DEPARTMENT OF CIVIL ENGINEERING
ANNA UNIVERSITY, CHENNAI

OUR VISION:

Department of Civil Engineering, Anna University, shall strive hard to develop and impart technical knowledge and professional skills required for Civil Engineering practice through excellence in teaching, research and consultancy to address sustainable infrastructure development needs at local, national and International levels.

OUR MISSION:

Department of Civil Engineering, Anna University shall contribute to technological and development by

1. Providing a firm scientific and technological base in Civil Engineering to achieve self-reliance.
2. Providing quality education through innovation in teaching practices at par with global standards.
3. Nurturing leadership and entrepreneurship qualities with ethical values.
4. Developing and disseminating latest knowledge and technologies in emerging areas of Civil Engineering.
5. Sharing intellectual resources and infrastructure facilities through collaborative partnership.
6. Ensuring supporting conditions for enhancing the employability skills.

ANNA UNIVERSITY, CHENNAI
UNIVERSITY DEPARTMENTS
REGULATION – 2019
CHOICE BASED CREDIT SYSTEM

B.E.CIVIL ENGINEERING

PROGRAMME EDUCATIONAL OBJECTIVES (PEOs) – Five PEOs

Graduates of the programme B E Civil Engineering will

PEO1	gain knowledge and skills in Civil engineering which will enable them to have a career and professional accomplishment in the public or private sector organisations
PEO2	become consultants on complex real life Civil Engineering problems related to Infrastructure development especially housing, construction, water supply, sewerage, transport, spatial planning.
PEO3	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.
PEO4	perform investigation for solving Civil Engineering problems by conducting research using modern equipment and software tools.
PEO5	function in multi-disciplinary teams and advocate policies, systems, processes and equipment to support civil engineering

Programme Outcomes

Graduates of the programme B E Civil Engineering will be able to

PO1	Knowledge of Engineering Sciences	Apply the knowledge of mathematics, science and engineering fundamentals to the conceptualization of Civil Engineering models
PO2	Problem analysis	Identify, formulate and solve Civil Engineering problems
PO3	Design / development of solutions	Design solutions for complex Civil Engineering problems and design systems, components or processes that meet specified needs with appropriate consideration for public health and safety, cultural, societal and Civil engineering considerations.
PO4	Investigation	Conduct investigations of Civil Engineering problems including literature survey, application of appropriate research methodologies, analysis and interpretation of data, and synthesis of information to provide valid conclusions
PO5	Modern Tool Usage	Create, select and apply appropriate techniques and modern engineering tools including prediction and modelling software, with due understanding of the limitations.
PO6	Individual and Team work	Function effectively as an individual and as a member or leader in diverse teams and in multi-disciplinary settings and demonstrating a capacity for self-management and teamwork, decision-making based on open-mindedness, objectivity and rational analysis.
PO7	Communication	Communicate effectively on Civil Engineering issues with the engineering community and with society at large, and write reports and make effective presentations.
PO8	Engineer and Society	Demonstrate understanding of the societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to Civil Engineering practice.

PO9	Ethics	Understand and commit to professional ethics and responsibilities of Civil Engineers and to contribute to the society for sustainable development.
PO10	Environment and Sustainability	Understand the socio economic impact of Civil Engineering solutions and demonstrate knowledge of sustainable development
PO11	Project Management and Finance	Demonstrate a knowledge and understanding of management and business practices, such as risk and change management, and understand their limitations
PO12	Life Long Learning	Develop ability to engage in independent and life-long learning to improve competence by critical examination of the outcomes of one's actions in addressing Civil Engineering issues and learning from corrective and preventive measures.
PROGRAM SPECIFIC OUTCOMES (PSOs) – Minimum Two Graduates of the programme B E Civil Engineering will be able to		
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

1. PEO / PO Mapping:

PROGRAMME EDUCATIONAL OBJECTIVES	PROGRAMME OUTCOMES											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
I	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
II	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
III	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
IV	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
V	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓

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	Technical English															
		Engineering Mathematics I															
		Engineering Physics															
		Engineering Chemistry															
		Problem Solving and Python Programming	✓	✓	✓	✓	✓			✓	✓			✓			
		Basic Sciences Laboratory															
		Problem Solving and Python Programming Laboratory	✓	✓	✓	✓	✓			✓	✓			✓			
	SEMESTER II	Engineering Mathematics II															
		Engineering Graphics	✓		✓		✓								✓		✓
		Basics of Electrical and Electronics Engineering	✓	✓	✓	✓	✓										
		Engineering Mechanics	✓		✓												
		Environmental Sciences															
		Audit Course I															
		Workshop Practices Laboratory	✓	✓	✓	✓											
		Electrical and Electronics Engineering Laboratory	✓	✓	✓	✓	✓				✓		✓				
		Course Name	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
YEAR II	SEMESTER III	Transform Techniques and Partial Differential Equations															
		Engineering Geology	2	2	3	3	2	2	1	2	2	2	2	2	2	2	2
		Strength of Materials	3	3	3	3	2	3	3	2	1	1	2	1	3	2	2
		Fluid Mechanics	3	2	3	2	1	1	1	2	1	2	1	2	3	3	3
		Construction Materials, Techniques and Practices	3	2	3	2	1	2	1	3	2	1	2	1	3	3	3
		Elective – Humanities I															
		Strength of Materials Laboratory	3	2		3	3	3	2	3				2	3	3	3
		Construction Materials Laboratory	3	3			3	2				1			3	3	3

	SEMESTER IV	Water Supply Engineering	3	2	3	2	3	2	1	3	2	3	2	2	3	2	3
		Highway Engineering	3	3	3	2	2	2	1	3	3	2	3	3	3	3	3
		Plane and Geodetic Surveying	3	2	2	1	3	2		2				2			
		Applied Hydraulic Engineering	3	3	2	3	1	2	1	2	1	2	1	3	3	2	3
		Structural Analysis - I	3	3	2	2	1	2	3	1	1		1	2	3	2	2
		Soil Mechanics	3	3	2	2	2	2	1	1	1	1	2	3	2	2	3
		Plane and Geodetic Surveying Laboratory	1	1	2		3	2		2				1			
		Hydraulic Engineering Laboratory	3	3	2	3	1	2	1	2	1	2	1	2	3	2	1
		Course Name	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
YEAR III	SEMESTER V	Elective – Humanities I															
		Foundation Engineering	2	3	3	3	1	1	1	2	1	1	2	3	2	3	3
		Structural Analysis - II	3	3	3	2	2	3	2	2	1	1	1	2	3	2	2
		Waste Water Engineering	3	2	3	2	2	2	1	3	3	3	2	3	3	3	3
		Design of Reinforced Cement Concrete Structures	3	3	3	2	2	2	1	2	1	2	1	2	3	3	3
		Professional Elective - I															
		Water and Waste Water Analysis Laboratory	2	2	2	2	2	2	2	2	3	2	2	3	2	2	2
		Soil Mechanics Laboratory	1	2	3	3	1	3	1	1	1	1	1	3	2	3	3
	SEMESTER VI	Design of Steel Structures	2	2	3	2	2	2	1	2	2	2	2	2	2	2	3
		Audit Course II															
		Railways, Airports and Harbour Engineering	3	3	3	2	2	2	1	3	3	2	1	2	3	3	3
		Professional Elective II															
		Professional Elective III															
		Professional Elective IV															
		Professional Elective V															
		Open Elective – I															
		Building and Structural Drawing	3			3	3	2	1	3				3	3	3	3
		Highway Engineering Laboratory		3	3	2	2	2	1	3	3	2	3	3	3	3	3
		Survey Camp (2 weeks)		1	2		3	2		1				2			

		Course Name	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
YEAR IV	SEMESTER VII	Principles of Management															
		Irrigation Engineering	3	2		2	2	3	3	3	1	2	3	2	3	3	2
		Estimation, Costing and Valuation Engineering	3	2	3	3	3	3	2	3	2	2	2	3	3	3	3
		Professional Elective VI															
		Professional Elective VII															
		Open Elective – II															
		Summer Internship / Summer	2	3	3	2	2	3	3	2	2	1	2	3	3	3	3
		Irrigation and Environmental															
		Project I	3	2	1	3		3	2	2	2	1	1	3	3	3	3
		Course Name	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
	SEMESTER VIII	Project II	3	2	2	2	2	3	2	2	2	2	2	3	3	3	3

PROFESSIONAL ELECTIVE COURSES

S. No.	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1.	Remote Sensing	2	3	2	3	3	2	3	3	1	2	1	2	2	2	2
2.	Geographic Information System	2	3	1		3	1	2	2	1	2	1		1	2	2
3.	Geo informatics Applications for Civil Engineers	2	2	3	3	3	2		2	3	3	2	3	3	3	3
4.	Total Station and GPS Surveying	3	3	3	1	3			3	3		2	3			
5.	Air Pollution and Control Engineering	3	3	3	3	1	2	3	3	3	3	2	3	3	3	3

6.	Environmental and Social Impact Assessment	3	2	3	3	3	2	2	2	3	2	3	2	3	3	3
7.	Industrial Wastewater Treatment	3	3	3	3	2	1	2	3	3	2	3	2	3	2	3
8.	Municipal Solid Waste Management	2	2	2	2	2	3	3	2	2	3	2	2	3	2	3
9.	Integrated Water Resources Management	2	2	2	1	1	2	2	3	2	3	1	2	2	2	2
10.	Participatory Water Resources Management	2	2	3	2	1	2	2	3	2	1	1	3	3	1	3
11.	Hydrology and Water Resource Engineering	3	3	3	3	3	2	2	3	2	2	3	2	2	2	3
12.	Groundwater Engineering	2	2	3	3	3	3	2	3	3	3	2	2	3	3	3
13.	Water Resources Systems Engineering	3	3	3	3	3	3	2	3	2	2	3	3	3	3	3
14.	Pavement Engineering		3	3	2	2	2	1	3	3	2	3	3	3	3	2
15.	Traffic Engineering and Management	3	3	3	2	2	2	1	3	3	2	2	3	3	3	2
16.	Transport and Environment	3	3	3	2	2	2	1	3	3	2	2	2	3	2	3
17.	Transportation Planning and Systems	2	3	3	2	2	2	1	3	3	2	3	3	3	3	2
18.	Urban Planning and Development	3	1	2	3	2	2	1	3	3	3	3	3	3	3	2
19.	Design of Plate and Shell Structures	3	2	3			1			1	1		1	1	1	2
20.	Design of Prestressed Concrete Structures	3	2	3			1			1	1		1	1	1	2
21.	Industrial Structures	3	2	2			1			1	1		2	1	2	2
22.	Maintenance, Repair and Rehabilitation of Structures	3	2	3			1			1	1		1	1	1	2
23.	Powerplant Structures	3	2	3			1			1	1		1	1	1	2
24.	Prefabricated Structures	3	2	3			1			1	1		1	1	1	2
25.	Tall Structures	3	3	2	1	2	2	2	2	1	3	1	1	3	2	2
26.	Structural Dynamics and Earthquake Engineering	3	2	3	2	3	2	2	2	1	1	1	1	3	2	3
27.	Geo-Environmental	3	1	3	3	2	1	1	3	3	3	1	3	2	2	3

	Engineering															
28.	Ground Improvement Techniques	3	3	2	3	3	1	2	3	1	2	2	3	2	3	3
29.	Soil Dynamics and Machine Foundations	3	3	3	3	1	1	1	3	1	3	1	3	2	2	3
30.	Rock Mechanics	3	3	3	3	3	1	1	3	1	3	1	3	2	2	3
31.	Coastal Engineering	3	3	3	3	3	3	2	3	3	3	3	3	3	3	2
32.	Coastal Zone Management	2	3	3	2	3	3	2	2		3	1	2		3	3
33.	Global Climate Change	2	3	3	2	2	3	3	2	3	3	2	3	2	2	3
34.	Climate Change and Vulnerability Assessment	2	3	2	2	3	3	2	2	2	2	2	2	2	2	2

ANNA UNIVERSITY, CHENNAI
UNIVERSITY DEPARTMENTS
B.E. CIVIL ENGINEERING
REGULATION – 2019
CHOICE BASED CREDIT SYSTEM
CURRICULA AND SYLLABI FOR I TO VIII SEMESTERS
(Applicable to Students admitted from the Academic Year 2020-2021 onwards)

SEMESTER I

S. NO.	COURSE CODE	COURSE TITLE	CATE GORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
THEORY								
1.	HS5151	Technical English	HSMC	4	0	0	4	4
2.	MA5158	Engineering Mathematics I	BSC	3	1	0	4	4
3.	PH5151	Engineering Physics	BSC	3	0	0	3	3
4.	CY5151	Engineering Chemistry	BSC	3	0	0	3	3
5.	GE5153	Problem Solving and Python Programming	ESC	3	0	0	3	3
PRACTICALS								
6.	BS5161	Basic Sciences Laboratory	BSC	0	0	4	4	2
7.	GE5161	Problem Solving and Python Programming Laboratory	ESC	0	0	4	4	2
			TOTAL	**16**	**1**	**8**	**25**	**21**

SEMESTER II

S. NO.	COURSE CODE	COURSE TITLE	CATE GORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
THEORY								
1.	MA5252	Engineering Mathematics II	BSC	3	1	0	4	4
2.	GE5151	Engineering Graphics	ESC	1	0	4	5	3
3.	GE5152	Engineering Mechanics	ESC	3	1	0	4	4
4.	EE5251	Basics of Electrical and Electronics Engineering	ESC	3	0	0	3	3
5.	GE5251	Environmental Sciences	BSC	3	0	0	3	3
6.		Audit Course I*	AC	3	0	0	3	0
PRACTICALS								
7.	GE5162	Workshop Practices Laboratory	ESC	0	0	4	4	2
8.	EE5261	Electrical and Electronics Engineering Laboratory	ESC	0	0	4	4	2
			TOTAL	**16**	**2**	**12**	**30**	**21**

* Audit Course is optional

SEMESTER III

S. NO.	COURSE CODE	COURSE TITLE	CATE GORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
THEORY								
1.	MA5355	Transform Techniques and Partial Differential Equations	BSC	3	1	0	4	4
2.	AG5305	Engineering Geology	ESC	3	0	0	3	3
3.	CE5301	Strength of Materials	PCC	3	0	0	3	3
4.	CE5302	Construction Materials, Techniques and Practices	PCC	3	0	0	3	3
5.	CE5351	Fluid Mechanics	PCC	3	0	0	3	3
6.		Elective - Humanities I	HSMC	3	0	0	3	3
PRACTICALS								
7.	CE5311	Strength of Materials Laboratory	PCC	0	0	4	4	2
8.	CE5312	Construction Materials Laboratory	PCC	0	0	4	4	2
			TOTAL	**18**	**1**	**8**	**27**	**23**

SEMESTER IV

S. NO.	COURSE CODE	COURSE TITLE	CATE GORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
THEORY								
1.	CE5401	Water Supply Engineering	PCC	3	0	0	3	3
2.	CE5402	Highway Engineering	PCC	3	0	0	3	3
3.	CE5403	Applied Hydraulic Engineering	PCC	3	0	0	3	3
4.	CE5404	Structural Analysis - I	PCC	3	0	0	3	3
5.	CE5405	Soil Mechanics	PCC	3	0	0	3	3
6.	CE5451	Plane and Geodetic Surveying	PCC	3	0	0	3	3
PRACTICALS								
7.	CE5461	Plane and Geodetic Surveying Laboratory	PCC	0	0	4	4	2
8.	CE5411	Hydraulic Engineering Laboratory	PCC	0	0	4	4	2
			TOTAL	**18**	**0**	**8**	**26**	**22**

SEMESTER V

S. NO.	COURSE CODE	COURSE TITLE	CATE GORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
THEORY								
1.		Elective - Humanities I	HSMC	3	0	0	3	3
2.	CE5501	Foundation Engineering	PCC	3	0	0	3	3
3.	CE5502	Structural Analysis - II	PCC	3	0	0	3	3
4.	CE5503	Waste Water Engineering	PCC	3	0	0	3	3
5.	CE5504	Design of Reinforced Cement Concrete Structures	PCC	3	0	0	3	3
6.		Professional Elective I	PEC	3	0	0	3	3
PRACTICALS								
7.	CE5511	Water and Waste Water Analysis Laboratory	PCC	0	0	4	4	2
8.	CE5512	Soil Mechanics Laboratory	PCC	0	0	4	4	2
			TOTAL	**18**	**0**	**8**	**26**	**22**

SEMESTER VI

S. NO.	COURSE CODE	COURSE TITLE	CATE GORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
THEORY								
1.	CE5601	Design of Steel Structures	PCC	3	0	0	3	3
2.	CE5602	Railways, Airports and Harbour Engineering	PCC	3	0	0	3	3
3.		Professional Elective II	PEC	3	0	0	3	3
4.		Professional Elective III	PEC	3	0	0	3	3
5.		Professional Elective IV	PEC	3	0	0	3	3
6.		Professional Elective V	PEC	3	0	0	3	3
7.		Open Elective - I	OEC	3	0	0	3	3
8.		Audit Course II*	AC	3	0	0	3	0
PRACTICALS								
9.	CE5611	Building and Structural Drawing	PCC	0	0	4	4	2
10.	CE5612	Highway Engineering Laboratory	PCC	0	0	4	4	2
11.	CE5613	Survey Camp (2 weeks)	EEC	0	0	0	0	1
			TOTAL	**24**	**0**	**8**	**32**	**26**

