Rump",– Second Edition, VCH, Germany, 3rd Edition, 1999.
3. James P.Lodge Jr (Editor)"Methods of air sampling & analysis", 3rd Edition, Lew is Publishers, Inc, USA,1989.

REFERENCE BOOKS

1. Gopalan, R. and Sugumar, R.W., A laboratory manual for environmental chemistry. IK International Pvt Ltd, 2013.
2. Bhutiani, R., Laboratory manual of water and wastewater analysis. Daya Books, 2008.
3. Sawyer, C.N., McCarty, P.L. and Parkin, G.F., Chemistry for environmental engineering and science. New York: McGraw-Hill, 2003.
4. Kumar, A., Yadav, J., Vohra, R. and Sebastian, A., Water and Wastewater Engineering. In Advanced Geospatial Practices in Natural Environment Resource Management. IGI Global, 2024.
5. Garg, S.K., “Environmental Engineering Vol. I & II”, Khanna Publishers, New Delhi, 2022.

Mapping of Cos with POs & PSOs

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

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

24CE5203 SURVEY CAMP (2 weeks) **L T P C**

0 0 0 1

COURSE OBJECTIVES

- To provide hands-on experience with modern surveying tools and techniques in real-world conditions.
- To bridge theory and practice through field projects like topographic mapping, triangulation, leveling, traversing, and contouring.
- To develop skills in teamwork, data analysis, map preparation, and technical report writing essential for engineering practice.

Two weeks Survey Camp will be conducted during summer vacation in the following activities:

LIST OF EXPERIMENTS

1. Traverse – using Theodolite / Total station
2. Contouring
   (i). Radial tachometric contouring - Radial Line at Every 45 Degree and Length not less than60 Meter on each Radial Line
   (ii). Block Level/ By squares of size at least 100 Meter x 100 Meter atleast 20 Meter interval.
   (iii). L.S & C.S - Road and canal alignment for a Length of not less than 1 Kilo Meter atleast L.S at Every 30M and C.S at every 90 M
3. Offset of Buildings and Plotting the Location
4. Sun observation to determine azimuth (guidelines to be given to the students)
5. Use of GPS to determine latitude and longitude and locate the survey camp location
6. Traversing using GPS
7. Curve setting by deflection angle

COURSE OUTCOMES

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

CO1: Handle the modern surveying instruments like Total station and GPS
CO2: Apply modern surveying techniques in field to establish horizontal control.
CO3: Explain the surveying techniques in field to establish vertical control

CO4: Apply different survey adjustment techniques.
CO5: Carry out different setting out works in the field

TOTAL: 45 PERIODS

TEXT BOOKS

1. T. P. Kanetkarand S. V. Kulkarni, Surveying and Levelling, Parts 1 & 2, Pune Vidyarthi Griha Prakashan, Pune, 24th Reprint, 2015.
2. Dr. B. C. Punmia, Ashok K. Jainand Arun K Jain, Surveying Vol. I & II, Lakshmi Publications Pvt Ltd, New Delhi, 17th Edition, 2016.
3. R. Subramanian, Surveying and Levelling, Oxford University Press, Second Edition, 2012.

REFERENCE BOOKS

1. James M. Anderson and Edward M. Mikhail, Surveying, Theory and Practice, Seventh Edition, McGraw Hill 2001.
2. Bannister and S. Raymond, Surveying, Seventh Edition, Longman 2004.
3. David Clark and James Clendinning, Plane and Geodetic Surveying for Engineers, Volume II, Constable and Company Ltd, London, CBS, 6th Edition, 2004.
4. S. K. Roy, Fundamentals of Surveying, Second Edition, Prentice 'Hall of India 2004
5. K. R. Arora, Surveying Vol. I & II, Standard Book house, Eleventh Edition, 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	2	3	3	2	2	2	3	3	2	3	3	3
CO2	3	3	2	3	3	2	2	2	3	3	2	3	3	3
CO3	3	3	2	3	3	2	2	2	3	3	2	3	3	3
CO4	3	3	2	3	3	2	2	2	3	3	2	3	3	3
CO5	3	3	2	3	3	2	2	2	3	3	2	3	3	3
AVG	**3**	**3**	**2**	**3**	**3**	**2**	**2**	**2**	**3**	**3**	**2**	**3**	**3**	**3**

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

24CE6101 DESIGN OF STEEL STRUCTURES **L T P C**
3 0 2 4

COURSE OBJECTIVES

- To introduce the types, properties, and design philosophy of structural steel and its connections.
- To develop skills in designing steel structural members like tension members, columns, and beams.
- To train students in detailing steel structures and using software tools like AutoCAD for construction drawings.

UNIT I INTRODUCTION TO STRUCTURAL STEEL AND DESIGN OF CONNECTIONS **9**

General -Types of Steel -Properties of structural steel - I.S. rolled sections - Concept of Limit State Design - Design of Simple and eccentric Bolted and welded connections - Types of failure and efficiency of joint — prying action - Introduction to HSFG bolts

UNIT II DESIGN OF TENSION AND COMPRESSION MEMBERS **9**

Behaviour and Design of simple and built-up members subjected to tension - Shear lag effect-Design of lug angles - Behaviour of short and long columns - Euler's column theory-Design of simple and built-up compression members with lacings and battens - Design of column bases - slab base and gusseted base

UNIT III DESIGN OF BEAMS **9**

Design of laterally supported and unsupported beams - Design of built-up beams - Design of plate girders

UNIT IV INDUSTRIAL STRUCTURES **9**

Design of roof trusses – loads on trusses – purlin design using angle and channel sections – trussdesign, Design of joints and end bearings–Design of gantry girder - Introduction to pre-engineered buildings

UNIT V PLASTIC ANALYSIS AND DESIGN **9**

Introduction to plastic analysis - Theory of plastic Analysis - Design of continuous beams and portalframes using plastic design approach

TOTAL:45 PERIODS

LIST OF EXPERIMENTS

Use Computer software, draft the detailing of connections for the following steel structural elements

1. Detailing of Bolted beam to Beam and beam to Column Connection
2. Detailing of Welded beam to beam and beam to Column Connection
3. Steel Structures detailing – Roof truss & Purlins
4. Steel Column gusseted base Bolted Connections
5. Steel Column Slab base connections
6. Detailing of Compression Member - Lacing and Battens
7. Plate Girder (welded) and Gantry girder
8. Industrial Structures - North Light Roof

TOTAL:30 PERIODS

COURSE OUTCOMES

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

CO1: Explain the types of structural steel, its properties, and design methods using limit state concepts.

CO2: Design structural steel members subjected to tension and compression, including laced and battened columns with suitable base connections.

CO3: Design laterally supported and unsupported beams, built-up beams, and plate girders.
CO4: Design industrial steel structures such as roof trusses, purlins, and gantry girders.
CO5: Apply plastic analysis techniques to design continuous beams and portal frames and develop steel detailing using AutoCAD.

TEXT BOOKS

1. Gambhir.M.L., "Fundamentals of Structural Steel Design", McGraw Hill Education India Pvt. Ltd., 2013
2. Shiyekar.M.R., "Limit State Design in Structural Steel", Prentice Hall of India Pvt. Ltd, Learning Pvt. Ltd., 2nd Edition, 2013.
3. Subramanian.N, "Design of Steel Structures", Oxford University Press, New Delhi,2013.

REFERENCE BOOKS

1. Narayanan.R. "Teaching Resource on Structural Steel Design", INSDAG, Ministry of Steel Publications, 2002
2. Duggal. S.K, "Limit State Design of Steel Structures", Tata McGraw Hill Publishing Company, 2005
3. Bhavikatti.S.S, "Design of Steel Structures" By Limit State Method as per IS:800–2007, IK International Publishing House Pvt. Ltd., 2009
4. Shah.V.L. and Veena Gore, "Limit State Design of Steel Structures", IS 800–2007 Structures Publications, 2009.
5. IS 800:2007, General Construction in Steel-Code of Practice, (Third Revision), Bureau of Indian Standards, New Delhi, 2007

Mapping of Cos with POs and PSOs

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

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

24CE6102 STRUCTURAL ANALYSIS II **L T P C**
3 0 0 3

COURSE OBJECTIVES

- To learn the method of drawing influence lines and its uses in various applications like beams and plane trusses.
- To analyse the arches, suspension bridges and space trusses.
- To learn rigid frame by approximate method analysis.

UNIT I INFLUENCE LINES FOR DETERMINATE BEAMS **9**

Influence lines for reactions in statically determinate beams – Influence lines for shear force and bending moment – Calculation of critical stress resultants due to concentrated and distributed moving loads – absolute maximum bending moment - influence lines for member forces in pin jointed plane frames.

UNIT II INFLUENCE LINES FOR INDETERMINATE BEAMS **9**

Muller Breslau's principle– Influence line for Shearing force, Bending Moment and support reaction components of propped cantilever, continuous beams (Redundancy restricted to one), and fixed beams.

UNIT III ARCHES **9**

Arches - Types of arches – Analysis of three hinged, two hinged and fixed arches - Parabolic and circular arches – Settlement and temperature effects.

UNIT IV CABLES AND SUSPENSION BRIDGES **9**

Equilibrium of cable – length of cable - anchorage of suspension cables – stiffening girders - cables with three hinged stiffening girders – Influence lines for three hinged stiffening girders.

UNIT V APPROXIMATE ANALYSIS OF FRAMES **9**

Approximate analysis for gravity loadings - substitute frame method for maximum moments in beams and columns - Approximate analysis for horizontal loads - portal method and cantilever method - assumptions - axial force, shearing force and bending moment diagrams.

TOTAL:45 PERIODS

COURSE OUTCOMES

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

CO1: Draw influence lines for statically determinate structures and calculate critical stress resultants.

CO2: Explain Muller Breslau principle and draw the influence lines for statically indeterminate beams.

CO3: Analyse three hinged, two hinged and fixed arches.

CO4: Analyse the suspension bridges with stiffening girders

CO5: Apply approximate methods to analyze internal forces in frames.

TEXTBOOKS

1. Vaidyanathan, R., & Perumal, P. Structural Analysis Vol. I & II (3rd ed.). Laxmi Publications, 2007.
2. Bhavikatti, S.S,Structural Analysis,Vol.1,& 2, Vikas Publishing House Pvt.Ltd.,NewDelhi-4, 2014.
3. Vazrani.V.N And Ratwani, M.M, Analysis of Structures, Vol.II, Khanna Publishers, 2015.

REFERENCE BOOKS

1. Punmia. B.C, Ashok Kumar Jain & Arun Kumar Jain, Theory of structures, Laxmi Publications, New Delhi, 2004.
2. William Weaver, Jr and James M.Gere, Matrix analysis of framed structures, CBS Publishers & Distributors, Delhi,1995
3. Hibbeler, R.C., Structural Analysis, VII Edition, Prentice Hall, 2012.
4. Pandit G.S. and Gupta S.P., Structural Analysis–A Matrix Approach, Tata McGraw Hill Publishing Company Ltd.,2006
5. Rajasekaran. S, & G. Sankarasubramanian., "Computational Structural Mechanics", PHI Learning Pvt. Ltd, 2015

Mapping of COs, POs and PSOs

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

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

24CE6103 WATER RESOURCES AND IRRIGATION ENGINEERING **L T P C**
3 0 0 3

COURSE OBJECTIVES

- To learn the amount of water required for crops and understand the impact of rainfall, evaporation, and runoff on water availability.
- To understand precipitation and its hydrologic interception, evaporation, and infiltration using measurement tools.
- To gain knowledge about the use and management of reservoirs and groundwater for water storage and supply.

UNIT I CROP WATER REQUIREMENT **9**

Need and classification of irrigation- historical development and merits and demerits of irrigation types of crops-crop season-duty, delta and base period- consumptive use of crops-estimation of Evapotranspiration using experimental and theoretical methods.

UNIT II IRRIGATION METHODS **9**

Tank irrigation – Well irrigation – Irrigation methods: Surface and Sub-Surface and Micro Irrigation – design of drip and sprinkler irrigation – ridge and furrow irrigation-Irrigation scheduling – Water distribution system- Irrigation efficiencies.

UNIT III PRECIPITATION AND ABSTRACTIONS **9**

Hydrological cycle - Meteorological measurements – Types and forms of precipitation - Rain gauges-Spatial analysis of rainfall data using Thiessen polygon and Iso-hyetal methods - Interception – Evaporation: Measurement, Evaporation suppression methods – Infiltration: Horton‟s equation - Double ring infiltrometer - Infiltration indices.

UNIT IV RUNOFF **9**

Catchment: Definition, Morphological characteristics - Factors affecting runoff - Run off estimation using Strange's table and empirical methods - SCS-CN method – Stage discharge relationship - Flow measurements - Hydrograph – Unit Hydrograph – IUH.

UNIT V RESERVOIRS AND GROUNDWATER MANAGEMENT **9**

Classification of reservoirs - Site selection - General principles of design - Spillways - Elevation-Area- Capacity curve - Storage estimation - Sedimentation - Life of reservoirs – Rule curve Origin - Classification and types - Properties of aquifers - Governing equations – Steady and unsteady flow - Artificial recharge - RWH in rural and urban areas.

TOTAL: 45 PERIODS

COURSE OUTCOMES

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

CO1: Explain the water needs of crops and apply key concepts like duty, delta, and base period in irrigation planning.

CO2: Identify and explain different irrigation methods, including modern systems like drip and sprinkler irrigation

CO3: Interpret rainfall, evaporation, and infiltration data for better water resource planning.

CO4: Estimate runoff and understand hydrograph concepts for managing surface water flow.

CO5: Explain the working of reservoirs and groundwater systems, including methods for water conservation and recharge.

TEXT BOOKS

1. Subramanya K, "Engineering Hydrology"- Tata McGraw Hill, 2010.
2. Jayarami Reddy P, "Hydrology", Tata McGraw Hill, 2008.
3. Garg, S.K. Irrigation Engineering and Hydraulic Structures, Khanna Publishers, 2012.

REFERENCE BOOKS

1. David Keith Todd. "Groundwater Hydrology", John Wiley & Sons, Inc. 2007.
2. Ven Te Chow, Maidment, D.R. and Mays, L.W. "Applied Hydrology", McGraw Hill International Book Company, 1998.
3. Raghunath. H.M., "Hydrology", Wiley Eastern Ltd., 1998.
4. Bhagu R. Chahar, Groundwater Hydrology, McGraw Hill Education (India) Pvt Ltd, New Delhi, 2017.

5. Sharma, R.K. and Sharma, T.K. Irrigation Engineering, S. Chand Publishing, 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	3	2	2	-	2	2	-	-	-	-	3	2	2
CO2	3	3	2	2	-	2	2	-	-	-	-	3	2	2
CO3	3	3	2	2	-	2	2	-	-	-	-	3	2	2
CO4	3	3	2	2	-	2	2	-	-	-	-	3	2	2
CO5	3	3	2	2	-	2	2	-	-	-	-	3	2	2
AVG	3	3	2	2	-	2	2	-	-	-	-	3	2	2

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

24CE6201 BUILDING INFORMATION MODELING LAB **L T P C**
0 0 3 1.5

COURSE OBJECTIVES

- To master architectural modeling by creating and modifying building elements like walls, doors, and roofs.
- To integrate MEP systems into building designs for full system coordination.
- To create professional documentation and visualizations through accurate drawings and renderings.

LIST OF EXPERIMENTS

1. Setting up levels and grids.
2. Using Templates and setting of units.
3. Modeling Walls, Doors and Windows.
4. Modify Tools and Placing of Components.
5. Curtain Walls and Wall Opening.
6. Modeling floors, ceilings and roofs.
7. Modeling stairs, railings, and ramps.
8. Text, Dimension, Annotations, Model Text, Model line, Room and Area.
9. Paint, Colour Scheme, creating new Materials, Sweep and Extrude Modeling.
10. Camera view, Hide elements, Render view and Walkthrough.
11. Massing and Site, toposurface, sub region, building pad, site component, parking site.
12. Component Schedule and Creating Title Block.

TOTAL: 45 PERIODS

COURSE OUTCOMES

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

CO1: Create accurate 3D models of building elements such as walls, windows, doors, floors, roofs, and MEP components.

CO2: Apply design software tools efficiently to set up, modify, and coordinate architectural and MEP designs.
CO3: Develop comprehensive construction documents, including dimensions, annotations, schedules, and MEP layouts.
CO4: Generate realistic visualizations and walkthroughs incorporating architectural and MEP elements for effective presentations.
CO5: Design and model complete site plans, including landscaping, parking areas, topography, and external MEP services.

TEXT BOOKS

1. Peter B. and Nigel D., "BIM in Principle and in Practice", 1st Edition, ICE Publishing, 2014.
2. Wing, E., "Mastering Autodesk Revit for Architecture", 2023 Edition, Sybex, 2023.
3. Seidler, D. R., "Revit Architecture 2023 for Designers", 1st Edition, Delmar Cengage Learning, 2023.

REFERENCE BOOKS

1. Ching, F. D. K., "Building Construction Illustrated", 5th Edition, Wiley, 2014.
2. Jha, V. R., "Revit Architecture 2023: A Problem-Solving Approach", 1st Edition, BPB Publications, 2023.
3. Kramp, M. R., "Digital Design and Manufacturing: CAD/CAM Applications in Architecture and Design", 1st Edition, Wiley, 2004.
4. Rossi, A., "The Architecture of the City", 1st Edition, MIT Press, 1982.
5. Levy, M. Fundamentals of Building Construction: Materials and Methods (7th ed.). John Wiley & Sons, 2018.

Mapping COs, POs & PSOs

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

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

24CE6202 STRUCTURAL ANALYSIS USING COMPUTER SOFTWARE **L T P C**
0 0 3 1.5

COURSE OBJECTIVES

- To introduce structural analysis software and basic modeling techniques.
- To learn advanced modeling, analysis, and result interpretation.
- To apply lateral loads and get the reinforcement detailing in building models.

LIST OF EXPERIMENTS

Using computer software, analyze the following models

1. Introduction to Structural Analysis software.
2. Modelling of a structure.
3. Advanced commands used for modelling.
4. Model checking, analysis and design
5. Post processing and result analysis
6. Analysis of a 3D multi storied building.
7. Grouping of elements
8. The concept of lateral loading
9. Application of lateral load - seismic load on a multistoried building.
10. Application of lateral load - wind load on a multistoried building.
11. Reinforcement detailing
12. Modelling of a shear wall in building

TOTAL: 30 HOURS

COURSE OUTCOME

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

CO1: Model simple and complex structures using structural analysis software.
CO2: Check, analyze, and design structural models using software tools.
CO3: Interpret post-processing results for structural components.
CO4: Apply lateral loads (seismic and wind) on multistory building models.
CO5: Detail reinforcement and model shear walls in building structures.

Mapping of COs, POs and PSOs

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

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

TEXT BOOKS

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

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

24CE7501 DESIGN PROJECT **L T P C**
0 0 4 2

COURSE OBJECTIVES

- To develop design skills using modern Engineering Software.
- To encourage collaborative and independent problem-solving.
- To strengthen the drafting skills and technical documentation competency

STRATEGY

The objective of this course is to impart and improve the design capability of the student with the aid of latest design software as per the industrial requirement. This course conceives purely a design problem in any one of the disciplines of Civil Engineering. The design problem can be allotted to a group of students comprising of not less than two and not more than four. At the end of the course the group should submit a complete report on the design problem consisting of the data given, the design calculations, specifications if any and complete set of drawings which follow the design.

TOTAL: 60 PERIODS

COURSE OUTCOMES

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

CO1: Identify and define practical Civil Engineering design problems aligned with industry requirements.

CO2: Apply appropriate design principles, codes, and software tools to develop effective engineering solutions.

CO3: Collaborate effectively within a team environment, managing tasks, timelines, and responsibilities to achieve project goals.

CO4: Produce precise and detailed engineering drawings through drafting skills, adhering to industry standards.

CO5: Prepare and present complete technical documentation, including design calculations, specifications, and final project reports.

Mapping of Cos with POs and PSOs

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

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%

COURSE OUTCOMES

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

CO1: Apply appropriate workplace behaviors in a professional setting.

CO2: Demonstrate content knowledge appropriate to job assignment.

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

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

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

Mapping of COs with POs & PSOs

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

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

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

0 0 0 1

COURSE OBJECTIVES

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

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

Part A: Case study on Industry Operation

The students should undergo case study on Industrial Operations.

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

Part B: Case study on Completed Project

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

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

At the end of study,

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

COURSE OUTCOMES

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

CO1: Explain 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

24CE8501 PROJECT WORK **L T P C**

0 0 20 10

COURSE OBJECTIVE

- To develop problem-solving and research skills.
- To enhance project management and technical documentation abilities.
- To build confidence in technical communication and professional review.

STRATEGY

Students will select a project topic based on current trends and industry needs, aligned with their area of interest. Guides will be allotted based on the student's topic of interest and the faculty member's specialization to ensure effective mentoring. Under faculty guidance, students will apply theoretical knowledge to practical problems, engage in experimental or computational work as required, and maintain regular progress reviews. Emphasis will be placed on independent thinking, innovation, and adherence to project timelines. Upon completion, students will submit a comprehensive project report, demonstrate their work through presentations or prototypes, and undergo evaluation by both internal and external examiners.

COURSE OUTCOMES

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

CO1: Identify, formulate, and analyze real-world engineering problems through critical review of literature and contemporary practices.

CO2: Develop effective project plans, applying theoretical knowledge and technical skills to execute practical solutions independently or as part of a team.

CO3: Apply appropriate methodologies, tools, and techniques for experimental, computational, or design-based project work.

CO4: Prepare professional-quality project reports that clearly document objectives, methodologies, results, and conclusions with proper referencing and formatting.

CO5: Communicate project outcomes effectively through oral presentations, defending ideas and responding confidently during viva voce examinations.

TOTAL: 300 PERIODS

Mapping of COs with POs and PSOs

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

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

24CEPE01 ENGINEERING GEOLOGY **L T P C**

3 0 0 3

COURSE OBJECTIVES

- To understand the significance of geology in Civil Engineering and its impact on construction projects.
- To identify and classify common minerals and rocks, and assess their engineering properties.
- To apply knowledge of structural geology in evaluating geological features for civil engineering applications.

UNIT I PHYSICAL GEOLOGY AND GEOMORPHOLOGY **9**

Significance of Geology in Civil Engineering; Internal structure of the Earth; Weathering: types, engineering classification of weathered rocks and relevance to Civil Engineering; Fluvial, Marine, Glacial and Aeolian landforms and their importance in Civil Engineering; Plate tectonics and its relevance to earthquakes; Groundwater: types of aquifers, origin, movement and role of groundwater in Civil Engineering constructions.

UNIT II MINERALOGY AND PETROLOGY **9**

Physical and Chemical properties of common rock forming minerals: Quartz family, Feldspar family, Mica (Muscovite, Biotite & Vermiculite), Pyroxene (Augite & Hypersthene), Amphibole (Hornblende), Calcite, Gypsum and Clay minerals and their significance. Formation of Igneous, Metamorphic and Sedimentary rocks; Description of important rocks: Granite, Syenite, Dolerite, Basalt, Quartzite, Slate, Schist, Gneiss, Marble, Sandstone, Limestone, Shale and Conglomerate. Engineering properties of rocks: field and laboratory tests.

UNIT III STRUCTURAL GEOLOGY AND ROCK MECHANICS **9**

Attitudes of beds: Strike and Dip measurements and their relevance to civil engineering; Different types of folds, faults, joints and fractures in rocks and their significance in civil engineering constructions; Geomechanical properties of rocks: Rock Quality Designation (RQD), Rock Mass Rating (RMR) and Geological Strength Index (GSI) and their importance in various civil engineering projects.

UNIT IV GEOPROSPECTING **9**

Definition of boundary layers – Laminar and turbulent boundary layers – Displacement, momentum and energy thickness – Momentum integral equation – Applications – Separation of boundary layer – Drag and Lift forces.

UNIT V GEOLOGICAL CONSIDERATIONS AND GEOHAZARDS **9**

Geological conditions necessary for designing and construction of important structures: Dams, Reservoirs, Tunnels, Road cuttings and Coastal protection; Landslides: Causes and mitigation; Earthquakes & Tsunamis: Causes and mitigation; Case studies for the above topics.

TOTAL: 45 PERIODS

COURSE OUTCOMES

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

CO1: Explain about Earth's structure, earthquakes, and landforms for Civil Engineering.

CO2: Explore rocks and minerals used in construction and road building, and test rocks for foundations.

CO3: Apply knowledge of geological structures and rock properties to solve basic problems in civil engineering.

CO4: Demonstrate the practical use of mapping, remote sensing, geophysical surveys, and borehole techniques in engineering site assessment.

CO5: Implement geological knowledge for designing structures and managing hazards like earthquakes and landslides**.**

TEXT BOOKS

1. Parbin Singh, “A Textbook of Engineering and General Geology”, S. K. Kataria and Sons, 2021.
2. Chenna Kesavulu, N. “Textbook of Engineering Geology”, Macmillan India Ltd., 2018.
3. Venkat Reddy, D. “Engineering Geology”, Vikas Publishing House Pvt. Lt, 2021.

REFERENCE BOOKS

1. Legget, “Geology and Engineering”, McGraw Hill Book company, 1998 Blyth,“Geology for Engineers”, ELBS 1995.
2. Krynine and Judd, “Principals of Engineering Geology and Geotechnics” Tata McGraw Hill, New Delhi, 2018.
3. Bell, F.G. “Fundamentals of Engineering Geology”, B.S. Publications. Hyderabad, 2011.
4. Gokhale, K.V.G.K, "Principles of Engineering Geology", B.S. Publications, Hyderabad 2019.
5. Varghese, P.C., “Engineering Geology for Civil Engineering”, Prentice Hall of India,Learning Private Limited, New Delhi, 2012.

Mapping of COs, 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	2	2
CO2	2	2	2	-	-	2	2	-	-	-	-	2	2	2
CO3	2	2	2	-	-	2	2	-	-	-	-	2	2	2
CO4	2	2	2	-	-	2	2	-	-	-	-	2	2	2
CO5	2	2	2	-	-	2	2	-	-	-	-	2	2	2
AVG	2	2	2	-	-	2	2	-	-	-	-	2	2	2

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

24CEPE02 AIR AND NOISE POLLUTION **L T P C**
3 0 0 3

COURSE OBJECTIVES

- To impart knowledge on the sources, effects and control techniques of air pollutants and noise pollution.
- To know the dispersion of air pollutants, control of particulate pollutants and control of gaseous pollutant.
- To impart knowledge on the control of vehicular, indoor air and noise pollution.

UNIT I GENERAL **9**

Atmosphere as a place of disposal of pollutants – Air Pollution – Definition - Air Pollution and Global Climate - Units of measurements of pollutants - Air quality criteria - emission standards - National ambient air quality standards - Air pollution indices - Air quality management in India.

