(An Autonomous Institution)

REGULATIONS 2024 CHOICE BASED CREDIT SYSTEM

B.E. CIVIL ENGINEERING

1. PROGRAMME EDUCATIONAL OBJECTIVES (PEOs):

Graduates of the programme B E Civil Engineering will

I. Gain knowledge and skills in Civil engineering which will enable them to have a career and professional accomplishment in the public or private sector organizations

II. Become consultants on complex real life Civil Engineering problems related to Infrastructure development especially housing, construction, water supply, sewerage, transport, spatial planning.

III. Become entrepreneurs and develop processes and technologies to meet desired infrastructure needs of society and formulate solutions that are technically sound, Economically feasible, and socially acceptable.

IV. Perform investigation for solving Civil Engineering problems by conducting research using modern equipment and software tools.

V. Function in multi-disciplinary teams and advocate policies, systems, processes and equipment to support civil engineering

2. PROGRAM OUTCOMES (POs)

PO	Graduate Attribute
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.

3. PROGRAM SPECIFIC OUTCOMES (PSOs)

On successful completion of the Civil Engineering Degree programme, the Graduates shall exhibit the following:

PSO1 Knowledge of Civil Engineering discipline

Demonstrate in-depth knowledge of Civil Engineering discipline, with an ability to evaluate, analyze and synthesize existing and new knowledge.

PSO2 Critical analysis of Civil Engineering problems and innovation

Critically analyze complex Civil Engineering problems, apply independent judgment for synthesizing information and make innovative advances in a theoretical, practical and policy context.

PSO3 Conceptualization and evaluation of engineering solutions to Civil Engineering

Issues Conceptualize and solve Civil Engineering problems, evaluate potential solutions and arrive at technically feasible, economically viable and environmentally sound solutions with due consideration of health, safety, and socio cultural factors

PEO / PO Mapping:

	POs												PSOs		
PEOs	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
I	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
II	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
III	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
IV	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
V	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3

Mapping of Course Outcome and Programme Outcome																
		Course Name	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
YEAR I	**SEMESTER I**	Professional English - I	1.6	2.2	1.8	2.2	1.5	3	3	3	1.6	3	3	3	-	-	-
		Matrices and Calculus	3	3	1	1	0	0	0	0	2	0	2	3	-	-	-
		Engineering Physics	3	3	1.6	1.2	1.8	1	-	-	-	-	-	1	-	-	-
		Engineering Chemistry	2.8	1.3	1.6	1	-	1.5	1.8	-		-	-	1.5	-	-	-
		Problem Solving and Python Programming	2	3	3	3	2	-	-	-	-	-	2	2	3	3	-
		தமிழர் மரபு /Heritage of Tamils	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		Problem Solving and Python Programming Laboratory	2	3	3	3	2	-	-	-	-	-	2	2	3	3	-
		Physics and Chemistry Laboratory	3	2.4	2.6	1	1	-	-	-	-	-	-	-	-	-	-
			2.6	1.3	1.6	1	1	1.4	1.8	-	-	-	-	1.3	-	-	-
		English Laboratory[$]	3	3	3	3	1	3	3	3	3	3	3	3	-	-	-
		Skill Enhancement- I	1	-	-	-	1	-	-	1	2	2	-	3	-	-	-
	SEMESTER II	Professional English - II	3	3	3	3	2.75	3	3	3	2.2	3	3	3	-	-	-
		Statistics and Numerical Methods	3	3	1	1	1	0	0	0	2	0	2	3	-	-	-
		Physics for Civil Engineering	3	1.75	2	2	1.2	1.4	-	-	-	-	-	-	-	-	-
		Basic Electrical, Electronics and Instrumentation Engineering	2	1	1	-	-	-	-	1	-	-	-	-	-	-	-
		Engineering Graphics	3	1	2	2	-	-	-	-	-	3	-	2	2	2	-
		தமிழரும் தொழில் நுட்பமும் /Tamils and Technology	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		NCC Credit Course Level 1[#]	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		Engineering Practices Laboratory	3	2	-	-	1	1	1	-	-	-	-	2	2	1	1
		Basic Electrical, Electronics and Instrumentation Engineering Laboratory	1.6	1.4	0.8	1.6	-	-	-	1.2	1.6	-	-	-	-	-	-
		Communication Laboratory / Foreign Languages	2.4	2.8	3	3	1.8	3	3	3	3	3	3	3	-	-	-
		Skill Enhancement- II	-	1	-	-	1	-	-	1	2	2	1	3	-	-	-
YEAR II	**SEMESTER III**	Transforms and Partial Differential Equations	3	3	1	1	0	0	0	0	2	0	0	3	-	-	-
		Strength of Materials I	3	3	3	3	2	3	2	3	3	2	1	2	3	3	3
		Construction Materials and Practice	3	3	3	3	3	2	2	3	2	3	3	3	3	3	3
		Fluid Mechanics	3	3	3	2	3	2	2	1	2	3	2	2	3	3	3
		Railways, Airports and Harbour Engineering	3	3	3	3	2	2	3	2	2	2	2	2	2	2	2
		Surveying and Levelling	3	3	3	2	3	3	1	3	3	2	2	2	3	3	3
		Skill Enhancement- III	3	2	2	2	2	2	2	1	2	2	2	2	-	-	-

YEAR II	**SEMESTER IV**	Strength of Materials II	3	3	3	3	2	3	1	3	2	3	1	3	3	3	3
		Soil Mechanics	3	3	3	3	2	2	2	1	3	2	2	3	2	3	3
		Applied Hydraulic Engineering	3	2	2	2	1	1	1	2	3	2	2	2	3	3	2
		Highway Engineering	3	3	3	2	2	2	2	2	2	2	2	2	3	3	3
		Water Supply and Waste Water Engineering	3	2	2	2	1	2	1	2	2	1	1	2	3	2	2
		Engineering Entrepreneurship Development	1	2	2	1	2	2	-	-	2	2	3	2	-	-	-
		Skill Enhancement- IV	2	2	2	2	2	2	2	2	2	2	2	2	-	-	-
YEAR III	**SEMESTER V**	Design of Reinforced Concrete Structural Elements	3	3	3	3	-	2	2	3	2	-	-	3	3	2	2
		Structural Analysis I	3	3	3	3	2	3	2	3	1	1	1	2	3	3	2
		Foundation Engineering	3	3	2	2	2	2	2	2	2	2	2	3	3	2	2
		Professional Elective I	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		Professional Elective II	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		Open Elective I*****	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		Survey Camp (2 Weeks)	3	3	2	3	3	2	2	2	2	2	2	3	3	3	3
		Skill Enhancement- V	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		Mandatory Course-I[&]	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	SEMESTER VI	Design of Steel Structural Elements	3	2	3	2	2	2	1	1	1	1	1	1	3	3	3
		Structural Analysis II	3	3	3	3	2	3	2	3	1	1	1	2	3	3	2
		Professional Elective III	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		Professional Elective IV	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		Professional Elective V	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		Open Elective II*	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		Structural Drawing and Detailing Laboratory	3	2	-	2	2	3	-	2	3	2	-	2	3	2	2
		Skill Enhancement – VI	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		Mandatory Course-II[&]	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

1 – Low; 2 – Medium; 3 – High; '- "– No correlation

PROFESSIONAL ELECTIVE COURSES : VERTICALS

S. No.	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1.	Concrete Structures	3	3	2	3	3	1	2	3	1	2	1	2	3	3	3
2.	Advanced Concrete Structures	3	-	3	-	-	-	-	-	-	-	-	-	3	-	-
3.	Steel Structures	3	2	2	1	2	1	1	2	1	1	1	2	3	3	3
4.	Prefabricated Structures	3	2	3	2	2	3	1	3	2	2	1	2	3	2	2
5.	Rehabilitation/Heritage Restoration	3	2	3	-	-	-	1	1	1	-	-	1	1	1	2
6.	Introduction to Finite Element Method	3	3	2	2	2	1	-	-	3	-	1	2	3	2	2
7.	Analysis of Structural Stability	3	3	2	2	1	-	-	-	-	1	-	2	3	2	1
8.	Analysis and Design of Structures under Wind and Cyclone Effects	3	3	3	2	2	-	-	-	-	1	-	2	3	3	2
9.	Formwork Engineering	2	3	3	2	1	1	2	-	3	-	2	2	3	2	2
10.	Building Information Modelling	3	-	3	-	3	1	2	-	-	2	2	-	2	3	-
11.	Sustainable Construction and Lean Construction	3	1	3	2	2	2	3	1	1	1	3	2	3	3	3
12.	Project planning, scheduling and control	3	2	3	2	2	2	2	2	2	2	2	2	3	2	2
13.	Construction Management and Safety	2	3	2	2	3	2	1	2	2	3	3	1	2	2	3
14.	Advanced Construction Techniques	2	3	3	3	2	2	2	1	1	1	2	1	3	3	3
15.	Engineering Economics	3	2	2	2	1	-	-	-	-	1	1	3	3	2	2
16.	Cost Management of Engineering Projects	2	3	1	2	2	-	-	-	1	2	-	2	1	1	1
17.	Subsurface Investigation and Instrumentation	3	3	2	2	2	1	-	-	-	1	-	2	3	2	2
18.	Geo environmental Engineering	1	1	2	2	1	2	3	2	3	2	1	3	2	2	3
19.	Ground Improvement Techniques	2	3	3	2	3	3	2	1	2	1	1	3	3	3	3
20.	Soil Dynamics and Machine Foundations	2	3	3	3	2	3	2	3	2	1	1	3	3	3	3
21.	Rock Mechanics	3	3	3	2	3	3	3	2	2	1	3	3	3	2	3

22.	Earth and Earth Retaining Structures	3	3	3	3	3	3	2	2	2	2	3	3	3	3	3
23.	Pile Foundation	2	3	3	2	2	1	1	1	2	2	1	3	3	2	3
24.	Tunneling Engineering	2	2	2	1	1	2	1	1	1	1	1	3	2	3	3
25.	Traffic Engineering and Management	3	2	3	2	2	2	1	2	2	2	3	1	2	2	3
26.	Urban Planning and Development	3	2	2	2	2	3	2	2	2	2	3	2	2	2	2
27.	Smart cities	3	2	3	2	2	2	3	2	2	2	3	2	3	3	3
28.	Intelligent Transportation Systems	2	2	2	3	3	2	2	2	3	2	3	2	3	2	3
29.	Pavement Engineering	3	3	3	2	2	3	2	3	2	1	3	3	3	3	2
30.	Transportation Planning Process	2	3	3	2	2	2	1	3	3	2	3	3	3	3	2
31.	Transport and Environment	3	3	3	2	2	3	2	3	2	1	2	-	3	2	3
32.	Transportation Economics	3	2	2	2	2	1	1	1	1	1	1	2	3	3	2
33.	Climate Change Adaptation and Mitigation	2	3	2	2	3	2	3	-	3	1	3	2	2	2	3
34.	Air and Noise Pollution Control Engineering	2	3	3	3	3	2	2	1	2	1	2	2	2	2	2
35.	Environmental Impact Assessment	3	2	3	2	2	2	2	3	3	2	1	1	2	2	2
36.	Industrial Wastewater Management	2	3	3	2	2	1	2	3	3	2	3	2	2	2	3
37	Solid and Hazardous Waste Management	3	2	3	2	2	2	2	2	2	1	2	1	3	2	3
38.	Environmental Policy and Legislations	2	3	2	3	3	2	3	3	-	1	1	2	3	2	2
39.	Environment Health and Safety	2	2	2	2	2	3	2	1	3	2	3	2	3	3	2
40.	Life Cycle Assessment	2	2	2	3	2	2	2	3	3	2	3	3	3	3	3
41.	Remote Sensing concepts	2	3	2	3	3	3	3	3	3	3	1	2	3	3	3
42.	Geographical Information System	2	3	3	2	1	1	2	-	3	-	2	2	3	2	3
43.	Hydrographic Surveying	3	2	3	3	3	3	3	3	3	3	3	3	3	3	3
44.	Earth and Rock fill Dams	3	3	3	2	3	3	3	2	2	1	3	3	3	2	3
45.	Computational Fluid Dynamics	3	2	3	2	2	2	1	1	2	2	2	1	2	2	3
46.	Rainwater Harvesting	2	2	2	2	2	2	2	2	1	1	2	2	2	2	2
47.	Metro Systems and Engineering	3	2	3	2	2	1	2	2	2	2	1	2	3	2	2
48.	Environmental Quality Monitoring	3	2	2	2	3	3	2	2	-	2	2	2	2	2	2

REGULATIONS 2024 CHOICE BASED CREDIT SYSTEM

B. E. CIVIL ENGINEERING CURRICULUM & SYLLABI FOR SEMESTERS I TO VIII

SEMESTER I

S. NO.	COURSE CODE	COURSE TITLE	CATE-GORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
1.	24IP3151	Induction Programme	-	-	-	-	-	0
THEORY								
2.	24HS3152	Professional English - I	HSMC	3	0	0	3	3
3.	24MA3151	Matrices and Calculus	BSC	3	1	0	4	4
4.	24PH3151	Engineering Physics	BSC	3	0	0	3	3
5.	24CY3151	Engineering Chemistry	BSC	3	0	0	3	3
6.	24GE3151	Problem Solving and Python Programming	ESC	3	0	0	3	3
7.	24GE3152	தமிழர் மரபு /Heritage of Tamils	HSMC	1	0	0	1	1
PRACTICALS								
8.	24GE3171	Problem Solving and Python Programming Laboratory	ESC	0	0	4	4	2
9.	24BS3171	Physics and Chemistry Laboratory	BSC	0	0	4	4	2
10.	24GE3172	English Laboratory$	EEC	0	0	2	2	1
EMPLOYABILITY ENHANCEMENT COURSES								
11.	24TP3101	Skill Enhancement- I	EEC	1	0	1	2	0
			TOTAL	**16**	**1**	**12**	**29**	**22**

SEMESTER II

S. NO.	COURSE CODE	COURSE TITLE	CATE-GORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
THEORY								
1.	24HS3252	Professional English - II	HSMC	2	0	0	2	2
2.	24MA3251	Statistics and Numerical Methods	BSC	3	1	0	4	4
3.	24PH3201	Physics for Civil Engineering	BSC	3	0	0	3	3
4.	24BE3252	Basic Electrical, Electronics and Instrumentation Engineering	ESC	3	0	0	3	3
5.	24GE3251	Engineering Graphics	ESC	2	0	4	6	4
6.		NCC Credit Course Level 1[#]	-	2	0	0	2	2
7.	24GE3252	தமிழரும் தொழில் நுட்பமும்/Tamils and Technology	HSMC	1	0	0	1	1
PRACTICALS								
8.	24GE3271	Engineering Practices Laboratory	ESC	0	0	4	4	2
9.	24BE3272	Basic Electrical, Electronics and Instrumentation Engineering Laboratory	ESC	0	0	4	4	2
10.	24GE3272	Communication Laboratory / Foreign Language	EEC	0	0	4	4	2
EMPLOYABILITY ENHANCEMENT COURSES								
11.	24TP3201	Skill Enhancement- II	EEC	1	0	1	2	0
			TOTAL	**14**	**1**	**18**	**33**	**23**

[#] NCC Credit Course level 1 is offered for NCC students only. 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 III

S. NO.	COURSE CODE	COURSE TITLE	CATE-GORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
THEORY								
1.	24MA3351	Transforms and Partial Differential Equations	BSC	3	1	0	4	4
2.	24CE3304	Railways, Airports and Harbour Engineering	PCC	3	0	0	3	3
THEORY COURSE WITH PRACTICAL COMPONENTS								
3.	24CE3301	Strength of Materials I	PCC	3	0	2	5	4
4.	24CE3302	Construction Materials and Practices	PCC	3	0	2	5	4
5.	24CE3303	Fluid Mechanics	PCC	3	0	2	5	4
6.	24CE3351	Surveying and Levelling	PCC	3	0	4	7	5
EMPLOYABILITY ENHANCEMENT COURSES								
7.	24TP3301	Skill Enhancement- III	EEC	0	0	2	2	1
			TOTAL	**18**	**1**	**12**	**31**	**25**

SEMESTER IV

S. NO.	COURSE CODE	COURSE TITLE	CATE-GORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
THEORY								
1.	24CE3401	Strength of Materials II	PCC	3	0	0	3	3
THEORY COURSE WITH PRACTICAL COMPONENTS								
2.	24CE3402	Soil Mechanics	PCC	3	0	2	5	4
3.	24CE3403	Applied Hydraulic Engineering	PCC	3	0	2	5	4
4.	24CE3404	Highway Engineering	PCC	3	0	2	5	4
5.	24CE3405	Water Supply and Waste Water Engineering	PCC	3	0	2	5	4
6.	24IC3401	Engineering Entrepreneurship Development	ICC	2	0	2	4	3
EMPLOYABILITY ENHANCEMENT COURSES								
7.	24TP3401	Skill Enhancement- IV	EEC	0	0	2	2	1
			TOTAL	**17**	**0**	**12**	**29**	**23**

SEMESTER V

S. NO.	COURSE CODE	COURSE TITLE	CATE-GORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
THEORY								
1.	24CE3501	Design of Reinforced Concrete Structural Elements	PCC	3	1	0	4	4
2.	24CE3502	Structural Analysis I	PCC	3	0	0	3	3
3.	24CE3503	Foundation Engineering	PCC	3	0	0	3	3
4.		Professional Elective I	PEC	3	0	0	3	3
5.		Professional Elective II	PEC	3	0	0	3	3
THEORY COURSE WITH PRACTICAL COMPONENETS								
6.		Open Elective I*	OEC	2	0	2	4	3
PRACTICALS								
7.	24CE3512	Survey Camp (2 Weeks)	EEC	0	0	0	0	1
EMPLOYABILITY ENHANCEMENT COURSES								
8.	24TP3501	Skill Enhancement- V	EEC	0	0	2	2	1
MANDATORY COURSE								
9.		Mandatory Course-I[&]	MC	3	0	0	3	0
			TOTAL	**20**	**1**	**4**	**25**	**21**

[&]Mandatory Course-I is a Non-credit Course (Student shall Select one course from the list given under MC-I)

***Open Elective–I shall be chosen from the emerging technologies**

SEMESTER VI

S. NO.	COURSE CODE	COURSE TITLE	CATE-GORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
THEORY								
1.	24CE3601	Design of Steel Structural Elements	PCC	3	1	0	4	4
2.	24CE3602	Structural Analysis II	PCC	3	0	0	3	3
3.		Professional Elective III	PEC	3	0	0	3	3
4.		Professional Elective IV	PEC	3	0	0	3	3
5.		Professional Elective V	PEC	3	0	0	3	3
THEORY COURSE WITH PRACTICAL COMPONENETS								
6.		Open Elective II*	OEC	2	0	2	4	3
PRACTICALS								
7.	24CE3611	Structural Drawing and Detailing Laboratory	PCC	0	0	4	4	2
EMPLOYABILITY ENHANCEMENT COURSES								
8.	24TP3601	Skill Enhancement- VI	EEC	0	0	2	2	1
MANDATORY COURSE								
9.		Mandatory Course-II[&]	MC	3	0	0	3	0
			TOTAL	**20**	**1**	**8**	**25**	**22**

[&]Mandatory Course-II is a Non-credit Course (Student shall Select one course from the list given under MC-II)

***Open Elective–II shall be chosen from the emerging technologies**

SEMESTER VII

S. NO	COURSE CODE	COURSE TITLE	CATE-GORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
THEORY								
1.	24CE3701	Estimation, Costing and Valuation Engineering	PCC	3	0	0	3	3
2.	24CE3702	Prestressed Concrete Structures	PCC	3	0	0	3	3
3.	24GE3752	Total Quality Management	HSMC	3	0	0	3	3
4.	24GE3791	Human Values and Ethics	HSMC	2	0	0	2	2
5.		Professional Elective VI	PEC	3	0	0	3	3
6.		Open Elective III*	OEC	3	0	0	3	3
PRACTICALS								
7.	24CE3711	Design and Product Development	EEC	0	0	4	4	2
8.	24CE3712	Internship (Four weeks during VI semester-summer)	EEC	0	0	0	0	2
EMPLOYABILITY ENHANCEMENT COURSES								
9.	24TP3701	Skill Enhancement- VII	EEC	0	0	2	2	1
			TOTAL	**21**	**0**	**2**	**23**	**22**

***Open Elective–III shall be chosen from the list given under Open Elective-III**

SEMESTER VIII

S. NO.	COURSE CODE	COURSE TITLE	CATE-GORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
PRACTICALS								
1.	24CE3811	Project Work	EEC	0	0	20	20	10
TOTAL				**0**	**0**	**20**	**20**	**10**

TOTAL CREDITS:168

MANDATORY COURSES I*

S. NO.	COURSE CODE	COURSE TITLE	CATE-GORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS
				L	T	P	
1.	24MX3081	Introduction to Women and Gender Studies	MC	3	0	0	3
2.	24MX3082	Elements of Literature	MC	3	0	0	3
3.	24MX3083	Film Appreciation	MC	3	0	0	3
4.	24MX3084	Disaster Risk Reduction and Management	MC	3	0	0	3
5.	24MX3085	Environmental Sciences and Sustainability	MC	3	0	0	3

***Mandatory Courses are offered as Non-Credit Courses**

MANDATORY COURSES II*

S. NO.	COURSE CODE	COURSE TITLE	CATE-GORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS
				L	T	P	
1.	24MX3086	Well, Being with Traditional Practices - Yoga, Ayurveda and Siddha	MC	3	0	0	3
2.	24MX3087	History of Science And Technology in India	MC	3	0	0	3
3.	24MX3088	Political and Economic Thought for a Human Society	MC	3	0	0	3
4.	24MX3089	State, Nation Building and Politics in India	MC	3	0	0	3
5.	24MX3090	Industrial Safety	MC	3	0	0	3

***Mandatory Courses are offered as Non-Credit Courses**

PROFESSIONAL ELECTIVE COURSES :

VERTICAL I (Structures)	VERTICAL II (Construction techniques and Practices)	VERTICAL III (Geotechnical)	VERTICAL IV (Transportation infrastructure)	VERTICAL V (Environment)	VERTICAL VI (Diversified Course)
Concrete Structures	Formwork Engineering	Subsurface Investigation and Instrumentation	Traffic Engineering and Management	Climate Change Adaptation and Mitigation	Remote Sensing Concepts
Advanced Concrete Structures	Building Information Modelling	Geo Environmental Engineering	Urban Planning and Development	Air and Noise Pollution Control Engineering	Geographical Information System
Steel Structures	Sustainable Construction And Lean Construction	Ground Improvement Techniques	Smart cities	Environmental Impact Assessment	Hydrographic Surveying
Prefabricated Structures	Project planning, scheduling and control	Soil Dynamics and Machine Foundations	Intelligent Transportation Systems	Industrial Wastewater Management	Earth and Rockfill Dams
Rehabilitation/ Heritage Restoration	Construction Management and Safety	Rock Mechanics	Pavement Engineering	Solid and Hazardous Waste Management	Computational Fluid Dynamics
Introduction to Finite Element Method	Advanced construction Technology	Earth and Earth Retaining Structures	Transportation planning Process	Environmental Policy and Legislations	Rainwater Harvesting
Analysis of Structural Stability	Engineering Economics	Pile Foundation	Transport and Environment	Environment, Health and Safety	Metro Systems and Engineering
Analysis and Design of Structures under Wind and Cyclone Effects	Cost Management of Engineering Projects	Tunneling Engineering	Transportation Economics	Life Cycle Assessment	Environmental quality Monitoring

PROFESSIONAL ELECTIVE COURSES : VERTICALS

VERTICAL I: (STRUCTURES)

S. NO.	COURSE CODE	COURSE TITLE	CATE-GORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
1.	24CE3001	Concrete Structures	PEC	3	0	0	3	3
2.	24CE3002	Advanced Concrete Structures	PEC	3	0	0	3	3
3.	24CE3003	Steel Structures	PEC	3	0	0	3	3
4.	24CE3004	Prefabricated Structures	PEC	3	0	0	3	3
5.	24CE3005	Rehabilitation/Heritage Restoration	PEC	3	0	0	3	3
6.	24CE3006	Introduction to Finite Element Method	PEC	3	0	0	3	3
7.	24CE3007	Analysis of Structural Stability	PEC	3	0	0	3	3
8.	24CE3008	Analysis and Design of Structures under Wind and Cyclone Effects	PEC	3	0	0	3	3

VERTICAL II : (CONSTRUCTION TECHNIQUES AND PRACTICES)

S. NO.	COURSE CODE	COURSE TITLE	CATE-GORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
1.	24CE3009	Formwork Engineering	PEC	3	0	0	3	3
2.	24CE3010	Building Information Modelling	PEC	3	0	0	3	3
3.	24CE3011	Sustainable Construction And Lean Construction	PEC	3	0	0	3	3
4.	24CE3012	Project planning, scheduling and control	PEC	3	0	0	3	3
5.	24CE3013	Construction Management and Safety	PEC	2	0	2	4	3
6.	24CE3014	Advanced Construction Techniques	PEC	3	0	0	3	3
7.	24CE3015	Engineering Economics	PEC	3	0	0	3	3
8.	24CE3016	Cost Management of Engineering Projects	PEC	3	0	0	3	3

VERTICAL III : (GEOTECHNICAL)

S. NO.	COURSE CODE	COURSE TITLE	CATE-GORY	PERIODS PER WEEK				CREDITS
				L	T	P		
1.	24CE3017	Subsurface Investigation and Instrumentation	PEC	3	0	0		3
2.	24CE3018	Geo-environmental Engineering	PEC	3	0	0		3
3.	24CE3019	Ground Improvement Techniques	PEC	3	0	0		3
4.	24CE3020	Soil Dynamics and Machine Foundations	PEC	3	0	0		3
5.	24CE3021	Rock Mechanics	PEC	3	0	0		3
6.	24CE3022	Earth and Earth Retaining Structures	PEC	3	0	0		3
7.	24CE3023	Pile Foundation	PEC	3	0	0	3	3
8.	24CE3024	Tunneling Engineering	PEC	3	0	0	3	3

VERTICAL IV: (TRANSPORTATION INFRASTRUCTURE)

S. NO.	COURSE CODE	COURSE TITLE	CATE-GORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
1.	24CE3025	Traffic Engineering and Management	PEC	3	0	0	3	3
2.	24CE3026	Urban Planning and Development	PEC	3	0	0	3	3
3.	24CE3027	Smart Cities	PEC	3	0	0	3	3
4.	24CE3028	Intelligent Transportation Systems	PEC	3	0	0	3	3
5.	24CE3029	Pavement Engineering	PEC	3	0	0	3	3
6.	24CE3030	Transportation Planning Process	PEC	3	0	0	3	3
7.	24CE3031	Transport and Environment	PEC	3	0	0	3	3
8.	24CE3032	Transportation Economics	PEC	3	0	0	3	3

VERTICAL V: (ENVIRONMENT)

S. NO.	COURSE CODE	COURSE TITLE	CATE-GORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
1.	24CE3033	Climate Change Adaptation and Mitigation	PEC	3	0	0	3	3
2.	24CE3034	Air and Noise Pollution Control Engineering	PEC	3	0	0	3	3
3.	24CE3035	Environmental Impact Assessment	PEC	3	0	0	3	3
4.	24CE3036	Industrial Wastewater Management	PEC	3	0	0	3	3
5.	24CE3037	Solid and Hazardous Waste Management	PEC	3	0	0	3	3
6.	24CE3038	Environmental Policy and Legislations	PEC	3	0	0	3	3
7.	24CE3039	Environmental Health and Safety	PEC	3	0	0	3	3
8.	24CE3040	Life Cycle Assessment	PEC	3	0	0	3	3

VERTICAL VI: WATER RESOURCES

S. NO.	COURSE CODE	COURSE TITLE	CATE-GORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
1.	24CE3041	Remote Sensing Concepts	PEC	3	0	0	3	3
2.	24CE3042	Geographical Information System	PEC	3	0	0	3	3
3.	24CE3043	Hydrographic Surveying	PEC	3	0	0	3	3
4.	24CE3044	Earth and Rock fill Dams	PEC	3	0	0	3	3
5.	24CE3045	Computational Fluid Dynamics	PEC	3	0	0	3	3
6.	24CE3046	Rainwater Harvesting	PEC	3	0	0	3	3
7.	24CE3047	Metro Systems and Engineering	PEC	3	0	0	3	3
8.	24CE3048	Environmental Quality Monitoring	PEC	3	0	0	3	3

LIST OF OPEN ELECTIVE COURSES

[* Students shall choose the open elective courses, such that the course contents are not similar to any other course contents / title under other course categories.
**** Students are not permitted to opt for Open Elective (OE) courses offered by their parent department.]**

OPEN ELECTIVE-I							
S. No.	**Course Code**	**Course Title**	**Category**	**L**	**T**	**P**	**C**
1	24OEEE01	Semiconductor Memories	OEC	3	0	0	3
2	24OEEE02	Electrical Safety And Safety Management	OEC	3	0	0	3
3	24OEEC01	IoT Concepts And Applications	OEC	2	0	2	3
4	24OEEC02	Drone Technologies	OEC	3	0	0	3
5	24OECE01	Plastic And E-Waste Management	OEC	3	0	0	3
6	24OECE02	Remote Sensing And GIS Applications In Environmental Management	OEC	3	0	0	3
7	24OECS01	Advanced Java Technologies	OEC	3	0	0	3
8	24OECS02	Machine Learning Paradigms	OEC	3	0	0	3
9	24OEME01	Fundamentals Of Aeronautical Engineering	OEC	3	0	0	3
10	24OEME02	Energy Technology	OEC	3	0	0	3
11	24OEAD01	Artificial Intelligence And Machine Learning Fundamentals	OEC	3	0	0	3
12	24OEAD02	Business Intelligence And Its Applications	OEC	3	0	0	3
OPEN ELECTIVE-II							
S. No.	**Course Code**	**Course Title**	**Category**	**L**	**T**	**P**	**C**
1	24OEEE03	Energy Storage Systems	OEC	3	0	0	3
2	24OEEE04	Energy Management And Auditing	OEC	3	0	0	3
3	24OEEC03	Robotic Process Automation	OEC	2	0	2	3
4	24OEEC04	Fundamentals Of Embedded And IoT	OEC	2	0	2	3
5	24OECE03	Green Building Design	OEC	3	0	0	3
6	24OECE04	Web User Interface Design	OEC	3	0	0	3
7	24OECS03	IoT And Edge Computing	OEC	3	0	0	3

VERTICAL VI: WATER RESOURCES

8	24OECS04	IT In Agricultural System	OEC	3	0	0	3
9	24OEME03	Environmental Engineering And Pollution Control	OEC	3	0	0	3
10	24OEME04	Elements Of Marine Engineering	OEC	3	0	0	3
11	24OEAD03	Augmented Reality / Virtual Reality	OEC	3	0	0	3
12	24OEAD04	Digital Forensics	OEC	3	0	0	3
OPEN ELECTIVE-III							
S. No.	**Course Code**	**Course Title**	**Category**	**L**	**T**	**P**	**C**
1	24OEEE05	Electric Vehicles	OEC	3	0	0	3
2	24OEEE06	Green Energy Sources	OEC	3	0	0	3
3	24OEEC05	Consumer Electronics	OEC	3	0	0	3
4	24OEEC06	Sensors And Actuators	OEC	3	0	0	3
5	24OECE05	Urban Agriculture	OEC	3	0	0	3
6	24OECE06	Irrigation Engineering	OEC	3	0	0	3
7	24OECS05	Deep Learning Techniques	OEC	3	0	0	3
8	24OECS06	Ethical Hacking And Network Defense	OEC	3	0	0	3
9	24OEME05	Alternative Fuels And Energy Systems	OEC	3	0	0	3
10	24OEME06	Foundation of Robotics	OEC	3	0	0	3
11	24OEAD05	Block chain Architecture And Design	OEC	3	0	0	3
12	24OEAD06	Full Stack Development	OEC	3	0	0	3

S.No.	Subject Area	CREDITS PER SEMESTER								CREDITS TOTAL
		I	II	III	IV	V	VI	VII	VIII/VII	
1.	**HSMC**	4	3	-	-	-	-	5	-	12
2.	**BSC**	12	7	4	-	-	-	-	-	23
3.	**ESC**	5	11	-	-	-	-	-	-	16
4.	**PCC**	-	-	20	19	10	9	6	-	64
5.	**PEC**	-	-	-	-	6	9	3	-	18
6.	**OEC**	-	-	-	-	3	3	3	-	9
7.	**EEC**	1	2	1	1	2	1	5	10	23
8.	**ICC**	-	-	-	3	-	-	-	-	3
	Total	**22**	**23**	**25**	**23**	**21**	**22**	**22**	**10**	**168**
9.	**MANDATORY COURSE (Non-credit)**	-	-	-	-	✓	✓	-	-	-

24IP3151 **INDUCTION PROGRAMME**

This is a mandatory 2 week programme to be conducted as soon as the students enter the institution. Normal classes start only after the induction program is over.

The induction programme has been introduced by AICTE with the following objective:

“Engineering colleges were established to train graduates well in the branch/department of admission, have a holistic outlook, and have a desire to work for national needs and beyond. The graduating student must have knowledge and skills in the area of his/her study. However, he/she must also have broad understanding of society and relationships. Character needs to be nurtured as an essential quality by which he/she would understand and fulfill his/her responsibility as an engineer, a citizen and a human being. Besides the above, several meta-skills and underlying values are needed.”

“One will have to work closely with the newly joined students in making them feel comfortable, allow them to explore their academic interests and activities, reduce competition and make them work for excellence, promote bonding within them, build relations between teachers and students, give a broader view of life, and build character. “

Hence, the purpose of this programme is to make the students feel comfortable in their new environment, open them up, set a healthy daily routine, create bonding in the batch as well as between faculty and students, develop awareness, sensitivity and understanding of the self, people around them, society at large, and nature.

The following are the activities under the induction program in which the student would be fully engaged throughout the day for the entire duration of the program.

(i) Physical Activity

This would involve a daily routine of physical activity with games and sports, yoga, gardening, etc.

(ii) Creative Arts

Every student would choose one skill related to the arts whether visual arts or performing arts. Examples are painting, sculpture, pottery, music, dance etc. The student would pursue it every day for the duration of the program. These would allow for creative expression. It would develop a sense of aesthetics and also enhance creativity which would, hopefully, grow into engineering design later.

(iii) Universal Human Values

This is the anchoring activity of the Induction Programme. It gets the student to explore oneself and allows one to experience the joy of learning, stand up to peer pressure, take decisions with courage, be aware of relationships with colleagues and supporting stay in the hostel and department, be sensitive to others, etc. A module in Universal Human Values provides the base. Methodology of teaching this content is extremely important. It must not be through do's and don’ts, but get students to explore and think by engaging them in a dialogue. It is best taught through group discussions and real life activities rather than lecturing.
Discussions would be conducted in small groups of about 20 students with a faculty mentor each. It would be effective that the faculty mentor assigned is also the faculty advisor for the student for the full duration of the UG programme.

(iv) Literary Activity

Literary activity would encompass reading, writing and possibly, debating, enacting a play etc.

(v) Proficiency Modules

This would address some lacunas that students might have, for example, English, computer familiarity etc.

(vi) Lectures by Eminent People

Motivational lectures by eminent people from all walks of life should be arranged to give the students exposure to people who are socially active or in public life.

(vii) Visits to Local Area

A couple of visits to the landmarks of the city, or a hospital or orphanage could be organized. This would familiarize them with the area as well as expose them to the under privileged.

(viii) Familiarization to Dept./Branch & Innovations

They should be told about what getting into a branch or department means what role it plays in society, through its technology. They should also be shown the laboratories, workshops & other facilities.

(ix) Department Specific Activities

About a week can be spent in introducing activities (games, quizzes, social interactions, small experiments, design thinking etc.) that are relevant to the particular branch of Engineering/Technology/Architecture that can serve as a motivation and kindle interest in building things (become a maker) in that particular field. This can be conducted in the form of a workshop. For example, CSE and IT students may be introduced to activities that kindle computational thinking, and get them to build simple games. ECE students may be introduced to building simple circuits as an extension of their knowledge in Science, and so on. Students may be asked to build stuff using their knowledge of science.

Induction Programme is totally an activity based programme and therefore there shall be no tests / assessments during this programme.

References:
Guide to Induction program from AICTE

24HS3152 PROFESSIONAL ENGLISH I L T P C

3 0 0 3

COURSE OBJECTIVES:

- To improve the communicative competence of learners
- To learn to use basic grammatical structures in suitable contexts
- To acquire lexical competence and use them appropriately in a sentence and understand their meaning in a text
- To help learners use language effectively in professional contexts
- To develop learners' ability to read and write complex texts, summaries, articles, blogs, definitions, essays and user manuals.

UNIT I INTRODUCTION TO EFFECTIVE COMMUNICATION 1

What is effective communication? (Explain using activities) Why is communication critical for excellence during study, research and work? What are the seven C's of effective communication? What are key language skills? What is effective listening? What does it involve? What is effective speaking? What does it mean to be an excellent reader? What should you be able to do? What is effective writing? How does one develop language and communication skills? What does the course focus on? How are communication and language skills going to be enhanced during this course? What do you as a learner need to do to enhance your English language and communication skills to get the best out of this course?

INTRODUCTION TO FUNDAMENTALS OF COMMUNICATION **8**

Reading - Reading brochures (technical context), telephone messages / social media messages relevant to technical contexts and emails. Writing - Writing emails / letters introducing oneself. Grammar - Present Tense (simple and progressive); Question types: Wh/ Yes or No/ and Tags. Vocabulary - Synonyms; One word substitution; Abbreviations & Acronyms (as used in technical contexts).

UNIT II NARRATION AND SUMMATION **9**

Reading - Reading biographies, travelogues, newspaper reports, Excerpts from literature, and travel & technical blogs. Writing - Guided writing-- Paragraph writing Short Report on an event (field trip etc.) Grammar –Past tense (simple); Subject-Verb Agreement; and Prepositions. Vocabulary - Word forms (prefixes& suffixes); Synonyms and Antonyms. Phrasal verbs.

UNIT III DESCRIPTION OF A PROCESS / PRODUCT **9**

Reading – Reading advertisements, gadget reviews; user manuals. Writing - Writing definitions; instructions; and Product /Process description. Grammar - Imperatives; Adjectives; Degrees of comparison; Present & Past Perfect Tenses. Vocabulary - Compound Nouns, Homonyms; and Homophones, discourse markers (connectives & sequence words).

UNIT IV CLASSIFICATION AND RECOMMENDATIONS **9**

Reading – Newspaper articles; Journal reports –and Non-Verbal Communication (tables, pie charts etc.,). Writing – Note-making / Note-taking (*Study skills to be taught, not tested); Writing recommendations; Transferring information from nonverbal (chart , graph etc., to verbal mode) Grammar –Articles; Pronouns
- Possessive & Relative pronouns. Vocabulary - Collocations; Fixed / Semi fixed expressions.

UNIT V EXPRESSION **9**

Reading – Reading editorials; and Opinion Blogs; Writing – Essay Writing (Descriptive or narrative). Grammar – Future Tenses, Punctuation; Negation (Statements & Questions); and Simple, Compound & Complex Sentences. Vocabulary - Cause & Effect Expressions – Content vs Function words.

TOTAL : 45 PERIODS

LEARNING OUTCOMES :

At the end of the course, learners will be able

CO1: To use appropriate words in a professional context
CO2: To gain understanding of basic grammatical structures and use them in right context.
CO3: To read and infer the denotative and connotative meanings of technical texts
CO4: To read and interpret information presented in tables, charts and other graphic forms
CO5: To write definitions, descriptions, narrations and essays on various topics

TEXT BOOKS :

1. English for Engineers & Technologists Orient Blackswan Private Ltd. Department of English, Anna University, (2020 edition)
2. English for Science & Technology Cambridge University Press, 2021. Authored by Dr. Veena Selvam, Dr. Sujatha Priyadarshini, Dr. Deepa Mary Francis, Dr. KN. Shoba, and Dr. Lourdes Joevani, Department of English, Anna University.

REFERENCES:

1. Technical Communication – Principles And Practices By Meenakshi Raman & Sangeeta Sharma, Oxford Univ. Press, 2016, New Delhi.
2. A Course Book On Technical English By Lakshminarayanan, Scitech Publications (India) Pvt. Ltd.
3. English For Technical Communication (With CD) By Aysha Viswamohan, Mcgraw Hill Education, ISBN : 0070264244.
4. Effective Communication Skill, Kulbhusan Kumar, RS Salaria, Khanna Publishing House.
5. Learning to Communicate – Dr. V. Chellammal, Allied Publishing House, New Delhi, 2003.

ASSESSMENT PATTERN

Two internal assessments and an end semester examination to test students' reading and writing skills along with their grammatical and lexical competence.

CO's-PO's & PSO's MAPPING

CO	PO												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
1	1	1	1	1	1	3	3	3	1	3	-	3	-	-	-
2	1	1	1	1	1	3	3	3	1	3	-	3	-	-	-
3	2	3	2	3	2	3	3	3	2	3	3	3	-	-	-
4	2	3	2	3	2	3	3	3	2	3	3	3	-	-	-
5	2	3	3	3	-	3	3	3	2	3	-	3	-	-	-
Avg.	**1.6**	**2.2**	**1.8**	**2.2**	**1.5**	**3**	**3**	**3**	**1.6**	**3**	**3**	**3**	**-**	**-**	**-**

- 1-low, 2-medium, 3-high, '-"- no correlation
- **Note:** The average value of this course to be used for program articulation matrix.

24MA3151 MATRICES AND CALCULUS L T P C

3 1 0 4

COURSE OBJECTIVES:

- To develop the use of matrix algebra techniques that is needed by engineers for practical applications.
- To familiarize the students with differential calculus.
- To familiarize the student with functions of several variables. This is needed in many branches of engineering.
- To make the students understand various techniques of integration.
- To acquaint the student with mathematical tools needed in evaluating multiple integrals and their applications.

UNIT I MATRICES 9+3

Eigen values and Eigenvectors of a real matrix – Characteristic equation – Properties of Eigenvalues and Eigenvectors – Cayley - Hamilton theorem – Diagonalization of matrices by orthogonal transformation
– Reduction of a quadratic form to canonical form by orthogonal transformation – Nature of quadratic forms
– Applications: Stretching of an elastic membrane.

UNIT II DIFFERENTIAL CALCULUS 9+3

Representation of functions - 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 – Total derivative – Change of variables – Jacobians – Partial differentiation of implicit functions – 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 - Applications : Hydrostatic force and pressure, moments and centers of mass.

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 – Applications : Moments and centers of mass, moment of inertia.

TOTAL : 60 PERIODS

COURSE OUTCOMES :

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

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

TEXTBOOKS :

1. Kreyszig.E, "Advanced Engineering Mathematics", John Wiley and Sons, 10th Edition, New Delhi, 2016.
2. Grewal.B.S., "Higher Engineering Mathematics", Khanna Publishers, New Delhi, 44th Edition, 2018.
3. James Stewart, "Calculus : Early Transcendentals", Cengage Learning, 8th Edition, New Delhi, 2015. [For Units II & IV - Sections 1.1, 2.2, 2.3, 2.5, 2.7 (Tangents problems only), 2.8, 3.1 to 3.6, 3.11,
4. 1, 4.3, 5.1 (Area problems only), 5.2, 5.3, 5.4 (excluding net change theorem), 5.5,7.1 - 7.4 and 7.8].

REFERENCES :

1. Anton. H, Bivens. I and Davis. S, " Calculus ", Wiley, 10th Edition, 2016
2. Bali. N., Goyal. M. and Watkins. C., "Advanced Engineering Mathematics", Firewall Media (An imprint of Lakshmi Publications Pvt., Ltd.,), New Delhi, 7th Edition, 2009.
3. Jain. R.K. and Iyengar. S.R.K., "Advanced Engineering Mathematics", Narosa Publications, New Delhi, 5th Edition, 2016.
4. Narayanan. S. and Manicavachagom Pillai. T. K.,"Calculus" Volume I and II, S. Viswanathan Publishers Pvt. Ltd., Chennai, 2009.
5. Ramana. B.V., "Higher Engineering Mathematics", McGraw Hill Education Pvt. Ltd, New Delhi, 2016.
6. Srimantha Pal and Bhunia. S.C, "Engineering Mathematics " Oxford University Press, 2015.
7. Thomas. G. B., Hass. J, and Weir. M.D, "Thomas Calculus", 14th Edition, Pearson India, 2018.