* Audit Course is optional

SEMESTER VII

S. NO.	COURSE CODE	COURSE TITLE	CATE GORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
THEORY								
1.	MG5451	Principles of Management	HSMC	3	0	0	3	3
2.	CE5701	Irrigation Engineering	PCC	3	0	0	3	3
3.	CE5801	Estimation, Costing and Valuation Engineering	PCC	3	0	0	3	3
4.		Professional Elective VI	PEC	3	0	0	3	3
5.		Professional Elective VII	PEC	3	0	0	3	3
6.		Open Elective – II	OEC	3	0	0	3	3
PRACTICALS								
7.	CE5711	Summer Internship / Summer training (4 weeks)	EEC	0	0	0	0	2
8.	CE5712	Irrigation and Environmental Engineering Drawing	PCC	0	0	4	4	2
9.	CE5713	Project I	EEC	0	0	6	6	3
			TOTAL	**18**	**0**	**10**	**28**	**25**

SEMESTER VIII

S. NO.	COURSE CODE	COURSE TITLE	CATE GORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
PRACTICALS								
1.	CE5811	Project II	EEC	0	0	16	16	8
			TOTAL	**0**	**0**	**16**	**16**	**8**

Total Credits: 168

HUMANITIES AND SOCIAL SCIENCES (HSMC) – MANAGEMENT AND OTHERS

Sl. No	Course Code	Course Title	Periods per week			Credits	Semester
			Lecture	Tutorial	Practical		
1.	HS5151	Technical English	4	0	0	4	1
2.	MG5451	Principles of Management	3	0	0	3	7
					Total	**7**	

HSMC– ELECTIVES – HUMANITIES I (ODD SEMESTER)

Sl. No	Course Code	Course Title	Periods per week			Credits
			Lecture	Tutorial	Practical	
1.	HU5171	Language and Communication	3	0	0	3
2.	HU5172	Values and Ethics	3	0	0	3
3.	HU5173	Human Relations at Work	3	0	0	3
4.	HU5174	Psychological Processes	3	0	0	3
5.	HU5175	Education, Technology and Society	3	0	0	3
6.	HU5176	Philosophy	3	0	0	3
7.	HU5177	Applications of Psychology in Everyday Life	3	0	0	3

BASIC SCIENCE COURSE [BSC]

Sl. No.	Course Code	Course Title	Periods per week			Credits	Semester
			Lecture	Tutoria	Practica		
1.	MA5158	Engineering Mathematics I	3	1	0	4	1
2.	PH5151	Engineering Physics	3	0	0	3	1
3.	CY5151	Engineering Chemistry	3	0	0	3	1
4.	BS5161	Basic Sciences Laboratory	0	0	4	2	1
5.	MA5252	Engineering Mathematics II	3	1	0	4	2
6.	GE5251	Environmental Sciences	3	0	0	3	2
7.	MA5355	Transform Techniques and Partial Differential Equations	3	1	0	4	3
					Total Credits:	**23**	

ENGINEERING SCIENCE COURSE [ESC]

Sl. No	Course Code	Course Title	Periods per week			Credits	Semester
			Lectur	Tutorial	Practical		
1.	GE5161	Problem Solving and Python Programming Laboratory	0	0	4	2	1
2.	GE5153	Problem Solving and Python Programming	3	0	0	3	1
3.	EE5251	Basics of Electrical and Electronics Engineering	3	0	0	3	2
4.	GE5152	Engineering Mechanics	3	1	0	4	2
5.	EE5261	Electrical and Electronics Engineering Laboratory	0	0	4	2	2
6.	GE5151	Engineering Graphics	1	0	4	3	2
7.	GE5162	Workshop Practices Lab	0	0	4	2	2
8.	AG5305	Engineering Geology	3	0	0	3	3
					Total Credits:	**22**	

PROFESSIONAL CORE COURSES [PCC]

Sl. No	Course Code	Course Title	Periods per week			Credits	Semester
			Lecture	Tutorial	Practical		
1.	CE5301	Strength of Materials	3	0	0	3	3
2.	CE5302	Construction Materials, Techniques and Practices	3	0	0	3	3
3.	CE5311	Strength of Materials Laboratory	0	0	4	2	3
4.	CE5312	Construction Materials Laboratory	0	0	4	2	3
5.	CE5351	Fluid Mechanics	3	0	0	3	3
6.	CE5401	Water Supply Engineering	3	0	0	3	4
7.	CE5402	Highway Engineering	3	0	0	3	4
8.	CE5403	Applied Hydraulic	3	0	0	3	4
9.	CE5404	Structural Analysis - I	3	0	0	3	4
10.	CE5405	Soil Mechanics	3	0	0	3	4
11.	CE5451	Plane and Geodetic Surveying	3	0	0	3	4
12.	CE5461	Plane and Geodetic Surveying Laboratory	0	0	4	2	4
13.	CE5411	Hydraulic Engineering Laboratory	0	0	4	2	4
14.	CE5501	Foundation Engineering	3	0	0	3	5
15.	CE5502	Structural Analysis - II	3	0	0	3	5
16.	CE5503	Wastewater Engineering	3	0	0	3	5
17.	CE5504	Design of Reinforced Cement Concrete Structures	3	0	0	3	5
18.	CE5511	Water and Waste Water Analysis Laboratory	0	0	4	2	5
19.	CE5512	Soil Mechanics Laboratory	0	0	4	2	5
20.	CE5601	Design of Steel Structures	3	0	0	3	6
21.	CE5602	Railways, Airports and Harbour Engineering	3	0	0	3	6
22.	CE5611	Building and Structural Drawing	0	0	4	2	6
23.	CE5612	Highway Engineering Laboratory	0	0	4	2	6
24.	CE5701	Irrigation Engineering	3	0	0	3	7
25.	CE5712	Irrigation and Environmental Engineering Drawing	0	0	4	2	7
26.	CE5801	Estimation, Costing and Valuation Engineering	3	0	0	3	8
Total Credits						**69**	

EMPLOYABILITY ENHANCEMENT COURSES (EEC)

Sl. No	Course Code	Course Title	Periods per week			Credits	Semester
			Lecture	Tutori	Practical		
1.	CE5613	Survey Camp (2 weeks)	0	0	0	1	6
2.	CE5711	Summer Internship / Summer Project (4 weeks)	0	0	0	2	7
3.	CE5713	Project I	0	0	6	3	7
4.	CE5811	Project II	0	0	16	8	8
Total Credits:						**14**	

AUDIT COURSES (AC)

Registration for any of these courses is optional to students

Sl. No	Course Code	Course Title	Periods per week			Credits	Semester
			Lecture	Tutorial	Practical		
1.	AD5091	Constitution of India	3	0	0	0	**2/6**
2.	AD5092	Value Education	3	0	0	0	
3.	AD5093	Pedagogy Studies	3	0	0	0	
4.	AD5094	Stress Management by Yoga	3	0	0	0	
5.	AD5095	Personality Development Through Life Enlightenment Skills	3	0	0	0	
6.	AD5096	Unnat Bharat Abhiyan	3	0	0	0	
7.	AD5097	Essence of Indian Knowledge Tradition	3	0	0	0	
8.	AD5098	Sanga Tamil Literature Appreciation	3	0	0	0	
Total Credits:						**0**	

PROFESSIONAL ELECTIVE COURSES (PEC I) –Semester V

Sl. No	Course Code	Course Title	Periods per week			Credits
			Lecture	Tutorial	Practical	
1.	CE5001	Remote Sensing	3	0	0	3
2.	CE5002	Geographic Information System	3	0	0	3
3.	CE5003	Geo informatics Applications for Civil Engineers	3	0	0	3
4.	GI5551	Total Station and GPS surveying	3	0	0	3

PROFESSIONAL ELECTIVE COURSES (PEC II) –Semester VI

Sl. No	Course Code	Course Title	Periods per week			Credits
			Lecture	Tutorial	Practical	
1.	CE5004	Air Pollution and Control Engineering	3	0	0	3
2.	CE5005	Environmental and Social Impact Assessment	3	0	0	3
3.	CE5006	Industrial Wastewater Treatment	3	0	0	3
4.	CE5007	Municipal Solid Waste Management	3	0	0	3

PROFESSIONAL ELECTIVE COURSES (PEC III) –Semester VI

Sl. No	Course Code	Course Title	Periods per week			Credits
			Lecture	Tutorial	Practical	
1.	CE5071	Hydrology and Water Resources Engineering	3	0	0	3
2.	CE5072	Integrated Water Resources Management	3	0	0	3
3.	CE5073	Participatory Water Resources Management	3	0	0	3
4.	CE5008	Groundwater Engineering	3	0	0	3
5.	CE5009	Water Resources Systems Engineering	3	0	0	3

PROFESSIONAL ELECTIVE COURSES (PEC IV) –Semester VI

Sl. No	Course Code	Course Title	Periods per week			Credits
			Lecture	Tutorial	Practical	
1.	CE5010	Pavement Engineering	3	0	0	3
2.	CE5011	Traffic Engineering and Management	3	0	0	3
3.	CE5012	Transport and Environment	3	0	0	3
4.	CE5013	Transportation Planning and Systems	3	0	0	3
6	CE5014	Urban Planning and Development	3	0	0	3

PROFESSIONAL ELECTIVE COURSES (PEC V) –Semester VI

Sl. No	Course Code	Course Title	Periods per week			Credits
			Lecture	Tutorial	Practical	
1.	CE5015	Design of Plate and Shell Structures	3	0	0	3
2.	CE5016	Design of Prestressed Concrete Structures	3	0	0	3
3.	CE5017	Industrial Structures	3	0	0	3
4.	CE5018	Maintenance, Repair and Rehabilitation of Structures	3	0	0	3
5.	CE5019	Powerplant Structures	3	0	0	3
6.	CE5020	Prefabricated Structures	3	0	0	3
7.	CE5021	Tall Structures	3	0	0	3
8.	CE5022	Structural Dynamics and Earthquake Engineering	3	0	0	3

PROFESSIONAL ELECTIVE COURSES (PEC VI) –Semester VII

Sl. No	Course Code	Course Title	Periods Per Week			Credits
			Lecture	Tutorial	Practical	
1.	CE5023	Geo-Environmental Engineering	3	0	0	3
2.	CE5024	Ground Improvement Techniques	3	0	0	3
3.	CE5025	Soil Dynamics and Machine Foundations	3	0	0	3
4.	CE5026	Rock Mechanics	3	0	0	3

PROFESSIONAL ELECTIVE COURSES (PEC VII) –Semester VII

Sl. No	Course Code	Course Title	Periods Per Week			Credits
			Lecture	Tutorial	Practical	
1.	CE5027	Coastal Engineering	3	0	0	3
2.	CE5028	Coastal Zone Management	3	0	0	3
3.	CE5029	Global Climate Change	3	0	0	3
4.	CE5030	Climate Change and Vulnerability Assessment	3	0	0	3

SUMMARY

Name of the Programme										
	Subject Area	**Credits per Semester**								**Credits Total**
		I	II	III	IV	V	VI	VII	VIII	
1.	HSMC	4	0	3	0	3	0	3	0	13
2.	BSC	12	7	4	0	0	0	0	0	23
3.	ESC	5	17	0	0	0	0	0	0	22
4.	PCC	0	0	13	22	16	10	8	0	69
5.	PEC	0	0	0	0	3	12	6	0	21
6.	OEC	0	0	0	0	0	3	3	0	6
7.	EEC	0	0	0	0	0	1	5	8	14
8.	Non Credit / Audit Course		✓			✓				
	Total	**21**	**24**	**20**	**22**	**22**	**26**	**25**	**08**	**168**

HS5151	TECHNICAL ENGLISH	L	T	P	C
		4	0	0	4

OBJECTIVES:

The first semester English course entitled 'Technical English' aims to,

- Familiarise first year students of engineering and technology with the fundamental aspects of technical English.
- Develop all the four language skills by giving sufficient practice in the use of the skills in real life contexts.
- Enhance the linguistic and communicative competence of first year engineering and technology students.

UNIT I INTRODUCING ONESELF 12

Listening: Listening and filling a form, listening to speeches by specialists from various branches of engineering and completing activities such as answering questions, identifying the main ideas of the listening text, style of the speaker (tone and tenor) – **Speaking**: Introducing oneself – introducing friend/ family - **Reading:** Descriptive passages (from newspapers / magazines)- **Writing**: Writing a paragraph (native place, school life)- **Grammar:** Simple present, present continuous – **Vocabulary Development**: One word substitution

UNIT II DIALOGUE WRITING 12

Listening: Listening to conversations (asking for and giving directions) –**Speaking:** making conversation using (asking for directions, making an enquiry), Role plays-dialogues- **Reading:** Reading a print interview and answering comprehension questions-**Writing**: Writing a checklist, Dialogue writing- **Grammar**: Simple past – question formation (Wh- questions, Yes or No questions, Tag questions)- **Vocabulary Development**: Stress shift, lexical items related to the theme of the given unit.

UNIT III FORMAL LETTER WRITING 12

Listening: Listening to speeches by famous people and identifying the central message of the speech – answering multiple-choice questions)-**Speaking:** Giving short talks on a given topic-**Reading:** Reading motivational essays on famous engineers and technologists (answering open-ended and closed questions)- **Writing:** Writing formal letters/ emails (Complaint letters)-**Grammar**: Future Tense forms of verbs, subject and verb agreement-**Vocabulary Development**: Collocations – Fixed expressions

UNIT IV WRITING COMPLAINT LETTERS 12

Listening: Listening to short talks (5 minutes duration and fill a table, gap-filling exercise) note taking/note making- **Speaking:** Small group discussion, giving recommendations-**Reading:** Reading problem – solution articles/essays drawn from various sources- **Writing:** Making recommendations – Writing a letter/ sending an email to the Editor- note making- **Grammar:** Modals – Phrasal verbs – cause and effect sentences- **Vocabulary Development**: Connectives, use of cohesive devices in writing, technical vocabulary.

UNIT V WRITING DEFINITIONS AND PRODUCT DESCRIPTION 12

Listening: Listening to a product description (labeling and gap filling) exercises- **Speaking:** Describing a product and comparing and contrasting it with other products- **Reading**: Reading graphical material for comparison (advertisements)-**Writing:** Writing Definitions (short and long) – compare and contrast paragraphs- **Grammar:** Adjectives – Degrees of comparison - compound nouns- **Vocabulary Development**: Use of discourse markers – suffixes (adjectival endings).

TOTAL : 60 PERIODS

Learning Outcomes

At the end of the course the students will have gained,

- Exposure to basic aspects of technical English.
- The confidence to communicate effectively I various academic situations.
- Learnt the use of basic features of Technical English.

Textbook:

1. Revised Edition of 'English for Engineers and Technologists' Volume 1 published by Orient Black Swan Limited 2019.

Assessment Pattern

- Assessments will assess all the four skills through both pen and paper and computer based tests.
- Assessments can be pen and paper based, quizzes.

MA5158	ENGINEERING MATHEMATICS – I (Common to all branches of B.E. / B.Tech. Programmes in I Semester)	L	T	P	C
		3	1	0	4

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 **12**

Eigenvalues and Eigenvectors of a real matrix – Characteristic equation – Properties of eigenvalues and eigenvectors – Cayley-Hamilton theorem – Diagonalization of matrices – Reduction of a quadratic form to canonical form by orthogonal transformation – Nature of quadratic forms.

UNIT II DIFFERENTIAL CALCULUS **12**

Limit of function – One sided limit – Limit Laws – Continuity – left and right continuity – types of discontinuities – Intermediate Value Theorem – Derivatives of a function - Differentiation rules – Chain rule – Implicit differentiation – logarithmic differentiation – Maxima and minima – Mean value theorem – (Optional: Polar coordinate system – Differentiation in polar coordinates).

UNIT III FUNCTIONS OF SEVERAL VARIABLES **12**

Partial derivatives – Homogeneous functions and Euler's theorem – Total derivative – Differentiation of implicit functions – Change of variables – Jacobians – Partial differentiation of implicit functions – Taylor's series for functions of two variables – Errors and approximations – Maxima and minima of functions of two variables – Lagrange's method of undetermined multipliers.

UNIT IV INTEGRAL CALCULUS **12**

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

UNIT V MULTIPLE INTEGRALS **12**

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

TOTAL :60 PERIODS

OUTCOMES:

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

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

TEXTBOOKS:

1. Grewal B.S., "Higher Engineering Mathematics", Khanna Publishers, 44th Edition, New Delhi, 2017.
2. James Stewart, "Calculus with Early Transcendental Functions", Cengage Learning, 6th Edition, New Delhi,2013.
3. Joel Hass, Christopher Heil and Maurice D.Weir, "Thomas' Calculus", Pearson, 14th Edition, New Delhi, 2018.
4. Narayanan S. and Manicavachagom Pillai T. K., "Calculus" Volume I and II, S. Viswanathan Publishers Pvt. Ltd., Chennai, 2009.

REFERENCES:

1. Bali N., Goyal M. and Watkins C., "Advanced Engineering Mathematics", Firewall Media (An imprint of Lakshmi Publications Pvt., Ltd.,), 7th Edition, New Delhi, 2009.
2. Erwin Kreyszig, "Advanced Engineering Mathematics", John Wiley and Sons, 10th Edition, New Delhi, 2015.
3. Greenberg M.D., "Advanced Engineering Mathematics", Pearson Education2nd Edition, 5th Reprint, Delhi, 2009.
4. Jain R.K. and Iyengar S.R.K., "Advanced Engineering Mathematics",Narosa Publications, 5th Edition, New Delhi, 2017.
5. Peter V.O'Neil, "Advanced Engineering Mathematics", Cengage Learning India Pvt., Ltd, 7th Edition, New Delhi , 2012.
6. Ramana B.V., "Higher Engineering Mathematics", Tata McGraw Hill Co. Ltd., 11th Reprint, New Delhi, 2010.