UNIT II SOURCES, CLASSIFICATION AND EFFECTS **9**

Sources and classification of air pollutants - Man made - Natural sources - Type of air pollutants - Pollution due to automobiles - Analysis of air pollutants - Chemical, Instrumental and biological methods. Air pollution and its effects on human beings, plants and animals - Economic effects of air pollution - Effect of air pollution on meteorological conditions - Changes on the Meso scale, Micro scale and Macro scale.

UNIT III SAMPLING, METEOROLOGY AND AIR QUALITY MODELLING **9**

Sampling and measurement of particulate and gaseous pollutants - Ambient air sampling - Stack sampling. Environmental factors - Meteorology - temperature lapse rate and stability – Adiabatic lapse rate - Windrose - Inversion – Wind velocity and turbulence - Plume behavior - Dispersion of air pollutants- Air Quality Modeling.

UNIT IV AIR POLLUTION CONTROL MEASURES **9**

Control - Source correction methods - Control equipment's - Particulate control methods – Bag house filter - Settling chamber - cyclone separators - inertial devices - Electrostatic precipitator

- scrubbers - Control of gaseous emissions - Absorption - Absorption equipment - adsorption and combustion devices (Theory and working of equipment only).

UNIT V NOISE POLLUTION AND ITS CONTROL **9**

Sources of noise – Units and Measurements of Noise - Characterization of Noise from Construction, Mining, Transportation and Industrial Activities, Airport Noise – General Control Measures – Effects of noise pollution – auditory effects, non-auditory effects. Noise Menace– Prevention and Control of Noise Pollution – Control of noise at source, control of transmission, protection of exposed person - Control of other types of Noise Sound Absorbent.

TOTAL: 45 PERIODS

COURSE OUTCOMES

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

CO1: Explore the various types and sources of air pollution and its effects.
CO2: Explain the dispersion of air pollutants and their modeling.
CO3: Summarize the principles and design of control of particulate pollutants.
CO4: Apply principles of gaseous pollutant control to design effective pollution mitigation systems.
CO5: Examine and evaluate the sources, impacts, and control strategies of vehicular, indoor air, and noise pollution.

TEXT BOOKS

1. C. S. Rao, “Environmental Pollution Control Engineering”, Wiley Eastern Limited, 2006.
2. M. N. Rao, H. V. N. Rao, Air pollution, Tata McGraw Hill Pvt Ltd, New Delhi, 2017
3. Dr. Y. Anjaneyulu, “Air Pollution and Control Technologies”, Allied publishers Pvt. Ltd., 2019.

REFERENCE BOOKS

1. Noel De Nevers, "Air pollution control Engineering", McGraw Hill International Edition, McGraw Hill Inc, New Delhi, 2000.
2. Peterson and E.Gross Jr., “Hand Book of Noise Measurement”, 7th Edition, 1974.
3. Mukherjee, "Environmental Pollution and Health Hazards", causes and effects, 1986.
4. Antony Milne, “Noise Pollution: Impact and Counter Measures”, David & Charles PLC, 1979.
5. Kenneth wark, Cecil F.Warner, “Air Pollution its Origin and Control”, Harper and Row Publishers, New York, 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	2	3	3	2	-	3	3	3	-	-	-	2	2	3
CO2	2	3	3	2	-	3	3	3	-	-	-	2	2	3
CO3	2	3	3	2	-	3	3	3	-	-	-	2	2	3
CO4	2	3	3	2	-	3	3	3	-	-	-	2	2	3
CO5	2	3	3	2	-	3	3	3	-	-	-	2	2	3
AVG	**2**	**3**	**3**	**2**	**-**	**3**	**3**	**3**	**-**	**-**	**-**	**2**	**2**	**3**

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

24CEPE03 REMOTE SENSING AND GIS **L T P C**
3 0 0 3

COURSE OBJECTIVES

- To introduce the concepts of remote sensing processes and its components.
- To expose the various remote sensing platforms and sensors.
- To impart the knowledge on basic components of GIS.

UNIT I REMOTE SENSING AND ELECTROMAGNETIC RADIATION **9**

Definition – components of RS – History of Remote Sensing – Merits and demerits of data collation between conventional and remote sensing methods - Electromagnetic Spectrum – Radiation principles - Wave theory, Planck's law, Wien's Displacement Law, Stefan's Boltzmann law, Kirchoff's law – Radiation sources: active & passive - Radiation Quantities.

UNIT II EMR INTERACTION WITH ATMOSPHERE AND EARTH MATERIAL **9**

of radiation with atmosphere – Scattering, absorption and refraction – Atmospheric windows - Energy balance equation – Specular and diffuse reflectors – Spectral reflectance & emittance – Spectroradiometer – Spectral Signature concepts – Typical spectral reflectance curves for vegetation, soil and water – solid surface scattering in microwave region.

UNIT III ORBITS AND PLATFORMS **9**

Relationship Between Sustainability and Smart planning - Place making project guidelines Surveillance, Smart Street Lighting, Intelligent Emergency Services, Intelligent Disaster Forecasting and Management, GIS-based Spatial Decision Support Systems, Smart Communication Services.

UNIT IV FUNDAMENTALS OF GIS **9**

Introduction to GIS - Basic spatial concepts - Coordinate Systems - GIS and Information Systems – Definitions – History of GIS - Components of a GIS – Hardware, Software, Data, People, Methods – Proprietary and open source Software - Types of data – Spatial, Attribute data- types of attributes – scales/ levels of measurements.

UNIT V SPATIAL DATA MODELS **9**

Database Structures – Relational, Object Oriented – Entities – ER diagram - data models - conceptual, logical and physical models - spatial data models – Raster Data Structures – Raster Data Compression - Vector Data Structures - Raster vs Vector Models- TIN and GRID data models.

TOTAL:45 PERIODS

COURSE OUTCOMES

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

CO1: Explain the key concepts and laws governing remote sensing.

CO2: Describe interaction of electromagnetic radiation with the atmosphere and Earth materials.

CO3: Apply knowledge of satellite orbits and classifications to practical remote sensing scenarios.

CO4: Use fundamental GIS principles to perform basic spatial data operations.

CO5: Analyze various data model types and their applications in GIS.

TEXT BOOKS

1. Thomas M.Lillesand, Ralph W. Kiefer and Jonathan W. Chipman, Remote Sensing and Image interpretation, John Wiley and Sons, Inc, New York,2015.
2. George Joseph and C Jeganathan, Fundamentals of Remote Sensing, Third Edition Universities Press (India) Private limited, Hyderabad, 2018.
3. Kang - Tsung Chang, Introduction to Geographic Information Systems, McGraw Hill Publishing, 2nd Edition, 2011.

REFERENCE BOOKS

1. Janza, F.Z., Blue H.M. and Johnson,J.E. Manual of Remote Sensing. Vol.I, American Society of Photogrametry, Virginia, USA, 2002.
2. Verbyla, David, Satellite Remote Sensing of Natural Resources. CRC Press, 1995.
3. Paul Curran P.J. Principles of Remote Sensing. Longman, RLBS, 1988.
4. Introduction to Physics and Techniques of Remote Sensing , Charles Elachi and Jacob Van Zyl, 2006 Edition II, Wiley Publication.
5. Lo. C. P., Albert K.W. Yeung, Concepts and Techniques of Geographic Information Systems, Prentice-Hall India Publishers, 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	2	2	2	-	-	3	3	2	-	-	-	2	2	2
CO2	2	2	2	-	-	3	3	2	-	-	-	2	2	2
CO3	2	2	2	-	-	3	3	2	-	-	-	2	2	2
CO4	2	2	2	-	-	3	3	2	-	-	-	2	2	2
CO5	2	2	2	-	-	3	3	2	-	-	-	2	2	2
AVG	2	2	2	-	-	3	3	2	-	-	-	2	2	2

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

24CEPE04 CLIMATE CHANGE **L T P C**
3 0 0 3

COURSE OBJECTIVES

- To know the basics, importance of global warming
- To know the concept of mitigation measures against global warming
- To learn about the global warming and climate change

UNIT I EARTHS CLIMATE SYSTEM **9**

Role of ozone in environment ozone layer ozone depleting gases Green House Effect, Radiative effects of Greenhouses Gases Hydrological Cycle Green House Gases and Global Warming Carbon Cycle

UNIT II ATMOSPHERE AND ITS COMPONENTS **9**

Importance of Atmosphere - Physical Chemical Characteristics of Atmosphere - Vertical structure of the atmosphere- Composition of the atmosphere Atmospheric stability- Temperature profile of the atmosphere - Lapse rates - Temperature inversion - effects of inversion on pollution dispersion.

UNIT III IMPACTS OF CLIMATE CHANGE **9**

Causes of Climate change : Change of Temperature in the environment Melting of ice Pole sea level rise-Impacts of Climate Change on various sectors Agriculture, Forestry and Ecosystem Water Resources Human Health Industry, Settlement and Society Methods and Scenarios Projected Impacts for Different Regions Uncertainties in the Projected Impacts of Climate Change Risk of Irreversible Changes.

UNIT IV CLIMATE CHANGES AND ITS CAUSES **9**

Climate change and Carbon credits - CDM - Initiatives in India-Kyoto Protocol Intergovernmental Panel on Climate change - Climate Sensitivity and Feedbacks - The Montreal Protocol - UNFCCCIPCC - Evidences of Changes in Climate and Environment - on a Global Scale and in India.

UNIT V CLIMATE CHANGE AND MITIGATION MEASURES **9**

Clean Development Mechanism -Carbon Trading -examples of future Clean Technology - Biodiesel - Natural Compost - Eco-Friendly Plastic - Alternate Energy -Hydrogen - Bio-fuels - Solar Energy - Wind - Hydroelectric Power -Mitigation Efforts in India and Adaptation funding Key Mitigation Technologies and Practices-Energy Supply - Transport - Buildings-Industry Agriculture - Forestry - Carbon sequestration- Carbon capture and storage (CCS) - Municipal solid Waste (MSW) & Bio waste, Biomedical, Industrial waste International and Regional cooperation.

TOTAL: 45 PERIODS

COURSE OUTCOMES

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

CO1: Demonstrate how the threats and opportunities of predicted climate changes will influence specific sectors at global and regional scale.

CO2: Identify the relationship between atmosphere and its components.

CO3: Analyze the impacts of climate change on environment parameters.

CO4: Evaluate the scientific insights underlying the assessment reports of the IPCC, with a focus on impacts, adaptation and mitigation.

CO5: Critically evaluate the relative opportunities and needs for mitigation and adaptation (including vulnerability assessments) in a variety of sectoral contexts.

TEXT BOOKS

1. Sangam Shrestha, Mukand S. Babel and Vishnu Prasad Pandey,2014, Climate Change and Water Resources, CRC Press an imprint of the Taylor & Francis Group.
2. Velma. I. Grover “Global Warming and Climate” Change. Vol I and II. Science Publishers, 2005.
3. Dash Sushil Kumar, “Climate Change – An Indian Perspective”, Cambridge University Press India Pvt. Ltd, 2007

REFERENCE BOOKS

1. Thomas E, Lovejoy and Lee Hannah “Climate Change and Biodiversity”,TERI Publishers, 2005.
2. J.M. Wallace and P.V. Hobbs “Atmospheric Science” Elsevier / Academic Press 2006.
3. Jan C. van Dam, “Impacts of Climate Change and Climate Variability on Hydrological Regimes” Cambridge University Press, 2003.
4. Ramesh, Mridula, “The Climate Solution: India's Climate-Change Crisis and What We Can Do about It”. Hachette UK, 2018.
5. Dessler, Andrew E, “Introduction to modern climate change”, Cambridge University 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	3	2	2	3	-	-	2	-	-	-	-	2	3
CO2	2	3	2	2	3	-	-	2	-	-	-	-	2	3
CO3	2	3	2	2	3	-	-	2	-	-	-	-	2	3
CO4	2	3	2	2	3	-	-	2	-	-	-	-	2	3
CO5	2	3	2	2	3	-	-	2	-	-	-	-	2	3
AVG	2	3	2	2	3	-	-	2	-	-	-	-	2	2

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

24CEPE05 ENVIRONMENTAL HEALTH AND SAFETY **L T P C**
3 0 0 3

COURSE OBJECTIVES

- To understand the importance of EHS (Environment, Health, and Safety) in the workplace and the related laws and regulations.
- To learn about different workplace health hazards, how to assess them, and the ways to control and prevent them using safety measures and personal protective equipment (PPE).
- To understand how to ensure workplace safety through good design, safety systems, and effective emergency plans.

UNIT I INTRODUCTION **9**

Need for developing Environment, Health and Safety systems in work places- International initiatives, National Policy and Legislations on EHS in India - Regulations and Codes of Practice - Role of trade union safety representatives - Ergonomics.

UNIT II OCCUPATIONAL HEALTH AND HYGIENE **10**

Definition of occupational health and hygiene - Categories of health hazards – Exposure pathways and human responses–Exposure Assessment-occupational exposure limits - Hierarchy of control measures - Role of personal protective equipment and the selection criteria

UNIT III WORKPLACE SAFETY AND SAFETY SYSTEMS **11**

Features of Satisfactory and Safe design of work premises – good housekeeping - lighting and colour, Ventilation and Heat Control, Noise, Chemical and Radiation Safety – Electrical Safety – Fire Safety – Safety at Construction sites, ETP – Machine guarding – Process Safety, Working at different levels.

UNIT IV HAZARDS AND RISK MANAGEMENT **8**

Safety appraisal – Job Safety Analysis-Control techniques – plant safety inspection – Accident investigation - Analysis and Reporting – Hazard and Risk Management Techniques –Onsite and Offsite emergency Plans. Employee Participation- Education and Training- Case Studies.

UNIT V ENVIRONMENTAL HEALTH AND SAFETY MANAGEMENT **7**

Concept of Environmental Health and Safety Management – Elements of Environmental Health and Safety Management Policy and implementation and review – ISO 45001-Strucure and Clauses-Case Studies.

TOTAL: 45 PERIODS

COURSE OUTCOMES

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

CO1: Explore the need for EHS in workplaces and the laws related to safety in India and worldwide.

CO2: Explain the health risks at work and how to assess and control them using safety equipment.

CO3: Learn how to make workplaces safe, including fire safety, chemical handling, and overall safety systems.

CO4: Learn how to effectively prepare emergency response plans and conduct thorough accident investigations.

CO5: Explain the components of an EHS Management System and how it supports the implementation of safety standards and practices.

TEXT BOOKS

1. Dr. K.U. Mistry, Fundamentals of Industrial Safety and Health, Siddharth Prakashan., 2012.
2. Brian Gallant, The Facility Manager's Guide to Environmental Health and Safety, Government Inst Publ, 2002.
3. Bill Taylor, Effective Environmental, Health, and Safety Management Using the Team Approach, Culinary and Hospitality Industry Publications Services, 2005.

REFERENCE BOOKS

1. M. S. S. Rao, Occupational Health and Safety for the 21st Century, Wiley India Pvt. Ltd, 2011
2. Sivasubramanium K., Water Management SIMRES Publication, Chennai 2009.
3. Korten F.F and Robert Y. Siy, Jr. Transforming a Bureaucracy – The experience of the Philippines National Irrigation Administration, Ateneo De Manila University Press, Manila, 1989.
4. Michael C.M., Putting people first, Sociology variables in Rural Development, Oxford University press, London 1985
5. Ott, W.R., “Environmental indices, Theory and Practice”, Ann Arbor, 1978.

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

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

24CEPE06 CONTRUCTION MATERIALS FOR SUSTAINABLE FUTURE **L T P C 3 0 0 3**

COURSE OBJECTIVES

- To learn about different building materials, their types, uses, and testing procedures.
- To understand the use of materials in a way that saves energy and reduces waste.
- To introduce sustainable construction methods and environmental evaluation tools, focusing on energy-efficient materials, life cycle analysis, and green building standards.

UNIT I TRADITIONAL BUILDING MATERIALS AND MASONRY UNITS **9**

Stone as a building material, its selection criteria, testing, deterioration, and preservation techniques. Bricks – classification, manufacturing of clay bricks, essential tests (compressive strength, water absorption, efflorescence), and special bricks like refractory bricks. Concrete blocks, including cement and lightweight concrete blocks, are introduced as alternatives in masonry construction.

UNIT II BINDERS, AGGREGATES, AND MORTARS **9**

Lime and lime mortar preparation. Cement – ingredients, manufacturing, types, grades, and key properties such as hydration, compressive and tensile strength, fineness, soundness, and setting time. Cement mortar and the role of industrial by-products like fly ash. Aggregates – types, properties (crushing strength, impact strength, flakiness, elongation, abrasion resistance), grading, and sand bulking.

UNIT III CONCRETE, TIMBER, AND MODERN MATERIALS **9**

Concrete: Ingredients, manufacturing (RMC, batching), properties (slump, flow, strength), mix proportioning (BIS), and types (high-strength, HPC, self-compacting). Timber: Forms, industrial timber, plywood, veneer, and finishes (paints, varnishes, distempers). Modern Materials: Glass, ceramics, joint sealants, FRP, clay products, refractories, composites (laminar, fibre), geosynthetics (geomembranes, geotextiles).

UNIT IV RECYCLED MATERIALS FOR CONSTRUCTION **9**

Recycling, waste reduction, reuse of materials and buildings, sustainable building materials, alternative cement and fuels, recycled materials in concrete, reduced cement content, sustainable additives, water conservation, permeable concrete, cool concrete, UHPC, sustainable steel, insulated precast systems, engineered lumber, bio-based products, construction and demolition waste management.

UNIT V INDUSTRIAL WASTE MANAGEMENT IN CONSTRUCTION **9**

Introduction to Industrial Waste Management – Types of industrial waste (Construction and demolition waste, Excavation and earthwork waste, Packaging waste)- Hazardous waste (Plastics and polymers - Metal waste - Wood and timber waste, demolished waste, Asbestos, lead-based paints, solvents, chemicals, and oils) – Waste minimization techniques – recycling and reuse of construction materials – waste segregation and on site practices – waste to energy technologies - Sustainable Materials and Green Building Practices - Regulatory and Legal Aspects of Industrial Waste Management - Case Studies - Future Trends in Industrial Waste Management.

TOTAL:45 PERIODS

COURSE OUTCOMES

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

CO1: Classify and assess various building materials based on their properties and suitability for construction.

CO2: Conduct standard tests on materials like bricks, cement, and concrete to ensure quality.

CO3: Design appropriate mortar and concrete mixes using established standards, incorporating sustainable practices.

CO4: Implement sustainable construction methods, focusing on resource efficiency, waste reduction, and energy conservation.

CO5: Classify Industrial waste and its waste management techniques.

TEXT BOOKS

1. Rajput.R.K., "Engineering Materials", S.Chand and Company Ltd.,2008.
2. Shetty.M.S., "Concrete Technology (Theory and Practice)", S.Chand and Company Ltd.,2018.
3. “Sustainable Building Design Manual- Volume II”, Published by TERI, New Delhi, 2009.

REFERENCE BOOKS

1. Jagadish.K.S, "Alternative Building Materials Technology", New Age International, 2007.
2. Gambhir. M.L., & Neha Jamwal., "Building Materials, products, properties and systems", Tata McGraw Hill Educations Pvt. Ltd, New Delhi, 2012.
3. Osman Attmann, “Green Architecture: Advanced Technologies and Materials”, Mc-Graw Hill, 2010.

4. Kibert, C.J., "Sustainable Construction: Green Building Design and Delivery", John Wiley & Sons, 2016.
5. Gajanan M. Sabnis "Green Building with Concrete: Sustainable Design and Construction", CRC Press, 2015.

Mapping of Cos with POs & PSOs

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

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

24CEPE07 RAINWATER HARVESTING **L T P C**
3 0 0 3

COURSE OBJECTIVES

- To understand the need and rules for water conservation and rainwater harvesting.
- To learn basics of rainfall, runoff, and groundwater.
- To develop the skills to analysis and manage effective rainwater harvesting systems.

UNIT I BASICS OF RAINWATER HARVESTING **8**

Water and its sources - Need for water conservation – Types of water demand - Conservation Methods - Global and Indian perspectives - National mission and goals towards rainwater harvesting – National water policy - Legislation on rainwater harvesting in India and Tamil Nadu.

UNIT II HYDROLOGY AND GROUND WATER **10**

Hydrological cycle – Precipitation - Rainfall measurement - Rain-gauges – Hyetograph - Infiltration - Runoff estimation – Rooftop runoff estimation. Ground water - Aquifer Properties – Darcy law and well hydraulics - Steady flow.

UNIT III METHODS OF RAINWATER HARVESTING **7**

Rainwater harvesting potential of an area - Traditional harvesting practices – Rooftop harvesting - Methods of RWH structures – Site selection for rainwater harvesting - Surface runoff Harvesting - Ground water recharge - Artificial recharge.

UNIT IV DESIGN OF RAINWATER HARVESTING STRUCTURES **10**

Design Considerations - Components of Rainwater harvesting system - Simple roof water collection system - Design of Storage structure - Design of Recharge structures – Recharge pit

- Recharge trench - Recharge well - Gully plug - Contour bund - Percolation tank - Check dam - Recharge shaft - Efficiency of RWH system.

UNIT V MANAGEMENT OF RWH AND CASE STUDIES **10**

Difficulties in RWH - At catchment level - At household level - Evaluation of RWH systems – Maintenance of RWH structures - Modernisation of RWH system - Case studies on best practice of RWH in urban - Success stories of Contemporary practices of RWH in India.

TOTAL: 45 PERIODS

COURSE OUTCOMES

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

CO1: Explain the importance of water conservation and rainwater harvesting policies.
CO2: Explore rainfall, runoff, and groundwater concepts.
CO3: Identify suitable methods for rainwater harvesting in different areas.
CO4: Design basic rainwater harvesting and recharge structures.
CO5: Evaluate and maintain rainwater harvesting systems using real-life examples.

.

TEXT BOOKS

1. H.M Raghunath “Ground Water” 3rd Edition, New Age International, 2007.
2. Jayarami Reddy.P, “A Text book of Hydrology” Firewall media Publication, 2005.
3. Ramakrishnan S, “Ground Water”, Scitech Publications (India) Pvt Ltd, 2010.

REFERENCE BOOKS

1. Subramanya.K. "Engineering Hydrology", 5th Edition, McGraw Hill, 2020.
2. C.P.R. Environmental Education Centre. Traditional Water Harvesting Systems of India,Chennai, India, 2004.
3. Ministry of Water and Environment, Uganda. Handbook on Rainwater Harvesting Storage Options, 2015.
4. Central Ground Water Board. Rain Water Harvesting Techniques to Augment Ground Water. Ministry of Water Resources, Faridabad. 2003.
5. Ott, W.R., “Environmental indices, Theory and Practice”, Ann Arbor, 1978.

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

1-Low, 2-Medium, 3-High, “-” – No correlation

24CEPE08 GROUNDWATER ENGINEERING **L T P C**
3 0 0 3

COURSE OBJECTIVES

- To understand hydrogeological parameters and their role in groundwater flow.
- To gain knowledge of well hydraulics and methods for analyzing groundwater movement.
- To learn techniques for groundwater management, conservation, and quality assessment.

UNIT I HYDROGEOLOGICAL PARAMETERS **9**

Introduction – Water bearing Properties of Rock – Type of aquifers - Aquifer properties – permeability, specific yield, transmissivity and storage coefficient – Methods of Estimation – GEC norms - Steady state flow - Darcy's Law - Groundwater Velocity –- Dupuit Forchheimer assumption – Steady Radial Flow into a Well**.**

UNIT II WELL HYDRAULICS **9**

Unsteady state flow - Theis method - Jacob method – Chow's method – Law of Times – Theis Recovery – Bailer method – Slug method - tests - Image well theory – Partial penetrations of wells - Well losses – Specific Capacity and Safe yield - Collector well and Infiltration gallery**.**

UNIT III GROUNDWATER MANAGEMENT **9**

Need for Management Model – Database for Groundwater Management – Groundwater balance study – Introduction to Mathematical model – Model Conceptualization – Initial and Boundary Condition – Calibration – Validation – Future Prediction – Sensitivity Analysis – Uncertainty – Development of a model**.**

UNIT IV GROUNDWATER QUALITY **9**

Ground water chemistry - Origin, movement and quality - Water quality standards – Drinking water Industrial water – Irrigation water - Groundwater Pollution and legislation - Environmental Regulatory requirements.

UNIT V GROUNDWATER CONSERVATION **9**

Artificial recharge techniques – Reclaimed wastewater recharge – Soil aquifer treatment (SAT) – Aquifer Storage and Recovery (ASR) Seawater Intrusion and Remediation – Ground water Basin management and Conjunctive use – Protection zone delineation, Contamination source inventory and remediation schemes.

TOTAL: 45 PERIODS

COURSE OUTCOMES

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

CO1: Define the groundwater system basic, types of aquifers, aquifer parameters, movement and its potential for confined and unconfined aquifers.

CO2: Apply the knowledge of groundwater flow in steady and unsteady flow characteristics of well hydraulics.
CO3: Explain the concept of groundwater model development and data base management for groundwater management.
CO4: Describe the importance of artificial recharge and groundwater quality concepts.
CO5: Apply the creative and innovative technique on conservation of groundwater.

TEXT BOOKS

1. Raghunath H.M., "Ground Water Hydrology", New Age International (P) Limited, New Delhi,2010.
2. Todd D.K., "Ground Water Hydrology", John Wiley and Sons, New York,2000.
3. Ramakrishnan, S, Ground Water, K.J. Graph arts, Chennai, 1998.

REFERENCE BOOKS

1. Fitts R Charles, "Groundwater Science". Elsevier, Academic Press,2002.
2. Chahar BR, Groundwater hydrology, McGraw Hill Education (India) Pvt Ltd, New Delhi, 2015.
3. RastogiA.K. , Numerical Groundwater Hydrology,2011
4. Fried, J.J., "Ground Water Pollution", Elsevier, 1975.
5. Ott, W.R., "Environmental indices, Theory and Practice", Ann Arbor, 1978.

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

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

24CEPE09 URBAN PLANNING AND DEVELOPMENT **L T P C**
3 0 0 3

COURSE OBJECTIVES

- To enable students to have the knowledge on planning process.
- To introduce to the students about the planning regulations.
- To develop knowledge on laws related to Urban Planning

UNIT I INTRODUCTION **9**

Definition of Human settlement, Urban area, Town, City, Metropolitan City, Megalopolis, Urbanisation, Urbanism, Suburbanisation, Urban sprawl, Peri-urban areas, Central Business District (CBD), Urban Agglomeration, Census definition of urban settlements, Classification

of urban areas –Positive and negative impacts of urbanisation, - Atal Mission for Rejuvenation and Urban Transformation (AMRUT).