CO's-PO's & PSO's MAPPING

	PO 01	PO 02	PO 03	PO 04	PO 05	PO 06	PO 07	PO 08		PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO1	3	3	1	1	0	0	0	0	2	0	2	3	-	-	-
CO2	3	3	1	1	0	0	0	0		0	2	3	-	-	-
CO3	3	3	1	1	0	0	0	0	2	0	2	3	-	-	-
CO4	3	3	1	1	0	0	0	0	2	0	2	3	-	-	-
CO5	3	3	1	1	0	0	0	0		0	2	3	-	-	-
Avg.	3	3	1	1	0	0	0	0		0	2	3	-	-	-

24PH3151 ENGINEERING PHYSICS L T P C

3 0 0 3

COURSE OBJECTIVES:

- To make the students effectively to achieve an understanding of mechanics.
- To enable the students to gain knowledge of electromagnetic waves and its applications.
- To introduce the basics of oscillations, optics and lasers.
- Equipping the students to be successfully understand the importance of quantum physics.
- To motivate the students towards the applications of quantum mechanics.

UNIT I MECHANICS 9

Multi-particle dynamics: Center of mass (CM) – CM of continuous bodies – motion of the CM – kinetic energy of system of particles. Rotation of rigid bodies: Rotational kinematics – rotational kinetic energy and moment of inertia - theorems of M .I –moment of inertia of continuous bodies – M.I of a diatomic molecule - torque – rotational dynamics of rigid bodies – conservation of angular momentum – rotational energy state of a rigid diatomic molecule - gyroscope - torsional pendulum – double pendulum –Introduction to nonlinear oscillations.

UNIT II ELECTROMAGNETIC WAVES 9

The Maxwell's equations - wave equation; Plane electromagnetic waves in vacuum, Conditions on the wave field - properties of electromagnetic waves: speed, amplitude, phase, orientation and waves in matter - polarization - Producing electromagnetic waves - Energy and momentum in EM waves: Intensity, waves from localized sources, momentum and radiation pressure - Cell-phone reception. Reflection and transmission of electromagnetic waves from a non-conducting medium- vacuum interface for normal incidence.

UNIT III OSCILLATIONS, OPTICS AND LASERS 9

Simple harmonic motion - resonance –analogy between electrical and mechanical oscillating systems - waves on a string - standing waves - traveling waves - Energy transfer of a wave - sound waves - Doppler effect. Reflection and refraction of light waves - total internal reflection – interference –Michelson interferometer – Theory of air wedge and experiment. Theory of laser – characteristics - Spontaneous and stimulated emission - Einstein's coefficients - population inversion - Nd-YAG laser, CO_2 laser, semiconductor laser –Basic applications of lasers in industry.

UNIT IV BASIC QUANTUM MECHANICS 9

Photons and light waves - Electrons and matter waves –Compton effect - The Schrodinger equation (Time dependent and time independent forms) - meaning of wave function - Normalization –Free particle - particle in a infinite potential well: 1D,2D and 3D Boxes- Normalization, probabilities and the correspondence principle.

UNIT V APPLIED QUANTUM MECHANICS 9

The harmonic oscillator(qualitative)- Barrier penetration and quantum tunneling(qualitative)- Tunneling microscope - Resonant diode - Finite potential wells (qualitative)- Bloch's theorem for particles in a periodic potential –Basics of Kronig-Penney model and origin of energy bands.

TOTAL : 45 PERIODS

COURSE OUTCOMES:

After completion of this course, the students should be able to

CO1 Understand the importance of mechanics.

CO2 Express their knowledge in electromagnetic waves.

CO3 Demonstrate a strong foundational knowledge in oscillations, optics and lasers.

CO4 Understand the importance of quantum physics.

CO5 Comprehend and apply quantum mechanical principles towards the formation of energy bands.

TEXT BOOKS:

1. D.Kleppner and R.Kolenkow. An Introduction to Mechanics. McGraw Hill Education (Indian Edition), 2017.
2. E.M.Purcell and D.J.Morin, Electricity and Magnetism, Cambridge Univ.Press, 2013.
3. Arthur Beiser, Shobhit Mahajan, S. Rai Choudhury, Concepts of Modern Physics, McGraw-Hill (Indian Edition), 2017.

REFERENCES:

1. R.Wolfson. Essential University Physics. Volume 1 & 2. Pearson Education (Indian Edition),2009.
2. Paul A. Tipler, Physic – Volume 1 & 2, CBS, (Indian Edition), 2004.
3. K.Thyagarajan and 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. N.Garcia, A.Damask and S.Schwarz. Physics for Computer Science Students. Springer-Verlag, 2012.

CO's-PO's & PSO's MAPPING

CO's	PO's												PSO's		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
1	3	3	2	1	1	1	-	-	-	-	-	-	-	-	-
2	3	3	2	1	2	1	-	-	-	-	-	-		-	-
3	3	3	2	2	2	1	-	-	-	-	-	1		-	-
4	3	3	1	1	2	1	-	-	-	-	-	-	-	-	
5	3	3	1	1	2	1	-	-	-	-	-	-		-	-
Avg.	3	3	1.6	1.2	1.8	1	-	-	-	-	-	1		-	-

1- Low,2-Medium,3-High,"-"-no correlation

24CY3151 **ENGINEERING CHEMISTRY** **L T P C**
3 0 0 3

COURSE OBJECTIVES:

- To inculcate sound understanding of water quality parameters and water treatment techniques.
- To impart knowledge on the basic principles and preparatory methods of nanomaterials.
- To introduce the basic concepts and applications of phase rule and composites.
- To facilitate the understanding of different types of fuels, their preparation, properties and combustion characteristics.
- To familiarize the students with the operating principles, working processes and applications of energy conversion and storage devices.

UNIT I WATER AND ITS TREATMENT **9**

Water: Sources and impurities, Water quality parameters: Definition and significance of-colour, odour, turbidity, pH, hardness, alkalinity, TDS, COD and BOD, fluoride and arsenic. Municipal water treatment: primary treatment and disinfection (UV, Ozonation, break-point chlorination). Desalination of brackish water: Reverse Osmosis. Boiler troubles: Scale and sludge, Boiler corrosion, Caustic embrittlement, Priming &foaming. Treatment of boiler feed water: Internal treatment (phosphate, colloidal, sodium aluminate and calgon conditioning) and External treatment – Ion exchange de-mineralization and zeolite process.

UNIT II NANOCHEMISTRY **9**

Basics: Distinction between molecules, nanomaterials and bulk materials; Size-dependent properties (optical, electrical, mechanical and magnetic); Types of nanomaterials: Definition, properties and uses of – nanoparticle, nanocluster, nanorod, nanowire and nanotube. Preparation of nanomaterials: sol-gel, solvothermal, laser ablation, chemical vapour deposition, electrochemical deposition and electro spinning. Applications of nanomaterials in medicine, agriculture, energy, electronics and catalysis.

UNIT III PHASE RULE AND COMPOSITES **9**

Phase rule: Introduction, definition of terms with examples. One component system - water system; Reduced phase rule; Construction of a simple eutectic phase diagram - Thermal analysis; Two component system: lead- silver system - Pattinson process.

Composites: Introduction: Definition & Need for composites; Constitution: Matrix materials (Polymer matrix, metal matrix and ceramic matrix) and Reinforcement (fiber, particulates, flakes and whiskers). Properties and applications of: Metal matrix composites (MMC), Ceramic matrix composites and Polymer matrix composites. Hybrid composites - definition and examples.

UNIT IV FUELS AND COMBUSTION **9**

Fuels: Introduction: Classification of fuels; Coal and coke: Analysis of coal (proximate and ultimate), Carbonization, Manufacture of metallurgical coke (Otto Hoffmann method). Petroleum and Diesel: Manufacture of synthetic petrol (Bergius process), Knocking - octane number, diesel oil
- cetane number; Power alcohol and biodiesel.

Combustion of fuels: Introduction: Calorific value - higher and lower calorific values, Theoretical calculation of calorific value; Ignition temperature: spontaneous ignition temperature, Explosive range; Flue gas analysis
- ORSAT Method. CO_2 emission and carbon foot print.

UNIT V ENERGY SOURCES AND STORAGE DEVICES **9**

Stability of nucleus: mass defect (problems), binding energy; Nuclear energy: light water nuclear power plant, breeder reactor. Solar energy conversion: Principle, working and applications of solar cells; Recent developments in solar cell materials. Wind energy; Geothermal energy; Batteries: Types of batteries, Primary battery - dry cell, Secondary battery - lead acid battery and lithium-ion-battery; Electric vehicles- working principles; Fuel cells: H_2-O_2 fuel cell, microbial fuel cell; Supercapacitors: Storage principle, types and examples.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

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

CO1 To infer the quality of water from quality parameter data and propose suitable treatment methodologies to treat water.

CO2 To identify and apply basic concepts of nanoscience and nanotechnology in designing the synthesis of nanomaterials for engineering and technology applications.

CO3 To apply the knowledge of phase rule and composites for material selection requirements.

CO4 To recommend suitable fuels for engineering processes and applications.

CO5 To recognize different forms of energy resources and apply them for suitable applications in energy sectors.

TEXT BOOKS:

1. P. C. Jain and Monica Jain, "Engineering Chemistry", 17th Edition, Dhanpat Rai Publishing Company (P) Ltd, New Delhi, 2018.
2. Sivasankar B., "Engineering Chemistry", Tata McGraw-Hill Publishing Company Ltd, New Delhi, 2008.
3. S.S. Dara, "A text book of Engineering Chemistry", S. Chand Publishing, 12th Edition, 2018.

REFERENCES:

1. B. S. Murty, P. Shankar, Baldev Raj, B. B. Rath and James Murday, "Text book of nanoscience and nanotechnology", Universities Press-IIM Series in Metallurgy and Materials Science, 2018.
2. O.G. Palanna, "Engineering Chemistry" McGraw Hill Education (India) Private Limited, 2nd Edition, 2017.
3. Friedrich Emich, "Engineering Chemistry", Scientific International PVT, LTD, New Delhi, 2014.
4. Shikha Agarwal, "Engineering Chemistry-Fundamentals and Applications", Cambridge University Press, Delhi, Second Edition, 2019.
5. O.V. Roussak and H.D. Gesser, Applied Chemistry-A Text Book for Engineers and Technologists, Springer Science Business Media, New York, 2nd Edition, 2013.

CO's-PO's & PSO's MAPPING

CO	PO												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
1	3	2	2	1	-	1	1	-	-	-	-	1	-	-	-
2	2	-	-	1	-	2	2	-	-	-	-	-	-	-	-
3	3	1	-	-	-	-	-	-	-	-	-	-	-	-	-
4	3	1	1	-	-	1	2	-	-	-	-	-	-	-	-
5	3	1	2	1	-	2	2	-	-	-	-	2	-	-	-
Avg.	2.8	1.3	1.6	1	-	1.5	1.8	-		-	-	1.5	-	-	-

- 1-low, 2-medium, 3-high, '-"- no correlation

24GE3151 PROBLEM SOLVING AND PYTHON PROGRAMMING L T P C

3 0 0 3

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.
- To use Python data structures - lists, tuples, dictionaries to represent complex data.
- To do input/output with files in Python.

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

TOTAL : 45 PERIODS

COURSE OUTCOMES:

Upon completion of the course, students will be able to

CO1: Develop algorithmic solutions to simple computational problems.
CO2: Develop and execute simple Python programs.
CO3: Write simple Python programs using conditionals and looping for solving problems.
CO4: Decompose a Python program into functions.
CO5: Represent compound data using Python lists, tuples, dictionaries etc.
CO6: 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.

REFERENCES:

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 Press2021
4. Eric Matthes, "Python Crash Course, A Hands - on Project Based Introduction to Programming", 2nd Edition, No Starch Press, 2019.
5. https://www.python.org/
6. Martin C. Brown, "Python: The Complete Reference", 4th Edition, Mc-Graw Hill,2018.

COs- PO's & PSO's MAPPING

\CO's	PO's												PSO's		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
1	3	3	3	3	2	-	-	-	-	-	2	2	3	3	-
2	3	3	3	3	2	-	-	-	-	-	2	2	3	-	-
3	3	3	3	3	2	-	-	-	-	-	2	-	3	-	-
4	2	2	-	2	2	-	-	-	-	-	1	-	3	-	-
5	1	2	-	-	1	-	-	-	-	-	1	-	2	-	-
6.	2	2	-	-	2	-	-	-	-	-	1	-	2	-	-
Avg.	2	3	3	3	2	-	-	-	-	-	2	2	3	3	-

1 - low, 2 - medium, 3 - high, '-' - no correlation

24GE3152 **தமிழர் மரபு** **L T P C**
1 0 0 1

அலகு I மொழி மற்றும் இலக்கியம்: **3**

இந்திய தமமத ொழிக் குடுமப ்பங்கள் – திமுத ொவிட தமமத ொழிகள் – தமிழ் ஒரு மதமப ்தமமத ொழி – தமிழ் மதவ்விலக்கியங்கள் - ம ங்க இலக்கியத்தின் ம மமய் ம ம த ொர ்பற்ற தன்மமப – ம ங்க இலக்கியத்தில் பகிர ்தல் அறமப ் – திருக்குறளில் மமமதலொண்மமக் கருத்Fக்கள் – தமிழ்க் மதகொப்பியங்கள், தமிழகத்தில் ம மண தமதபௌத்த ம மயங்களின் மததொக்கமப ் - பக்தி இலக்கியமப ், ஆழ்மதவொர ்கள் மற்றுமப ் மதநொயன்மமத ொர ்கள் – சிற்றிலக்கியங்கள் – தமிழில் நவீன இலக்கியத்தின் வளர ்ம ்சி – தமிழ் இலக்கிய வளர ்ம ்சியில் மதபொர்திமதயொர மற்றுமப மதபொர்திமததொம ன் ஆகிமமதயொர ின் பங்களிப்பு.

அலகு II மரபு – ஓவியங்கள் முதல் நவீன ஓவியங்கள் சிற்பக்கலை **3**

நடுகல் முதல் நவீன சிற்பங்கள் வமர – ஐம ்தமதபொன் சிமலகள்– பழங்குடியினர ் மற்றுமப அவர ்கள் தமதயொர ிக்குமப மகவிமனப் தமதபொருட்கள், தமதபொமப ்மமகள் – மதர ் மதய்யுமப ் கமல – சுடுமண் சிற்பங்கள் – மதநொட்டுப்புறத் ததய்வங்கள் – குமர ிமுமனயில் திருவள்ளுவர ் சிமல – இமமக் கருவிகள் – மிருதங்கமப ், பமற, வீமண, மதயொழ், மதநொதஸ்வரமப – தமிழர ்களின் ம மூக தமதபொருமதளொமததொர்மதவொழ்வில் மமதகொவில்களின் பங்கு.

அலகு III நாட்டுப்புறக் கலைகள் மற்றும் வீர விளையாட்டுகள்: **3**

ததருக்கூத்F, கரமதகொட்டமப ், வில்லுப்மதபொட்டு, கணிமதயொன் கூத்F, ஒயிமதலொட்டமப ், மமததொல்மதபொமவக் கூத்F, சிலமப ்மதபொட்டமப ், வளர ி, புலிமதயொட்டமப ், தமிழர ்களின் விமளமதயொட்டுகள்.

அலகு IV தமிழர்களின் திலறக் கமமகொட்மம ொடுகள்: **3**

தமிழகத்தின் மததொவரங்களுமப ், விலங்குகளுமப ் – தமததொல்மதகொப்பியமப ் மற்றுமப ் ம ங்க இலக்கியத்தில் அகமப ் மற்றுமப ் புறக் மமதகொட்மதபொடுகள் – தமிழர ்கள் மமதபொற்றிய அறக்மமதகொட்மதபொடு – ம ங்கமதகொலத்தில் தமிழகத்தில் எழுத்தறிவுமப ், கல்வியுமப ்ங்கமதகொல நகரங்களுமப ் Fமற முகங்களுமப ் – ம ங்கமதகொலத்தில் ஏற்றுமதி மற்றுமப இறக்குமதி – கடல்கடந்த மதநொடுகளில் மமமத ொழர ்களின் தவற்றி.

அலகு V இந்திய கதசிய இயக்கம் மற்றும் இந்திய ல ்ம ம ொட்டிற்குத் தமிழர்களின் ங்கள ்ப்: **3**

இந்திய விடுதமலப்மமதபொர ில் பங்கு – இந்திமதயொவின் தமிழர ்களி ன்

பிறப்பகுதிகளில் தமிழ்ப் பண்மதபொட்டின் மததொக்கமப – சுயமர ிமதயொமத இயக்கமப – இந்திய மருத்Fவத்தில், சித்த மருத்Fவத்தின் பங்கு – கல்தவட்டுகள், மகதயழுத்Fப்படிகள் - தமிழ்ப் புத்தகங்களின் மஅ்சுவரமதலொறு.

TOTAL : 15 PERIODS

TEXT-CUM-REFERENCE BOOKS

1. தமிழக வுமதலொறு – மக்களும பண்மதபொடும – மக.மக. பிள்மள (தவளியீடு: தமிழ்மதநாடு மதபொடநாலல் மற்றாம ் கல்வியியல் பணிகள் கழகம ்).
2. கணினித் தமிழ் – முமனவு இல. சுந்துமம ். (விகடன் பியசுமம ்).
3. கீழடி – மவமக நதிக்கமுயில் ம ங்கமதகொல நகுமதநொகு ிகம (தமததொல்லியல் மற தவளியீடு)
4. தமதபொருமந – ஆற்றங்கமுமதநொகு ிகம ். (தமததொல்லியல் Fமற தவளியீடு)
5. Social Life of Tamils (Dr.K.K.Pillay) A joint publication of TNTB & ESC and RMRL – (in print)
6. Social Life of the Tamils - The Classical Period (Dr.S.Singaravelu) (Published by: InternationalInstitute of Tamil Studies.
7. Historical Heritage of the Tamils (Dr.S.V.Subatamanian, Dr.K.D. Thirunavukkarasu) (Published by:International Institute of Tamil Studies).
8. The Contributions of the Tamils to Indian Culture (Dr.M.Valarmathi) (Published by: InternationalInstitute of Tamil Studies.)
9. Keeladi - 'Sangam City C ivilization on the banks of river Vaigai' (Jointly Published by: Departmentof Archaeology & Tamil Nadu Text Book and Educational Services Corporation, Tamil Nadu)
10. Studies in the History of India with Special Reference to Tamil Nadu (Dr.K.K.Pillay) (Published by: The Author)
11. Porunai Civilization (Jointly Published by: Department of Archaeology & Tamil Nadu Text BookandEducational Services Corporation, Tamil Nadu)
12. Journey of Civilization Indus to Vaigai (R.Balakrishnan) (Published by: RMRL) – Reference Book.

24GE3151 HERITAGE OF TAMILS L T P C
1 0 0 1

UNIT I LANGUAGE AND LITERATURE 3

Language Families in India - Dravidian Languages – Tamil as a Classical Language - Classical Literature in Tamil – Secular Nature of Sangam Literature – Distributive Justice in Sangam Literature
- Management Principles in Thirukural - Tamil Epics and Impact of Buddhism & Jainism in Tamil Land - Bakthi Literature Azhwars and Nayanmars - Forms of minor Poetry - Development of Modern literature in Tamil - Contribution of Bharathiyar and Bharathidhasan.

UNIT II HERITAGE - ROCK ART PAINTINGS TO MODERN ART – SCULPTURE 3

Hero stone to modern sculpture - Bronze icons - Tribes and their handicrafts - Art of temple car making - - Massive Terracotta sculptures, Village deities, Thiruvalluvar Statue at Kanyakumari, Making of musical instruments - Mridhangam, Parai, Veenai, Yazh and Nadhaswaram - Role of Temples in Social and Economic Life of Tamils.

UNIT III FOLK AND MARTIAL ARTS 3

Therukoothu, Karagattam, Villu Pattu, Kaniyan Koothu, Oyillattam, Leatherpuppetry, Silambattam, Valari, Tiger dance - Sports and Games of Tamils.

UNIT IV THINAI CONCEPT OF TAMILS 3

Flora and Fauna of Tamils & Aham and Puram Concept from Tholkappiyam and Sangam Literature
- Aram Concept of Tamils - Education and Literacy during Sangam Age - Ancient Cities and Ports of Sangam Age - Export and Import during Sangam Age - Overseas Conquest of Cholas.

UNIT V CONTRIBUTION OF TAMILS TO INDIAN NATIONAL MOVEMENT AND INDIAN CULTURE 3

Contribution of Tamils to Indian Freedom Struggle - The Cultural Influence of Tamils over the otherparts of India – Self-Respect Movement - Role of Siddha Medicine in Indigenous Systems of Medicine – Inscriptions & Manuscripts – Print History of Tamil Books.

TOTAL : 15 PERIODS

TEXT-CUM-REFERENCE BOOKS

1. தமிழக வுமதலொறு – மக்களும பண்மதபொடுும – மக.மக. பிள்மள (தவளியீடு: தமிழ்மதநொடு மதபொடநூல் மற்றும ் கல்வியியல் பணிகள் கழகம ்).
2. கணினித் தமிழ் – முமனவு ் இல. சுந்தயம ். (விகடன் பிyசுyம ்).
3. கீழடி – மவமக நதிக்கமyயில் ம ங்கமதகொல நகyமதநொகy ிகம (தமததொல்லியல் Fமற தவளியீடு)
4. தமதபொருமந – ஆற்றங்கமyமதநொகy ிகம ். (தமததொல்லியல் Fமற தவளியீடு)
5. Social Life of Tamils (Dr.K.K.Pillay) A joint publication of TNTB & ESC and RMRL – (in print)
6. Social Life of the Tamils - The Classical Period (Dr.S.Singaravelu) (Published by: International Instituteof Tamil Studies.
7. Historical Heritage of the Tamils (Dr.S.V.Subatamanian, Dr.K.D. Thirunavukkarasu) (Published by:International Institute of Tamil Studies).
8. The Contributions of the Tamils to Indian Culture (Dr.M.Valarmathi) (Published by: InternationalInstitute of Tamil Studies)
9. Keeladi - 'Sangam City C ivilization on the banks of river Vaigai' (Jointly Published by: Department ofArchaeology & Tamil Nadu Text Book and Educational Services Corporation, Tamil Nadu)
10. Studies in the History of India with Special Reference to Tamil Nadu (Dr.K.K.Pillay) (Publishedby:The Author)
11. Porunai Civilization (Jointly Published by: Department of Archaeology & Tamil Nadu Text BookandEducational Services Corporation, Tamil Nadu)
12. Journey of Civilization Indus to Vaigai (R.Balakrishnan) (Published by: RMRL) – ReferenceBook.

24GE3171 PROBLEM SOLVING AND PYTHON PROGRAMMING LABORATORY L T P C
0 0 4 2

COURSE OBJECTIVES:

- To understand the problem solving approaches.
- To learn the basic programming constructs in Python.
- To practice various computing strategies for Python-based solutions to real world problems.
- To use Python data structures - lists, tuples, dictionaries.
- To do input/output with files in Python.

EXPERIMENTS:

Note: The examples suggested in each experiment are only indicative. The lab instructor is expected to design other problems on similar lines. The Examination shall not be restricted to the sample experiments listed here.

1. Identification and solving of simple real life or scientific or technical problems, and developing flow charts for the same. (Electricity Billing, Retail shop billing, Sin series, weight of a motorbike, Weight of a steel bar, compute Electrical Current in Three Phase AC Circuit, etc.)
2. Python programming using simple statements and expressions (exchange the values of two variables, circulate the values of n variables, distance between two points).
3. Scientific problems using Conditionals and Iterative loops. (Number series, Number Patterns, pyramid pattern)
4. Implementing real-time/technical applications using Lists, Tuples. (Items present in a library/Components of a car/ Materials required for construction of a building –operations of list & tuples)
5. Implementing real-time/technical applications using Sets, Dictionaries. (Language, components of an automobile, Elements of a civil structure, etc.- operations of Sets &Dictionaries)
6. Implementing programs using Functions. (Factorial, largest number in a list, area of shape)
7. Implementing programs using Strings. (reverse, palindrome, character count, replacing characters)
8. Implementing programs using written modules and Python Standard Libraries (pandas, numpy. Matplotlib, scipy)
9. Implementing real-time/technical applications using File handling. (copy from one file to another, word count, longest word)
10. Implementing real-time/technical applications using Exception handling. (divide by zero error, voter's age validity, student mark range validation)
11. Exploring Pygame tool.
12. Developing a game activity using Pygame like bouncing ball, car race etc.

TOTAL: 60 PERIODS

COURSE OUTCOMES:

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

CO1: Develop algorithmic solutions to simple computational problems
CO2: Develop and execute simple Python programs.
CO3: Implement programs in Python using conditionals and loops for solving problems..
CO4: Deploy functions to decompose a Python program.
CO5: Process compound data using Python data structures.
CO6: Utilize Python packages in developing software applications.

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.

REFERENCES:

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. https://www.python.org/
6. Martin C. Brown, "Python: The Complete Reference", 4th Edition, Mc-Graw Hill, 2018.

COs- PO's & PSO's MAPPING

CO's	PO's												PSO's		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
1	3	3	3	3	3	-	-	-	-	-	3	2	3	3	-
2	3	3	3	3	3	-	-	-	-	-	3	2	3	-	-
3	3	3	3	3	2	-	-	-	-	-	2	-	3	-	-
4	3	2	-	2	2	-	-	-	-	-	1	-	3	-	-
5	1	2	-	-	1	-	-	-	-	-	1	-	2	-	-
6	2	-	-	-	2	-	-	-	-	-	1	-	2	-	-
AVG	2	3	3	3	2	-	-	-	-	-	2	2	3	3	-

1 - low, 2 - medium, 3 - high, '-' - no correlation

BS3171 PHYSICS AND CHEMISTRY LABORATORY L T P C
0 0 4 2

PHYSICS LABORATORY : (Any Seven Experiments)

COURSE OBJECTIVES:

- To learn the proper use of various kinds of physics laboratory equipment.
- To learn how data can be collected, presented and interpreted in a clear and concise manner.
- To learn problem solving skills related to physics principles and interpretation of experimental data.
- To determine error in experimental measurements and techniques used to minimize sucherror.
- To make the student as an active participant in each part of all lab exercises.

1. Torsional pendulum - Determination of rigidity modulus of wire and moment of inertia of regular and irregular objects.
2. Simple harmonic oscillations of cantilever.
3. Non-uniform bending - Determination of Young's modulus
4. Uniform bending – Determination of Young's modulus
5. Laser- Determination of the wave length of the laser using grating
6. Air wedge - Determination of thickness of a thin sheet/wire
7. a) Optical fibre -Determination of Numerical Aperture and acceptance angle
8. b) Compact disc- Determination of width of the groove using laser.
9. Acoustic grating- Determination of velocity of ultrasonic waves in liquids.
10. Ultrasonic interferometer – determination of the velocity of sound and compressibility of liquids
11. Post office box -Determination of Band gap of a semiconductor.
12. Photoelectric effect
13. Michelson Interferometer.
14. Melde's string experiment
15. Experiment with lattice dynamics kit.

TOTAL: 30 PERIODS

COURSE OUTCOMES:

Upon completion of the course, the students should be able to

CO1 Understand the functioning of various physics laboratory equipment.
CO2 Use graphical models to analyze laboratory data.
CO3 Use mathematical models as a medium for quantitative reasoning and describing physical reality.
CO4 Access, process and analyze scientific information.
CO5 Solve problems individually and collaboratively.

CO's-PO's & PSO's MAPPING

CO's	PO's												PSO's		
	1		3	4	5	6	7	8	9	10	11	12	1	2	3
1	3		3	1	1	-	-	-	-	-	-	-	-	-	-
2	3		2	1	1	-	-	-	-	-	-	-	-	-	-
3	3	2	3	1	1	-	-	-	-	-	-	-	-	-	-
4	3		2	1	1	-	-	-	-	-	-	-	-	-	-
5	3		3	1	1	-	-	-	-	-	-	-	-	-	-
Avg.	3	2.4	2.6	1	1										

1-Low,2-Medium,3-High,"-"-no correlation

CHEMISTRY LABORATORY: (Any seven experiments to be conducted)

COURSE OBJECTIVES:

- To inculcate experimental skills to test basic understanding of water quality parameters, such as, acidity, alkalinity, hardness, DO, chloride and copper.
- To induce the students to familiarize with electroanalytical techniques such as, pH metry, potentiometry and conductometry in the determination of impurities in aqueous solutions.
- To demonstrate the analysis of metals and alloys.
- To demonstrate the synthesis of nanoparticles

1. Preparation of Na_2CO_3 as a primary standard and estimation of acidity of a water sample using the primary standard
2. Determination of types and amount of alkalinity in water sample.
   - Split the first experiment into two
3. Determination of total, temporary & permanent hardness of water by EDTA method.
4. Determination of DO content of water sample by Winkler's method.
5. Determination of chloride content of water sample by Argentometric method.
6. Estimation of copper content of the given solution by Iodometry.
7. Estimation of TDS of a water sample by gravimetry.
8. Determination of strength of given hydrochloric acid using pH meter.
9. Determination of strength of acids in a mixture of acids using conductivity meter.

10. Conductometric titration of barium chloride against sodium sulphate (precipitation titration)
11. Estimation of iron content of the given solution using potentiometer.
12. Estimation of sodium /potassium present in water using flame photometer.
13. Preparation of nanoparticles (TiO_2/ZnO/CuO) by Sol-Gel method.
14. Estimation of Nickel in steel
15. Proximate analysis of Coal

TOTAL : 30 PERIODS

COURSE OUTCOMES :

CO1 To analyse the quality of water samples with respect to their acidity, alkalinity, hardness and DO.
CO2 To determine the amount of metal ions through volumetric and spectroscopic techniques
CO3 To analyse and determine the composition of alloys.
CO4 To learn simple method of synthesis of nanoparticles
CO5 To quantitatively analyse the impurities in solution by electroanalytical techniques''

TEXT BOOKS:

1. J. Mendham, R. C. Denney, J.D. Barnes, M. Thomas and B. Sivasankar, Vogel's Textbook of Quantitative Chemical Analysis (2009).

COs- PO's & PSO's MAPPING

CO	PO												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
1	3	-	1	-	-	2	2	-	-	-	-	2	-	-	-
2	3	1	2	-	-	1	2	-	-	-	-	1	-	-	-
3	3	2	1	1	-	-	1	-	-	-	-	-	-	-	-
4	2	1	2	-	-	2	2	-	-	-	-	-	-	-	-
5	2	1	2	-	1	2	2	-	-	-	-	1	-	-	-
Avg.	**2.6**	**1.3**	**1.6**	**1**	**1**	**1.4**	**1.8**	**-**	**-**	**-**	**-**	**1.3**	**-**	**-**	**-**

- **1-low, 2-medium, 3-high, '-"- no correlation**

24GE3172 **ENGLISH LABORATORY** **L T P C**
0 0 2 1

COURSE OBJECTIVES :

- To improve the communicative competence of learners
- To help learners use language effectively in academic /work contexts
- To develop various listening strategies to comprehend various types of audio materials like lectures, discussions, videos etc.
- To build on students' English language skills by engaging them in listening, speaking and grammar learning activities that are relevant to authentic contexts.
- To use language efficiently in expressing their opinions via various media.

UNIT I INTRODUCTION TO FUNDAMENTALS OF COMMUNICATION 6

Listening for general information-specific details- conversation: Introduction to classmates - Audio / video (formal & informal); Telephone conversation; Listening to voicemail & messages; Listening and filling a form. Speaking - making telephone calls-Self Introduction; Introducing a friend; - politeness strategies- making polite requests, making polite offers, replying to polite requests and offers- understanding basic instructions(filling out a bank application for example).

UNIT II NARRATION AND SUMMATION 6

Listening - Listening to podcasts, anecdotes / stories / event narration; documentaries and interviews with celebrities. Speaking - Narrating personal experiences / events-Talking about current and temporary situations & permanent and regular situations* - describing experiences and feelings- engaging in small talk- describing requirements and abilities.

UNIT III DESCRIPTION OF A PROCESS PRODUCT 6

Listening - Listen to product and process descriptions; a classroom lecture; and advertisements about products. Speaking – Picture description- describing locations in workplaces- Giving instruction to use the product- explaining uses and purposes- Presenting a product- describing shapes and sizes and weights- talking about quantities (large & small)-talking about precautions.

UNIT IV CLASSIFICATION AND RECOMMENDATIONS 6

Listening – Listening to TED Talks; Listening to lectures - and educational videos. Speaking – Small Talk; discussing and making plans-talking about tasks-talking about progress- talking about positions and directions of movement-talking about travel preparations- talking about transportation

UNIT V EXPRESSION 6

Listening – Listening to debates/ discussions; different viewpoints on an issue; and panel discussions. Speaking – making predictions- talking about a given topic- giving opinions- understanding a website- describing processes

TOTAL : 30 PERIODS

LEARNING OUTCOMES:

At the end of the course, learners will be able

CO1 To listen to and comprehend general as well as complex academic information
CO2 To listen to and understand different points of view in a discussion
CO3 To speak fluently and accurately in formal and informal communicative contexts
CO4 To describe products and processes and explain their uses and purposes clearly and accurately
CO5 To express their opinions effectively in both formal and informal discussions

ASSESSMENT PATTERN

- One online / app based assessment to test listening /speaking
- End Semester **ONLY** listening and speaking will be conducted online.
- Proficiency certification is given on successful completion of listening and speaking internal test and end semester exam.

COs- PO's & PSO's MAPPING

CO	PO												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
1	3	3	3	3	1	3	3	3	3	3	3	3	-	-	-
2	3	3	3	3	1	3	3	3	3	3	3	3	-	-	-
3	3	3	3	3	1	3	3	3	3	3	3	3	-	-	-
4	3	3	3	3	1	3	3	3	3	3	3	3	-	-	-
5	3	3	3	3	1	3	3	3	3	3	3	3	-	-	-
Avg.	**3**	**3**	**3**	**3**	**1**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	-	-	-

- 1-low, 2-medium, 3-high, '-"- no correlation

Note: The average value of this course to be used for program articulation matrix

24TP3101 SKILL ENHANCEMENT-I L T P C

1 0 1 0

COURSE OBJECTIVE

- To enhance students' personal and professional development through self-discovery, grooming, effective communication, positive attitude building, and digital productivity. This course aims to foster confidence, creativity, professional etiquette, and essential workplace skills for academic and career success.

UNIT I SELF-DISCOVERY AND CREATIVITY 6

SWOT Analysis – Who am I – Attributes – Importance of self-confidence and self-esteem – Out-of-box thinking – Lateral thinking – Reflection and personality awareness activities.

UNIT II GROOMING AND ETIQUETTE 6

Dress Code and Presentation – Formal and casual wear for academic and professional settings – Grooming and personal hygiene – Social etiquette – Greetings and introductions – Dining etiquette – Classroom and campus etiquette – Digital etiquette (email and social media behavior).

UNIT III ATTITUDE AND SELF-RESPECT 6

Understanding attitude – Types and impact – Building a positive attitude – Overcoming negative thinking – Positive approach to challenges– Motivation (intrinsic and extrinsic) – Self talk – Techniques to stay motivated – Self-respect and self-esteem – Ego and self-confidence – Managing ego and building healthy confidence.

UNIT IV COMMUNICATION SKILLS 6

Interpersonal communication – Team communication – Assertion, persuasion, and negotiation – Effective verbal communication (tone, pitch, and clarity) – Non-verbal communication (facial expressions, gestures, posture) – Active listening – Providing feedback – Group discussion: importance, planning, skills assessed, disagreeing, summarizing, and attaining objectives.

UNIT V DIGITAL PRODUCTIVITY TOOLS 6

Introduction to G-Suite tools (Docs, Sheets, Slides) – Sharing rights, access control, and privacy settings – MS Word and PowerPoint essentials – Document formatting and presentation – Collaboration tools and best practices.

TOTAL: 30 PERIODS

COURSE OUTCOMES (COs)

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

CO1 Analyze personal strengths and areas of improvement through self-assessment and develop creative thinking skills.

CO2 Demonstrate appropriate grooming, social manners, and digital etiquette in academic and professional environments.

CO3 Cultivate a positive attitude, build self-confidence and self-respect, and manage ego for effective personal development

CO4 Communicate effectively using verbal, non-verbal, and written skills in interpersonal, team, and group settings.

CO5 Apply essential digital tools such as G-Suite, MS Word, and PowerPoint for academic and professional productivity

COs- PO's & PSO's MAPPING

CO	PO												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
1	2	-	-	-		-	-	-	2	1	-	3	-	-	-
2	-	-	-	-		2	-	2	2	2	-	3	-	-	-
3	-	-	-	-		-	-	2	2	2	-	3	-	-	-
4	-	-	-	-		-	-	-	3	3	1	2	-	-	-
5	2	-	-	-	3	-	-	-	-	2	1	3	-	-	-
AVG	**1**	-	-	-		-	-	**1**	**2**	**2**	-	**3**	-	-	-

24HS3252 **PROFESSIONAL ENGLISH II** **L T P C**

2 0 0 2

COURSE OBJECTIVES:

- To engage learners in meaningful language activities to improve their reading and writing skills
- To learn various reading strategies and apply in comprehending documents in professional context.
- To help learners understand the purpose, audience, contexts of different types of writing
- To develop analytical thinking skills for problem solving in communicative contexts
- To demonstrate an understanding of job applications and interviews for internship and placements.

UNIT I MAKING COMPARISONS 6

Reading - Reading advertisements, user manuals, brochures; Writing – Professional emails, Email etiquette - Compare and Contrast Essay; Grammar – Mixed Tenses, Prepositional phrases

UNIT II EXPRESSING CAUSAL RELATIONS IN SPEAKING AND WRITING 6

Reading - Reading longer technical texts– Cause and Effect Essays, and Letters / emails of complaint, Writing - Writing responses to complaints. Grammar - Active Passive Voice transformations, Infinitive and Gerunds

UNIT III PROBLEM SOLVING 6

Reading - Case Studies, excerpts from literary texts, news reports etc. Writing – Letter to the Editor, Checklists, Problem solution essay / Argumentative Essay. Grammar – Error correction; If conditional sentences

UNIT IV REPORTING OF EVENTS AND RESEARCH 6

Reading –Newspaper articles; Writing – Recommendations, Transcoding, Accident Report, Survey Report Grammar – Reported Speech, Modals Vocabulary – Conjunctions- use of prepositions

UNIT V THE ABILITY TO PUT IDEAS OR INFORMATION COGENTLY 6

Reading – Company profiles, Statement of Purpose, (SOP), an excerpt of interview with professionals; Writing – Job / Internship application – Cover letter & Resume; Grammar –Numerical adjectives, Relative Clauses.

TOTAL : 30 PERIODS

COURSE OUTCOMES:

At the end of the course, learners will be able

CO1 To compare and contrast products and ideas in technical texts.
CO2 To identify and report cause and effects in events, industrial processes through technical texts
CO3 To analyse problems in order to arrive at feasible solutions and communicate them in the written format.
CO4 To present their ideas and opinions in a planned and logical manner
CO5 To draft effective resumes in the context of job search.

TEXT BOOKS :

1. English for Engineers & Technologists (2020 edition) Orient Black swan Private Ltd. Department of English, Anna University.
2. English for Science & Technology Cambridge University Press 2021.
3. Authored by Dr. Veena Selvam, Dr. Sujatha Priyadarshini, Dr. Deepa Mary Francis, Dr. KN. Shoba and Dr. Lourdes Joevani, Department of English, Anna University.

REFERENCES:

1. Raman. Meenakshi, Sharma. Sangeeta (2019). Professional English. Oxford university press.New Delhi.
2. Improve Your Writing ed. V.N. Arora and Laxmi Chandra, Oxford Univ. Press, 2001, New Delhi.
3. Learning to Communicate – Dr. V. Chellammal. Allied Publishers, New Delhi, 2003
4. Business Correspondence and Report Writing by Prof. R.C. Sharma & Krishna Mohan, Tata McGrawHill & Co. Ltd., 2001, New Delhi.
5. Developing Communication Skills by Krishna Mohan, Meera Bannerji- Macmillan India Ltd.1990,Delhi.

ASSESSMENT PATTERN

Two internal assessments and an end semester examination to test students' reading and writingskills alongwith their grammatical and lexical competence.

COs- PO's & PSO's MAPPING

CO	PO												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
1	3	3	3	3	3	3	3	3	2	3	3	3	-	-	-
2	3	3	3	3	3	3	3	3	2	3	3	3	-	-	-
3	3	3	3	3	3	3	3	3	2	3	3	3	-	-	-
4	3	3	3	3	2	3	3	3	2	3	3	3	-	-	-
5	-	-	-	-	-	-	-	-	3	3	3	3	-	-	-
Avg.	3	3	3	3	2.75	3	3	3	2.2	3	3	3	-	-	-

- 1-low, 2-medium, 3-high, '-"- no correlation

24MA3251 STATISTICS AND NUMERICAL METHODS L T P C

3 1 0 4

COURSE OBJECTIVES:

- This course aims at providing the necessary basic concepts of a few statistical and numerical methods and give procedures for solving numerically different kinds of problems occurring in engineering and technology.
- To acquaint the knowledge of testing of hypothesis for small and large samples which plays an important role in real life problems.
- To introduce the basic concepts of solving algebraic and transcendental equations.
- To introduce the numerical techniques of interpolation in various intervals and numerical techniques of differentiation and integration which plays an important role in engineering and technology disciplines.
- To acquaint the knowledge of various techniques and methods of solving ordinary differential equations.

UNIT I TESTING OF HYPOTHESIS 9+3

Sampling distributions - Tests for single mean, proportion and difference of means (Large and small samples)
– Tests for single variance and equality of variances – Chi square test for goodness of fit
– Independence of attributes.

UNIT II DESIGN OF EXPERIMENTS 9+3

One way and two way classifications - Completely randomized design – Randomized block design
– Latin square design - 2^2 factorial design.

UNIT III SOLUTION OF EQUATIONS AND EIGENVALUE PROBLEMS 9+3

Solution of algebraic and transcendental equations - Fixed point iteration method – Newton Raphson method- Solution of linear system of equations - Gauss elimination method – Pivoting - Gauss Jordan method – Iterative methods of Gauss Jacobi and Gauss Seidel - Eigenvalues of a matrix by Power method and Jacobi's method for symmetric matrices.

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 derivates using interpolation polynomials – Numerical singleand 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'sand Adams - Bash forth predictor corrector methods for solving first order differential equations.

TOTAL: 60 PERIODS

COURSE OUTCOMES:

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

CO1 Apply the concept of testing of hypothesis for small and large samples in real life problems.

CO2 Apply the basic concepts of classifications of design of experiments in the field of agriculture.

CO3 Appreciate the numerical techniques of interpolation in various intervals and apply the numerical techniques of differentiation and integration for engineering problems.

CO4 Understand the knowledge of various techniques and methods for solving first and second order ordinary differential equations.

CO5 Solve the partial and ordinary differential equations with initial and boundary conditions by using certain techniques with engineering applications.

TEXT BOOKS:

1. Grewal, B.S., and Grewal, J.S., "Numerical Methods in Engineering and Science", Khanna Publishers, 10th Edition, New Delhi, 2015.
2. Johnson, R.A., Miller, I and Freund J., “Miller and Freund’s Probability and Statistics for Engineers",Pearson Education, Asia, 8th Edition, 2015.

REFERENCES:

1. Burden, R.L and Faires, J.D, "Numerical Analysis”, 9th Edition, Cengage Learning, 2016.
2. Devore. J.L., "Probability and Statistics for Engineering and the Sciences”, Cengage Learning, NewDelhi, 8th Edition, 2014.
3. Gerald. C.F. and Wheatley. P.O. "Applied Numerical Analysis” Pearson Education, Asia, New Delhi,7th Edition, 2007.
4. Gupta S.C. and Kapoor V. K., “Fundamentals of Mathematical Statistics”, Sultan Chand & Sons, NewDelhi, 12th Edition, 2020.
5. Spiegel. M.R., Schiller. J. and Srinivasan. R.A., "Schaum’s Outlines on Probability and Statistics", TataMcGraw Hill Edition, 4th Edition, 2012.
6. Walpole. R.E., Myers. R.H., Myers. S.L. and Ye. K., “Probability and Statistics for Engineers andScientists", 9th Edition, Pearson Education, Asia, 2010.