PH5151 **ENGINEERING PHYSICS** **L T P C**

(Common to all branches of B.E / B. Tech programmes) **3 0 0 3**

OBJECTIVE

- To make the students in understanding the importance of mechanics.
- To equip the students on the knowledge of electromagnetic waves.
- To introduce the basics of oscillations, optics and lasers.
- To enable the students in understanding the importance of quantum physics.
- To elucidate the application of quantum mechanics towards the formation of energy bands in crystalline materials.

UNIT I MECHANICS **9**

Moment of inertia (M.I) - Radius of gyration - Theorems of M .I - M.I of circular disc, solid cylinder , hollow cylinder , solid sphere and hollow sphere - K.E of a rotating body – M.I of a diatomic molecule – Rotational energy state of a rigid diatomic molecule - centre of mass – conservation of linear momentum – Relation between Torque and angular momentum - Torsional pendulum.

UNIT II ELECTROMAGNETIC WAVES 9

Gauss's law – Faraday's law - Ampere's law - 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 - 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 - interferometers - air wedge experiment. Theory of laser - characteristics - Spontaneous and stimulated emission - Einstein's coefficients - population inversion - Nd-YAG laser, CO_2 laser, semiconductor laser - applications.

UNIT IV BASIC QUANTUM MECHANICS 9

Photons and light waves - Electrons and matter waves - The Schrodinger equation (Time dependent and time independent forms) - meaning of wave function - Normalization - Particle in a infinite potential well - Normalization, probabilities and the correspondence principle.

UNIT V APPLIED QUANTUM MECHANICS 9

The harmonic oscillator - Barrier penetration and quantum tunneling - Tunneling microscope - Resonant diode - Finite potential wells - particle in a three dimensional box - Bloch's theorem for particles in a periodic potential, Kronig-Penney model and origin of energy bands.

TOTAL: 45 PERIODS

OUTCOME

After completion of this course, the students should able to

- Understanding the importance of mechanics.
- Express the knowledge of electromagnetic waves.
- Know the basics of oscillations, optics and lasers.
- Understanding the importance of quantum physics.
- Apply quantum mechanical principles towards the formation of energy bands in crystalline materials.

TEXT BOOKS

1. D.Kleppner and R.Kolenkow. An Introduction to Mechanics. McGraw Hill Education, 2017.
2. D.Halliday, R.Resnick and J.Walker. Principles of Physics. John Wiley & Sons, 2015.
3. N.Garcia, A.Damask and S.Schwarz. Physics for Computer Science Students. Springer-Verlag, 2012.

REFERENCES

1. R.Wolfson. Essential University Physics. Volume 1 & 2. Pearson, 2016.
2. D.J.Griffiths. Introduction to Electrodynamics. Pearson Education, 2015
3. K.Thyagarajan and A.Ghatak. Lasers: Fundamentals and Applications. Springer, 2012.

CY5151 **ENGINEERING CHEMISTRY** **L T P C**
(COMMON TO ALL BRANCHES) **3 0 0 3**

OBJECTIVES:

- To introduce the basic concepts of polymers, their properties and some of the important applications.
- To impart knowledge on the basic principles and preparatory methods of nanomaterials.
- To facilitate the understanding of the laws of photochemistry, photo processes and instrumentation & applications of spectroscopic techniques.
- To familiarize the operating principles and applications of energy conversion, its processes and storage devices.
- To inculcate sound understanding of water quality parameters and water treatment techniques.

UNIT I POLYMER CHEMISTRY 9

Introduction: Functionality-degree of polymerization. Classification of polymers- natural and synthetic, thermoplastic and thermosetting. Types and mechanism of polymerization: addition (free radical, cationic, anionic and living); condensation and copolymerization. Properties of polymers: Tg, tacticity, molecular weight-weight average, number average and polydispersity index. Techniques of polymerization: Bulk, emulsion, solution and suspension. Structure, Properties and uses of: PE, PVC, PC, PTFE, PP, Nylon 6, Nylon 66, Bakelite, Epoxy; Conducting polymers – polyaniline and polypyrrole.

UNIT II NANOCHEMISTRY 9

Basics-distinction between molecules, nanomaterials and bulk materials; size-dependent properties. Types –nanoparticle, nanocluster, nanorod, nanowire and nanotube. Preparation of nanomaterials: sol-gel, solvothermal, laser ablation, chemical vapour deposition, electrochemical deposition and electro spinning. Characterization - Scanning Electron Microscope and Transmission Electron Microscope - Principle and instrumentation (block diagram). Properties (optical, electrical, mechanical and magnetic) and Applications of nanomaterials - medicine, agriculture, electronics and catalysis.

UNIT III PHOTOCHEMISTRY AND SPECTROSCOPY 9

Photochemistry: Laws of photochemistry - Grotthuss-Draper law, Stark-Einstein law and Lambert-Beer Law (derivation and problems). Photo physical processes – Jablonski diagram. Chemiluminescence, photo-sensitization and photoquenching – mechanism and examples. Spectroscopy: Electromagnetic spectrum - absorption of radiation - electronic, vibrational and rotational transitions. Width and intensities of spectral lines. Atomic absorption spectroscopy, UV-Vis and IR spectroscopy- principles, instrumentation (Block diagram) and applications.

UNIT IV ENERGY CONVERSIONS AND STORAGE 9

Nuclear fission - controlled nuclear fission - nuclear fusion - differences between nuclear fission and fusion - nuclear chain reactions - nuclear energy - light water nuclear power plant – fast breeder reactor. Solar energy conversion - solar cells. Wind energy. Batteries - types of batteries – primary battery (dry cell), secondary battery (lead acid, nickel-cadmium and lithium-ion-battery). Fuel cells – H_2-O_2 and microbial fuel cell. Explosives – classification, examples: TNT, RDX, Dynamite; Rocket fuels and propellants – definition and uses.

UNIT V WATER TECHNOLOGY 9

Water – sources and impurities – water quality parameters: colour, odour, pH, hardness, alkalinity, TDS, COD and BOD. Boiler feed water – requirement – troubles (scale & sludge, caustic embrittlement, boiler corrosion and priming & foaming. Internal conditioning – phosphate, calgon and carbonate treatment. External conditioning - zeolite (permutit) and ion exchange demineralization. Municipal water treatment process – primary (screening, sedimentation and coagulation), secondary (activated sludge process and trickling filter process) and tertiary (ozonolysis, UV treatment, chlorination, reverse osmosis).

TOTAL: 45 PERIODS

OUTCOMES:

- To recognize and apply basic knowledge on different types of polymeric materials, their general preparation methods and applications to futuristic material fabrication needs.
- To identify and apply basic concepts of nanoscience and nanotechnology in designing the synthesis of nanomaterials for engineering and technology applications.
- To identify and apply suitable spectroscopic technique for material analysis and study different forms of photochemical reactions.
- To recognize different forms of energy resources and apply them for suitable applications in energy sectors.
- To demonstrate the knowledge of water and their quality in using at different industries.

TEXT BOOKS:

1. Jain P. C. & Monica Jain., "Engineering Chemistry", 16th Edition, Dhanpat Rai Publishing Company (P) Ltd, New Delhi, 2015.
2. Sivasankar B., "Engineering Chemistry", Tata McGraw-Hill Publishing Company Ltd, New Delhi, 2012.
3. S.S.Dara, "A text book of Engineering Chemistry", Chand Publications, 2014.

REFERENCE BOOKS:

1. Schdeva M V, "Basics of Nano Chemistry", Anmol Publications Pvt Ltd
2. B.Sivasankar, "Instrumental Methods of Analysis", Oxford University Press. 2012.
3. Friedrich Emich, "Engineering Chemistry", Scientific International Ltd.
4. V RGowariker, N V Viswanathan and Jayadev Sreedhar, "Polymer Science" New AGE International Publishers, 2009.

GE5153 PROBLEM SOLVING AND PYTHON PROGRAMMING

L T P C
3 0 0 3

OBJECTIVES:

- To know the basics of algorithmic problem solving.
- To develop Python programs with conditionals and loops.
- To define Python functions and use function calls.
- To use Python data structures - lists, tuples, dictionaries.
- To do input/output with files in Python.

UNIT I INTRODUCTION TO COMPUTING AND PROBLEM SOLVING 9

Fundamentals of Computing – Computing Devices – Identification of Computational Problems – Pseudocodes and Flowcharts – Instructions – Algorithms – Building Blocks of Algorithms – Introduction to Python Programming – Python Interpreter and Interactive Mode – Variables and Identifiers – Arithmetic Operators– Values and Types – Statements.

Suggested Activities:

- Developing Pseudocodes and flowcharts for real life activities such as railway ticket booking using IRCTC, admission process to undergraduate course, academic schedules during a semester etc.
- Developing algorithms for basic mathematical expressions using arithmetic operations.
- Installing Python.
- Simple programs on print statements, arithmetic operations.

Suggested Evaluation Methods:

- Assignments on pseudocodes and flowcharts.
- Tutorials on Python programs.

UNIT II CONDITIONALS AND FUNCTIONS 9

Operators – Boolean Values – Operator Precedence – Expression – Conditionals: If-Else Constructs – Loop Structures/Iterative Statements – While Loop – For Loop – Break Statement – Function Call and Returning Values – Parameter Passing – Local and Global Scope – Recursive Functions.

Suggested Activities:

- Simple Python program implementation using Operators, Conditionals, Iterative Constructs and Functions.
- Implementation of a simple calculator.
- Developing simple applications like calendar, phone directory, to-do lists etc.
- Flow charts for GCD, Exponent Functions, Fibonacci Series using conditionals and iterative statements.
- External learning - Recursion vs. Iteration.

Suggested Evaluation Methods:

- Tutorials on the above activities.
- Group Discussion on external learning.

UNIT III SIMPLE DATA STRUCTURES IN PYTHON 10

Introduction to Data Structures – List – Adding Items to a List – Finding and Updating an Item – Nested Lists – Cloning Lists – Looping Through a List – Sorting a List – List Concatenation – List Slices – List Methods – List Loop – Mutability – Aliasing – Tuples: Creation, Accessing, Updating, Deleting Elements in a Tuple, Tuple Assignment, Tuple as Return Value, Nested Tuples, Basic Tuple Operations – Sets.

Suggested Activities:

- Implementing python program using lists, tuples, sets for the following scenario:
  - Simple sorting techniques
  - Student Examination Report
  - Billing Scheme during shopping.
- External learning - List vs. Tuple vs. Set – Implementing any application using all the three data structures.

Suggested Evaluation Methods:

- Tutorials on the above activities.
- Group Discussion on external learning component.

UNIT IV STRINGS, DICTIONARIES, MODULES 10

Strings: Introduction, Indexing, Traversing, Concatenating, Appending, Multiplying, Formatting, Slicing, Comparing, Iterating – Basic Built-In String Functions – Dictionary: Creating, Accessing, Adding Items, Modifying, Deleting, Sorting, Looping, Nested Dictionaries Built-in Dictionary Function – Finding Key and Value in a Dictionary – Modules – Module Loading and Execution – Packages – Python Standard Libraries.

Suggested Activities:

- Implementing Python program by importing Time module, Math package etc.
- Creation of any package (student's choice) and importing into the application.

Suggested Evaluation Methods:

- Tutorials on the above activities.

UNIT V FILE HANDLING AND EXCEPTION HANDLING 7

Introduction to Files – File Path – Opening and Closing Files – Reading and Writing Files – File Position – Exception: Errors and Exceptions, Exception Handling, Multiple Exceptions.

Suggested Activities:

- Developing modules using Python to handle files and apply various operations on files.
- Usage of exceptions, multiple except blocks - for applications that use delimiters like age, range of numerals etc.
- Implementing Python program to open a non-existent file using exceptions.

Suggested Evaluation Methods:

- Tutorials on the above activities.
- Case Studies.

TOTAL: 45 PERIODS

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: Write simple Python programs 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 BOOK:

1. Reema Thareja, “Python Programming: Using Problem Solving Approach”, Oxford University Press, 2017.
2. Allen B. Downey, “Think Python: How to Think Like a Computer Scientist”, Second Edition, Shroff/O‘Reilly Publishers, 2016. (http://greenteapress.com/wp/thinkpython/).

REFERENCES:

1. Guido van Rossum, Fred L. Drake Jr., “An Introduction to Python – Revised and Updated for Python 3.2”, Network Theory Ltd., 2011.
2. John V Guttag, “Introduction to Computation and Programming Using Python”, Revised and Expanded Edition, MIT Press , 2013
3. Charles Dierbach, “Introduction to Computer Science using Python”, Wiley India Edition, 2016.
4. Timothy A. Budd, “Exploring Python”, Mc-Graw Hill Education (India) Private Ltd., 2015.
5. Kenneth A. Lambert, “Fundamentals of Python: First Programs”, Cengage Learning, 2012.

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	✓	✓	✓									✓
CO2	✓		✓		✓							✓
CO3	✓	✓	✓									✓
CO4	✓	✓	✓	✓	✓							✓
CO5	✓	✓	✓	✓	✓	✓			✓	✓	✓	✓
CO6	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓

BS5161 BASIC SCIENCES LABORATORY L T P C

(Common to all branches of B.E. / B.Tech Programmes) **0 0 4 2**

PHYSICS LABORATORY: (Any Seven Experiments)

OBJECTIVE

- To inculcate experimental skills to test basic understanding of physics of materials including properties of matter, thermal and optical properties.
- To induce the students to familiarize with experimental determination of velocity of ultrasonic waves and band gap determination.

LIST OF EXPERIMENTS

1. Torsional pendulum - Determination of rigidity modulus of wire and moment of inertia of disc
2. Non-uniform bending - Determination of Young's modulus
3. Uniform bending – Determination of Young's modulus
4. Lee's disc Determination of thermal conductivity of a bad conductor
5. Potentiometer-Determination of thermo e.m.f of a thermocouple
6. Laser- Determination of the wave length of the laser using grating
7. Air wedge - Determination of thickness of a thin sheet/wire
8. a) Optical fibre -Determination of Numerical Aperture and acceptance angle
   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. Spectrometer- Determination of wavelength using gating.
13. Photoelectric effect
14. Michelson Interferometer.
15. Estimation of laser parameters.
16. Melde's string experiment

TOTAL: 30 PERIODS

OUTCOME

Upon completion of the course, the students will be able

- To determine various moduli of elasticity and also various thermal and optical properties of materials.
- To determine the velocity of ultrasonic waves, band gap determination and viscosity of liquids.

CHEMISTRY LABORATORY: (Minimum of 8 experiments to be conducted)

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 polymers by spectroscopy and viscometry methods.

LIST OF EXPERIMENTS:

1. Estimation of HCl using Na_2CO_3 as primary standard and Determination of alkalinity in water sample.
2. Determination of total, temporary & permanent hardness of water by EDTA method.
3. Determination of DO content of water sample by Winkler‟s method.
4. Determination of chloride content of water sample by argentometric method.
5. Estimation of copper content of the given solution by Iodometry.
6. Determination of strength of given hydrochloric acid using pH meter.
7. Determination of strength of acids in a mixture of acids using conductivity meter.
8. Estimation of iron content of the given solution using potentiometer.
9. Estimation of iron content of the water sample using spectrophotometer (1, 10-Phenanthroline / thiocyanate method).
10. Estimation of sodium and potassium present in water using flame photometer.
11. Determination of molecular weight of polyvinylalcohol using Ostwald viscometer.
12. Pseudo first order kinetics-ester hydrolysis.
13. Corrosion experiment-weight loss method.
14. Phase change in a solid.

TOTAL: 30 PERIODS

OUTCOMES:

- To analyse the quality of water samples with respect to their acidity, alkalinity, hardness and DO.
- To determine the amount of metal ions through volumetric and spectroscopic techniques
- To determine the molecular weight of polymers by viscometric method.
- To quantitatively analyse the impurities in solution by electroanalytical techniques
- To design and analyse the kinetics of reactions and corrosion of metals

TEXTBOOKS:

1. Laboratory Manual- Department of Chemistry, CEGC, Anna University (2014).
2. Vogel's Textbook of Quantitative Chemical Analysis (8^{th} edition, 2014).

GE5161 PROBLEM SOLVING AND PYTHON PROGRAMMING LABORATORY L T P C
0 0 4 2

OBJECTIVES:

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

EXPERIMENTS:

1. Identification and solving of simple real life or scientific or technical problems, and developing flow charts for the same.
2. Python programming using simple statements and expressions.
3. Scientific problems using Conditionals and Iterative loops.
4. Implementing real-time/technical applications using Lists, Tuples.
5. Implementing real-time/technical applications using Sets, Dictionaries.
6. Implementing programs using Functions.
7. Implementing programs using Strings.
8. Implementing programs using written modules and Python Standard Libraries.
9. Implementing real-time/technical applications using File handling.
10. Implementing real-time/technical applications using Exception handling.
11. Exploring Pygame tool.
12. Developing a game activity using Pygame like bouncing ball, car race etc.

TOTAL: 60 PERIODS

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: Structure simple Python programs for solving problems.
CO4: Decompose a Python program into functions.
CO5: Represent compound data using Python data structures.
CO6: Apply Python features in developing software applications.