UNIT II PLANNING PROCESS AND THEORIES **9**

Principles of Planning –Stages in Planning Process – Goals, Objectives, Delineation of Planning Areas, Draft Plans, Evaluation, Final Plan. Planning Theories - Garden City Concept, Geddesian Triad by Patrick Geddes, Modernism Concept by Le-Corbusier, Radbun Concept, Neighbourhoods, Theories of Ekistics, Bid-rent Theory by William Alonso, Green Belt Concept.

UNIT III DEVELOPMENT PLANS, PLAN FORMULATION AND EVALUATION **9**

Types of plans – Regional Plan, Master Plan, Structure Plan, Detailed Development Plan, New Town/ Satellite town- Development Plan, urban nodes, Smart City Plan -Scope and Content of Regional Plan (RP), Master Plan (MP), and the Detailed Development Plan (DDP), Methodologies for the preparation of the RP, MP, and the DDP – Case Studies.

UNIT IV PLAN IMPLEMENTATION **9**

Planning Standards, Project Formulation and evaluation; Project Report preparation and presentation; Legal, Financial and Institutional constraints – Problems due to multiple laws, rules and institutions; Financing of Urban Development Projects; Urban planning agencies and their functions in the plan formulation and implementation.

UNIT V URBAN AND REGIONAL PLANNING LEGISLATIONS, REGULATIONS AND DESIGNS **9**

Town and Country Planning, Local Bodies and Land Acquisition Acts, Development and Building Rules, Site analyses, Layouts and Buildings Design.

TOTAL:45 PERIODS

COURSE OUTCOMES

On Successful completion of this course, the student will able to

CO1: Describe basic issues in urban planning.
CO2: Formulate plans for urban and rural development.
CO3: Acquire knowledge to develop and formulation of urban plans.
CO4: Design of urban development projects
CO5: Manage urban development projects.

TEXT BOOKS

1. Goel, S.L Urban Development and Management, Deep and Deep publications, New Delhi 2002.
2. George Chadwick, A Systems view of planning, Pergamon press, Oxford 1978.
3. Singh V.B, Revitalised Urban Administration in India, Kalpaz publication, Delhi, 2001.

REFERENCE BOOKS

1. Tamil Nadu Town and Country Planning Act 1971, and Rules made thereunder, Government of Tamil Nadu, Chennai.
2. Thooyavan, K.R., Human Settlements – A Planning Guide to Beginners, M.A Publications, Chennai, 2005.
3. Chennai City Municipal Corporation Act, 1919 and Tamil Nadu District Municipalities Act, 1920.
4. The Right to Fair Compensation and Transparency in Land Acquisition, Rehabilitation and Resettlement Act, 2013.
5. The Tamil Nadu Combined Development and Building Rules, 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	2	-	-	-	3	3	2	-	-	-	2	2	2
CO2	2	2	-	-	-	3	3	2	-	-	-	2	2	2
CO3	2	2	-	-	-	3	3	2	-	-	-	2	2	2
CO4	2	2	-	-	-	3	3	2	-	-	-	2	2	2
CO5	2	2	-	-	-	3	3	2	-	-	-	2	2	2
AVG	**2**	**2**	**-**	**-**	**-**	**3**	**3**	**2**	**-**	**-**	**-**	**2**	**2**	**2**

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

24CEPE10 URBAN WATER INFRASTRUCTURE **L T P C**
3 0 0 3

COURSE OBJECTIVES

- To understand urban ecosystems and hydrology.
- To design and manage urban stormwater systems.
- To promote water conservation, reuse, and governance.

UNIT I URBAN ECOSYSTEM **9**

Cities as Ecological system – hybrid ecosystem – Resilience in urban ecosystem. Human components of Ecosystem – Urban pattern and Ecosystem function. Population and Community dynamics, functions of Urban Ecosystem.

UNIT II URBANHYDROLOGY **9**

The urban hydrological cycle – Function – Human induced changes in urban watershed – Hydrological calculation – Runoff – Infiltration – hydrograph.

UNIT III URBAN STORM WATERMANAGEMENT **9**

Design of Drainage System – Roadway Drainage Analysis – Types of inlet – inlet design – Design of storm drain - Storm water management regulations - structural storm management systems – Newer trends in storm water management (Green infrastructure) – installation – operation and maintenance.

UNIT IV WATER CONSERVATION AND REUSE **9**

Trends in supply and demand – indoor conservation – outdoor conservation – water reuse – Rainwater harvesting – public education.

UNIT V WATER GOVERNANCE **9**

Challenges in water sector - Institutional setting, Supply Management, Demand Management, Waste water management – Private sector participation, urban service delivery, customer satisfaction, financial resource management – case studies of best practices in cities across the world.

TOTAL: 45 PERIODS

COURSE OUTCOMES

On Successful Completion of this course, the student will be able to

CO1: Explain various functional elements of urban ecosystem.
CO2: Calculate urban runoff, compute supply and demand of water, draw hydrograph.
CO3: Compare advantages of newer techniques of green infrastructure and illustrate benefits.
CO4: Assess the Operation and Maintenance needs of urban water systems.
CO5: Propose best management practices for Indian context.

TEXT BOOKS

1. Anand Chiplunkar, K Seetharam and Cheon Kheong (ed), "Good Practices in urban water management" ADB, National University Singapore,2012.
2. Marina Alberti, "Advances in Urban Ecology", Springe R, 2008.
3. Mohammad Karamouz, Ali Moridi, Sara Nazif, Urban Water Engineering and Management, 1st Edition, CRC Press, 2010.

REFERENCE BOOKS

1. Hormoz Pazwash, "Urban storm water management", CRC Press, 2016.
2. Larry W. Mays, Urban Stormwater Management Tools, McGraw-Hill Companies, 2004.
3. J Parkinson, O Mark Urban Stormwater Management in Developing Countries, IWA Publishing, 2005.
4. Monzur A. Imteaz , Urban Water Resources, CRC Press, 2019.
5. Michael A.M., Irrigation Theory and Practice, 2nd Edition, Vikas Publishing House Pvt. Ltd., Noida, Up, 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	3	2	-	-	-	3	-	-	-	-	2	3	2
CO2	3	3	2	-	-	-	3	-	-	-	-	2	3	2
CO3	3	3	2	-	-	-	3	-	-	-	-	2	3	2
CO4	3	3	2	-	-	-	3	-	-	-	-	2	3	2
CO5	3	3	2	-	-	-	3	-	-	-	-	2	3	2
AVG	3	3	2	-	-	-	3	-	-	-	-	2	3	2

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

24CEPE11 SMART CITY **L T P C**
3 0 0 3

COURSE OBJECTIVES

- To help the students to understand the concepts of smart city.
- To introduce the students about application of technologies in smart cities.
- To develop knowledge on Smart cities management.

UNIT I INTRODUCTION **6**

Urbanisation, need of focused development, role of Authorities, Smart city, Opportunity and Challenges- Smart infrastructures for city- Smart Cities Mission.

UNIT II SMART PHYSICAL INFRASTRUCTURE **12**

Infrastructure development in Smart Cities - Physical Infrastructure, Land Use - Compact/mixed-use development, Transit oriented development (TOD); Smart City Management-Transportation Unified governance structure (UMTA). Smart public transportation, Smart parking, Intelligent traffic management, Detour management; Low emission vehicles, Electric Mobility - Environmental projects etc.

UNIT III SUSTAINABILITY AND SMART PLANNING **10**

Relationship Between Sustainability and Smart planning - Place making project guidelines Surveillance, Smart Street Lighting, Intelligent Emergency Services, Intelligent Disaster Forecasting and Management, GIS-based Spatial Decision Support Systems, Smart Communication Services.

UNIT IV APPLICATION OF TECHNOLOGIES IN SMART CITIES **8**

Role of Technologies in Smart Cities - Integrated Command and Control Center (ICCC), Data Analytics, Data driven strategies implementation in smart cities.

UNIT V SMART CITIES PROJECT MANAGEMENT **9**

Need for project management, Philosophy and concepts; Project phasing and stages; Project organizational structuring: Planning and Scheduling: Project cost analysis; Procurement and Contracting: PPP: Project Monitoring and Evaluation: Risk Management; Case studies.

TOTAL:45 PERIODS

COURSE OUTCOMES

On Successful completion of this course, the student will able to

CO1: Explore the basics of Urbanization and the role of smart cities.
CO2: Gain knowledge on implementation of smart physical infrastructure.
CO3: Explain the role of smart planning for sustainable development.
CO4: Comprehend the knowledge of Technologies in Smart City planning.
CO5: Reviewing the case studies of smart city projects.

TEXT BOOKS

1. Barlow, M., & Levy-Bencheton, C.. The smart city: Innovation, technology, and sustainability, 2017.
2. Coutard, O., & Rutherford, J. (Eds.). (nd.). Smart cities: A spatialised intelligence Rutherford.
3. Townsend, A. M. (2013). Smart cities: Big data, civic hackers, and the quest for a newutopia. W.W. Norton & Company, 2017.

REFERENCE BOOKS

1. P Sharma , "Sustainable Smart cities in India, Challenges and Future Perspectives", Springer Link, 2017.
2. Sameer Sharma,"Smart Cities Unbounded- Ideas and Practice of Smart Cities in India", Bloomsbury India, 2018.
3. Binti Singh, Manoj Parmar, "Smart City in India Urban Laboratory, Paradigm or Trajectory Routledge India,2019
4. R. K. Mishra, Samanta Sahu, P. Srinivas Rao – Smart Cities: Concepts, Practices, and Applications, Springer, 2021.
5. Vinod Kumar T. M. – Smart Global Megacities: Sustainable, Resilient, and Safe, Elsevier, 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	-	-	-	-	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

24CEPE12 INTELLIGENT TRANSPORT SYSTEM **L T P C**
3 0 0 3

COURSE OBJECTIVES

- To learn the fundamentals of Intelligent Transportation Systems.
- To study the Intelligent Transportation Systems functional areas.
- To have an overview of Intelligent Transportation Systems implementation in developing countries

UNIT I INTRODUCTION TO ITS **9**

Fundamentals of ITS: Definition of ITS, Challenges in ITS Development-Purpose of ITS Deployment- Benefits of ITS- Overview of application of ITS in Transportation Planning.

UNIT II DATA COLLECTION THROUGH ITS **9**

Sensors & its application in traffic data collection - Elements of Vehicle Location and Route Navigation and Guidance concepts; ITS Data collection techniques – vehicle Detectors, Automatic Vehicle Location (AVL), Automatic Vehicle Identification (AVI), GIS, RFID, video data collection, Internet of Things (IOT).

UNIT III ITS IN TRAFFIC MANAGEMENT **9**

ITS User Needs and Services and Functional areas –Introduction, Advanced Traffic Management systems (ATMS), Advanced Traveler Information systems (ATIS), Advanced Vehicle Control systems (AVCS), Advanced Public Transportation systems (APTS), Advanced Rural Transportation systems (ARTS)- Autonomous Vehicles- Autonomous Intersections.

UNIT IV ITS IN TRANSPORTATION PLANNING **9**

ITS and safety, ITS and security- Traffic and incident management systems; ITS and sustainable mobility, travel demand management, electronic toll collection, ITS and road-pricing.; Transportation network operations – public transportation applications- Weight –in Motion.

UNIT V ITS APPLICATION IN LOGISTICS **9**

Commercial vehicle operations and intermodal freight-Fleet Management- IT application in freight logistics-E commerce.

TOTAL:45 PERIODS

COURSE OUTCOMES

On Successful completion of this course, the student will able to

CO1: Explain the fundamentals of ITS and its benefits.
CO2: Gain knowledge on data collection using sensors and its applications.
CO3: Explore with the application of ITS in traffic management.
CO4: Apply the concept of ITS in Transportation Planning.
CO5: Gain knowledge on application of ITS in Logistics

TEXT BOOKS

1. R. Srinivasa Kumar, “Intelligent Transportation Systems”, Universities Press P Ltd, Telangana, 2022.
2. Intelligent Transport Systems, Intelligent Transportation Primer, Washington, US,2001.
3. Henry F.Korth, and Abraham Siberschatz, Data Base System Concepts, McGraw Hill,1992.

REFERENCE BOOKS

1. TurbanE.,”Decision Support and Export Systems Management Support Systems", Maxwell Macmillan,1998.
2. Sitausu S. Mittra, "Decision Support Systems–Tools and Techniques", John Wiley, New York,1986.
3. Cycle W.Halsapple and Andrew B.Winston, "Decision Support Systems–Theory and Application“, Springer Verlog, New York, 1987.
4. ITS Hand Book 2000: Recommendations for World Road Association (PIARC) by Kan Paul Chen, John Miles.
5. Smaili. A and Mrad. F, “Mechatronics Integrated Technologies for Intelligent Machines”, Oxford University Press, 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	2	2	-	-	-	3	3	2	-	-	-	2	2	2
CO2	2	2	-	-	-	3	3	2	-	-	-	2	2	2
CO3	2	2	-	-	-	3	3	2	-	-	-	2	2	2
CO4	2	2	-	-	-	3	3	2	-	-	-	2	2	2
CO5	2	2	-	-	-	3	3	2	-	-	-	2	2	2
AVG	**2**	**2**	**-**	**-**	**-**	**3**	**3**	**2**	**-**	**-**	**-**	**2**	**2**	**2**

1-Low, 2-Medium, 3-High, “-” – No correlation

24CEPE13 PRINCIPLE OF BUILDING PLANNING AND APPROVAL PROCEDURES

L	T	P	C
3	0	0	3

COURSE OBJECTIVES

- To provide foundational knowledge of the principles involved in building planning, including functionality, safety, aesthetics, and sustainability.
- To familiarize students with site analysis, building codes, and zoning laws that influence architectural design and land use.
- To explain the processes and requirements involved in obtaining building permits and statutory approvals from regulatory authorities.

UNIT I INTRODUCTION TO BUILDING PLANNING **9**

Objectives and importance of building planning -Fundamental principles (e.g., utility, economy, aesthetics) - Classification of buildings (residential, commercial, industrial, institutional) - Basic terminologies in building design- Role of building codes and regulations.

UNIT II SITE SELECTION AND ANALYSIS **9**

Factors affecting site selection - Site survey and soil investigation - Orientation and climate considerations - Zoning regulations and land use - Topography, access, and utilities

UNIT III BUILDING BYELAWS AND REGULATIONS **7**

Introduction to building byelaws - Floor Area Ratio (FAR), setbacks, height restrictions - Open space requirements, lighting, and ventilation norms - National Building Code (NBC) and local authority guidelines - - Fire safety, accessibility, and green building norms

UNIT IV BUILDING APPROVAL PROCESS **11**

Stages of building approval - Submission of drawings and documents - Role of statutory bodies and municipal corporations - Legal procedures, NOCs, and clearances -Common issues in the approval process and mitigation.

UNIT V SUSTAINABLE AND SMART BUILDING PRACTICES **9**

Green building concepts and certifications (e.g., LEED, GRIHA) - Smart building technologies and automation - Environmental impact assessment (EIA) - Energy efficiency and water conservation-Integration of sustainability in planning and approval.

TOTAL:45 PERIODS

COURSE OUTCOMES

On Successful completion of this course, the student will able to

CO1: Plan buildings using standard design principles.
CO2: Assess site suitability based on key factors.
CO3: Apply building byelaws and codes.
CO4: Prepare documents for approval.
CO5: Promote sustainable and smart building practices.

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

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

24CEPE14 CONSTRUCTION PLANNING, SCHEDULING AND CONTROL **L T P C 3 0 0 3**

COURSE OBJECTIVE

- To develop construction plans, define work tasks, and estimate resources and durations.
- To apply scheduling techniques like critical path method and resource-based scheduling.
- To implement cost control, quality control, and safety measures during construction.

UNIT I CONSTRUCTION PLANNING **9**

Basic concepts in the development of construction plans-Choice of Technology and Construction method-Defining Work Tasks- Work breakdown structure- Definition-Precedence relationships among activities-Estimating Activity Durations-Estimating Resource Requirements for work activities-coding systems.

UNIT II SCHEDULING PROCEDURES AND TECHNIQUES **9**

Relevance of construction schedules-Bar charts - The critical path method-Calculations for critical path scheduling-Activity float and schedules-Presenting project schedules-Critical path scheduling for Activity-on-node and with leads, Lags and Windows-Calculations for scheduling with leads, lags and windows-Resource oriented scheduling-Scheduling with resource constraints and precedences -Use of Advanced Scheduling Techniques-Scheduling with uncertain durations- Crashing and time/cost tradeoffs -Improving the Scheduling process – Introduction to application software.

UNIT III COST CONTROL MONITORING AND ACCOUNTING **9**

The cost control problem-The project budget-Forecasting for Activity cost control - financial accounting systems and cost accounts-Control of project cash flows-Schedule control-Schedule and Budget updates-Relating cost and schedule information.

UNIT IV QUALITY CONTROL AND SAFETY DURING CONSTRUCTION **9**

Quality and safety Concerns in Construction-Organizing for Quality and Safety-Work and Material Specifications-Total Quality control-Quality control by statistical methods -Statistical Quality control with Sampling by Attributes-Statistical Quality control by Sampling and Variables-Safety.

UNIT V ORGANIZATION AND USE OF PROJECT INFORMATION **9**

Types of project information-Accuracy and Use of Information-Computerized organization and use of Information - Organizing information in databases-relational model of Data bases-Other conceptual Models of Databases-Centralized database Management systems-Databases and application programs-Information transfer and Flow.

TOTAL: 45 PERIODS

COURSE OUTCOMES

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

CO1: Learn to create construction plans, define tasks, and estimate activity durations.

CO2: Master scheduling methods, including critical path and resource-oriented scheduling.

CO3: Explain cost control, budget forecasting, and schedule management.

CO4: Apply quality control and safety standards during construction.

CO5: Organize and manage project information using databases and computer systems.

TEXT BOOKS

1. P. K. Jain, "Project Planning and Control with PERT and CPM," Khanna Publishers, New Delhi, 2011.
2. Chitkara, K.K. “Construction Project Management Planning”, Scheduling and Control, Tata McGraw Hill Publishing Co., New Delhi, 2009
3. Srinath,L.S., “Pert and CPM Principles and Applications“, Affiliated East West Press, 2001

REFERENCE BOOKS

1. Chris Hendrickson and Tung Au, “Project Management for Construction – Fundamentals Concepts for Owners”, Engineers, Architects and Builders, Prentice Hall, Pitsburgh, 2000.
2. Moder.J., Phillips. C. and Davis E, “Project Management with CPM”, PERT and Precedence Diagramming, Van Nostrand Reinhold Co., 8th Edition, 2020.
3. Willis., E.M., “Scheduling Construction projects”, John Wiley and Sons, 1986
4. Halpin,D.W., “Financial and Cost Concepts for Construction Management”, John Wiley and Sons, New York, 2020.

5. R. S. P. Gahlot, "Construction Management and Planning," McGraw Hill Education, New Delhi, 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	3	2	-	2	3	2	3	2	3	2
CO2	3	3	2	2	3	2	-	2	3	2	3	2	3	2
CO3	3	3	2	2	3	2	-	2	3	2	3	2	3	2
CO4	3	3	2	2	3	2	-	2	3	2	3	2	3	2
CO5	3	3	2	2	3	2	-	2	3	2	3	2	3	2
AVG	**3**	**3**	**2**	**2**	**3**	**2**	**-**	**2**	**3**	**2**	**3**	**2**	**3**	**2**

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

24CEPE15 CONTRACT LAWS AND REGULATION **L T P C**
3 0 0 3

COURSE OBJECTIVES

- To provide an understanding of construction contracts, including their types, elements, and legal frameworks.
- To familiarize students with tendering processes, contract formation, and evaluation techniques in construction projects.
- To explore the principles of arbitration, legal requirements, and labour regulations in the construction industry.

UNIT I CONSTRUCTION CONTRACTS **9**

Indian Contracts Act – Elements, types and features of contracts – Suitability – Design of Contract Documents – International Contract Document – Standard Contract Document – Law of Torts.

UNIT II TENDERS **9**

Prequalification – Bidding – Accepting – Evaluation of Tender from Technical, Contractual and Commercial perspectives – Contract Formation and Interpretation – Potential Contractual Problems – World Bank Procedures and Guidelines – Tamilnadu Transparency in Tenders Act.

UNIT III ARBITRATION **9**

Comparison of Actions and Laws – Agreements – Appointment of Arbitrators – Conditions of Arbitration – Powers and Duties of Arbitrator – Rules of Evidence – Enforcement of Award – Costs.

UNIT IV LEGAL REQUIREMENTS **9**

Insurance and Bonding – Laws Governing Sale, Purchase and Use of Urban and Rural Land – Land Revenue Codes – Tax Laws – Income Tax, Sales Tax, Excise and Custom Duties and

their Influence on Construction Costs – Legal Requirements for Planning – Property Law – Agency Law – Local Government Laws for Approval – Statutory Regulations.

UNIT V LABOUR REGULATIONS **9**

Social Security – Welfare Legislation – Laws relating to Wages, Bonus and Industrial Disputes, Labour Administration – Insurance and Safety Regulations – Workmen's Compensation Act – Indian Factory Act – Tamilnadu Factory Act – Child Labour Act - Other Labour Laws.

TOTAL: 45 PERIODS

COURSE OUTCOMES

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

CO1: Identify the key elements, types, and features of construction contracts, including their legal implications.

CO2: Evaluate tenders based on technical, contractual, and commercial criteria.

CO3: Explain the arbitration process, the role of arbitrators, and the enforcement of awards in resolving construction disputes.

CO4: Analyze the legal requirements related to land use, taxation, insurance, and statutory regulations in construction projects.

CO5: Apply knowledge of labour laws, welfare legislation, and safety regulations to ensure compliance in construction activities.

TEXT BOOKS

1. Chandran, R. Construction Law and Contract Management, McGraw-Hill Education, 2014.
2. Kumar, S. Construction Project Management: Planning, Scheduling, and Controlling, Pearson Education, 2011.
3. Mehta, V.K. & Mehta, R. Principles of Civil Engineering Contracts, S. Chand & Company, 2009.

REFERENCE BOOKS

1. Gajaria G.T., Laws Relating to Building and Engineering Contracts in India.
2. Jimmie Hinze, Construction Contracts, McGraw Hill, 2001.
3. Joseph T. Bockrath, Contracts and the Legal Environment for Engineers and Architects, McGraw Hill, 2000.
4. Kwaku, A., Tenah, P.E. Jose M.Guevara, P.E., Fundamentals of Construction Management and Organisation, Printice Hall, 1985.M.M. Tripathi Private Ltd., Bombay, 1982.
5. Patil. B.S, Civil Engineering Contracts and Estimates, Universities Press (India) Private Limited, 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	2	2	-	-	3	2	2	2
CO2	3	2	2	2	-	2	2	2	-	-	3	2	2	2
CO3	3	2	2	2	-	2	2	2	-	-	3	2	2	2
CO4	3	2	2	2	-	2	2	2	-	-	3	2	2	2
CO5	3	2	2	2	-	2	2	2	-	-	3	2	2	2
AVG	**3**	**2**	**2**	**2**	**-**	**2**	**2**	**2**	**-**	**-**	**3**	**2**	**2**	**2**

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

24CEPE16 ENERGY EFFICIENT GREEN BUILDING **L T P C**
3 0 0 3

COURSE OBJECTIVES

- To learn how to design buildings that adapt to or reject climate conditions.
- To understand sustainable construction methods and materials.
- To explore energy-efficient design strategies for different climates.

UNIT I CLIMATE RESPONSIVE DESIGN AND ENVIRONMENTAL IMPACTS **9**

Introduction to climate-adapted and climate-rejecting buildings. Principles of heat transfer: conduction, convection, radiation, latent and sensible heat. Thermal storage and greenhouse effect. Microclimate, site planning, and environmental factors (temperature, humidity, wind, sun path). Sun protection: shading devices and orientation. Environmental impacts of buildings: energy use, carbon emissions. Building materials: sources, production methods, transportation and maintenance energy.

UNIT II BUILDING TECHNOLOGIES AND EMBODIED ENERGY **9**

Framed and masonry construction methods. Resource-efficient and alternative materials in construction. Embodied energy in buildings and construction processes. Recycling of industrial and construction waste. Use of biomass and sustainable building resources. Green composites and their applications. Water management in buildings: low-energy use and sustainable practices. Solid waste, sullage, and sewage management in green building contexts.

UNIT III PASSIVE HEATING, COOLING, AND VENTILATION STRATEGIES **9**

Passive solar heating: direct gain, sunspaces, Trombe walls, water walls, air loops. Passive cooling: natural ventilation, courtyards, roof ponds, cool pools, wind catchers. Mass effect, zoning, load control, and air filtration. Thermal comfort and heat transfer in buildings. Ventilation principles and design for natural airflow. Low-energy cooling techniques and solar passive design – case studies.

UNIT IV DAYLIGHTING, LIGHTING SYSTEMS, AND HEAT CONTROL 9

Daylighting principles, sources, and apertures. Design strategies: light shelves, codal requirements, daylight design methods. Glazing materials and spectral response. Electric lighting integration: controls, switching, light zones, task lighting. Insulation, optical materials, radiant barriers. Heat insulation and solar radiation analysis. Thermal performance of building sections and material characteristics. Mechanical controls and thermal design for different climates.

UNIT V ENERGY-EFFICIENT DESIGN FOR CLIMATIC ZONES 9

Climate-specific design strategies: cold and cloudy, cold and sunny, composite, hot and dry, moderate, warm and humid. Passive Downdraft Evaporative Cooling (PDEC). Energy-efficient design concepts and architectural interventions. Energy audit processes and certification systems. Case studies: residential, commercial, and public buildings across climate zones.

TOTAL: 45 PERIODS

COURSE OUTCOMES

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

CO1: Explain the effect of climate and environmental factors on building construction.
CO2: Identify and use sustainable building materials and methods.
CO3: Apply passive heating, cooling, and ventilation techniques.
CO4: Use natural light effectively and reduce energy consumption.
CO5: Develop energy-efficient solutions for buildings in various climate zones.

TEXT BOOKS

1. Marian Keeler and Prasad Vaidya, Fundamentals of Integrated Design for Sustainable Building, John Wiley & Sons, 2016.
2. Low Energy Cooling for Sustainable Buildings. John Wiley and Sons Ltd, 2009.
3. Majumdar, M (Ed), Energy - Efficient Buildings in India, Tata Energy Research Institute, Ministry of Non-Conventional Energy Sources, 2009.