COs- PO’s & PSO’s MAPPING

	PO 01	PO 02	PO 03	PO 04	PO 05	PO 06	PO 07	PO 08	PO 09	PO 10	PO 11	PO 12	PS O1	PS O2	PS O3
CO1	3	3	1	1	1	0	0	0	2	0	2	3	-	-	-
CO2	3	3	1	1	1	0	0	0	2	0	2	3	-	-	-
CO3	3	3	1	1	1	0	0	0	2	0	2	3	-	-	-
CO4	3	3	1	1	1	0	0	0	2	0	2	3	-	-	-
CO5	3	3	1	1	1	0	0	0	2	0	2	3	-	-	-
Avg.	3	3	1	1	1	0	0	0	2	0	2	3	-	-	-

24PH3201 **PHYSICS FOR CIVIL ENGINEERING** **L T P C**

3 0 0 3

COURSE OBJECTIVES:

- To introduce the basics of heat transfer through different materials, thermal performance of building and various thermal applications
- To impart knowledge on the ventilation and air conditioning of buildings
- To introduce the concepts of sound insulation and lighting designs
- To give an introduction to the processing and applications of new engineering materials
- To create an awareness on natural disasters and safety measures

UNIT I THERMAL APPLICATIONS 9

Principles of heat transfer, steady state of heat flow, conduction through compound media-series and parallel-conductivity of rubber tube and powder materials - heat transfer through fenestrations, thermal insulation and its benefits - heat gain and heat loss estimation - factors affecting the thermal performance of buildings, thermal measurements, thermal comfort, indices of thermal comfort, climate and design of solar radiation, shading devices - central heating.

UNIT II VENTILATION AND REFRIGERATION 9

Requirements, principles of natural ventilation - ventilation measurements, design for natural ventilation - Window types and packaged air conditioners - chilled water plant - fan coil systems
- water piping - cooling load - Air conditioning systems for different types of buildings - Protection against fire to be caused by A.C Systems.

UNIT III ACOUSTICS AND LIGHTING DESIGNS 9

Methods of sound absorptions - absorbing materials - noise and its measurements, sound insulation and its measurements, impact of noise in multi stored buildings. Visual field glare, colour - day light calculations - day light design of windows, measurement of day-light and use of models and artificial skies, principles of artificial lighting, supplementary artificial lighting.

UNIT IV NEW ENGINEERING MATERIALS 9

Composites - Definition and Classification - Fibre reinforced plastics (FRP) and fiber reinforced metals (FRM) - Metallic glasses - Shape memory alloys - Ceramics - Classification - Crystalline - Non Crystalline - Bonded ceramics, Manufacturing methods - Slip casting - Isostatic pressing - Gas pressure bonding - Properties - thermal, mechanical, electrical and chemical ceramic fibres - ferroelectric and ferromagnetic ceramics - High Aluminum ceramics.

UNIT V NATURAL DISASTERS 9

Seismology and Seismic waves - Earth quake ground motion - Basic concepts and estimation techniques -site effects - Probabilistic and deterministic Seismic hazard analysis - Cyclone and flood hazards - Fire hazard sand fire protection, fire-proofing of materials, fire safety regulations and firefighting equipment - Prevention and safety measures.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

After completion of the course, the students should be able to

CO1 Acquire knowledge about heat transfer through different materials, thermal performance of building and thermal insulation.
CO2 Gain knowledge on the ventilation and air conditioning of buildings
CO3 Understand the concepts of sound absorption, noise insulation and lighting designs
CO4 Now about the processing and applications of composites, metallic glasses, shape memory alloys and ceramics
CO5 Get an awareness on natural disasters such as earth quake, cyclone, fire and safety measures

TEXT BOOKS:

1. Marko Pinteric, Building Physics, Springer 2017.
2. D.S.Mathur. Elements of Properties of Matter. S Chand & Company, 2010.
3. Hugo Hens, Building Physics: Heat, Air and Moisture, Wiley, 2017

REFERENCES:

1. W.R.Stevens. Building Physics: Lighting. Pergamon Press, 2013..
2. Hugo Hens, Applied Building Physics, Wiley, 2016
3. K.G.Budinski and M.K.Budinski. Engineering Materials: Properties and Selection. PearsonEducation, 2016.
4. Peter A. Claisse, Civil Engineering Materials, Elsevier, 2016.
5. Patrick L. Abbott, Natural Disasters, McGraw-Hill, 2017.

CO's-PO's & PSO's MAPPING

CO's	PO's												PSO's		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
1	3	2	2	-	1	1	-	-	-	-	-	-	-	-	-
2	3	2	2	-	1	1	-	-	-	-	-	-	-	-	-
3	3	2	2	-	1	1	-	-	-	-	-	-	-	-	-
4	3	-	2	2	2	1	-	-	-	-	-	-	-	-	-
5	3	1	-	-	1	3	-	-	-	-	-	-	-	-	-
Avg.	3	1.75	2	2	1.2	1.4	-	-	-	-	-	-	-	-	-

1- Low,2-Medium,3-High,"-"-no correlation

24BE3252 BASIC ELECTRICAL, ELECTRONICS AND INSTRUMENTATION ENGINEERING **L T P C 3 0 0 3**

UNIT I ELECTRICAL CIRCUITS **9**

DC Circuits: Circuit Components: Conductor, Resistor, Inductor, Capacitor – Ohm's Law - Kirchhoff'sLaws

– Simple problems- Nodal Analysis, Mesh analysis with Independent sources only (Steady state) Introduction to AC Circuits and Parameters: Waveforms, Average value, RMS Value, Instantaneous power, real power, reactive power and apparent power, power factor – Steady state analysis of RLCcircuits (Simple problems only), Three phase supply

– star and delta connection – power in three-phase systems

UNIT II MAGNETIC CIRCUITS AND ELECTRICAL INSTALLATIONS **9**

Magnetic circuits-definitions-MMF, flux, reluctance, magnetic field intensity, flux density, fringing, self and mutual inductances-simple problems.

Domestic wiring , types of wires and cables, earthing ,protective devices- switch fuse unit- Miniature circuit breaker- moulded case circuit breaker- earth leakage circuit breaker, safety precautions and First Aid

UNIT III ELECTRICAL MACHINES **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, Working principle and Applications of Transformer, Three phase Alternator, Synchronous motor and Three Phase Induction Motor.

UNIT IV ANALOG ELECTRONICS **9**

Resistor, Inductor and Capacitor in Electronic Circuits- Semiconductor Materials: Silicon &Germanium

– PN Junction Diodes, Zener Diode –Characteristics Applications – Bipolar Junction Transistor-Biasing, JFET, SCR, MOSFET, IGBT – Types, I-V Characteristics and Applications, Rectifier and Inverters, harmonics

UNIT V SENSORS AND TRANSDUCERS **9**

Sensors, solenoids, pneumatic controls with electrical actuator, mechatronics, types of valves and its applications, electro-pneumatic systems, proximity sensors, limit switches, piezoelectric, hall effect, photo sensors,Strain gauge, LVDT, differential pressure transducer,optical and digital transducers, Smart sensors, Thermal Imagers.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

After completing this course, the students will be able to

CO1: Compute the electric circuit parameters for simple problems
CO2: Explain the concepts of domestics wiring and protective devices
CO3: Explain the working principle and applications of electrical machines
CO4: Analyze the characteristics of analog electronic devices
CO5: Explain the types and operating principles of sensors and transducers

TEXT BOOKS:

1. D P Kothari and I.J Nagarath, "Basic Electrical and Electronics Engineering", McGraw HillEducation (India) Private Limited, Second Edition, 2020
2. A.K. Sawhney, Puneet Sawhney 'A Course in Electrical & Electronic Measurements &Instrumentation', Dhanpat Rai and Co, 2015.
3. S.K. Bhattacharya, Basic Electrical Engineering, Pearson Education, 2019
4. James A Svoboda, Richard C. Dorf, Dorf's Introduction to Electric Circuits, Wiley,2018

REFERENCES:

1. John Bird, "Electrical Circuit theory and technology", Routledge; 2017.
2. Thomas L. Floyd, 'Electronic Devices', 10th Edition, Pearson Education, 2018.
3. Albert Malvino, David Bates, '**Electronic Principles**, McGraw Hill Education; 7th edition, 2017
4. Muhammad H.Rashid, "Spice for Circuits and electronics", 4th Edition., Cengage India,2019.
5. H.S. Kalsi, 'Electronic Instrumentation', Tata McGraw-Hill, New Delhi, 2010

CO's, PO's & PSO's MAPPING

CO's	PO's												PSO's		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
1	2	1	1	-	-	-	-	1	-	-	-	-	-	-	-
2	2	1	1	-	-	-	-	1	-	-	-	-	-	-	-
3	2	1	1	-	-	-	-	1	-	-	-	-	-	-	-
4	2	1	1	-	-	-	-	1	-	-	-	-	-	-	-
5	2	1	1	-	-	-	-	1	-	-	-	-	-	-	-
Avg.	2	1	1	-	-	-	-	1	-	-	-	-	-	-	-

24GE3251 **ENGINEERING GRAPHICS** **L T P C**
2 0 4 4

COURSE OBJECTIVES:

The main learning objective of this course is to prepare the students for:

- Drawing engineering curves.
- Drawing freehand sketch of simple objects.
- Drawing orthographic projection of solids and section of solids.
- Drawing 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 **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.

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 and traces. Projection of planes (polygonal and circular surfaces) inclined to both the principal planes by rotating object method.

UNIT III PROJECTION OF SOLIDS AND FREEHAND SKETCHING **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. Visualization concepts and Free Hand sketching: Visualization principles —Representation of Three Dimensional objects — Layout of views- Freehand sketching of multiple views from pictorial views of objects.

Practicing three dimensional modeling of simple objects by CAD Software (Not for examination)

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.

Practicing three dimensional modeling of simple objects by CAD Software (Not for examination)

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.

Practicing three dimensional modeling of isometric projection of simple objects by CAD Software (Not for examination)

TOTAL: (L=30+P=60) 90 PERIODS

COURSE OUTCOMES:

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

CO1 Use BIS conventions and specifications for engineering drawing.
CO2 Construct the conic curves, involutes and cycloid.
CO3 Solve practical problems involving projection of lines.
CO4 Draw the orthographic, isometric and perspective projections of simple solids.
CO5 Draw the development of simple solids.

TEXT BOOKS:

1. Bhatt N.D. and Panchal V.M., "Engineering Drawing", Charotar Publishing House, 53 Edition, 2019.
2. Natrajan K.V., "A Text Book of Engineering Graphics", Dhanalakshmi Publishers, Chennai, 2018.
3. Parthasarathy, N. S. and Vela Murali, "Engineering Drawing", Oxford University Press, 2015

REFERENCES:

1. Basant Agarwal and Agarwal C.M., "Engineering Drawing", McGraw Hill, 2nd Edition, 2019.
2. Gopalakrishna K.R., "Engineering Drawing" (Vol. I&II combined), Subhas Publications, Bangalore, 27th Edition, 2017.
3. 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.
4. Parthasarathy N. S. and Vela Murali, "Engineering Graphics", Oxford University, Press, New Delhi, 2015.
5. Shah M.B., and Rana B.C., "Engineering Drawing", Pearson Education India, 2nd Edition, 2009.
6. Venugopal K. and Prabhu Raja V., "Engineering Graphics", New Age International (P) Limited,2008.

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.

Special points applicable to University Examinations on Engineering Graphics:

1. There will be five questions, each of either or type covering all units of the syllabus.
2. All questions will carry equal marks of 20 each making a total of 100.
3. The answer paper shall consist of drawing sheets of A3 size only. The students will be permitted to use appropriate scale to fit solution within A3 size.
4. The examination will be conducted in appropriate sessions on the same day

COs- PO's & PSO's MAPPING

CO	PO												PSO		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
1	3	1	2	-	2	-	-	-	-	3	-	2	2	2	-
2	3	1	2	-	2	-	-	-	-	3	-	2	2	2	-
3	3	1	2	-	2	-	-	-	-	3	-	2	2	2	-
4	3	1	2	-	2	-	-	-	-	3	-	2	2	2	-
5	3	1	2	-	2	-	-	-	-	3	-	2	2	2	-
AVG	**3**	**1**	**2**	-	**2**	-	-	-	-	**3**	-	**2**	**2**	**2**	-
Low (1) ; Medium (2) ; High (3)															

24**NX3251** **(ARMY WING) NCC Credit Course Level – I** **L T P C**

2 0 0 2

NCC GENERAL **6**

NCC 1 Aims, Objectives & Organization of NCC 1

NCC 2 Incentives 2

NCC 3 Duties of NCC Cadet 1

NCC 4 NCC Camps: Types & Conduct 2

NATIONAL INTEGRATION AND AWARENESS **4**

NI 1 National Integration: Importance & Necessity 1

NI 2 Factors Affecting National Integration 1

NI 3 Unity in Diversity & Role of NCC in Nation Building 1

NI 4 Threats to National Security 1

PERSONALITY DEVELOPMENT **7**

PD 1 Self-Awareness, Empathy, Critical & Creative Thinking, Decision Making and Problem Solving 2

PD 2 Communication Skills 3

PD 3 Group Discussion: Stress & Emotions 2

LEADERSHIP **5**

L 1 Leadership Capsule: Traits, Indicators, Motivation, Moral Values, Honour 'Code 3

L 2 Case Studies: Shivaji, Jhasi Ki Rani 2

SOCIAL SERVICE AND COMMUNITY DEVELOPMENT **8**

SS 1 Basics, Rural Development Programmes, NGOs, Contribution of Youth 3

SS 4 Protection of Children and Women Safety 1

SS 5 Road / Rail Travel Safety 1

SS 6 New Initiatives 2

SS 7 Cyber and Mobile Security Awareness 1

TOTAL : 30 PERIODS

NCC Credit Course Level 1*

24**NX3252** **(NAVAL WING) NCC Credit Course Level - I** **L T P C**

2 0 0 2

NCC GENERAL **6**

NCC 1 Aims, Objectives & Organization of NCC 1

NCC 2 Incentives 2

NCC 3 Duties of NCC Cadet 1

NCC 4 NCC Camps: Types & Conduct 2

NATIONAL INTEGRATION AND AWARENESS		**4**
NI 1	National Integration: Importance & Necessity	1
NI 2	Factors Affecting National Integration	1
NI 3	Unity in Diversity & Role of NCC in Nation Building	1
NI 4	Threats to National Security	1
PERSONALITY DEVELOPMENT		**7**
PD 1	Self-Awareness, Empathy, Critical & Creative Thinking, Decision Making and Problem	2
SOLVING		**3**
PD 2	Communication Skills	2
PD 3	Group Discussion: Stress & Emotions	**5**
		3
LEADERSHIP		2
L 1	Leadership Capsule: Traits, Indicators, Motivation, Moral Values, Honour Code	**8**
L 2	Case Studies: Shivaji, Jhasi Ki Rani	3
SOCIAL SERVICE AND COMMUNITY DEVELOPMENT		1
SS 1	Basics, Rural Development Programmes, NGOs, Contribution of Youth	1
SS 4	Protection of Children and Women Safety	2
SS 5	Road / Rail Travel Safety	1
SS 6	New Initiatives	
SS 7	Cyber and Mobile Security Awareness	

TOTAL : 30 PERIODS

NCC Credit Course Level 1*

24**NX3253**	**(AIR FORCE WING) NCC Credit Course Level - I**	**L T P C**
		2 0 0 2

NCC GENERAL		**6**
NCC 1	Aims, Objectives & Organization of NCC	1
NCC 2	Incentives	2
NCC 3	Duties of NCC Cadet	1
NCC 4	NCC Camps: Types & Conduct	2
NATIONAL INTEGRATION AND AWARENESS		**4**
NI 1	National Integration: Importance & Necessity	1
NI 2	Factors Affecting National Integration	1
NI 3	Unity in Diversity & Role of NCC in Nation Building	1
NI 4	Threats to National Security	1
PERSONALITY DEVELOPMENT		**7**
Self-Awareness, Empathy, Critical & Creative Thinking, Decision Making and Problem Solving		2
PD 2	Communication Skills	3
PD 3	Group Discussion: Stress & Emotions	2
LEADERSHIP		**5**
L 1	Leadership Capsule: Traits, Indicators, Motivation, Moral Values, Honour Code	3
L 2	Case Studies: Shivaji, Jhasi Ki Rani	2
SOCIAL SERVICE AND COMMUNITY DEVELOPMENT		**8**
SS 1	Basics, Rural Development Programmes, NGOs, Contribution of Youth	3
SS 4	Protection of Children and Women Safety	1
SS 5	Road / Rail Travel Safety	1
SS 6	New Initiatives	2
SS 7	Cyber and Mobile Security Awareness	1

TOTAL : 30 PERIODS

24GE32 தமிழரும் தமதொழில் நுட்பமும் **L T P C**
1 0 0 1

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 வீட்டுப் பொருட்களில் வடிவமைப்பு– சங்க காலத்தில் கட்டுமான பொருட்களும் நடுகல்லும் – சிலப்பதிகாரத்தில் மேடை அமைப்பு பற்றிய விவரங்கள் – மாமல்லபுரச் சிற்பங்களும், கோவில்களும் – சோழர் காலத்துப் பெருங்கோயில்கள் மற்றும் பிற வழிபாட்டுத் தலங்கள் – நாயக்கர் காலக் கோயில்கள் – மாதிரி கட்டமைப்புகள் பற்றி அறிதல், மதுரை மீனாட்சி அம்மன் ஆலயம் மற்றும் திருமலை நாயக்கர் மஹால் – செட்டிநாட்டு வீடுகள் – பிரிட்டிஷ் காலத்தில் சென்னையில் இந்தோ–சாரோசெனிக் கட்டிடக் கலை.

அலகு III உற்பத்தித் தொழில் நுட்பம்: **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 – எலும்புத்துண்டுகள் – தொல்லியல் சான்றுகள் – சிலப்பதிகாரத்தில் மணிகளின் வகைகள்.

அலகு IV வேளாண்மை மற்றும் நீர்ப்பாசனத் தொழில் நுட்பம்: **3**
அணை, ஏரி, குளங்கள், மதகு – சோழர்காலக் குமுழித் தூம்பின் முக்கியத்துவம் – கால்நடை பராமரிப்பு – கால்நடைகளுக்காக வடிவமைக்கப்பட்ட கிணறுகள் – வேளாண்மை மற்றும் வேளாண்மைச் சார்ந்த செயல்பாடுகள் – கடல்சார் அறிவு – மீன்வளம் – முத்து மற்றும் முத்துக்குளித்தல் – பெருங்கடல் குறித்த பண்டைய அறிவு – அறிவுசார் 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.

தமிழக வரலாறு – மக்களும் பண்பாடும் – கே.கே. பிள்ளை (வெளியீடு: தமிழ்நாடு பாடநூல் மற்றும் கல்வியியல் பணிகள் கழகம்).
கணினித் தமிழ் – முனைவர் இல. சுந்தரம். (விகடன் பிரசுரம்).
கீழடி – வைகை நதிக்கரையில் சங்ககால நகர நாகரிகம் (தொல்லியல் துறை வெளியீடு)
பொருநை – ஆற்றங்கரை நாகரிகம். (தொல்லியல் துறை வெளியீடு)

TOTAL : 15 PERIODS

TEXT-CUM-REFERENCE

1. தமிழக வரலாறு – மக்களும் பண்பாடும் – கே.கே. பிள்ளை (வெளியீடு: தமிழ்நாடு பாடநூல் மற்றும் கல்வியியல் பணிகள் கழகம்).
2. கணினித் தமிழ் – முனைவர் இல. சுந்தரம். (விகடன் பிரசுரம்).
3. கீழடி – வைகை நதிக்கரையில் சங்ககால நகர நாகரிகம் (தொல்லியல் துறை வெளியீடு)
4. தமிழ்ப்பொருநை – ஆற்றங்கரை நாகரிகம். (தொல்லியல் துறை வெளியீடு)
5. Social Life of Tamils (Dr.K.K.Pillay) A joint publication of TNTB & ESC and RMRL – (in print)
6. Social Life of Tamils (Dr.K.K.Pillay) A joint publication of TNTB & ESC and RMRL – (in print)
7. Social Life of the Tamils - The Classical Period (Dr.S.Singaravelu) (Published by: International Instituteof Tamil Studies.
8. Historical Heritage of the Tamils (Dr.S.V.Subatamanian, Dr.K.D. Thirunavukkarasu) (Published by: International Institute of Tamil Studies).
9. The Contributions of the Tamils to Indian Culture (Dr.M.Valarmathi) (Published by: International Instituteof Tamil Studies.)
10. Keeladi - 'Sangam City C ivilization on the banks of river Vaigai' (Jointly Published by: Department of Archaeology & Tamil Nadu Text Book and Educational Services Corporation, Tamil Nadu)
11. Studies in the History of India with Special Reference to Tamil Nadu (Dr.K.K.Pillay) (Published by: TheAuthor)
12. Porunai Civilization (Jointly Published by: Department of Archaeology & Tamil Nadu

24GE3252	TAMILS AND TECHNOLOGY	L T P C
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UNIT I WEAVING AND CERAMIC TECHNOLOGY 3

Weaving Industry during Sangam Age – Ceramic technology – Black and Red Ware Potteries (BRW) – Graffiti on Potteries.

UNIT II DESIGN AND CONSTRUCTION TECHNOLOGY 3

Designing and Structural construction House & Designs in household materials during Sangam Age - Building materials and Hero stones of Sangam age – Details of Stage Constructions in Silappathikaram - Sculptures and Temples of Mamallapuram - Great Temples of Cholas and other worship places - Temples of Nayaka Period - Type study (Madurai Meenakshi Temple)- ThirumalaiNayakar Mahal - Chetti Nadu Houses,Indo - Saracenic architecture at Madras during British Period.

UNIT III MANUFACTURING TECHNOLOGY 3

Art of Ship Building - Metallurgical studies - Iron industry - Iron smelting,steel -Copper and gold-Coins as source of history - Minting of Coins – Beads making-industries Stone beads -Glass beads - Terracotta beads -Shell beads/ bone beats - Archeological evidences - Gem stone types described in Silappathikaram.

UNIT IV AGRICULTURE AND IRRIGATION TECHNOLOGY 3

Dam, Tank, ponds, Sluice, Significance of Kumizhi Thoompu of Chola Period, Animal Husbandry - Wells designed for cattle use - Agriculture and Agro Processing - Knowledge of Sea - Fisheries – Pearl - Conche diving - Ancient Knowledge of Ocean - Knowledge Specific Society.

UNIT V SCIENTIFIC TAMIL & TAMIL COMPUTING 3

Development of Scientific Tamil - Tamil computing – Digitalization of Tamil Books – Development of Tamil Software – Tamil Virtual Academy – Tamil Digital Library – Online Tamil Dictionaries – Sorkuvai Project.

TOTAL: 15 PERIODS

TEXT-CUM-REFERENCE BOOKS

1. தமிழக வரலாறு – மக்களும் பண்பாடும் – கே.கே. பிள்ளை (வெளியீடு: தமிழ்நாடு பாடநூல் மற்றும் கல்வியியல் பணிகள் கழகம்).
2.
3. கணினித் தமிழ் – முனைவர் இல. சுந்தரம். (விகடன் பிரசுரம்).
4. கீழடி – வைகை நதிக்கரையில் சங்ககால நகர நாகரிகம் (தொல்லியல் துறை வெளியீடு)
5. பொருநை – ஆற்றங்கரை நாகரிகம். (தொல்லியல் துறை வெளியீடு)
6. Social Life of Tamils (Dr.K.K.Pillay) A joint publication of TNTB & ESC and RMRL – (in print)
7. Social Life of the Tamils - The Classical Period (Dr.S.Singaravelu) (Published by: International Instituteof Tamil Studies.
8. Historical Heritage of the Tamils (Dr.S.V.Subatamanian, Dr.K.D. Thirunavukkarasu) (Published by:International Institute of Tamil Studies).
9. The Contributions of the Tamils to Indian Culture (Dr.M.Valarmathi) (Published by: International Institute of Tamil Studies.)
10. Keeladi - 'Sangam City C ivilization on the banks of river Vaigai' (Jointly Published by: Department ofArchaeology & Tamil Nadu Text Book and Educational Services Corporation, Tamil Nadu)
11. Studies in the History of India with Special Reference to Tamil Nadu (Dr.K.K.Pillay) (Published by:The Author)
12. Porunai Civilization (Jointly Published by: Department of Archaeology & Tamil Nadu Text BookandEducational Services Corporation, Tamil Nadu)
13. Journey of Civilization Indus to Vaigai (R.Balakrishnan) (Published by: RMRL) – Reference Book.

24GE3271 **ENGINEERING PRACTICES LABORATORY** **L T PC**
0 0 4 2

COURSE OBJECTIVES:

The main learning objective of this course is to provide hands on training to the students in:

- Drawing pipe line plan; laying and connecting various pipe fittings used in common household plumbing work; Sawing; planning; making joints in wood materials used in common household wood work.
- Wiring various electrical joints in common household electrical wire work.
- Welding various joints in steel plates using arc welding work; Machining various simple processes like turning, drilling, tapping in parts; Assembling simple mechanical assembly of common household equipments; Making a tray out of metal sheet using sheet metal work.
- Soldering and testing simple electronic circuits; Assembling and testing simple electronic components on PCB.

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
d) Laying pipe connection to the delivery side of a pump.
e) Connecting pipes of different materials: Metal, plastic and flexible pipes used in house hold appliances.

WOOD WORK:

a) Sawing,
b) Planning and
c) Making joints like T-Joint, Mortise joint and Tenon joint and Dovetail joint.

Wood Work Study:

a) Studying joints in door panels and wooden furniture
b) Studying 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 socket
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 usingDiac/Triac/quadrac)Study of emergency lamp wiring/Water heater

GROUP – B (MECHANICAL AND 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) (simple)Turning.
b) (simple)Drilling.
c) (simple)Tapping.

ASSEMBLY WORK:

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

SHEET METAL WORK:

a) Making of a square tray

FOUNDRY WORK:

a) Demonstrating basic foundry operations.

PART IV ELECTRONIC ENGINEERING PRACTICES 15

SOLDERING WORK:

a) Soldering simple electronic circuits and checking continuity.

ELECTRONIC ASSEMBLY AND TESTING WORK:

a) Assembling and testing electronic components on a small PCB.

ELECTRONIC EQUIPMENT STUDY:

a) Study an elements of smart phone..
b) Assembly and dismantle of LED TV.
c) Assembly and dismantle of computer/ laptop **TOTAL : 60 PERIODS**

COURSE OUTCOMES:

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

CO1 Draw pipe line plan; lay and connect various pipe fittings used in common household plumbing work; Saw; plan; make joints in wood materials used in common household woodwork.

CO2 Wire various electrical joints in common household electrical wire work.

CO3 Weld various joints in steel plates using arc welding work; Machine various simple processes like turning, drilling, tapping in parts; Assemble simple mechanical assembly of common household equipments; Make a tray out of metal sheet using sheet metal work.

CO4 Solder and test simple electronic circuits; Assemble and test simple electronic components on PCB.

COs- PO's & PSO's MAPPING

CO	PO												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
1	3	2			1	1	1					2	2	1	1
2	3	2			1	1	1					2	2	1	1
3	3	2			1	1	1					2	2	1	1
Avg	**3**	**2**			**1**	**1**	**1**					**2**	**2**	**1**	**1**
Low (1) ; Medium (2) ; High (3)															

24BE3272 BASIC ELECTRICAL, ELECTRONICS AND INSTRUMENTATION ENGINEERING LABORATORY **L T P C 0 0 4 2**

COURSE OBJECTIVES:

- To train the students in conducting load tests electrical machines
- To gain practical experience in experimentally obtaining the characteristics of electronic devices and rectifiers
- To train the students to measure three phase power and displacement

List of Experiments

1. Verification of ohms and Kirchhoff's Laws.
2. Three Phase Power Measurement
3. Load test on DC Shunt Motor.
4. Load test on Self Excited DC Generator
5. Load test on Single phase Transformer
6. Load Test on Induction Motor
7. Characteristics of PN and Zener Diodes
8. Characteristics of BJT, SCR and MOSFET
9. Design and analysis of Half wave and Full Wave rectifiers
10. Measurement of displacement of LVDT

TOTAL: 60 PERIODS

COURSE OUTCOMES:

After completing this course, the students will be able to

CO1: Use experimental methods to verify the Ohm's law and Kirchhoff's Law and to measure three phasepower

CO2: Analyze experimentally the load characteristics of electrical machines

CO3: Analyze the characteristics of basic electronic devices

CO4: Use LVDT to measure displacement

CO's, PO's & PSO's MAPPING

CO's	PO's												PSO's		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
1	2	3	1	2				1.5	2				-	-	-
2	2	3	1	2				1.5	2				-	-	-
3	2	3	1	2				1.5	2				-	-	-
4	2	3	1	2				1.5	2				-	-	-
Avg.	1.6	1.4	0.8	1.6				1.2	1.6						

24GE3272 **COMMUNICATION LABORATORY** **L T P C**

0 0 4 2

COURSE OBJECTIVES

- To identify varied group discussion skills and apply them to take part in effective discussions inaprofessional context.
- To analyse concepts and problems and make effective presentations explaining them clearlyandprecisely.
- To be able to communicate effectively through formal and informal writing.
- To be able to use appropriate language structures to write emails, reports and essays
- To give instructions and recommendations that are clear and relevant to the context

UNIT I **12**

Speaking-Role Play Exercises Based on Workplace Contexts, - talking about competition- discussing progress toward goals-talking about experiences- talking about events in life- discussing past events-Writing: writing emails (formal & semi-formal).

UNIT II **12**

Speaking: discussing news stories-talking about frequency-talking about travel problems- discussing travel procedures- talking about travel problems- making arrangements-describing arrangements- discussing plans and decisions- discussing purposes and reasons- understanding common technology terms-Writing: - writing different types of emails.

UNIT III **12**

Speaking: discussing predictions-describing the climate-discussing forecasts and scenarios- talking about purchasing-discussing advantages and disadvantages- making comparisons- discussing likes and dislikes- discussing feelings about experiences-discussing imaginary scenarios Writing: short essays and reports- formal/semi-formal letters.

UNIT IV **12**

Speaking: discussing the natural environment-describing systems-describing position and movement- explaining rules-(example- discussing rental arrangements)- understanding technical instructions-Writing: writing instructions-writing a short article.

UNIT V **12**

Speaking: describing things relatively-describing clothing-discussing safety issues (making recommendations) talking about electrical devices-describing controlling actions- Writing: job application (Cover letter + Curriculum vitae)-writing recommendations.

TOTAL: 60 PERIODS

LEARNING OUTCOMES

At the end of the course, learners will be able

CO1 Speak effectively in group discussions held in ~~a~~ formal/semi formal contexts.
CO2 Discuss, analyse and present concepts and problems from various perspectives to arrive at suitable solutions.
CO3 Write emails, letters and effective job applications.
CO4 Write critical reports to convey data and information with clarity and precision
CO5 Give appropriate instructions and recommendations for safe execution of tasks

Assessment Pattern

- One online / app based assessment to test speaking and writing skills
- Proficiency certification is given on successful completion of speaking and writing.

COs- PO's & PSO's MAPPING

CO	PO												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
1	2	3	3	3	1	3	3	3	3	3	3	3	-	-	-
2	2	3	3	3	1	3	3	3	3	3	3	3	-	-	-
3	2	2	3	3	1	3	3	3	3	3	3	3	-	-	-
4	3	3	3	3	3	3	3	3	3	3	3	3	-	-	-
5	3	3	3	3	3	3	3	3	3	3	3	3	-	-	-
Avg.	2.4	2.8	3	3	1.8	3	3	3	3	3	3	3	-	-	-

1-low, 2-medium, 3-high, '-"- no correlation

24TP3201 **SKILL ENHANCEMENT-II** **L T P C**

1 0 1 0

COURSE OBJECTIVES

To develop leadership, decision-making, emotional resilience, and digital career readiness among students. The course aims to empower learners with interpersonal, analytical, and professional communication skills while enhancing their ability to adapt to modern workplace expectations and digital platforms.

UNITI **LEADERSHIP AND INTERPERSONAL SKILLS** **6**

Leadership qualities – Types and styles of leadership – Techniques for self-discipline and self-regulation – Developing leadership through practice – Understanding the relationship between leadership networking, and teamwork – Building interpersonal relationships – Strategies for effective teamwork, overcoming challenges in team settings.

UNIT II PROBLEM AND STRESS MANAGEMENT 6

Types and models of problem solving skills – Steps in effective problem solving – Applying problem solving techniques – Causes of stress and its impact–How to manage stress–Stress busters – Emotional intelligence – Emotional quotient and why emotional intelligence matters– Managing emotions.

UNIT III DECISION MAKING AND TIME MANAGEMENT 6

Decision making process – Types and models of decision making – Individual vs. group decision making – Ethical decision making – Common decision making challenges – Problems and dilemmas in applying decision making skills –Techniques of time management – Value of time –Diagnosing time use – Prioritizing work – Extempore and planning exercises

UNIT IV CAREER SKILLS AND DIGITAL ENGAGEMENT 6

Basics of email writing and formats – Types of business emails (application, follow-up, inquiry, thank-you) – Professional email writing for internship/job communication – Exploring virtual internship platforms (Internshala, AICTE Portal) – Digital resume building using Canva, Resume.io, Zety – Understanding ATS- friendly formats and professional structuring – Awareness of digital hiring processes (assessments, coding rounds, AI-based screening)

UNIT V–PROFESSIONAL DIGITAL PRESENCE 6

LinkedIn profile optimization and networking strategies – Introduction to Hacker Rank and Hacker Earth platforms – Overview of industry-recognized certifications and their importance – Basics of portfolio presentation

COURSE OUTCOMES(COs)

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

CO1: Demonstrate leadership qualities, interpersonal skills, and teamwork strategies for personal and professional growth.

CO2: Apply problem-solving models, manage stress effectively, and understand the role of emotional intelligence in decision-making.

CO3: Make informed decisions in academic and workplace scenarios while managing time efficiently through practical planning techniques.

CO4: Write professional business emails and develop digital career tools like resumes and internship applications aligned with industry practices.

CO5: Build a professional online presence through platforms like LinkedIn, Hacker Rank, and portfolio websites to enhance employability.

COs- PO's & PSO's MAPPING

CO	PO												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
1	-	-	-	-	-	-	-	-	3	2	2	2	-	-	-
2	-	3	-	-	-	-	-	2	2	2	-	2	-	-	-
3	-	2	-	-	-	-	-	2	2	2	2	3	-	-	-
4	-	-	-	-	3	-	-	-	2	3	2	3	-	-	-
5	-	-	-	-	3	-	-	-	-	2	1	3	-	-	-
Avg.	-	1	-	-	**1**	-	-	**1**	**2**	**2**	**1**	**3**	-	-	-

24MA3351 TRANSFORMS AND PARTIAL DIFFERENTIAL EQUATIONS L T P C
3 1 0 4

COURSE OBJECTIVES:

- To acquaint the student with Fourier transform techniques used in wide variety of situations.
- To introduce the effective mathematical tools for the solutions of partial differential equations that model several physical processes and to develop Z transform techniques for discrete time systems.
- To introduce the basic concepts of PDE for solving standard partial differential equations.
- To introduce Fourier series analysis which is central to many applications in engineering apart from its use in solving boundary value problems.
- To acquaint the student with Fourier series techniques in solving heat flow problems used in various situations.

UNIT I PARTIAL DIFFERENTIAL EQUATIONS 12

Formation of partial differential equations –Solutions of standard types of first order partial differential equations - Lagrange's linear equation - Homogeneous Linear partial differential equations of second and higher order with constant coefficients

UNIT II FOURIER SERIES 12

Dirichlet's conditions – General Fourier series – Odd and even functions – Half range sine series and cosine series – Root mean square value – Parseval's identity – Harmonic analysis.

UNIT III APPLICATIONS OF PARTIAL DIFFERENTIAL EQUATIONS 12

Classification of PDE – Method of separation of variables - Fourier series solutions of one dimensional wave equation – One dimensional equation of heat conduction (Excluding insulated ends) – Steady state solution of two-dimensional equation of heat conduction (Cartesian coordinates only) (Excluding insulated edges)

UNIT IV FOURIER TRANSFORMS 12

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

UNIT V LAPLACE TRANSFORMS 12

Existence conditions- Transforms of elementary functions–Basic properties- Shifting theorems– Initial and final value theorems- Inverse transforms – Convolution theorem – Transform of periodic functions – Application to solution of linear second order differential equations with constant coefficients.

COURSE OUTCOMES:

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

CO1 Understand the mathematical principles on transforms and partial differential equations would provide them the ability to formulate and solve some of the physical problems of engineering.
CO2 Use the effective mathematical tools for the solutions of partial differential equations by using Z transform techniques for discrete time systems.
CO3 Understand how to solve the given standard partial differential equations.
CO4 Solve differential equations using Fourier series analysis which plays a vital role in engineering applications.
CO5 Appreciate the physical significance of Fourier series techniques in solving one and two dimensional heat flow problems and one dimensional wave equations.

TEXTBOOKS

1. Grewal B.S., "Higher Engineering Mathematics", 43rd Edition, Khanna Publishers, New Delhi, 2014.
2. Narayanan S., ManicavachagomPillay.T.K and Ramanaiah.G "Advanced Mathematics for Engineering Students", Vol. II & III, S.Viswanathan Publishers Pvt. Ltd, Chennai, 1998.

REFERENCES

1. B.V Ramana, "Higher Engineering Mathematics", McGraw Hill Education Pvt. Ltd, New Delhi, 2016.
2. Erwin Kreyszig, "Advanced Engineering Mathematics ", 10th Edition, John Wiley, India, 2016.
3. G. James, "Advanced Modern Engineering Mathematics", 3rd Edition, Pearson Education, 2007.
4. L.C Andrews, L.C and Shivamoggi, B, "Integral Transforms for Engineers" SPIE Press, 1999.
5. N.P. Bali. and Manish Goyal, "A Textbook of Engineering Mathematics", 9th Edition, Laxmi Publications Pvt. Ltd, 2014.

COs- PO's & PSO's MAPPING

CO	PO												PSO		
CO1	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
	3	2	1	-	-	-	-	-	-	-	-	-	1	-	-
CO2	3	3	3	3	2	-	-	-	-	-	-	-	2	1	-
CO3	3	3	1	-	-	-	-	-	-	-	-	-	3	1	-
CO4	3	3	3	3	1	-	-	-	-	-	-	-	2	1	-
CO5	3	3	3	1	1	-	-	-	-	-	-	-	2	-	-
Avg.	3	3	2	1	1	-	-	-	-	-	-	-	2	1	-

24CE3301 STRENGTH OF MATERIALS I L T P C
3 0 2 4

COURSE OBJECTIVES:

- Understand the fundamental concepts of stress and strain in mechanics of solids and composite Bar
- Determine Shear force and bending moment in beams and understand concept of theory of simple bending.
- Determine slope and deflection of determinate beams using different methods.
- Apply theory of torsion in design of circular shafts and helical springs
- Analyze the pin jointed plane trusses by using various methods and understand the concept of principal stresses and planes

UNIT I STATICS OF PARTICLES, STRESS, STRAIN AND DEFORMATION OF SOLIDS 9

Laws of Mechanics - Lame's theorem, Parallelogram and triangular law of forces - Coplanar forces - Resolution and composition of forces-Simple Stresses and strains – Elastic constants - Relationship among elastic constants – Ultimate Stress – Yield Stress – Factor of Safety- Deformation of axially loaded member - Composite Bars - Thermal Stresses – stresses on inclined planes

UNIT II SHEAR AND BENDING IN BEAMS 9

Beams and Bending - Types of loads, supports, beams – concept of shearing force and bending moment - Relationship between intensity of load, Shear Force and Bending moment - Shear Force and Bending Moment Diagrams for Cantilever, simply supported and overhanging beams with concentrated load, uniformly distributed load, uniformly varying load and concentrated moment. Theory of Simple Bending – Stress Distribution due to bending moment and shearing force - Flitched Beams.

UNIT III DEFLECTION OF BEAMS 9

Elastic curve – Double integration method - Macaulay's method – Area moment method - conjugate beam method for computation of slope and deflection of determinant beams.

UNIT IV SPRING AND TORSION 9

Closed and Open Coiled helical springs – Leaf spring - springs in series and parallel – Elastic Theory of Torsion – Stresses and Deformations in Solid and Hollow Circular Shafts – combined bending moment and torsion of shafts - Power transmitted to shaft – Shaft in series and parallel.

UNIT V ANALYSIS OF TRUSSES 9

Determinate and indeterminate trusses - Analysis of pin jointed plane determinate trusses by method of joints, method of sections. method of tension coefficient - Application to space trusses.

List of Experiments:

1. Compression test on wood
2. Impact test on metal specimen (Izod and charpy)
3. Hardness test on metals (Rockwell and Brinell Hardness Tests)
4. Double shear test on metal
5. Deflection test on Mild Steel / Aluminium Beam
6. Torsion test on mild steel rod
7. Compression test on helical spring
8. Tension test on mild steel rod

OUTCOMES:

Students will be able to

- Understand and apply the concept of stress and strain to solve structural mechanics problem also transformation of stress
- Practice shear force and bending moment computations and construct shear force and bending moment diagrams
- Calculate the deflection of beams by different methods and selection of method for determining slope or deflection
- Apply basic equation of torsion in design of circular shafts and helical springs
- Analyze the pin jointed plane trusses

TEXTBOOKS:

1. Rajput.R.K. “Strength of Materials”, S.Chand and Co, New Delhi, 2015.
2. Bansal. R.K. “Strength of Materials”, Laxmi Publications Pvt. Ltd., New Delhi, 2010

REFERENCES :

1. Timoshenko.S.B. and Gere.J.M, “Mechanics of Materials”, Van Nos Reinbhold, New Delhi 1999.
2. Vazirani.V.N and Ratwani.M.M, “Analysis of Structures”, Vol I Khanna Publishers, NewDelhi,1995.
3. Junnarkar.S.B. and Shah.H.J, “Mechanics of Structures”, Vol I, Charotar Publishing House, New Delhi 2016.
4. Singh. D.K., “ Strength of Materials”, Ane Books Pvt. Ltd., New Delhi, 2016
5. Basavarajaiah, B.S. and Mahadevappa, P., Strength of Materials, Universities Press, Hyderabad,2010.
6. Gambhir. M.L., "Fundamentals of Solid Mechanics", PHI Learning Private Limited., NewDelhi,2009.
7. Punmia.B.C., Ashok Kumar Jain and Arun Kumar Jain, SMTS –I Strength of materials, Laxmi publications. New Delhi, 2015
8. Rattan . S. S, “Strength of Materials”, Tata McGraw Hill Education Private imited, NewDelhi, 2012

COs- PO’s & PSO’s MAPPING

CO	PO												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
1	3	3	2	3	1	2	2	3	3	2	1	2	3	3	3
2	3	3	3	3	2	3	2	3	3	2	1	2	3	3	3
3	3	3	3	3	2	3	2	3	3	2	1	2	3	3	3
4	3	3	3	3	2	2	2	3	3	2	1	2	3	3	3
5	3	3	3	3	2	3	2	2	2	2	1	2	3	3	3
Avg.	**3**	**3**	**3**	**3**	**2**	**3**	**2**	**3**	**3**	**2**	**1**	**2**	**3**	**3**	**3**

24CE3302	CONSTRUCTION MATERIALS AND PRACTICES	L T P C
		3 0 2 4

COURSE OBJECTIVES:

This course provides a foundational understanding of building materials and construction practices. It covers the properties, selection, testing, and applications of materials like stone, brick, cement, timber, steel, and composites. Students also learn key construction techniques and service requirements for effective building execution.

UNIT I STONES AND BRICKS 9

Stone as building material - Criteria for selection - Tests on stones - Bricks - Classification - Manufacturing of clay bricks - Tests on bricks - Compressive strength - Water Absorption - Efflorescence - Bricks for special application.

UNIT II LIME, CEMENT AND CONCRETE 9

Lime - Uses - Preparation of lime mortar - Cement - Ingredients - Mechanism of hydration - Cement mortar - Test on cement - Aggregates - Fine and coarse aggregates - Test on aggregates - Ingredients for concrete - Water cement ratio - Concrete blocks - Paver blocks - Hollow blocks - Lightweight concrete blocks.

UNIT III SUPPLEMENTARY MATERIALS 9

Timber - Market forms - Plywood - Veneer - False ceiling materials - Laminates - Steel - Mechanical treatment - Aluminium - Uses - Market forms - Glass - Refractories - Composite Materials - FRP - Geo synthetics - Floor finishing materials - Bitumen - Nano materials.