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	✓	✓	✓									✓
CO2	✓		✓		✓							✓
CO3	✓	✓	✓									✓
CO4	✓	✓	✓	✓	✓							✓
CO5	✓	✓	✓	✓	✓	✓			✓	✓	✓	✓
CO6	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓

MA5252	ENGINEERING MATHEMATICS – II (Common to all branches of B.E. / B.Tech. Programmes in II Semester)	L	T	P	C
		3	1	0	4

OBJECTIVES:

- To acquaint the students with the concepts of vector calculus which naturally arises in many engineering problems.
- To develop an understanding of the standard techniques of complex variable theory in particular analytic function and its mapping property.
- To familiarize the students with complex integration techniques and contour integration techniques which can be used in real integrals.
- To acquaint the students with Differential Equations which are significantly used in Engineering problems.
- To make the students appreciate the purpose of using transforms to create a new domain in which it is easier to handle the problem that is being investigated.

UNIT I VECTOR CALCULUS **12**

Gradient and directional derivative – Divergence and Curl – Irrotational and Solenoidal vector fields – Line integral over a plane curve – Surface integral - Area of a curved surface - Volume integral - Green's theorem, Stoke's theorem and Gauss divergence theorem – Verification and application in evaluating line, surface and volume integrals.

UNIT II ANALYTIC FUNCTION **12**

Analytic functions – Necessary and sufficient conditions for analyticity - Properties – Harmonic conjugates – Construction of analytic function - Conformal mapping – Mapping by functions - Bilinear transformation $w = c + z,\ az,\ 1/z,\ z^2$

UNIT III COMPLEX INTEGRATION **12**

Line integral - Cauchy's integral theorem – Cauchy's integral formula – Taylor's and Laurent's series – Singularities – Residues – Residue theorem – Application of residue theorem for evaluation of real integrals – Use of circular contour and semicircular contour with no pole on real axis.

UNIT IV DIFFERENTIAL EQUATIONS **12**

Method of variation of parameters – Method of undetermined coefficients – Homogenous equations of Euler's and Legendre's type – System of simultaneous linear differential equations with constant coefficients.

UNIT V LAPLACE TRANSFORMS **12**

Existence conditions – Transforms of elementary functions – Transform of unit step function and unit impulse function – Basic properties – Shifting theorems – Transforms of derivatives and integrals – Initial and Final Value Theorems – Inverse Transforms – Convolution Theorem – Transform of periodic functions – Application to solution of linear ordinary differential equations with constant coefficients.

TOTAL : 60 PERIODS

OUTCOMES:

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

- Calculate grad, div and curl and use Gauss, Stokes and Greens theorems to simplify calculations of integrals.
- Construct analytic functions and use their conformal mapping property in application problems.
- Evaluate real and complex integrals using the Cauchy's integral formula and residue theorem.
- Apply various methods of solving differential equation which arise in many application problems.
- Apply Laplace transform methods for solving linear differential equations.

TEXT BOOKS:

1. Erwin Kreyszig, "Advanced Engineering Mathematics", John Wiley and Sons, 10th Edition, New Delhi, 2015.
2. Grewal B.S., "Higher Engineering Mathematics", Khanna Publishers, 44th Edition, New Delhi, 2017.

REFERENCES:

1. Bali N., Goyal M. and Watkins C., "Advanced Engineering Mathematics", Firewall Media (An imprint of Lakshmi Publications Pvt., Ltd.,), 7th Edition, New Delhi, 2009.
2. Glyn James, "Advanced Modern Engineering Mathematics", Pearson Education, 4th Edition, New Delhi, 2011.
3. Jain R.K. and Iyengar S.R.K., "Advanced Engineering Mathematics", Narosa Publications, 5th Edition, New Delhi, 2017.
4. Peter V.O'Neil, "Advanced Engineering Mathematics", Cengage Learning India Pvt., Ltd, 7th Edition, New Delhi, 2012.
5. Ramana B.V., "Higher Engineering Mathematics", Tata McGraw Hill Co. Ltd., 11th Reprint, New Delhi, 2010.

GE5151 ENGINEERING GRAPHICS **L T P C**
1 0 4 3

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

1. Drawing free hand sketches of basic geometrical shapes and multiple views of objects.
2. Drawing orthographic projections of lines and planes.
3. Drawing orthographic projections of solids.
4. Drawing development of the surfaces of objects.
5. Drawing isometric and perspective views of simple solids.

CONCEPTS AND CONVENTIONS (NOT FOR EXAMINATION) **1**
Importance of graphics in engineering applications – Use of drafting instruments – BIS conventions and specifications – Size, layout and folding of drawing sheets – Lettering and dimensioning.

UNITI PLANE CURVES AND FREE HANDSKETCHING **14**
Basic Geometrical constructions, Curves used in engineering practices-Conics – Construction of ellipse, parabola and hyperbola by different methods – Construction of cycloid – construction of involutes of square and circle – Drawing of tangents and normal to the above curves. Visualization concepts and Free Hand sketching: Visualization principles – Representation of Three-Dimensional objects – Layout of views- Free hand sketching of multiple views from pictorial views of objects

UNITII PROJECTION OF POINTS, LINES AND PLANE SURFACES **15**
Orthographic projection- principles-Principle 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 trapezoidal method and traces Projection of planes (polygonal and circular surfaces) inclined to both the principal planes by rotating object method.

UNITIII PROJECTION OF SOLIDS **15**
Projection of simple solids like prisms, pyramids, cylinder, cone and truncated solids when the axis is inclined to both the principal planes by rotating object method and auxiliary plane method.

UNITIV PROJECTION OF SECTIONED SOLIDS AND DEVELOPMENT OF SURFACES 15

Sectioning of 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. Development of lateral surfaces of solids with cut-outs and holes.

UNITV ISOMETRIC AND PERSPECTIVE PROJECTIONS 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 and miscellaneous problems. Perspective projection of simple solids-Prisms pyramids and cylinders by visual ray method and vanishing point method.

COMPUTER AIDED DRAFTING (DEMONSTRATION ONLY) 3

Introduction to drafting packages and demonstration of their use

TOTAL (L: 15 + P: 60)=75 PERIODS

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

1. Draw free hand sketching of basic geometrical shapes and multiple views of objects.
2. Draw orthographic projections of lines and planes
3. Draw orthographic projections of solids
4. Draw development of the surfaces of objects
5. Draw isometric and perspective views of simple solids.

TEXT BOOKS:

1. Bhatt, N. D.,Panchal V M and Pramod R. Ingle, “Engineering Drawing”, Charotar Publishing House, 53rd Edition, 2014.
2. Parthasarathy, N. S. and Vela Murali, “Engineering Drawing”, Oxford University Press, 2015

REFERENCES:

1. Agrawal, B. and Agrawal C.M., “Engineering Drawing”, Tata McGraw, N.Delhi, 2008.
2. Gopalakrishna, K. R., “Engineering Drawing”, Subhas Stores, Bangalore, 2007.
3. Natarajan, K. V., “A text book of Engineering Graphics”, 28thEd., Dhanalakshmi Publishers, Chennai, 2015.
4. Shah, M. B., and Rana, B. C., “Engineering Drawing”, Pearson, 2ndEd., 2009.
5. Venugopal, K. and Prabhu Raja, V., “Engineering Graphics”, New Age,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.
4. The students will be permitted to use appropriate scale to fit solution within A3 size.
5. The examination will be conducted in appropriate sessions on the same day.

CO	PO												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
1	0.9				0.9					0.6		0.6	0.6	0.9	0.6
2	0.9									0.6		0.6	0.6	0.6	
3	0.9				0.9					0.6		0.6	0.6	0.6	
4	0.9		0.6		0.9					0.6		0.6	0.6	0.6	
5	0.9		0.9		0.9					0.6		0.6	0.6	0.6	

GE5152 ENGINEERING MECHANICS L T P C
3 1 0 4

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

1. Applying the various methods to determine the resultant forces and its equilibrium acting on a particle in 2D and 3D.
2. Applying the concept of reaction forces (non-concurrent coplanar and noncoplanar forces) and moment of various support systems with rigid bodies in 2D and 3D in equilibrium. Reducing the force, moment, and couple to an equivalent force - couple system acting on rigid bodies in 2D and 3D.
3. Applying the concepts of locating centroids/center of gravity of various sections / volumes and to find out area moments of inertia for the sections and mass moment of inertia of solids.
4. Applying the concepts of frictional forces at the contact surfaces of various engineering systems.
5. Applying the various methods of evaluating kinetic and kinematic parameters of the rigid bodies subjected to concurrent coplanar forces.

UNIT I STATICS OF PARTICLES (9+3)

Fundamental Concepts and Principles, Systems of Units, Method of Problem Solutions, Statics of Particles -Forces in a Plane, Resultant of Forces, Resolution of a Force into Components, Rectangular Components of a Force, Unit Vectors. Equilibrium of a Particle- Newton's First Law of Motion, Space and Free-Body Diagrams, Forces in Space, Equilibrium of a Particle in Space.

UNITII EQUILIBRIUM OF RIGID BODIES (9+3)

Principle of Transmissibility, Equivalent Forces, Vector Product of Two Vectors, Moment of a Force about a Point, Varignon's Theorem, Rectangular Components of the Moment of a Force, Scalar Product of Two Vectors, Mixed Triple Product of Three Vectors, Moment of a Force about an Axis, Couple - Moment of a Couple, Equivalent Couples, Addition of Couples, Resolution of a Given Force into a Force -Couple system, Further Reduction of a System of Forces, Equilibrium in Two and Three Dimensions - Reactions at Supports and Connections.

UNITIII DISTRIBUTED FORCES (9+3)

Centroids of lines and areas – symmetrical and unsymmetrical shapes, Determination of Centroids by Integration , Theorems of Pappus-Guldinus, Distributed Loads on Beams, Centre of Gravity of a Three-Dimensional Body, Centroid of a Volume, Composite Bodies , Determination of Centroids of Volumes by Integration.

Moments of Inertia of Areas and Mass - Determination of the Moment of Inertia of an Area by Integration , Polar Moment of Inertia , Radius of Gyration of an Area , Parallel-Axis Theorem, Moments of Inertia of Composite Areas, Moments of Inertia of a Mass - Moments of Inertia of Thin Plates , Determination of the Moment of Inertia of a Three-Dimensional Body by Integration

UNIT IV FRICTION (9+3)

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

UNITV DYNAMICS OF PARTICLES (9+3)

Kinematics - Rectilinear Motion and Curvilinear Motion of Particles. Kinetics- Newton's Second Law of Motion -Equations of Motions, Dynamic Equilibrium, Energy and Momentum Methods - Work of a Force , Kinetic Energy of a Particle, Principle of Work and Energy, Principle of Impulse and Momentum, Impact, Method of Virtual Work - Work of a Force, Potential Energy, Potential Energy and Equilibrium.

TOTAL (L: 45 + T: 15) = 60 PERIODS

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

1. Apply the various methods to determine the resultant forces and its equilibrium acting on a particle in 2D and 3D.
2. Apply the concept of reaction forces (non-concurrent coplanar and noncoplanar forces) and moment of various support systems with rigid bodies in 2D and 3D in equilibrium. Reducing the force, moment, and couple to an equivalent force - couple system acting on rigid bodies in 2D and 3D.
3. Apply the concepts of locating centroids / center of gravity of various sections / volumes and to find out area moments of inertia for the sections and mass moment of inertia of solids.
4. Apply the concepts of frictional forces at the contact surfaces of various engineering systems.
5. Apply the various methods of evaluating kinetic and kinematic parameters of the rigid bodies subjected to concurrent coplanar forces.

TEXT BOOKS:

1. Beer Ferdinand P, Russel Johnston Jr., David F Mazurek, Philip J Cornwell, SanjeevSanghi, Vector Mechanics for Engineers: Statics and Dynamics, McGraw Higher Education., 11thEdition, 2017.
2. Vela Murali, "Engineering Mechanics-Statics and Dynamics", Oxford University Press, 2018.

REFERENCES:

1. Boresi P and Schmidt J, Engineering Mechanics: Statics and Dynamics, 1/e, Cengage learning, 2008.
2. Hibbeller, R.C., Engineering Mechanics: Statics, and Engineering Mechanics: Dynamics, 13th edition, Prentice Hall, 2013.
3. Irving H. Shames, Krishna Mohana Rao G, Engineering Mechanics – Statics and Dynamics, 4thEdition, Pearson Education Asia Pvt. Ltd., 2005.
4. Meriam J L and Kraige L G, Engineering Mechanics: Statics and Engineering Mechanics: Dynamics, 7th edition, Wiley student edition, 2013.
5. Timoshenko S, Young D H, Rao J V and Sukumar Pati, Engineering Mechanics, 5thEdition, McGraw Hill Higher Education, 2013.

CO	PO												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
1	0.9	0.6	0.6	0.3								0.6	0.9	0.3	0.3
2	0.9	0.6	0.6	0.3								0.6	0.9	0.3	0.3
3	0.9	0.6	0.9	0.3								0.6	0.9	0.3	0.6
4	0.9	0.6	0.9	0.3								0.6	0.9	0.3	0.6
5	0.9	0.6	0.9	0.3								0.6	0.9	0.3	0.6

EE5251 BASICS OF ELECTRICAL AND ELECTRONICS ENGINEERING L T P C
3 0 0 3

OBJECTIVES:

- To understand the basic concepts of electric circuits, magnetic circuits and wiring.
- To understand the operation of AC and DC machines.
- To understand the working principle of electronic devices and circuits.

UNIT I BASIC CIRCUITS AND DOMESTIC WIRING 9

Electrical circuit elements (R, L and C)-Dependent and independent sources – Ohm's Law-Kirchhoff's laws - mesh current and node voltage methods (Analysis with only independent source) - Phasors – RMS-Average values-sinusoidal steady state response of simple RLC circuits. Types of wiring- Domestic wiring - Specification of Wires-Earthing-Methods-Protective devices.

UNIT II THREE PHASE CIRCUITS AND MAGNETIC CIRCUITS 9

Three phase supply – Star connection – Delta connection –Balanced and Unbalanced Loads-Power in three-phase systems – Comparison of star and delta connections – Advantages-Magnetic circuits-Definitions-MMF, Flux, Reluctance, Magnetic field intensity, Flux density, Fringing, self and mutual inductances-simple problems.

UNIT III ELECTRICAL MACHINES 9

Working principle of DC generator, motor-EMF and Torque equation-Types –Shunt, Series and Compound-Applications. Working principle of transformer-EMF equation-Operating principles of three phase and single phase induction motor-Applications. Working principles of alternator-EMF equation-Operating principles of Synchronous motor, stepper motor-Applications.

UNIT IV BASICS OF ELECTRONICS 9

Intrinsic semiconductors, Extrinsic semiconductors – P-type and N-type, P-N junction, VI Characteristics of PN junction diode, Zener effect, Zener diode, Zener diode Characteristics-Rectifier circuits-Wave shaping.

UNIT V CURRENT CONTROLLED AND VOLTAGE CONTROLLED DEVICES 9

Working principle and characteristics - BJT, SCR, JFET, MOSFET.

TOTAL: 45 PERIODS

OUTCOMES:

CO1 To be able to understand the concepts related with electrical circuits and wiring.
CO2 To be able to study the different three phase connections and the concepts of magnetic circuits.
CO3 Capable of understanding the operating principle of AC and DC machines.
CO4 To be able to understand the working principle of electronic devices such as diode and zener diode.
CO 5 To be able to understand the characteristics and working of current controlled and voltage controlled devices.

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	✓	✓	✓	✓	✓							
CO2	✓	✓	✓	✓	✓						✓	
CO3	✓	✓	✓	✓	✓						✓	✓
CO4	✓	✓	✓	✓	✓						✓	✓
CO5	✓		✓	✓	✓						✓	✓

TEXT BOOKS:

1. Kothari DP and I.J Nagrath, “Basic Electrical and Electronics Engineering”, McGraw Hill Education, 2014
2. Del Toro, “Electrical Engineering Fundamentals”, Second edition, Pearson Education, New Delhi, 1989.
3. John Bird, “Electrical Circuit theory and technology”, Routledge; 5th edition, 2013

REFERENCES:

1. Thomas L. Floyd, ‘Electronic Devices’, 10th Edition, Pearson Education, 2018.
2. Albert Malvino, David Bates, ‘Electronic Principles, McGraw Hill Education, 7th edition, 2017
3 Kothari DP and I.J Nagrath, “Basic Electrical Engineering”, McGraw Hill, 2010.
4 Muhammad H. Rashid, “Spice for Circuits and electronics”, 4th ed., Cengage India,2019

GE5251 ENVIRONMENTAL SCIENCES L T P C
3 0 0 3

OBJECTIVES:

- To introduce the basic concepts of environment, ecosystems and biodiversity and emphasize on the biodiversity of India and its conservation.
- To impart knowledge on the causes, effects and control or prevention measures of environmental pollution and natural disasters.
- To facilitate the understanding of global and Indian scenario of renewable and non-renewable resources, causes of their degradation and measures to preserve them.
- To familiarize the influence of societal use of resources on the environment and introduce the legal provisions, National and International laws and conventions for environmental protection.
- To inculcate the effect of population dynamics on human and environmental health and inform about human right, value education and role of technology in monitoring human and environmental issues.