REFERENCE BOOKS

1. Osman Attmann Green Architecture Advanced Technologies and Materials. McGraw Hill, 2010.
2. Jerry Yudelson Green building Through Integrated Design. McGraw Hill, 2009.
3. Marian Keeler and Prasad Vaidya, Fundamentals of Integrated Design for Sustainable Building, John Wiley & Sons, 2016.
4. G.V.S. Suryanarayana, Sustainable Construction – Green Building Design and Delivery, Oxford University Press, 2013.
5. K.S.Jagadish, B. U. Venkataramareddy and K. S. Nanjundarao. Alternative Building Materials and Technologies. New Age International, 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	2	2	2	-	2	2	-	-	-	-	3	2	2
CO2	3	2	2	2	-	2	2	-	-	-	-	3	2	2
CO3	3	2	2	2	-	2	2	-	-	-	-	3	2	2
CO4	3	2	2	2	-	2	2	-	-	-	-	3	2	2
CO5	3	2	2	2	-	2	2	-	-	-	-	3	2	2
AVG	**3**	**2**	**2**	**2**	**-**	**2**	**2**	**-**	**-**	**-**	**-**	**3**	**2**	**2**

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

24CEPE17 GROUND IMPROVEMENT TECHNIQUES **L T P C**
3 0 0 3

COURSE OBJECTIVES

- To understand the scope and necessity of ground improvement methods
- To evaluate the design principles and applications of different soil modification methods.
- To develop the ability to design and implement ground improvement solutions.

UNIT I HYDRAULIC MODIFICATIONS **9**

Scope and necessity of ground improvement in Geotechnical engineering basic concepts. Drainage – Ground Water lowering by well points, deep wells, vacuum and electro-osmotic methods. Stabilization by thermal and freezing techniques - Applications.

UNIT II MECHANICAL MODIFICATIONS **9**

In-situ compaction of granular and cohesive soils, Shallow and Deep compaction methods – Sand piles – Concept, design, factors influencing compaction. Blasting and dynamic consolidation design and relative merits of various methods – Soil liquefaction mitigation methods.

UNIT III PHYSICAL MODIFICATION **9**

Preloading with sand drains, fabric drains, wick drains – theories of sand drain - Stone column with and without encased, lime stone – functions – methods of installation – design, estimation of load carrying capacity and settlement. Root piles and soil nailing – methods of installation – Design and Applications.

UNIT IV MODIFICATION BY INCLUSIONS **9**

Reinforcement – Principles and basic mechanism of reinforced earth, simple design: Synthetic and natural fiber based Geotextiles and their applications. Filtration, drainage, separation, erosion control.

UNIT V CHEMICAL MODIFICATION **9**

Grouting – Types of grout – Suspension and solution grouts – Basic requirements of grout. Grouting equipment – injection methods – jet grouting – grout monitoring – Electro – Chemical stabilization – Stabilization with cement, lime - Stabilization of expansive clays.

TOTAL: 45 PERIODS

COURSE OUTCOMES

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

CO1: Identify and evaluate the deficiencies in the deposits of the given project area and improve its characteristics by hydraulic modifications.

CO2: Improve the ground characteristics by mechanical modifications using various method and design the system.

CO3: Improve the ground characteristics by physical modifications using various method and design the system.

CO4: Improve the characteristics of soils by various reinforcement techniques and design.

CO5: Analyse the ground and decide the suitable chemical method for improving its characteristics.

TEXT BOOKS

1. Das, B.M., Principles of Foundation Engineering, Fourth Edition, PWS Publishing, 1999.
2. Day, R.W., Foundation Engineering Handbook, McGraw – Hill Companies, Inc. 2006.
3. Han,J., Principles and Practice of Ground Improvement, John Wiley and Sons, New Jersey, Canada 2015.

REFERENCE BOOKS

1. Pappala, A.J.,Huang, J., Han, J., and Hoyos, L.R., Ground Improvement and Geosynthetics; Geotechnical special publication No.207, Geo Institute, ASCE, 2010
2. Jewell, R.A., Soil Reinforcement with Geotextiles, CIRIA, London, 1996
3. Rowe, R.K., Geotechnical and Geo-environmental Engineering Handbook, Kluwer Academic Publishers, 2001.
4. Moseley, M.P., Ground Treatment, Blackie Academic and Professionals, 1998.
5. Koerner, R.M., Designing with Geosynthetics, Third Edition, Prentice Hall 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	2	2	3	-	2	2	-	-	-	-	2	2	2
CO2	3	2	2	2	-	2	2	-	-	-	-	2	2	2
CO3	3	2	2	2	-	2	2	-	-	-	-	2	2	2
CO4	3	2	2	2	-	2	2	-	-	-	-	2	2	2
CO5	3	2	2	2	-	2	2	-	-	-	-	2	2	2
AVG	3	2	2	2	-	2	2	-	-	-	-	2	2	2

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

24CEPE18 ANALYSIS AND DESIGN OF DEEP FOUNDATION **L T P C**
3 0 0 3

COURSE OBJECTIVES

- To understand the fundamental concepts of pile foundation systems.
- To analyze and evaluate the axial, lateral, and uplift load capacities of piles and pile groups.
- To introduce the design principles of offshore structures and caissons.

UNIT I PILE CLASSIFICATIONS AND LOAD TRANSFER PRINCIPLE **9**

Necessity of pile foundation – classification of piles – Factors governing choice of type of pile – Load transfer mechanism – piling equipments and methods – effect of pile installation on soil condition – pile raft system – basic interactive analysis - criteria for pile socketing.

UNIT II AXIAL LOAD CAPACITY OF PILES AND PILE GROUPS **9**

Allowable load of piles and pile groups – Static and dynamic methods – for cohesive and cohesionless soil – negative skin friction – group efficiency – pile driving formulae - limitation – Wave equation application – evaluation of axial load capacity from field test results - Settlement of piles and pile group.

UNIT III LATERAL AND UPLIFT LOAD CAPACITIES OF PILES **9**

Piles under Lateral loads – Broms method, elastic, p-y curve analyses – Batter piles – – piles under uplift loads – under reamed piles – Lateral and pull out capacity from load test - Structural design of pile– structural capacity – pile cap design.

UNIT IV OFFSHORE STRUCTURES **9**

Introduction to Offshore Environment - Types of offshore structures - Functional and structural requirements of an offshore platform - loads on offshore structures - Design considerations - Codes and provisions

UNIT V CAISSONS **9**

Necessity of caisson – type and shape – well foundation - Stability of caissons – principles of analysis and design – tilting of caisson – construction - seismic influences.

TOTAL: 45 PERIODS

COURSE OUTCOMES

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

CO1: Identify and classify piles, understand load transfer, and select suitable piling methods.

CO2: Determine the vertical load carrying capacity of pile and pile group- keeping the settlement of pile as an important criterion based on field practices and codal provisions.

CO3: Analyze lateral and uplift loads on piles and design structural components like pile caps.

CO4: Explain types and design aspects of offshore structures, considering environmental loads.

CO5: Explain the importance of caisson foundation and checking the stability of caissons based on codal provisions.

TEXT BOOKS

1. Bowles, J.E., Foundation Analysis and Design, Fifth Edition, McGraw Hill, New York, 1996.
2. Poulos, H.G., Davis, E.H., Pile foundation analysis and design, John Wiley and Sons, New York, 1980.
3. Tomlinson, M.J. Foundation engineering, ELBS, Longman Group, U.K. Ltd., England 1995.

REFERENCE BOOKS

1. Das, B.M., Principles of Foundation Engineering, Design and Construction, Fourth Edition, PWS Publishing, 1999.
2. Michael Tomlinson and John Woodward, Pile design and construction practice, Taylor & Francis Group, London & New York, 2008.
3. Donald, P., Coduto, Foundation Design Principles and Practices, Prentice Hall, Inc. Englewood Cliffs, New Jersey, 1996.
4. Varghese P.C.," Foundation Engineering", PHI Learning Private Limited, New Delhi, 2005.
5. Reese, L. C. and Van Impe, W. F., Single Piles and Pile Groups Under Lateral Loading, Taylor and Francis, London, 2011.

Mapping of COs with POs & PSOs

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

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

24CEPE19 EARTH AND EARTH RETAINING STRUCTURES **L T P C**
3 0 0 3

COURSE OBJECTIVES

- To understand Earth Pressure Theories and Their Applications.
- To analyze the Stability and Design Considerations of Retaining and Excavation Systems.
- To apply Engineering Principles to Advanced Excavation Support Systems.

UNIT I EARTH PRESSURE THEORIES **9**

Introduction – State of stress in retained soil mass – Earth pressure theories – Classical and graphical techniques (Culmann's method) – Active and passive cases – Earth pressure due to external loads.

UNIT II COMPACTION, DRAINAGE AND STABILITY OF RETAINING STRUCTURES **9**

Retaining structure – Selection of soil parameters - Lateral pressure due to compaction, strain softening, wall flexibility, drainage arrangements and its influence. – Stability analysis of retaining structure both for regular and earthquake forces.

UNIT III SHEET PILE WALLS **9**

Types of sheet piles - Analysis and design of cantilever and anchored sheet pile walls – free earth support method – fixed earth support method. Design of anchor systems - isolated and continuous.

UNIT IV SUPPORTED EXCAVATIONS **9**

Lateral pressure on sheeting in braced excavation, stability against piping and bottom heaving. Earth pressure around tunnel lining, shaft and silos – Soil anchors – Soil pinning –Basic design concepts.

UNIT V SLURRY SUPPORTED EXACAVATION **9**

Slurry supported trenches-basic principles-slurry characteristics-specifications-diaphragm walls-bored pile walls-contiguous pile wall-secant piles-stability analysis.

TOTAL: 45 PERIODS

COURSE OUTCOMES

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

CO1: Analyse the earth pressure acting on retaining structures by applying classical theories considering all influencing parameters and suggest the earth pressure to be considered for the design of retaining structures.

CO2: Apply the knowledge of engineering and earth pressure to analyse and design rigid retaining structures considering effect of compaction, wall flexibility, pore water pressure and earth quake forces.

CO3: Apply the knowledge of engineering and earth pressure to analyse and design flexible earth retaining walls and also acquire the knowledge of design of anchors

CO4: Apply the knowledge on lateral earth pressure behind and around excavation to analyse and design braced excavations, slurry supported excavations and underground utilities.

CO5: Explore the role of slurry in supporting excavations and to perform stability analysis by considering the actual shape of slurry support.

TEXT BOOKS

1. Clayton, C.R.I., Militisky, J. and Woods, R.I., Earth pressure and Earth-Retaining structures, Second Edition, Survey University Press, 1993.
2. Militisky, J. and Woods, R., Earth and Earth retaining structures, Routledge,1992.
3. Winterkorn, H.F. and Fang, H.Y., Foundation Engineering Handbook, GalgotiaBooksource, 2000.

REFERENCE BOOKS

1. Rowe, R.K., Geotechnical and Geoenvironmental Engineering Handbook, Kluwer Academic Publishers, 2001.
2. Koerner, R.M. Designing with Geosynthetics, Third Edition, Prentice Hall, 1997.
3. Day, R.W., Geotechnical and Foundation Engineering: Design and Construction, McGraw Hill, 1999.
4. Mandal, J.N., Reinforced Soil and Geotextiles, Oxford & IBH Publishing Co. Pvt. Ltd., New Delhi, 1993.
5. Hajnal, I., Marton, J. and Regele, Z., Construction of diaphragm walls, A Wiley – Interscience Publication, 1984.

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

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

24CEPE20 ADVANCED CONSTRUCTION TECHNIQUES **L T P C**
3 0 0 3

COURSE OBJECTIVES

- To learn and understand the latest construction techniques.
- To gain knowledge on construction for sub structure, super structure and special structures.
- To develop skills on rehabilitation and strengthening techniques and demolition techniques.

UNIT I SUB STRUCTURE CONSTRUCTION **9**

Construction Methodology - Box jacking - Pipe jacking - Under water construction of diaphragm walls and basement - Tunneling techniques - Piling techniques - Driving well and caisson - sinking cofferdam - cable anchoring and grouting - Driving diaphragm walls, Sheet piles - Laying operations for built up offshore system - Shoring for deep cutting - Large reservoir construction - well points - Dewatering for underground open excavation.

UNIT II SUPER STRUCTURE CONSTRUCTION FOR BUILDINGS **9**

Vacuum dewatering of concrete flooring – Concrete paving technology – Techniques of construction for continuous concreting operation in tall buildings of various shapes and varying sections – Erection techniques of tall structures, Large span structures – launching techniques for heavy decks – in-situ prestressing in high rise structures, Post tensioning of slab- aerial transporting – Handling and erecting lightweight components on tall structures.

UNIT III CONSTRUCTION OF SPECIAL STRUCTURES **9**

Erection of lattice towers - Rigging of transmission line structures – Construction sequence in cooling towers, Silos, chimney, sky scrapers - Bow string bridges, Cable stayed bridges – Launching and pushing of box decks – Construction of jetties and break water structures – Construction sequence and methods in domes – Support structure for heavy equipment and machinery in heavy industries – Erection of articulated structures and space decks.

UNIT IV REHABILITATION AND STRENGTHENING TECHNIQUES **9**

Seismic retrofitting - Strengthening of beams - Strengthening of columns - Strengthening of slab - Strengthening of masonry wall, Protection methods of structures, Mud jacking and grouting for foundation – Micro piling and underpinning for strengthening floor and shallow profile - Sub grade water proofing, Soil Stabilization techniques.

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 able to

CO1: Explain the modern construction techniques used in the sub structure construction.
CO2: Demonstrate knowledge and understanding of the principles and concepts relevant to super structure construction for buildings.
CO3: Explore the concepts used in the construction of special structures.
CO4: Knowledge on Various strengthening and repair methods for different cases.
CO5: Identify the suitable demolition technique for demolishing a building.

TEXT BOOKS

1. Manoranjan Samal 'Advanced Construction Techniques and Equipment', S.K. Kataria & Sons,2022.
2. Arora S.P. and Bindra S.P., Building Construction, Planning Techniques and Method of Construction, Dhanpat Rai and Sons, 2018.
3. P.C.Varghese, Maintenance Repair and Rehabilitation & Minor works of building, Prentice Hall India Pvt Ltd, 2014.

REFERENCE BOOKS

1. Jerry Irvine, Advanced Construction Techniques, CA Rocket, 1984.
2. Patrick Powers. J., Construction Dewatering: New Methods and Applications, John Wiley & Sons, 1992.
3. Peter H.Emmons, "Concrete repair and maintenance illustrated", Galgotia Publications Pvt. Ltd., 2001.Press, 2008.
4. Robertwade Brown, Practical foundation engineering hand book, McGraw Hill Publications, 1995.
5. Sankar, S.K. and Saraswati, S., Construction Technology, Oxford University, New Delhi, 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	2	-	2	2	-	2	2	2	-	-	-	2	2	2
CO2	2	-	2	2	-	2	2	2	-	-	-	2	2	2
CO3	2	-	2	2	-	2	2	2	-	-	-	2	2	2
CO4	2	-	2	2	-	2	2	2	-	-	-	2	2	2
CO5	2	-	2	2	-	2	2	2	-	-	-	2	2	2
AVG	2	-	2	2	-	2	2	2	-	-	-	2	2	2

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

24CEPE21 WATER QUALITY MANAGEMENT **L T P C**
3 0 0 3

COURSE OBJECTIVES

- To learn to develop, calibrate, and verify mathematical models for water quality.
- To learn how pollutants move in surface and groundwater using transport concepts like advection and diffusion.
- To utilize surface water and groundwater quality models.

UNIT I MODELLING INSIGHTS **9**

Engineers and Mathematical Models-Water quality models – historical development - different types of models-- steps in model development - importance of model building. - calibration and verification of models- finite element, finite difference and finite volume methods.

UNIT II POLLUTION TRANSPORT **9**

Transport phenomena – advection, diffusion, dispersion- contamination transport in surface and subsurface water - Simple transport models –steady state and time variable solutions-conservation of mass, momentum and energy balance, governing equation for contaminant fate and transport.

UNIT III SURFACE WATER QUALITY MODELLING **9**

Water quality modeling of streams, lakes and estuaries – water quality– model sensitivity – assessing model performance; Models for dissolved oxygen, pathogens and COD, BOD-Streeter Phelp's model for point and distributed sources – modified streeter Phelp's equations.

UNIT IV GROUNDWATER QUALITY MODELLING **9**

Groundwater flow and mass transport of solutes – groundwater quality modelling using numerical methods – Parameters, Input-output stresses, Initial and Boundary conditions-degradation of organic compounds in subsurface – Model calibration: steady state and unsteady state – sensitivity analysis – Model validation –seawater intrusion – basic concepts and modelling.

UNIT V WATER QUALITY MANAGEMENT MODELS **9**

Exposure to surface water and groundwater quality modelling software's – MIKE 21, WASP, QUAL2E and MODFLOW – demonstration – case studies – Modeling multilayer groundwater flow system – Artificial recharge feasibility through modeling – Groundwater contamination, restoration and management.

TOTAL: 45 PERIODS

COURSE OUTCOMES

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

CO1: Explain the fundamentals of modelling water quality.
CO2: Explore the pollutant transport phenomena in surface and groundwater.
CO3: Apply the knowledge of surface water quality modelling to predict the water quality of rivers, lakes and estuary.
CO4: Predict the groundwater contamination transport.
CO5: Predict water quality of surface and sub surface water using numerical solution.

TEXT BOOKS

1. Zhen-Gang Ji, John Wiley & Sons,2018, "Hydrodynamics and Water Quality: Modelling Rivers, Lakes, and Estuaries".
2. Jacob Bear, A. H.-D. Cheng, Springer Science & Business Media,2010, "Modelling Groundwater Flow and Contaminant Transport.
3. Ne-Zheng Sun, Alexander Sun, Springer New York, 2012, "Mathematical Modelling of Groundwater Pollution".

REFERENCE BOOKS

1. Steven C. Chapra, "Surface Water Quality Modelling", Tata McGraw-Hill Companies, Inc., New Delhi 2018.
2. Benedini, Marcello, Tsakiris, George, "Water Quality Modelling for Rivers and Streams" Springer Netherlands 2017.
3. Ghanashyam Das, Hydrology and Soil Conservation Engineering, Prentice Hall of India Private Limited, New Delhi, Second Edition, 2009.
4. Suresh, R. Soil and Water Conservation Engineering, Standard Publishers and Distributors Private Limited, New Delhi, 2020.
5. Glenn O Schwab. etal, Soil and Water Conservation engineering, Wiley India Private Limited, 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	2	-	-	-	3	-	-	-	-	2	3	2
CO2	3	3	2	-	-	-	3	-	-	-	-	2	3	2
CO3	3	3	2	-	-	-	3	-	-	-	-	2	3	2
CO4	3	3	2	-	-	-	3	-	-	-	-	2	3	2
CO5	3	3	2	-	-	-	3	-	-	-	-	2	3	2
AVG	3	3	2	-	-	-	3	-	-	-	-	2	3	2

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

24CEPE22 WATERSHED CONSERVATION AND ENGINEERING **L T P C**
3 0 0 3

COURSE OBJECTIVES

- To introduce the fundamental concepts of watershed characteristics and their influence on hydrological behavior.
- To impart knowledge on the processes of precipitation, runoff estimation, and soil erosion relevant to watershed areas.
- To develop the ability to design and analyse soil and water conservation structures and rainwater harvesting systems.

UNIT I HYDROGEOLOGICAL PARAMETERS **9**

Introduction – Water bearing Properties of Rock – Type of aquifers - Aquifer properties – permeability, specific yield, transmissivity and storage coefficient – Methods of Estimation – GEC norms - Steady state flow - Darcy's Law - Groundwater Velocity – Dupuit Forchheimer assumption.

UNIT II WELL HYDRAULICS **9**

Unsteady state flow - Theis method - Jacob method – Chow's method – Law of Times – Theis Recovery – Bailer method – Slug method - tests - Image well theory – Partial penetrations of wells - Well losses – Specific Capacity and Safe yield - Collector well and Infiltration gallery.

UNIT III WATERSHED CONCEPTS **9**

Watershed – Definition, Need and Elements – Principles - Influencing Factors: Geology – Soil – Morphological Characteristics - Toposheet - Delineation – Codification – Prioritization – Watershed Atlas.

UNIT IV SOIL CONSERVATION MEASURES **9**

Types of Erosion – Water and Wind Erosion: Causes, Factors, Effects and Management – Soil Conservation Measures: Agronomical and Mechanical – Design of Terraces and Bunds - Estimation of Soil Loss – USLE Equation - Sedimentation.

UNIT V WATER HARVESTING AND CONSERVATION **9**

Yield from a Catchment - Traditional Water Harvesting Techniques – Micro-Catchments - Design of Small Water Harvesting Structures: Farm Ponds, Percolation Tanks, Check dams, Grassed Waterways.

TOTAL:45 PERIODS

COURSE OUTCOMES

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

CO1: Define and describe key physical characteristics of watersheds and their influence on runoff.

CO2: Apply hydrological methods to estimate runoff and analyze rainfall-runoff relationships in small catchments.

CO3: Calculate soil loss using standard models like USLE and identify appropriate erosion control measures.

CO4: Design basic soil and water conservation structures such as bunds, trenches, and gully control structures.

CO5: Explain and design rainwater harvesting and groundwater recharge structures suitable for different terrains.

TEXT BOOKS

1. Ghanashyam Das, Hydrology and Soil Conservation Engineering, Prentice Hall of India Private Limited, New Delhi, Second Edition, 2009.
2. Suresh, R. Soil and Water Conservation Engineering, Standard Publishers and Distributors Private Limited, New Delhi, 2020. Steven C. Chapra, “Surface Water Quality Modelling”, Tata McGraw-Hill Companies, Inc., New Delhi 2018.
3. R.K. Sharma and T.K. Sharma, Hydrology and Water Resources Engineering, Dhanpat Rai and Sons, New Delhi, Second Edition, 2008.

REFERENCE BOOKS

1. Glenn O Schwab. et al, Soil and Water Conservation engineering, Wiley India Private Limited, 2009.
2. Heathcote, I. W. Integrated Watershed Management: Principles and Practice. John Wiley and Sons, Inc., New York, Second Edition 2009.
3. John G. Lyon, GIS for Water Resources and Watershed Management, CRC Press, 2002.
4. Vijay P. Singh, Donald K. Frevert, Watershed Models, CRC Press, 2005.
5. Vir Singh, Raj, Watershed Planning and Management, Bio- Green Publisher, 2016.

Mapping of Cos with POs & PSOs

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

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

24CEPE23 MUNICIPAL SOLID WASTE MANAGEMENT **L T P C**
3 0 0 3

COURSE OBJECTIVES

- To impart knowledge on the types sources, generation, storage, collection, transport and processing of municipal solid waste.
- To gain knowledge in recycling, processing and disposal of solid and hazardous wastes
- To acquire knowledge related to regulations, engineering principles, design criteria, methods and equipment.

UNIT I SOURCES AND TYPES **8**

Sources and types of municipal solid wastes-waste generation rates-factors affecting generation, characteristics-methods of sampling and characterization; Effects of improper disposal of solid wastes-Public health and environmental effects. Elements of solid waste management –Social and Financial aspects – Municipal solid waste (M&H) rules – integrated management-Public awareness; Role of NGO"s.

UNIT II ON-SITE STORAGE AND PROCESSING **8**

On-site storage methods – Effect of storage, materials used for containers – segregation of solid wastes – Public health and economic aspects of open storage – waste segregation and storage – case studies under Indian conditions – source reduction of waste – Reduction, Reuse and Recycling.

UNIT III COLLECTION AND TRANSFE **8**

Methods of Residential and commercial waste collection – Collection vehicles – Manpower– Collection routes – Analysis of collection systems; Transfer stations – Selection of location, operation & maintenance; options under Indian conditions – Field problems- solving.

UNIT IV OFF-SITE PROCESSING **12**

Objectives of waste processing – Physical Processing techniques and Equipment; Resource recovery from solid waste composting and bio-methanation; Thermal processing options – case studies under Indian conditions.

UNIT V DISPOSAL **9**

Land disposal of solid waste; Sanitary landfills – site selection, design and operation of sanitary landfills – Landfill liners – Management of leachate and landfill gas- Landfill bioreactor– Dumpsite Rehabilitation

TOTAL: 45 PERIODS

COURSE OUTCOMES

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

CO1: Explain the nature and characteristics of municipal solid wastes and the regulatory requirements regarding municipal solid waste management.

CO2: Explain the segregation of solid waste and the onsite storage methods.

CO3: Explain the various transfer methods and to know the site condition for the transfer station.

CO4: Select appropriate methods for processing and disposal of solid and hazardous wastes, taking into account the impact of the solutions in a sustainability context.

CO5: Knowledge about selection of appropriate disposal methods and its handling in an efficient manner.

TEXT BOOKS

1. Tchobanoglous. G., Theisen, H. M., and Eliassen, R. Solid. Wastes: Engineering Principles and Management Issues. New York: McGraw Hill, 1977.
2. Vesilind, P.A. and Rimer, A.E., "Unit Operations in Resource Recovery Engineering", Prentice Hall, Inc., 1981.
3. Paul T Willams, "Waste Treatment and Disposal", John Wiley and Sons, 2005.

REFERENCE BOOKS

1. Manual on Municipal Solid Waste Management, CPHEEO, Ministry of Urban Development, Government of India, New Delhi, 2016.
2. Bhide A.D. and Sundaresan, B.B. Solid Waste Management Collection, Processing and Disposal, 2001.
3. Manser A.G.R. and Keeling A.A, "Practical Handbook of Processing and Recycling of Municipal solid Wastes", Lewis Publishers, CRC Press, 1996.
4. George Tchobanoglous and Frank Kreith, Handbook of "Solid waste Management", McGraw Hill, New York, 2002.
5. John Pitchtel, Waste Management Practices, CRC Press, Taylor and Francis Group, 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	3	2	-	2	3	2	-	-	-	-	2	2
CO2	3	2	3	2	-	3	3	2	-	-	-	-	2	2
CO3	3	2	3	2	-	2	3	2	-	-	-	-	2	2
CO4	3	2	3	2	-	2	3	2	-	-	-	-	2	2
CO5	3	2	3	2	-	2	3	2	-	-	-	-	2	2
AVG	**3**	**2**	**3**	**2**	**-**	**2**	**3**	**2**	**-**	**-**	**-**	**-**	**2**	**2**

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

24CEPE24 MAINTENANCE REPAIR AND REHABILITATION OF STRUCTURES **L T P C 3 0 0 3**

COURSE OBJECTIVES

- To acquire the knowledge on the quality of concrete.
- To introduce to the students about the causes of deterioration, assessment of distressed structures, repairing of structures.
- To develop knowledge on Restoration of Heritage structures and 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 SPECIAL CONCRETES **9**

Polymer concrete - Sulphur infiltrated concrete - Fibre reinforced concrete - High strength concrete- High performance concrete - Self compacting concrete - Geopolymer concrete - Concrete made with industrial wastes.

UNIT IV 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 V STRENGTHENING, REPAIR, REHABILITATION AND RESTORATION OF STRUCTURES **9**

Strengthening of Structural elements, Repair of structures distressed due to corrosion, fire, leakage and earthquake - Restoration of Heritage structures- Case studies.