UNIT IV CONSTRUCTION PRACTICES 9

Stone masonry - Brick masonry – English bond & Flemish Bond- Cavity walls - Flooring - Formwork - Centering and shuttering - Sheet piles - Slip and moving forms - Roofs and roof covering - Plastering and pointing - Shoring - Scaffolding- Underpinning - Submerged structures - New technologies (activity-based).

UNIT V SERVICE REQUIREMENTS 9

Painting, distempering and white washing - Surface preparation and defects in painting and distempering and white washing - Fire Protection - Thermal insulation - Ventilation and air conditioning- Acoustics and sound insulation - Damp proofing - Termite proofing- Service Specification and Requirements.

List of Experiments:

1. Determination of Compressive Strength of Bricks
2. Determination of water absorption of Bricks
3. Determination of Efflorescence of Bricks
4. Determination of fineness of Cement
5. Determination of consistency of Cement
6. Determination of initial and final setting time of Cement
7. Determination of specific gravity of Cement
8. Determination of Compacted and loose bulk density of coarse aggregate
9. Determination of specific gravity of coarse aggregate
10. Determination of impact value of coarse aggregate
11. Determination of elongation index of coarse aggregate
12. Determination of flakiness index of coarse aggregate
13. Determination of aggregate crushing value of coarse aggregate
14. Determination of Slump of Concrete
15. Determination of Compressive Strength of Concrete
16. Construct a masonry wall with 1½ brick thickness using English bond

TOTAL: 45L + 30P = 75 PERIODS

COURSE OUTCOMES:

On completion of this course, the student is expected to be able to:

CO1 Identify the good qualities of stones and determine the suitable properties of aggregates for construction through testing techniques

CO2 Understand the basic properties, preparation methods, and tests of lime, cement, aggregates, and concrete as per IS codes.

CO3 Classify the bricks suitable for construction and recognize the market forms of other construction materials such as timber, plywood, steel, Aluminium etc.

CO4 Explore the various construction practices and practical importance

CO5 Impart knowledge on appropriate service requirements and perform non-destructive tests at site locations

TEXTBOOKS:

1. Varghese P. C., "Building Construction", Second Edition, PHI Learning Ltd., 2016.
2. Gambhir and Neha Jamwal, "Building and Construction Materials", Second Edition, McGraw Hill Education Pvt. Ltd., 2015.

REFERENCES:

1. Construction Materials Laboratory Manual, Anna University, Chennai - 600 025.
2. IS 4031 (Part 2) : 1999 R(2004) METHOD OF PHYSICAL TESTS FOR HYDRAULIC CEMENT
3. IS 4031 (Part 3 and Part 5) - 1988. METHOD OF PHYSICAL TESTS FOR HYDRAULIC CEMENT
4. IS 4031 (Part 4) : 1988 R (2005). METHOD OF PHYSICAL TESTS FOR HYDRAULIC CEMENT
5. IS 2386 (Part 1 & Part 3) : 1963 R (2002) METHODS OF TEST FOR AGGREGATES FOR CQNCRETE PART Ill SPECIFIC GRAVITY, DENSITY, VOIDS, ABSORPTION AND BULKING
6. IS 3495 (Part 1, Part 2 & Part 3): 1992 R (2002) METHODS OF TESTS OF BURNT CLAY BUILDING BRICKS
7. IS 516 : 1959 R (2004) METHODS OF TESTS FOR STRENGTH OF CONCRETE
8. IS 383 - 2016, Indian Standard specification for coarse and fine aggregates from natural sources for concrete.
9. Arora S. P. and Bindra S. P., "Building Construction", Dhanpat Rai and Sons,1997.
10. Ponmalar. V, Construction Materials (Tamil book), 2011.
11. Punmia B. C., "Building Construction", Laxmi Publication (p) Ltd., 2008.
12. Neville A. M., "Properties of Concrete", Fourth Edition, Pearson Education Ltd, 2012.

COs- PO's & PSO's MAPPING

CO	PO												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
1	2	3	2	2	3	2	2	3	2	3	3	2	2	3	3
2	3	2	3	3	3	3	2	3	2	3	3	3	3	3	3
3	2	3	2	2	2	2	3	2	2	3	3	3	3	2	3
4	3	2	3	3	3	2	2	3	3	2	2	3	2	2	3
5	3	3	3	3	3	3	3	3	3	2	3	2	3	3	3
Avg.	3	3	3	3	3	2	2	3	2	3	3	3	3	3	3

24CE3303 **FLUID MECHANICS** **L T P C**

3 0 2 4

COURSE OBJECTIVES:

To impart the students about properties and behavior of the fluids under static conditions and to impart basic knowledge of the dynamics of fluids through the control volume approach and to expose to the applications of the conservation laws to a) flow measurements b) flow through pipes (both laminar and turbulent) and c) forces on pipe bends with an exposure to the significance of boundary layer theory and its applications.

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 – Buoyancy and floatation – Stability of floating bodies.

UNIT II BASIC CONCEPTS OF FLUID FLOW 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 – Applications to velocity and discharge measurements – Linear momentum equation – Application to Pipe bends – Moment of momentum equation.

UNIT III 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.

UNIT IV 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 – Siphon – Pipes in series and parallel – Equivalent pipes.

UNIT V 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.

List of Practicals

1. Calibration of Rotameter
2. Determination of Coefficient of discharge for Orifice meter
3. Determination of Coefficient of discharge for notches
4. Study of friction losses in pipes
5. Study of minor losses in pipes
6. Determination of coefficient of discharge for venturimeter.

TOTAL: L:45+P: 30 PERIODS

COURSE OUTCOMES:

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

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

CO3 Formulate the relationship among the parameters involved in the given fluid phenomenon and to predict the performance of prototypes by model studies.

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

CO5 Explain the concept to boundary layer and its application to find the drag force excreted by the fluid on the flat solid surface.

TEXTBOOKS:

1. Modi P.N and Seth Hydraulics and Fluid Mechanics including Hydraulic Machines Standard Book House New Delhi. 2015.
2. A Textbook of Fluid Mechanics and Hydraulic Machines" by R.K. Bansal, 9th Edition (2019)

REFERENCES:

1. SK Som; Gautam Biswas and S Chakraborty, Introduction to Fluid Mechanics and Fluid Machines, Tata McGraw Hill Education Pvt. Ltd.,2012.
2. Pani BS ,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, (3rdEd.) University Press (India) Pvt. Ltd. 2009.
5. Streeter, V.L. Wylie, E. B. and Bedford K.W, Fluid Mechanics. (9th Ed.) Tata McGraw Hill, New Delhi, 1998.

COs- PO's & PSO's MAPPING

CO	PO												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
1	3	2	2	1	2	1	1	1	1	3	1	2	3	2	2
2	3	3	3	3	3	2	2	1	2	3	2	2	3	3	3
3	3	3	3	3	2	2	1	3	2	3	1	3	3	3	3
4	3	3	3	3	3	1	2	1	3	3	3	2	3	3	3
5	3	2	3	1	3	1	2	1	2	3	3	3	3	2	3
Avg.	**3**	**3**	**3**	**2**	**3**	**2**	**2**	**1**	**2**	**3**	**2**	**2**	**3**	**3**	**3**

24CE3304 RAILWAYS, AIRPORTS AND HARBOUR ENGINEERING L T P C
3 0 0 3

COURSE OBJECTIVES:

This course teaches the basics of planning, designing, building, and maintaining transport systems like railways, airports, and harbours. It covers important parts of each system, including MRTS and RTS. Students also learn about terminals, coastal structures, and environmental aspects of port operations.

UNIT I RAILWAY TRANSIT AND PLANNING 9

Elements of permanent way - Rails, Sleepers, Ballast, rail fixtures and fastenings, Selection of gauges- Unigauge- 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- Level Crossings - Introduction to metro rail systems- RTS (Rapid Transit System)- MRTS (Mass Rapid transit system).

UNIT II RAILWAY CONSTRUCTION AND MAINTENANCE 9

Earthwork - Stabilization of track on poor soil - Tunneling Methods, drainage and ventilation - Calculation of Materials required for track laying - Construction and maintenance of tracks -Signalling- Railway Station and yards and passenger amenities

UNIT III AIRPORT PLANNING 9

Air transport characteristics-airport classification- site selection, airport planning: objectives, components, layout characteristics, socio-economic characteristics of the Catchment area, typical Airport Layouts, parking and Circulation Area, Terminal area planning- Passenger Facilities and Services

UNIT IV AIRPORT DESIGN 9

Runway Design: Orientation, Wind Rose Diagram, correction factors as ICAO stipulations Problems on basic and actual Length, Geometric Design, Configuration and Pavement Design Principles - Elements of Taxiway Design - Airport Zones - Runway and Taxiway Markings & Lighting

UNIT V HARBOUR ENGINEERING 9

Definition of Basic Terms: Harbour, 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 - Wave action on Coastal Structures and Coastal Protection Works - Environmental concern of Port Operations- Inland Water Transport.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

On completion of the course, the student is expected to be able to:

CO1 Understand the concepts and elements in Planning, Design and construction of Railways
CO2 Select appropriate methods for construction and maintenance of railway tracks and other infrastructures
CO3 Understand the concepts and elements in Planning and selection of site for Airport
CO4 Design the Runway length and evaluate the orientation of runways
CO5 Understand the terminologies, infrastructures in Harbour Engineering and Coastal regulations

TEXTBOOKS:

1. Subramanian K.P., Highways, Railways, Airport and Harbour Engineering, Scitech Publications (India), Chennai, 2010
2. C.Venkatramaiah., Transportation Engineering-Vol.2 Railways, Airports, Docks and Harbours, Bridges and Tunnels.,Universities Press (India) Private Limited, Hyderabad, 2015.
3. Vazirani.V.N and Chandola.S.P, "Transportation Engineering-Vol.II", Khanna Publishers, New Delhi, 2015.
4. Sirinivasa Kumar R Transportation Engineering Railways, Airports, Docks and Harbours. University Press 2014
5. Saxena Subhash, C.and Satyapal Arora, A Course in Railway Engineering, Dhanapat Rai and Sons, Delhi, 1998

REFERENCES:

1. Khanna.S.K. Arora.M.G and Jain.S.S, Airport Planning and Design, Nemachand and Bros, Roorkee, 1994
2. Mundrey J S, Railway Track Engineering, McGraw Hill Education (India) Private Ltd, New Delhi, 2013.

COs- PO's & PSO's MAPPING

CO	PO												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
1	3	3	3	2	1	1	1	2	2	1	1	3	3	2	3
2	3	3	3	3	3	3	3	3	2	3	2	2	2	3	2
3	2	2	3	3	2	3	3	2	2	3	2	2	3	2	2
4	3	2	3	3	3	2	3	3	2	3	2	2	2	2	2
5	2	3	3	2	2	2	3	1	1	1	1	3	2	2	2
Avg.	**3**	**3**	**3**	**3**	**2**	**2**	**3**	**2**	**2**	**2**	**2**	**2**	**2**	**2**	**2**

24CE3351 SURVEYING AND LEVELLING L T P C

3 0 4 5

COURSE OBJECTIVES:

Surveying is the process of determining by measurement, the relative positions of points on or near the earth surface. The data collected from survey is used in the preparation of plans, maps, profiles, charts and diagrams. In addition survey may be used for the delineation of property boundaries, computation of areas and volumes also to set out the proposed work on the ground

UNIT I INTRODUCTION 9

Definition –Principles of surveying - Classification - Plans and maps – Linear measurements using chain and tape- Obstacles in chaining - Compass surveying –prismatic and surveyor's compass–angles and bearings- Local attraction – Computations of corrected bearings and angles.

UNIT II LEVELLING 9

Definition - Methods of leveling - Levelling instruments - Temporary adjustments of a level – Terms and abbreviations - Differential leveling - Height of collimation method - Rise and fall method - Profile leveling- Reciprocal levelling - contouring – methods – characteristics and uses of contours - Plane Table Surveying.

UNIT III THEODOLITE AND TACHEOMETRIC SURVEYING 9

Theodolite: Introduction, The essentials of transit theodolite - Definitions and terms – Temporary adjustments - Measurement of horizontal and vertical angles - Sources of errors in theodolite work.

Tacheometric Surveying: Stadia and tangential methods of Tacheometry - Distance and Elevation formulae for Staff held normal and vertical.

UNIT IV CURVE SETTING AND SURVEY ADJUSTMENTS 9

Curves - Types - Simple curves, Compound curves, Reverse curve- Setting out methods and Problems - Error sources– Classification of errors – True and Most probable values – Principle of least squares - Normal equation – Correlates- Adjustment of simple triangulation networks.

UNIT V MODERN SURVEYING **9**

Total Station: Fundamental quantities measured – Parts and accessories – Working principle – Field procedure – Errors and Good practices- Electronics Distance Measurement (EDM)

GPS Surveying: Different segments –Satellite configuration – Signal structure – Orbit determination and representation. Data management functions- Raster to Vector and Vector to Raster Image Conversion

LIST OF EXPERIMENTS:

1. Determine the area of a boundary by chain survey
2. Conducting a Closed traverse of a given area using a prismatic compass and plotting after adjustment.
3. Compass Traversing–Measuring Bearings& arriving of included angles
4. Fly leveling (Height of collimation & Rise and Fall Method)
5. Check leveling
6. Measurements of horizontal angles and vertical angles(Reitration and Repitation Method)
7. Determination of elevation of an object using the single plane method when the base is accessible
8. Determination of the height of an object whose base is inaccessible using the single plane method - instrument axes at different levels.
9. Determination of Tacheometric Constants
10. Setting out works
11. Marking of Foundation (Center Line Method)

TOTAL: (L: 45+ P :60) 105 PERIODS

COURSE OUTCOMES :

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

CO1 Compute the distance between two points using chains, angular measurements using compass
CO2 Find the relative position of points on the ground using leveling principles, contouring- methods computation of areas and volume
CO3 Calculate the height and distance of objects using tacheometric and trigonometric principle
CO4 Compute the elements of different types of curves and triangulation systems
CO5 Understand the principle of working with Total station and find the distance, elevation, Area etc.

TEXTBOOKS :

1. Kanetkar.T.P and Kulkarni.S.V, Surveying and Levelling, Parts 1 & 2, Pune Vidyarthi Griha Prakashan, Pune, 2008
2. Punmia.B.C., Ashok K.Jain and Arun K Jain , Surveying Vol. I & II, Lakshmi Publications Pvt Ltd, New Delhi, 2005
3. S. K. Husain and M. S. Nagaraj, Textbook of Surveying , S. Chand & Company 1978

REFERENCES :

1. Alfred Leick, “GPS satellite surveying”, John Wiley & Sons Inc., 3rd Edition, 2004.
2. Guocheng Xu, “GPS Theory , Algorithms and Applications”, Springer – Berlin, 2003.
3. SatheeshGopi, rasathishkumar, N. madhu, “Advanced Surveying, Total Station GPS and Remote Sensing” Pearson education, 2007
4. Roy S.K., "Fundamentals of Surveying", 2nd Edition, Prentice Hall of India, 2004.
5. Arora K.R.,"Surveying Vol I & II", Standard Book house, 10th Edition 2008
6. James M. Anderson and Edward M. Mikhail, "Surveying, Theory and Practice", 7th Edition, McGraw Hill, 2001.
7. Bannister and S. Raymond, "Surveying", 7th Edition, Longman 2004.
8. Laurila, S.H. "Electronic Surveying in Practice", John Wiley and Sons Inc, 1993
9. Venkatramaiah, Text book of Surveying, University press, New Delhi, 2014

COs- PO's & PSO's MAPPING

CO	PO												PSO		
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1	2	2	3	2	2	3	1	3	3	2	2	2	3	3	3
2	3	3	2	2	3	3	1	3	3	2	2	2	3	3	3
3	3	3	2	2	3	3	1	3	3	2	2	2	3	3	3
4	3	3	3	3	3	3	2	3	3	2	2	2	3	3	3
5	3	3	3	3	3	3	2	3	3	2	2	2	3	3	3
AVG	3	3	3	2	3	3	1	3	3	2	2	2	3	3	3

24TP330 **SKILL ENHANCEMENT – III** **L T P C**
0 0 2 1

COURSE OBJECTIVE:
To educate and enrich the students on quantitative ability, reasoning ability, and verbal ability. **6**

UNIT I QUANTITATIVE ABILITY – I

Problems on Trains - Time and Distance - Height and Distance - Time and **6**

UNIT II QUANTITATIVE ABILITY – II
Problems on Ages - Alligation or Mixture - Chain Rule - Simple Interest - Simple Equation - Theory of Equation. **6**

UNIT III REASONING ABILITY – I
Analytical Reasoning - Pipes and Cistern - Logical Problems - Logical Games - Logical Deduction - Data Sufficiency - Arithmetic Reasoning. **6**

UNIT IV VERBAL ABILITY – I
Idioms & Phrases - Synonyms - Antonyms - **6**

UNIT V CREATIVITY ABILITY – I
Venn Diagrams, Cube and Cuboids, Dice, Cubes and Dice, Figure

TOTAL : 30 PERIODS

COURSE OUTCOMES:
On successful completion the students will be able to

CO1 Apply basic mathematical concepts to solve problems related to time, distance, work, and mixtures using quantitative techniques
CO2 Solve real-life logical and numerical problems through reasoning strategies and analytical thinking.
CO3 Demonstrate verbal ability by identifying correct usage of idioms, phrases, synonyms, antonyms, and classification patterns
CO4 Analyze and interpret visual and spatial data using Venn diagrams, cubes, dice, and figure matrices to enhance creative thinking
CO5 Develop speed and accuracy in solving aptitude-related questions, preparing students for competitive exams and placement opportunities

COs- PO's & PSO's MAPPING

COs	PO												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	3	2	2	2	1	1	1	1	2	2	2	-	-	-
CO2	2	2	3	2	2	2	1	2	2	2	1	2	-	-	-
CO3	2	1	1	3	2	2	2	1	2	3	2	2	-	-	-
CO4	2	2	2	2	3	3	2	2	3	2	1	2	-	-	-
CO5	3	2	2	2	2	2	3	1	1	2	2	3	-	-	-
Avg.	3	2	2	2	2	2	2	1	2	2	2	2	-	-	-

24CE3401 STRENGTH OF MATERIALS – II L T P C
3 0 0 3

COURSE OBJECTIVES:

At the end of this course, a student will be able to

- Understand the basic concepts for determination of principal stresses and strains in various structural elements.
- Demonstrate analytical methods for determining strength & stiffness and assess stability of structural members.
- Analyze the critical loads for column with different end conditions
- Analyze the indeterminate structure with different load conditions.
- Understand the concept of unsymmetrical bending.

UNIT I ENERGY PRINCIPLES 9

Strain Energy And Strain Energy Density — Strain Energy Due To Axial Load (Gradual, Sudden And Impact Loadings) — Castigliano's Theorems — Maxwell's Reciprocal Theorem — Principle of Virtual Work — Unit Load Method

UNIT II INDETERMINATE BEAMS 9

Concept of Analysis — Propped cantilever and fixed beams — fixed end moments and reactions — sinking and rotation of supports — Theorem of three moments — analysis of continuous beams — shear force and bending moment diagrams

UNIT III COLUMNS 9

Introduction, short and long columns. Euler's theory; Assumptions, Derivation for Euler's Buckling load for different end conditions, Limitations of Euler's theory. Rankine-Gordon's formula for columns.

UNIT IV STATE OF STRESS IN THREE DIMENSIONS 9

Stress tensor at a point — Stress invariants — Determination of principal stresses and principal planes - Volumetric strain. Theories of failure: Maximum Principal stress theory - Maximum Principal strain theory - Maximum shear stress theory - Total Strain energy theory - Maximum distortion energy theory - Application problems.

UNIT V ADVANCED TOPICS 9

Unsymmetrical bending of beams of symmetrical and unsymmetrical sections — Shear Centre — curved beams- Stresses in links and hooks.

OUTCOMES:

On completion of this course, the student is expected to be able to:

1. Apply the concepts of energy principle for determining deflection of beams, frames, and trusses
2. Analyze indeterminate beams using theorem of three moment equations
3. Assess the load carrying capacity of long columns and stresses in short columns
4. Determine the principal stresses in three-dimensional state of stress, analyze the stresses in thick cylinders and apply various theories of failures
5. Gain knowledge in the concept of shear centre, unsymmetrical bending and curved beams

TEXTBOOKS:

1. Rajput.R.K. “Strength of Materials”, S.Chand and Co, New Delhi, 2015.
2. Punmia.B.C., Ashok Kumar Jain and Arun Kumar Jain, SMTS –I Strength of materials, Laxmi publications. New Delhi, 2015
3. Rattan . S. S, “Strength of Materials”, Tata McGraw Hill Education Private Limited, New Delhi, 2012
4. Bansal. R.K. “Strength of Materials”, Laxmi Publications Pvt. Ltd., New Delhi, 2010

REFERENCES :

1. Timoshenko.S.B. and Gere.J.M, “Mechanics of Materials”, Van Nos Reinbhold, New Delhi 1999.
2. Vazirani.V.N and Ratwani.M.M, “Analysis of Structures”, Vol I Khanna Publishers, NewDelhi,1995.
3. Junnarkar.S.B. and Shah.H.J, “Mechanics of Structures”, Vol I, Charotar Publishing House, New Delhi 2016.
4. Singh. D.K., “ Strength of Materials”, Ane Books Pvt. Ltd., New Delhi, 2016
5. Basavarajaiah, B.S. and Mahadevappa, P., Strength of Materials, Universities Press, Hyderabad, 2010.
6. Gambhir. M.L., "Fundamentals of Solid Mechanics", PHI Learning Private Limited., NewDelhi, 2009.

COs- PO’s & PSO’s MAPPING

CO	PO												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
1	3	3	3	3	2	3	1	3	2	3	1	3	3	3	3
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3	3	3	3	3	2	3	1	3	2	3	1	3	3	3	3
4	3	3	3	3	2	3	1	3	2	3	1	3	3	3	3
5	3	3	3	3	2	3	1	3	2	3	1	3	3	3	3
AVG	3	3	3	3	2	3	1	3	2	3	1	3	3	3	3

24CE3402 SOIL MECHANICS L T P C

3 0 2 4

COURSE OBJECTIVES

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

UNIT-1 SOIL CLASSIFICATION 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 –clay minerology- BIS classification system – Unified classification system

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 COMPACTION AND CONSOLIDATION 9

Compaction of soils – Theory, Laboratory and field tests – Field Compaction methods –Factors influencing compaction of soils - Components of settlement — Immediate and consolidation settlement – Factors influencing settlement- Terzaghi’s one dimensional consolidation theory – Computation of rate of settlement.

– √t and log t methods– e–log p relationship.

UNIT-IV STRESS DISTRIBUTION AND SHEAR STRENGTH 9

Stress distribution in homogeneous and isotropic medium – Boussinesq theory – (Point land, Line load and udl) Use of New marks influence chart- 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.

LIST OF EXPERIMENTS:

1. Specific gravity of soil solids
2. Grain size distribution – Sieve analysis
3. Grain size distribution - Hydrometer analysis
4. Liquid limit
5. Plastic limit tests
6. Shrinkage limit
7. Differential free swell tests
8. Field density Test - Sand replacement method
9. Field density Test – Core cutter
10. Permeability determination by constant head and falling head methods
11. Determination of moisture – density relationship using standard proctor compaction test.
12. One dimensional consolidation test (Determination of co-efficient of consolidation only)
13. California Bearing Ratio Test
14. Direct shear test in cohesion less soil
15. Unconfined compression test in cohesive soil
16. Laboratory vane shear test in cohesive soil
17. Tri-axial compression test in cohesion less soil (Demonstration only)

30 PERIODS

TOTAL: (L: 45+ P :30) 75 PERIODS

COURSE OUTCOMES:

On Completion of the course, the students should be able to:

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

CO2 Show the basic understanding of flow through soil medium and its impact of engineering solution

CO3 Understand the basic concept of Compaction in soil medium and soil settlement due to consolidation

CO4 Show the understanding of stress distribution and shear strength of soils and its impact of engineering solutions to the loaded soil medium and also will be aware of contemporary issues on shear strength of soils.

CO5 Demonstrate an ability to design both finite and infinite slopes, component and process as per needs and specifications.

TEXTBOOKS:

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

REFERENCES:

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, 2005
5. IS Code of Practice (2720) Relevant Parts, as amended from time to time, Bureau of Indian Standards, New Delhi.
6. Braja M. Das., "Soil Mechanics: Laboratory Manual", Oxford University Press, eighth edition, 2012.
7. IS : 1498-1970 Classification and Identification of soil for general engineering purpose.

COs- PO's & PSO's MAPPING

CO	PO												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
1	2	3	3	3	3	2	1	2	3	2	2	3	3	3	3
2	3	2	3	3	3	2	1	2	3	3	2	3	2	3	3
3	3	3	3	3	2	2	1	2	3	2	2	3	2	3	3
4	2	3	3	3	2	2	1	2	3	2	2	3	2	3	3
5	3	3	2	3	2	2	2	2	3	2	1	3	2	3	2
Avg.	**3**	**3**	**3**	**3**	**2**	**2**	**1**	**2**	**3**	**2**	**2**	**3**	**2**	**3**	**3**

24CE3403 APPLIED HYDRAULICS ENGINEERING L T P C
3 0 2 4

COURSE OBJECTIVES:

To impart basic knowledge to the students about the open channel flows with analysis of uniform flow, gradually varied flow and rapidly varied flow and to expose them to basic principles of working of hydraulic machineries and to design Pelton wheel, Francis and Kaplan turbine, Centrifugal and Reciprocating pumps.

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.

Lab Experiment

1. Study of pressure test on pipes
2. Study on Performance Characteristics of Pelton turbine
3. Study on Performance Characteristics of Francis turbine
4. Study on Performance Characteristics of Kaplan turbine
5. Study on Performance Characteristics of Centrifugal Pump
6. Study on Performance Characteristics of Gear Pump
7. Study on Performance Characteristics of Submersible pump
8. Study on Performance Characteristics of Reciprocating pump

TOTAL: (L: 45+ P :30) 75 PERIODS

COURSE OUTCOMES:

CO1 Describe the basics of open channel flow, its classification and analysis of uniform flow in steady State conditions with specific energy concept and its application

CO2 Analyse steady gradually varied flow, water surface profiles and its length calculation using direct and standard step methods with change in water surface profiles due to change in grades.

CO3 Derive the relationship among the sequent depths of steady rapidly varied flow and estimating energy loss in hydraulic jump with exposure to positive and negative surges

CO4 Design turbines and explain the working principle

CO5 Differentiate pumps and explain the working principle with characteristic curves and design

TEXT BOOKS:

1. Jain. A.K., Fluid Mechanics, Khanna Publishers, Delhi, 2010.
2. Chandramouli P N, Applied Hydraulic Engineering, Yes Dee Publisher, 2017

REFERENCES:

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.

COs- PO's & PSO's MAPPING:

CO	PO												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
1	3	2	1	1	1	1	1	2	3	2	1	2	3	2	2
2	3	2	1	1	1	1	1	2	3	2	2	2	3	2	2
3	3	2	3	2	1	1	1	2	3	2	1	2	3	3	2
4	3	3	3	2	1	1	1	2	3	2	3	3	3	3	3
5	3	3	2	2	1	1	1	2	3	2	3	3	3	3	3
Avg.	3	2	2	2	1	1	1	2	3	2	2	2	3	3	2

24CE3404 **HIGHWAY ENGINEERING** **L T P C**

3 0 2 4

COURSE OBJECTIVES:

This course provides an understanding of highway planning, design, construction, and maintenance. It covers road alignment, geometric design, pavement types, materials, and design methods as per IRC standards. Students also learn about modern construction practices, drainage, road safety, and pavement evaluation techniques.

UNIT I HIGHWAY PLANNING AND ALIGNMENT 9

History of road development in India - Classification of highways - Institutions for Highway planning, design and construction at different levels - factors influencing highway alignment - Road ecology - Preliminary Survey-Typical cross sections of Urban and Rural roads - cross sectional elements- IRC and Recommendation of Jayakar committee.

UNIT II GEOMETRIC DESIGN OF HIGHWAYS 9

Importance of geometric design, Sight distance - stopping sight distance-overtaking sight distance - sight distance at intersections, Design of horizontal alignment - super elevation, widening of pavements, transition curves. Design of vertical alignment - gradients, summit, and valley curves- IRC standards-Road signs and safety. Urban utility services.

UNIT III DESIGN OF FLEXIBLE PAVEMENTS 9

Desirable properties of subgrade soil, road aggregates and bituminous materials, testing methods - Pavement components and their functions - Factors influencing the design of pavements - Design principles - Design of flexible pavements as per IRC.

UNIT IV DESIGN OF RIGID PAVEMENTS 9

Rigid Pavement components and their functions- Factors affecting cement concrete pavements, stresses in rigid pavements: Westergaard's theory, Wheel load stress, Temperature stresses, Frictional stresses, design of joints- dowel bars- tie bars, design of rigid pavement using IRC method

UNIT V HIGHWAY CONSTRUCTION AND MAINTENANCE 9

Construction of subgrade, subbase, base layers, bituminous and cement concrete roads modern materials and methods, Highway drainage - Special considerations for hilly roads; Pavement failures

- Types and causes of failures in flexible and rigid pavements. Evaluation and Maintenance of pavements.

List of Experiments:

I TEST ON AGGREGATES

a) Specific Gravity of Aggregates- IS 2386 (Part 3), Reaffirmed 2021
b) Aggregate Impact Value- IS 2386 (Part 4), Reaffirmed 2021
c) Los Angeles Abrasion Test- IS 2386 (Part 5), Reaffirmed 2021
d) Water Absorption of Aggregates- IS 2386 (Part 3), Reaffirmed 2021

II TEST ON BITUMEN

a) Specific Gravity of Bitumen-IS 1202: 2021
b) Penetration Test- IS 1203: 2022
c) Viscosity Test-IS 1206 (Part 1): 2023, IS 1206 (Part 2): 2022, IS 1206 (Part 3): 2021
d) Softening Point Test-IS 1205: 2022
e) Ductility-IS 1208 (Part 1) :2023

III TEST ON BITUMINOUS MIXES- DEMONSTRATION CLASSES ONLY.

a) Marshall Stability and Flow
b) Determination of Binder Content

TOTAL: 45L + 30P = 75 PERIODS

COURSE OUTCOMES:

On completion of this course, the student is expected to be able to:

CO1 Understand the concepts and standards adopted in Planning, Design and construction of Highways and its related infrastructures

CO2 Apply the knowledge of science and engineering fundamentals in designing the geometrics for an efficient Highway network and design concepts

CO3 Evaluate the properties of the aggregates and bitumen and Apply the knowledge of science and engineering fundamentals in designing flexible pavement. by adopting IRC guidelines

CO4 Design rigid pavements based on design concepts and Codal provisions

CO5 Select appropriate methods for construction, evaluation and maintenance of roadways and know about field testing methods

TEXTBOOKS:

1. Veeraragavan. A, Khanna.K and Justo.C.E.G. Highway Engineering, Nem Chand & Bros Publishers, 2014
2. Subramanian K.P., Highways, Railways, Airport and Harbour Engineering,Scitech Publications (India), Chennai, 2010
3. C.Venkatramaiah., Transportation Engineering-Highway Engineering, Universities Press `(India) Private Limited, Hyderabad, 2015
4. Subhash C Saxena, Textbook of Highway and Traffic Engineering. CBS Publishers, 2017.
5. R.Srinivasa Kumar., Textbook of Highway Engineering Universities Press (India) Private Limited, Hyderabad, 2011

REFERENCES:

1. Partha Chakroborty and Animesh Das Principles of Transportation Engineering, PHI Learning Pvt. Ltd., 2005
2. Kadiyali. L. R. Principles and Practice of Highway Engineering, Khanna Technical Publications, Delhi, 1997.
3. Indian Road Congress (IRC), Guidelines and Special Publications on Planning and Design of Highways.
4. Sharma.S.K Principles , Practices and Design of Highway Engineering, S.Chand and Company Ltd.1995
5. Indian Road Congress (IRC), Guidelines and Special Publications on Planning and Design of Highways.
6. Khanna.S. K., Justo.C.E.G and Veeraragavan A. "Highway Materials and Pavement Testing", Nem Chand and Bros., Roorkee, Revised Fifth Edition, 2009
7. Mix Design Methods Asphalt Institute Manual Series No. 2, Sixth Edition, 1997, Lexington, KY, USA.

COs- PO's & PSO's MAPPING

CO	PO												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
1	3	3	3	3	2	2	2	2	1	1	2	2	3	2	2
2	3	3	3	2	2	2	1	2	2	2	2	2	3	3	3
3	3	3	3	2	2	2	1	1	1	2	2	2	2	3	3
4	3	3	3	2	2	2	2	1	2	2	2	2	2	3	3
5	2	2	2	3	2	2	2	2	3	2	2	2	3	3	3
Avg.	**3**	**3**	**3**	**2**	**2**	**2**	**2**	**2**	**2**	**2**	**2**	**2**	**3**	**3**	**3**

24CE3405 WATER SUPPLY AND WASTEWATER ENGINEERING L T P C 3 0 2 4

COURSE OBJECTIVES:

To introduce students with the components and design of water supply systems, including treatment methods, storage and distribution networks, as well as sewage treatment, disposal, and sewerage systems.

UNIT I WATER SUPPLY 8

Public water supply scheme- Population forecasting – Predicting demand for water- Impurities of water and their significance – Physical, chemical and bacteriological analysis - Waterborne diseases – Standards for potable water, Sources of water, Intake of water, Pumping and gravity schemes.

UNIT II WATER TREATMENT 10

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 8

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 10

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

LIST OF EXPERIMENTS

1. Introduction to Standards, Collection, Preservation of samples and Sampling Techniques – A Study Experiment
2. Determination of Turbidity, Electrical conductivity and PH
3. Determination of Acidity
4. Determination of Alkalinity
5. Determination of Hardness
6. Determination of Optimum Coagulant Dosage
7. Determination of Chlorides
8. Determination of Available and Residual Chlorine
9. Determination of Suspended, Volatile and Fixed solids
10. Determination of DO for the Given Sample
11. Determination of COD for Given Sample
12. Determination of BOD for the Given Sample
13. Determination of Sludge Volume Index of Biological Sludge
14. Determination of MPN Index of given water sample (Demonstration only)

TOTAL: 45L + 30P = 75 PERIODS

COURSE OUTCOMES:

Upon completion of the course, the students will be able to:

CO1 Understand the components of a water supply scheme, estimate water demand, analyze water impurities, and recognize the significance of potable water standards.

CO2 Describe the principles, functions, and design of water treatment processes, including coagulation, filtration, disinfection, and desalination

CO3 Ability to design and evaluate water distribution system and water supply in buildings

CO4 Design sewerage systems by estimating sewage flow, selecting appropriate sewer materials, and addressing storm water drainage and corrosion control.

CO5 Design various sewage and sludge treatment processes and understand their 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.
4. Punmia, B.C., Jain, A.K., and Jain. A. K.., Environmental Engineering, Vol. II, Laxmi Publications, 2010
5. Peavy, H.s, Rowe, D.R, Tchobanoglous, G. "Environmental Engineering", Mc-Graw – Hill Indian Editions, New York 1st Edition2013.
6. Modi, P.N., Sewage Treatment disposal & Wastewater Engineering, Vol.II Standard Book House, New Delhi, 2020

REFERENCES:

1. Metcalf and Eddy – Wastewater Engineering – Treatment and Reuse, Tata Mc. Graw – Hill Company, New Delhi, 2010.
2. Gray N.F, "Water Technology", Elsevier India Pvt. Ltd. New Delhi, 2006.
3. "Manual on Water Supply and Treatment". Ministry of Urban Development, New Delhi,3rd Edition 2013.
4. "Manual on Sewerage and Sewage Treatment Systems, Part A, B and C", Central Public Health and Environmental Engineering Organization, Ministry of Urban Development, 3rd Edition.2013.
5. "APHA, AWWA Standard methods for the Examination of Water and Wastewater", American Public Health Association, Washington, D.C, 22nd Edition,2012.
6. G. L. Karia, R.A. Christian, wastewater Treatment: Concepts and Design Approach, PHI Learning Publishers, New Delhi, 2nd Edition, 2013.

COs- PO's & PSO's MAPPING

CO	PO												PSO		
	1	**2**	**3**	**4**	**5**	**6**		**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
1	3	**2**	**1**	**2**	**1**	**1**	**1**	**2**	**2**	**1**	**1**	**2**	**3**	**1**	**1**
2	3	2	1	2	1	1	1	2	2	1	1	2	3	1	1
3	3	2	3	1	1	3	2	2	2	1	1	2	3	2	3
4	3	2	3	1	2	3		2	2	1	1	2	3	2	3
5	3	2	3	2	2	3	3	2	2	1	1	2	3	3	3
Avg.	3	**2**	**2**	**2**	**1**	**2**	**1**	**2**	**2**	1	**1**	**2**	**3**	**2**	**2**

24IC3401 ENGINEERING ENTREPRENEURSHIP DEVELOPMENT L T P C
2 0 2 3

COURSE OBJECTIVES:

- Learn basic concepts in entrepreneurship, develop mind-set and skills necessary to explore entrepreneurship
- Apply process of problem - opportunity identification and validation through human centered approach to design thinking in building solutions as part of engineering projects
- Analyse market types, conduct market estimation, identify customers, create customer persona, develop the skills to create a compelling value proposition and build a Minimum Viable Product
- Explore business models, create business plan, conduct financial analysis and feasibility analysis to assess the financial viability of a venture ideas & solutions built with domain expertise
- Prepare and present an investible pitch deck of their practice venture to attract stakeholders

UNIT I ENTREPRENEURIAL MINDSET 9

Introduction to Entrepreneurship: Definition – Types of Entrepreneurs – Emerging Economies – Developing and Understanding an Entrepreneurial Mindset – Importance of Technology Entrepreneurship – Benefits to the Society. Case Analysis: Study cases of successful & failed engineering entrepreneurs - Foster Creative Thinking: Engage in a series of Problem-Identification and Problem-Solving tasks

UNIT II OPPORTUNITIES 9

Problems and Opportunities – Ideas and Opportunities – Identifying problems in society – Creation of opportunities – Exploring Market Types – Estimating the Market Size, - Knowing the Customer and Consumer - Customer Segmentation - Identifying niche markets – Customer discovery and validation; Market research techniques, tools for validation of ideas and opportunities. Activity Session: Identify emerging sectors / potential opportunities in existing markets - Customer Interviews: Conduct preliminary interviews with potential customers for Opportunity Validation - Analyse feedback to refine the opportunity.

UNIT III PROTOTYPING & ITERATION 9

Prototyping – Importance in entrepreneurial process – Types of Prototypes - Different methods – Tools & Techniques. Hands-on sessions on prototyping tools (3D printing, electronics, software), Develop a prototype based on identified opportunities; Receive feedback and iterate on the prototypes.

UNIT IV BUSINESS MODELS & PITCHING 9

Business Model and Types - Lean Approach - 9 block Lean Canvas Model - Riskiest Assumptions in Business Model Design – Using Business Model Canvas as a Tool – Pitching Techniques: Importance of pitching - Types of pitches - crafting a compelling pitch – pitch presentation skills - using storytelling to gain investor/customer attention. Activity Session: Develop a business model canvas for the prototype; present and receive feedback from peers and mentors - Prepare and practice pitching the business ideas- Participate in a Pitching Competition and present to a panel of judges - receive & reflect feedback

UNIT V ENTREPRENEURIAL ECOSYSTEM 9

Understanding the Entrepreneurial Ecosystem – Components: Angels, Venture Capitalists, Maker Spaces, Incubators, Accelerators, Investors. Financing models – equity, debt, crowdfunding, etc, Support from the government and corporates. Navigating Ecosystem Support: Searching & Identifying the Right Ecosystem Partner – Leveraging the Ecosystem- Building the right stakeholder network. Activity Session: Arrangement of Guest Speaker Sessions by successful entrepreneurs and entrepreneurial ecosystem leaders (incubation managers; angels; etc), Visit one or two entrepreneurial ecosystem players (Travel and visit a research park or incubator or makerspace or interact with startup founders).

TOTAL : 45 PERIODS

COURSE OUTCOMES:

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

CO1 Develop an Entrepreneurial Mind-set and Understand the Entrepreneurial Ecosystem Components and Funding types

CO2 Comprehend the process of opportunity identification through design thinking, identify market potential and customers

CO3 Generate and develop creative ideas through ideation techniques

CO4 Create prototypes to materialize design concepts and conduct testing to gather feedback and refine prototypes to build a validated MVP

CO5 Analyse and refine business models to ensure sustainability and profitability Prepare and deliver an investible pitch deck of their practice venture to attract stakeholders

TEXT BOOKS:

1. Robert D. Hisrich, Michael P. Peters, Dean A. Shepherd, Sabyasachi Sinha (2020). Entrepreneurship, McGrawHill, 11th Edition
2. Bill Aulet (2024). Disciplined Entrepreneurship: 24 Steps to a Successful Startup. John Wiley & Sons.
3. Bill Aulet (2017). Disciplined Entrepreneurship Workbook. John Wiley & Sons.
4. Ries, E. (2011). The Lean Startup: How Today's Entrepreneurs Use Continuous Innovation to Create Radically Successful Businesses. Crown Business
5. Blank, S. G., & Dorf, B. (2012). The Startup Owner's Manual: The Step-by-Step Guide for Building a Great Company. K&S Ranch
6. Osterwalder, A., & Pigneur, Y. (2010). Business Model Generation: A Handbook for Visionaries, Game Changers, and Challengers. John Wiley & Sons
7. Marc Gruber & Sharon Tal (2019). Where to Play: 3 Steps for Discovering Your Most Valuable Market Opportunities. Pearson.

COs- PO's & PSO's MAPPING:

CO	PO												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	2	1	–	–	–	3	–	1	2	2	3	2	-	-	-
CO2	2	3	2	1	1	2	–	–	2	2	2	3	-	-	-
CO3	1	2	3	–	2	1	–	–	2	2	2	2	-	-	-
CO4	2	2	3	2	3	1	–	–	3	2	3	2	-	-	-
CO5	2	2	3	2	2	2	1	1	3	3	3	2	-	-	-
AVG	1	2	2	1	2	2	-	-	2	2	3	2	-	-	-

24TP3401 SKILL ENHANCEMENT- IV L T P C
0 0 2 1

COURSE OBJECTIVE:

- Improve their quantitative ability.
- Improve their reasoning ability.
- Enhance their verbal ability through vocabulary building and grammar.
- Equip with creative thinking and problem solving skills.

UNIT I QUANTITATIVE ABILITY **6**

Compound Interest - Profit and Loss - Partnership - Percentage – Set

UNIT II QUANTITATIVE ABILITY **6**

True Discount - Ratio and Proportion - Simplification - Problems on H.C.F and L.C.M

UNIT III QUANTITATIVE ABILITY **6**

Course of Action - Cause and Effect - Statement and Conclusion - Statement and Argument - Data Sufficiency (DS) - Statement and Assumption - Making Assumptions.

UNIT IV VERBAL ABILITY **6**

Change of Voice - Change of Speech - Letter and Symbol Series - Essential Part - Verbal Reasoning - Analyzing Arguments.

UNIT V CREATIVITY ABILITY **6**

Seating Arrangement - Direction Sense Test - Character Puzzles

TOTAL : 30

COURSE OUTCOMES:

After studying the above subject, students should have the:

CO1 Solve advanced quantitative aptitude problems involving compound interest, profit & loss, percentages, ratios, and set theory with accuracy and efficiency.

CO2 Apply logical reasoning to evaluate arguments, draw conclusions, identify assumptions, and determine cause-effect relationships.

CO3 Demonstrate proficiency in complex verbal reasoning tasks such as voice/speech transformation, symbol series, and argument analysis.

CO4 Develop creative problem-solving skills through puzzles, direction tests, and seating arrangements using analytical approaches.

CO5 Enhance critical thinking and decision-making abilities necessary for success in competitive exams and professional assessment.

COs- PO's & PSO's MAPPING:

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

24CE3501 DESIGN OF REINFORCED CEMENT CONCRETE ELEMENTS **L T P C 3 1 0 4**

COURSE OBJECTIVE:

To equip the students to understand the principles of reinforced concrete and design the element using the Limit State Method, in accordance with IS codes, and design of structural elements such as beams, slabs, columns, staircases, and footings under various loading conditions.