UNIT I ENVIRONMENT, ECOSYSTEMS AND BIODIVERSITY 14

Definition, scope and importance of environment – need for public awareness - concept of an ecosystem – structure and function of an ecosystem – producers, consumers and decomposers – energy flow in the ecosystem – ecological succession – food chains, food webs and ecological pyramids – Introduction, types, characteristic features, structure and function of the (a) forest ecosystem (b) grassland ecosystem (c) desert ecosystem (d) aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries) – Introduction to biodiversity definition: genetic, species and ecosystem diversity – bio geographical classification of India – value of biodiversity: consumptive use, productive use, social, ethical, aesthetic and option values – Biodiversity at global, national and local levels – India as a mega-diversity nation – hot-spots of biodiversity – threats to biodiversity: habitat loss, poaching of wildlife, man-wildlife conflicts – endangered and endemic species of India – conservation of biodiversity: In-situ and ex-situ conservation of biodiversity. Field study of common plants, insects, birds Field study of simple ecosystems – pond, river, hill slopes, etc.

UNIT II ENVIRONMENTAL POLLUTION 8

Definition – causes, effects and control measures of: (a) Air pollution (b) Water pollution (c) Soil pollution (d) Marine pollution (e) Noise pollution (f) Thermal pollution (g) Nuclear hazards – soil waste management: causes, effects and control measures of municipal solid wastes – role of an individual in prevention of pollution – pollution case studies – disaster management: floods, earthquake, cyclone and landslides. Field study of local polluted site – Urban / Rural / Industrial / Agricultural.

UNIT III NATURAL RESOURCES 10

Forest resources: Use and over-exploitation, deforestation, case studies- timber extraction, mining, dams and their effects on forests and tribal people – Water resources: Use and over-utilization of surface and ground water, floods, drought, conflicts over water, dams-benefits and problems – Mineral resources: Use and exploitation, environmental effects of extracting and using mineral resources, case studies – Food resources: World food problems, changes caused by agriculture and overgrazing, effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity, case studies – Energy resources: Growing energy needs, renewable and non renewable energy sources, use of alternate energy sources. case studies – Land resources: Land as a resource, land 47 degradation, man induced landslides, soil erosion and desertification – role of an individual in conservation of natural resources – Equitable use of resources for sustainable lifestyles. Field study of local area to document environmental assets – river / forest / grassland / hill / mountain.

UNIT IV SOCIAL ISSUES AND THE ENVIRONMENT 7

From unsustainable to sustainable development – urban problems related to energy – water conservation, rain water harvesting, watershed management – resettlement and rehabilitation of people; its problems and concerns, case studies – role of non-governmental organization-environmental ethics: Issues and possible solutions – climate change, global warming, acid rain, ozone layer depletion, nuclear accidents and holocaust, case studies. – wasteland reclamation – consumerism and waste products – environment protection act – Air (Prevention and Control of Pollution) act – Water (Prevention and control of Pollution) act – Wildlife protection act – Forest conservation act – enforcement machinery involved in environmental legislation- central and state pollution control boards- Public awareness.

UNIT V HUMAN POPULATION AND THE ENVIRONMENT 6

Population growth, variation among nations – population explosion – family welfare programme – environment and human health – human rights – value education – HIV / AIDS – women and child welfare – role of information technology in environment and human health – Case studies.

TOTAL: 45 PERIODS

OUTCOMES:

- To recognize and understand the functions of environment, ecosystems and biodiversity and their conservation.
- To identify the causes, effects and environmental pollution and natural disasters and contribute to the preventive measures in the immediate society.
- To identify and apply the understanding of renewable and non-renewable resources and contribute to the sustainable measures to preserve them for future generations.
- To recognize different forms of energy and apply them for suitable applications in for technological advancement and societal development.
- To demonstrate the knowledge of societal activity on the long and short term environmental issues and abide by the legal provisions, National and International laws and conventions in professional and personal activities and to identify and analyse effect of population dynamics on human value education, consumerism and role of technology in environmental issues.

TEXT BOOKS:

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

REFERENCE BOOKS:

1. R.K. Trivedi, 'Handbook of Environmental Laws, Rules, Guidelines, Compliances and Standards', Vol. I and II, Enviro Media.

2. Cunningham, W.P. Cooper, T.H. Gorhani, 'Environmental Encyclopedia', Jaico Publ., House, Mumbai, 2001.
3. Dharmendra S. Sengar, 'Environmental law', Prentice hall of India PVT. LTD, New Delhi, 2007.
4. Rajagopalan, R, 'Environmental Studies-From Crisis to Cure', Oxford University Press (2005).
5. Erach Bharucha "Textbook of Environmental Studies for Undergraduate Courses" Orient Blackswan Pvt. Ltd. (2013).

GE5162 WORKSHOP PRACTICES LABORATORY L T P C
(Common to all Branches of B.E. / B.Tech. Programmes) 0 0 4 2

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

1. Drawing pipe line plan; laying and connecting various pipe fittings used in common household plumbing work; Sawing; planing; making joints in wood materials used in common household wood work.
2. Wiring various electrical joints in common household electrical wire work.
3. 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.
4. 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 household 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

WIRING WORK:

a) Wiring Switches, Fuse, Indicator and Lamp etc. such as in basic household,
b) Wiring Stair case light.

c) Wiring tube – light.
d) Preparing wiring diagrams for a given situation.

Wiring Study:

a) Studying an Iron-Box wiring.
b) Studying a Fan Regulator wiring.
c) Studying an Emergency Lamp wiring.

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) Studying a FM radio.
b) Studying an electronic telephone.

TOTAL (P: 60) = 60 PERIODS

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

1. 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 wood work.
2. Wire various electrical joints in common household electrical wire work.
3. 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.
4. Solder and test simple electronic circuits; Assemble and test simple electronic components on PCB.

CO	PO												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
1	0.6	0.3											0.3	0.3	
2		0.6	0.6											0.6	
3		0.6	0.3										0.6	0.6	
4		0.6	0.6	0.3										0.6	

EE5261 ELECTRICAL AND ELECTRONICS ENGINEERING LABORATORY L T P C
0 0 4 2

OBJECTIVES

1. To impart hands on experience in verification of circuit laws and measurement of circuit parameters
2. To train the students in performing various tests on electrical motors.
3. It also gives practical exposure to the usage of CRO, power sources & function generators

List of Experiments

1. Verification of Kirchhoff's Law.
2. Steady state response of AC and DC circuits (Mesh, Node Analysis)
3. Frequency response of RLC circuits.
4. Measurement power in three phase circuits by two-watt meter method.
5. Regulation of single phase transformer.
6. Performance characteristics of DC shunt generator.
7. Performance characteristics of single phase induction motor.
8. Characteristics of PN diode and Zener diode
9. Characteristics of Zener diode
10. Half wave and full wave Rectifiers
11. Application of Zener diode as shunt regulator.
12. Characteristics of BJT and JFET

TOTAL: 60 PERIODS

OUTCOMES:

1. To become familiar with the basic circuit components and know how to connect them to make a real electrical circuit;
2. Ability to perform speed characteristic of different electrical machines
3. Ability to use logic gates and Flip flops

MA5355 TRANSFORM TECHNIQUES AND PARTIAL DIFFERENTIAL EQUATIONS L T P C
3 1 0 4

OBJECTIVES:

- To introduce the effective mathematical tools for the solutions of partial differential equations that model physical processes;
- To introduce Fourier series analysis which is central to many applications in engineering :
- To develop the analytic solutions for partial differential equations used in engineering by Fourier series;
- To acquaint the student with Fourier transform techniques used in wide variety of situations in which the functions used are not periodic;
- To develop Z- transform techniques which will perform the same task for discrete time systems as Laplace Transform, a valuable aid in analysis of continuous time systems.

UNIT I PARTIAL DIFFERENTIAL EQUATIONS 12

Formation – Solutions of first order equations – Standard types and Equations reducible to standard types – Lagrange's Linear equation – Solution of linear equations of higher order with constant coefficients – Linear non-homogeneous partial differential equations.

UNIT II FOURIER SERIES 12

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

UNIT III APPLICATIONS OF PARTIAL DIFFERENTIAL EQUATION 12

Classification of partial differential equations- Method of separation of variables – Solutions of one dimensional wave equation and one-dimensional heat equation – Steady state solution of two-dimensional heat equation – Fourier series solutions in cartesian coordinates.

UNIT IV FOURIER TRANSFORM 12

Fourier integral theorem – Fourier transform pair - Sine and cosine transforms – Properties – Transform of elementary functions – Convolution theorem – Parseval's identity.

UNIT V Z – TRANSFORM AND DIFFERENCE EQUATIONS 12

Z-transform – Elementary properties – Inverse Z-transform – Convolution theorem – Initial and final value theorems – Formation of difference equation – Solution of difference equation using Z - transform.

TOTAL : 60 PERIODS

OUTCOMES :

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

- Solve partial differential equations which arise in application problems.
- Analyze the functions as an infinite series involving sine and cosine functions.
- Obtain the solutions of the partial differential equations using Fourier series.
- Obtain Fourier transforms for the functions which are needed for solving application problems.
- Manipulate discrete data sequences using Z transform techniques.

TEXTBOOKS:

1. Erwin kreyszig, "Advanced Engineering Mathematics", John Wiley & Sons, 10th Edition, New Delhi, 2015.
2. Grewal B.S., "Higher Engineering Mathematics", Khanna Publishers, 44th Edition, New Delhi, 2017.

REFERENCES:

1. Bali N., Goyal M. and Watkins C., "Advanced Engineering Mathematics", Firewall Media (An imprint of Lakshmi Publications Pvt., Ltd.,), 7th Edition, New Delhi, 2009.
2. Glyn James, "Advanced Modern Engineering Mathematics", Pearson Education, 4th Edition, New Delhi, 2011.
3. Peter V.O'Neil, "Advanced Engineering Mathematics", Cengage Learning India Pvt., Ltd, 7th Edition, New Delhi, 2012.
4. Ramana, B.V. "Higher Engineering Mathematics", Tata McGraw Hill, 11th Reprint, New Delhi, 2010.

AG5305 ENGINEERING GEOLOGY L T P C
3 0 0 3

OBJECTIVES:

- This course will familiarize the students on the role and importance of geology in civil engineering, apart from learning the methods of surface and subsurface investigations using geological, geophysical and remote sensing methods.

UNIT I INTRODUCTION AND GEOMORPHOLOGY 9

Significance of Geology in Civil Engineering; Internal structure of the Earth; Surface geologic processes in: Hilly terrains, Plains, Deserts and Coastal regions; physiographic forms and drainage patterns.

UNIT II MINERALS AND ROCKS 9

Physical and Chemical properties of minerals. Properties of Quartz, Feldspar, Mica, Olivine, Pyroxene, Amphibole. Reactivity of alkaline minerals with cement and sand.

Origin, texture, structure and petrography of: Hard rocks – Igneous and Metamorphic (Granite, Basalt, Dolerite, Gneiss, Quartzite, Schist, Slate, Marble); Soft rocks – Sedimentary (Sandstone, Limestone, Shale/clay).

UNIT III STRUCTURAL GEOLOGY AND GEOTECHNICAL PROPERTIES OF ROCKS 9

Attitude of rocks – Dip, Strike measurement of attitude and thickness of rock beds. Relevance to civil engineering.

Overview of folds, fractures, faults, joints in rocks. Relevance to civil engineering.

Introduction to index properties of rocks- strength- structures and discontinuities in rocks, Geological factors controlling the strength of rock – weathering (process and grades); influence on strength of rocks. Rock Mass Rating (RMR), Rock Quality Designation (RQD), Geological Strength Index (GSI), Q system for rock mass classification.

UNIT IV SURFACE AND SUB-SURFACE GEOLOGICAL INVESTIGATIONS 9

Reconnaissance surface investigation – Geological mapping; remote sensing and field surveys for geological mapping.

Overview of Geophysical methods- Electrical, Seismic, GPR. Applications for sub-surface investigation and groundwater exploration.

Borehole core logging and interpretation to characterize weathering grade, strength, colour, hydro-properties, RMR, RQD, GSI and Q parameters.

UNIT V GEOLOGICAL CONSIDERATIONS FOR ENGINEERING STRUCTURES AND GEOHAZARDS 9

Geological conditions necessary for design and construction of Dams, Reservoirs, Tunnels and Road cuttings. Coastal protection. Earthquake – Seismic zones of India, Landslides – causes and mitigation. Tsunami – causes and mitigation. Case studies from India.

TOTAL :45PERIODS:

OUTCOMES:

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

CO1	Understand the internal structure of earth and its relation to earthquake, volcanism and the various geological agents.
CO2	Have better understanding of the role of minerals in engineering properties of construction materials and foundation rocks. Will also realize the importance of rocks as construction materials, foundation and road aggregates.
CO3	Appreciate the role of geological structures in the design and construction of major civil engineering projects such as dams, tunnels, bridges, roads, airport and harbours, apart from learning the significance of engineering properties of rocks.
CO4	Gain knowledge on the role of geological mapping, remote sensing and geophysics for surface and subsurface investigations. In addition, the student

	will also gain knowledge on bore hole logging methods and their applications.
CO5	Use all the geological knowledge in design and construction of major civil engineering structures, in addition to mitigating geological hazards such as earthquakes, landslides and Tsunami that affect civil engineering structures.

TEXTBOOKS:

1. Varghese, P.C., Engineering Geology for Civil Engineering PHI Learning Private Limited, New Delhi, 2012.
2. Parbin Singh. A Text book of Engineering and General Geology, Katson publishing house, Ludhiana 2009.

REFERENCES:

1. F.G.Bell. Fundamentals of Engineering Geology, B.S. Publications. Hyderabad 2011.
2. Venkatareddy. D. Engineering Geology, Vikas Publishing House Pvt. Ltd. 2010.
3. KVGK Gokhale, Principles of Engineering Geology, BS Publications, Hyderabad 2011.
4. N. Chenna Kesavulu. Textbook of Engineering Geology, Macmillan India Ltd., 2009.

CO – PO Mapping – ENGINEERING GEOLOGY

PO/PSO		Course Outcome					Overall Correlation of CO s to POs
		CO1	CO2	CO3	CO4	CO5	
PO1	Knowledge of Engineering Sciences	2	2	2			2
PO2	Problem analysis			2	2	3	2
PO3	Design / development of solutions			3		3	3
PO4	Investigation		2	3	3	3	3
PO5	Modern Tool Usage		2		2		2
PO6	Individual and Team work		2	2		2	2
PO7	Communication					1	1
PO8	Engineer and Society	2			2	2	2
PO9	Ethics				2	2	2
PO10	Environment and Sustainability	2			2	2	2
PO11	Project Management and Finance				2	2	2
PO12	Life Long Learning				2	2	2
PSO1	Knowledge of Civil Engineering discipline		2		2	2	2
PSO2	Critical analysis of Civil Engineering problems and innovation				2	2	2
PSO3	Conceptualization and evaluation of engineering solutions to Civil Engineering Issues			2		2	2

CE5301 **STRENGTH OF MATERIALS** **L T P C**
3 0 0 3

OBJECTIVES:

- To learn the fundamental concepts of Stress in simple and complex states.
- To know the mechanism of load transfer in beams and the induced stresses due to simple bending and unsymmetrical bending
- To determine the deformation in determinate beams
- To know the basic concepts of analysis of indeterminate beams

UNIT I SIMPLE AND COMPOUND STRESSES 9

Stresses in simple and compound bars – Thermal stresses – Elastic constants - Thin cylindrical and spherical shells – Biaxial state of stress – Principal stresses and principal planes – Mohr's circle of stresses - Torsion on circular shafts.

UNIT II BENDING OF BEAMS 9

Types of beams and transverse loadings– Shear force and bending moment for Simply supported, cantilever and over-hanging beams - Theory of simple bending – Bending stress distribution – Shear stress distribution.

UNIT III DEFLECTION OF BEAMS 9

Double Integration method – Macaulay's method – Area moment method – Conjugate beam method - Strain energy method for determinate beams.

UNIT IV INDETERMINATE BEAMS 9

Propped Cantilever and Fixed Beams – Fixed end moments reactions, slope and deflection for standard cases of loading — Continuous beams – support reactions and moments – Theorem of three moments – Shear Force and Bending Moment Diagrams.

UNIT V ADVANCED TOPICS 9

Unsymmetrical bending of beams - shear centre - Thick cylinders - Theories of failure – Principal stress, principal strain, shear stress, strain energy and distortion energy theories – application problems.

TOTAL: 45 PERIODS

OUTCOMES:

Students will be able to

- Understand the concepts of stress and strain, principal stresses and principal planes.
- Determine Shear force and bending moment in beams and understand concept of theory of simple bending.
- Calculate the deflection of beams by different methods and selection of method for determining slope or deflection.
- Analyze propped cantilever, fixed beams and continuous beams for external loadings and support settlements.
- Determine the stresses due to Unsymmetrical bending of beams, locate the shear center, and study the various theories of failure

TEXTBOOKS:

1. Vazirani.V.N, Ratwani.M.M, Duggal .S.K Analysis of Structures: Analysis, Design and Detailing of Structures-Vol.1, Khanna Publishers, New Delhi 2014.
2. Rajput.R.K. Strength of Materials, S.Chand& Company Ltd., New Delhi 2014.

REFERENCES:

1. Irwing H.Shames, James M.Pitarresi, Introduction to Solid Mechanics, Prentice Hall of India, New Delhi, 2002
2. Beer. F.P. &Johnston.E.R.“Mechanics of Materials”, Tata McGraw Hill, Sixth Edition, New Delhi 2010.
3. James M.Gere., Mechanics of Materials, Thomas Canada Ltd., Canada, 2006.
4. Egor. P.Popov, Engineering Mechanics of Solids, Prentice Hall of India, Second Edition New Delhi 2015.