TOTAL:45 PERIODS

COURSE OUTCOMES

On Successful completion of this course, the student will able to

CO1: Know the importance of inspection and maintenance.
CO2: Study the Impacts of cracks, corrosion and climate on structures.
CO3: Gain knowledge special concretes.
CO4: Explain the testing techniques and various protection measures.
CO5: Know the Repair of structures and Restoration of Heritage structures.

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.Press, 2008.

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. Varghese, P.C. Maintenance, Repair and Rehabilitation & Minor Works of Buildings. New Delhi: Prentice Hall of India, 2014.
4. India Pvt Ltd 2014. The Right to Fair Compensation and Transparency in Land Acquisition, Rehabilitation and Resettlement Act, 2013.
5. Dodge Woodson, Concrete Structures, Protection, Repair and Rehabilitation, Butterworth- Heinemann, Elsevier, New Delhi 2012.

Mapping of COs with POs & PSOs

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

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

24CEPE25 PRESTRESSED CONCRETE STRUCTURES **L T P C**
3 0 2 4

COURSE OBJECTIVES

- To introduce the methods and types of Prestressing.
- To acquire the knowledge on design of prestressed concrete structural elements.
- To impart knowledge about the different types of prestressed concrete structures.

UNIT I INTRODUCTION – THEORY AND BEHAVIOUR **9**

Basic principles of prestressing – Classification and types – Advantages over ordinary reinforced concrete – Materials – High strength concrete and high tensile steel – Methods of prestressing – Freyssinet, Magnel, Lee-McCall and Gifford Udall anchorage systems – Analysis of sections of stresses by stress concept, strength concept and load balancing concept – Losses of prestress in post -tensioned and pre-tensioned members.

UNIT II DESIGN FOR FLEXURE AND SHEAR **9**

Basic assumptions of flexural design – Permissible stresses in steel and concrete as per IS 1343 Code – Different Types of sections - Design of sections of Type I and Type II post-tensioned and pre-tensioned beams – Check for flexural capacity based on IS 1343 Code – Influence of Layout of cables in post-tensioned beams – Location of wires in pre-tensioned beams – Design for shear based on IS 1343 Code.

UNIT III DEFLECTION AND DESIGN OF ANCHORAGE ZONE **9**

Factors influencing deflections – Short-term deflections of uncracked members – Prediction of long-term deflections due to creep and shrinkage – Check for serviceability limit states. Determination of anchorage zone stresses in post-tensioned beams by Magnel's method, Guyon's method and IS 1343 code – design of anchorage zone reinforcement – Check for transfer bond length in pre-tensioned beams– design of anchorage zone reinforcement – Check for transfer bond length in pre-tensioned beams.

UNIT IV COMPOSITE BEAMS AND CONTINUOUS BEAMS **9**

Analysis and design of composite beams – Shrinkage strain and its importance – Differential shrinkage - Methods of achieving continuity in continuous beams – Analysis for secondary moments– Concordant cable and linear transformation – Calculation of stresses – Principles of design.

UNIT V MISCELANEOUS STRUCTURES **9**

Role of prestressing in members subjected to Tensile forces and compressive forces – Design of Tension members and Compression members - Design of Tanks, Pipes, Sleepers and Poles – Partial prestressing – methods of achieving partial prestressing, merits and demerits of partial prestressing.

TOTAL: 45 PERIODS

LIST OF EXPERIMENTS

1. Stress-Strain Behavior of Prestressing Steel.
2. Pre-Tensioned Beam Testing.
3. Post-Tensioned Beam Experiment.
4. Losses in Prestress (Elastic Shortening, Creep, Shrinkage).
5. Cable Profile Effect on Bending Moments.
6. Ultimate Load Test of Prestressed Beams.
7. Shear Resistance in Prestressed Concrete.
8. Anchorage Zone (End Block) Behavior.

TOTAL: 30 PERIODS

COURSE OUTCOMES

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

CO1: Explore the theory and behaviour for a prestressed concrete beam accounting for losses.

CO2: Design for flexure and shear.

CO3: Estimate the deflection in beams and design the anchorage zone for post-tensioned members and estimate the deflection in beams.

CO4: Analyse and design composite members and continuous beams.

CO5: Design water tanks, pipes, poles and sleepers.

TEXT BOOKS

1. Krishna Raju N., "Prestressed concrete", 5th Edition, Tata McGraw Hill Company, New Delhi, 2012.
2. Pandit.G.S. and Gupta. S.P., "Prestressed Concrete", CBS Publishers and Distributers Pvt.Ltd, 2014.
3. Arthur H. Nilson, “Design of Prestressed Concrete”, John Wiley and Sons Inc, New York, 2004.

REFERENCE BOOKS

1. Lin T.Y. and Ned.H.Burns, "Design of prestressed Concrete Structures", Third Edition, Wiley India Pvt. Ltd., New Delhi, 2013.
2. Rajagopalan.N, "Prestressed Concrete", Narosa Publishing House, 2017.
3. Dayaratnam.P., "Prestressed Concrete Structures", Oxford and IBH, 2017.
4. Sinha.N.C. And Roy.S.K. Fundamentals of Prestressed Concrete, S.Chand and Co. Ltd., 2011.
5. Shamsher Bahadur Singh Analysis and Design of Prestressed Concrete Structures, wiley,2023.

Mapping of COs with POs & PSOs

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

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

24CEPE26 PREFABRICATED STRUCTURES **L T P C**
3 0 2 4

COURSE OBJECTIVES

- To understand the need, principles and materials used in prefabrication
- To analyze and design prefabricated structural components and joints.
- To apply design principles for abnormal loads and prevent progressive collapse.

UNIT I INTRODUCTION **9**

Need for prefabrication -Advantages and limitations – Principles of prefabrication – Modular coordination – Standarization– Loads and load combinations– Materials – Production – Transportation – Erection.

UNIT II PREFABRICATED COMPONENTS AND SYSTEMS **9**

Behaviour and types of structural components– roof and floor slabs – Walls panels - Shear walls - Beams - Columns – skeletal system- portal frame system-Large panel systems- block system

UNIT III DESIGN PRINCIPLES **9**

Design philosophy- Design of cross section based on efficiency of material used – Problems in design because of joint flexibility – Allowance for joint deformation - Demountable precast concrete systems- Design for stripping , stacking ,transportation and erection of elements

UNIT IV JOINTS AND CONNECTIONS IN STRUCTURAL MEMBERS **9**

Types of Joints – based on action of forces - compression joints - shear joints - tension joints - based on function - construction joints , contraction joints, expansion joints. Design of expansion joints - Dimensions and detailing - Types of sealants - Types of structural connections - Beam to Column - Column to Column - Beam to Beam - Column to foundation.

UNIT V DESIGN FOR ABNORMAL LOADS **9**

Progressive collapse – Codal provisions – Equivalent design loads for considering abnormal effects such as earthquakes, cyclones, etc., - Importance of avoidance of progressive collapse -case study.

TOTAL: 45 PERIODS

LIST OF EXPERIMENTS

1. Analysis of a Prefabricated concrete portal frame.
2. Joint behavior in prefabricated concrete portal frame.
3. Behavior of Rigid joints (Monolithic behavior).
4. Behavior of Hinged or semi-Rigid joints (Dry connections).
5. Modelling of a prefabricated simple room using modular building unit (creation of wall, roof and floor panels).
6. Recommendation for Academic Modelling.
7. Seismic analysis of prefab structure.
8. Prefabricated Truss roof system.

TOTAL: 30 PERIODS

COURSE OUTCOMES

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

CO1: Explain concepts about principles of prefabrication, production, transportation and erection.

CO2: Acquire knowledge about panel systems, slabs, beams, shear walls and columns used in precast construction.

CO3: Gain knowledge on design of cross section and joint flexibility.

CO4: Acquire knowledge on joints and connection in precast construction.

CO5: Gain knowledge about structural stability.

TEXT BOOKS

1. Bruggeling A.S. G and Huyghe G.F. "Prefabrication with Concrete", A.A. Balkema Publishers, USA,1991.
2. Lewitt,M. " Precast Concrete- Materials, Manufacture, Properties And Usage, CRC Press, 2019.
3. Alfred Steinle, Hubert Bachmann, Mathias Tillmann, Philip Thrift. "Precast Concrete Structures", Ernst & Sohn, Berlin, 2019.

REFERENCE BOOKS

1. Koncz T., "Manual of precast concrete construction", Vol. I, II and III, Bauverlag, GMBH, 1976.
2. "Handbook on Precast Concrete Buildings", Indian Concrete Institute, 2016.
3. "Precast concrete connection details", Structural Design manual, Society for the studies in the use of precast concrete, Netherland Betor Verlag, 2009.
4. Ryan e.smith from the Foreword by James Timberlake, Prefab Architecture: A Guide to Modular Design and Construction, FAIA, 2010.

5. Kim S. Elliott, Precast Concrete Structures: From Theories and Research to Strategies and Interventions, 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	3	-	2	2	3
CO2	3	2	3	2	-	-	-	-	3	3	-	2	2	3
CO3	3	2	3	2	-	-	-	-	3	3	-	2	2	3
CO4	3	2	3	2	-	-	-	-	3	3	-	2	2	3
CO5	3	2	3	2	-	-	-	-	3	3	-	2	2	3
AVG	**3**	**2**	**3**	**2**	**-**	**-**	**-**	**-**	**3**	**3**	**-**	**2**	**2**	**3**

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

24CEPE27 FINITE ELEMENT ANALYSIS **L T P C**
3 0 2 4

COURSE OBJECTIVES

- To introduce the concept of finite element analysis techniques.
- To acquire the knowledge on finite element method of analysis for solving practical problems in Civil Engineering.
- To impart knowledge on the one- and two-dimensional problems and analysis of plates.

UNIT I INTRODUCTION **9**

Historical Background – Mathematical Modeling of field problems in Engineering –Governing Equations – Discrete and continuous models – Boundary, Initial and Eigen Value problems– Weighted Residual Methods – Variational Formulation of Boundary Value Problems – Ritz Technique – Basic concepts of the Finite Element Method.

UNIT II STIFFNESS MATRIX FORMULATION **9**

Introduction to Discrete and Continuous elements – Discrete Elements - Direct stiffness method -Special characteristics of stiffness matrix - Assemblage of elements – Boundary condition & reaction- 2D – truss element - 2D - beam element - Analysis of framed Structures - Basic steps in finite element analysis - Differential equilibrium equations - strain displacement relation - linear constitutive relation - Numerical methods in finite element analysis- Gauss elimination method.

UNIT III ONE DIMENSIONAL PROBLEMS **9**

One Dimensional Second Order Equations – Discretization – Element types- Linear and Higher order Elements – Continua Elements - Displacement models - convergence requirements. Natural coordinate systems - Shape function. Interpolation function. Linear and quadratic elements -Lagrange & Serendipity elements. Strain displacement matrix - element stiffness matrix and nodal load vector. Natural frequencies of longitudinal vibration and mode shapes.

UNIT IV TWO DIMENSIONAL PROBLEMS **9**

Two dimensional isoparametric elements - Four noded quadrilateral elements - triangular elements. Computation of stiffness matrix for isoparametric elements - numerical integration (Gauss quadrature) Convergence criteria for isoparametric elements.

UNIT V ANALYSIS OF PLATES **9**

Introduction to Plate Bending Problems - displacement functions – Analysis of Thin Plate – Analysis of Thick Plate - Analysis of Skew Plate, Finite Element Analysis of Shell, plane stress and plane strain analysis, Example problem using any general-purpose finite element software.

TOTAL: 45 PERIODS

LIST OF EXPERIMENTS (using Finite Element Software)

1. Creating geometry, and Assigning material properties.
2. Applying Boundary conditions and loading.
3. Meshing of elements.
4. Modelling and Finite Element Analysis of RC beams.
5. Modelling and Finite Element Analysis of RC column.
6. Finite Element Analysis of 2D truss.
7. Finite Element Analysis of 3D space trusses.
8. Finite Element Analysis of thin plates & thick plates.

TOTAL: 30 PERIODS

COURSE OUTCOMES

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

CO1: Explore the basics of finite element formulation.
CO2: Formulate the stiffness matrix for beam, truss and framed structures.
CO3: Apply finite element formulations to solve one-dimensional problems.
CO4: Acquire knowledge on finite element method to solve two dimensional problems.
CO5: Gain knowledge and apply finite element method to analyze plate bending problems.

TEXT BOOKS

1. Rao, S.S., “The Finite Element Method in Engineering”, 6th Edition, Butterworth Heinemann, 2018.
2. Reddy,J.N. “Introduction to the Finite Element Method”, 4th Edition, TataMcGrawHill,2018.
3. David Hutton, Fundamentals of Finite Element Analysis, Tata McGraw Hill Publishing Company Limited, New Delhi, 2005.

REFERENCE BOOKS

1. Krishnamoorthy, C. S, Finite Element Analysis - Theory and Programming, McGraw Hill, 1995.
2. G.R. Liu and S.S.Quek, Finite Element Method: A Practical Course, Butterworth-Heinemann;1st edition
3. Chennakesava R. Alavala Finite Element Methods: Basic Concepts and Applications, Prentice Hall Inc., 2010.

4. R. T. Chandrupatla and A. D. Belegundu, Introduction to Finite Elements in Engineering, PHI Learning Pvt Ltd, New Delhi, 1997.
5. S. S. Bhavikatti, Finite Element Analysis, New Age Publishers, 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	2	3	-	-	-	3	3	-	2	2	3
CO2	3	3	3	2	3	-	-	-	3	3	-	2	2	3
CO3	3	3	3	2	3	-	-	-	3	3	-	2	2	3
CO4	3	3	3	2	3	-	-	-	3	3	-	2	2	3
CO5	3	3	3	2	3	-	-	-	3	3	-	2	2	3
AVG	3	3	3	2	3	-	-	-	3	3	-	2	2	3

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

24CEPE28 MODERN APPROACHES TO INDUSTRIAL STRUCTURE DESIGN **L T P C 3 0 2 4**

COURSE OBJECTIVES

- To learn to plan and ensure safety in industrial buildings.
- To understand the design of steel parts like girders, silos, and towers.
- To gain knowledge in modern building systems including cold-formed steel and pre-engineered buildings.

UNIT I INDUSTRIAL PLANNING AND FUNCTIONAL REQUIREMENTS **9**

Classification of industries and industrial structures - Planning for layout requirements (Lighting, Ventilation, Fire safety) - Protection against noise and vibration - Guidelines from the Factories Act - Material handling systems - Erection sequence and supporting structure guidelines

UNIT II STEEL STRUCTURES AND STRUCTURAL COMPONENTS **9**

Introduction to steel structures and connection details - Design of Gantry girders, Plate girders, Cooling towers, Bunkers and silos, Forms and features of light gauge steel structures, Direct strength method.

UNIT III ANALYSIS AND DESIGN OF INDUSTRIAL BUILDINGS **9**

Analysis of industrial buildings for Gravity loads and Wind loads. Design of framing components (Girders, Trusses, Gable frames). Analysis and design of Gantry columns, Purlins, girts, bracings. All structural connections.

UNIT IV COMPRESSION MEMBERS & TRANSMISSION LINE TOWERS 9

Behaviour of compression elements - Effective width determination - Load and deflection - Stiffened and unstiffened elements - Flange curling, shear lag, and lateral buckling of beams. Analysis of transmission line towers for wind load. Design of towers including all types of connections

UNIT V COLD-FORMED LIGHT GAUGE STEEL STRUCTURES 9

Forms of light gauge sections. Effective width computation for Unstiffened, stiffened, and multiple stiffened compression elements. Concept of Local buckling, post-buckling strength, Limiting width-to-thickness ratio. Design of Compression and tension members, Flexural members. Introduction to Pre-engineered buildings (PEBs).

TOTAL:45 PERIODS

LIST OF EXPERIMENTS

1. Modelling and analysis of industrial structural elements.
2. Application of wind load and seismic load on Industrial Buildings as per IS 875 (Part 3) and IS1893.
3. Modelling and analysis of Northlight roof truss.
4. Design and Analysis of an Industrial Truss System.
5. Modelling of bunkers and silos.
6. Analysis of Portal Frame under Lateral and Gravity Loads.
7. Analysis of Transmission line towers.
8. Design and Analysis of Plate girders.

TOTAL:30 PERIODS

COURSE OUTCOMES

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

CO1: Identify planning needs and apply safety standards for industrial structures.
CO2: Design steel structural elements used in industries like girders and silos.
CO3: Analyze and design industrial frames and connections under different loading conditions.
CO4: Design compression members and transmission towers with consideration of buckling effects.
CO5: Design cold-formed steel sections and their use in modern industrial structures.

TEXT BOOKS

1. Duggal. S.K, "Limit State Design of Steel Structures", Tata McGraw Hill Publishing Company, 2005.
2. Subramanian.N, "Design of Steel Structures", Oxford University Press, New Delhi, 2019.
3. Ramamrutham, S. & Narayanan, R., Design of Steel Structures, Dhanpat Rai Publishing Company, 2015.

REFERENCE BOOKS

1. Narayanan.R. "Teaching Resource on Structural Steel Design", INSDAG, Ministry of Steel Publications, 2002.
2. Bhavikatti.S.S, "Design of Steel Structures" By Limit State Method as per IS:800–2007, IK International Publishing House Pvt. Ltd., 2009.
3. Shah.V.L. and Veena Gore, "Limit State Design of Steel Structures", IS 800–2007 Structures Publications, 2009.
4. IS 800:2007, General Construction in Steel-Code of Practice, (Third Revision), Bureau of Indian Standards, New Delhi, 2007.
5. IS 801:1975 – Code of Practice for Use of Cold-Formed Light Gauge Steel Structural Members in General Building Construction, BIS.

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

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

24CEPE29 BRIDGE STRUCTURES **L T P C**
3 0 2 4

COURSE OBJECTIVE

- To learn the components, classification and importance of bridges.
- To study the specification of road bridges and loads considered.
- To familiarize students with various types of concrete bridges such as slab-bridge and T-beam bridge.

UNIT I GENERAL OVERVIEW ON BRIDGES **9**

Components of Bridges - Classification - Importance of Bridges - Investigation for Bridges - Selection of Bridge site - Economical span - Choice of bridge type.

UNIT II SPECIFICATION AND LOADING **9**

Specification of road bridges - width of carriageway - loads to be considered - dead load - IRC standard live load and IRS loading - Impact effect.

UNIT II DESIGN CONSIDERATIONS **9**

General design considerations - Concrete bridges - Slab Bridge - Design of T - beam bridge (superstructure only)

UNIT IV STEEL BRIDGES **9**

Steel bridges - truss bridge - plate girder bridge (superstructure only)

UNIT V BEARINGS AND JOINTS **9**

Importance of Bearings - Bearings for slab bridges - Bearings for girder bridges - Electrometric bearing - Joints - Expansion joints - substructure (theory only): piers, pier caps, types of foundations, piles and pile caps.

TOTAL: 45 PERIODS

LIST OF EXPERIMENTS (Using Analysis software)

1. Load Distribution in a Beam Bridge.
2. Live Load Analysis for Road Bridges.
3. Creating bridge model using software.
4. Application of moving loads in bridge model.
5. Analysis of bridge model and post processing of results.
6. Model creation of steel truss bridge.
7. Application of loading.
8. Analysis of steel truss bridge and post processing of results.

TOTAL: 30 PERIODS

COURSE OUTCOMES

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

CO1: Explain the components of bridges, classification of bridges, importance of bridges.
CO2: Explore the specification of road bridges and loads to be considered.
CO3: Acquire knowledge on various types of concrete bridges such as slab-bridge and T beam bridge.
CO4: Comprehend various types of steel bridges such as truss bridge and girder bridge.
CO5: Explain the evaluation of sub structures, type of foundations and importance of bearings.

TEXT BOOKS

1. Ponnuswamy, S., Bridge Engineering, Tata McGraw –Hill, New Delhi, 1997.
2. Victor, D. J., Essentials of Bridge Engineering, Oxford and IBH Publishers Co., New Delhi, 1980.
3. N. Rajagopalan, Bridge Superstructure, Narosa Publishing House, New Delhi, 2006.

REFERENCE BOOKS

1. Rangwala, Bridge Engineering, Charotar Publication, Anand, India, 2015.
2. Raju N. K., Design of Bridges, Oxford and IBH Publishers Co., New Delhi, 2019.
3. Jagadeesh. T.R. and Jayaram. M.A., “Design of Bridge Structures”, Second Edition, Prentice Hall of India Pvt. Ltd. 2009.
4. Johnson Victor, D. “Essentials of Bridge Engineering”, Sixth Edition, Oxford and IBH Publishing Co. New Delhi, 2019.

5. Design of Highway Bridges, Richard M. Barker & Jay A. Puckett, John Wiley & Sons, Inc., 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	2	-	-	-	-	3	3	-	2	2	2
CO2	3	3	3	2	-	-	-	-	3	3	-	2	2	2
CO3	3	3	3	2	-	-	-	-	3	3	-	2	2	2
CO4	3	3	3	2	-	-	-	-	3	3	-	2	2	2
CO5	3	3	3	2	-	-	-	-	3	3	-	2	2	2
AVG	3	3	3	2	-	-	-	-	3	3	-	2	2	2

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

24CEPE30 ADVANCED DESIGN OF CONCRETE STRUCTURES **L T P C 3 0 2 4**

COURSE OBJECTIVES

- To develop the ability to design structural elements such as retaining walls, water tanks, staircases, and flat slabs.
- To understand and apply yield line theory for slab design and analyze collapse loads using the virtual work method.
- To analyze and design brick masonry structures, considering stability, load dispersion, and permissible stresses.

UNIT I RETAINING WALLS **9**

Design of Cantilever and Counterfort Retaining walls.

UNIT II WATER TANKS **9**

Design of rectangular and circular water tanks both below and above ground level - Design of circular slab.

UNIT III SELECTED TOPICS **9**

Design of staircases - ordinary and doglegged staircase – Design of flat slabs with drop and column head.

UNIT IV YIELD LINE THEORY **9**

Assumptions - Characteristics of yield line - Determination of collapse load / plastic moment - Application of virtual work method - square, rectangular, circular and triangular slabs - Design Problems.

UNIT V BRICK MASONRY **9**

Introduction, Classification of walls, Lateral supports and stability, effective height of wall and columns, effective length of walls, design loads, load dispersion, permissible stresses, design of axially and eccentrically loaded brick walls.

TOTAL: 45 PERIODS

COURSE OUTCOMES

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

CO1: Design cantilever and counterfort retaining walls.

CO2: Design rectangular and circular water tanks for underground and overhead applications, including circular slabs.

CO3: Design staircases, flat slabs, and the principles of designing mat foundations, box culverts, and road bridges.

CO4: Determine collapse loads using the virtual work method and apply yield line theory to slab design.

CO5: Analyze and design axially and eccentrically loaded brick walls considering stability and permissible stresses.

TEXT BOOKS

1. Krishnaraju.N "Design of Reinforced Concrete Structures, CBS Publishers & Distributors Pvt. Ltd., New Delhi.
2. Gambhir.M.L., "Fundamentals of Reinforced Concrete Design", Prentice Hall of India Private Limited, New Delhi, 2006.
3. Punmia.B.C., Ashok Kumar Jain, Arun Kumar Jain, "Limit State Design of Reinforced Concrete",Laxmi Publication Pvt. Ltd., New Delhi, 2016

REFERENCE BOOKS

1. Sinha, S.N., "Reinforced Concrete Design", Tata McGraw Hill Publishing Company Ltd., New Delhi, 2017
2. Unnikrishna Pillai, S., Devdas Menon, "Reinforced Concrete Design", Tata McGraw Hill Publishing Company Ltd., 2021
3. Shah V L Karve S R., "Limit State Theory and Design of Reinforced Concrete", Structures Publilcations, Pune, 2013
4. IS456:2000, Code of practice for Plain and Reinforced Concrete, Bureau of Indian Standards, New Delhi, 2000
5. SP16, IS456:1978 "Design Aids for Reinforced Concrete to Bureau of Indian Standards, New Delhi, 1999

TOTAL: 30 HOURS

LIST OF EXPERIMENTS

Using Computer software, create detailed reinforcement drawings for the following structural elements:

1. Cantilever and Counterfort Retaining Wall.
2. Rectangular Water Tank with reinforcement details.

3. Circular Water Tank wall detailing.
4. Circular slab reinforcement details.
5. Dog-legged Staircase with reinforcement details.
6. Cantilever Staircase Detailing.
7. Design of solid slab and RCC Tee beam bridges for IRC loading and reinforcement details.
8. Flat Slab.

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

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

24CEPE32 ESTIMATION, COSTING AND VALUATION ENGINEERING **L T P C 3 0 2 4**

COURSE OBJECTIVES

- To learn methods of estimating quantities for various construction projects, including buildings, roads, and infrastructure.
- To gain knowledge in rate analysis and costing for construction works.
- To develop skills in preparing construction specifications, reports, and tenders.

UNIT I QUANTITY ESTIMATION **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, retaining walls – Culverts (additional practice in class room using computer softwares- qE Pro)

UNIT II RATE ANALYSIS AND COSTING **9**

Standard Data – Observed Data – Schedule of rates – Market rates – Materials and Labour – Standard Data for Man Hours and Machineries for common civil works – Rate Analysis for all Building works, canals, and Roads – Cost Estimates (additional practice in class room using Computer softwares) – (Analysis of rates for the item of work asked, the data regarding labour, rates of material and rates of labour to be given in the Examination Question Paper)

UNIT III SPECIFICATIONS, REPORTS AND TENDERS **9**

Specifications – Detailed and general specifications – Constructions – Sources – Types of specifications – Principles for report preparation – report on estimate of residential building – Culvert – Roads – TTT Act 2000 – Tender notices – types – tender procedures – Drafting model tenders , E-tendering- e NOI – e NOT -Digital signature certificates – Encrypting - Decrypting – Reverse Auctions.

UNIT IV CONTRACTS **9**

Contract – Types of contracts – BOT – Types - Formation of contract – Contract conditions – Contract for labour, material, design, construction – Drafting of contract documents based on IBRD/ MORTH Standard bidding documents – Construction contracts – Contract problems – Arbitration ,litigation and legal requirements.

UNIT V 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 – Mortgage – Lease - Types of lease.

TOTAL:45 PERIODS

LIST OF EXPERIMENTS (using 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 building 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 techniques and software.
CO2: Analyze rates and develop cost estimates for various construction works.
CO3: Preparing construction specifications, reports, and drafting tenders.
CO4: Explore different types of construction contracts, their formation, and legal aspects, including dispute resolution.
CO5: Develop proficiency in property valuation methods for land, buildings, mortgages, and leases.