UNIT I INTRODUCTION TO STRUCTURAL DESIGN

Objective of structural design – Grades of concrete – Type of loads on structures and load combinations – Design considerations – Code of practices and Specifications – Cover requirements - Stress– Strain curve for concrete in compression – Types and grades of reinforcement – Stress – Strain curve for reinforcing steel - Concepts of Working Stress Method (WSD), Ultimate Load Method (ULD) and Limit State Method (LSD) – Advantages of Limit State Method over other methods –Factor of safety and Partial safety factors – Various limit states. Design of singly and Doubly reinforced rectangular beams by Limit state Method

UNIT II LIMIT STATE DESIGN OF BEAMS 9

Assumptions– Analysis and Design of flanged Beam -Design of shear reinforcement–Design for combined bending shear and torsion–Design requirement for bond and anchorage as per IS codes.

UNIT III LIMIT STATE DESIGN OF SLABS AND STAIRCASE 9

Types of slabs– Analysis and design of one way and two way slab.
-Types of staircases– Design of dog-legged staircase.

UNIT IV LIMIT STATE DESIGNOF COLUMNS 9

Classification of columns - Axial, uniaxial and biaxial bending - Braced and unbraced columns - Orientation of columns in buildings - Design of short columns - Square, rectangular and circular columns subjected to axial, uniaxial and biaxial loadings.

UNITV LIMITSTATEDESIGNOF FOOTINGS 9

Types of footings - Behaviour of concentric and eccentric footings - Design of axially and eccentrically loaded square and rectangular footing - Behaviour of combined rectangular footing (two columns only).

TOTAL: 45 PERIODS

COURSE OUTCOMES:

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

CO1: Explain the fundamental principles of structural design, including types of loads, material properties, design philosophies, codal provisions, and apply the Limit State Method for designing singly and doubly reinforced rectangular beams.

CO2: Analyze and design the flanged beams including shear, torsion, and anchorage requirements as per IS codes.

CO3: Design of one-way and two-way slabs and develop staircase layouts (dog-legged) based on limit state method and codal requirements.

CO4: Design of axially loaded short columns with uniaxial and Bi axial bending

CO5: Design of isolated square and rectangular footing for axial and eccentric loads and explain the behavior of combined footing

TEXT BOOKS:

1. Gambhir. M.L., "Fundamentals of Reinforced Concrete Design", Prentice Hall of India Private Limited, New Delhi, 2006..
2. Krishnaraju.N“ Design of Reinforced Concrete Structures “, CBS Publishers & Distributors Pvt. Ltd., New Delhi.
3. NC Sinha & SK Roy,” Fundamentals of Reinforced Concrete “,S. Chand Publishing, 2007, New Delhi.

REFERENCES

1. Unnikrishna Pillai S. and Devdas Menon, "Reinforced Concrete Design", 4th Edition, Tata McGraw-Hill, New Delhi, 2021.
2. Varghese. P.C., "Limit State Design of Reinforced Concrete", 2nd Edition, Prentice Hall of India, New Delhi, 2013.
3. Subramanian. N., "Design of Reinforced Concrete Structures", 1st Edition, Oxford University Press, 2014.
4. Relevant to IS codes (IS 456, IS 875, IS 13920, SP 16, SP 34)

CO-PO & PSO MAPPING: DESIGN OF REINFORCED CEMENT CONCRETE ELEMENTS

CO	PO												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	2	2	3	2	-	1	2	-	-	-	-	3	3	2	2
CO2	2	2	3	2	-	1	2	-	-	-	-	3	2	1	2
CO3	3	3	3	3	-	2	-	3	2	-	-	3	3	2	1
CO4	3	3	3	3	-	2	-	3	2	-	-	3	3	1	2
CO5	3	3	3	3	-	2	-	3	2	-	-	3	1	2	2
Avg.	3	3	3	3	-	2	2	3	2	-	-	3	3	2	2

24CE3502 **STRUCTURAL ANALYSIS – I** **L T P C**
3 0 0 3

COURSE OBJECTIVE:
Students are able to know the basic theory and concepts of classical methods of structural analysis and compute the SF,BM, Reaction etc..

UNIT I SLOPE DEFLECTION METHOD **9**
Continuous beams (two span only) and rigid frames (with and without sway) – Symmetry and antisymmetry – Simplification for hinged end – Support displacements

UNIT II MOMENT DISTRIBUTION METHOD **9**
Distribution and carryover of moments – Stiffness and carry over factors – Analysis of continuous beams – Plane rigid frames with and without sway – Neylor's simplification.

UNIT III FLEXIBLITY METHOD OR (FORCE METHOD) **9**
Primary structures - Compatibility conditions - Formation of flexibility matrices - Analysis of indeterminate pin-jointed plane frames, continuous beams by direct flexibility approach.

UNIT IV STIFFNESS METHOD OR (DISPLACEMENT 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.

UNIT V PLASTIC ANALYSIS **9**
Basis of plastic analysis and design - Material behavior - Cross-section behavior - Plastic moment of resistance - Plastic modulus - Shape factor - Load factor - Plastic hinge and mechanism - Static and kinematic methods - Upper and lower bound theorems - Plastic analysis of indeterminate beams and frames.

COURSE OUTCOMES:
On completion of this course, the student is expected to be able to:

CO1 Analyze the continuous beams and rigid frames by slope defection method
CO2 Understand the concept of moment distribution and analysis of continuous beams and rigid frames with and without sway
CO3 Analyze the indeterminate pin jointed plane frames and continuous beams using direct flexibility method
CO4 Understand the concept of direct stiffness method and analysis of continuous beams, pin jointed trusses and rigid plane frames
CO5 Explore the basis of plastic analysis and design of structures

TEXTBOOKS:

1. Reddy C. S., "Basic Structural Analysis", Tata McGraw Hill Publishing Company, 2005.
2. Punmia B. C., Ashok Kumar Jain and Arun Kumar Jain, "Theory of structures (SMTS 2)", Laxmi Publications, 2004.
3. Vaidyanathan R. and Perumal P., "Structural Analysis, Vol. 2", Laxmi Publications, 2017.

REFERENCES:

1. Punmia B. C., Ashok Kumar Jain & Arun Kumar Jain, "Theory of structures (SMTS 2)", Laxmi Publications, New Delhi, 2017.
2. Hibbeler R. C., "Structural Analysis", VII Edition, Prentice Hall, 2012.
3. Bhavikatti S. S., "Matrix Methods of Structural Analysis", I.K. International Publishing House Pvt. Ltd., New Delhi, 2014.
4. Vaidyanathan R., Perumal P. & Abdul Aleem M. I., "Structural Analysis, Vol. 3", Laxmi Publications, New Delhi, 2020.
5. Bhavikatti S. S., "Structural Analysis Vol. 2", Vikas Publishing House Pvt. Ltd., New Delhi, 2016.

CO-PO&PSO MAPPING:STRUCTURALANALYSIS–I

CO	PO												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
1	3	3	2	3	2	2	2	3	1	1	1	2	3	3	2
2	3	3	3	3	2	3	2	3	1	1	1	2	3	2	2
3	3	3	3	3	2	3	2	3	1	1	1	2	3	3	2
4	3	3	3	3	2	2	2	2	1	1	1	2	3	2	2
5	3	3	3	3	2	3	2	3	1	1	1	2	3	3	2
Avg.	3	3	3	3	2	3	2	3	1	1	1	2	3	3	2

- 1'=Low; '2'=Medium;'3'=High

24CE3503 **FOUNDATION ENGINEERING** **L T P C**
3 0 0 3

COURSE OBJECTIVES
The course aims to provide students with a strong understanding of subsurface investigation techniques and the selection of suitable foundations based on soil conditions. It focuses on analyzing the behavior and design principles of shallow foundations, footings, rafts, piles, and retaining structures. Students will be able to interpret field test data, evaluate bearing capacity, settlement, and earth pressure, and apply codal provisions for safe and efficient geotechnical design.

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 - Selection of foundation based on soil condition - Bore log report.

UNIT II 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 - 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 - 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 (Feld'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.

UNITV 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 Graphical method - Pressure on the wall due to line load - Stability analysis of retaining walls.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

On Completion of the course, the students should be able to:

CO1 Plan and execute site investigation, interpret bore logs and field test data, and recommend appropriate foundations based on soil properties.

CO2 Determine the bearing capacity and settlement of shallow foundations using analytical, empirical, and codal methods for both granular and clayey soils.

CO3 Proportion isolated, combined footings and raft foundations considering contact pressure, settlement behavior, and codal requirements.

CO4 Evaluate the load carrying capacity and settlement of single piles and pile groups, analyze negative skin friction and uplift, and interpret routine pile load tests

CO5 Compute active and passive earth pressures using Rankine and Coulomb theories, assess stability of retaining walls, and analyze earth pressure variations due to surcharge loads.

TEXTBOOKS:

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

REFERENCES:

1. Das, B.M., "Principles of Geotechnical Engineering". Brooks / Coles / Thompson Learning Singapore, 8th Edition, 2013.
2. Punmia, B.C., "Soil Mechanics and Foundations", Laxmi Publications Pvt. Ltd. New Delhi, 2005
3. Kaniraj, S.R. "Design aids in Soil Mechanics and Foundation Engineering", Tata McGraw Hill publishing company Ltd., New Delhi, 2002.
4. Varghese, P.C., "Foundation Engineering", Prentice Hall of India Private Limited, New Delhi, 2005.
5. IS6403:1981, "Code of Practice for determination of bearing capacity of shallow foundation".
6. IS 1904: 2021 / 1986, "Code of Practice for Design and Construction of Foundations".
7. IS 2950 (Part 1): 2010, "Code of Practice for Design and Construction of Raft Foundations – Part 1 (Design)".

COs- PO's & PSO's MAPPING

CO	PO												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
1	2	3	2	2	3	3	3	2	2	2	2	3	3	3	3
2	3	2	3	2	3	2	3	2	2	2	2	3	3	2	2
3	3	3	2	2	2	2	2	2	2	2	2	3	3	2	2
4	2	3	3	2	2	2	2	2	2	2	2	3	3	2	2
5	3	3	2	2	2	2	2	2	2	2	2	3	3	2	3
Avg.	3	3	2	2	2	2	2	2	2	2	2	3	3	2	2

24CE3512 **SURVEY CAMP (2 weeks)** **L T P C**
0 0 0 1

COURSE OBJECTIVES:

The objective of the survey camp is to enable the students to get practical training in the field work. Groups of not more than six members in a group will carry out each exercise in survey camp. At the end of the camp, each student shall have mapped and contoured the area. The camp record shall include all original field observations, calculations and plots.

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

1. Traverse – using Theodolite / Total station (Closed Traverse)
2. Preparing a Contour map (Direct Method)

(i). Radial tachometric contouring - Radial Line at Every 45 Degree and Length not less than 60 Meter on each Radial Line

(ii). Block Level/ By grid of size at least 100 Meter x 100 Meter atleast 20 Meter interval

(iii). L.S & C.S - Road and canal alignment using LS & CS. L.S at Every 30M and C.S at every 90 M

3. Offset of Buildings and Plotting the Location
4. To Determine the Azimuth of Sun using Extra Meridian observation on Sun
5. Use of GPS to determine latitude and longitude and locate the survey camp location
6. Traversing using GPS
7. Setting out of Simple circular curve using Rankine and Deflection angle method

Apart from above students may be given survey exercises in other area also based on site condition to give good exposure on survey.

COURSE OUTCOMES

On completion of the course, the student is expected to be able to

CO1 Able to use and work with total Station, EDM etc.
CO2 Apply modern surveying techniques in field to establish horizontal control.
CO3 Understand the surveying techniques in field to establish vertical control
CO4 Adjustment of Errors and apply correction.
CO5 Carry out different setting out works in the field for a building using Center lime Method

COs- PO's & PSO's MAPPING

CO	PO												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
1	3	3		3	3	3	2	2	2	2	2	3	3	3	3
2	3	3		3	3	3	2	2	2	2	2	3	3	3	3
3	3	3	2	3	3	2	2	2	3	2	2	3	3	3	3
4	3	3	2		3	2	2	2	2	2	2	3	3	3	3
5	3	3	2		3	2	2		2	2	2	3	3	3	3
Avg.	3	3	2	3	3	2	2	2	2	2	2	3	3	3	3

24TP3501	SKILL ENHANCEMENT – V	L T P C 0 0 2 1

COURSE OBJECTIVE

To enhance students' personal and professional development through self-discovery, grooming, effective communication, positive attitude building, and digital productivity. This course aims to foster confidence, creativity, professional etiquette, and essential workplace skills for academic and career success.

UNIT I QUANTITATIVE ABILITY

- Probability Applications in Hiring Assessments
- Number System (Advanced problem types)
- Statistics: Distribution types, Outliers, Skewness
- Variance & Standard Deviation for real-world analytics
- Area & Mensuration – Industry case-based problems

Activities

- **Solve 20 industry-based quantitative aptitude problems**
- **Perform variance & standard deviation calculation using real datasets**

UNIT II VERBAL ABILITY

- Direct & Indirect Speech – advanced contextual usage
- Active–Passive Voice transformations in professional writing
- Applied Tenses for workplace & technical communication
- Vocabulary Building – domain-based word banks (IT, business, HR)

Activities

- **Convert informal statements into formal business email language**
- **Rewrite 10 sentences using proper tense & voice transformation**

UNIT III REASONING ABILITY

- Blood Relations – symbolic & coded
- Logical Arrangement & Ranking
- Direction-based reasoning
- Data Interpretation – charts & tables used in placements

Activities

- Reasoning test (Blood relations, Directions, Ranking)
- Solve logical arrangement puzzles

UNIT IV – Employability Aptitude

- Error spotting in professional communication
- Reading & interpreting English passages
- Word usage in business contexts
- Grammar application in real-time scenarios
- Pattern-based language solving

Activities

- **Peer-review: Correct real-world grammatical errors in office communication**
- **Comprehension practice (short business passages)**

UNIT V – Workplace Communication & Career Readiness

- Foundations of workplace messaging
- Business email writing (formal tone, agenda clarity)
- Resume fundamentals – first resume creation
- Skills mapping & achievement recording
- LinkedIn basics – headline, skills, visibility
- Identifying internship opportunities
- Digital learning platforms—Coursera/Udemy/TCS iON credential showcasing

Activities

- Create first professional resume (mandatory)
- Draft 3 internship-request emails
- Build LinkedIn headline & about section

COURSE OUTCOMES

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

CO1: Apply quantitative and statistical methods to solve aptitude-based problems.

CO2: Use refined grammar and vocabulary to improve written communication.

CO3: Solve reasoning-based analytical problems accurately.

CO4: Interpret and correct language errors in contextual usage.

CO5: Prepare internship-oriented resumes and build an initial LinkedIn presence for career readiness.

COs- PO's & PSO's MAPPING

CO	PO												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
1	3	3	0	2	1	0	0	0	2	0	0	2	1	3	2
2	0	0	0	0	2	0	0	0	3	0	1	2	-	1	2
3	3	3	0	2	0	0	0	0	2	0	0	2	1	3	2
4	0	0	0	0	3	0	0	0	2	0	2	2	-	1	1
5	0	0	0	0	3	0	0	0	3	0	3	3	-	-	3
Avg.	**1**	**1**	**0**	**1**	**2**	**0**	**0**	**0**	**2**	**0**	**1**	**2**	**0**	**2**	**2**

REFERENCES:

1. Aggarwal, R. S., *Quantitative Aptitude for Competitive Examinations*, S. Chand Publishing, 2022.
2. Aggarwal, R. S., *A Modern Approach to Verbal & Non-Verbal Reasoning*, S. Chand Publishing, 2021.
3. Raman, M. and Sharma, S., *Technical Communication: Principles and Practice*, Oxford University Press, 2019.
4. Guffey, M. E. and Loewy, D., *Business Communication: Process and Product*, Cengage Learning, 2018.
5. Yate, M., *Knock 'em Dead Resumes: A Killer Resume Gets More Job Interviews!*, Adams Media, 2016.

24CE3601 **DESIGN OF STEEL STRUCTURES** **L T P C**
3 1 0 4

COURSE OBJECTIVE:

To design the steel structures as per limit state method for various industrial and framed structures as per the recommendations of IS: 800 – 2007.

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 MEMBERS 9

Behavior and design of simple and built-up members subjected to tension - Shear lag effect - Design of lug angles - Tension splice.

UNIT III DESIGN OF COMPRESSION MEMBERS 9

Design of simple and built-up compression members with lacings and battens - Design of column bases - Slab base and gusseted base.

UNIT IV FLEXURAL MEMBERS 9

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

UNIT V INDUSTRIAL STRUCTURES 9

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

TOTAL: 45 PERIODS

COURSE OUTCOMES:

On completion of this course, the student is expected to be able to:

CO1 Identify the different failure modes of bolted and welded connections, and to determine their design strengths

CO2 Select the most suitable section shape and size for tension members as per specific design criteria

CO3 Design laterally supported and unsupported beams

CO4 Select the most suitable section shape and size for compression members according to specific design criteria

CO5 Identify and compute the design loads on Industrial structures, and gantry girder

TEXT BOOKS:

1. Gambhir M. L., "Fundamentals of Structural Steel Design", McGraw Hill Education India Pvt. Ltd., 2013.
2. Subramanian N., "Design of Steel Structures", Oxford University Press, New Delhi, 2013.
3. Duggal S. K., "Limit State Design of Steel Structures", Tata McGraw Hill Publishing Company, 2005.

REFERENCES:

1. Narayanan R. et. al., "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. Sai Ram K. S., "Design of Steel Structures", Dorling Kindersley (India) Pvt. Ltd., New Delhi, 2nd Edition, 2015,
6. Shiyekar M. R., "Limit State Design in Structural Steel", Prentice Hall of India Pvt. Ltd., 2nd Edition,2013.

CO-PO&PSOMAPPING:DESIGN OF STEEL STRUCTURES

CO	PO												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
1	3	2	3	2	2	1	1	1	1	1	1	1	3	3	3
2	3	2	3	2	2	2	1	1	1	1	1	1	3	3	3
3	3	2	3	2	2	2	1	1	1	1	1	1	3	3	3
4	3	2	3	2	2	2	1	1	1	1	1	1	3	3	3
5	3	3	2	2	2	1	1	1	1	1	1	1	3	3	3
Avg.	3	2	3	2	2	2	1	1	1	1	1	1	3	3	3

- 1"=Low; „2"=Medium;„3"=High

24CE3602 STRUCTURAL ANALYSIS II L T P C
3 0 0 3

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.
- Also to learn Plastic analysis of beams and rigid frames

UNIT I INFLUENCE LINES FOR DETERMINATE STRUCTURES 9

Introduction to moving loads, Concept of Influence Lines, Influence lines for reactions in statically determinate structures –Influence lines for shear force and bending moment in beam section – Calculation of critical stress resultants due to concentrated and distributed moving loads-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 support reactions, shearing force and bending moments for indeterminate beams - propped cantilevers, fixed beams and continuous beams.

UNIT III ARCHES 9

Arches -Eddy"s theorem-Types of arches – Analysis of three-hinged and two-hinged -Parabolic and circular arches-Settlement of support and temperature effects.

UNIT IV SUSPENSION BRIDGES 9

Analysis of suspension bridges – Unstiffened cables and cables with three hinged stiffening girders– Influence lines for three hinged stiffening girders

UNITV 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 - assumptions - axial force, shearing force and bending moment diagrams.

COURSE OUTCOMES:

CO1: Draw influence lines for statically determinate structures and calculate critical stress resultants
CO2: Understand Muller Breslau principle and draw the influence lines for statically indeterminate beams.
CO3: Analyse of three hingedand two hinged parabolic and circular arches.
CO4: Analyse the suspension bridges with stiffening girders
CO5: Analys HYDE rigid frames by approximate methods for gravity and horizontal loads.

TEXTBOOKS:

1. Bhavikatti,S.S, Structural Analysis,Vol.1 & 2, Vikas Publishing House Pvt.Ltd., NewDelhi-4, 2014.
2. Punmia.B.C, Ashok Kumar Jain and Arun Kumar Jain, Theory of structures, Laxmi, Publications,2004.

REFERENCES:

1. Negi.L.S and Jangid R.S ., Structural Analysis , Tata McGraw-Hill Publishers, 2004.
2. Reddy C.S., Basic Structural Analysis, Tata McGraw Hill Publishing Co. Ltd., Third Edition, 2010.
3. Gambhir.M.L., Fundamentals of Structural Mechanics and Analysis, PHI Learning Pvt. Ltd., 2011.
4. Vazrani.V.N And Ratwani,M.M, Analysis of Structures, Vol.II, Khanna Publishers,2015.

CO-PO&PSO MAPPING:STRUCTURALANALYSIS–II

CO	PO												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
1	3	3	2	3	2	2	2	3	1	1	1	2	3	3	2
2	3	3	3	3	2	3	2	3	1	1	1	2	3	2	2
3	3	3	3	3	2	3	2	3	1	1	1	2	3	3	2
4	3	3	3	3	2	2	2	2	1	1	1	2	3	2	2
5	3	3	3	3	2	3	2	3	1	1	1	2	3	3	2
Avg.	3	3	3	3	2	3	2	3	1	1	1	2	3	3	2

- 1"=Low; „2"=Medium; „3"=High

24CE3611 STRUCTURAL DRAWING AND DETAILING LABORATORY L T P C
0 0 4 2

COURSE OBJECTIVE:

To impart knowledge and skill relevant to Building drawing and Detailing lab using computer software

LIST OF EXPERIMENTS

1. Principles of planning and orientation
2. Buildings with load bearing walls and RCC roof (Plan , section , elevation)
3. Buildings with sloping roof
4. Buildings with Framed structure Building information modeling.
5. Reinforcement details of RCC structural elements (slab, beam and column)
6. Reinforcement details of footings (Isolated, stepped, combined rectangular footing)
7. Steel structures (Steel Connections detailing, beam to column connection, beam to beam connection – bolt & Weld, Roof truss & purlin)

TOTAL : 60 PERIODS

REFERENCES:

1. V.B.Sikka, "A course in Civil Engineering Drawing" S.K.Kataria & Sons Publishers, Seventh Edition, 2015.
2. D.N.Ghose, "Civil Engineering Drawing and Design" CBS Publishers & Distributors Pvt.Ltd., 2nd Edition, 2010.
3. National Building Code of India 2016 (NBC 2016)
4. Unnikrishna Pillai and Devdas Menon, Reinforced Concrete Design (Third Edition), Tata Mc Graw Hill Publishing Company Ltd., New Delhi, 3rd Edition, 2017.
5. Subramanian N, Design of Steel Structures, Oxford University Press, New Delhi, 2016

COURSE OUTCOME

On completion of the course, the student is expected to be able to

CO1 Draft the plan, elevation and sectional view of the load bearing and framed buildings
CO2 Draw the structural detailing of RCC elements
CO3 Draw the structural detailing of RCC water tanks, footings and retaining walls
CO4 Draw the structural detailing of steel structures
CO5 Draft the structural detailing of Industrial structures

COs- PO's & PSO's MAPPING

CO	PO												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
1	3	-	-	-	2	-	-	1	-	-	-	1	3	2	-
2	3	2	-	-	2	3	-	2	3	2	-	2	3	2	2
3	3	2	-		2	3	-	2	3	2	-	2	3	2	2
4	3	2	-	2	2	3	-	1	3	2	-	2	3	2	2
5	3	2	-	2	2	3	-	2	3	2	-	2	3	2	2
Avg.	3	2	-	2	2	3	-	2	3	2	-	2	3	2	2

24TP3601	SKILL ENHANCEMENT – VI	L T P C 0 0 2 1

COURSE OBJECTIVE

- This course aims to strengthen students‟ advanced quantitative, verbal, and logical reasoning abilities to successfully tackle complex aptitude and analytical assessments required for competitive placements.
- This course aims to build students‟ professional readiness through advanced resume and portfolio development, cover letter creation, and effective workplace communication for successful career presentation and engagement.

UNIT I QUANTITATIVE ABILITY

- Permutation & Combination (combinatorial thinking)
- Surds & Indices (exponent simplification)
- Geometry – advanced property-based problems
- Trigonometry – identities & applications in engineering

Activities

- Solve previous-year national-level aptitude tests (TCS NQT / AMCAT / CoCubes)

UNIT II VERBAL ABILITY

- One-word substitution
- Sentence completion
- Data-arrangement in language contexts
- Vocabulary expansion – roots, etymology, prefixes/suffixes

Activities

- Build a vocabulary bank using root-based technique
- Practice one-word substitution exercises

UNIT III REASONING ABILITY

- Critical reasoning arguments
- Clock reasoning
- Calendar reasoning
- Puzzle Tests (seating, floor, distribution, multi-layer constraints)

Activities

- Solve 10 advanced puzzles (including clock & calendar reasoning)
- Floor/seating arrangement puzzle-solving worksheets

UNIT IV CREATIVE & ANALYTICAL ABILITY

- Para-jumbles
- Vocabulary analytics – semantic clusters
- Image analysis
- Grouping & visual recognition
- Pattern identification problems

Activities

- Perform visual pattern recognition tasks
- Semantic-cluster vocabulary mapping

UNIT V ADVANCED CAREER READINESS SKILLS

- Advanced Resume tailoring (role-focused, ATS-optimized)
- STAR storytelling for experience & achievements
- Professional cover letters
- Specialized internship/job-oriented emails
- GitHub portfolio creation
- Showcasing project repositories
- Presentation & articulation for interviews
- PPT design for final-year project reviews

Activities

- Create a role-specific ATS-optimized resume
- Prepare a PPT for final-year project presentation
- Draft a professional cover letter

COURSE OUTCOMES

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

CO1: Apply advanced quantitative concepts to solve complex aptitude assessments.
CO2: Improve verbal reasoning & structured language use.
CO3: Solve multi-layer logical puzzles and analytical reasoning tasks.
CO4: Demonstrate enhanced creative, linguistic & visual reasoning.
CO5: Develop advanced resumes, personal branding, GitHub & professional presentations.

COs- PO's & PSO's MAPPING

CO	PO												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
1	3	3	0	2	1	0	0	0	1	0	0	2	1	3	2
2	0	0	0	0	2	0	0	0	3	3	1	2	–	1	2
3	3	3	0	2	0	0	0	0	2	0	1	2	1	3	2
4	2	2	0	1	2	0	0	0	2	1	1	2	–	1	2
5	0	0	0	0	3	0	0	0	3	3	3	3	–	–	3
Avg.	**2**	**2**	**0**	**1**	**2**	**0**	**0**	**0**	**2**	**1**	**1**	**2**	**0**	**2**	**2**

PROFESSIONAL ELECTIVE COURSES: VERTICALS

VERTICAL I: STRUCTURES

24CE3001 **CONCRETE STRUCTURES** **L T P C**
3 0 0 3

COURSE OBJECTIVE

To acquire hands on experience in design and preparation of structural drawings for concrete / steel structures for practicing Civil Engineers using Computer Software Staad Pro, E-Tabs and any Structural design and analysis Software.

UNIT I INTRODUCTION AND CODES 9

Geometric Parameters, Grade of concrete and steel for different elements, Exposure and cover requirements, Fire rating, Load Combinations, Serviceability Requirements, Analysis tools. Indian & International Codes for Reinforced concrete Design, Design loads, National Building Code 2016, Practical building example, drawing sizes and scale.

UNIT II LOADS ACTING ON STRUCTURES 9

Introduction, Dead, Live loads, Wind loading and Calculations of - force coefficients, Wind pressure, storey forces and base shears. Earthquake loading and Calculations of - acceleration coefficient, Time period, Base shear.
Scheme Design, Concrete floor systems, Sizing and design of various slab systems, Beams, Reinforced Concrete Columns - Location and Shape, Design Axial Load, sizing, Lateral Load Systems, IS 1893- Requirements.

UNIT III MODELLING OF BASIC STRUCTURAL ELEMENTS 9

Introduction to Analysis & Modelling, Modelling of Cantilever, Portal Frame, three bay Portal Frame, 3D structural models - Geometry, gravity loads, defining earthquake loads, defining wind loads, Modelling Shear walls, Practical Structural Model of building, Structural models of Floor System, Estimation of deflections

UNIT IV DESIGN OF STRUCTURAL ELEMENTS 9

Design of Beams- flexural reinforcement, shear reinforcement, Design of flat slabs- Flexural Reinforcement, shear reinforcement, Design of 2-way continuous slabs.
Design of Reinforcements in Columns, Post processing, Design and arrangement of vertical reinforcement, horizontal reinforcement in the design of buildings.
Design of shear walls - Sizing of elements based on Constructability aspects like formwork, concrete placement and compaction, rebar arrangement to satisfy economy and optimum utilisation.

UNIT V DETAILING OF STRUCTURAL ELEMENTS 9

Development of Reinforcement, Typical details of- flat slabs, two-way continuous slabs, beams, columns and shear wall, detailing and documentation.

Case Studies : Structural analysis and design of a multi-storey building with load calculation (dead, live, wind and seismic) as per Indian standard codes using any Structural design and analysis Software.

TOTAL: 45 PERIODS

COURSE OUTCOMES

At the end of the course the student will able to

CO1 Plan a layout of a structure
CO2 Calculate loads using IS codes and various computational tools
CO3 Analyse the structure for various loads and load combination according to the relevant IS codes
CO4 Design and Analysis of structures using computer software/tools
CO5 Prepare the complete structural drawings using computer software

REFERENCES

1. Unnikrishna Pillai, S., Devdas Menon, “Reinforced Concrete Design”, Tata McGraw Hill Publishing Company Ltd., 2009.
2. Gambhir.M.L., "Fundamentals of Reinforced Concrete Design", Prentice Hall of India Private Limited, New Delhi, 2006.
3. Krishnaraju.N “ Design of Reinforced Concrete Structurres “, CBS Publishers & Distributors Pvt. Ltd., New Delhi.
4. Sinha, S.N., “Reinforced Concrete Design”, Tata McGraw Hill Publishing Company Ltd., New Delhi, 2002.
5. Punmia.B.C., Ashok Kumar Jain, Arun Kumar Jain, “Limit State Design of Reinforced Concrete”,Laxmi Publication Pvt. Ltd., New Delhi, 2007.

COs- PO’s & PSO’s MAPPING

CO	PO												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
1	3	-	3	-	2	1	-	3	1	-	1	3	3	1	2
2	3	-	-	2	1	-	-	-	1	-	1	-	3	1	2
3	3	2	-	3	3	-	-	3	1	2	1	-	3	2	3
4	3	3	2	3	3	-	-	1	1	-	1	2	2	3	3
5	3	3	2	3	3	-	2	1	1	-	1	2	2	3	3
Avg.	3	3	2	3	3	1	2	3	1	2	1	2	3	3	3

24CE3002 ADVANCED CONCRETE STRUCTURES L T P C

3 0 0 3

UNIT I DESIGN OF LONG COLUMNS AND DEEP BEAMS 9

Design of long column subjected to biaxial bending moment and axial load, SP 16. Behavior of deep beams - Designs as per IS 456 - 2000.

UNIT II CHECK FOR SERVICEABILITY 9

Limit State of Serviceability - calculation of deflection and cracking - Check for deflection and cracking as per IS 456 - 2000.

UNIT III DESIGN OF FLAT SLAB AND GRID FLOOR 9

Grid and coffered floors, general features, rigorous and approximate method of analysis and design of grid floor - Design of flat slab with and without drop, column and middle strip, proportioning of flat slab element as per IS 456-2000

UNIT IV LIMIT ANALYSIS 9

Limit Analysis of RCC structures - Fundamental principles, concept of moment redistribution - moment rotation characteristics permissible rotation capacity - Cambridge method - A.L.L. Baker's method of Limit analysis.

UNIT V TALL STRUCTURES 9

Analysis of R.C. Chimneys by Elastic theory - Design by LSD. Design of square bunker using Rankine's theory. Design of circular Silo using Jansen's theory and Airy's theory (Derivation not required for both theories).

COURSE OUTCOMES

Upon completion of this course the students will be able to

CO1: Design long columns under biaxial bending and axial loads and deep beams, handling complex bending scenarios in concrete elements.

CO2: Assess deflection and cracking in concrete structures using Limit State of Serviceability principles. Effectively controlling deflection and cracking within permissible limits to ensure structural functionality.

CO3: Analysis and design of grid floors and flat slabs with/without drops, employing both rigorous and approximate methods.

CO4: Apply limit analysis principles to assess ultimate bearing capacity of RCC structures.

CO5: Evaluate and apply appropriate theories to design diverse tall structures in selecting and implementing suitable methods for each scenario. Apply IRC codes to design single-span slab bridges for A Class loading (two lanes).

TOTAL: 45 PERIODS

TEXT BOOK

1. ―Limit State Design of Reinforced Concrete‖ by P.C. Varghese, PHI Learning Private
2. "Advanced Reinforced Concrete Design" by Krishna Raju N., CBS Publishers and Distributors, Delhi, 2016.

REFERENCES

1. ―Plain and Reinforced Concrete" by Jain and Jai Krishna., Nem Chand Brothers, Roorkee, 2010.
2. IS 456:2000 Plain and Reinforced Concrete, Bureau of Indian Standards (BIS).
3. SP 16 Design Aids for Wind Loading on Helical Piles, BIS.
4. ―Limit State Design of Concrete Structures‖ by M.L. Gambhir, Macmillan India Ltd., Delhi, 2011.
5. ―Design of Reinforced Concrete‖ by Structures,S. Ramamrutham, Dhanpat Rai Publishing Company (P) Ltd., New Delhi, 2011.

CO - PO & PSO MAPPING

CO	PO												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
1	3	-	3	-	-	-	-	-	-	-	-	-	3	-	-
2	3	-	3	-	-	-	-	-	-	-	-	-	3	-	-
3	3	-	3	-	-	-	-	-	-	-	-	-	3	-	-
4	3	-	2	-	-	-	-	-	-	-	-	-	3	-	-
5	3	-	3	-	-	-	-	-	-	-	-	-	3	-	-
Avg.	3	-	3	-	-	-	-	-	-	-	-	-	3	-	-

1 – Low, 2 – Medium, 3 – High

24CE3003 **STEEL STRUCTURE** **L T P C**
3 0 0 3

COURSE OBJECTIVES

- To acquire hands on experience in design and preparation of structural drawings for steel structures like industrial buildings, steel framed buildings using structural design software and detailed drawing softwares
- To introduce the students to design of light gauge steel structures

UNIT I DESIGN ASPECTS AND LOADS ON A STEEL BUILDING 9

Inputs for the design of a steel building - Design basis report, covering Site Data, geometrical, functional and structural requirements for its end usage - material specifications - Methods of designing a steel building. Calculating the various loads acting on a steel building - Vertical & Lateral loads - Effects of each loads separately and in combination – Dead, superimposed dead, live, temperature, MEP service loads - Lateral loads due to Wind and Seismic effects.

UNIT II SELECTION OF LOAD RESISTING SYSTEM AND MODELLING OF STRUCTURE 9

Studying the layout plans of the structure - Selection of load resisting systems - Load flow in each system - Satisfying Stability and strength of the structure - Vertical and Lateral load resisting systems
- Analysis and design of Sway and non-sway frames - Manual and Computer aided modelling, analysis and design - Geometric and structural parameters of the structure - Loading the structure - Interpretation of the results of the software – Analysis and Design of a multi-storeyed building.

UNIT III DESIGN OF VARIOUS ELEMENTS OF A STEEL BUILDING 9

Manual and Software aided design – Beams, columns, floors, bracings, purlins/girts and facades, base plates and anchor bolts – Various loads, different conditions of supports, exposure, and purpose of use - Design of Connections between the members – bolted and welded, moment and shear connections

UNIT IV DESIGN OF AN INDUSTRIAL BUILDING 9

Functional requirements - Serviceability Requirements - Structural Configurations - Selection of sections as per requirements - Configuration of the elements, connectivity - Analysis and design of different types of trusses — Design of Gantry Girders – Design of gable frames – Design of steel columns for combined loading - Analysis and design of industrial buildings - Study of General assembly drawings - Fabrication processes - Fabrication, logistics & erection – Sequence of erection - Inspection of a completed structure.

UNIT V DESIGN OF LIGHT GAUGE STEEL STRUCTURES 9

Philosophy of design of light gauge steel members, Direct Strength Method (DSM) ,Effective width method (EWM) – Concept of buckling, local buckling and post-buckling strength - Analysis and design of Compression members– Analysis and design of flexural members, Lateral buckling of beams, Shear Lag, Flange Curling – Design of wall panels

TOTAL : 45 PERIODS

COURSE OUTCOMES

Students will be able to

CO1 Plan the layout of the structure and calculate the loads of the steel structure.
CO2 Select a load resisting system, model the structure and interpret the results.
CO3 Design the various elements of a steel buildings
CO4 Design a typical industrial building
CO5 Design the various elements of a cold –formed steel buildings

TEXT BOOKS

1. Subramanian N, Design of Steel Structures, Oxford University Press, New Delhi, 2016
2. Negi L.S. "Design of steel structures" McGraw Hill Co., New Delhi, 2014
3. Duggal S.K., Design of Steel Structures, Tata McGraw Hill, Publishing Co. Ltd., New Delhi,2010

REFERENCES

1. Gambhir M L, Fundamentals of Structural Steel Design, McGraw Hill Education India Pvt Limited, 2013
2. Jack C. McCormac and Stephen F Csernak, Structural Steel Design, Pearson Education Limited, 2013.
3. Sarwar Alam Raz, Structural Design in Steel, New Age International Publishers, 2014
4. Gaylord E H, Gaylord N C and Stallmeyer J E, "Design of Steel Structures", 3rd edition, McGraw Hill Publications, 1992.
5. Salmon, Johnson & Malhas," Steel Structures: Design and Behavior, 4th Edition, Harper Collins College Publisher, 1996
6. Bhavikatti S.S, Design of Steel Structures, Ik International Publishing House, New Delhi,2017.
7. Wie Wen Yu, Design of Cold Formed Steel Structures, McGraw Hill Book Company, 1996
8. www.nptel.ac.in
9. http://www.steel-insdag.org/TM_Contents.asp

INDIAN STANDARD CODES

1. IS: 800 – 2007, Code of Practice for general construction in steel, BIS, New Delhi
2. SP 6 (1) – Structural steel sections
3. IS 875 (1-5) - 1987 Code of practice for Design Loads (Other than Earthquake) for Buildings and Structures, BIS
4. IS 816 :1969 - Code of practice for Metal Arc Welding for general Construction in Mild Steel, BIS
5. IS: 808 – 1989 Dimensions For Hot Rolled Steel Beam, Column, Channel and Angle Sections.

COs- PO's & PSO's MAPPING

CO	PO												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
1	3	2	1	-	2	-	-	1	-	2	1	2	3	2	3
2	3	2	1	-	2	-	1	1	1	1	-	1	3	2	3
3	3	3	2	2	2	-	1	2	1	1	-	1	3	3	3
4	3	2	2	1	2	1	2	2	2	1	1	2	3	3	3
5	3	3	2	1	2	1	2	2	1	1	1	2	3	3	3
Avg.	3	2	2	1	2	1	1	2	1	1	1	2	3	3	3

24CE3004 **PREFABRICATED STRUCTURES** **L T P C**
3 0 0 3

COURSE OBJECTIVES:

- To introduce the basic concepts of prefabrication
- To acquire the knowledge of prefabrication components and systems
- To understand the design principles in prefabrication
- To perceive the types of joints and connections in structural members
- To impart knowledge about the structural stability.

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

COURSE OUTCOMES

Students will be able to

CO1 Understand concepts about principles of prefabrication, production, transportation, erection.
CO2 Acquire knowledge about panel systems, slabs, beams, shear walls and columns used in precast construction.
CO3 Acquire knowledge about design of cross section, joint flexibility.
CO4 Acquire knowledge about joints and connection in precast construction.
CO5 Acquire knowledge about structural stability.

TEXTBOOKS

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.

REFERENCES

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.

COs- PO's & PSO's MAPPING

CO	PO												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
1	3	3	3	3	3	3	1	3	3	2	1	2	3	2	2
2	3	1	2	1	1	3	1	3	1	2	1	2	3	2	2
3	3	3	3	3	3	3	1	3	2	2	1	2	3	2	2
4	3	2	2	2	1	3	1	3	1	2	1	2	3	2	2
5	3	2	3	3	1	3	1	3	1	2	1	2	3	2	2
Avg.	3	2	3	2	2	3	1	3	2	2	1	2	3	2	2

24CE3005 REHABILITATION / HERITAGE RESTORATION L T P C
3 0 0 3

COURSE OBJECTIVE

To acquire the knowledge on quality of concrete, durability aspects, causes of deterioration, assessment of distressed structures, repairing of structures, 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

Students will be able to

CO1 Know the importance of inspection and maintenance.
CO2 Study the Impacts of cracks, corrosion and climate on structures.
CO3 Know about various special concretes
CO4 Understand 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.

REFERENCES

1. Hand book on Seismic Retrofit of Buildings, CPWD and Indian Buildings Congress, Narosa Publishers, 2008.
2. Hand Book on "Repair and Rehabilitation of RCC Buildings" – Director General works CPWD, Govt of India , New Delhi – 2002
3. P.C.Varghese, Maintenance Repair and Rehabilitation & Minor works of building, Prentice Hall India Pvt Ltd 2014.
4. Dodge Woodson, Concrete Structures, Protection, Repair and Rehabilitation, Butterworth-Heinemann, Elsevier, New Delhi 2012

COs- PO's & PSO's MAPPING

CO	PO												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
1	3	2	3	-	-	-	1	1	2	-	-	1	-	-	-
2	3	2	3	-	-	-	1	1	1	-	-	1	1	1	1
3	3	2	3	-	-	-	1	1	1	-	-	1	1	-	2
4	2	2	3	-	-	-	1	1	1	-	-	1	-	1	-
5	2	2	3	-	-	-	1	1	1	-	-	1	-	2	2
Avg.	3	2	3	-	-	-	1	1	1	-	-	1	1	1	2

24CE3006 INTRODUCTION TO FINITE ELEMENT METHOD L T P C
3 0 0 3

COURSE OBJECTIVE

To develop a thorough understanding of the finite element analysis techniques with an ability to effectively use the tools of the analysis for solving practical problems arising in Civil Engineering.

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 Continua 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

COURSE OUTCOMES

CO1 to understand the basics of finite element formulation.
CO2 to formulate the stiffness matrix for beam, truss and framed structures.
CO3 to apply finite element formulations to solve one-dimensional problems.
CO4 to apply finite element method to solve two dimensional problems.
CO5 to apply finite element method to analyze plate bending problems.

TEXT BOOKS

1. Rao, S.S., "The Finite Element Method in Engineering", 6th Edition, ButterworthHeinemann,2018.
2. Reddy,J.N. "Introduction to the Finite Element Method", 4thEdition, Tata McGrawHill,2018.

REFERENCES

1. Krishnamoorthy, C. S, Finite Element Analysis - Theory and Programming, McGraw - Hill, 1995.
2. David Hutton, Fundamentals of Finite Element Analysis, Tata McGraw Hill Publishing Company Limited, New Delhi, 2005.
3. G.R. Liu and S.S.Quek, Finite Element Method: A Practical Course, Butterworth-Heinemann; 1st edition (21 February 2003)
4. Chennakesava R. Alavala Finite Element Methods: Basic Concepts and Applications, Prentice Hall Inc., 2010.
5. R. T. Chandrupatla and A. D. Belegundu, Introduction to Finite Elements in Engineering, PHI Learning Pvt Ltd, New Delhi, 1997.
6. S. S. Bhavikatti, Finite Element Analysis, New Age Publishers, 2007.

COs- PO's & PSO's MAPPING

CO	PO												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
1	3	3	1	1	1	1	3	1	1	3	2	2	3	3	1
2	3	3	2	1	1	1	3	1	1	3	2	2	3	3	2
3	3	3	1	2	2	1	3	2	1	3	2	2	3	3	1
4	2	3	1	1	2	1	3	1	2	3	2	2	2	3	1
5	3	3	2	1	3	2	3	1	2	3	2	2	3	3	2
Avg.	3	3	2	2	2	1	3	1	2	3	2	2	3	3	2

24CE3007 ANALYSIS OF STRUCTURAL STABILITY L T P C 3 0 0 3

COURSE OBJECTIVE

To introduce the fundamental concepts of structural stability and to analyze the buckling behavior of columns, beam-columns, frames, and plates under different loading conditions.