CO – PO Mapping – STRENGTH OF MATERIALS

PO/PSO		Course Outcome					Overall Correlation of CO s to POs
		CO1	CO2	CO3	CO4	CO5	
PO1	Knowledge of Engineering Sciences	3					3
PO2	Problem analysis		2	3	3		3
PO3	Design / development of solutions			3	2	3	3
PO4	Investigation		2	3	2	3	3
PO5	Modern Tool Usage		2	2	2		2
PO6	Individual and Team work	3	3	3			3
PO7	Communication	3					3
PO8	Engineer and Society				2	2	2
PO9	Ethics	1					1
PO10	Environment and Sustainability	1					1
PO11	Project Management and Finance			2	2	2	2
PO12	Life Long Learning				1	1	1
PSO1	Knowledge of Civil engineering discipline	3	3	3	3	3	3
PSO2	Civil Engineering Performance Evaluation and coordination	2	2	2	2	2	2
PSO3	Conceptualization of Civil Engineering Systems	2	2	2	2	2	2

CE5302 CONSTRUCTION MATERIALS, TECHNIQUES AND PRACTICES L T P C
3 0 0 3

OBJECTIVE:

- To introduce students to various construction materials, techniques and practices commonly used in civil engineering construction.

UNIT I STONES - BRICKS - CONCRETE BLOCKS - LIME 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 use - Lime - Preparation of lime mortar - Concrete hollow blocks - Lightweight concrete blocks.

UNIT II CEMENT - AGGREGATES 9

Cement - Ingredients - Manufacturing process - Types and grades - Properties of cement and Cement mortar - Tests on Cement - Fineness - Soundness, Consistency - Setting time - Coarse Aggregate -Crushing strength - Impact strength - Flakiness Index - Elongation Index - Abrasion resistance - Grading – Fine aggregate - grading – Bulking.

UNIT III CONCRETE 9

Concrete - Ingredients - Hydration - Batching plants – RMC - Properties of fresh concrete - Slump , Flow and Compaction factor - Properties of Hardened concrete - Compressive, Tensile and Shear strength -Modulus of rupture tests – Non-destructive testing - Mix Specification - Concept and design of mix proportion - BIS method - High strength concrete and HPC - Self compacting concrete.

UNIT IV TIMBER AND OTHER MATERIALS 9

Timber - Market forms - Plywood - Veneer - False ceiling materials - Laminates - Steel - Mechanical treatment - Aluminum - Uses - Market forms - Glass - Refractories - Composite Materials - FRP.

UNIT V CONSTRUCTION PRACTICES & SERVICE REQUIREMENTS 9

Types of Foundations - Shallow and Deep Foundations - Brick Masonry - Plastering and Pointing - Cavity Walls – Diaphragm Walls - Formwork - Centering and Shuttering – Shoring - Scaffolding - Underpinning - Roofing - Flooring - Joints in concrete - Contraction/Construction/Expansion joints - Fire Protection - Thermal Insulation - Ventilation and Air conditioning - Acoustics and Sound Insulation - Damp Proofing.

TOTAL: 45 PERIODS

TEXTBOOKS:

1. Varghese.P.C, Building Construction,Second Edition PHI Learning ltd., 2016.
2. Shetty.M.S., Concrete Technology (Theory and Practice), S Chand and company limited 2015.

REFERENCES:

1. Arora S.P and Bindra S.P Building construction ,Dhanpat Rai and sons,1997.
2. Punmia ,B.C Building construction , Laxmi publication (p)ltd..,2008.
3. Neville A.M Properties of concrete ,fourth edition ,Pearson education ltd.2012.
4. Peurifoy R.L., Schexnayder,C.J., Shapira A., Schmitt.R., Construction Planning Equipment and Methods, Tata mcgraw-hill,2011.

OUTCOMES

Students will be able to

CO1	Identify the good quality of brick for construction.
CO2	Design the concrete mixes for different exposure conditions
CO3	Understand material properties of cement and aggregates.
CO4	Study the market forms of timber and steel.
CO5	Recognize the good practices of thermal insulations and air conditioning of building.

.**CO – PO Mapping- CONSTRUCTION MATERIALS, TECHNIQUES AND PRACTICES**

PO/PSO		Course Outcome					Overall Correlation of CO s to POs
		CO1	CO2	CO3	CO4	CO5	
PO1	Knowledge of Engineering Sciences	3	3	3	3	2	3
PO2	Problem analysis	2					2
PO3	Design / development of solutions		3				3

PO4	Investigation	2				2	2
PO5	Modern Tool Usage		1				1
PO6	Individual and Team work			2			2
PO7	Communication				1		1
PO8	Engineer and Society	3			3	3	3
PO9	Ethics	2				2	2
PO10	Environment and Sustainability		1				1
PO11	Project Management and Finance				2		2
PO12	Life Long Learning					1	1
PSO1	Knowledge of Civil engineering discipline	3	2			3	3
PSO2	Civil Engineering Performance Evaluation and coordination	3				3	3
PSO3	Conceptualization of Civil Engineering Systems	3	3	3		3	3

CE5351 FLUID MECHANICS L T P C
3 0 0 3

OBJECTIVE:

- To introduce the students about properties of the fluids, behaviour of 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 – 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

(a) Kinematics - Classification of flows - Streamline, streak-line and path-lines - Stream function and velocity potentials - Flow nets;

(b) 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 - 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.

TOTAL: 45 PERIODS

OUTCOMES:

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

CO1	Demonstrate the difference between solid and fluid, its properties and behaviour in static conditions.
CO2	Apply the conservation laws applicable to fluids and its application through fluid kinematics and dynamics.
CO3	Formulate the relationship among the parameters involved in the given fluid phenomenon and to predict the performances of prototype by model studies.
CO4	Estimate losses in pipelines for both laminar and turbulent conditions and analysis of pipes connected in series and parallel.
CO5	Explain the concept of boundary layer and its application to find the drag force excreted by the fluid on the flat solid surface.

TEXTBOOKS:

1. Streeter, V.L. Wylie, E. B. and Bedford K.W, Fluid Mechanics. (9^{th} Ed.) Tata McGraw Hill, NewDelhi, 1998
2. Modi P.N and Seth Hydraulics and Fluid Mechanics including Hydraulic Machines, Standard Book House New Delhi. 2003

REFERENCES:

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

PO/PSO		Course Outcome					Overall Correlation of COs to POs
		CO1	CO2	CO3	CO4	CO5	
PO1	Knowledge of Engineering Sciences	3	3	3	3	3	3
PO2	Problem analysis	2	2	2	3	3	2
PO3	Design / development of solutions	1	1	3	3	2	3
PO4	Investigation	1	1	2	2	2	2
PO5	Modern Tool Usage	1	1	1	1	1	1
PO6	Individual and Team work	1	1	1	1	1	1
PO7	Communication	1	1	1	1	1	1
PO8	Engineer and Society	2	2	2	3	3	2
PO9	Ethics	1	1	1	1	1	1
PO10	Environment and Sustainability	2	2	2	2	2	2
PO11	Project Management and	1	1	1	1	1	1

	Finance						
PO12	Life Long Learning	2	2	2	3	3	2
PSO1	Knowledge of Civil Engineering discipline	3	3	3	3	3	3
PSO2	Critical analysis of Civil Engineering problems and innovation	2	2	3	3	3	3
PSO3	Conceptualization and evaluation of engineering solutions to Civil Engineering Issues	1	1	2	3	3	3

CE5311 STRENGTH OF MATERIALS LABORATORY L T P C
0 0 4 2

OBJECTIVES:

- To impart knowledge and skill relevant to the mechanical properties of materials subjected to different types of loading on wood and steel.

LIST OF EXPERIMENTS:

1. Compression test on wood
2. Double shear test on metal
3. Torsion test on mild steel rod
4. Impact test on metal specimen (Izod and Charpy)
5. Hardness test on metals (Rockwell and Brinell Hardness Tests)
6. Deflection test on metal beam
7. Compression test on helical spring
8. Deflection test on carriage spring
9. Tension test on mild steel rod

OUTCOMES:

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

CO1	Apply the knowledge of testing steel rod subjected to tension and torsion.
CO2	Explain the hardness of different metals.
CO3	Exert the knowledge about the testing of helical spring and carriage spring.
CO4	Acquire the knowledge about double shear test on metal and impact test on metal.
CO5	Obtain the practical knowledge about the deflection of the beam.

REFERENCES:

1. Strength of Materials Laboratory Manual, Anna University, Chennai-600 025.
2. IS 432(Part I) -1992 – Specification for mild steel and medium tensile steel bars and hard drawn steel wire for concrete reinforcement
3. Rajput.R.K. Strength of Materials, S.Chand& Company Ltd., New Delhi 2014.

CO – PO Mapping - STRENGTH OF MATERIALS LABORATORY

PO/PSO		Course Outcome					Overall Correlation of CO s to POs
		CO1	CO2	CO3	CO4	CO5	
PO1	Knowledge of Engineering Sciences	3	3	3	3	3	3
PO2	Problem analysis	2	2	2	2	2	2
PO3	Design / development of solutions						
PO4	Investigation	3	3	3	3	3	3
PO5	Modern Tool Usage	3	3	3	3	3	3
PO6	Individual and Team work	3	3	3	3	3	3
PO7	Communication	2	2	2	2	2	2
PO8	Engineer and Society	3	3	3	3	3	3
PO9	Ethics						
PO10	Environment and Sustainability						
PO11	Project Management and Finance						
PO12	Life Long Learning	2	2	2	2	2	2
PSO1	Knowledge of Civil engineering discipline	3	3	3	3	3	3
PSO2	Civil Engineering Performance Evaluation and coordination	3	3	3	3	3	3
PSO3	Conceptualization of Civil Engineering Systems	3	3	3	3	3	3

CE5312 **CONSTRUCTION MATERIALS LABORATORY** **L T P C**
0 0 4 2

OBJECTIVE:

- To facilitate the understanding of the behavior of construction materials.

I. TEST ON CEMENT **12**

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

II. TEST ON FINE AGGREGATES **12**

5. Grading of fine aggregates
6. Test for specific gravity
7. Compacted and loose bulk density of fine aggregate

III. TEST ON BRICKS **12**

8. Test for compressive strength
9. Test for Water absorption

10. Determination of Efflorescence

IV. TEST ON COARSE AGGREGATE **12**

11. Determination of specific gravity
12. Determination of impact value
13. Determination of elongation index
14. Determination of flakiness index
15. Determination of aggregate crushing value

V. TEST ON CONCRETE **12**

16. Test for slump
17. Test for Compressive strength

TOTAL: 60 PERIODS

OUTCOMES:

Student will be able to

CO1	Find the fineness, specific gravity, initial and final setting time of cement.
CO2	Find the grading, specific gravity and density of fine aggregate.
CO3	Find the compressive strength, water absorption and efflorescence of bricks.
CO4	Find the specific gravity, impact value, crushing value, elongation and flakiness index of coarse aggregate.
CO5	Find the slump of fresh concrete and compressive strength of hardened concrete.

REFERENCES:

1. Construction Materials Laboratory Manual, Anna University, Chennai-600 025.
2. IS 4031 (Part 1) – 1996 – Indian Standard Codes.
3. IS 4031 (Part 3 and Part 5) – 1988
4. IS 2386 (Part 1 to Part 6) – 1963
5. IS 383– 2016 Indian Standard specification for coarse and fine aggregates from natural sources for concrete.

CO – PO Mapping – CONSTRUCTION MATERIALS LABORATORY

PO/PSO		Course Outcome					Overall Correlation of CO s to POs
		CO1	CO2	CO3	CO4	CO5	
PO1	Knowledge of Engineering Sciences	3	3	3	3	3	3
PO2	Problem analysis	3	3	3	3	3	3
PO3	Design / development of solutions						
PO4	Investigation						
PO5	Modern Tool Usage	3	3	3	3	3	3
PO6	Individual and Team work	2	2	2	2	2	2
PO7	Communication						
PO8	Engineer and Society						
PO9	Ethics						
PO10	Environment and Sustainability	1	1	1	1	1	1

PO11	Project Management and Finance						
PO12	Life Long Learning						
PSO1	Knowledge of Civil Engineering discipline	3	3	3	3	3	3
PSO2	Critical analysis of Civil Engineering problems and innovation	3	3	3	3	3	3
PSO3	Conceptualization and evaluation of engineering solutions to Civil Engineering Issues	3	3	3	3	3	3

CE5401 WATER SUPPLY ENGINEERING L T P C
3 0 0 3

OBJECTIVE:

- To equip the students with the principles and design of water treatment and distribution.

UNIT I SOURCES AND QUALITY OF WATER 9

Public water supply system – Planning, Objectives, Design period, Population forecasting; Water demand – Sources of water and their characteristics – Analytical techniques, Surface and Groundwater – Impounding Reservoir – Development and selection of source – Source Water quality – Characterization – Significance – Drinking Water quality standards.

UNIT II COLLECTION AND CONVEYANCE OF WATER 9

Water supply –Types and design of intake structures – Functions; Pipes and conduits for water – Pipe materials – Hydraulics of flow in pipes – Transmission main design – Laying, jointing and testing of pipes – appurtenances – Types and capacity of pumps – Selection of pumps and pipe materials.

UNIT III CONVENTIONAL WATER TREATMENT 9

Objectives – Unit operations and processes – Principles, functions, and design of water treatment plant units, aerators, flash mixers, Coagulation and flocculation –Design of Clarifloccuator-Plate and tube settlers - Pulsator clarifier - sand filters - Disinfection - Residue Management – Operation and Maintenance aspects.

UNIT IV ADVANCED WATER TREATMENT 9

Water softening – Iron and Manganese removal - Defluoridation - Adsorption - Desalination- R.O. Plant – demineralization process –Ion exchange– Membrane Systems – RO Reject Management - Operation & Maintenance aspects – Recent advances.

UNIT V WATER DISTRIBUTION AND SUPPLY 9

Requirements of water distribution – Components – Selection of pipe material – Service reservoirs Functions – Network design – Analysis of distribution networks – Appurtenances – Leak detection.

Principles of design of water supply in buildings – House service connection – Fixtures and fittings, systems of plumbing and types of plumbing.

TOTAL: 45 PERIODS

OUTCOMES:

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

CO1	Understand the various components of water supply scheme
CO2	design of intake structure and conveyance system for water transmission
CO3	Understand the process of conventional treatment of water and design of water treatment system.
CO4	Able to Understand and design the various advanced treatment system and knowledge about the recent advances in water treatment process
CO5	ability to design and evaluate water distribution system and water supply in buildings

TEXTBOOKS:

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, 2010.

REFERENCES:

1. Punmia, B.C.,Ashok Jain and Arun Jain, Water Supply Engineering, Laxmi Publications (P) Ltd., New Delhi, 2010.
2. Manual on Water Supply and Treatment, CPHEEO, Ministry of Urban Development, Government of India, New Delhi, 2013.
3. Syed R. Qasim and Edward M. Motley Guang Zhu, Water Works Engineering Planning, Design and Operation, Prentice Hall of India Learning Private Limited, New Delhi, 2009.

CO – PO Mapping- WATER SUPPLY ENGINEERING

PO/PSO		Course Outcome					Overall Correlation of CO s to POs
		CO1	CO2	CO3	CO4	CO5	
PO1	Knowledge of Engineering Sciences		3	3		3	3
PO2	Problem analysis	3	2	2	2	2	2
PO3	Design / development of solutions		2	3		3	3
PO4	Investigation	3				2	2
PO5	Modern Tool Usage		2		3		3
PO6	Individual and Team work		2	2			2
PO7	Communication	1					1
PO8	Engineer and Society	3				3	3
PO9	Ethics	2					2
PO10	Environment and Sustainability		3	3	3		3
PO11	Project Management and Finance					2	2
PO12	Life Long Learning				2		2
PSO1	Knowledge of Civil Engineering discipline	3	3	3	3	3	3
PSO2	Critical analysis of Civil Engineering problems and innovation	2	2	2	2	3	2
PSO3	Conceptualization and evaluation of engineering	3					3

	solutions to Civil Engineering Issues						

CE5402 HIGHWAY ENGINEERING L T P C
3 0 0 3

OBJECTIVE:

- To give an overview on the basics of highway engineering and to impart the various process and methods involved in the planning, development, design, construction and maintenance of highways.

UNIT I HIGHWAY PLANNING AND ALIGNMENT 8

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 - Engineering surveys for alignment, objectives, conventional and modern methods.

UNIT II GEOMETRIC DESIGN OF HIGHWAYS 10

Typical cross sections of Urban and Rural roads — Cross sectional elements – Horizontal curves, super elevation, transition curves, widening of curves – Sight distances – Vertical curves, gradients, hairpin bends – Lateral and vertical clearance at underpasses – IRC standards-Road signs and safety. Urban utility services.

UNIT III DESIGN OF FLEXIBLE AND RIGID PAVEMENTS 9

Design principles – pavement components and their role - Design practice for flexible and rigid pavements (IRC methods only).

UNIT IV HIGHWAY CONSTRUCTION AND MAINTENANCE 10

Highway construction materials, properties, testing methods – Construction practice of flexible and concrete pavements including modern materials and methods, Highway drainage – Special considerations for hilly roads; Evaluation and Maintenance of pavements.

UNIT V HIGHWAY ECONOMICS AND FINANCE 8

Introduction, Highway User Benefits, Highway Costs, Vehicle Operation Costs, Economic analysis, Highway projects under Public-Private Sector Participation, Bidding process, Highway finance.