TEXT BOOKS

1. B.N Dutta 'Estimating and Costing in Civil Engineering', CBS Publishers & Distributors (P) Ltd, Twenty eighth revised edition, 2020.

2. B.S.Patil, 'Civil Engineering Contracts and Estimates', 7th edition, University Press, 2015.
3. D.N. Banerjee, 'Principles and Practices of Valuation', V Edition, Eastern Law House, 2015.

REFERENCE BOOKS

1. Hand Book of Consolidated Data – 8/2000, Vol.1, TNPWD.
2. Tamil Nadu Transparencies in Tenders Act, 1998 and rules 2000.
3. Arbitration and Conciliation Act, 1996.
4. Standard Bid Evaluation Form, Procurement of Good or Works, The World Bank, April 1996.
5. Standard Data Book for Analysis and Rates, IRC, New Delhi, 2019.

Mapping of COs with POs & PSOs

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

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

24CEPE32 DYNAMICS AND EARTHQUAKE RESISTANT STRUCTURES **L T P C 3 0 2 4**

COURSE OBJECTIVES

- To introduce the concepts of dynamic systems.
- To understand the earthquake loading and earthquake effects on structures.
- To design the structures as earthquake resistant as per codal provisions.

UNIT I INTRODUCTION TO DYNAMICS **9**

Dynamics - Degree of freedom – Free and forced vibration - Idealization of structure as Single Degree of Freedom (SDOF) and Multi degree of freedom (MDOF) system – D'Alemberts Principles - Formulation of equation of motion for SDOF system and MDOF system –- Evaluation of natural frequencies and modes - Effect of damping.

UNIT II SEISMOLOGY **9**

Elements of Engineering Seismology – Seismic hazard - Earthquake phenomenon – Seismotectonics – Seismic Instrumentation – Characteristics of Strong Earthquake motion – Estimation of Earthquake Parameters – Soil Structure Interaction – Liquefaction of soil - Seismic zone map – Response spectra.

UNIT III EARTHQUAKE EFFECTS ON STRUCTURES **9**

Inertia force on structures – load transfer path – Effect of architectural features on behavior of structures – Hysteretic Behaviour of RCC, steel and prestressed concrete - Pinching Effect – Bouchinger Effects - Energy dissipation - P-delta effect - storey drift - Behavior of brick masonry, stone masonry and reinforced concrete structures under past earthquakes – typical failures - Causes of damage –- Lessons learnt from past earthquakes.

UNIT IV EARTHQUAKE LOAD ANALYSIS **9**

Design spectra – Codal provision – Different methods of earthquake analysis –- Analysis of structure by Equivalent static method – Analysis of structure by Response spectrum method – Introduction to time-history method of analysis

UNIT V EARTHQUAKE RESISTANT DESIGN **9**

Philosophy of earthquake resistant design - Planning considerations and Architectural concepts - Design and detailing as per codal provisions - Design and detailing of typical flexural member and column member, Ductile detailing of beam-column joints and footing – Concept and principle of shear wall - Introduction to performance based seismic design - Seismic isolation principles and methods.

TOTAL:45 PERIODS

LIST OF EXPERIMENTS

1. Model Analysis of a Multi-Storey Building.
2. Response Spectrum Analysis.
3. Time History Analysis.
4. Seismic Base Isolation Experiment.
5. Pounding Effect Between Adjacent Buildings.
6. Wind and Seismic Load Combination Analysis.
7. Soft Storey Behavior Simulation.
8. Damping Effect in Structural Response.

TOTAL: 30 PERIODS

COURSE OUTCOMES

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

CO1: Develop the equations of motion for SDOF and MDOF system and to evaluate the natural frequencies and mode shapes.

CO2: Explain the elements of engineering seismology, characteristics of earthquake and seismic instrumentation.

CO3: Explain the behavior of various types of structures under earthquake.

CO4: Determine the forces in a structure due to earthquake.

CO5: Design earthquake resistant building structures.

TEXT BOOKS

1. Mario Paz, Structural Dynamics – Theory and Computations, Fifth Edition 2nd printing, CBS publishers, 2006.

2. Agarwal.P and Shrikhande.M. Earthquake Resistant Design of Structures, Prentice Hall of India Pvt. Ltd. 2011.
3. Chopra A.K. "Dynamics of Structures Theory and Application to Earthquake Engineering" Pearson Education, 2001.

REFERENCE BOOKS

1. Roy R Craig, Jr., Structural Dynamics, John Wiley & Sons, 1981.
2. Clough.R.W, and Penzien.J, Dynamics of Structures, Second Edition, McGraw Hill International Edition, 1995.
3. Minoru Wakabayashi, Design of Earthquake Resistant Buildings, Mc Graw – Hill Book Company, 1986.
4. Anil K Chopra, Dynamics of structures – Theory and applications to Earthquake Engineering, Prentice Hall Inc., 2007.
5. Moorthy.C.V.R., Earthquake Tips, NICEE, IIT Kanpur,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	3	2	-	-	-	-	3	3	-	2	2	3
CO2	3	3	3	2	-	-	-	-	3	3	-	2	2	3
CO3	3	3	3	2	-	-	-	-	3	3	-	2	2	3
CO4	3	3	3	2	-	-	-	-	3	3	-	2	2	3
CO5	3	3	3	2	-	-	-	-	3	3	-	2	2	3
AVG	**3**	**3**	**3**	**2**	**-**	**-**	**-**	**-**	**3**	**3**	**-**	**2**	**2**	**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: Analyze the cyber and labour law.
CO4: Explain 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,2019.
3. Dr. Vinod K. Singhania and Dr. Monica Singhania , Student's Guide To Income Tax, Taxmann Publications (P) Ltd, 2023.
4. S.C. Srivastava, Industrial Relations and Labour Laws, Vikas Publishing House Pvt. Ltd,2022.
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. 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: Utilize 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: Understand the food groups.
CO2: Understand properties of pulses and grams.
CO3: Understand properties of beverages.
CO4: Understand properties of milk.
CO5: Understand properties of meats.

TEXT BOOKS

1. M. Swaminathan. Food science, Chemistry and Experimental foods, International Book House Publication.
2. Norman.N.Potter, Food Science, New York: Chapman & HalI, 1995.
3. Griswold R.M, Experimental study of Foods, John Wiely & Sons, INC, New York, 1962.

REFERENCE BOOKS

1. Helen Charley, Food Science, Macmillan, 1982.
2. A.G. Peckam, Foundation of Food Preparation, Collier Macmillan Ltd, 1969.
3. Modern Cookery for teaching and trade, volume I&II ,Thangam Philip. Orient Longmans Ltd.
4. Food Fundamentals by MacWiliams, John Willy and son‟s, New York.
5. Food Facts & Principles by Shakunthala manay & Shadakhraswamy.

24MC5102 DESIGN THINKING **L T P C**

3 0 0 0

COURSE OBJECTIVES

- To learn design thinking concepts and principles.
- To use design thinking methods in every stage of the problem.
- To learn the different phases of design thinking.

UNIT I INTRODUCTION **9**

Why Design? - Four Questions, Ten Tools - Principles of Design Thinking - The process of Design Thinking - How to plan a Design Thinking project.

UNIT II UNDERSTAND, OBSERVE AND DEFINE THE PROBLEM **9**

Search field determination - Problem clarification - Understanding of the problem - Problem, analysis - Reformulation of the problem - Observation Phase - Empathetic design - Tips for observing - Methods for Empathetic Design - Point-of-View Phase - Characterization of the target group - Description of customer needs.

UNIT III IDEATION AND PROTOTYPING **9**

Ideate Phase - The creative process and creative principles - Creativity techniques - Evaluation of ideas - Prototype Phase - Lean Startup Method for Prototype Development - Visualization and presentation techniques.

UNIT IV TESTING AND IMPLEMENTATION **9**

Test Phase - Tips for interviews - Tips for surveys - Kano Model - Desirability Testing - How to conduct workshops - Requirements for the space - Material requirements - Agility for Design Thinking.

UNIT V FUTURE **9**

Design Thinking meets the corporation – The New Social Contract – Design Activism – Designing tomorrow**.**

TOTAL: 45 PERIODS

COURSE OUTCOMES

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

CO1: Explain the principles of design thinking.
CO2: Define the problems.
CO3: Create prototype.
CO4: Test the product.
CO5: Implement the product in the market sale.

TEXT BOOKS

1. Christian Mueller-Roterberg, Handbook of Design Thinking - Tips & Tools for how to design thinking.
2. Jeanne Liedtka and Tim Ogilvie, Designing for Growth: a design thinking tool kit for managers.
3. Tim Brown, Change by Design: How Design Thinking Transforms Organizations and Inspires Innovation.

REFERENCE BOOKS

1. Johnny Schneider, “Understanding Design Thinking, Lean and Agile”, O'Reilly Media, 2017.

2. Roger Martin, "The Design of Business: Why Design Thinking is the Next Competitive Advantage", Harvard Business Press, 2009.
3. Hasso Plattner, Christoph Meinel and Larry Leifer (eds), "Design Thinking: Understand – Improve – Apply", Springer, 2011.
4. http://ajjuliani.com/design-thinking-activities.
5. https://venturewell.org/class-exercices.

24MC5103 HISTORY OF SCIENCE AND TECHNOLOGY IN INDIA **L T P C**
3 0 0 0

COURSE OBJECTIVES

- To know the contributions of sciences.
- To gain knowledge astronomy, mathematics and Ayurveda.
- To gain knowledge on technological development of India.

UNIT I INTRODUCTION **9**

Logic and methodology of Indian sciences. An overview of Indian contributions to sciences. An overview of Indian contributions to technology.

UNIT II ASTRONOMY **9**

Development of astronomy in India. Pancanga: Indian calendrical computations. The distinct features of Indian planetary models. Computation of eclipses: Its simplicity, elegance and efficiency. Observational astronomy in India.

UNIT III MATHEMATICS **9**

An overview of the development of mathematics in India. Mathematics contained in Sulbasutras. Combinatorial aspects of the Chandassastra. Solutions to the first and second order indeterminate equations. Weaving mathematics into beautiful poetry: Bhaskaracarya. The evolution of sine function in India. The discovery of calculus by Kerala astronomers.

UNIT IV AYURVEDA **9**

History of Ayurveda, Rational foundations of Ayurveda, Textual sources in Ayurveda, Ayurveda and allied disciplines, Approach to health and disease in Ayurveda – 2 lectures, Approach to diet and nutrition in Ayurveda. Modern medicine, Ayurveda and Yoga.

UNIT V TECHNOLOGICAL DEVELOPMENT IN INDIA **9**

Agriculture- Origin, development, and Ancient crops, Water management- Overview, Harappan water management, other case studies, Medieval Water structures, Pottery-technical aspects, Silpasastra: Architecture and Construction- An introduction to Silpasastra and Construction Technology.

TOTAL: 45 PERIODS

COURSE OUTCOMES

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

CO1: Explain the Indian science.
CO2: Explore essence of Indian astronomy.
CO3: Enumerate the development of Indian mathematics
CO4: Discuss the sources of Ayurveda.
CO5: Explain the technological development of India.

TEXT BOOKS

1. Soni, S., India's glorious scientific tradition: Exploration of ancient knowledge and modern insights. Prabhat Prakashan.2020.
2. Joseph, G. G, A passage to infinity: Medieval Indian mathematics from Kerala and its impact. SAGE Publications, 2009.
3. Mohan, K., Science and technology in colonial India. Routledge, 2023.

REFERENCE BOOKS

1. Sarma, K. V. A history of the Kerala school of Hindu astronomy. Vishveshvarananda Institute of Sanskrit and Indological Studies, 1972.
2. Seshadri, C. S. (Ed.). Studies in the history of Indian mathematics. Hindustan Book Agency, 2010.
3. Datta, B., & Singh, A. N. History of Hindu mathematics: A source book. Asia Publishing House, 1962.
4. Kashyapa, K., Kashyapa Samhita. Chaukhambha Orientalia, 2007.
5. https://onlinecourses.swayam2.ac.in/arp19_ap87/preview.

24MC5104 POLITICAL AND ECONOMIC THOUGHT **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.

TOTAL: 45 PERIODS

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.

TOTAL: 45 PERIODS

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- Hazard and Operability- Fault Tree Analysis- Event Tree Analysis Qualitative and Quantitative Risk Assessment Checklist Analysis- Root cause analysis- What-If Analysis- and Hazard Identification and Risk Assessment.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

Course outcomes on completion of this course the student will be able:

CO1: Explain the basic concept of safety.
CO2: Obtain knowledge of Statutory Regulations and standards.
CO3: Know about the safety Activities of the Working Place.
CO4: Analyze on the impact of Occupational Exposures and their Remedies
CO5: Obtain knowledge of Risk Assessment Techniques.

TEXT BOOKS

1. R.K. Jain and Prof. Sunil S. Rao Industrial Safety, Health and Environment Management Systems KHANNA PUBLISHER
2. L. M. Deshmukh Industrial Safety Management: Hazard Identification and Risk Control McGraw-Hill Education
3. Asfahl, C. R., & Rieske, D. W., Industrial safety and health management (7th ed.). Pearson 2018.

REFERENCE BOOKS

1. Frank Lees, 'Lees' Loss Prevention in Process Industries. Butterworth-Heinemann publications, UK, 4th Edition., 2012.
2. John Ridley & John Channing, Safety at Work: Routledge, 7th Edition., 2008.
3. Dan Petersen, Techniques of Safety Management: A System Approach, 2003
4. Alan Waring, Safety management system: Chapman & Hall, England 5. Society of Safety Engineers, USA, 1996
5. Ferris, R. W., & Murphy, D, Workplace safety: Establishing an effective violence prevention program. Butterworth-Heinemann.

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, 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	2	2
CO2	3	2	3	–	3	–	–	–	–	–	–	3	2	2
CO3	3	2	3	–	3	–	–	–	–	–	–	3	2	2
CO4	3	2	2	–	3	–	–	–	–	–	–	3	2	2
CO5	3	3	3	2	3	2	2	–	2	2	2	3	2	2
AVG	3	2.3	2.6	2	3	2	2	-	2	2	2	2.8	2	2

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 print Area(). Provide three classes named Rectangle, Triangle, and Circle such that each one of the classes extends the class Shape. Each one of the classes contains only the method print Area() that prints the area of the given shape.
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, McGraw Hill 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

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	3	–	2	–	3	–	–	–	–	2	–	2	2	-
CO2	3	2	3	–	3	–	–	–	–	–	–	3	2	-
CO3	3	2	3	–	3	–	–	–	–	–	–	3	2	-
CO4	3	2	2	–	3	–	–	–	–	–	–	3	2	-
CO5	3	3	3	2	3	2	2	–	2	2	2	3	2	-
AVG	3	2.3	2.6	2	3	2	2	-	2	2	2	2.8	2	-

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: Recall and define the fundamental concepts of 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 Edition, 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 Edition, 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	2	2
CO2	3	3	2	-	2	-	-	-	-	-	-	-	2	2
CO3	3	3	3	-	3	-	-	-	1	-	1	-	2	2
CO4	2	3	2	3	2	-	-	-	-	-	1	-	2	2
CO5	3	2	2	-	3	-	-	-	-	-	-	1	2	2
AVG	2.8	2.6	2.3	3	2.2	-	-	-	1	-	1	1.5	2	2

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	2	2
CO2	3	3	-	2	2	-	-	-	-	-	1	-	2	2
CO3	3	2	2	2	1	-	-	-	-	-	1	-	2	2
CO4	2	1	-	-	2	-	-	-	-	-	-	-	2	2
CO5	2	2	2	-	3	-	-	-	1	2	2	1	2	2
AVG	2.6	2	2	2	1.8	-	-	-	1	2	1.3	1.5	2	2

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

24OEI101 CONTROL SYSTEMS ENGINEERING **L T P C**
3 0 2 4

COURSE OBJECTIVES

- To understand the use of transfer function models for analysis physical systems and introduce the control system components.
- To provide adequate knowledge in the time response of systems and steady state error analysis.
- To accord basic knowledge in obtaining the open loop and closed–loop frequency responses of systems

UNIT I MATHEMATICAL MODELS OF PHYSICALSYSTEMS **9**

Definition & classification of system – terminology & structure of feedback control theory – Analogous systems - Physical system representation by Differential equations – Block diagram reduction–Signal flow graphs.

UNIT II TIME RESPONSE ANALYSIS **9**

Standard test signals – Steady state error & error constants – Time Response of I and II order system.

UNIT III FREQUENCY RESPONSE ANALYSIS **9**

Correlation between Time & Frequency response – Polar plots – Bode Plots – Determination of Transfer Function from Bode plot.

UNIT IV STABILITY CONCEPTS & ANALYSIS **9**

Concept of stability – Necessary condition – RH criterion – Relative stability – Nyquist stability criterion – Stability from Bode plot – Relative stability from Nyquist & Bode – Closed loop frequency response.

UNIT V STATE VARIABLE ANALYSIS **9**

Concept of state – State Variable & State Model – State models for linear & continuous time systems–Solution of state & output equation–controllability & observability.

TOTAL: 45 PERIODS

LIST OF EXPERIMENTS

1. Mathematical modelling and analysis of Mechanical and Electrical systems using transfer function approach.
2. Time domain analysis of second order system .
3. Study of stability using Routh Hurwitz criterion .
4. Root locus technique based stability analysis.
5. Frequency response and stability analysis using Bode plot.
6. Frequency response and stability analysis using Polar plot.
7. Mathematical modelling and analysis of Mechanical and Electrical systems using state space approach.
8. Test of controllability and observability of a state space model.

TOTAL: 30 PERIODS

COURSE OUTCOMES

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

CO1: Design the basic mathematical model of physical System.
CO2: Analyze the time response analysis and techniques.
CO3: Analyze the transfer function from different plots.
CO4: Apply the stability concept in various criterion.
CO5: Assess the state models for linear and continuous Systems.

TEXT BOOKS

1. Farid Golnarghi , Benjamin C. Kuo, Automatic Control Systems Paper back,
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 Analysis and Design, 5th Edition, CRC PRESS, 2003.
4. S . Palani, Control System Engineering, McGraw-Hill Education Private Limited, 2009.
5. Yaduvir Singh and S.Janardhanan, Modern Control, Cengage Learning, First 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	2	-
CO2	3	3	2	3	1	1	-	-	-	-	-	1	2	-
CO3	3	3	3	2	2	2	-	-	-	-	-	1	2	-
CO4	3	3	3	2	2	1	-	-	-	-	-	1	2	-
CO5	3	3	3	1	1	1	-	-	-	-	-	1	2	-
AVG	**3**	**3**	**2.8**	**2**	**1.6**	**1.2**	**-**	**-**	**-**	**-**	**-**	**1**	**2**	-

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.iot
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 and its dynamic characteristics
CO2: Design low power SMPS.
CO3: Analyze the various uncontrolled rectifiers and design suitable filter circuits.
CO4: Analyze the operation of the n-pulse converters and evaluate the performance parameters.
CO5: Apply voltage control and harmonic Elimination methods to inverter circuits.

TEXT BOOKS

1. Ned Mohan, T.M.Undeland, W.P.Robbins, "Power Electronics: Converters, applications and design", John Wiley and Sons, 3rd Edition (reprint), 2009
2. Rashid M.H., Power Electronics Circuits, Devices and Applications, Prentice Hall India, 3 rd Edition, New Delhi, 2004.
3. Bimal.K.Bose "Modern Power Electronics and AC Drives", Pearson Education, Second Edition, 2003.

REFERENCE BOOKS

1. Cyril.W.Lander, Power Electronics, McGraw Hill International, Third Edition, 1993.
2. P.S.Bimbhra, Power Electronics, Khanna Publishers, Third Edition 2003
3. PhilipT.Krein, Elements of Power Electronics, Oxford University Press, 2013.
4. P.C.Sen, Power Electronics, Tata McGraw-Hill, 30th reprint, 2008.
5. Bin Wu, Mehdi Narimani, "High-Power Converters and AC Drives", Wiley, 2nd Edition, 2017.

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

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

4. JR.Hack worth and F.D Hackworth Jr., Pearson, 2004.
5. Embedded Systems- An integrated approach - Lyla b das, Pearson education 2012. Computers as Components –Wayne Wolf, Morgan Kaufmann (second edition).

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

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

24OEOI104 FUNDAMENTALS OF ELECRONIC DEVICES AND CIRCUITS **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", Third edition, New Age publishers,2014.

REFERENCE BOOKS

1. Millman and Halkias, "Integrated Electronics", McGraw Hill Publications, 2010.
2. Muhammad H. Rashid, "Linear Integrated Circuits", Cengage Learning, 2014.
3. Donald A Neamen, "Electronic Circuits", McGraw Hill, edition, 2007.
4. Sergio Franco, "Design with Operational Amplifiers and Analog Integrated Circuits", McGraw Hill,
5. Floyd, Buchla, "Fundamentals of Analog Circuits", Pearson, 2013.

Mapping of COs with POs & 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	2
CO2	2	1	2	3	3	1	-	-	2	-	-	1	2	2
CO3	2	1	2	3	3	1	-	-	2	-	-	1	2	2
CO4	2	1	2	3	3	1	-	-	2	-	-	1	2	2
CO5	2	1	2	3	3	1	-	-	2	-	-	1	2	2
AVG	2	1	2	3	3	1	-	-	2	-	-	1	2	2

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

24OMI101 INTERNAL COMBUSTION ENGINES **L T P C**
3 0 2 4

COURSE OBJECTIVES

- To impart the basic fundamental knowledge on IC engines and its working along with some of the recent trends in IC engine.
- To impart knowledge on cooling and lubrication.
- To study the modern engine technologies.

UNIT I INTRODUCTION IC ENGINES **9**

Introduction, Types of IC engines, Constructional details IC engine, working, principles – 2 & 4 stroke engines, Cycles – Air standard cycles, Fuel air cycles and actual cycles, Actual Indicator diagram for four stroke and two stroke engines, General fuel properties, ignition properties –octane and cetane rating, Materials for engine components.

UNIT II PETROL ENGINES **9**

Working and constructional details of petrol engines, Carburetor – constructional and working, types of carburetors, additional features in modern carburetor, A/F ratio calculation, Petrol Injection - introduction, Ignition – introduction and requirements, Battery and magneto coil ignition system, Electronic ignition system, Stages of combustion in petrol engines, Combustion chambers for petrol engine, formation of knock in petrol engine.

UNIT III DIESEL ENGINES **9**

Working and constructional details of diesel engines, fuel injection – requirements, types of injection systems – inline, distributor pumps, unit injector, Mechanical and pneumatic governors. Fuel injector, Types of injection nozzles, Spray characteristics. Injection timing, Split and multiple injection, Stages of combustion in Diesel engines, direct and indirect combustion chambers for diesel engine, knocking in diesel engine, Introduction on supercharging and turbocharging.

UNIT IV COOLING AND LUBRICATION **9**

Requirements, Types- Air cooling and liquid cooling systems, forced circulation cooling system, pressure and Evaporative cooling systems, properties of coolants for IC engine. Need

of lubrication, Lubricants for IC engines - Properties of lubricants, Types of lubrication – Mist, Wet and dry sump lubrication systems.

UNIT V MODERN TECHNOLOGIES IN IC ENGINES **9**

HCCI Engines – construction and working, CRDi injection system, GDI Technology, E - Turbocharger, Variable compression ratio engines, variable valve timing technology, Fuel cell, Hybrid Electric Technology.

TOTAL: 45 PERIODS

LIST OF EXPERIMENTS

1. Valve Timing Diagram of a Four-Stroke Engine.
2. Port Timing Diagram of a Two-Stroke Engine.
3. Actual Pressure-Volume (P–V) Diagrams of Internal Combustion Engines.
4. Performance Test on a Four-Stroke Diesel Engine.
5. Heat Balance Test on a Four-Stroke Diesel Engine.
6. Morse Test on a Multi-Cylinder Petrol Engine.
7. Retardation Test on a Diesel Engine.
8. Viscosity Measurement Using a Redwood Viscometer.

TOTAL: 30 PERIODS

COURSE OUTCOMES

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

CO1: Explain the working SI engine fundamentals.
CO2: Explain SI engine fundamentals.
CO3: Express concept of CI engines.
CO4: Explore 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	-	-	-	-	-	-	-	-	-	2	2
CO2	3	3	3	-	-	-	-	-	-	-	-	-	2	2
CO3	3	3	3	-	-	-	-	-	-	-	-	-	2	2
CO4	3	3	3	-	-	-	-	-	-	-	-	-	2	2
CO5	3	3	3	-	-	-	-	-	-	-	-	-	2	2
AVG	3	2.8	2.8	-	-	-	-	-	-	-	-	-	2	2

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

24OMI102 TESTING OF ENGINEERING MATERIALS **L T P C**
3 0 2 4

COURSE OBJECTIVES

- To gain and understanding of the response of various metals under the application of stress and temperature.
- To build necessary theoretical back ground of the role of lattice defects in governing both elastic and plastic properties of metals will be discussed.
- Obtain a working knowledge of various hardness testing machines BHN, VHN, RHN.

UNIT I INTRODUCTION **9**

Introduction, Importance of testing Hardness Test: Methods of hardness testing – Brinell, Vickers, Rockwell hardness tests. The Impact Test: Notched bar impact test and its significance, Charpy and Izod Tests, fracture toughness testing - COD and CTOD tests, significance of transition temperature curve.

UNIT II TENSILE TESTING **9**

Engineering stress-strain and True stress-strain curves. Tensile properties, conditions for necking. Stress-Strain diagrams for steel, Aluminum and cast iron.

UNIT III FATIGUE TESTING **9**

Introduction, Stress cycles, S-N Curve, Effect of mean stress, Mechanism of fatigue failure, Effect of stress concentration, size, surface condition and environments on fatigue.

UNIT IV CREEP AND STRESS RUPTURE **9**

Introduction, The creep curve, Stress-rupture test, Structural changes during creep, Mechanism of creep deformation, theories of creep. Fracture at elevated temperature.

UNIT V NON DESTRUCTIVE TESTING **9**

Principle, Operation, Advantages and Limitations of Liquid Penetrant, Magnetic Particle, Radiography and Ultrasonic tests.

TOTAL: 45 PERIODS

LIST OF EXPERIMENTS

1. Tension test on mild steel rod.
2. Torsion test on mild steel rod.
3. Hardness test on metal beam (Rockwell and Brinell Hardness Tests).
4. Compression test on helical spring.
5. Deflection test on carriage spring.
6. Impact Testing on mild steel rod.
7. Deflection of a cantilever wooden and steel beam.
8. Determine the deflection of a simply supported wooden and steel beam

TOTAL: 30 PERIODS

COURSE OUTCOMES

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

CO1: Classify mechanical testing of ferrous and non-ferrous metals and alloys.

CO2: Recognize the importance of crystal defects including dislocations in plastic deformation.

CO3: Solve the 2D vector variable problems using Finite Element technique.