UNIT I FUNDAMENTALS OF COLUMN STABILITY 9

Concept of equilibrium and stability – energy, imperfection, and vibration approaches to stability analysis – Governing differential equation for column buckling – Determination of critical load using equilibrium and energy methods – Approximate approaches: Rayleigh–Ritz and Galerkin's methods – Numerical solutions using finite difference method.

UNIT II STABILITY OF BEAM–COLUMNS AND FRAMES 9

Behavior of beam-columns – Stability analysis of beam-columns under concentrated, distributed loads, and end couples – Analysis of rigid-jointed frames with and without side sway – Application of stability functions to determine critical loads

UNIT III TORSIONAL AND LATERAL INSTABILITY 9

Torsional buckling – Combined torsional–flexural buckling – Local buckling in thin-walled members – Buckling of open sections – Lateral buckling of beams under uniform bending – Simply supported and cantilever cases.

UNIT IV STABILITY OF PLATES 9

Governing equation for thin plates – Buckling of rectangular plates under various edge conditions – Analysis by equilibrium and energy methods – Finite difference approach for plate buckling.

UNIT V INELASTIC AND POST-BUCKLING BEHAVIOUR 9

Tangent modulus and double modulus theories – Shanley's model for inelastic columns – Eccentrically loaded inelastic columns – Inelastic buckling of plates – Post-buckling strength and behavior of plates.

COURSE OUTCOMES (COs)

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

CO1 Describe the fundamental concepts of buckling and determine the critical load of columns using various methods.

CO2 Evaluate the stability of beam-columns and rigid frames subjected to different load conditions.

CO3 Interpret torsional, lateral, and local buckling behavior of thin-walled structural members.

CO4 Analyze the buckling of thin plates under different boundary conditions.

CO5 Assess the inelastic and post-buckling behavior of columns and plates.

COs- PO's & PSO's MAPPING

CO	PO												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
1	3	3	2	2	1	-	-	-	-	1	-	2	3	2	1
2	3	3	3	2	2	-	-	-	1	1	-	2	3	3	1
3	3	2	2	2	1	-	-	-	-	1	-	2	3	2	1
4	3	3	2	3	2	-	-	-	-	1	-	3	3	3	1
5	3	3	3	2	1	-	-	-	-	1	-	2	3	2	1
Avg.	3	3	2	2	1	-	-	-	-	1	-	2	3	2	1

24CE3008 ANALYSIS AND DESIGN OF STRUCTURES UNDER WIND AND CYCLONE EFFECTS

L T P C
3 0 0 3

COURSE OBJECTIVES

- To understand the characteristics of wind and cyclone forces acting on structures.
- To learn analysis and design methodologies for structures subjected to wind and cyclone effects.
- To gain knowledge of codal provisions and experimental methods in wind engineering

UNIT I WIND CHARACTERISTICS AND FUNDAMENTALS 9

Nature and characteristics of wind – Types and classification – Measurement and variation of wind velocity with height – Atmospheric boundary layer concepts – Shape factor, aspect ratio, drag and lift coefficients – Pressure and suction distribution – Gust factor – Spectral analysis and turbulence effects – Dynamic characteristics of wind.

UNIT II STRUCTURAL RESPONSE TO WIND LOADS 9

Classification of structures as rigid and flexible – Static and dynamic effects of wind on buildings – Vortex shedding and resonance – Crosswind and along-wind response – Wind effects on tall buildings, towers, and chimneys – Simplified methods for estimating wind-induced response.

UNIT III DESIGN FOR WIND LOADS 9

Design criteria as per IS 875 (Part 3), ASCE 7, and NBC provisions – Design methodology for tall buildings, industrial structures, chimneys, transmission towers, and monopoles – Load combinations and serviceability checks – Structural detailing for wind resistance.

UNIT IV CYCLONE LOADS AND RESISTANT DESIGN 9

Characteristics of cyclonic winds – Cyclone-prone regions – Effects on low-rise, sloped-roof, and tall buildings – Cladding performance under cyclones – Design of roof and wall cladding using codal guidelines – Analytical modeling of cyclone loads – Mitigation and design strategies for cyclone resistance.

UNIT V WIND TUNNEL TESTING AND ADVANCED STUDIES 9

Introduction to wind tunnel testing – Types of tunnels and models – Aerodynamic and aeroelastic modeling – Scaling and similitude requirements – Data acquisition and analysis – Prediction of acceleration, damping, and natural period – Load combinations for wind design – Case studies and interpretation of wind tunnel data.

TOTAL: 45 PERIODS

COURSE OUTCOMES (COs)

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

CO1 Explain the characteristics of wind and cyclone effects on structures.
CO2 Analyze the structural behavior under static and dynamic wind loading.
CO3 Apply relevant codal provisions to design wind- and cyclone-resistant structures.
CO4 Evaluate cladding and roofing systems subjected to cyclone pressures.
CO5 Interpret results from wind tunnel studies for use in practical design.

TEXTBOOKS / REFERENCES

1. Simiu, E. and Scanlan, R.H., *Wind Effects on Structures – Fundamentals and Applications to Design*, Wiley, 1996.
2. Cook, N.J., *The Designer's Guide to Wind Loading of Building Structures*, Butterworths, 1990.
3. Lawson, T.V., *Building Aerodynamics*, Imperial College Press, 2001.
4. IS 875 (Part 3): 2015 – *Design Loads (Other than Earthquake) for Buildings and Structures – Wind Loads.*
5. ASCE 7: *Minimum Design Loads and Associated Criteria for Buildings and Other Structures*.
6. Kareem, A., *Wind Engineering for Structural Design*, CRC Press, 2020.

COs- PO's & PSO's MAPPING

CO	PO												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
1	3	3	2	2	2	-	-	-	-	1	-	2	3	2	1
2	3	3	3	2	2	-	-	-	1	1	-	2	3	3	1
3	3	2	3	2	2	-	-	-	-	1	-	2	3	3	2
4	3	2	2	2	1	-	1	-	-	1	-	2	3	2	3
5	3	3	3	3	2	-	-	-	-	1	-	3	3	3	2
Avg.	3	3	3	2	2	-	-	-	-	1	-	2	3	3	2

VERTICAL II: CONSTRUCTION TECHNIQUES AND PRACTICES

24CE3009 FORM WORK ENGINEERING L T P C
3 0 0 3

COURSEOBJECTIVE:

On completion of this course the students will be able to know the detailed planning of form work, design of forms and erection of formwork.

UNIT I INTRODUCTION TO FORM WORK 9

Introduction to Formwork and false work, Temporary work systems, Requirements, Constructionplanningandsiteconstraints,Selection,andClassification(Types)ofFormwork,Generalobjectivesof formwork building - Planning for safety - Development of a Basic System - Key Areas of costreduction-Planningexamples-OverallPlanning-Detailedplanning-Overallprogramme-Detailedprogramme - Costing - Planning crane arrangements - Site layout plan - Transporting plant –Formwork beams-Scaffold frames-Framed panel formwork.

UNIT II FORM WORK MATERIALS ASSESORIES &PRESSURES 9

Formwork Materials, Accessories and consumables–Application of tools, Reconstituted wood-Steel – Aluminum Plywood - Types and grades Standard units - Corner units – Pass units, Calculation of labour constants-Formwork hours-Labour Requirement. Hardware and fasteners-Nails in Plywood - Allowable withdrawal load and lateral load. Pressures on formwork - Examples - Finish – Sheathing boards working stresses- Repetitive member stress Vertical loads for design of slab forms- Uplift on shores –Laterals loads on slabs and walls.

UNIT III FORMWORK DESIGN 9

Concepts, Formwork Systems – components, assembly, De-shuttering, safety of work and Design for Tall Structures, Foundation Wall, Column, Slab and Beam formworks .Design of Decks and Falseworks. Effects of various loads-Loading and moment of formwork, IS Code provisions.

UNIT IV FORMWORK FOR SPECIAL STRUCTURES 9

Formwork for Bridge Structures, Shells, Domes, Folded Plates, Overhead Water Tanks, Natural Draft Cooling Tower, Nuclear Reactor, Tunnel, Lift Shaft, stairs and Formwork for Precast Concrete. Various climbing system, Table lifting system.

UNIT V CASE STUDIES 9

Formwork failures: Causes of failures – Inadequate shoring inadequate bracing of members –improper vibration – Premature stripping Errors in design – Case studies – Finish of exposed concrete design deficiencies – Safety factors – Prevention of rotation – Stripping sequence – failure formwork issues in multi - story building construction – vertical and horizontal elements used in the industry.

TOTAL:45 PERIODS

COURSE OUTCOMES:

CO1 To understand the overall and detailed planning of form work.
CO2 To impart knowledge on formwork materials, accessories, pressures and labour requirement.
CO3 To develop the conceptual understanding of design, construction and erection of formwork.
CO4 To impart the knowledge about different types of form work used for special structures.
CO5 To understand the errors in design and judge the formwork failures through case studies.

TEXTBOOKS

1. Peurify R.Land Oberlender G.D,Form work for Concrete Structures, McGraw Hill Education India,2015
2. Jha KN, Formwork for Concrete Structures, Tata Mc Graw Hill Education, 2012.

REFERENCES:

1. Austin, C.K., Formwork forConcrete,Cleaver-HumePressLtd.,London,1996.
2. Hurd, M.K., Formwork for Concrete, Special PublicationNo.4 ,American Concrete Institute, Detroit,1996
3. Michael P. Hurst, Construction Press, London and NewYork,2003.
4. Christopher Souder, (2014),Temporary Structure Design, Wiley Publications, London.
5. IS14687:1999,Falsework for Concrete Structures- Guidelines, BIS.

COs-PO's & PSO's MAPPING

CO	PO												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
1	2	-	-	-	-	2	2	-	3	-	3	2	3	2	
2	3	3	3	2		-	2	-	3	-	2	2	3	3	3
3	3	3	3	2	2	-	-	-	3	-	2	2	3	3	3
4	2	3	-	-	-	-	-	-	2	-	2	2	3	2	3
5	2	1	2	3	-	-	-	-	2	-	3	2	3	2	1
Avg.	2	3	3	2	1	1	2	-	3	-	2	2	3	2	3

24CE30010 BUILDING INFORMATION MODELLING L T P C
3 0 0 3

COURSE OBJECTIVE

This course introduces modern construction techniques and equipment used in specialized projects like bridges, tunnels, and offshore works..

UNIT I BIM WITH BUILDING SYSTEMS 9

Review of Buildings and Systems- Building components and systems Integrating BIM in Construction Contracts-Contract Systems, Work Organization and Process Details.

UNIT II BIM MODELING WITH AUTODESK REVIT 9

BIM for modelling (Autodesk Revit) Model Support in Coordination, Creating Levels and Grids,Walls Modelling, Object Modification, Doors and Windows, Floors and Roofs, Curtain, Stairs and Ramps, Dimensions and Constraints, Annotation and Documentation.

UNIT III OPTIMIZING BUILDING DESIGN AND PERFORMANCE 9

Importing and modifying families of objects and elements, Clash Detection, Model Support in Coordination. BIM for Energy Analysis, Use of BIM for the Tasks of Energy Demand Calculation and Building Simulation. BIM for Construction Safety and Health.

UNIT IV INTEGRATING BIM FOR SAFER, MORE EFFICIENT CONSTRUCTION 9

Integrating BIM in the Safety Planning Process, Safety and BIM- Based Quantity Take-Off. BIM in Industrial Prefabrication for Construction

UNIT V BIM FOR PREFABRICATION & 3DPRINTING 9

BIM in Industrial Prefabrication for Construction- Production Models for Digital Production Methods. BIM for 3D Printing in Construction

COURSE OUTCOMES:

At the end of the course the student will be able to understand the output of construction equipment and machineries:

CO1 Integrate BIM within construction contracts, considering different systems, contract types, and project workflows

CO2 Create and modify building models in Autodesk Revit, applying best practices for efficient coordination and documentation

CO3 Analyze BIM for energy analysis, clash detection, and construction safety planning, optimizing building design and performance

CO4 Evaluate BIM into construction workflows for improved safety, efficiency, and quantity take-off.

CO5 Apply BIM for prefabrication production models and explore its potential for 3D printing in construction.

TEXT BOOK:

1. Building Information Modeling: BIM in Current Practice by Michael Gagnon, Flavius C. Bologea, Azhar Irani, 2019
2. BIM for Facility Management by Thomas O'Connor, Daniel Talbott,2019.

REFERENCES:

1. BIM for Structural Engineers: Leveraging Building Information Modeling for Efficient Structural Design and Analysis‖ by Behzad Razavi, 2019.
2. BIM for MEP Contractors: A Practical Guide to Integrating Mechanical, Electrical & Plumbing Systems into Building Information Models‖ by John Messner, 2018.
3. BIM for Architects: Integrating Design, Construction and Facility Management‖ by EddyKrygiel, John Frazer, 2018.
4. Digital Twins: Bridging the Physical and the Virtual World by Christoph Reinhart, Markus Bechmann, Daniel Menges, 2020.
5. BIM Handbook: Building Information Modeling for Owners, Managers, Designers, Engineers and Contractors‖ by Chuck Eastman, Paul Teicholz, Rafael Sacks, Kathleen Liston, 2018.

ONLINE RESOURCES:

1. **https://www.coursera.org/learn/bim-fundamentals**

COs-PO's & PSO's MAPPING

CO	PO												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
1	2	-	2	-	-	1	-	-	-	-	-	-	2	3	-
2	3	-		-	3	-	-	-	-	2	-	-	-	-	-
3	3	-	3	-	-	-	2	-	-	-	-	-	-	-	-
4	2	-		-	-	-	-	-	-	-	2	-	-	-	-
5	3	-	3	-	-	-	-	-	-	-	-	-	-	-	-
Avg.	3	-	3	-	3	1	2	-	-	2	2	-	2	3	-

24CE3011 SUSTAINABLE CONSTRUCTION AND LEAN CONSTRUCTION L T P C
3 0 0 3

COURSE OBJECTIVE:

To impart knowledge about sustainable construction and to understand the concepts of sustainable materials, energy calculations, green buildings and environmental effects.

UNIT I INTRODUCTION & MATERIALS USED IN SUSTAINABLE CONSTRUCTION 9

Introduction and definition of Sustainability - Carbon cycle - role of construction material: concrete and steel, etc. - CO2 contribution from cement and other construction materials - Recycled and manufactured aggregate-Role of QC and durability-Life cycle and sustainability.

UNIT II ENERGY CALCULATIONS 9

Components of embodied energy - calculation of embodied energy for construction materials -Energy concept and primary energy - Embodied energy-operational energy in conditioned building-Life Cycle energy use.

UNIT III GREEN BUILDINGS 9

Control of energy use in building –National Building Code(NBC), ECBC code, codes in neighboring tropical countries - OTTV concepts and calculations – Features of LEED and TERI – Griha ratings -Role of insulation and thermal properties of construction materials - influence of moisture content and modeling-Performance ratings of green buildings-Zero energy building'

UNIT IV CORE CONCEPTS IN LEAN 9

Introduction to the Course; Lean Overview; Need for Productivity Measurement and improvement; Productivity Measurement System (PMS).

UNITV LEANCONSTRUCTION TOOLSANDTECHNIQUES 9

Sampling/ Work Sampling; Survey/ Foreman delay survey; Value Stream/ Process Mapping– 5S ,Collaborative Planning System (CPS)/ Last Planner™ System (LPS) – Big Room Approach, IT/BIM and Lean, How to Start Practicing Lean Tools in Project Site.

TOTAL: 45 PERIODS

COURSEOUTCOMES:

On completion of the course, the student is expected to be able to

CO1 Describe the various sustainable materials used in construction.

CO2 Explain the method of estimating the amount of energy required for building.

CO3 Describe the features of LEED, TERI and GRIHA ratings of buildings.\

CO4 Explain the core concepts of lean construction tools and techniques and their importance in achieving better productivity.

CO5 Apply lean tools & techniques to achieve sustainability in construction projects.

REFERENCES:

1. Charles J Kibert, Sustainable Construction: Green Building Design & Delivery, 4th Edition, Wiley Publishers 2016.
2. Steve Good hew, Sustainable Construction Process, Wiley Blackwell,UK ,2016.
3. CraigA. Langston & GraceK.C. Ding, Sustainable Practices in the Built Environment , Butterworth Heinemann Publishers, 2011.
4. Ballard, G., Tommelein, I., Koskela, L. and Howell, G., Lean construction tools and techniques,2002.
5. Salem, O., Solomon, J., Genaidy, A. and Luegring, M., Site implementation and Assessment of Lean Construction Techniques, Lean Construction Journal,2005.

COs-PO's & PSO's MAPPING

CO	PO												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
1	2	-	1	1	-	2	3	1	1	-	2	1	3	2	3
2	3	1	3	2	1	2	2	-	1	1	1	2	3	2	3
3	2	2	3	1	1	1	1	-	-	-	3	1	3	3	3
4	3	1	3	2	2	1	3	1	1	1	3	2	3	3	3
5	3	1	2	2	2	2	3	1	-	1	3	2	3	3	3
Avg.	3	1	3	2	2	2	3	1	1	1	3	2	3	3	3

24CE3012 PROJECT PLANNING, SCHEDULING AND CONTROL L T P C

3 0 0 3

COURSE OBJECTIVE:

To provide students with knowledge of construction project management principles, lifecycle phases, resource planning, scheduling, contract and risk management, and the use of modern Construction 4.0 tools with emphasis on ethics, leadership, teamwork, and safety.

UNIT I FUNDAMENTALS OF CONSTRUCTION PROJECT MANAGEMENT 9

Introduction to Projects- Types of Projects- Introduction to Construction Project Management- Project Lifecycle and its Phases- Key Activities Involved in Different Project Lifecycle Phases- Role of Various Stakeholders in Different Project Lifecycle Phases- Project Organisation Structure and its Types.

UNIT II RESOURCE MANAGEMENT IN CONSTRUCTION 9

Gathering Project Requirements- Project Scope and Specifications- Project Scope Matrix- Project Contract Management- Work Breakdown Structure (WBS)- WBS Types- Creating WBS- Scope Management Steps and Processes

UNIT III PROJECT PLANNING AND SCHEDULING 9

Project Planning- Planning and Scheduling- Steps Involved in Project Planning- Networking and Non-Networking Techniques Scheduling Techniques, Gantt-Chart, Formulation and Applications of Critical Path Method (CPM), Program Evaluation & Review Technique (PERT) and Precedence Diagram Method (PDM), Introduction to Linear Scheduling Methods

UNIT IV CONTRACT ADMINISTRATION AND PROJECT GOVERNANCE 9

Time-Cost Tradeoff- Earned Value Management (EVM)- Crashing and Fast -tracking Projects- Resource Constrained Scheduling- Resource Levelling- Schedule Updation and Project Control

UNIT V DIGITAL AND TECHNOLOGICAL APPLICATION IN CONSTRUCTION MANAGEMENT 9

Software Applications and Use of AI in Project Planning- Scheduling and Control- Data- driven Decision Making

TOTAL: 45 PERIODS

COURSE OUTCOMES:

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

CO1 Explain the phases of the construction project lifecycle, management objectives, organization structures, and the roles and responsibilities of construction managers

CO2 Assess the manpower and machinery requirements for a project, including recruitment, motivation, welfare, and safety considerations

CO3 Develop project plans and schedules using CPM, PERT, and other planning tools for effective time and resource management.

CO4 Analyze and manage different types of contracts, handle disputes through arbitration, and apply ethical and leadership principles in construction management

CO5 Utilize computer applications and modern technologies such as Construction 4.0 tools for project planning, scheduling, and control

REFERENCES:

1. Oberlender,G.D.,& Oberlender,G.D.(1993).Project management for engineering And construction(Vol.2).NewYork:McGraw-Hill.
2. Sears,S.K.,Sears,G.A.,&Clough,R.H.(2010).Construction project management: A practical guide to field construction management. John Wiley &Sons.
3. Callahan,M.T.,Quackenbush,D.G.,&Rowings,J.E.(1992).Construction project scheduling.
4. Guide,P.M.B.O.K.(2008).A guide to the project management body of knowledge
5. Mubarak,S.A.(2015).Construction project scheduling and control .John Wiley& Sons.
6. Wiest,J.D.(1977).A management guide to PERT/CPM;with GERT/PDM/DCPM And other Networks

COs-PO's & PSO's MAPPING

CO	PO												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
1	3	2	2	1	2	1	1	2	2	3	3	2	3	2	2
2	3	2	3	2	2	2	3	2	2	2	2	2	3	2	2
3	3	3	3	3	3	2	2	2	2	3	3	3	3	3	2
4	3	2	2	2	2	2	3	3	3	3	3	2	3	2	2
5	3	3	3	3	3	2	2	2	2	3	3	3	3	3	3
Avg.	3	2	3	2	2	2	2	2	2	2	2	2	3	2	2

24CE3013 CONSTRUCTION MANAGEMENT AND SAFETY L T P C
2 0 2 3

COURSEOBJECTIVE

To study and understand the formulation, costing of construction projects, scheduling and various safety concepts and its requirements applied to construction projects.

UNIT I GENERAL OVERVIEW AND PROJECT ORGANIZATION 6

Introduction - Interdisciplinary nature of modern construction projects – execution of project –evaluation of bits– resource management.

UNIT II ESTIMATION OF PROJECT COST& ECONOMICS 6

Estimating quantities – description of items – estimation of project cost – running account bills –decision making in construction projects–depreciation of construction equipment–case study.

UNIT III PLANNING AND SCHEDULING 6

Introduction – project scheduling – uncertainties in duration of activities using PERT – Project monitoring and control system–resource leveling and allocation–crashing of network.

UNIT IV SAFETY DURING CONSTRUCTION 6

Basic terminology in safety - types of injuries - safety pyramid - Accident patterns - Planning for safety budget, safety culture - Introduction to OSHA regulations - Site safety programs - Job hazard analysis, accident investigation & accident indices-violation ,penalty.

UNIT V SAFE OPERATING PROCEDURES 6

Safety during alteration, demolition works – Earthwork, steel construction, temporary structures, masonry & concrete construction, cutting & welding - Construction equipment, materials handling-disposal & hand tools-Other hazards–fire, confined spaces, electrical safety.

TOTAL: 30 PERIODS

LAB

Ex1 Introduction to various construction management software
Ex2 Planning and creating new project
Ex3 Scheduling and constraints using PRIMAVERA
Ex4 Project cost management using PRIMAVERA
Ex5 Construction project safety management using BIM

COURSE OUTCOMES:

At the end of the course the student will be able to
CO1 Perform formulations of projects.
CO2 Analyze project costing.
CO3 Identify and estimate the activity in the construction.
CO4 Develop the knowledge on accidents and their causes.
CO5 Plan, access, analyze and manage the construction project sites.

REFERENCES:

1. Barcus,S.W.andWilkinson.J.W., HandBook of Management Consulting Services, McGrawHill, New York,1986.
2. JoyP.K.,Total Project Management-The Indian Context, New Delhi, MacmillanIndiaLtd.,1992
3. AlbertLester,Project Management, Planning and Control,7thEdition,Butterworth-Heinemann,USA,2017.
4. PatrickX.W.Zou,Riza Yosia Sunindijo, Strategic Safety Management in Construction and Engineering JohnWiley &Sons,Ltd2015.

COs-PO's & PSO's MAPPING

CO	PO												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
1	2	3	-	-	3	2	-	2	2	3	3	1	2	2	3
2	2	3	-	-	3	2	-	2	2	3	3	1	2	2	3
3	-	3	3	-	3	-	1	-	-	-	3	-	3	3	2
4	2	3	-	2	3	-	2	-	-	-	3	2	-	-	-
5	2	2	2	-	-	-	-	-	2	-	2	-	2	2	2
Avg.	2	3	2	2	3	2	1	2	2	3	3	1	2	2	3

24CE3014 ADVANCED CONSTRUCTION TECHOLOGY L T P C
3 0 0 3

COURSE OBJECTIVE

This course introduces modern construction techniques and equipment used in specialized projects like bridges, tunnels, and offshore works.

UNIT I SPECIALIZED CONSTRUCTION TECHNIQUES 9

Construction aspects and procedures of specialized construction techniques - Box pushing –Box type retaining walls - Slip form for Chimney and Silo construction - Sheet piling and Diaphragm walls –Well and Caisson - Underpinning - Shotcreting &Guniting - Vacuum dewatering - Finishing & Curing method

UNIT II UNDERGROUND CONSTRUCTION 9

Site investigation and Geological studies - Drilling - Pneumatic breakers - Explosives - Blasting. Tunneling technology- Mechanized shield- Micro method- Cut and cover method-Pipe Jacking - Hazards and safety measures in underground construction.

UNIT III OFFSHORE CONSTRUCTION 9

Underwater construction - Stages of offshore structure, Construction, Facilities and Methods of fabrication-Equipment's- Crane barges- derrick barges - Drilling vessels.

UNIT IV BRIDGE CONSTRUCTION TECHNIQUES 9

Types of Bridge- Based on span- Material- Type of super structure- Support condition- Piers & Abutment -Position of floor - High flood level- Bridge construction methods - In situ and Precast construction methods- Balanced cantilever methods - Span by span method - Incremental launching method- Segmented construction method.

UNIT V EARTHWORK AND MATERIAL HANDLING EQUIPMENTS 9

Importance of construction equipment's their classification, selection and contribution rate of production (Output), Owning and operating cost. Fundamentals of earthwork operations – Selection of equipment for earthwork-Types of earthwork equipment - Tractors, Motor graders, Scrapers, Front end waders, Earth movers. Material handling equipment - Forklifts and related equipment - conveyors-hauling equipment

COURSE OUTCOMES:

At the end of the course the student will be able to understand the output of construction equipment and machineries:

CO1 Apply appropriate specialized construction techniques like box pushing, diaphragm walls, and shotcreting, considering project conditions and safety requirements

CO2 Identifysafeandefficientundergroundconstructionmethodsliketunnelingandpipe jacking, considering geological challenges and hazard mitigation strategies

CO3 Select suitable offshore construction equipment and methodologies based on the type of structure, fabrication needs, and environmental factors

CO4 Outlinebridgeconstructionmethodslikebalancedcantileverorincrementallaunching, considering bridge type, site constraints, and economic feasibility

CO5 Selectappropriateearthworkandmaterialhandlingequipmentbasedonprojectrequirements, cost-effectiveness, and environmental considerations.

TEXTBOOKS:

1. AdvancedConstructionTechnology‖byM.L.Gambhir,McGraw-HillEducation,2023.
2. ConstructionTechnology‖byR.B.Peuri,WileyBlackwell,2020.
3. Essentials of bridge engineering.Johnson, D. V. (2017). Oxford and IBH Publishing.

REFERENCES:

1. HandbookofTunnelConstruction‖byMichaelS.Mooney,CRCPress,2023
2. OffshoreStructures:Design,ConstructionandApplication‖byDongwookChoiandJin-Yong Kim, Academic Press, 2022. (2nd Edition)
3. BridgeEngineering:Design,Construction,andAnalysis‖byW.F.ChenandJ.Y.Zhan, Springer, 2020. (2nd Edition)
4. Earthwork& Its Equipment‖by B.C.Punmia & AshokKumar Jain,Laxmi Publications,2019. (8th Edition)
5. ConstructionEquipmentManagementforEngineers&Managers‖byWilliamR.Riggs&Namdar Gowrishankar, McGraw-Hill Education, 2018.
6. Design of Bridges, N. Krishna Raju, Oxford and IBH Publishing.

ONLINE RESOURCES:

1. https://archive.nptel.ac.in/courses/105/103/105103206/
2. https://archive.nptel.ac.in/courses/105/105/105105212/

COs-PO's & PSO's MAPPING

CO	PO												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
1	3	-	2	-	-	2	-	-	-	-	-	-	3	-	1
2	3	2	-	-	-	-	-	-	-	-	-	-	3	-	1
3	3	-	-	-	-	-	-	-	-	-	-	-	3	-	-
4	3	-	2	-	-	-	-	-	-	-	-	-	3	-	-
5	3	-	-	-	1	-	-	-	-	-	-	-	3	-	-
Avg.	3	2	2	-	1	2	-	-	-	-	-	-	3	-	1

24CE3015 ENGINEERING ECONOMICS L T P C
3 0 0 3

COURSE OBJECTIVE:

To enable students to understand economic principles, cost analysis, financial evaluation, pricing strategies, replacement decisions, and depreciation methods essential for effective engineering and managerial decision-making.

UNIT I ENGINEERING ECONOMICS AND COST ANALYSIS 8

Introduction to Economics- Flow in an economy, Law of supply and demand, Macroeconomics and micro economics - Concept of Engineering Economics - Engineering efficiency, Economic efficiency, Scope of engineering economics - Element of costs, Marginal cost, Marginal Revenue, Sunk cost, Opportunity cost, Break-even analysis – V ratio, Elementary economic Analysis - Material selection for product - Design selection for a product, Process planning

UNIT II DECISION ANALYSIS AND FINANCIAL EVALUATION TECHNIQUES IN ENGINEERING PROJECTS **9**

Make or buy decision, Value engineering - Function, aims, Value engineering procedure. Interest formulae and their applications-Time value of money, Single payment compound amount factor, Single payment present worth factor, Equal payment series sinking fund factor, Equal payment series payment Present worth factor- equal payment series capital recovery factor – Uniform gradient series annual equivalent factor, Effective interest rate, Examples in all the methods

UNIT III PRICING **9**

Determinants of price– Pricing under different objectives–Pricing under different market structures – Pricing discrimination – Pricing of joint products – Pricing methods in practice (Theory only).

UNIT IV REPLACEMENT ANALYSIS, MAINTENANCE STRATEGIES **9**

Replacement and Maintenance analysis - Types of maintenance, types of replacement problem, determination of economic life of an asset, Replacement of an asset with a new asset - capital recovery with return –concept of challenger and defender.

UNIT V DEPRECIATION METHODS IN ENGINEERING ECONOMICS **9**

Depreciation- Introduction, Straight line method of depreciation, declining balance method of depreciation-Sum of the year‘s digits method of depreciation, sinking fund method of depreciation/ Annuity method of depreciation, service output method of depreciation.

TOTAL: 45 PERIODS

COURSE OUTCOMES

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

CO1 Identify economic principles and cost analysis techniques to evaluate and optimize engineering projects, considering both economic efficiency and engineering feasibility.

CO2 determine financial evaluations of engineering projects using time value of money concepts and decision analysis tools, recommending optimal solutions.

CO3 Analyze different pricing strategies in various market structures, critically evaluating their impact on market dynamics and business profitability.

CO4 Prepare the optimal replacement time for assets and develop effective maintenance strategies, balancing economic considerations with performance and reliability requirements.

CO5 Selectandapplyappropriatedepreciationmethodsforcalculatingassetvaluedecline, ensuring accurate financial reporting and informed decision-making.

COs-PO’s & PSO’s MAPPING

CO	PO												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
1	3	2	1	1	-	-	-	-	-	1	-	2	3	2	2
2	3	3	2	2	1	-	-	-	-	1	2	3	3	3	3
3	2	2	1	1	-	-	-	-	-	2	-	2	2	2	2
4	3	2	2	3	1	-	-	-	-	1	1	3	3	3	2
5	3	3	2	3	1	-	-	-	-	1	-	3	3	2	3
Avg.	3	2	2	2	1	-	-	-	-	1	1	3	3	2	2

TEXTBOOK:

1. Engineering Economics: Analysis and Practice by Donald G.Newnan ,Jerome P.Lavelle, and Ted G. Eschenbach, Oxford University Press, 2021.
2. Engineering Economy by Lel and Blank and Anthony Tarquin, McGraw-Hill Education, 2020.

REFERENCES:

1. Principles of Engineering Economics by JohnR.Park, Pearson Education India, 2020.
2. Modern Engineering Economy by Theodore E.Riggs & David G.Cle and ,Mc Graw-Hill Education, 2019.
3. Economic Analysis for Engineering and Managerial Decision Making by StephenG.Gilley, James R. Riggs, & David G. Cleland, McGraw-Hill Education, 2018.
4. Engineering Economics by N. Ravichandran, Sri Krishna Publications Media PLtd, 2019.
5. A Text Book of Engineering Economics by S.D.Umale, Himalaya Publishing House,2019.

ONLINE RESOURCES:

1. https://nptel.ac.in/courses/112107209

24CE3016 COST MANAGEMENT OF ENGINEERING PROJECTS LT P C
3 0 0 3

COURSEOBJECTIVE:

Costing and project management concepts help control expenses, plan efficiently, and ensure proper resource use. Using costing, budgeting, and quantitative techniques improves financial planning and enhances overall organizational performance.

UNIT I INTRODUCTION TO COSTING CONCEPTS 9

Objectives of a Costing System; Cost concepts in decision- making; Relevant cost, Differential cost, Incremental cost and Opportunity cost; Creation of a Database for operational control

UNIT II INTRODUCTION TO PROJECT MANAGEMENT 9

Project: meaning, Different types, why to manage, cost overruns centres, various stages of project execution: conception to commissioning. Project execution as conglomeration of technical and non technical activities, Detailed Engineering activities, Preproject execution main clearances and documents, Project team: Role of each member, Importance Project site: Data required with significance, Project contracts

UNIT III PROJECT EXECUTION AND COSTING CONCEPTS 9

Project execution Project cost control, Bar charts and Network diagram, Project commissioning: mechanical and process, Cost Behavior and Profit Planning Marginal Costing; Distinction between Marginal Costing and Absorption Costing; Break-even Analysis, Cost-Volume-Profit Analysis, Various decision-making problems, Pricing strategies: Pareto Analysis, Target costing, Life Cycle Costing

UNIT IV COSTING OF SERVICE SECTOR AND BUDGETERY CONTROL 9

Just-in time approach, Material Requirement Planning, Enterprise Resource Planning, Activity Based Cost Management, Bench Marking; Balanced Score Card and Value-Chain Analysis, Budgetary Control: Flexible Budgets; Performance budgets; Zero-based budgets

UNIT V QUANTITATIVE TECHNIQUES FOR COST MANAGEMENT 9

Linear Programming, PERT/CPM, Transportation problems, Assignment problems, Learning Curve Theory.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

Upon successful completion of the course, students should be able to:

CO1 Understand the costing concepts and their role in decision making.
CO2 Understand the project management concepts and their various aspects in selection.
CO3 Interpret costing concepts with project execution.
CO4 Gain knowledge of costing techniques in service sector and various budgetary control techniques.
CO5 Become familiar with quantitative techniques in cost management

TEXTBOOKS:

1. JohnM.Nicholas,HermanSteynProjectManagementforEngineering,BusinessandTechnology,Taylor&Francis,2August2020,ISBN:9781000092561.
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1. Ashish K. Bhattacharya, Principles & Practices of Cost Accounting A. H. Wheeler publisher,1991.
2. CharlesT. HorngrenandGeorgeFoster, AdvancedManagement Accounting, 1988.
3. CharlesT.HorngrenetalCostAccountingaManagerialEmphasis,PrenticeHallofIndia,NewDelhi,2011.
4. RobertSKaplanAnthonyA.Alkinson,Management& CostAccounting, 2003.
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COs-PO's & PSO's MAPPING

CO	PO												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
1	3	2	-	-	-	-	-	-	-	2	-	2	3	-	-
2	2	2	3	2	2	-	-	2	3	2	-	2	-	3	-
3	2	3	2	2	2	-	-	-	2	2	-	2	-	3	-
4	2	3	-	2	2	2	2	-	2	2	-	2	-	-	3
5	3	3	2	3	2	-	-	-	-	2	2	3	-	-	3
Avg.	2	3	1	2	2	-	-	-	1	2	-	2	1	1	1

VERTICAL III: GEOTECHNICAL

24CE3017 SUBSURFACE INVESTIGATION AND INSTRUMENTATION L T P C
3 0 0 3

OBJECTIVE

Students are expected to understand the importance of site investigation, planning of sub soil investigation, interpretation of investigated data to design suitable foundation system.

UNIT I PLANNING OF EXPLORATION AND GEOPHYSICAL METHODS 8

Scope and objectives, planning an exploration program, methods of exploration, exploration for preliminary and detailed design, spacing and depth of bores, data presentation. Geophysical exploration and interpretation, seismic and electrical methods, cross bore hole, single bore hole – up hole -down hole methods.

UNIT II EXPLORATION TECHNIQUES 7

Methods of boring and drilling, non-displacement and displacement methods, drilling in difficult subsoil conditions, limitations of various drilling techniques, stabilization of boreholes, bore logs.

UNIT III SOIL SAMPLING 8

Sampling Techniques – quality of samples – factors influencing sample quality - disturbed and undisturbed soil sampling advanced sampling techniques, offshore sampling, shallow penetration samplers, preservation and handling of samples.

UNIT IV FIELD TESTING IN SOIL EXPLORATION 12

Field tests, penetration tests, Field vane shear, Insitu shear and bore hole shear test, pressuremeter test, dilatometer test - plate load test–monotonic and cyclic; field permeability tests – block vibration test. Procedure, limitations, correction and data interpretation of all methods.

UNIT V INSTRUMENTATION 10

Instrumentation in soil engineering, strain gauges, resistance and inductance type, load cells,
earth pressure cells, settlement and heave gauges, pore pressure measurements – slope indicators, sensing units, case studies.

TOTAL: 45 PERIODS

COURSE OUTCOME

CO1 Understand the objectives, planning, and geophysical methods used in site exploration.
CO2 Explain various boring and drilling techniques and their suitability for different soil conditions.
CO3 Describe soil sampling methods and assess the quality of disturbed and undisturbed samples.
CO4 Perform and interpret major in-situ field tests used in subsoil investigation.
CO5 Apply geotechnical instrumentation for monitoring soil behaviour and foundation performance.

.REFERENCES

1. Hunt, R.E., "Geotechnical Engineering Investigation Manual, McGraw Hill,1984.
2. Winterkorn, H.F. and Fang, H.Y., Foundation Engineering Hand Book, a Nostrand Reinhold 1994.
3. Alam Singh and Chowdhary, G.R., "Soil Engineering in Theory and Practice, Volume-2, Geotechnical testing and instrumentation, CBS Publishers and Distributors, New Delhi, 2006.
4. Nair, R.J. and Wood, P.M., "Pressuremeter Testing Methods and Interpretation", Butter-worths, 1987.
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8. Bowles, J.E., "Foundation Analysis and Design", 5 th Edition, The McGraw-Hill companies, Inc., New York, 1995.

COs- PO's & PSO's MAPPING

CO	PO												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
1	3	3	2	2	2	-	-	-	-	1	-	2	3	2	1
2	3	3	2	2	1	-	-	-	-	1	-	2	3	2	1
3	3	2	2	2	1	-	-	-	-	1	-	2	3	2	2
4	3	3	3	3	2	-	-	-	-	1	-	3	3	3	2
5	3	2	2	2	2	1	-	-	-	1	-	3	3	3	2
Avg.	3	3	2	2	2	1	-	-	-	1	-	2	3	2	2

24CE 3018 GEOENVIRONMENTAL ENGINEERING L T P C
3 0 0 3

COURSE OBJECTIVE

The student acquires the knowledge on the Geotechnical engineering problems associated with soil contamination, safe disposal of waste and remediate the contaminated soils by different techniques hereby protecting environment.

UNIT I SOIL – WASTE INTERACTION 9

Role of Geo-environmental Engineering – sources, generation and classification of wastes – causes and consequences of soil pollution – case studies in soil failure -factors influencing soilpollutant interaction – modification of index, chemical and engineering properties – physical and physio- chemical mechanisms.

UNIT II CONTAMINANT TRANSPORT AND SITE CHARACTERISATION 9

Transport of contaminant in subsurface – advection, diffusion, dispersion – chemical process – biological process, sorption, desorption, precipitation, dissolution, oxidation, complexation, ion exchange, Volatization, biodegradation – characterization of contaminated sites – soil and rock data – hydrological and chemical data – analysis and evaluation.

UNIT III WASTE CONTAINMENT AND REMEDIATION OF CONTAMINATED SITES 9

In-situ containment – vertical and horizontal barrier – surface cover – ground water pumping system on subsurface drain – soil remediation – Soil Vapour extraction, soil waste stabilization, solidification of soils, electrokinetic remediation, soil heating, vitrification, bio remediation, Phyto-remediation – ground water remediation – pump and treat , In-situ flushing, permeable reacting barrier, In-situ air sparging.

UNIT IV LANDFILLS AND SURFACE IMPOUNDMENTS 9

system – Source and characteristics of waste - site selection for landfills – components of landfills – liner soil, geomembrane, geosynthetic clay, geo-composite liner system – leachate collection – final cover design – monitoring landfill - Environmental laws and regulations**.**

UNIT V STABILISATION OF WASTE 9

Evaluation of waste materials – flyash, municipal sludge, plastics, scrap tire, blast furnace slag, construction waste, wood waste and their physical, chemical and biological characteristics – potential reuse – utilization of waste and soil stabilization.

TOTAL:45 PERIODS

COURSE OUTCOMES:

On completion of the course, the student is expected to be able to;

CO1 Understand the various causes and consequences of waste interaction with soil and their modification

CO2 Understand the various mechanism of transport of contaminants into the subsurface and characterization of contaminated sites and their risk analysis.

CO3 Understand on how to decontaminate the site so as to reuse the site for human settlement

CO4 Understand how to safely dispose the waste through different containment process.

CO5 Expose on how to convert the waste into a resource material through soil waste stabilization techniques with or without chemical stabilization.

REFERENCES:

1. Daniel B.E, Geotechnical Practice for waste disposal, Chapman & Hall, London, 1993.
2. Hari D. Sharma and Krishna R.Reddy, Geo-Environmental Engineering – John Wiley and Sons, INC, USA, 2004.
3. Westlake, K., Landfill Waste pollution and Control, Albion Publishing Ltd., England, 1995.
4. Wentz, C.A., Hazardous Waste Management, McGraw Hill, Singapore, 1989.
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11. Hari D. Sharma and Krishna R.Reddy, Geo-Environmental Engineering – John Wiley and Sons, INC, USA, 2004.

12. Westlake, K., Landfill Waste pollution and Control, Albion Publishing Ltd., England, 1995.
13. Wentz, C.A., Hazardous Waste Management, McGraw Hill, Singapore, 1989.
14. Proceedings of the International symposium of Environmental Geotechnology (Vol.I and II), Environmental Publishing Company, 1986 and 1989.
15. Ott, W.R., Environmental Indices, Theory and Practice, Ann Arbor, 1978.
16. Fried, J.J., Ground Water Pollution, Elsevier, 1975.
17. ASTM Special Tech. Publication 874, Hydraulic Barrier in Soil and Rock, 1985.
18. Lagrega, M.d., Buckingham, P.L., and Evans, J.C., Hazardous Waste Management, McGraw Hill, Inc. Singapore, 1994.

COs- PO's & PSO's MAPPING

CO	PO												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
1	1	1	1	1	2	2	3	-	-	-	1	3	2	2	3
2	3	1	-	-	2	2	3	-	2	-	-	3	2	2	3
3	2	1	2	2	1	3	3	2	-	-	-	3	2	2	2
4	1	3	3	2	-	2	3	2	2	2	-	3	3	2	3
5	2	2	3	3	-	2	3	2	3	2	1	3	1	2	2
Avg.	1	1	2	2	1	2	3	2	3	2	1	3	2	2	3

24CE3019 GROUND IMPROVEMENT TECHNIQUES L T P C
3 0 0 3

COURSE OBJECTIVE:

Students will be exposed to various problems associated with soil deposits and methods to evaluate them. The different techniques will be taught to them to improve the characteristics of difficult soils as well as design techniques required to implement various ground improvement methods**.**

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

Insitu 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 completion of the course, the student is expected to 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

REFERENCES:

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2. Cox, B.R., and Grifiths S.C., Practical Recommendation for Evaluation and mitigation of Soil Liquefaction in Arkansas, (Project Report), 2010.
3. Day, R.W., Foundation Engineering Handbook, McGraw – Hill Companies, Inc. 2006.
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9. Jewell, R.A., Soil Reinforcement with Geotextiles, CIRIA, London, 1996.
10. Koerner, R.M. and Welsh, J.P., Construction and Geotechnical Engineering using Synthetic Fabrics, John Wiley, 1990.
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12. Jones, J.E.P., Earth Reinforcement and Soil Structure, Butterworths, 1985.
13. Manfred R. Hausmann, Engineering Principles of Ground Modifications, McGraw-Hill Publishing Company, New York

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CO	PO												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
1	3	3	2	3	1	3	3	3	3	3	2	3	3	3	2
2	2	3	3	2	3	2	2	1	2	2	1	3	3	3	3
3	2	3	3	2	3	3	2	1	2	1	1	3	3	3	3
4	2	3	3	1	3	2	2	1	2	1	1	3	3	3	3
5	2	3	2	2	1	2	2	1	2	1	1	3	3	3	3
Avg.	2	3	3	2	3	3	2	1	2	1	1	3	3	3	3

24CE3020 SOIL DYNAMICS AND MACHINE FOUNDATIONS L T P C
3 0 0 3

COURSE OBJECTIVE

To design different types of machine foundations based on the dynamic properties of soils and to get an exposure on vibration isolation techniques.