TOTAL: 45 PERIODS

OUTCOMES:

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	Designing various types of pavements to meet specified needs of safety, efficiency and long time sustainability by adopting various design standards.
CO4	Select appropriate methods for construction, evaluation and maintenance of roadways.
CO5	Understand the bidding processes and types of highway projects and analyze the economic, financial aspects of the highway projects ,

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

CO – PO Mapping – Highway Engineering

PO/PSO		Course Outcome					Overall Correlation of CO s to POs
		CO1	CO2	CO3	CO4	CO5	
PROGRAM OUTCOMES (PO)							
PO1	Knowledge of Engineering Sciences	3	3	2	2		3
PO2	Problem analysis			3	3	2	3
PO3	Design / development of solutions		3	3	2	1	3
PO4	Investigation	2		2	2	1	2
PO5	Modern Tool Usage			2	2		2
PO6	Individual and Team work			2		2	2
PO7	Communication					1	1
PO8	Engineer and Society	3			3	3	3
PO9	Ethics	3		3	3	3	3
PO10	Environment and Sustainability	1	1	2	3	1	2
PO11	Project Management and Finance			2	3	3	3
PO12	Life Long Learning		2	3	3	3	3
PROGRAM SPECIFIC OUTCOMES (PSO)							
PSO1	Knowledge of Civil Engineering discipline	3	3	3	3	2	3
PSO2	Critical analysis of Civil Engineering problems and innovation	2	3	3	3	2	3
PSO3	Conceptualization and evaluation of engineering solutions to Civil Engineering Issues				3	3	3

CE5403 APPLIED HYDRAULIC ENGINEERING L T P C
3 0 0 3

OBJECTIVE:

- To impart basic knowledge about the open channel flows with analysis of uniform flow, gradually varied flows and rapidly varied flows and expose 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 10

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 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 8

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.

UNIT V PUMPS 9

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

TOTAL: 45 PERIODS

OUTCOMES:

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

CO1	Describe the basics of open channel flows, its classifications 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 centrifugal and reciprocating pumps.

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, 2005.
4 Subramanya K., Flow in open channels, Tata McGraw Hill, New Delhi, 2000.

PO/PSO		Course Outcome					Overall Correlation of COs to POs
		CO1	CO2	CO3	CO4	CO5	
PO1	Knowledge of Engineering Sciences	3	3	3	3	3	3
PO2	Problem analysis	3	3	3	3	3	3
PO3	Design / development of solutions	2	2	2	3	3	2
PO4	Investigation	3	3	3	3	3	3
PO5	Modern Tool Usage	1	2	1	1	1	1
PO6	Individual and Team work	2	2	2	2	2	2
PO7	Communication	1	1	1	1	1	1
PO8	Engineer and Society	2	2	2	2	2	2
PO9	Ethics	1	1	1	1	1	1
PO10	Environment and Sustainability	2	2	2	2	2	2
PO11	Project Management and Finance	1	1	1	1	1	1
PO12	Life Long Learning	3	3	3	3	3	3
PSO1	Knowledge of Civil Engineering discipline	3	3	3	3	3	3
PSO2	Critical analysis of Civil Engineering problems and innovation	2	2	2	2	2	2
PSO3	Conceptualization and evaluation of engineering solutions to Civil Engineering Issues	2	2	3	3	3	3

CE5404 STRUCTURAL ANALYSIS – I L T P C
3 0 0 3

OBJECTIVE:

- To introduce the students to the basic theory and concepts of classical methods of structural analysis

UNIT I ANALYSIS OF TRUSSES 9

Determinate and indeterminate trusses - analysis of determinate trusses - method of joints - method of sections - Deflections of pin-jointed plane frames - lack of fit - change in temperature method of tension coefficient - application to space trusses.

UNIT II SLOPE DEFLECTION METHOD 9

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

UNIT III MOMENT DISTRIBUTION METHOD 9

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

UNIT IV FLEXIBLITY METHOD 9

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

UNIT V STIFFNESS METHOD 9

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

TOTAL: 45 PERIODS

OUTCOMES:

Students will be able to

- Analyze the pin-jointed plane and space frames
- Analyse the continuous beams and rigid frames by slope defection method.
- Understand the concept of moment distribution and analysis of continuous beams and rigid frames with and without sway.
- Analyse the indeterminate pin jointed plane frames continuous beams and rigid frames using matrix flexibility method.
- Understand the concept of matrix stiffness method and analysis of continuous beams, pin jointed trusses and rigid plane frames.

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 & Arun Kumar Jain, Theory of structures, Laxmi Publications, New Delhi, 2004.

REFERENCES:

1. William Weaver, Jr and James M.Gere, Matrix analysis of framed structures, CBS Publishers & Distributors, Second Edition, Delhi, 2004
2. Reddy .C.S, “Basic Structural Analysis”, Tata McGraw Hill Publishing Company, 2005.
3. Negi L.S. and Jangid R.S., Structural Analysis, Tata McGraw Hill Publishing. Co. Ltd. 2004
4. Bhavikatti, S.S, Matrix Method of Structural Analysis, I. K. International Publishing House Pvt.Ltd.,New Delhi-4, 2014.

CO – PO Mapping - STRUCTURAL ANALYSIS – I

PO/PSO		Course Outcome					Overall Correlation of CO s to POs
		CO1	CO2	CO3	CO4	CO5	
PO1	Knowledge of Engineering Sciences	3		3		3	3
PO2	Problem analysis	3	3	2	3	2	3
PO3	Design / development of solutions		3	1	2	2	2
PO4	Investigation	2	2		2		2
PO5	Modern Tool Usage	1					1
PO6	Individual and Team work			1	2	2	2
PO7	Communication	3					3
PO8	Engineer and Society	1					1
PO9	Ethics		1	1			1
PO10	Environment and Sustainability						

PO11	Project Management and Finance			1	1	1	1
PO12	Life Long Learning					2	2
PSO1	Knowledge of Civil Engineering discipline	3	3	3	3	3	3
PSO2	Critical analysis of Civil Engineering problems and innovation	2					2
PSO3	Conceptualization and evaluation of engineering solutions to Civil Engineering Issues	2					2

CE5405 SOIL MECHANICS L T P C
3 0 0 3

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 compaction, flow through soil, stress transformation, stress distribution, consolidation and shear strength of soils. To impart knowledge of design of both finite and infinite slopes.

UNIT I SOIL CLASSIFICATION AND COMPACTION 9

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

UNIT II EFFECTIVE STRESS AND PERMEABILITY 9

Soil - water – Static pressure in water - Effective stress concepts in soils – Capillary phenomena– Permeability interaction – Hydraulic conductivity – Darcy's law – Determination of Hydraulic Conductivity – Laboratory Determination (Constant head and falling head methods) and field measurement pumping out in unconfined and confined aquifer – Factors influencing permeability of soils – Seepage - Two dimensional flow – Laplace's equation – Introduction to flow nets – Simple problems. (Sheet pile and wier).

UNIT III STRESS DISTRIBUTION AND SETTLEMENT 9

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

UNIT IV SHEAR STRENGTH 9

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

UNIT V SLOPE STABILITY 9

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

TOTAL: 45 PERIODS

OUTCOME:

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

CO1	Graduates will demonstrate an ability to identify various types of soils and its properties, formulate and solve engineering Problems
CO2	Graduate will show the basic understanding of flow through soil medium and its impact of engineering solution
CO3	Graduate to understand about the basic concept of stress distribution in loaded soil medium and soil settlement due to consolidation
CO4	Graduate will show the understanding of 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	Graduates will 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.

CO – PO Mapping – SOIL MECHANICS

PO/PSO		Course Outcome					Overall Correlation of CO s to POs
		CO1	CO2	CO3	CO4	CO5	
PO1	Knowledge of Engineering Sciences	2	3	3	2	3	3
PO2	Problem analysis	3	2	3	3	3	3
PO3	Design / development of solutions	2	3	2	3	2	2
PO4	Investigation	2	2	2	2	2	2
PO5	Modern Tool Usage	3	3	2	2	2	2
PO6	Individual and Team work	2	2	2	1	1	2
PO7	Communication	1	1	1	1	1	1
PO8	Engineer and Society	1	1	2	1	1	1
PO9	Ethics	1	1	1	1	1	1
PO10	Environment and Sustainability	1	1	1	1	1	1
PO11	Project Management and Finance	2	2	2	2	1	2
PO12	Life Long Learning	3	3	3	3	3	3

PSO1	Knowledge of Civil Engineering discipline	3	2	2	2	2	2
PSO2	Critical analysis of Civil Engineering problems and innovation	3	2	2	2	3	2
PSO3	Conceptualization and evaluation of Engineering solutions to Civil engineering issues	2	3	3	3	2	3

CE5451 PLANE AND GEODETIC SURVEYING L T P C
3 0 0 3

OBJECTVE

- To learn the various methods of plane and geodetic surveying for solve the real world problems.

UNIT I FUNDAMENTALS OF SURVEYING 9

Classifications and basic principles of surveying – Equipment and accessories for ranging and chaining – Basic principles Compass surveying - Plane Table Surveying accessories and methods - Levels and staves - Methods of levelling - Booking - Reduction – Curvature and refraction correction – Contouring.

UNIT II THEODOLITE SURVEYING AND COMPUTATIONS 9

Horizontal and vertical angle measurements by Theodolite – Heights and distances–Tacheometric surveying – Trigonometric levelling - Computation of cross sectional areas and volumes - Earthwork calculations - Mass haul diagrams.

UNIT III CONTROL SURVEYING AND ADJUSTMENT 9

Horizontal and vertical control- Methods – Triangulation - Traversing - Gale‘s table - Trilateration - Concepts of measurements and errors – error propagation and linearization – adjustment methods – least square methods – angles, lengths and levelling network.

UNIT IV MODERN SURVEYING 9

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

UNIT V MISCELLANY 9

Route Surveying - Reconnaissance - Route surveys for highways, railways and waterways - Simple curves – Compound and reverse curves – Transition curves - Setting out different methods of simple curve - Vertical curves - Hydrographic surveying – Tides - MSL - Sounding methods - Three-point problem – Determination of depth and position using multi-beam sounder and GPS - Astronomical terms and definitions - Celestial coordinate systems – different time systems - Field observations and determination of azimuth by altitude and hour angle method.

TOTAL PERIODS: 45 HOURS

OUTCOMES

.**CO1**	Introduce the rudiments of various surveying and its principles.
CO2	Imparts concepts of Theodolite Surveying and computation of area and volume calculation.
CO3	Understand the procedure for establishing horizontal and vertical control and its adjustment procedure.
CO4	Introduce the basics of Electronic Surveying
CO5	Initiate the knowledge in Route surveying, Hydrographic surveying and Field Astronomical surveying.

TEXTBOOKS:

1. T.P.Kanetkar and S.V.Kulkarni, Surveying and Levelling, Parts1 & 2, Pune Vidyarthi Griha Prakashan, Pune, 2008
2. Dr.B.C.Punmia, Ashok K.Jain and Arun K Jain, Surveying Vol.I & II, Lakshmi Publications Pvt Ltd, New Delhi, 2005.

REFERENCES:

1. R. Subramanian, Surveying and Levelling, Oxford University Press, Second Edition, 2012.
2. Bannister and S. Raymond, Surveying, Seventh Edition, Longman 2004
3. S.K. Roy, Fundamentals of Surveying, Second Edition, Prentice‘ Hall of India 2004
4. K.R. Arora, Surveying Vol I & II, Standard Book house , Twelfth Edition. 2013

CO – PO Mapping – Plane And Geodetic Surveying

PO/PSO		Course Outcome					Overall Correlation of CO s to POs
		CO1	CO2	CO3	CO4	CO5	
PO1	Knowledge of Engineering Sciences	2	3	3	3	1	3
PO2	Problem analysis	2	3	2	2	3	2
PO3	Design / development of solutions	1	2	1	2	2	2
PO4	Investigation	1	1	1	2	2	1
PO5	Modern Tool Usage	2	2	3	3	3	3
PO6	Individual and Team work	2	2	1	3	2	2
PO7	Communication						
PO8	Engineer and Society	2	2	1	2	2	2
PO9	Ethics						
PO10	Environment and Sustainability						
PO11	Project Management and Finance						
PO12	Life Long Learning	1	1	2	2	2	2
PSO1	Knowledge of Civil Engineering discipline						
PSO2	Critical analysis of Civil Engineering problems and innovation						
PSO3	Conceptualization and evaluation of engineering solutions to Civil Engineering						

	Issues						

CE5461 PLANE AND GEODETIC SURVEYING LABORATORY L T P C
0 0 4 2

OBJECTIVE:

- To familiarize with the various surveying instruments and methods.

EXERCISES

1. Finding Pace Value of Surveyor using Chaining and Ranging
2. Computation of Included Angle after adjustment of Local Attraction
3. Planimetric Mapping of an Area using Plane Table Surveying (Radiation, Intersection)
4. Fly leveling using dumpy level.
5. Fly leveling using tilting level.
6. Transfer of Bench Mark using Check Levelling.
7. Contour Mapping using Grid Levelling.
8. Study of Theodolite and Angle Observations by Repetition.
9. Observation of Angles by method of Reiteration and Station Adjustment.
10. Establishment of Horizontal Control Points by Traversing.
11. Preparation of Planimetric Map using Stadia Tacheometry.
12. Determination of horizontal distance and height difference between two points by Tangential Tacheometry.
13. Estimation of Sun Rise/ Sun Set time using Sun Observations
14. Determination of Azimuth by Ex-Meridian observation.

OUTCOMES:

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

CO1	use conventional surveying tools such as chain/tape, compass, plane table in the field of civil engineering applications
CO2	Prepare planimetric map contour map
CO3	Imparts knowledge in computation of Distance and Elevation using horizontal and vertical angles
CO4	Establish horizontal and vertical control points.
CO5	Determination of Azimuth by Astronomical observation.

REFERENCES:

1. T.P.Kanetkar and S.V.Kulkarni, Surveying and Levelling, Parts1 & 2, Pune Vidyarthi Griha Prakashan, Pune, 2008
2. Dr.B.C.Punmia, Ashok K.Jain and Arun K Jain, Surveying Vol.I & II, Lakshmi Publications Pvt Ltd, New Delhi, 2005
3. James M.Anderson and Edward M. Mikhail, Surveying Theory and Practice, Tata McGraw Hill Education Private Limited, New Delhi, 2012
4. Bannister and S. Raymond, Surveying, Seventh Edition, Longman 2004

CO – PO Mapping – PLANE AND GEODETIC SURVEYING LABORATORY

PO/PSO		Course Outcome					Overall Correlation of CO s to POs
		CO1	CO2	CO3	CO4	CO5	
PO1	Knowledge of Engineering Sciences	1	2	1	2	1	1

PO2	Problem analysis	1	2	1	2	1	1
PO3	Design / development of solutions	1	1	2	2	2	2
PO4	Investigation						
PO5	Modern Tool Usage	2	3	3	2	2	3
PO6	Individual and Team work	2	3	3	2	2	2
PO7	Communication						
PO8	Engineer and Society	1	2	2	2	1	2
PO9	Ethics						
PO10	Environment and Sustainability						
PO11	Project Management and Finance						
PO12	Life Long Learning	1	1	2	1	1	1
PSO1	Knowledge of Civil Engineering discipline						
PSO2	Critical analysis of Civil Engineering problems and innovation						
PSO3	Conceptualization and evaluation of engineering solutions to Civil Engineering Issues						

CE5411 HYDRAULIC ENGINEERING LABORATORY L T P C
0 0 4 2

OBJECTIVE:

- To provide hands on experience in calibration of flow meters, performance characteristics of pumps and turbines.

LIST OF EXPERIMENTS (Any 10 of the following)

A. FLOW MEASUREMENT
1. Calibration of Rotameter
2. Calibration of Orifice/Venturimeter
3. Bernoulli's Experiment

B. LOSSES IN PIPES
4. Determination of friction factor in pipes.
5. Determination of minor losses

C. PUMPS
6. Characteristics of Centrifugal pumps
7. Characteristics of Gear pump
8. Characteristics of Submersible pump
9. Characteristics of Reciprocating pump

D. TURBINES
10. Characteristics of Pelton wheel turbine
11. Characteristics of Francis turbine

E. DETERMINATION OF METACENTRIC HEIGHT

12. Determination of metacentric height of floating bodies.

TOTAL : 60 PERIODS

OUTCOMES:

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

CO1 Apply Bernoulli equation for calibration of flow measuring devices.
CO2 Measure friction factor in pipes and compare with Moody diagram
CO3 Determine the performance characteristics of rotodynamic pumps.
CO4 Determine the performance characteristics of positive displacement pumps.
CO5 Determine the performance characteristics of turbines.