CO4: Identify the testing methods for obtaining strength and hardness.

CO5: Examine the mechanisms of materials failure through fatigue and creep.

TEXT BOOKS

1. Mechanical Metallurgy – G. E. Dieter, Third edition, published by New York Mc GrawHill,1986.
2. J. Wulff,".Mechanical behavior", John Wiley & Sons Inc; Trans-ed edition.
3. Baldev Raj, T.Jayakumar, M.Thavasimuthu "Practical Non-Destructive Testing", Narosa Publishing House, 2009.

REFERENCE BOOKS

1. Mechanical Metallurgy – White & Lemay.
2. Testing of Metallic Materials - A.V.K. Suryanarayana
3. Metals Handbook: Mechanical testing, (Volume 8) ASM Handbook Committee, 9th Edition, American Society for Metals, 1978.
4. Brandon D.G., "Modern Techniques in Metallography", Von Nostrand Inc. NJ, USA, 1986.
5. ASM Metals Handbook, "Non-Destructive Evaluation and Quality Control", American Society of Metals, Metals Park, Ohio, USA.

Mapping of COs with POs & 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	-	2	-	-	-	-	-	-	-	-	2	2
CO3	3	3	-	2	-	-	-	-	-	-	-	-	2	2
CO4	3	3	-	2	-	-	-	-	-	-	-	-	2	2
CO5	3	3	-	2	-	-	-	-	-	-	-	-	2	2
AVG	3	3	-	2	-	-	-	-	-	-	-	-	**2**	**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 impression by 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	-	-	-	-	-	-	-	-	-	-	2	2
CO2	2	2	-	-	-	-	-	-	-	-	-	-	2	2
CO3	3	3	2	-	-	-	-	-	-	-	-	-	2	2
CO4	3	3	3	2	-	-	-	-	-	-	-	-	2	2
CO5	3	3	3	2	-	-	-	-	-	-	-	-	2	2
AVG	2.6	2.4	2.67	2	-	-	-	-	-	-	-	-	2	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, Immonen Anselmie, 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	-	-	-	-	-	-	-	-	-	2	2
CO2	2	-	2	-	-	-	-	-	-	-	-	-	2	2
CO3	-	-	2	-	-	-	-	-	-	-	-	-	2	2
CO4	2	2	2	-	-	-	-	-	-	-	-	-	2	2
CO5	-	-	2	-	-	-	-	-	-	-	-	-	2	2
AVG	**2.33**	**2**	**2**	-	-	-	-	-	-	-	-	-	**2**	**2**

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

24OBI101 INTRODUCTION TO DIGITAL SIGNAL PROCESSING **L T P C**
3 0 2 4

COURSE OBJECTIVES

- To introduce the concepts of discrete time random signal processing.
- To introduce about multirate signal processing and its applications.
- To understand the spectrum estimation techniques.

UNIT I MULTIRATE SIGNAL PROCESSING **9**

Review of Convolution, DFT and ZT, Multirate Signal Processing - Decimation, Interpolation, Sampling Rate Conversion by a rational factor – digital filter banks, sub band coding, Quadrature Mirror Filter.

UNIT II DISCRETE TIME RANDOM PROCESSES **9**

Stationary random processes, Autocorrelation, Rational Power Spectra, Filters for generating random Processes from white noise and inverse filter – AR, MA and ARMA processes – relationship between autocorrelation and the filter parameters.

UNIT III LINEAR PREDICTION AND FILTERING **9**

Linear Prediction – Forward and Backward - Wiener filters for filtering and prediction – FIR Wiener Filter – IIR Wiener Filter – Kalman Filter.

UNIT IV ADAPTIVE FILTERING **9**

FIR adaptive filters – adaptive filters based on steepest descent method – LMS algorithm – Variants of LMS algorithm – adaptive echo cancellation – adaptive channel equalization – RLS Algorithm.

UNIT V SPECTRUM ESTIMATION **9**

Estimation of power spectra from finite duration observations of signals – Non parametric methods of spectrum estimation – the Bartlett and the Welch method – Parametric spectrum estimation – AR MA and ARMA.

TOTAL:45 PERIODS

LIST OF EXPERIMENTS

1. Study of autocorrelation and Cross Correlation of random signals.
2. Design and Implementation of Multirate Systems.
3. Design and Implementation of Wiener Filter.
4. Design and Implementation of FIR Linear Predictor.
5. Design of adaptive filters using LMS algorithm.
6. Spectrum Estimation using Bartlett and Welch Methods.
7. Design and Implementation of IIR .
8. Design of adaptive filters using RLS algorithm.

TOTAL:30 PERIODS

COURSE OUTCOMES

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

CO1: Comprehend multirate signal processing and demonstrate its applications.

CO2: Demonstrate an understanding of the power spectral density and apply to discrete random signals and systems.

CO3: Apply linear prediction and filtering techniques to discrete random signals for signal detection and estimation.

CO4: Analyze adaptive filtering problems and demonstrate its application.

CO5: Apply power spectrum estimation techniques to random signals.

TEXT BOOKS

1. John G. Proakis & Dimitris G.Manolakis, ―Digital Signal Processing – Principles, Algorithms & Applications, Fourth Edition, Pearson Education / Prentice Hall, 2007.
2. P. Vaidyanathan, "Multirate systems and filter banks", Prentice Hall Inc. 1993.
3. A. V. Oppenheim, R.W. Schafer and J.R. Buck, ―Discrete-Time Signal Processing", 8th Indian Reprint, Pearson, 2004.

REFERENCE BOOKS

1. Monson H. Hayes, "Statistical digital signal processing and modeling", John Wiley and Sons Inc. New York, Indian reprint 2008.
2. Haykin, Adaptive Filter Theory, 4th Edition, Pearson Education, New Delhi, 2006.
3. Sophoncles J. Orfanidis, "Optimum Signal Processing ", McGraw Hill, 2000.

4. Emmanuel C. Ifeachor& Barrie. W. Jervis, “Digital Signal Processing”, Second Edition, Pearson Education / Prentice Hall, 2002.
5. Sanjit K. Mitra, “Digital Signal Processing – A Computer Based Approach”, Tata Mc Graw Hill, 2007.

Mapping of COs with POs and PSOs

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

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

24OBI102 IOT AND SENSORS TYPES **L T P C**
3 0 2 4

COURSE OBJECTIVES

- To understand the fundamental concepts related to IoT and sensors types.
- To understand basics of an IOT System, IoT hardware and communication protocols, data storage, data analysis and use them for real time IoT enabled domains.
- To become familiar with sensor types and its functions.

UNIT I INTRODUCTION TO IOT AND IOT LEVELS **9**

Functional blocks of an IoT system (Sensors, Data Ingress, Data Aggregation Point Communication point back to the cloud, Analysis, Decision making, Actuation) Basic of Physical and logical design of IoT (IoT protocols, communication models) IoT enabled domains (Home automation, Smart cities, environment monitoring, renewable energy, agriculture, industry, healthcare, marketing and management) M2M, Difference between IoT, Embedded Systems and M2M, Industry 4.0 concepts.

UNIT II IOT SENSORS AND HARDWARE **9**

Passive and active sensors, differences, Different kinds of sensors (Temperature, humidity, pressure, obstacle, water flow, accelerometer, colour, gyro, load cell, finger print, motion, ultrasonic distance, magnetic vibration, eye blink, hear beat, PPG, glucose, body position, blood pressure), Multi-sensors, Pre-processing (sampling, filtering, ADC, size of data, local memory, compression), IoT front end hardware (Raspberry Pi, Arduino, Galileo, beagle bone equivalent platforms).

UNIT III INTRODUCTION TO IOT PROTOCOLS **9**

Infrastructure (6LowPAN, IPv4/IPv6, RPL), Identification (EPC, uCode, IPv6, URIs), Communication/ Transport (Wi-Fi, Bluetooth, ZigBee, LPWAN), Data Protocols (MQTT, CoAP, AMQP, Websocket, Node).

UNIT IV IOT CLOUD AND DATA ANALYTICS **9**

Collecting data from sensors, Data Ingress, Cloud storage, IoT cloud platforms (Amazon AWS, Microsoft Azure, Google APIs), Data analytics for IoT, Software and management tool for IoT, Dashboard design.

UNIT V IOT ARCHITECTURES WITH CASE STUDIES **9**

Business models for IoT, smart cities, agriculture, healthcare, industry. Case studies/Mini projects for the real time IoT applications.

TOTAL:45 PERIODS

LIST OF EXPERIMENTS

1. Introduction to Arduino platform and programming .
2. Explore different communication methods with IoT devices (Zigbee, GSM, Bluetooth) .
3. Introduction to Raspberry PI platform and python programming.
4. Interfacing sensors with Raspberry PI .
5. Communicate between Arduino and Raspberry PI using any wireless medium.
6. Setup a cloud platform to log the data.
7. Log Data using Raspberry PI and upload to the cloud platform.
8. Design an IOT based system.

TOTAL:30 PERIODS

COURSE OUTCOMES

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

CO1: Enumerate basic premise of an IOT System.

CO2: Implement basic and to be familiar with the sensors available for IoT applications.

CO3: Explore the front-end hardware platforms and communication protocols for IoT.

CO4: Explore the cloud storage systems involved in organizing and analyzing data

CO5: Design and develop the usage for real time IoT enabled domains.

TEXT BOOKS

1. Arshdeep Bahga, Vijay Madisetti, “Internet of Things – A hands-on approach”, Universities Press, 2015.
2. Mayur Ramgir, Internet – of – Things, Architecture, Implementation and Security, First Edition, Pearson Education, 2020.
3. Robert Barton, Patrick Grossetete, David Hanes, Jerome Henry, Gonzalo Salgueiro, “IoT Fundamentals: Networking Technologies, Protocols, and Use Cases for the Internet of Things”, CISCO Press, 2017.

REFERENCE BOOKS

1. Raj kamal, Internet of Things, Architecture and Design Principles, McGraw-Hill, 2017.
2. Manoel Carlos Ramon, "Intel® Galileo and Intel® Galileo Gen 2: API Features and Arduino Projects for Linux Programmers", Apress, 2014.H.Gerez, "Algorithms for VLSI Design Automation", John Wiley, 1999.
3. Marco Schwartz, "Internet of Things with the Arduino Yun", Packt Publishing, 2014.
4. Perry Lea, "Internet of things for architects", Packt, 2018.
5. Olivier Hersent, David Boswarthick, Omar Elloumi , "The Internet of Things – Key applications and Protocols", Wiley, 2012.

Mapping of COs with POs and PSOs

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

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

24OBI103 MEDICAL DIAGNOSTIC AND THERAPEUTIC EQUIPMENTS L T P C
3 0 2 4

COURSE OBJECTIVES

- To understand the working of the devices for measurement of parameters related to ECG, EEG and EMG.
- To explain diagnostic and therapeutic devices related to respiratory parameters.
- To understand the various sensory measurements that hold clinical importance.

UNIT I CARDIAC EQUIPMENT **9**

Electrocardiograph, Normal and Abnormal Waves, Heart rate monitor- Holter Monitor, Phonocardiography, Cardiac Pacemaker-Internal and External Pacemaker, AC and DC Defibrillator- Internal and External.

UNIT II NEUROLOGICALEQUIPMENT **9**

Clinical significance of EEG, Multi-channel EEG recording system, Evoked Potential– Visual, Auditory and Somatosensory, MEG (Magneto Encephalo Graph), EEG Bio Feedback Instrumentation.

UNIT III MUSCULAR AND BIOMECHANICAL EQUIPMENT **9**

Clinical significance of EEG, Multi-channel EEG recording system, Evoked Potential– Visual, Auditory and Somatosensory, MEG (Magneto Encephalo Graph), EEG Bio Feedback Instrumentation.

UNIT IV RESPIRATORY MEASUREMENT AND ASSIST SYSTEM **9**

Instrumentation for measuring the mechanics of breathing – Spiro meter, Lung Volume and vital capacity, measurements of residual volume, Pneumotacho meter, Whole body Plethysmo graph, Apnoea Monitor.

UNIT V SENSORY DIAGNOSTIC EQUIPMENT **9**

Psycho physiological Measurements – polygraph, basal skin resistance (BSR), galvanic skin resistance (GSR), Sensory responses - Audiometer-Pure tone, Speech, Eye Tonometer, auto refractometer.

TOTAL: 45 PERIODS

LIST OF EXPERIMENTS

1. Measurement of visually and auditory evoked potential.
2. Galvanic skin resistance (GSR) measurement.
3. Measurement of output intensity from short wave and ultra sonic diathermy.
4. Electrical safety measurements.
5. Measurement of stimulation current wave forms used in medical stimulator.
6. Recording of Audiogram.
7. Study the working of Defibrillator and pacemakers.
8. Study of ECG, EEG and EMG electrodes.

TOTAL:30 PERIODS

COURSE OUTCOMES

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

CO1: Describe the working and recording setup of all basic cardiac equipment.
CO2: Follow the working and recording of all basic neurological equipment's.
CO3: Discuss the recording of diagnostic and therapeutic equipment's related to EMG.
CO4: Explain about measurements of parameters related to respiratory system.
CO5: Describe the measurement techniques of sensory responses.

TEXT BOOKS

1. John G.Webster," Medical Instrumentation Application and Design",4th edition, Wiley India Pvt Ltd, New Delhi, 2015.
2. Joseph J. Carrand John M. Brown," Introduction to Biomedical Equipment Technology", Pearson education, 2012.
3. Khandpur. R.S., "Handbook of Biomedical Instrumentation". Second Edition. Tata Mc-Graw Hill Pub. Co.,Ltd. 2003.

REFERENCE BOOKS

1. L.A Geddes and L.E.Baker, "Principles of Applied Biomedical Instrumentation", 3rd Edition, 2008.
2. Khandpur. R.S., "Handbook of Biomedical Instrumentation". Second Edition. Tata Mc Graw Hill Pub. Co., Ltd. 2003.
3. Antony Y. K. Chan, "Biomedical Device Technology, Principles and design", Charles Thomas Publisher Ltd, Illinois, USA, 2008.
4. Leslie Cromwell, "Biomedical Instrumentation and Measurement", Pearson Education, New Delhi, 2007.
5. Shakti Chatterjee, Aubert Miller, "Bio medical Instrumentation Systems" 2010 1st edition, Delmar Cencage Learning, Clifton Park, New York.

Mapping of COs with POs and PSOs

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

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

24OBI104 BIOMEDICAL INSTRUMENT AND DESIGN **L T P C**
3 0 2 4

COURSE OBJECTIVES

- To understand the origin of various biological signals and electrode configurations specific to bio-potential measurements.
- To understand the characteristics of Bio signals and the design of bio amplifiers.
- To explain the different techniques used for measurement of non-electrical bio-parameters.

UNIT I ELECTRODE CONFIGURATIONS **9**

Bio signals characteristics – Origin of bio potential and its propagation, Frequency and amplitude ranges, Electrode configurations: Electrode-electrolyte interface, electrode–skin interface impedance, Unipolar and bipolar configuration, classification of electrodes.

UNIT II BIO SIGNAL CHARACTERISTICS **9**

Bio signals characteristics – ECG-frequency and amplitude ranges, Einthoven's triangle, standard 12 lead system. EEG – 10-20 electrode system, unipolar, bipolar and average mode. EMG– unipolar and bipolar mode. EMG - Electrode configuration -unipolar and bipolar mode.

UNIT III BIO AMPLIFIERS **9**

Infrastructure (6LowPAN, IPv4/IPv6, RPL), Identification (EPC, uCode, IPv6, URIs), Communication/ Transport (Wi-Fi, Bluetooth, ZigBee, LPWAN), Data Protocols (MQTT, CoAP, AMQP, Websocket, Node).

UNIT IV MEASUREMENT OF BIO SIGNALS **9**

Temperature, respiration rate and pulse rate measurements. Blood Pressure - indirect methods and direct methods, Blood flow and cardiac output measurement- Indicator dilution and thermal dilution , Electromagnetic and ultrasound blood flow measurements.

UNIT V BIO CHEMICAL MEASUREMENTS **9**

Biochemical sensors - pH, pO2 and pCO2, Blood gas analyzers, colorimeter, flame photometer, spectrophotometer, blood cell counter, auto analyzer.

TOTAL:45 PERIODS

LIST OF EXPERIMENTS

1. Design of ECG Amplifiers.
2. Design of EMG amplifier.
3. Design of frontal EEG amplifier.
4. Design a Multiplexer and Demultiplexer for any two bio signals.
5. Measurement of body Temperature.
6. Measurement of pulse-rate using Photo transducer.
7. Measurement of pH and conductivity.
8. Measurement of blood pressure using sphygmomanometer.

TOTAL:30 PERIODS

COURSE OUTCOMES

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

CO1: Illustrate the origin of various biological signals and their characteristics.

CO2: Describe the nature and features of bio-signals.

CO3: Demonstrate understanding of amplifier characteristics relevant to bio-signal applications.

CO4: Explain the different measurement techniques for non-electrical bio-parameters.

CO5: Explain the biochemical measurement techniques as applicable for diagnosis and further treatment.

TEXT BOOKS

1. Leslie Cromwell," Biomedical Instrumentation and measurement", 2nd edition, prentice hall of India, New Delhi, 2015.
2. John G.Webster, "Medical Instrumentation Application and Design", 4th edition, Wiley India Pvt Ltd, New Delhi, 2015.
3. Khandpur R. S, "Handbook of Biomedical Instrumentation", Tata Mc Graw Hill, New Delhi, 2003.

REFERENCE BOOKS

1. John Enderle, Susan Blanchard, Joseph Bronzino, "Introduction to Biomedical Engineering", second edition, Academic Press,2005.
2. Joseph J. Carrand John M.Brown, "Introduction to Biomedical Equipment Technology", Pearson Education, 2004.
3. L. A. Geddas and L. E. Baker, "Principles of Applied Biomedical Instrumentation",2004.
4. John G. Webster, "Bioinstrumentation", John Willey and sons, New York, 2004.
5. Myer Kutz, "Standard Handbook of Biomedical Engineering & Design", McGraw-Hill Publisher, 2003.

Mapping of COs with POs and PSOs

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

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: Describe the structure and features of unfamiliar programming languages

TEXT BOOKS

1. Robert W. Sebesta, “Concepts of Programming Languages”, Twelfth Edition (Global Edition), Pearson, 2022.
2. Michael L. Scott, “Programming Language Pragmatics”, 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	-	-	-	-	-	-	-	2	2
CO2	3	2	1	-	2	-	-	-	-	-	-	-	2	2
CO3	3	3	3	-	2	-	-	-	-	-	1	-	2	2
CO4	3	2	2	-	3	-	-	-	1	1	1	-	2	2
CO5	2	2	-	-	2	-	-	-	-	-	-	3	2	2
AVG	**2.8**	**2.2**	**2**	**-**	**2.2**	**-**	**-**	**-**	**1**	**1**	**1**	**3**	**2**	**2**

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: Recognize different security standards used to protect digital information

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	-	-	2	2
CO2	2	2	-	2	-	-	-	-	-	-	2	-	2	2
CO3	2	1	-	-	1	-	1	-	-	-	-	2	2	2
CO4	3	2	3	-	3	-	-	-	-	-	1	-	2	2
CO5	3	2	3	-	3	-	-	-	-	-	1	-	2	2
AVG	**2.4**	**1.8**	**3**	**2**	**2.3**	**3**	**1**	**3**	**-**	**2**	**1.3**	**2**	**2**	**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	-	-	-	-	-	2	2
CO2	2	-	2	-	2	-	3	-	-	-	-	-	2	2
CO3	3	2	3	2	3	-	2	-	-	-	2	-	2	2
CO4	2	2	2	-	2	-	2	-	-	-	-	-	2	2
CO5	2	-	-	-	2	2	2	3	-	-	-	2	2	2
AVG	2.4	2	2.3	2	2.4	2	2.2	3	-	-	2	2	2	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.

UNIT I 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: Describe the applications of Information Technology in remote sensing systems such as drones and similar technologies.

CO2: Explain the concept of greenhouse automation along with its functional advantages in agriculture.

CO3: Apply IT principles and concepts for management of field operations.

CO4: Examine different weather models by identifying their inputs and evaluating their applications in agriculture.

CO5: Implement IT-based solutions to enhance e-governance practices in the agricultural sector.

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

CO1: Peart, R.M.,and Shoup,W.D.,"Agricultural Systems Management", Marcel Dekker, New York,2004.

CO2: Hammer,G.L., Nicholls,N.,and Mitchell,C., "Applications of Seasonal Climate", Springer, Germany,2000.

CO3: ICT & its Applications in Agriculture" by Golla Ravi, MD. Mubeena, Apoorva Veldandi.

CO4: Communication Technologies in Agriculture" by Dr. P. Jaisridhar & Mrs. Surudhi.

CO5: 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	2	2
CO2	3	2	2	-	3	-	2	-	-	-	1	2	2	2
CO3	3	3	3	2	3	1	2	-	-	-	3	2	2	2
CO4	2	2	-	2	2	-	3	-	-	-	2	2	2	2
CO5	2	2	2	-	2	-	2	2	1	2	3	2	2	2
AVG	**2.6**	**2.4**	**2.3**	**2**	**2.6**	**1**	**2.2**	**2**	**1**	**2**	**2**	**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 – M Commerce – 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

CO1: Explain the basics of mobile telecommunication systems.

CO2: Illustrate the generations of telecommunication systems in wireless networks.

CO3: Determine the functionality of MAC, network layer and Identify a routing protocol for a given Ad hoc network.

CO4: Explain the functionality of Transport and Application layers.

CO5: 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	2
CO2	3	2	-	-	2	-	-	-	-	-	-	-	2	2
CO3	3	3	3	2	3	-	-	-	-	-	-	-	2	2
CO4	2	2	-	-	2	-	-	-	-	-	-	-	2	2
CO5	2	2	3	-	3	-	-	-	1	2	2	2	2	2
AVG	2.6	2.2	3	2	2.4				1	2	2	2	2	2

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	2	2
CO2	2	3	3	-	1	-	-	-	2	2	-	1	2	2
CO3	2	3	3	1	1	-	-	-	-	2	-	1	2	2
CO4	3	2	3	-	2	-	-	-	-	1	2	1	2	2
CO5	1	2	2	-	1	-	-	-	-	1	2	1	2	2
AVG	2.2	2.4	2.6	1	1.2	-	-	-	2	1.6	2	1	2	2

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 Edition, Wiley-IEEE Press, 2013.
4. Rashid M.H., "Power Electronics Circuits, Devices and Applications ", Pearson, fourth Edition, 10th Impression 2021.
5. Iqbal Husain, 'Electric and Hybrid Electric Vehicles', CRC Press, 2021.

Mapping of COs with POs & 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	2
CO2	2	1	2	3	3	1	-	-	2	-	-	1	2	2
CO3	2	1	2	3	3	1	-	-	2	-	-	1	2	2
CO4	2	1	2	3	3	1	-	-	2	-	-	1	2	2
CO5	2	1	2	3	3	1	-	-	2	-	-	1	2	2
AVG	**2**	**1**	**2**	**3**	**3**	**1**	**-**	**-**	**2**	**-**	**-**	**1**	**2**	**2**

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

24OET102 POWER SYSTEMS **L T P C**
3 0 0 3

COURSE OBJECTVES

- To develop a comprehensive understanding of power system components, their operation, and the overall structure of electrical power systems.
- To acquire the knowledge of transmission line parameters, insulators, cables, and protective devices such as circuit breakers, enabling effective design, analysis, and maintenance of power systems.
- To familiarize students with modern control and monitoring techniques in power systems.

UNIT I INTRODUCTION **9**

Power scenario in India – Power system components – Structure of Power System – Types of Power – Substation layout components.

UNIT II TRANSMISSION LINE PARAMETERS **9**

Parameters of single and three phase transmission lines with single and double circuits - Resistance, inductance and capacitance of solid, stranded and bundled conductors, conductor types – Symmetrical and unsymmetrical spacing and transposition-application of self and mutual GMD; skin and proximity effects.

UNIT 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 Edition 2005-08.
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	2	1	2	3	3	1	-	-	2	-	-	1	2	2
CO2	2	1	2	3	3	1	-	-	2	-	-	1	2	2
CO3	2	1	2	3	3	1	-	-	2	-	-	1	2	2
CO4	2	1	2	3	3	1	-	-	2	-	-	1	2	2
CO5	2	1	2	3	3	1	-	-	2	-	-	1	2	2
AVG	**2**	**1**	**2**	**3**	**3**	**1**	**-**	**-**	**2**	**-**	**-**	**1**	**2**	**2**

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,Second 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	2	-
CO2	3	3	3	3	2	-	-	-	-	-	-	2	2	-
CO3	2	3	2	3	3	-	-	-	-	-	-	1	2	-
CO4	3	2	2	2	2	-	-	-	-	-	-	3	2	-
CO5	3	3	3	2	2	-	-	-	-	-	-	1	2	-
AVG	**2.8**	**2.8**	**2.2**	**2.8**	**2.2**	**-**	**-**	**-**	**-**	**-**	**-**	**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: Explain the operation and characteristics of other special electrical machines.

CO5: Design and conduct experiments towards research.

TEXT BOOKS

1. K.Venkataratnam, 'Special Electrical Machines', Universities Press (India) Private Limited, 2008.
2. T. Kenjo, 'Stepping Motors and their Microprocessor Controls', Clarendon Press London, 1984
3. E.G. Janardanan, 'Special electrical machines', PHI learning Private Limited, Delhi, 2014.

REFERENCE BOOKS

1. T.J.E. Miller, 'Brushless magnet and Reluctance motor drives', Clarendon press, London,1989
2. T.Kenjo, ' Stepping motors and their microprocessor controls', Oxford University press, New Delhi, 2000 Dekker 2009
3. R. Krishnan - Switched Reluctance Motor Drives Modeling, Simulation, Analysis, Design and Applications -CRC Press 2017.
4. Bilgin, Berker Emadi, Ali Jiang, James Weisheng - Switched reluctance motor drives:fundamentals to applications-CRC 2019.
5. Ramu Krishnan - Permanent Magnet Synchronous and Brushless DC Motor Drives - CRC Press, Marcel Applications -CRC Press 2009.

Mapping of COs with POs & 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	2	2
CO2	2	3	3	2	3	1	-	-	-	-	-	1	2	2
CO3	2	3	3	2	3	1	-	-	-	-	-	1	2	2
CO4	1	1	1	2	2	1	-	-	-	-	-	1	2	2
CO5	1	2	2	2	1	1	-	-	-	-	-	1	2	2
AVG	**1.6**	**2.4**	**2.2**	**2.2**	**3**	**1**	**-**	**-**	**-**	**-**	**-**	**1**	**2**	**2**

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, Solar Energy 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, Solar Energy Utilization, Khanna Publishers, 3rd Edition, 1987.