UNIT I THEORY OF VIBRATION 9

Introduction – Nature of dynamic loads – Basic definitions – Simple harmonic motion – Fundamentals of vibration – Single degree and multi degree of freedom systems – Free vibrations of spring – Mass systems – Forced vibrations – Resonance – Viscous damping – Principles of vibrations measuring systems – Effect of transient and pulsating loads.

UNIT II DYNAMIC SOIL PROPERTIES 9

Dynamic stress-strain characteristics – Principles of measuring dynamic properties – Laboratory techniques – Field tests – Block vibration test – Factors affecting dynamic properties – Typical values. Mechanism of liquefaction – Influencing factors – Evaluation of liquefaction potential – Analysis from SPT test – Dynamic bearing capacity – Dynamic earth pressure.

UNIT III MACHINE FOUNDATIONS 9

Introduction – Types of machine foundations – General requirements for design of machine foundations – Design approach for machine foundation – Vibration analysis – Elastic Half-Space theory – Mass-spring-dashpot model – Permissible amplitudes – Permissible bearing pressures.

UNIT IV DESIGN OF MACHINE FOUNDATION 9

Evaluation of design parameters – Types of Machines and foundations – General requirements – their importance – Analysis and design of block type and framed type machine foundations – Modes of vibration of a rigid foundation – Foundations for reciprocating machines, impact machines, Two – Cylinder vertical compressor, Double-acting steam hammer –Codalrecommendations - Emprical approach – Barken's method – Bulb of pressure concept – Pauw's analogy – Vibration table studies.

UNIT V VIBRATION ISOLATION 9

Vibration isolation – Types of isolation – Transmissibility – Passive and active isolation – Methods of isolation – Use of springs and damping materials – Properties of isolating materials – Vibration control of existing machine foundation.

TOTAL:45 PERIODS

COURSE OUTCOMES

On completion of the course, the student is expected to be able to;

CO1 Acquire knowledge to apply theories of vibration to solve dynamic soil problems.
CO2 Evaluate the dynamic properties of soil using laboratory and field tests.
CO3 Acquire basic knowledge about machine foundations and design various types of machine foundation.
CO4 To know and capable of selecting the types of vibration isolation materials.
CO5 To apply vibration isolation techniques for various field problems.

REFERENCES

1. KameswaraRao, N.S.V., Dynamics soil tests and applications, Wheeler Publishing, New Delhi, 2000.
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COs- PO's & PSO's MAPPING

CO	PO												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
1	3	2	1	1	1	2	2	1	1	1	1	3	2	2	2
2	2	2	2	3	2	2	1	2	2	1	1	3	2	2	2
3	2	3	3	3	2	3	2	3	2			3	3	3	3
4	2	3	3	3	2	3	2	3	2	1		3	3	3	3
5	2	3	3	3		3	3	3	2	1	1	3	3	3	3
Avg.	2	3	3	3	2	3	2	3	2	1	1	3	3	3	3

24CE3021 ROCK MECHANICS L T P C

3 0 0 3

COURSE OBJECTIVES:

Students are expected to classify, understand stress-strain characteristics, failure criteria, and influence of in-situ stress in the stability of various structures and various technique to improve the in-situ strength of rocks.

UNIT I CLASSIFICATION OF ROCKS 9

Types of Rocks - Index properties and classification of rock masses, competent and incompetent rock - value of RMR and ratings in field estimations.

UNIT II STRENGTH CRITERIA OF ROCKS 9

Behaviour of rock under hydrostatic compression and deviatric loading - Modes of rock failure planes of weakness and joint characteristics - joint testing, Mohr - Coulomb failure criterion and tension cut- off. Hoek and Brown Strength criteria for rocks with discontinuity sets.

UNIT III INSITU STRESSES IN ROCKS 9

In-situ stresses and their measurements, Hydraulic fracturing, flat jack, over coring and under coring methods - stress around underground excavations – Design aspects of openings in rocks.

UNIT IV SLOPE STABILITY AND BEARING CAPACITY OF ROCKS 9

Rock slopes - role of discontinuities in slop failure, slope analysis and factor of safety - remedial measures for critical slopes – Bearing capacity of foundations on rocks.

UNIT V ROCK STABILIZATION 9

Stabilization of rocks-rock support and rock reinforcement-active and passive supports-ground response curve-support reaction curve-reinforcement of fractured and joined rocks-Shotcreting- bolting-anchoring-installation methods.

TOTAL: 45 PERIODS

COURSE OUTCOMES

On completion of the course, the student is expected to be able to

CO1 Classify the Rock mass and rate the quality of rock for tunnelling and foundations works and suggest the safer length of tunnelling and stand-up time.

CO2 Apply the knowledge of engineering and understand the stress – strain characteristics and failure criteria of rock and apply them to arrive at the shear strength parameters of rocks to be used for the design of structures resting on rock and also for the design of underground excavation in rocks.

CO3 Apply the knowledge of engineering and assess the influence of in-situ stress in the stability of various underground excavations and also acquire the knowledge of design of opening in rocks.

CO4 Apply the knowledge on rock mechanics and analyze the stability of rock slopes and arrive at the bearing capacity of shallow and deep foundations resting on rocks considering the presence of joints. design the foundations resting on rocks. Able to carry-out suitable foundation for the structure resting on rock.

CO5 Improve the in-situ strength of rocks by various methods such as rock reinforcement and rock support. Able to select suitable support system considering the interaction between rock and support. Also capable of executing the same in the field.

REFERENCES:

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8. Ramamurthy T., “Engineering in Rocks for Slopes Foundations and Tunnels”, PHI Learning Pvt. Ltd., 2007.

COs- PO’s & PSO’s MAPPING

CO	PO												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
1	2	2	2	3	1	2	1	3	2	1	2	3	3	2	2
2	3	3	3	2	3	2	2	1	2	1	2	3	3	2	2
3	3	3	3	3	2	3	2	1	2	2	3	3	3	2	3
4	3	3	3	2	3	3	3	1	3	2	3	3	3	3	3
5	2	2	3	1	3	3	3	3	3	1	3	3	3	3	3
Avg.	3	3	3	2	3	3	3	2	2	1	3	3	3	2	3

24CE3022 **EARTH AND EARTH RETAINING STRUCTURES** **L T P C**
3 0 0 3

COURSE OBJECTIVES

At the end of this course, students are expected to analyse and design rigid, flexible earth retaining structures, slurry supported trenches and deep cuts.

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 completion of the course, the student is expected to 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 To understand the role of slurry in supporting excavations and to perform stability analysis by considering the actual shape of slurry support

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13. Muni Budhu, Soil Mechanics and Foundation, John Wiley and Sons, INC 2007.

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3	2	2	3	3	3	2	1	1	2	2	3	3	2	2	2
4	3	3	3	1	3	3	1	1	1	2	3	3	3	3	3
5	3	1	2	2	3	2	2	3	1		3	3	2	3	3
Avg.	3	3	3	3	3	3	2	2	2	2	3	3	3	3	3

24CE3023 **PILE FOUNDATION** **L T P C**
3 0 0 3

COURSE OBJECTIVES:

The student will be exposed to the design of piles, pile groups and caissons with respect to vertical and lateral loads for various field conditions**.**

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 – response to moment – piles under uplift loads – under reamed piles – Drilled shaft – Lateral and pull out capacity from load test.

UNIT IV STRUCTURAL DESIGN OF PILE AND PILE GROUPS 9

Structural design of pile – structural capacity – pile and pile cap connection – pile cap design – shape, depth, assessment and amount of steel – truss and bending theory- Reinforcement details of pile and pile caps — pile subjected to vibration.

UNIT V CAISSONS 9

Necessity of caisson – type and shape - Stability of caissons – principles of analysis and design – tilting of caisson – construction - seismic influences.

TOTAL: 45 PERIODS

COURSE OUTCOMES

On completion of the course, the student is expected to be able to

CO1 Explain the importance of pile foundation and various functions and responsibilities of geotechnical engineer and contractor, in addition to the piling equipments.

CO2 Determine the vertical load carrying capacity of pile and pile group- keeping the settlement of pile as an important criteria based on field practices and codal provisions.

CO3 Apart from vertically loaded piles, the structures are exposed to the peculiar pile subjected to lateral and uplift load with reference to codal provision and case studies.

CO4 Understand the design of pile and pile caps, considering the wind and seismic loads.

CO5 Explain the importance of caisson foundation and checking the stability of caissons based on codal provisions.

REFERENCES

1. Das, B.M., Principles of Foundation Engineering, Design and Construction, Fourth Edition, PWS Publishing, 1999.
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.
4. Michael Tomlinson and John Woodward, Pile design and construction practice, Taylor & Francis Group, London & New York, 2008.

5. Cernica, J.N. Geotechnical Engineering Foundation Design, John Wiley and Sons, Inc. 1995.
6. Bowles, J.E., Foundation Analysis and Design, Fifth Edition, McGraw Hill, New York, 1996.
7. Donald, P., Coduto, Foundation Design Principles and Practices, Prentice Hall, Inc. Englewood Cliffs, New Jersey, 1996.
8. Varghese P.C.," Foundation Engineering", PHI Learning Private Limited, New Delhi, 2005.
9. Reese,L.C., Isenhower,W.M. and Wang,S.T. Analysis and Design of Shallow and Deep Foundations, John Wiley and Sons, New York, 2005.
10. Varghese P.C.," Design of Reinforced Concrete Foundations", PHI Learning Private Limited, New Delhi, 2009.
11. Reese, L. C. and Van Impe, W. F., Single Piles and Pile Groups Under Lateral Loading, Taylor and Francis, London, 2011.

COs- PO's & PSO's MAPPING

CO	PO												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
1	1	1	1	3	2	1	1	1	2	2	1	3	3	2	2
2	2	3	3	1	1		1	1	1	1	1	3	2	1	3
3	2	3	3	2	2	1	1	1	1	1		3	3	2	3
4	1	3	3	2	2		1	1	1	1	1	3	2	1	2
5	2	3	2	2	2	1	1	1	1	1	1	3	3	2	3
Avg.	2	3	3	2	2	1	1	1	2	2	1	3	3	2	3

24CE3024 TUNNELING ENGINEERING L T P C
3 0 0 3

COURSE OBJECTIVES

- Students mainly focused in visualizing and critically analyzing the behavior of underground structures with reference to various supporting systems under different loading conditions due to induced earth pressure on the underground structures.
- To give idea about the equipment used in underground excavations

UNIT I TUNNELS AND UNDERGROUND SPACE APPLICATION 9

History-caves-tunnels for transport-water,power supply-storage of LPG –nuclear waste disposal- defence facilities-submerged tunnels-underground library,museums.

UNIT II EXCAVATION TECHNIQUES 9

Types and purpose of tunnels-choice of excavation methods-soft ground tunneling-hardrock tunneling-tunnel drilling-blasting-impact hammers-problems encountered and remedial measures.

UNIT III PLANNING AND GEOMETRIC DESIGN OF TUNNELS 9

Topographical –geological survey-rock sampling-testing-determination of location size shape and alignment-subsidence problem on soft ground –tunneling design in hard rock.

UNIT IV CONSTRUCTION OF TUNNEL 9

Advanced drilling techniques –TBM-cuttability assessment-shield tunneling-advantages-types of shield tunneling-factors affecting selection of shield-twin tunnel-NATM.

UNIT V DESIGN OF TUNNEL SUPPORTING SYSTEMS AND VENTILATION 9

Classification of supports-active –passive-permanent-temporary-excavation support-steel supports- lining-grouting-ground freezing-environment in underground-various methods of ventilation.

TOTAL: 45 PERIODS

COURSE OUTCOME:

On completion of the course, the student is expected to be able to

CO1 To Understand need of utilization of underground space for various applications.
CO2 To study various methods of excavations and tunneling methods.
CO3 Planning and design process of tunnels.
CO4 To identify the suitable method of tunneling.
CO5 To study various types of support system and its merit and demerits.

REFERENCES

1. Underground infrastructure planning design construction-R.K.Goel, Bhavani singh, Jian Zhao, Butterworth heinemunn publishers.
2. Practical tunnel construction, Hemphill G.B 2012 John wiley and Son.
3. Introduction to tunnel construction, David chapran, Nicole metse and Alfred stark,Spor press.

COs- PO's & PSO's MAPPING

CO	PO												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
1	2	2	1	1	1	2	-	1	1	-	-	3	2	3	2
2	2	3	1	-	1	-	-	-	-	-	-	3	2	3	3
3	2	2	3	-	1	-	-	-	-	-	-	3	2	3	3
4	2	2	3	1	1	-	-	-	-	-	-	3	2	3	3
5	2	2	2	1	-	1	1	-	-	1	1	3	2	3	3
Avg.	2	2	2	1	1	2	1	1	1	1	1	3	2	3	3

VERTICAL IV: TRANSPORTATION INFRASTRUCTURE

24CE3025 TRAFFIC ENGINEERING AND MANAGEMENT L T P C
3 0 0 3

COURSE OBJECTIVE

To give an overview of Traffic engineering, various surveys to be conducted, traffic Regulation, management and traffic safety

UNIT I TRAFFIC SURVEYS AND ANALYSES 8

Traffic characteristics: Human, vehicular, and Pavement Characteristics, Problems- presentation of traffic volume data, Annual Average Daily Traffic, Average Daily Traffic, Design hourly traffic volume; Speed- spot speed, presentation of spot speed data, speed and delay studies, methods of conducting spot-speed studies and Speed and Delay studies; Problems Origin and Destination – methods of conducting the survey and presentation of data; parking surveys, presentation of data and analyses, determination of parking demand; Accident studies and analyses; Different problems.

UNIT II TRAFFIC FLOW AND ROADWAY CAPACITY 8

Traffic Flow Characteristics – Basic traffic manoeuvres, Traffic stream flow characteristics, Speed- Flow- Density Relations; Passenger Car Units – Mixed traffic flow and related issues – Concept of PCU value- Factors affecting PCU values- Recommended PCU values for different conditions; Capacity and Level of Service – Factors affecting practical capacity – Design Service Volumes

UNIT III COST – EFFECTIVE TRAFFIC MANAGEMENT TECHNIQUES 10

Traffic System Management: Regulatory Techniques- one way street, Reversible Street, Reversible lane, Turning moment restrictions, closing streets; Traffic Control Devices – Traffic Signs – Road Markings, Traffic Signals, Miscellaneous traffic control devices; Traffic Segregation – Vehicle segregation, Pedestrian segregation, Traffic signals design; Bus Priority Techniques – Priority manoeuvres – With-flow bus lane and contra-flow bus lane; Self-Enforcing Techniques- Demand Management Techniques (TDM) Road pricing, parking control, Tolls, Staggering of office/educational institution hours.

UNIT IV DESIGN OF ROAD INTERSECTIONS 10

Importance and Classification; Intersections at-grade – uncontrolled, channelised; Rotary intersections (problems)- Signalised intersections (problems)- Grade Separated Intersections – merits and demerits, types, pattern of intersections with different types of interchanges- Capacity, Concept diagrams.

UNIT V DESIGN OF PARKING AND PEDESTRIAN FACILITIES AND CYCLE TRACKS 9

Parking: Need for parking studies and its ill effects- Parking Standards for different land uses, different types of parking - Conceptual plans for different types of parking; **Pedestrians:** Importance, Barriers, Behaviour, Pedestrian facilities – Principles of planning, Level of Service (LoS), Design standards.; **Cycle Tracks:** Principles of design, Design criteria, Design standards for Rural Expressways.

TOTAL: 45 PERIODS

COURSE OUTCOMES

CO1 Apply the knowledge of science and engineering fundamentals in conducting traffic surveys, analyze the problems and relating it with standards
CO2 Understand the principles of traffic flow characteristics and their relationships
CO3 Understand various traffic management measures in addressing the demand Pricing and ITS applications.
CO4 Designing various types of control and regulatory measures to meet an efficient traffic network.
CO5 Understand various type of facilities and plan for Non Motorised Transport

TEXT BOOKS

1. Kadiyali. L.R. Traffic Engineering and Transport Planning, Khanna Publishers, Delhi, 2019.
2. Khanna .K and Justo C.E.G. and Veeraragavan, A Highway Engineering, Nem Chand Bros., Roorkee, Revised 10th Edition, 2014.
3. Srinivasa Kumar, "Introduction to Traffic Engineering", Universities Press, 2018
4. Partha Chakroborty and Animesh Das Principles of Transportation Engineering, PHI Learning Pvt. Ltd., 2011.
5. Papacosta.P.S and Prevedouros.P.D, " Transportation Engineering and Planning, third edition, 2015

REFERENCES

1. Indian Roads Congress (IRC) Specifications: Guidelines and special publications on Traffic Planning and Management.
2. Khanna S. K, and others, Highway Engineering, Nam Chand & Bros, Roorkee, 2014, Pages 177 – 308.
3. C. JotinKhisty, Kent Lall, Transportation Engineering: An Introduction, Prentice Hall, 1998
4. Taylor MAP and Young W, Traffic Analysis – New Technology and New Solutions, Hargreen Publishing Company , 1998.
5. Salter. R.I and Hounsell N.B, Highway Traffic Analysis and design, Macmillan Press Ltd.1996.
6. Roger P.Roess, William R.Mcshane and Elena S.Prassas, Traffic Engineering-Second Edition, Prentice Hall Publishers,, Upper Saddle River, New Jersey 1998.

COs- PO's & PSO's MAPPING

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1	3	2	2	2	1	1	1	1	2	2	3	1	3	3	3
2	3	3	3	3	3	2	1	2	3		3	1	3	2	3
3	3	2	3	2	1	1	1	2	2	3	2	1	2	2	2
4	2	3	3	3	3	2	2	2	2	3	3	1	2	3	3
5	2	2	1	1	1	2	3	3	1	1	2	1	2	2	2
Avg.	3	2	3	2	2	2	1	2	2	2	3	1	2	2	3

24CE3026 URBAN PLANNING AND DEVELOPMENT L T P C
3 0 0 3

COURSE OBJECTIVE

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

UNIT I INTRODUCTION 7

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 10

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 10

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 10

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 8

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

CO1 Understand the basic issues and meaning of terminologies in urban planning
CO2 Understand the different types of theories of urban planning and city development.
CO3 Understand the different types of plan, their strategies and their preparation process.
CO4 Comprehend the planning standards, evaluate the constraints and the financial mechanism
CO5 Knowledge on various town and country planning acts and their functions.

TEXTBOOKS

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
4. Edwin S.Mills and Charles M.Becker, Studies in Urban development, A World Bank publication, 1986

REFERENCES

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
6. Urban & Regional Development Plans Formulation & Implementation (URDPFI) Guidelines, Vol I & II, Jan 2015, Govt of India, Ministry of Urban Development
7. http:/.moud.gov.in

COs- PO's & PSO's MAPPING

CO	PO												PSO		
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1	3	-	-	-	-	3	3	-	3	-	3	-	3	2	3
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3	3	-	3	-	-	2	3	-	2	2	2	1	2	2	3
4	-	-	2	2	2	-	2	2	3	-	3	2	2	1	2
5	3	2	1	2	-	3	2	2	2	2	3	2	1	1	2
Avg.	3	2	2	2	2	3	2	2	2	2	3	2	2	2	2

24CE3027 SMART CITIES L T P C
3 0 0 3

COURSE OBJECTIVE

To help the leaners to understand the concepts of smart city and to introduce the students about application of technologies in smart cities

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

CO1 Understand the basics of Urbanisation and the role of smart cities.

CO2 Gain knowledge on implementation of smart physical infrastructure.

CO3 Understand 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.

REFERENCES

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, ManojParmar, “Smart City in India Urban Laboratory, Paradigm or Trajectory? Routledge India,2019
4. https://smartcities.gov.in/guidelines#block-habikon-content
5. https://smartnet.niua.org/learn/library

COs- PO’s & PSO’s MAPPING

CO	PO												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
1	3	1	2	1	3	2	3	1	1	2	2	1	3	3	2
2	3	3	3	2	1	3	3	2	3	1	3	1	3	3	3
3	3	1	3	2	1	1	3	3	2	2	3	2	3	2	3
4	3	2	2	2	3	2	3	2	3	1	3	2	3	2	2
5	2	2	3	3	2	2	2	2	3	3	2	2	2	3	3
Avg.	3	2	3	2	2	2	3	2	2	2	3	2	3	3	3

24CE3028 INTELLIGENT TRANSPORTATION SYSTEMS L T P C
3 0 0 3

COURSE OBJECTIVE

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

UNIT I INTRODUCTION TO ITS 7

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 **10**

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 **10**

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

CO1 Understand the fundamentals of ITS and its benefits.
CO2 Gain knowledge on data collection using sensors and its applications.
CO3 Acquainted with the knowledge of ITS in Traffic Management
CO4 Application of ITS in Transportation Planning
CO5 Able to gain knowledge on application of ITS in Logistics

TEXT BOOKS

1. R. Srinivasa Kumar,"Intelligent Transportation Systems", Universities Press P Ltd, Telangana, 2022.

REFERENCES:

1. Intelligent Transport Systems, Intelligent Transportation Primer, Washington, US,2001.
2. Henry F.Korth, and Abraham Siberschatz, Data Base System Concepts, McGraw Hill,1992.
3. TurbanE.,"Decision Support and Export Systems Management Support Systems", Maxwell Macmillan,1998.
4. Sitausu S. Mittra, "Decision Support Systems–Tools and Techniques", John Wiley, New York,1986.
5. Cycle W.Halsapple and Andrew B.Winston, "Decision Support Systems–Theory and Application", Springer Verlog, New York, 1987
6. ITS Hand Book 2000: Recommendations for World Road Association (PIARC) by Kan Paul Chen, John Miles.

COs- PO's & PSO's MAPPING

CO	PO												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
1	2	1		2	3	2	2	1	3	1	2	2	2	2	2
2	2	2	1	3	3	2	2	2	3	2	3	2	2	2	2
3	2	1	2	2	3	2	1	1	3	2	1	1	3	2	3
4	2	2	1	3	3	2	1	1	3	1	3	2	3	3	2
5	3	2	1	3	3	2	1	2	3	2	3	2	3	2	3
Avg.	2	2	2	3	3	2	2	2	3	2	3	2	3	2	3

24CE3029 PAVEMENT ENGINEERING **L T P C**
3 0 0 3

COURSE OBJECTIVE

Student gains knowledge on various IRC guidelines for designing rigid and flexible pavements. Further, the student will be in a position to assess quality and serviceability conditions of roads.

UNIT I PAVEMENT MATERIALS AND SUBGRADE ANALYSIS **8**

Introduction – Pavement as layered structure – Pavement types -rigid and flexible-Subgrade analysis- Stress and deflections in pavements- Pavement Materials and Testing- Modified Binders.

UNIT II DESIGN OF FLEXIBLE PAVEMENTS **10**

Flexible pavement design – Advantages and disadvantages -Factors influencing design of flexible pavement, Empirical – Mechanistic empirical and theoretical methods – Design procedure as per IRC guidelines – Design and specification of rural roads.

UNIT III DESIGN OF RIGID PAVEMENTS 9

Cement concrete pavements Factors influencing CC pavements – Modified Westergaard approach – Design procedure as per IRC guidelines – Concrete roads and their scope in India.

UNIT IV PAVEMENT CONSTRUCTION, EVALUATION AND MAINTENANCE 10

Construction Techniques practice of flexible and concrete pavement Pavement Evaluation - Causes of distress in rigid and flexible pavements – Evaluation based on Surface Appearance, Cracks, Patches and Pot Holes, Undulations, Raveling, Roughness, Skid Resistance. Structural Evaluation by Deflection Measurements - Pavement Serviceability index, - Pavement maintenance (IRC Recommendations only).

UNIT V STABILIZATION OF PAVEMENTS 8

Stabilization with special reference to highway pavements – Choice of stabilizers – Testing and field control - Stabilization for rural roads in India – Use of Geosynthetics in roads.

TOTAL: 45 PERIODS

COURSE OUTCOMES

CO1 Get knowledge about types of rigid and flexible pavements.
CO2 Able to design of rigid pavements
CO3 Able to design of flexible pavements.
CO4 Determine the causes of distress in rigid and flexible pavements.
CO5 Understand stabilization of pavements, testing and field control.

TEXTBOOKS

1. Khanna, S.K. and Justo C.E.G.and Veeraragavan, A, "Highway Engineering", New Chand and Brothers, Revised 10th Edition,2014.
2. Kadiyali, L.R.,"Principles and Practice of Highway Engineering", Khannatech. Publications, New Delhi,2015.

REFERENCES

1. Yoder, R.J. and Witchak M.W. "Principles of Pavement Design", John Wiley2000.
2. Guidelines for the Design of Flexible Pavements, IRC-37–2012, The Indian roads Congress, NewDelhi.
3. Guideline for the Design of Rigid Pavements for Highways, IRC 58-2018, The Indian Road Congress, NewDelhi.

COs- PO's & PSO's MAPPING

CO	PO												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
1	3	-	-	-		3	1	-	2	-	-	-	3	2	-
2	1	-	3	-	2	-	1	-	2	-	-	2	3	3	1
3	3	3	3	2	3	-	2	3	-	-	2	3	3	3	1
4	2	3	2	2	2	3	3	3	-	-	3	3	3	3	2
5	3	2	1	1	2	3	1	3	-	1	3	3	2	1	2
Avg.	3	3	3	2	2	3	2	3	2	1	3	3	3	3	2

24CE3030 TRANSPORTATION PLANNING PROCESS L T P C
3 0 0 3

COURSE OBJECTIVE

To impart knowledge in the rudiments and stages in Transportation Planning Process

UNIT I TRANSPORTATION PLANNING PROCESS 8

Importance of transportation planning, Integration of Land Use and Transport; Systems Approach to Transport Planning; Four Steps in the Transport Planning Process; Travel Demand Modelling Approach; Traffic Analyses Zones – internal and external; Various Transportation Surveys for the collection of data – methodology, analyses of data and presentation of results.

UNIT II TRIP GENERATION STAGE 9

Definition and importance; Trip Production and Attraction, Types of trips; Factors governing trip generation: population related data, land and building use, socio-economic, Trip generation models: Types, Assumptions made, Multiple Linear Regression, category analysis- merits and de-merits of the model, verification, calibration and validation of the model.

UNIT III TRIP DISTRIBUTION STAGE 10

Definition and objective; Data collection, analyses and presentation of trip matrix table, Desire Line Diagram, Development of Gravity, growth factor methods for Trip Distribution, Calibration of gravity model and its validation.

UNIT IV MODAL SPLIT STAGE 9

Factors influencing mode choice - Household characteristics; Zonal Characteristics; Network characteristics - Modal split: pre distribution or post distribution - Mode wise trip matrix and modal split analyses- Overview of Probit and Logit model

UNIT V TRAFFIC ASSIGNMENT STAGE 9

Meaning and objective; General principles; Assignment Techniques- all-or-nothing assignments, multiple route assignment, capacity restraint, diversion curves, Trip assignment route selection; Mode-wise trip matrices; element of transportation network, nodes and links, speed flow curves, minimum path trees

TOTAL: 45 PERIODS

COURSE OUTCOMES

CO1 Understand the principles of the transportation planning process and methods of data collection.
CO2 Acquainted with the trip production, trip attraction models and calibration.
CO3 Acquainted with the trip production, trip attraction models and calibration.
CO4 Able to understand trip distribution models and its application.
CO5 Gain knowledge on the mode choice behaviour and mode split models.

TEXTBOOKS:

1. Kadiyali. L.R., Traffic Engineering and Transport Planning, Khanna Publishers, Delhi, 2019.
2. C.S. Papacostas and P.D. Prevedouros, Transportation Engineering and Planning, Prentice Hall of India Pvt. Ltd., 2009.
3. Michael J.Bruton, Introduction to Transportation Planning, Hutchinson, London, 1995.

REFERENCES

1. J D Ortuzar and L G Willumnsen. Modeling Transport. John Wiley and Sons, New York, 2011.
2. John W. Dickey, Metropolitan Transportation Planning, Tata McGraw Hill Publishing Company Ltd., New Delhi, 1990.
3. C. JotinKhisty, Kent Lall, Transportation Engineering: An Introduction, Prentice Hall, 1998
4. Juan de Dios Ort zar and Luis G. Willumsen, Modelling Transport, John Wiley & Sons 2001
5. Chennai Comprehensive Traffic Study, Chennai Metropolitan Development Authority, 2007.
6. James H.Banks, Introduction to Transportation Engineering, Tata McGraw Hill Education Pvt Ltd, 2010

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3	2	3	3	3	2	1	2	2	2	1	3	1	-	1	2
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5	-	-	2	-	2	3	2	2	-	-	2	1	-	2	2
Avg.	2	2	3	3	2	2	2	2	2	1	3	1	2	2	2

24CE3031 TRANSPORT AND ENVIRONMENT L T P C

3 0 0 3

COURSE OBJECTIVE:

The objective of this course is to create an awareness / overview of the impact of Transportation Projects on the environment and society.

UNIT I INTRODUCTION 8

Environmental Inventory, Environmental Assessment, Environmental Impact Assessment (EIA), Environmental Impact of Transportation Projects, Need for EIA, EIA Guidelines for Transportation Project, Historical Development.

UNIT II METHODOLOGIES 8

Elements of EIA – Screening and Scoping – Methods of Impact Analysis – Applications – Appropriate methodology.

UNIT III ENVIRONMENTAL IMPACT, PREDICTION AND ASSESSMENT 10

Prediction and Assessment of Impact of Transportation Project at various stages on water, air, noise, land acquisition and resettlement, Socio economic impact, indigenous people, aesthetics, health and safety, energy studies, traffic impact studies, IRC guidelines.

UNIT IV ENVIRONMENTAL MITIGATION AND MANAGEMENT PLAN 10

Mitigation of the impact on Natural and Man-made Environment, Health, Water, Land, Noise, Air, Public participation, Environmental Management Plan, Energy Conservation, Methods to reduce Global Warming.

UNIT V ENVIRONMENTAL IMPACT ASSESSMENT CASE STUDIES 9

EIA Case Studies on Highway, Railway - EIA Case Studies on Transit Oriented Development (TOD), Compact Cities, Non-Motorised Transport (NMT)

TOTAL: 45 PERIODS

COURSE OUTCOMES

CO1 Understand the basic concepts of Environmental Impact of Assessment
CO2 Apply various methods of analyzing environmental Impact Analysis.
CO3 Gain knowledge on Stage Wise Assessment and Prediction of impact of transportation projects
CO4 Adopt environmental management plan and their impact on earth.
CO5 Reviewing various case studies on environmental impact assessment of transport projects.

TEXTBOOKS

1. Canter, L.R., Environmental Impact Assessment, McGraw Hill, New Delhi, 1996.
2. Indian Road Congress (IRC), Environmental Impact of Highway Projects, IRC, Delhi, 1998.
3. EIA Guidance Manual- Highway- MOEF & Govt of India, 2010
4. P. Meenakshi, Elements of Environmental Science and Engineering, Prentice Hall of India, New Delhi, 2006
5. Thirumurthy A.M., Introduction to Environmental Science and Management, Shroff Publishers, Bombay, 2005.

REFERENCES

1. John G.Rau and David, C.Hooten, Environmental Impact Analysis Handbook, McGraw Hill Book Company, 1995
2. James H.Banks, Introduction to Transportation Engineering, McGraw Hill Book Company, 2000
3. World Bank, A Handbook on Roads and Environment, Vol.I and II, Washington DC, 1997
4. Priya Ranjan Trivedi, International Encyclopedia of Ecology and Environment – EIA, Indian Institute of Ecology and Environment, New Delhi, 1998
5. Manual on Norms & Standards for Environmental Clearance of large construction projects, MOEF & Govt of India

COs- PO's & PSO's MAPPING

CO	PO												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
1	3	-	-	-	-	3	1	-	2	-	-	2	3	2	-
2	3	3	3	-	2	-	1	-	2	-	-	-	3	1	2
3	-	3	3	2	3	-	2	3	-	-	2	2	3	2	3
4	-	3	2	2	2	3	3	3	-	-	2	1	3	3	2
5	-	2	1	1	2	3	1	3	2	1	3	1	2	-	3
Avg.	3	3	3	2	2	3	2	3	2	1	2	2	3	2	3

24CE3032 TRANSPORTATION ECONOMICS L T P C
3 0 0 3

COURSE OBJECTIVE

This course provides an understanding of economic principles applied to transportation systems. It covers transportation project development, cost analysis, demand-supply modeling, traffic congestion economics, and financial evaluation of transport projects, including Public-Private Partnerships (PPP).

UNIT I INTRODUCTION TO TRANSPORTATION ECONOMICS 9

Concepts in transportation decision-making-Transportation project development process-Budgeting and financial planning-Models for evaluating transportation impacts

UNIT II TRANSPORTATION COSTS 9

Classification of transportation costs: agency costs and user costs-Structure and behavior of cost functions-Road pricing concepts-Vehicle operating costs: fuel, maintenance, depreciation, crew costs, travel time savings, accident costs

UNIT III TRANSPORTATION DEMAND AND SUPPLY 9

Estimating transportation demand and supply-Supply equilibration and demand-supply dynamics- Elasticity of travel demand and supply; classification of elasticity

UNIT IV ECONOMICS OF TRAFFIC CONGESTION AND PRICING POLICIES 9

Congestion and its economic implications-Pricing policies to manage congestion- Methods of economic evaluation of transport projects: cost-benefit ratio, net present value, internal rate of return, first-year rate of return-Indirect costs and benefits of transportation projects

UNIT V FINANCING AND CASE STUDIES 9

Financing methods for road projects: government funding, PPP, toll collection-Economic viability of Design-Build-Operate-Transfer (DBOT) schemes- Risk analysis, value for money, and case studies

TOTAL: 45 PERIODS

COURSE OUTCOMES

On completion of this course, the student is expected to be able to

CO1 Introduce basic concepts of transportation economics and project development
CO2 Analyze transportation costs, vehicle operating costs, and pricing strategies
CO3 Understand demand-supply dynamics and elasticity in transportation
CO4 Apply economic evaluation methods to transportation projects
CO5 Examine financing, PPP models, and risk analysis in real-world transport projects.

REFERENCES

1. Nash, C., et al., Urban Transportation Economics, Routledge, 2017.
2. Button, K., Transport Economics, Edward Elgar, 2010.
3. Small, K., The Economics of Urban Transportation, Routledge, 2013.
4. Vickerman, R., Transport Infrastructure and Economic Development, Edward Elgar, 2012.
5. Lakshmanan, T.R., The Broader Economic Consequences of Transport Infrastructure Investments, OECD, 2011.

COs-PO's & PSO's MAPPING

CO	PO												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
1	3	2	2	2	1	1	-	-	1	1	-	2	3	2	1
2	3	2	2	2	2	1	-	-	1	1	-	2	3	2	2
3	3	2	2	2	2	1	-	-	1	1	-	2	3	2	2
4	3	2	3	3	3	2	2	1	1	2	1	3	3	3	3
5	3	2	3	3	3	2	2	1	1	2	1	3	3	3	3
Avg.	3	2	2	2	2	1	1	1	1	1	1	2	3	3	2

VERTICAL V : ENVIRONMENT

24CE3033 CLIMATE CHANGE ADAPTATION AND MITIGATION L T P C
3 0 0 3

COURSE OBJECTIVE

To impart knowledge on the global warming, the impact of climate change on society and the adaptation and mitigation measures to the students

UNIT I INTRODUCTION 9

Atmosphere – weather and Climate - climate parameters – Temperature, Rainfall, Humidity, Wind – Global ocean circulation – El Nino and its effect - Carbon cycle

UNIT II ELEMENTS RELATED TO CLIMATE CHANGE 9

Greenhouse gases - Total carbon dioxide emissions by energy sector – industrial, commercial, transportation, residential – Impacts – air quality, hydrology, green space - Causes of global and regional climate change – Changes in patterns of temperature, precipitation and sea level rise – Greenhouse effect

UNIT III IMPACTS OF CLIMATE CHANGE 9

Effects of Climate Changes on living things – health effects, malnutrition, human migration, socioeconomic impacts-tourism, industry and business, vulnerability assessment- infrastructure, population and sector – Agriculture, forestry, human health, coastal areas

UNIT IV MITIGATING CLIMATE CHANGE 9

IPCC Technical Guidelines for Assessing Climate Change Impact and Adaptation -Identifying adaption options – designing and implementing adaption measures – surface albedo environment- reflective roofing and reflective paving – enhancement of evapotranspiration - tree planting programme – green roofing strategies – energy conservation in buildings – energy efficiencies – carbon sequestration.

UNIT V ALTERNATE FUELS AND RENEWABLE ENERGY 9

Energy source – coal, natural gas – wind energy, hydropower, solar energy, nuclear energy, geothermal energy – biofuels – Energy policies for a cool future - Energy Audit.

TOTAL: 45 PERIODS

COURSE OUTCOMES

The students completing the course will have

CO1 An insight into carbon cycle, physical basis of the natural greenhouse effect, including the meaning of the term radiative forcing, climate change, global warming and measures to adapt and to mitigate the impacts of climate change

CO2 Understanding on the growing scientific consensus established through the IPCC as well as the complexities and uncertainties

CO3 Ability to plan climate change mitigation and adaptation projects including the use of alternate fuels and renewable energy

CO4 Gain in-depth knowledge on climate models

CO5 Post process the model outputs for climate impact assessment, know about adaptation strategies

TEXTBOOKS

1. Ruddiman W.F, freeman W.H. and Company, "Earth"s Climate Past and Future", 2001
2. Velma. I. Grover "Global Warming and Climate" Change. Vol I an II. Science Publishers, 2005.
3. Dash Sushil Kumar, "Climate Change – An Indian Perspective", Cambridge University Press India Pvt. Ltd, 2007.

REFERENCES:

1. IPCC Fourth Assessment Report, Cambridge University Press, Cambridge, UK, 2007
2. Thomas E, Lovejoy and Lee Hannah "Climate Change and Biodiversity", TERI Publishers, 2005
3. Jan C. van Dam, Impacts of "Climate Change and Climate Variability on Hydrological Regimes", Cambridge University Press, 2003.

COs- PO's & PSO's MAPPING

CO's	PO's												PSO's		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
1	-	3	-	-	-	-	-	-	-	1	-	2	-	-	-
2	-	-	-	-	-	2	3	-	-	-	-	-	2	-	3
3	2	3	-	2	3	-	-	-	-	-	-	3	-	-	-
4	2	-	2	2	3	-	-	-	3	-	-	-	-	-	-
5	-	3	-	-	3	2	-	-	3	2	3	2	-	2	-
Avg.	2	3	2	2	3	2	3	-	3	1	3	2	2	2	3

24CE3034 AIR AND NOISE POLLUTION CONTROL ENGINEERING L T P C
3 0 0 3

COURSE OBJECTIVE

To impart knowledge on the sources, effects and control techniques of air pollutants 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 - Wind Rose - 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 - 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 completion of the course, the student is expected to

CO1 Understand various types and sources of air pollution and its effects
CO2 Know the dispersion of air pollutants and their modeling
CO3 Know about the principles and design of control of particulate pollutants
CO4 Understand the principles and design of control of gaseous pollutant
CO5 Know the sources, effects and control of vehicular, indoor air and noise pollution

TEXTBOOKS

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.

REFERENCES

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.

COs- PO’s & PSO’s MAPPING

CO’s	PO’s												PSO’s		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
1	3	-	-	-	3	-	-	2	1	2	-	-	2	-	-
2	2	-	-	3	-	2	-	-	-	-	-	2	1	2	2
3	2	-	3	-	3	-	1	-	-	-	2	-	2	2	2
4	2	-	3	-	3	-	1	-	-	-	2	-	2	2	2
5	3	3	2	3	2	-	-	-	-	2	-	-	2	-	-
Avg.	2	3	3	3	3	-	-	2	1	2	2	2	2	2	2

24CE3035 **ENVIRONMENTAL IMPACT ASSESSMENT** **L T P C**
3 0 0 3

COURSE OBJECTIVES:

- To expose the students to the need, methodology, documentation and usefulness of environmental impact assessment and to develop the skill to prepare environmental management plan.
- To participate in the performance of an environmental assessment process (EIA or SEA), given the disciplinary knowledge and skills in natural sciences and engineering the student have achieved in other courses.

UNIT I INTRODUCTION **9**

Historical development of Environmental Impact Assessment (EIA). Environmental Clearance- EIA in project cycle. legal and regulatory aspects in India – types and limitations of EIA –EIA process screening – scoping - terms of reference in EIA- setting – analysis – mitigation. Cross sectoral issues –public hearing in EIA- EIA consultant accreditation.

UNIT II IMPACT INDENTIFICATION AND PREDICTION **9**

Matrices – networks – checklists – cost benefit analysis – analysis of alternatives – expert systems in EIA. prediction tools for EIA – mathematical modelling for impact prediction – assessment of impacts – air – water – soil – noise – biological — cumulative impact assessment

UNIT III SOCIO-ECONOMIC IMPACT ASSESSMENT **9**

Socio-economic impact assessment - relationship between social impacts and change in community and institutional arrangements. factors and methodologies- individual and family level impacts. communities in transition-rehabilitation

UNIT IV EIA DOCUMENTATION AND EMP **9**

Environmental management plan(EMP) - preparation, implementation and review – mitigation and rehabilitation plans – policy and guidelines for planning and monitoring programmes – post project audit – documentation of EIA findings – ethical and quality aspects of environmental impact assessment

UNIT V CASE STUDIES **9**

Mining, power plants, cement plants, Nuclear Power plants, highways, petroleum refining industry, storage & handling of hazardous chemicals, common hazardous waste facilities, CETPs, CMSWMF, building and construction projects

TOTAL: 45 PERIODS

COURSE OUTCOMES:

On completion of the course, the student is expected to be able to

CO1 Carry out scoping and screening of developmental projects for environmental and social assessments
CO2 Explain different methodologies for environmental impact prediction and assessment
CO3 Asses socio-economic investigation of the environment in a project
CO4 Plan environmental impact assessments and environmental management plans
CO5 Knowledge to prepare environmental impact assessment reports for various projects

REFERENCES

1. Canter, L.W., "Environmental Impact Assessment", McGraw Hill, New York, 1996.
2. Lawrence, D.P., "Environmental Impact Assessment – Practical solutions to recurrent problems", Wiley-Interscience, New Jersey. 2003.
3. Cutter, S.L., "Environmental Risk and Hazards", Prentice-Hall of India Pvt. Ltd., New Delhi, 1999.
4. Kolluru Rao, Bartell Steven, Pitblado R and Stricoff “Risk Assessment and Management Handbook”, McGraw Hill Inc., New York,1996.
5. K. V. Raghavan and A A. Khan, "Methodologies in Hazard Identification and Risk Assessment", Manual by CLRI, 1990.
6. Sam Mannan, Lees' Loss Prevention in the Process Industries, Hazard Identification, Assessment and Control, 4th Edition, Butterworth Heineman, 2012.

COs- PO's & PSO's MAPPING

CO's	PO's												PSO's		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
1	-	-	-	-	-	2	3	3	-	-	-	-	2	-	-
2	3	2	3	2	2	-	-	3	2	-	-	1	-	2	2
3	-	2	3	2	2	-	-	3	2	-	-	1	-	2	-
4	-	-	3	-	3	2	2	2	2	1	1	-	-	2	2
5	3	-	-	2	-	-	-	2	-	-	-	-	-	-	-
Avg.	3	2	3	2	2	2	2	3	2	1	1	1	2	2	2

24CE3036 INDUSTRIAL WASTE WATER MANAGEMENT L T P C
3 0 0 3

COURSE OBJECTIVES:

- To impart knowledge on the concept and application of Industrial pollution prevention, cleaner technologies, industrial wastewater treatment and residue management.
- Understand principles of various processes applicable to industrial wastewater treatment.
- Identify the best applicable technologies for wastewater treatment from the perspective of yield production.