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	-	-	2	-
CO2	3	3	-	-	3	-	2	1	-	2	-	-	2	-
CO3	3	-	-	-	-	-	2	1	-	2	-	-	2	-
CO4	3	-	-	-	-	-	2	1	-	2	-	-	2	-
CO5	3	-	-	-	-	-	2	1	-	2	-	-	2	-
AVG	**3**	**3**	**-**	**-**	**3**	**-**	**2**	**1**	**-**	**2**	**-**	**-**	**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 IVELECTRICAL SAFETY IN HAZARDOUS AREAS **9**

Hazardous zones –class 0, 1 and 2 spark, flashovers and corona discharge and functional requirements Specifications of electrical plants, equipment's for hazardous locations Classification of equipment enclosure for various hazardous gases and vapours classification of equipment/enclosure for hazardous locations.

UNIT V FIRE EXTINGUISHERS **9**

Fundamentals of Fire-Initiation of Fires, Types; Extinguishing Techniques, Prevention of Fire, Types of Fire Extinguishers, Fire Detection and Alarm System, CO2 and Halogen Gas Schemes, Foam Schemes.

TOTAL: 45 PERIODS

COURSE OUTCOMES

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

CO1: Apply the Electrical Safety Principles.

CO2: Explain Safe Electrical Installations and Maintenances.

CO3: Manage Electrical Safety in Hazardous and Special Areas.

CO4: Apply safety measures during electrical installation, operation, and repair tasks.

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. www.apeasternpower.com/downloads/elecact2003.pdf .
3. Gupta, B.R., Handbook of Electrical Power System and Wiring, S. Chand Publishing, 2013.

REFERENCE BOOKS

1. Cooper.W.F, "Electrical safety Engineering", Newnes-Butterworth Company, 1978.
2. John Codick, "Electrical safety hand book", McGraw Hill Inc., New Delhi, 2000.
3. Nagrath, I.J. and Kothari, D.P., "Power System Engineering", Tata McGraw Hill, 1998.
4. Wadhwa, C.L., "Electric Power Systems", New Age International, 2004.
5. Pradeep Chaturvedi, "Energy management policy, planning and utilization", Concept Publishing company, New Delhi, 1997.

Mapping of COs with POs & PSOs

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

COs	POs												PSOs	
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
CO1	3	2	-	-	-	-	-	-	-	-	-	-	2	2
CO2	3	3	2	-	-	-	-	-	-	-	-	-	2	2
CO3	3	3	2	-	-	-	-	-	-	-	-	-	2	2
CO4	3	2	2	-	-	-	-	-	-	-	-	-	2	2
CO5	3	2	2	-	-	-	-	-	-	-	-	-	2	2
AVG	**3**	**2.4**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**2**	**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: Describe the design needs of various engine parts and identify suitable materials based on performance criteria.

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: Explain engine test cycles along with dynamometer usage 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	2	2
CO2	3	3	3	2	-	-	-	-	-	-	-	2	2	2
CO3	3	3	2	3	-	-	-	-	-	-	-	2	2	2
CO4	3	3	3	3	-	-	-	-	-	-	-	2	2	2
CO5	3	2	2	2	-	-	-	-	-	-	-	2	2	2
AVG	3	2.8	2.4	2.4	-	-	-	-	-	-	-	2	2	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	-	-	-	-	-	-	-	-	-	2	2
CO2	2	2	2	-	-	-	-	-	-	-	-	-	2	2
CO3	2	2	2	-	-	-	-	-	-	-	-	-	2	2
CO4	2	2	2	-	-	-	-	-	-	-	-	-	2	2
CO5	2	2	2	-	-	-	-	-	-	-	-	-	2	2
AVG	2	2	2	-	-	-	-	-	-	-	-	-	2	2

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

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 resources on mobility systems.

CO2: Explain the integration and functioning of fuel cells and battery energy storage systems in mobility applications.

CO3: Discuss on conventional and future propulsion system.

CO4: Enumerate alternate energy sources powered mobility.

CO5: Perform data analysis related to performance and efficiency of conventional and future propulsion systems.

TEXT BOOKS

1. Pundir B.P. "I.C. Engines Combustion and Emission", Narosa Publishing House, 2010.
2. Barclay F.J., "Fuel Cells, Engines and Hydrogen", Wiley, 2009.
3. Bent Sorensen (Sørensen), Hydrogen and Fuel Cells: Emerging Technologies and Applications, Elsevier, UK 2005.

REFERENCE BOOKS

1. Rakesh_Kumar_Maurya Characteristics and Control of Low Temperature Combustion Engines, Springer - ISSN 0941-5122 ISSN 2192-063X.
2. Mehrdad Ehsani, Yimi Gao, Sebastian E. Gay, Ali Emadi, Modern Electric, Hybrid Electric and Fuel Cell Vehicles: Fundamentals, Theory and Design, CRC Press, 2004.
3. Rand D.A.J, Woods, R & Dell RM Batteries for Electric vehicles, John Wiley & Sons 1998
4. HCCI and CAI Engines – Nptel - https://nptel.ac.in/courses/112104033/33 CO PO PS
5. HCCI Diesel Engines - Nptel - https://nptel.ac.in/courses/112104033/34.

Mapping of COs with POs & 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	3	2	-	-	-	-	-	-	-	-	-	2	2
CO3	3	3	2	-	-	-	-	-	-	-	-	-	2	2
CO4	3	2	2	-	-	-	-	-	-	-	-	-	2	2
CO5	3	2	2	-	-	-	-	-	-	-	-	-	2	2
AVG	3	2.4	2	-	-	-	-	-	-	-	-	-	2	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-17,2000.
3. Baldev Raj, T.Jayakumar, M.Thavasimuthu "Practical Non-Destructive Testing", Narosa Publishing House, 2009.

REFERENCE BOOKS

1. ASM International, ASM Handbook, Volume 17: Nondestructive Evaluation of Materials, 2018.
2. B. Hull and V. John, Non-Destructive Testing. New York, NY, USA: Springer, 2012.
3. N. Ida, C. Boller, and R. Diederichs, Eds., Handbook of Advanced Nondestructive Evaluation, 2nd ed. Cham, Switzerland: Springer, 2023.
4. Chuck Hellier, "Handbook of Nondestructive Evaluation", Mc Graw Hill, 2021.
5. G. Lacidogna, Ed., Nondestructive Testing (NDT). Basel: MDPI, 2021.

Mapping of COs with POs & 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	3	-	2	2	-	-	-	-	-	-	-	-	2	2
CO3	3	2	2	2	-	-	-	-	-	-	-	-	2	2
CO4	3	2	2	2	-	-	-	-	-	-	-	-	2	2
CO5	3	2	2	2	-	-	-	-	-	-	-	-	2	2
AVG	3	2	2	2	-	-	-	-	-	-	-	-	2	2

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

24OBT201 HOSPITAL MANAGEMENT **L T P C**
3 0 0 3

COURSE OBJECTIVES

- Understanding Health System Organization.
- To know Regulatory Requirements and Health Care Codes.
- To learn Equipment and Maintenance Management.

UNIT I HEALTH SYSTEM **9**

Health organization of the country, the state, the cities and the region, Health Financing System, Organization of Technical Section.

UNIT II HOSPITAL ORGANISATION AND MANAGEMEN **9**

Management of Hospital organization, Nursing section Medical Sector, Technical Department, Definition and Practice of Management by Objective, Transactional Analysis, Human relation in Hospital, Legal aspect in Hospital Management.

UNIT III REGULATORY REQUIREMENT AND HEAITH CARE CODES **9**

FDA Regulation, joint commission of Accreditation for Hospitals, National Fire Protection Association Standard, IRPC.

UNIT IV EQUIPMENT MAINTENANCE MANAGEMENT **9**

Organizing Maintenance Operations, Paper Work Control, Maintenance Job, Planning Maintenance Work, Measurement and Standards, Preventive Maintenance, Maintenance Budgeting and Forecasting, Maintenance Training.

UNIT V TRAINED TECHNICAL PERSONNEL **9**

Function of Clinical Engineer, Role to be performed in Hospital, Man power Market, Professional Registration, Structure in hospital.

TOTAL:45 PERIODS

COURSE OUTCOMES

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

CO1: Explain the principles, staffing and marketing processes, discussing their significance.

CO2: Manage their role in effective and efficient management of health care organizations.

CO3: Analyze the various regulations and standards to be followed in hospitals for safety.

CO4: Evaluate various aspects of equipment maintenance.

CO5: Apply the aspects of managing the hospital in terms of staff, marketing and the use of computers.

TEXT BOOKS

1. Cesar A. Caceresand Albert Zara,The practice of Clinical Engineering, Academic Press, 1977.

2. Webster,J.G. and Albert M.Cook, Clinical Engineering Principles and Practices, Prentice Hall Inc. Englewood Cliffs, 1979.
3. Antony Kelly, Maintenance planning and control, Butterworths London, 1984.

REFERENCE BOOKS

1. Hans P feiff,Vera Dammann (Ed.) Hospital Engineering in Developing Countries, Zreport Eschborn, 1986.
2. Jacob Kline, Handbook of Bio Medical Engineering, Academic Press, SanDiego1988.
3. R.C.Goyal, Handbook of Hospital Personal Management, Prentice Hall of India,1993.
4. G. D. Kunders, "Hospitals–Facilities Planning and Management", TMH, New Delhi–5th edition Reprint 2007.
5. Peter Berman, "Health Sector Reforming Developing Countries", Harvard University Press, 1995.

Mapping of COs with POs and PSOs

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

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

24OBT202 ASSIST DEVICES **L T P C**
3 0 0 3

COURSE OBJECTIVES

- To study the role and importance of machines that takes over the functions of the heart and lungs.
- To study various mechanical techniques that helps a non-functioning heart.
- To learn the functioning of the unit which does the clearance of urea from the blood.

UNIT I HEART LUNG MACHINE AND ARTIFICIAL HEART **9**

Different types of Oxygenators, Pumps, Pulsatile and Continuous Types, Monitoring Process, Shunting, Blood Handling System, Functioning and different types of Artificial Heart.

UNIT II CARDIAC ASSIST DEVICES **9**

Assisted through Respiration, Right and left Ventricular Bypass Pump, Auxiliary ventricle, Open Chest and Closed Chest type, Intra Aortic Balloon Pumping, Prosthetic Cardiac valves.

UNIT III ARTIFICIAL KIDNEY **9**

Indication and Principle of Haemodialysis, Dialysate, types of filter and membranes, Different types of hemodialyzers, Wearable Artificial Kidney, Implanting Type.

UNIT IV RESPIRATORY AND HEARING AIDS **9**

Ventilator and its types-Intermittent positive pressure, Breathing Apparatus Operating Sequence, Electronic IPPB unit with monitoring for all respiratory parameters. Types of Deafness, Hearing Aids, SISI, masking techniques.

UNIT V RECENT TRENDS **9**

Transcutaneous electrical nerve stimulator, bio-feedback, Electrical safety Analyser, Latest use of assistive technology for health care Information technology, Future trends in assistive technology.

TOTAL: 45 PERIODS

COURSE OUTCOMES

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

CO1: Explain the principles and construction of artificial heart.
CO2: Discuss the various mechanical techniques that improve therapeutic technology.
CO3: Explain the functioning of the membrane or filter that cleanses the blood.
CO4: Describe the tests to assess the hearing loss and development of wearable devices for the same.
CO5: Analyze and research on electrical stimulation and bio feedback techniques in rehabilitation and physiotherapy.

TEXT BOOKS

1. Gray E Wnek, Gray L Browlin – Encyclopedia of Biomaterials and Biomedical Engineering – Marcel Dekker Inc New York 2004.
2. John.G. Webster – Bioinstrumentation – John Wiley & Sons (Asia) Pvt Ltd-2004.
3. Joseph D. Bronzino, The Biomedical Engineering Handbook, Third Edition: Three Volume Set, CRC Press, 2006.

REFERENCE BOOKS

1. Andreas.F.Vonracum, “Handbook of biomaterial evaluation”, Mc-Millan publishers, 1980.
2. GrayEWnek, GrayLBrowlin, “Encyclopedia of Biomaterials and Biomedical Engineering” Marcel Dekker Inc New York 2004.
3. D.S.Sunder, “Rehabilitation Medicine”, 3rd Edition, Jaypee Medical Publication, 2010.
4. Albert M.Cooka nd WebsterJ.G., Therapeutic Medical Devices, Prentice Hall Inc., New Jersey,1982.
5. KolffW.J., Artificial Organs, John Wiley and Sons, NewYork, 1979.

Mapping of COs with POs and PSOs

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

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

24OBT203 ROBOTICS IN MEDICINE **L T P C**
3 0 0 3

COURSE OBJECTIVES

- To Get introduced to the fundamental of robotics and position analysis.
- Learn about Parallel robots, different types of motions and force analysis.
- Know the basics of trajectory planning, Motion control systems and actuators.

UNIT I FUNDAMENTALS AND POSITION ANALYSIS **9**

Fundamentals, Degrees of freedom, Joints, Coordinates, Reference frames, Programming modes, Collaborative robots, Position analysis – Robots as mechanisms, Conventions, Transformations, Denavit Hartenberg Representation, Degeneracy and Dextrerity, Position analysis of Articulated robot.

UNIT II PARALLEL ROBOTS, DIFFERENTIAL MOTIONS AND FORCE ANALYSIS **9**

Parallel robots, Planar and Spatial parallel robots, Differential relationships, The Jacobian, Large scale motions, Frame vs Robot, Differential motions and change, Hand frame, Operator, Jacobian and Inverse for Screw based and Parallel Robots, Differential operator, Lagarangian mechanics.

UNIT III TRAJECTORY PLANNING, MOTION CONTROL SYSTEMS AND ACTUATORS **9**

Path and Trajectory, Joint Space and Cartesian Space Descriptions and Trajectory Planning, Cartesian, Trajectory Recording, Basics, Steady state error, Root locus, Proportional, Compensators, Multiple IO systems, Characteristics of Hydraulic, Pneumatic, Electric motors, Other actuators.

UNIT IV SENSORS, IMAGE PROCESSING AND ANALYSIS WITH VISION SYSTEMS **9**

Sensor Characteristics, Micro switches, Visible and IR, Touch, Proximity, Transforms – Fourier, Hough, Resolution, Image processing, Segmentation, Region growing and splitting, Object recognition, Specialized lighting, Compression, Colour images.

UNIT V FUZZY CONTROL AND APPLICATIONS IN MEDICINE **9**

Fuzzy control - Crisp vs Fuzzy, Sets, Inference rules, Defuzzification, Simulation, Applications in Biomedical Engineering and rehabilitation, Nanobots in medicine, Cardiac and abdominal procedures with tele operated robots, Orthopedic surgery with cooperative robots

TOTAL:45 PERIODS

COURSE OUTCOMES

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

CO1: Describe the fundamental of robotics and position analysis.

CO2: Summarize the functional aspects of parallel robots including motion classification and force interaction analysis.

CO3: Explain the basic principles involved in trajectory planning along with the role of motion control systems and actuators.

CO4: Recognize and explain the use of various sensors and vision systems in robotics.

CO5: Demonstrate application of fuzzy logic in robotic systems designed for medical interventions.

TEXT BOOKS

1. S.B. Niku, Introduction to Robotics, Analysis, Control, Applications, Pearson Education, 2020.
2. Robert Schilling, Fundamentals of Robotics-Analysis and control, Prentice Hall of India, 2003.
3. Fu Gonzales and Lee, “Robotics” , Mc Graw Hill, 1987.

REFERENCE BOOKS

1. Grover, Wiess, Nagel and Oderey, Industrial Robotics, McGraw Hill, 2012.
2. Klafter, Chmielewski and Negin, Robot Engineering, Prentice Hall Of India, 1989.
3. Mittal, Nagrath, Robotics and Control, Tata McGraw Hill publications, 2003.
4. Bijay K. Ghosh, NingXi, T.J.Tarn, Controlling Robotics and Automation Sensor – Based integration, Academic Press, 1999.
5. Mikell P. Groover, Mitchell Weiss, Industrial robotics, technology, Programming and Applications, McGraw Hill International Editions, 1986.

Mapping of COs with POs and PSOs

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

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

24OBT204 DSP ARCHITECTURE **L T P C**
3 0 0 3

COURSE OBJECTIVES

- To introduce architectural features of programmable DSP Processors of TI and Analog Devices.
- To give practical examples of DSP Processor architectures for better understanding.
- To develop the programming knowledge using Instruction set of DSP Processors.

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

Introduction, A Digital signal-processing system, The sampling process, Discrete time sequences. Discrete Fourier Transform (DFT) and Fast Fourier Transform (FFT), Linear time-invariant systems, Digital filters, Decimation and interpolation.

UNIT II ARCHITECTURES FOR PROGRAMMABLE DSP DEVICES **9**

Basic Architectural features, DSP Computational Building Blocks, Bus Architecture and Memory, Data Addressing Capabilities, Address Generation UNIT, Programmability and Program Execution, Speed Issues, Features for External interfacing.

UNIT III PROGRAMMABLE DIGITAL SIGNAL PROCESSORS **9**

Commercial Digital signal-processing Devices, Data Addressing modes of TMS320C54XX DSPs, Data Addressing modes of TMS320C54XX Processors, Memory space of TMS320C54XX Processors, Program Control, TMS320C54XX instructions and Programming.

UNIT IV ANALOG DEVICES FAMILY OF DSP DEVICES **9**

Analog Devices Family of DSP Devices – ALU and MAC block diagram, Shifter Instruction, Base Architecture of ADSP 2100, ADSP-2181 high performance Processor.

UNIT V INTERFACING MEMORY **9**

Memory space organization, External bus interfacing signals, Memory interface, Parallel I/O interface, Programmed I/O, Interrupts and I/O, Direct memory access (DMA).

TOTAL:45 PERIODS

COURSE OUTCOMES

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

CO1: Classify RFID systems based on frequency, architecture and performance.
CO2: Define standards for RFID technology.
CO3: Illustrate the operation of various components of RFID systems.
CO4: Describe the privacy and security issues in RFID Systems .
CO5: Discuss the construction and applications of RFID enabled sensor .

TEXT BOOKS

1. Digital Signal Processing – Avtar Singh and S. Srinivasan, Thomson Publications, 2004.

2. A Practical Approach to Digital Signal Processing - K Padmanabhan, R. Vijayarajeswaran, Ananthi. S, New Age International, 2006/2009.
3. Embedded Signal Processing with the Micro Signal Architecture Publisher: Woon-Seng Gan,Sen M. Kuo, Wiley-IEEE Press, 2007.

REFERENCE BOOKS

1. Digital Signal Processors, Architecture, Programming and Applications – B. Venkataramani and M. Bhaskar, 2002, TMH.
2. Digital Signal Processing – Jonatham Stein, 2005, John Wiley.
3. DSP Processor Fundamentals, Architectures & Features – Lapsley et al. 2000, S. Chand & Co.
4. Digital Signal Processing Applications Using the ADSP-2100 Family by The Applications Engineering Staff of Analog Devices, DSP Division, Edited by Amy Mar, PHI.
5. The Scientist and Engineer's Guide to Digital Signal Processing by Steven W. Smith, Ph.D., California Technical Publishing, ISBN 0-9660176-3-3, 1997.

Mapping of COs with POs and PSOs

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

6. 1-Low, 2-Medium, 3-High, '-'- No correlation

24OBT205 IMAGE PROCESSING TECHNIQUES **L T P C**

3 0 0 3

COURSE OBJECTIVES

- To become familiar with digital image fundamentals.
- To get exposed to simple image enhancement techniques in Spatial and Frequency domain.
- To study the image segmentation and representation techniques.

UNIT I DIGITAL IMAGE FUNDAMENTALS **9**

Steps in Digital Image Processing – Components – Elements of Visual Perception – Image Sensing and Acquisition – Image Sampling and Quantization – Relationships between pixels - Color image fundamentals - RGB, HSI models, Two-dimensional mathematical preliminaries, 2D transforms - DFT, DCT.

UNIT II IMAGE ENHANCEMENT **9**

Spatial Domain: Gray level transformations – Histogram processing – Basics of Spatial Filtering Smoothing and Sharpening Spatial Filtering, Frequency Domain: Introduction to Fourier Transform– Smoothing and Sharpening frequency domain filters – Ideal, Butterworth and Gaussian filters, Homomorphic filtering, Color image enhancement.

UNIT III IMAGE RESTORATION **9**

Image Restoration - degradation model, Properties, Noise models – Mean Filters – Order Statistics – Adaptive filters – Band reject Filters – Band pass Filters – Notch Filters – Optimum Notch Filtering – Inverse Filtering – Wiener filtering .

UNIT IV IMAGE SEGMENTATION **9**

Edge detection, Edge linking via Hough transform – Thresholding - Region based segmentation Region growing – Region splitting and merging – Morphological processing- erosion and dilation, Segmentation by morphological watersheds – basic concepts – Dam construction – Watershed segmentation algorithm.

UNIT V IMAGE COMPRESSION AND RECOGNITION **9**

Need for data compression, Huffman, Run Length Encoding, Shift codes, Arithmetic coding, JPEG standard, MPEG. Boundary representation, Boundary description, Fourier Descriptor, Regional Descriptors – Topological feature, Texture - Patterns and Pattern classes - Recognition based on matching.

TOTAL:45 PERIODS

COURSE OUTCOMES

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

CO1: Explain the basics and fundamental concepts of digital image processing including digitization, sampling, quantization, and 2D transforms.

CO2: Apply image processing techniques such as smoothing, sharpening, and enhancement on digital images.

CO3: Explore the restoration concepts and filtering techniques.

CO4: Identify the processes involved in image segmentation, feature extraction, compression, and recognition using color models.

CO5: Interpret image compression techniques and their relevance in reducing storage and transmission requirements.

TEXT BOOKS

1. Rafael C. Gonzalez, Richard E. Woods, ‘Digital Image Processing’, Pearson, Third Edition,2010.
2. Anil K. Jain, ‘Fundamentals of Digital Image Processing’, Pearson, 2002.
3. G. R. Sinha and B. C. Patel, Medical Image Processing Concepts and Applications, PHI, 2014.

REFERENCE BOOKS

1. Kenneth R. Castleman, 'Digital Image Processing', Pearson, 2006.
2. Rafael C. Gonzalez, Richard E. Woods, Steven Eddins, 'Digital Image Processing using MATLAB', Pearson Education, Inc., 2011.
3. D,E. Dudgeon and RM. Mersereau, 'Multidimensional Digital Signal Processing', Prentice Hall Professional Technical Reference, 1990.
4. William K. Pratt, 'Digital Image Processing', John Wiley, New York, 2002.
5. Milan Sonka et al 'Image processing, analysis and machine vision', Brookes/Cole, Vikas Publishing House, 2nd edition, 1999.

Mapping of COs with POs and 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

24OBT206 WIRELESS SENSOR NETWORKS **L T P C**
3 0 0 3

COURSE OBJECTIVES

- To understand the fundamentals of wireless sensor network.
- To gain knowledge on the MAC and Routing Protocols of WSN.
- To acquire knowledge on the protocols required for developing real time applications using WSN and LOWPAN.

UNIT I INTRODUCTION **9**

Principle of Wireless Sensor Network -Introduction to wireless sensor networks- Challenges, Comparison with ad hoc network, Node architecture and Network architecture, design principles, Service interfaces, Gateway, Short range radio communication standards-IEEE 802.15.4, Zigbee and Bluetooth. Physical layer and transceiver design considerations.

UNIT II MAC AND ROUTING PROTOCOLS **9**

MAC protocols – fundamentals, low duty cycle protocols and wakeup concepts, contention and Schedule-based protocols - SMAC, BMAC,TRAMA, Routing protocols – Requirements, Classification -SPIN, Directed Diffusion, COUGAR, ACQUIRE, LEACH, PEGASIS.

UNIT III 6LOWPAN **9**

6LoWPAN Architecture - protocol stack, Adaptation Layer, Link layers – Addressing, Routing - MeshUnder - Route-Over, Header Compression - Stateless header compression - Context-

based header compression, Fragmentation and Reassembly , Mobility – types, Mobile IPv6, Proxy Home Agent, Proxy MIPv6, NEMO –Routing – MANET, ROLL, Border routing.

UNIT IV APPLICATION **9**

Design Issues, Protocol Paradigms -End-to-end, Real-time streaming and sessions, Publish/subscribe, Web service paradigms, Common Protocols -Web service protocols, MQ telemetry transport for sensor networks (MQTT-S), ZigBee compact application protocol (CAP),Service discovery, Simple network management protocol (SNMP), Real-time transport and sessions, Industry- Specific protocols.

UNIT V TOOLS **9**

TinyOS – Introduction, NesC, Interfaces, modules, configuration, Programming in TinyOS using NesC, TOSSIM, Contiki – Structure, Communication Stack, Simulation environment – Cooja simulator, Programming.

TOTAL:45 PERIODS

COURSE OUTCOMES

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

CO1: Design solutions for WSNs applications.
CO2: Develop efficient MAC and Routing Protocols.
CO3: Design solutions for 6LOWPAN applications.
CO4: Develop efficient layered protocols in 6LOWPAN.
CO5: Use Tiny OS and Contiki OS in WSNs and 6LOWPAN applications.

TEXT BOOKS

1. V. Daniel Hunt, Alber Puglia, Mike Puglia, “RFID: A guide for radio frequency identification”, Wiley & Sons, Inc., Publication, 2011.
2. Roy Want, RFID Explained, Springer 2022.
3. Amin Rida, Li Yang, Manos M. Tentzeris, RFID Enabled Sensor Design and Applications, Artech House, 2010.
4.

REFERENCE BOOKS

1. Holger Karl, Andreas willig, “Protocol and Architecture for Wireless Sensor Networks”, John Wiley Publication, 2006.
2. Anna Forster, “Introduction to Wireless Sensor Networks”, Wiley, 2017.
3. Zach Shelby Sensinode and Carsten Bormann, “ 6LoWPAN: The Wireless Embedded”.
4. Philip Levis, “TinyOS Programming”, 2006 –www.tinyos.net.
5. The Contiki Operating System.http://www.sics.se/contiki.

Mapping of COs with POs and PSOs

COs	POs												PSOs	
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
CO1	3	3	2	2	2	1	-	-	-	-	2	2	2	2
CO2	3	3	2	2	2	1	-	-	-	-	-	2	2	2
CO3	3	3	3	2	2	1	-	-	-	-	-	3	2	2
CO4	3	3	3	3	2	2	-	-	-	-	-	2	2	2
CO5	2	-	1	1	3	2	-	-	-	-	-	2	2	2
AVG	**2.8**	**2.4**	**2.2**	**2**	**2.2**	**1.4**	**-**	**-**	**-**	**-**	**2**	**2.2**	**2**	**2**

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


M.I.E.T
ENGINEERING COLLEGE