UNIT I INTRODUCTION 9

Industrial scenario in India– Industrial activity and Environment - Uses of Water by industry – Sources and types of industrial wastewater – Nature and Origin of Pollutants - Industrial wastewater and environmental impacts – Regulatory requirements for treatment of industrial wastewater – Industrial waste survey – Industrial wastewater monitoring and sampling – generation rates, characterization and variables –Toxicity of industrial effluents and Bioassay tests – Major issues on water quality management.

UNIT II INDUSTRIAL POLLUTION PREVENTION & WASTE MINIMISATION 9

Prevention vis a vis Control of Industrial Pollution – Benefits and Barriers – Waste management Hierarchy - Source reduction techniques – Periodic Waste Minimisation Assessments – Evaluation of Pollution Prevention Options – Cost benefit analysis – Pay-back period – Implementing & Promoting Pollution Prevention Programs in Industries.

UNIT III INDUSTRIAL WASTE WATER TREATMENT 9

Flow and Load Equalisation – Solids Separation – Removal of Fats, Oil & Grease- Neutralisation- Removal of Inorganic Constituents – Precipitation, Heavy metal removal, Nitrogen & Phosphorous removal, Ion exchange, Adsorption, Membrane Filtration, Electro dialysis & Evaporation –Removal of Organic Constituents – Biological treatment Processes, Chemical Oxidation Processes, Advanced Oxidation processes – Treatability Studies.

UNIT IV WASTE WATER REUSE AND RESIDUAL MANAGEMENT 9

Individual and Common Effluent Treatment Plants – Joint treatment of industrial and domestic wastewater - Zero effluent discharge systems - Quality requirements for Wastewater reuse Industrial reuse , Present status and issues - Disposal on water and land – Residuals of industrial wastewater treatment – Quantification and characteristics of Sludge – Thickening, digestion, conditioning, dewatering and disposal of sludge – Management of RO rejects.

UNIT V CASE STUDIES 9

Industrial manufacturing process description, wastewater characteristics, source reduction options and waste treatment flow sheet for Textiles – Tanneries – Pulp and paper – metal finishing – Sugar and Distilleries.

TOTAL: 45 PERIODS

COURSE OUTCOMES

After completion of this course, the students is expected to be able to,

CO1 Explain the source and types of industrial wastewater and their environmental impacts and choose the regulatory laws pertaining to environmental protection
CO2 Identify industrial wastewater pollution and implement pollution prevention, waste minimization in industries
CO3 Apply knowledge and skills to design industrial wastewater treatment schemes
CO4 Audit and analyze environmental performance of industries to internal, external client, regulatory bodies and design water reuse management techniques
CO5 Conduct research to develop effective management systems for industrial wastewater that are technically sound, economically feasible and socially acceptable

REFERENCES

1. "Industrial wastewater management, Treatment & disposal, Water Environment" Federation Alexandria Virginia, Third Edition, 2008.
2. Lawrance K. Wang, Yung Tse Hung, Howard H.Lo and Constantine Yapijakis "Handbook of Industrial and Hazardous waste Treatment", Second Edition, 2004.
3. Metcalf & Eddy, Inc., George Tchobanoglous, Franklin L. Burton and H. David Stensel, Wastewater engineering, treatment and reuse, Fourth Edition, McGraw-Hill, 2017
4. Nelson Leonard Nemerow, "Industrial waste Treatment", Elsevier, 2007.
5. Wesley Eckenfelder W., "Industrial Water Pollution Control", Second Edition, Mc Graw Hill, 2000.
6. Paul L. Bishop, "Pollution Prevention:Fundamentals and Practice", Mc-Graw Hill International, Boston, 2000.
7. Waste water Treatment for pollution control and reuse by Soli. J. Arceivala, Shyam. R. Asolekar, Tata McGraw Hill, 2007

COs- PO's & PSO's MAPPING

CO's	PO's												PSO's		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
1	3	-	-	-	-	-	-	-	-	-	3	1	2	-	3
2	-	3	2	2	-	-	-	3	3	2	-	-	-	2	-
3	2	3	3	-	-	-	-	-	3	2	2	3	-	2	3
4	2	-	3	-	2	-	2	3	3	-	-	-	-	-	-
5	2	3	2	3	-	1	2	-	-	2	3	-	3	-	3
Avg.	2	3	3	2	2	1	2	3	3	2	3	2	2	2	3

24CE3037 SOLID AND HAZARDOUS WASTE MANAGEMENT L T P C 3 0 0 3

COURSE OBJECTIVE

To impart knowledge and skills relevant to minimization, storage, collection, transport, recycling, processing and disposal of solid and hazardous wastes including the related regulations, engineering principles, design criteria, methods and equipment.

UNIT I WASTE CLASSIFICATION AND REGULATORY REQUIREMENTS 9

Sources and types of solid and hazardous wastes - need for solid and hazardous waste management – salient features of latest Indian legislations on management and handling of solid wastes, hazardous wastes, biomedical wastes, electronic wastes, construction and demolition wastes, plastics and discarded lead acid batteries – elements of integrated waste management and roles of stakeholders - seven elements and seven step approach to integrated solid waste management planning.

UNIT II WASTE CHARACTERIZATION, REDUCTION AND RECYCLING 9

Waste sampling and characterization plan - waste generation rates and variation – physical composition, chemical and biological properties – hazardous characteristics – ignitability, corrosivity and TCLP tests –source reduction, segregation and onsite storage of wastes – waste exchange - extended producer responsibility - recycling of plastics, C&D wastes and E wastes.

UNIT III WASTE COLLECTION TRANSPORT AND MATERIAL RECOVERY 9

Door to door collection of segregated solid wastes - analysis of hauled container and stationery container collection systems - compatibility, storage, labeling and handling of hazardous wastes – principles and design of transfer and transport facilities - hazardous waste transport and manifests - mechanical processing and material separation technologies – Size reduction – size separation - density separation - magenetic separation – compaction – principles and design of material recovery facilities – physico chemical treatment of hazardous wastes - solidification and stabilization – case studies on waste collection and material recovery

UNIT IV BIOLOGICAL AND THERMAL PROCESSING OF WASTES 9

Biological and thermos-chemical conversion technologies – composting – biomethanation – incineration – pyrolysis-plasma arc gasification –principles and design of biological and thermal treatment facilities - MSW processes to energy with high-value products and specialty By-products - operation of facilities and environmental controls - treatment of biomedical wastes – case studies and emerging waste processing technologies.

UNIT V WASTE DISPOSAL **9**

Sanitary and secure landfills - components and configuration– site selection - liner and cover systems - geo synthetic clay liners and geo membranes - design of sanitary landfills and secure landfills- leachate collection, treatment and landfill gas management – landfill construction and operational controls - landfill closure and environmental monitoring – landfill bioreactors – rehabilitation of open dumps and biomining of dumpsites-remediation of contaminated sites- Case studies

TOTAL: 45 PERIODS

COURSE OUTCOMES

On completion of the course, the student is expected to be able to

CO1 Explain the various functional elements of solid and hazardous waste management including the associated legal, health, safety, and cultural issues as well as responsibilities of different stakeholders

CO2 Apply the knowledge of science and engineering fundamentals to characterize different types of solid and hazardous wastes, assess the factors affecting variation and assess performance of waste treatment and disposal systems

CO3 Design of systems and processes to meet specified needs of waste minimization, storage, collection, transport, recycling, processing and disposal.

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 Conduct research pertinent to solid and hazardous waste management and communicate effectively to different stakeholders as well as engage in independent lifelong learning

REFERENCES

1. George Tchobanoglous, Hilary Theisen and Samuel A, Vigil, “Integrated Solid Waste Management, Mc-Graw Hill India, First edition, 2015.
2. CPHEEO, “Manual on Municipal Solid waste management, Vol I, II and III, Central Public Health and Environmental Engineering Organisation , Government of India, New Delhi, 2016.
3. William A. Worrell, P. Aarne Vesilind, Christian Ludwig, Solid Waste Engineering – A Global perspective, 3rd Edition, Cengage Learning, 2017.
4. John Pitchtel, Waste Management Practices, CRC Press, Taylor and Francis Group, 2014.
5. Gary C. Young, Municipal Solid Waste to Energy Conversion Processes: Economic, Technical, and Renewable Comparisons, Wiley, 2010
6. Cherry P M, Solid and Hazardous Waste Management, CBS publishers and distributors Pvt Ltd, 2018.
7. Rao M.N, Razia Sultana, Sri Harsha Kota, Solid and Hazardous waste management – Science and Engineering , Butterworth-Heinemann, 2016

COs- PO’s & PSO’s MAPPING

CO’s	PO’s												PSO’s		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
1	-	3	-	-	-	2	2	-	-	-	-	-	3	2	-
2	3	2	-	2	2	-	-	-	2	-	-	-	2	2	3
3	-	-	3	-	-	-	-	-	2	-	-	-	3	2	3
4	-	2	-	-	2	2	2	2	-	-	2	-	3	2	-
5	-	2	-	2	-	-	-	-	-	1	-	1	-	2	-
Avg.	3	2	3	2	2	2	2	2	2	1	2	1	3	2	3

24CE3038 ENVIRONMENTAL POLICY AND LEGISLATIONS **L T P C**

3 0 0 3

COURSE OBJECTIVES

The course will analyze the legislative and judicial responses to environmental problems and the administrative system of environment related laws such as air, water, land, and hazardous substances etc. Environment advocacy and approaches for using litigation in environment protection will receive special attention.

UNIT I INTRODUCTION TO ENVIRONMENTAL LEGISLATIONS **9**

Significance of Environmental Law -International Environmental Law -Development of International Environmental Law -Source and General principals of International Environmental Law –General rights and obligations of States - General Issues of the international law related to environmental protection -Stockholm Declaration-Rio Declaration on Environment and Development-Basel Convention on the Control of Trans boundary Movement of Hazardous Wastes and their disposal- Convention of Biological Diversity-U.N Frame Work Convention on Climate Change-Montreal Protocol on Substances that deplete Ozone Layer-Kyoto Protocol.

UNIT II INDIAN CONSTITUTIONS AND ENVIRONMENTAL PROTECTION 9

Indian Constitution and Environmental Protection -Constitutional provisions concerning Environment Articles 14,15,(2) (b) 19 (e),21,31,32,38,39,42,47, 48-A,49,51,51-A: Indian Environmental Policy 2006 Administrative machinery for pollution control Common Law & Criminal Law Nuisance, Negligence, Strict liability and Absolute liability, Provisions of IPC relating to environmental problems (public nuisance u/s 268 and others (Sections 269,270,277,284,285,286,425 to 440) Section 133 of Criminal Procedure Code (Cr.P.C).

UNIT III REMEDIES FOR ENVIRONMENTAL POLLUTION 9

Common Law Remedies/Remedies under Law of Tort – Penal Remedies – Indian Penal Code and Code of Criminal Procedure – Remedies under Constitutional Law – Writs – Public Interest Litigation - Public Liability Insurance Act, 1991 – The National Green Tribunal Act 2010

UNIT IV MAJOR INDIAN LEGISLATIONS 9

Water Act (1974) Air Act (1981) Environmental Protection Act (1986) Major Notifications, The Municipal solid Wastes (Management and Handling) Rules 2000-Bio Medical Wastes (Management and Handling) Rules 1998-Hazardous Wastes (Management and Handling Rules 1989- Environment Impact Assessment Notifications- Coastal Regulation Zone Notification- Public Hearing Notifications

UNIT V ENVIRONMENT AND DEVELOPMENT CASE LAWS 9

Meaning and concept of development - Its impact on environment; conflict between environment and development, Concept of Sustainable Development., Polluter Pay Principle, Precautionary Principle, Public Trust Doctrine. Landmark Judgments - Olium gas leakage case, Rural Litigation and Entitlement Kendra, Dehradun, (1985) Supp SCC 487) Vellore Citizen Welfare Forum v. Union of India, (1996) 5SCC 647) Ganga Pollution case (1988) I SCC) S. Jagannath v. UOI (1997) SCC867) Vellore Citizens welfare forum case M.C. Mehta V. Kamalnath (1997) I SCC 388)

TOTAL: 45 PERIODS

COURSE OUTCOMES:

On completion of the course, the student is expected to be able to

CO1 Understand origins and sources of environmental laws, and understand how and by whom environmental laws are made and interpreted

CO2 Understand the key principles of, and actors within, environmental laws

CO3 Understand the National Environmental Policy and Various Legislations enacted in line with Policy

CO4 Critically analyze environmental laws within various contexts and to evaluate laws against procedural and substantive criteria.

CO5 Understand and the Legal system operating in India and will be in a position to prepare compliance reports for getting environmental clearance.

REFERENCES

1. Leelakrishnan P., Environmental Law in India, Butterworths,1998.
2. Leelakrishnan P., Environmental Case Book, Lexis Nexis, 2000.
3. Shanthakumar S. , Environmental Law – An Introduction, Butterworths, 2004.
4. Shyam Diwan and Armin Rosencranz, Enviromental Law and Policy in India, Oxford, 2001.

COs- PO's & PSO's MAPPING

CO's	PO's												PSO's		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
1	2	-	-	-	-	-	2	-	2	1	-	-	3	-	-
2	1	-	-	-	-	1	2	-	2	1	-	-	3	-	-
3	2	-	2	3	-	2	3	3	-	2	-	2	3	-	-
4	2	-	2	-	-	2	3	3	-	1	-	2	-	-	-
5	-	3	2	3	3	2	3	3	-	2	1	2	3	2	2
Avg.	2	3	2	3	3	2	3	3	-	1	1	2	3	2	2

24CE3039 **ENVIRONMENTAL HEALTH AND SAFETY** **L T P C**
3 0 0 3

COURSE OBJECTIVE

To educate overview of EHS in industries and related Indian regulations, types of Health hazards, effect, assessment and control methods and EHS Management System

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 9

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 9

Features of Satisfactory and Safe design of work premises – good housekeeping - lighting and color, 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 9

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 9

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

After completion of this course, the students are expected to be able to understand:

CO1 Need for EHS in industries and related Indian regulations
CO2 Various types of Health hazards, effect, assessment and control methods
CO3 Various safety systems in working environments
CO4 The methodology for preparation of Emergency Plans and Accident investigation
CO5 EHS Management System and its elements

REFERENCES

1. Industrial Health and Safety Acts and Amendments, by Ministry of Labour and Employment, Government of India.
2. Fundamentals of Industrial Safety and Health by Dr.K.U.Mistry, Siddharth Prakashan, 2012.
3. The Facility Manager's Guide to Environmental Health and Safety by Brian Gallant, Government Inst Publ., 2007.
4. Effective Environmental, Health, and Safety Management Using the Team Approach by Bill Taylor, Culinary and Hospitality Industry Publications Services, 2005.
5. Environmental and Health and Safety Management by Nicholas P.Cheremisinoff and Madelyn L. Graffia, William Andrew Inc. NY, 1995

COs- PO's & PSO's MAPPING

CO's	PO's												PSO's		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
1	-	3	-	3	-	3	-	3	2	-	1	2	-	2	-
2	2	2	2	3	-	-	-	-	2	-	-	3	2	2	-
3	-	-	2	-	3	3	1	1	2	-	2	3	-	-	-
4	-	-	3	2	-	1	2	-	-	-	-	-	2	2	2
5	1	-	-	-	2	-	-	-	1	-	1	-	1	-	-
Avg.	2	3	2	3	3	3	1	2	2	-	1	2	2	2	2

24CE3040 **LIFE CYCLE ASSESSMENT** **L T P C**
3 0 0 3

COURSE OBJECTIVES

To impart knowledge and skills on the concept and methodology of Life Cycle Assessment as per international standards and its potential applications to develop sustainable products and promote sustainable consumption.

UNIT I LIFE CYCLE THINKING AND LIFE CYCLE MANAGEMENT 9

Introduction to Life Cycle Thinking – Industrial ecology – Life cycle management (LCM) and Stakeholder Expectations - LCM drivers and issues - materials flow analysis - Life cycle of Products and services- International organizations and networks - History and definition of LCA - Analytical tools for product and service systems - Value creation along the life cycle– technical characteristics – applications – limitations

UNIT II LCA GOAL, SCOPE AND INVENTORY 9

ISO 14040 framework for LCA - Life cycle goal and scope definition - function, functional unit and reference flow System boundaries, data categories, inputs and outputs, data quality, critical review and other procedural aspects - Inventory Analysis: Raw Material Extraction and Processing , Manufacturing and Production , Product Use and Consumption , End-of-life Management, Transportation and Distribution - Dealing with Allocation Issues - Solutions to the multi functionality problem - Flow diagram.

UNIT III LIFE CYCLE IMPACT ANALYSIS AND INTERPRETATION 9

Characterization factors and principle of characterization - Classification -Characterization - Optional elements - normalization , grouping, weighting ,data quality analysis - Characterization models – Impact assessment, Case studies -Simplified/streamlined Life Cycle Assessments – procedural approaches, numerical approaches - Examples of numerical approaches - contribution analysis, perturbation analysis, uncertainty - analysis, comparative analysis, key issue analysis – Treatment of uncertainties - Elements in uncertainty handling - Sensitivity of LCA results – Sustainability analysis - Extending LCA - economic dimension, social dimension - Life cycle costing – Eco efficiency - Combining LCA and LCC – Case studies

UNIT IV DESIGN FOR ENVIRONMENT AND ECOLABELLING 9

Sustainable consumption – Eco-efficiency - green consumerism - product stewardship and green engineering - Extended producer responsibility – Design For Environment Strategies, Practices, Guidelines, Methods, And Tools .Eco design strategies –Design for Disassembly - Dematerialization, re materialization, trans materialization – Green procurement and green distribution - Analysis framework for reuse and recycling – Typical constraints on reuse and recycling - Communication of Life Cycle Information - Indian eco mark scheme – Environmental product declarations – Environmental marketing

UNIT V INTEGRATION AND APPLICATIONS 9

Integrative approaches to LCA and LCM - real-world applications and emerging trends - stakeholder communication and reporting - regulatory contexts and international standards - challenges, limitations, and future directions, LCA Softwares.

TOTAL: 45 PERIODS

COURSE OUTCOMES

On completion of the course, the student is expected to be able to

CO1 Describe the basic concepts of life cycle thinking and explain its importance for managing environmental impacts.

CO2 Identify and outline appropriate goal, scope, and inventory components in life cycle assessment studies **CO3** Explain key impact categories and demonstrate the use of basic life cycle impact assessment techniques

CO4 Apply fundamental eco-design strategies and describe ecolabelling practices to support sustainable product development

CO5 Summarize how life cycle assessment supports sustainability decisions and communicate findings effectively.

REFERENCES:

1. ISO 14040-2016-Environmental management - Life cycle assessment - Principles and framework, International Organization for Standardization, 2016
2. Ralph Horne, Tim Grant, Karli Verghese, Life Cycle Assessment: Principles, Practice and Prospects, Csiro Publishing, 2009
3. ISO/TR 14047:2003, Environmental management - Life cycle impact assessment - Examples of application of ISO 14042, International Organization for Standardization, 2007.
4. International Organization for Standardization: ISO TR 14062 Environmental management- Integrating environmental aspects into product design and development, 2002.

5. European Commission - Joint Research Centre - Institute for Environment and Sustainability: International Reference Life Cycle Data System (ILCD) Handbook – General guide for Life Cycle Assessment - Detailed guidance. Luxembourg. European Union; 2010
6. Catherine Benoit, UQAM/CIRAIG, and Bernard Mazijn, Guidelines for Social Life Cycle Assessment of Products, United Nations Environment Programme,2009

CO's-PO's & PSO's MAPPING

CO's	PO's												PSO's		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
1	2	-	-	2	-	-	-	-	3	-	2	-	2	3	3
2	2	-	-	-	-	2	-	-	-	-	3	-	2	3	3
3	3	2	2	-	-	3	-	-	-	-	2	3	3	3	3
4	-	-	-	-	-	-	3	-	3	2	-	2	3	3	3
5	2	-	-	3	2	2	2	3	2	2	3	-	3	3	3
Avg.	2	2	2	3	2	2	2	3	3	2	3	3	3	3	3

VERTICAL VI : DIVERSIFIED COURSE

24CE3040 REMOTE SENSING CONCEPTS 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 and to introduce the elements of data interpretation

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

Standard atmospheric profile – main atmospheric regions and its characteristics – interaction 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

Motions of planets and satellites – Newton's law of gravitation - Gravitational field and potential - Escape velocity - Kepler's law of planetary motion - Orbit elements and types – Orbital perturbations and maneuvers – Types of remote sensing platforms - Ground based, Airborne platforms and Space borne platforms – Classification of satellites – Sun synchronous and Geosynchronous satellites – Legrange Orbit.

UNIT IV SENSING TECHNIQUES 9

Classification of remote sensors – Resolution concept : spatial, spectral, radiometric and temporal resolutions - Scanners - Along and across track scanners – Optical-infrared sensors – Thermal sensors – microwave sensors – Calibration of sensors - High Resolution Sensors - LIDAR , UAV – Orbital and sensor characteristics of live Indian earth observation satellites

UNIT V DATA PRODUCTS AND INTERPRETATION 9

Photographic and digital products – Types, levels and open source satellite data products –- selection and procurement of data– Visual interpretation: basic elements and interpretation keys - Digital interpretation – Concepts of Image rectification, Image enhancement and Image classification

TOTAL: 45 PERIODS

COURSE OUTCOMES:

On completion of the course, the student is expected to be able to

CO1 understand the concepts and laws related to remote sensing
CO2 understand the interaction of electromagnetic radiation with atmoshphere and earth material
CO3 acquire knowledge about satellite orbits and different types of satellites
CO4 understand the different types of remote sensors
CO5 gain knowledge about the concepts of interpretation of satellite imagery

TEXTBOOKS

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

REFERENCES

1. Janza, F.Z., Blue H.M. and Johnson,J.E. Manual of Remote Sensing. Vol.I, AmericanSociety 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 JacobVan Zyl, 2006 Edition II, Wiley Publication.
5. Basudeb Bhatta, Remote Sensing and GIS, Oxford University Press, 2011

COs- PO's & PSO's MAPPING

CO's	PO's												PSO's		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
1	3	-	-	-	-	-	-	-	-	-	-	-	3	3	-
2	3	-	-	-	-	-	-	-	-	-	-	-	3	3	-
3	2	-	-	-	-	-	-	-	3	3	-	-	3	2	-
4	2	3	2	3	3	-	3	3	-	-	1	2	3	2	3
5	2	3	2	3	3	3	3	-	3	3	1	2	3	2	3
Avg.	2	3	2	3	3	3	3	3	3	3	1	2	3	2	3

24CE3042 GEOGRAPHIC INFORMATION SYSTEM L T P C
3 0 0 3

OBJECTIVES

- To introduce the fundamentals and components of Geographic Information System
- To provide details of spatial data structures and input, management and output processes.

UNIT I 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 II 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 – RasterData Compression - Vector Data Structures - Raster vs Vector Models- TIN and GRID datamodels.

UNIT III DATA INPUT AND TOPOLOGY 9

Scanner - Raster Data Input – Raster Data File Formats – Georeferencing – Vector DataInput –Digitiser – Datum Projection and reprojection -Coordinate Transformation – Topology - Adjacency, connectivity and containment – Topological Consistency – Non topological fileformats - Attribute Data linking – Linking External Databases – GPS Data Integration

UNIT IV DATA QUALITY AND STANDARDS **9**

Data quality - Basic aspects - completeness, logical consistency, positional accuracy, temporalaccuracy, thematic accuracy and lineage – Metadata – GIS Standards –Interoperability - OGC - Spatial Data Infrastructure

UNIT V DATA MANAGEMENT AND OUTPUT **9**

Import/Export – Data Management functions- Raster image to Vector image and Vector image to Raster image Conversion - Data Output - Map Compilation – Chart/Graphs – Multimedia – Enterprise Vs. Desktop GIS-distributed GIS.

TOTAL: 45 PERIODS

OUTCOMES

This course equips the student to

- Have basic idea about the fundamentals of GIS.
- Understand the types of data models.
- Get knowledge about data input and topology.
- Gain knowledge on data quality and standards.
- Understand data management functions and data output

TEXT BOOKS

1. Kang - Tsung Chang, Introduction to Geographic Information Systems, McGraw Hill Publishing, 2nd Edition, 2011.
2. Ian Heywood, Sarah Cornelius, Steve Carver, Srinivasa Raju, "An Introduction Geographical Information Systems, Pearson Education, 2nd Edition,2007.

REFERENCE

1. Lo.C.P., Albert K.W. Yeung, Concepts and Techniques of Geographic Information Systems, Prentice-Hall India Publishers, 2006

COs-PO's & PSO's MAPPING

CO	PO												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
1	2	-	-	-	-	2	2	-	3	-	3	2	3	2	
2	3	3	3	2		-	2	-	3	-	2	2	3	3	3
3	3	3	3	2	2	-	-	-	3	-	2	2	3	3	3
4	2	3	-	-	-	-	-	-	2	-	2	2	3	2	3
5	2	1	2	3	-	-	-	-	2	-	3	2	3	2	1
Avg.	2	3	3	2	1	1	2	-	3	-	2	2	3	2	3

24CE3043 HYDROGRAPHIC SURVEYING **L T P C**

3 0 0 3

COURSE OBJECTIVES

- To provide the necessary knowledge and practical instrument operational and data processing skills needed for them to confidently accomplish a bathymetric survey in the real world
- To develop students' critical and creative thinking, as well as cooperative attitudes & behaviour of working with others.

UNIT I INTRODUCTION, TIDES AND DATUMS **9**

Overview of hydrographic surveying concepts- bathymetric and nautical charts- Basic tidal theory- tidal observations and predictions - common types of recording tide gauges - different vertical datums - Indian tides.

UNIT II SOUNDINGS **9**

Overview of depth data types- Working principle of echo sounders - characteristics and nature of underwater acoustic signals – transducers - error sources and calibrations- Advanced instrumentation.

UNIT III NAVIGATION AND POSITION FIXING **9**

Horizontal positioning methods and requirements - concept of line and surface of position - positioning and navigation using satellite positioning systems - differential GPS and Real-time kinematic (RTK)

UNIT IV PLANNING AND DATA PROCESSING **9**

General considerations for planning of an inshore hydrographic survey - ground and track control - practical soundings in inshore and coastal surveys - data processing and chart compilation - hydrographic software packages for data collection - processing and plotting.

UNIT V MARINE ENVIRONMENTAL MEASUREMENTS **9**

Methods of measuring and recording of currents - composition of the sea bed - and solids in suspension - Case Studies (The role of the hydrographic surveyor on different marine projects)

TOTAL: 45 PERIODS

COURSE OUTCOMES

On completion of the course, the student is expected to be able to

CO1 Learn the fundamentals of hydrographic surveying
CO2 Identify the appropriate techniques for different types of survey
CO3 Understand the various options available during the Navigation
CO4 Analyze the data collected from a survey and assess its quality against the project requirements
CO5 Discuss the different roles for a hydrographic surveyor on marine projects

TEXTBOOK

1. U.S. Army Corps of Engineers, (2002), Hydrographic Surveying, Document No. EM 1110-2-1003.

REFERENCES

1. de Jong, C. D., Lachapelle, G., Skone, S. & Elema, I. A. (2002), Hydrography, Delft University Press, The Netherlands.
2. Ingham, A. E. (1992), Hydrography for the Surveyor and Engineer, 3rd Edition revised by Abbott V. J., Blackwell Science.
3. International Hydrographic Organisation (1998), IHO Standards for Hydrographic Surveying (S- 44), IHB Monaco.
4. Loweth, R. P. (1997), Manual of Offshore Surveying for Geoscientists and Engineers Chapman & Hall.
5. Pugh, D. (2004), Changing Sea Levels – Effects of Tides, Weather and Climate, Cambridge University Press.
6. Sonnenberg, G. J. (1988), Radar and Electronic Navigation, Butterworths.

COs- PO's & PSO's MAPPING

CO	PO												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
1	3	-	-	-	-	-	-	-	-	-	-	-	3	2	3
2	3	-	-	-	-	-	-	3	-	-	-	-	3	3	3
3	3	2	3	3	3	-	3	3	-	-	-	3	3	3	3
4	3	3	3	3	3	3	3	3	-	3	3	3	3	3	3
5	3	2	3	3	3	3	3	3	3	3	3	3	3	3	3
Avg.	3	2	3	3	3	3	3	3	3	3	3	3	3	3	3

24CE3044 EARTH AND ROCK FILL DAMS **L T P C**
3 0 0 3

COURSE OBJECTIVE

Students are expected to learn reasons for failure and damages of embankments and slopes, various methods of analysis of slopes and remedial techniques to protect the slopes.

UNIT I DESIGN CONSIDERATION **9**

Design consideration, Factors influencing design, Types of earth and rock fill dams, Design details, Provisions to control pore pressure.

UNIT II SLOPE STABILITY AND SEEPAGE ANALYSIS **8**

Stability of infinite and finite slopes, Method of Slices, Bishop's method, Flow nets, Stability conditions during construction, Full reservoir and drawdown - cut off walls – Trenches – Importance of drainage and filters.

UNIT III HYDRAULIC FRACTURING 9

Introduction, Conditions and mechanisms for hydraulic fracturing, Failure criterion for hydraulic fracturing – cubic specimen with a crack – core with a transverse crack – core with a vertical crack, strike–dip of easiest crack spreading; factors affecting hydraulic fracturing, self-healing of a core crack.

UNIT IV FAILURE AND DAMAGES 9

Failure and damages, Nature and importance of failures in embankment and foundation - Piping, Differential settlement, Foundation slides, Earthquake damage, creep and anisotropic effects, Reservoir wave action, Dispersive piping.

UNIT V SLOPE PROTECTION MEASURES 10

Special design problems, Slope protection, Filter design, Foundation treatment, Earth dams on pervious soil foundation, Application of Geosynthetic materials in filtration. Treatment of rock foundation, Construction Techniques, Quality control and performance measurement

TOTAL: 45 PERIODS

COURSE OUTCOMES

On completion of thecourse, thestudent isexpected tobeableto

CO1 Assess the causes of failure and damage of embankments and slopes.

CO2 Apply the knowledge of engineering and analyse the stability of slopes for various seepage conditions and apply the concept in the design of earth and rock fill dams.

CO3 Apply the knowledge of engineering and assess the stability of dam against hydraulic fracturing and suggest suitable remedial measure.

CO4 Understand the nature of failures and damages in earth and rock fill dams and apply the concept in field to avoid distress.

CO5 Recommend suitable remedial measures to protect the slopes and implement quality control and monitor its performance

REFERENCES

1. Rowe, R.K., Geotechnical and Geoenvironmental Engineering Handbook, Kulwer Academic Publishers, 2001.
2. Anderson, M.G., and Richards, K.S., Slope Stability, John Wiley, 1987.
3. Sherard, J.L., Woodward, R.J., Gizienski, R.J. and Clevenger, W.A., Earth and Earth rock dam, John Wiley, 1963.
4. Chowdhury, D.F., Slope analysis, Prentice Hall, 1988.
5. McCarthy, D.F., Essentials of Soil Mechanics and Foundations: Basic Geotechnics, Sixth Edition, Prentice Hall, 2002.
6. Bramhead, E.N., The Stability of Slopes, Blacky Academic and Professionals Publications, Glasgow, 1986.
7. Chandhar, R.J., Engineering Developments and Applications, Thomas Telford, 1991
8. Koerner, R.M. Designing with Geosynthetics, Third Edition, Prentice Hall, 1997.
9. Jun-Jie Wang, Hydraulic Fracturing in Earth-rock Fill Dams, John Wiley & Sons, 2014.

COs- PO's & PSO's MAPPING

CO	PO												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
1	2	2	2	3	1	2	1	3	2	1	2	3	3		2
2	3	3	3	2	3	2	2	1	2	1	2	3	3		2
3	3	3	3	3	2	3	2	1	2	2	3	3	3		2
4	3	3	3	2	3	3	3	1	3	2	3	3	3		3
5	2	2	3	1	3	3	3	3	3	1	3	3	3		3
Avg.	3	3	3	2	3	3	3	2	2	1	3	3	3		2

24CE3045 **COMPUTATIONAL FLUID DYNAMICS** **L T P C**
3 0 0 3

COURSE OBJECTIVES

The main learning objective of this course is to prepare the students for

- Applying the fundamentals of CFD, and developing case specific governing equations,
- Performing finite difference and finite volume based analysis for steady and transient diffusion problems,
- Implementing various mathematical schemes under finite volume method for convention diffusion.
- Solving complex problems in the field of fluid flow and heat transfer with the support of high speed computers.
- Applying the various discretization methods, solution procedure and the concept of turbulence modelling.

UNIT I GOVERNING EQUATIONS ANDBOUNDARY CONDITIONS 9

Basics of computational fluid dynamics – Governing equations– Continuity, Momentum and Energy equations – Chemical species transport –Physical boundary conditions – Time-averaged equations for Turbulent Flow – Turbulent–Kinetic Energy Equations – Mathematical behavior of PDEs on CFD - Elliptic, Parabolic and Hyperbolic equations.

UNIT II FINITE DIFFERENCE AND FINITE VOLUME METHODS FOR DIFFUSION 9

Derivation of finite difference equations– General Methods for first and second order accuracy – Finite volume formulation for steady and transient diffusion problems –Example problems– Use of Finite Difference and Finite Volume methods

UNIT III FINITE VOLUME METHOD FORCONVECTION DIFFUSION 9

Steady one-dimensional convection and diffusion – Central, upwind differencing schemes, properties of discretization schemes, Hybrid, Power-law, QUICK Schemes, Conservativeness, Boundedness, Transportiveness.

UNIT IV FLOWFIELD ANALYSIS 9

Stream function and vorticity, Representation of the pressure gradient term, Staggered grid – Momentum equations, Pressure and Velocity corrections – Pressure Correction equation, SIMPLE algorithm and its variants – PISO Algorithms.

UNIT V TURBULENCE MODELS AND MESH GENERATION 9

Turbulence models, mixing length model, Two equation (k-Є) models – High and low Reynolds number models, Mesh Generation and refinement Techniques-software tools.

TOTAL : 45 PERIODS

COURSE OUTCOMES

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

CO1 Apply the fundamentals of CFD and develop case specific governingequations
CO2 Perform finite difference and finite volume based analysis for steady and transient diffusion problems
CO3 Implement various mathematical schemes under finite volume method for convention diffusion
CO4 Solve complex problems in the field of fluid flow and heat transfer with the support of high speedcomputers
CO5 Apply the various discretization methods, solution procedure and the concept of turbulence modelling

TEXT BOOKS

1. Versteeg, H.K. and Malalasekera, W. “An Introduction to Computational Fluid Dynamics: The finite volume Method”, Pearson Education,2014
2. Ghoshdastidar, P.S., “Computer Simulation of flow and heat transfer”, Tata McGraw Hill, 1998.

REFERENCES:

1. John. F. Wendt, “Computational Fluid Dynamics – An Introduction”, Springer,2013.
2. K.Muralidhar&T.Sundararajan, Computational Fluid Flow and Heat Transfer, Narora Publishing House,1994.
3. Suhas V, Patankar, “Numerical Heat transfer and Fluid flow”, Taylor & Francis,2009.
4. Uriel Frisch, Turbulence, Cambridge University Press,1999.
5. YogeshJaluria& Kenneth E. Torrance, “Computational Heat Transfer”, CRC press,2002.

COs- PO's & PSO's MAPPING

CO	PO												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
1	3	2	1	1	2	2	1	1	1	1	1	1	3	1	2
2	3	2	2	1	2	2	1	1	1	1	1	1	2	1	2
3	3	2	3	2	2	2	1	1	2	2	2	1	2	2	3
4	3	3	3	3	2	2	1	1	2	2	2	2	2	3	3
5	3	3	3	3	2	2	1	1	2	2	2	2	2	3	3
Avg.	3	2	3	2	2	2	1	1	2	2	2	1	2	2	3

24CE3046 RAIN WATER HARVESTING L T P C
3 0 0 3

COURSE OBJECTIVE

To impart knowledge and skills relevant to water conservation and management towards achieving the sustainability in water resources and relate the engineering principles and practices in estimation of runoff, storage, recharge into the ground and maintain the system through the best management practices followed around the world.

UNIT I BASICS OF RAIN WATER 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 Rain water Harvesting system

UNIT V MANAGEMENT OF RWH AND CASE STUDIES 10

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

TOTAL: 45 PERIODS

COURSE OUTCOMES

On completion of the course, the student is expected to be able to

CO1 Understand the need and importance of water conservation through global and Indian practices of rainwater harvesting

CO2 Understand and apply the concepts of hydrology and groundwater in the estimation of runoff and recharge potentials

CO3 Understand the various types of rainwater harvesting methods and apply it on the field

CO4 Design the various RWH structures to harvest the rainwater in surface and subsurface

CO5 Explain the difficulties of RWH, evaluation methods and maintenance through various case studies.

TEXT BOOKS

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

REFERENCES

1. Proceedings of UNHABITAT Blue water series "Rainwater harvesting and utilization", Book 2 beneficiaries and capacity builders.
2. Rain water Harvesting Techniques to Augment Ground Water: Ministry of Water Resources Central Ground Water Board Faridabad,2003.
3. Rainwater Harvesting: Indian Railway Institute of Civil Engineering Pune, October 2015.
4. A Manual on "Rainwater Harvesting and Conservation": Government of India, Consultancy Service Organization Central Public Works Department, New Delhi.
5. "A Water Harvesting Manual for Urban Areas" issued by Centre for Science and Environment.
6. Traditional Water Harvesting Systems of India" C.P.R. Environmental Education Centre, Chennai, India (2004).
7. Empowering Village Communities for A Sustainable Water Future - A Resource Book for Jaldoots, 2019, Prepared by Central Ground Water Board, Dept. of Water Resources, River Development and Ganga Rejuvenation, Ministry of Jal Shakti, Govt. of India and MARVI – Managing Aquifer Recharge and Sustaining Ground water Use through Village-level Intervention.
8. Handbook on rainwater harvesting storage options, Ministry of Water & Environment, Uganda

COs- PO's & PSO's MAPPING

CO	PO												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
1	2	1			1	2	2	2	1	1	1	2	2	2	1
2	3	3	2	2	3	2	1	1	1	1	2	2	2	2	2
3	2	2	2	2	2	2	2	1	1	1	1	2	2	2	2
4	3	3	3	3	3	3	2	2	2	1	3	2	3	3	3
5	2	2	2	2	2	2	2	2	2	1	2	2	3	3	3
Avg.	2	2	2	2	2	2	2	2	1	1	2	2	2	2	2

24CE3047 METRO SYSTEMS AND ENGINEERING L T P C
3 0 0 3

COURSE OBJECTIVE

This course provides a holistic understanding of metro rail systems, covering planning, construction, safety, operations, and multidisciplinary engineering components. It prepares students to contribute effectively to the design, execution, and operation of modern metro projects.

UNIT I INTRODUCTION 9

General: Overview of Metro Systems; Need for Metros; Routing studies; Basic Planning and Financials.

UNIT II CONSTRUCTION METHODS 9

Civil Engineering- Overview and construction methods for elevated and underground stations; Viaduct spans and bridges; Underground tunnels; Depots; Commercial and Service buildings. Initial Surveys & Investigations

UNIT III QUALITY & SAFETY SYSTEMS 9

Basics of Construction Planning & Management, Construction Quality & Safety Systems. Traffic integration, multimodal transfers and pedestrian facilities; Environmental and social safeguards; Track systems-permanent way. Facilities Management

UNIT IV OPERATION CONTROL CENTER 9

Electronics and Communication Engineering- Signaling systems; Automatic fare collection; Operation Control Centre (OCC and BCC); SCADA and other control systems; Platform Screen Doors.

UNIT V MECHANICAL & ROLLING STOCK 9

Mechanical & TVS, AC: Rolling stock, vehicle dynamics and structure; Tunnel Ventilation systems; Air conditioning for stations and buildings; Fire control systems; Lifts and Escalators. ELECTRICAL: OHE, Traction Power; Substations- TSS and ASS; Power SCADA; Standby and Back-up systems; Green buildings, Carbon credits and clear air mechanics

TOTAL:45 PERIODS

COURSE OUTCOMES

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

CO1 Explain the different metro systems
CO2 Discuss construction methods for elevated and underground section
CO3 Explain the construction quality and safety
CO4 Apply electronic signaling systems and automatic fare collection
CO5 Discuss the SCADA, lifts and escalators

TEXT BOOKS

1. Paul Garbutt, World Metro Systems, Capital Transport Pub; 2nd Edition, 1997.

REFERENCES

1. General & Technical information of Hyderabad Metro
2. General & Technical information of Delhi Metro

COs-PO's & PSO's MAPPING

CO	PO												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
1	3	2	2	1	1	1	2	1	1	2	1	2	3	2	1
2	3	3	3	1	2	1	1	1	2	2	1	2	3	3	2
3	2	2	3	2	2	2	3	3	2	2	1	3	3	3	2
4	2	3	2	2	3	1	1	1	2	3	2	2	2	2	2
5	3	2	3	2	2	2	3	2	2	2	1	3	2	2	3
Avg.	3	2	3	2	2	1	2	2	2	2	1	2	3	2	2

24CE3048 ENVIRONMENTAL QUALITY MONITORING L T P C
3 0 0 3

COURSE OBJECTIVES

To educate the students on the sample collection and various instrumental methods of monitoring the quality of air, water and solid waste.

UNIT I MONITORING AND CHARACRATERIZATION OF ENVIRONMENT 9

General approach to environmental analysis, Choice of Lab.Vs. Field analysis, Environmental monitoring-current and future status, Lab. Standards, Data quality objectives, statistics in environmental monitoring, Accuracy and precision, detection limit, types of errors, Automated Data acquisition and processing-sensors and transducers , Monitoring Network and real time monitoring

UNIT II ENVIRONMENTAL SAMPLING 9

Location, planning, sampling equipment's for water, solids and air, sample storage for physical and chemical contaminants ,types of sampling, representative samples, sample preparation techniques- Solvent Extraction, SPE, Head space, Purge and trap and SPME

UNIT III WATER ANALYSIS 9

Techniques for analysis of major ions-UV-visible Spectrophotometer, Flame photometer, AAS, ICP (AES and MS), Trace organic pollutants(PCB, dioxins, pecticides) GC and HPLC (Columns Detectors and Application)

UNIT IV ATMOSPHEREIC ANALYSIS 9

Ambient air and flue gas, Gaseous pollutants-Determination of time weighted average concentration(Absorption trains, solid adsorbents and differential tubes), Direct reading instruments(fluorescence ,chemiluminescent,IR and Electrochemical sensors, GC-MS for trace organics, Particulate sampling methods- High volume sampler, personal sampler, PM 10 and 2.5, Metals Direct(XRF) and dissolution methods(AAS/AES)

UNIT V ANALYSIS OF SOIL AND WASTE 9

Problem in analysis of soil and Waste -sampling, pretreatment -extraction and clean up, New extraction techniques, Automated soxhlet and solvent extraction,microwave digestion and sonication,SCF(CO2), Analysis for trace pollutants, Analysis of leachate.

TOTAL: 45 PERIODS

COURSE OUTCOMES

CO1 Understand the basics of environmental monitoring
CO2 Able to select appropriate sampling protocol for chemical analysis
CO3 Understand various methods of analysis of pollutants in water
CO4 Select correct method for toxic pollutants estimation in air
CO5 Familiar with analysis of land and wastes

REFERENCES

1. Reeve, R.N., "Introduction to Environmental Analysis", Analytical Techniques in the Sciences, John Wiley & Sons, Chichester, UK, 2002.
2. Barcelo, D.(editor), "Environmental analysis. Techniques, Applications and Quality Assurance", Elsevier, The Netherlands, 1996
3. Paul R. Loconto Trace Environmental Quantitative Analysis: Principles, Techniques, and Applications, Marcel Dekker; 2nd Edition , 2005,
4. Janick Artiola, Ian Pepper and Mark Brusseau, ENVIRONMENTAL MONITORING AND CHARACTERIZATION , Academic Press,2004.

COs- PO's & PSO's MAPPING

CO	PO												PSO		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
1	3	2	-	-	3	-	2	-	-	2	2	2	2	2	2
2	3	2	-	2	2	-	-	2	-	-	-	2	2	2	2
3	3	3	-	2	3	-	-	-	-	-	-	-	2	-	-
4	2	1	2	1	3	3	-	-	-	-	-	-	-	-	-
5	3	3	2	2	3	3	-	-	-	2	-	-	2	-	-
Avg.	3	2	2	2	3	3	2	2	-	2	2	2	2	2	2