REFERENCES:

1. Hydraulic Laboratory Manual, Centre for Water Resources, Anna University, 2015.
2. Modi P.N. and Seth S.M., Hydraulics and Fluid Mechanics. Standard Book House. New Delhi, 2017.
3. Subramanya K, Fluid Mechanics and Hydraulic Machines, Tata McGraw Hill Edu. Pvt. Ltd. 2011

CO – PO Mapping – HYDRAULIC ENGINEERING LABORATORY

PO/PSO		Course Outcome					Overall Correlation of COs to POs
		CO1	CO2	CO3	CO4	CO5	
PO1	Knowledge of Engineering Sciences	2	3	3	3	3	3
PO2	Problem analysis	2	2	3	3	3	3
PO3	Design / development of solutions	1	1	2	2	2	2
PO4	Investigation	3	3	3	3	3	3
PO5	Modern Tool Usage	1	1	1	1	1	1
PO6	Individual and Team work	2	2	3	3	3	2
PO7	Communication	1	1	1	1	1	1
PO8	Engineer and Society	2	2	2	2	2	2
PO9	Ethics	1	1	1	1	1	1
PO10	Environment and Sustainability	2	2	2	2	2	2
PO11	Project Management and Finance	1	1	1	1	1	1
PO12	Life Long Learning	2	2	2	2	2	2
PSO1	Knowledge of Civil Engineering discipline	2	3	3	3	3	3
PSO2	Critical analysis of Civil Engineering problems and innovation	1	1	2	2	2	2
PSO3	Conceptualization and evaluation of engineering solutions to Civil Engineering Issues	1	1	1	1	1	1

CE5501 FOUNDATION ENGINEERING L T P C
3 0 0 3

OBJECTIVE:

- To impart knowledge to plan and execute a detail site investigation programme, to select geotechnical design parameters and type of foundations. Also to familiarize the students for the geotechnical design of different type of foundations and retaining walls.

UNIT I SITE INVESTIGATION AND SELECTION OF FOUNDATION 9

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

UNIT II SHALLOW FOUNDATION 9

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

UNIT III FOOTINGS AND RAFTS 9

Types of Isolated footing, Combined footing, Mat foundation – Contact pressure and settlement distribution – Proportioning of foundations for conventional rigid behaviour – Minimum depth for rigid behaviour – Applications – Floating foundation – Special foundations – Seismic force consideration – Codal provision

UNIT IV PILE FOUNDATION 9

Types of piles and their functions – Factors influencing the selection of pile – Carrying capacity of single pile in granular and cohesive soil – Static formula – Dynamic formulae (Engineering news and Hileys) – Capacity from insitu tests (SPT, SCPT) – Negative skin friction – Uplift capacity-Group capacity by different methods (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 – Codal provision.

TOTAL: 45 PERIODS

OUTCOME:

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

CO1	Graduate will demonstrate an ability to plan and execute a detailed site investigation to select geotechnical design parameters and type of foundation
CO2	Graduate will demonstrate an ability to design shallow foundations, its component or process as per the needs and specifications.
CO3	Graduate will demonstrate an ability to design combined footings and raft foundations, its component or process as per the needs and specifications.
CO4	Graduate will demonstrate an ability to design deep foundations, its component or process as per the needs and specifications.

CO5	Graduate will demonstrate an ability to design retaining walls, its component or process as per the needs and specifications.

TEXTBOOKS:

1. Murthy, V.N.S., "Soil Mechanics and Foundation Engineering", CBS Publishers and Distributers Ltd., New Delhi, 2015.
2. Gopal Ranjan and Rao A.S.R. "Basic and Applied soil mechanics", New Age International (P) Ltd, New Delhi,2006.

REFERENCES:

1. Das, B.M. "Principles of Foundation Engineering" (Eigth edition), Thompson Asia Pvt. Ltd., Singapore, 2013.
2. Kaniraj, S.R. "Design aids in Soil Mechanics and Foundation Engineering", Tata McGraw Hill publishing company Ltd., New Delhi, 2002.
3. Varghese, P.C.,"Foundation Engineering", Prentice Hall of India Private Limited, New Delhi, 2005.
4. Punmia, B.C., "Soil Mechanics and Foundations", Laxmi Publications Pvt.Ltd., New Delhi, 2005.

CO – PO Mapping – FOUNDATION ENGINEERING

PO/PSO		Course Outcome					Overall Correlation of CO s to POs
		CO1	CO2	CO3	CO4	CO5	
PO1	Knowledge of Engineering Sciences	2	2	2	3	3	2
PO2	Problem analysis	3	3	3	3	3	3
PO3	Design / development of solutions	3	3	3	3	3	3
PO4	Investigation	3	3	3	3	3	3
PO5	Modern Tool Usage	1	1	1	1	1	1
PO6	Individual and Team work	1	1	1	1	1	1
PO7	Communication	1	1	1	1	1	1
PO8	Engineer and Society	2	2	2	1	2	2
PO9	Ethics	1	1	1	1	1	1
PO10	Environment and Sustainability	1	2	1	1	1	1
PO11	Project Management and Finance	1	1	2	2	2	2
PO12	Life Long Learning	3	3	3	3	3	3
PSO1	Knowledge of Civil Engineering discipline	3	2	2	2	2	2
PSO2	Critical analysis of Civil Engineering problems and innovation	2	3	3	3	3	3
PSO3	Conceptualization and evaluation of Engineering solutions to Civil engineering issues	3	2	2	3	3	3

CE5502 STRUCTURAL ANALYSIS – II L T P C
3 0 0 3

OBJECTIVE:

- To learn the method of drawing influence lines and its uses in various applications like beams, bridges and plane trusses.

- To analyse the arches and suspension bridges

UNIT I INFLUENCE LINES FOR DETERMINATE STRUCTURES 9

Influence lines for reactions in statically determinate structures –Influence lines for shear force and bending moment in beam sections – 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

Influence line for support reactions, shearing force and bending moments for indeterminate beams - propped cantilevers, fixed beams and continuous beams - Muller Breslau's principle.

UNIT III ARCHES 9

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

UNIT IV SUSPENSION BRIDGES 9

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

UNIT V APPROXIMATE ANALYSIS OF FRAMES 9

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

TOTAL: 45 PERIODS

OUTCOMES:

Students will be able to

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 three hinged, two hinged and fixed arches
CO4	Analyse the suspension bridges with stiffening girders
CO5	Analyze 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 Mapping - STRUCTURAL ANALYSIS – II

PO/PSO		Course Outcome					Overall Correlation of CO s to POs
		CO1	CO2	CO3	CO4	CO5	
PO1	Knowledge of Engineering Sciences	3		3			3

PO2	Problem analysis			3	3	3	3
PO3	Design / development of solutions		3		3	3	3
PO4	Investigation			2			2
PO5	Modern Tool Usage		1	2	2		2
PO6	Individual and Team work	3	3				3
PO7	Communication			2	2		2
PO8	Engineer and Society				1	2	2
PO9	Ethics	1					1
PO10	Environment and Sustainability	1					1
PO11	Project Management and Finance			2	1	1	1
PO12	Life Long Learning				2	2	2
PSO1	Knowledge of Civil Engineering discipline	3	3	3	3	3	3
PSO2	Critical analysis of Civil Engineering problems and innovation	2	2	2	2	2	2
PSO3	Conceptualization and evaluation of engineering solutions to Civil Engineering Issues	2	2	2	2	2	2

CE5503 WASTE WATER ENGINEERING L T P C
3 0 0 3

OBJECTIVE:

- The objectives of this course is to help students develop the ability to apply basic understanding of physical, chemical, and biological phenomena for successful design, operation and maintenance of sewage treatment plants.

UNIT I 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 runoff estimation – sewer appurtenances – sewage pumping-drainage in buildings-plumbing systems for drainage- Discharge standards for Effluents.

UNIT II PRIMARY TREATMENT OF SEWAGE 8

Objectives – Unit Operations and Processes – Selection of treatment processes –- Onsite sanitation - Septic tank- Primary treatment – Principles, functions and design of sewage treatment units - screens - grit chamber-primary sedimentation tanks –Operation and Maintenance aspects.

UNIT III SECONDARY TREATMENT OF SEWAGE 10

Objectives – Selection of Treatment Methods – Principles, Functions, - Activated Sludge Process and Extended aeration systems –Rotating biological contactors-Trickling filters Waste Stabilization Ponds – Operation and Maintenance

UNIT IV ADVANCES IN SEWAGE TREATMENT 8

Sequencing Batch Reactor – Moving bed biofilm reactor-Membrane Bioreactor - UASB - Biogas recovery- Reclamation and Reuse of sewage – Constructed Wetland –Nutient removal systems.

UNIT V SEWAGE DISPOSAL AND SLUDGE MANAGEMENT 10

Dilution – Self purification of surface water bodies Oxygen sag curve – deoxygenation and reaeration - Land disposal – Sewage farming – sodium hazards - Soil dispersion system. Objectives - Sludge characterization – Sludge Thickening – Dewatering – Drying - ultimate residue disposal – Septage Management.

TOTAL: 45 PERIODS

OUTCOMES:

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

CO1	Understand on the characteristics and composition of sewage ,ability to estimate sewage generation and design sewer system including sewage pumping stations
CO2	Select type of treatment system and able to perform basic design of the unit operations that are used in sewage treatment. knowledge of septic tank design
CO3	Gain knowledge of selection of treatment process and biological treatment process
CO4	Acquire knowledge of advance treatment technology and reuse of sewage
CO5	Understand the, self-purification of streams and sludge and septage disposal methods.

TEXTBOOKS:

1. Garg, S.K., Environmental Engineering Vol. II, Khanna Publishers,New Delhi, 2015.
2. Duggal K.N., “Elements of Environmental Engineering” S.Chand and Co. Ltd., New Delhi, 2014.
3. Punmia, B.C., Jain, A.K., and Jain.A.K.., Environmental Engineering, Vol.II, Laxmi Publications, 2010.

REFERENCES:

1. Manual on Sewerage and Sewage Treatment Systems Part A,B and C, CPHEEO, Ministry of Urban Development, Government of India, New Delhi, 2013.
2. Metcalf and Eddy- Wastewater Engineering–Treatment and Reuse, Tata Mc.Graw-Hill Company, New Delhi, 2010.
3. Syed R. Qasim “Wastewater Treatment Plants”, CRC Press, Washington D.C.,2010
4. Gray N.F, “Water Technology”, Elsevier India Pvt. Ltd., New Delhi, 2006.

CO – PO Mapping - WASTE WATER ENGINEERING

PO/PSO		Course Outcome					Overall Correlation of CO s to POs
		CO1	CO2	CO3	CO4	CO5	
PO1	Knowledge of Engineering Sciences		3	3	2	2	3
PO2	Problem analysis					2	2
PO3	Design / development of solutions	2	3	3	3	3	3
PO4	Investigation	3	2	2	2	2	2
PO5	Modern Tool Usage		2		3	2	2
PO6	Individual and Team work		2	2			2
PO7	Communication	1					1
PO8	Engineer and Society	3	3			3	3
PO9	Ethics					3	3
PO10	Environment and	3	3	3	3	3	3

	Sustainability						
PO11	Project Management and Finance	3			2	2	2
PO12	Life Long Learning				3	3	3
PSO1	Knowledge of Civil Engineering discipline		3	3	3	3	3
PSO2	Critical analysis of Civil Engineering problems and innovation	3	3	2	2	3	3
PSO3	Conceptualization and evaluation of engineering solutions to Civil Engineering Issues	3	3	3	3	3	3

CE5504 DESIGN OF REINFORCED CEMENT CONCRETE STRUCTURES L T P C
3 0 0 3

OBJECTIVE

- To impart knowledge on basic of concepts of design of reinforced concrete structures and to make the students able to design and detail the basic elements like beam, slab, column, footing and staircase and few structures like retaining wall, water tank and framed building using reinforced concrete.

UNIT I DESIGN CONCEPTS AND DESIGN OF BEAMS FOR FLEXURE 9

Design concepts - Concept of elastic method, ultimate load method and limit state method– Advantages of Limit State method over other methods –Design of rectangular beam section by working stress method – Limit state method of design of singly reinforced, doubly reinforced and flanged beams - use of design aids for flexure

UNIT II LIMIT STATE DESIGN OF BEAMS FOR SHEAR, TORSION AND SERVICEABILITY 9

Limit state design of RC beams for shear and torsion - Design of RC beams for combined bending, shear and torsion – Use of design aids - Design requirement for bond and anchorage as per IS code – Detailing of reinforcement – Concept of Serviceability - Serviceability requirements for deflection.

UNIT III LIMIT STATE DESIGN OF SLABS AND STAIRCASE 9

Behaviour of one way and two way slabs - Design of one way simply supported, cantilever and Continuous slabs - Design of two-way slabs for various edge conditions - Torsion reinforcement at corners - Design of flat slabs - Types of staircases - Design of dog-legged staircase.

UNIT IV LIMIT STATE DESIGN OF COLUMNS AND FOOTING 9

Types of columns – Design of short columns for axial load, combined axial load with uniaxial and biaxial bending - use of design aids. Design of footing for masonry and reinforced walls – Design of axially and eccentrically loaded square and rectangular footings – Design of combined rectangular footings for two columns.

UNIT V DESIGN OF MISCELLANEOUS STRUCTURES 9

Design of cantilever retaining wall, RC water tanks and single storey RC building frame. Introduction to computer aided RC design (Demo only)

TOTAL: 45 PERIODS

OUTCOMES:

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

CO1 Explain the various design concepts and design a beam under flexure and draw the reinforcement details.

CO2 Design the beam under shear and torsion, Calculate the anchorage and development length and check the serviceability requirements for RC structural elements.

CO3 Design a RC slab and staircase and draw the reinforcement details.

CO4 Design short columns and strip, isolated and combined footings and draw the reinforcement details

CO5 Design a retaining wall, water tank and a framed RC building and draw the reinforcement details.

.**TEXT BOOKS:**

1. B.C. Punmia. Ashok K. Jain and Arun K. Jain, Limit State design of Reinforced Concrete, Laxmi Publications (P) Ltd., New Delhi, 2016.
2. Gambhir M L, Fundamentals of Structural Steel Design, McGraw Hill Education India Pvt Limited, 2017

REFERENCES :

1. Unnikrishna Pillai and Devdas Menon, Reinforced Concrete Design (Third Edition), Tata Mc Graw Hill Publishing Company Ltd., New Delhi, 3rd Edition, 2017.
2. N. Subramanian, Design of Reinforced Concrete Structures, Oxford University Press, New Delhi, 2014.
3. P.C. Varghese, Limit State Design of Reinforced Concrete, Prentice Hall of India, Pvt. Ltd., New Delhi, Second Edition, 2008.
4. S.N. Sinha, Reinforced Concrete Design, Tata McGraw-Hill, New Delhi, 2002.

IS CODES

1. IS 456:2000 Plain and Reinforced Concrete – Code of Practice.
2. IS 875(1-5):1987 Code of Practice for Design Loads (Other than Earthquake) for Buildings and Structures.
3. SP 16:1980 Design Aids for Reinforced Concrete to IS 456:1978.
4. SP 34:1987 Handbook of concrete reinforcement and detailing.
5. National Building Code of India 2016 (NBC 2016)

CO – PO Mapping - DESIGN OF REINFORCED CEMENT CONCRETE STRUCTURES

PO/PSO		Course Outcome					Overall Correlation of CO s to POs
		CO1	CO2	CO3	CO4	CO5	
PO1	Knowledge of Engineering Sciences	3	3	3	3	3	3
PO2	Problem analysis	3	3	3	3	3	3
PO3	Design / development of solutions	3	3	3	3	3	3
PO4	Investigation	2	2	2	2	2	2
PO5	Modern Tool Usage	1	2	2	2	3	2
PO6	Individual and Team work	2	2	2	2	2	2
PO7	Communication	1	1	1	1	1	1
PO8	Engineer and Society	2	2	2	2	2	2
PO9	Ethics	2	1	1	1	1	1
PO10	Environment and Sustainability	2	1	1	1	2	2
PO11	Project Management and Finance	1	1	1	1	1	1
PO12	Life Long Learning	3	2	2	2	3	2

PSO1	Knowledge of Civil Engineering discipline	3	3	3	3	3	3
PSO2	Critical analysis of Civil Engineering problems and innovation	3	3	3	3	3	3
PSO3	Conceptualization and evaluation of engineering solutions to Civil Engineering Issues	3	3	3	3	3	3

CE5511 WATER AND WASTEWATER ANALYSIS LABORATORY L T P C
0 0 4 2

OBJECTIVES:

- This subject includes the list of experiments to be conducted for characterization of water and municipal sewage. At the end of the course, the student is expected to be aware of the procedure for quantifying quality parameters for water and sewage.

LIST OF EXPERIMENTS:

ANALYSIS OF WATER SAMPLE

1. Sampling and preservation methods for water and wastewater (Demonstration only)
2. Measurement of Electrical conductivity and turbidity
3. Determination of fluoride in water by spectrophotometric method /ISE
4. Determination of iron in water (Demo)
5. Determination of Sulphate in water
6. Determination of Optimum Coagulant Dosage by Jar test apparatus
7. Determination of available Chlorine in Bleaching powder and residual chlorine in water

ANALYSIS OF WASTEWATER SAMPLE

8. Estimation of suspended, volatile and fixed solids
9. Determination of Sludge Volume Index in waste water
10. Determination of Dissolved Oxygen
11. Estimation of B.O.D.
12. Estimation of C.O.D.
13. Determination of Ammonia Nitrogen in wastewater
14. Determination of coliform (Demonstration only)

TOTAL: 60 PERIODS

OUTCOMES:

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

CO1	calibrate and standardize the equipment
CO2	collect proper sample for analysis
CO3	to know the sample preservation methods
CO4	to perform field oriented testing of water, wastewater
CO5	to perform coliform analysis

REFERENCES:

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

CO – PO Mapping

PO/PSO		Course Outcome					Overall Correlation of CO s to POs
		CO1	CO2	CO3	CO4	CO5	
PO1	Knowledge of Engineering Sciences	2	2	1	3	2	2
PO2	Problem analysis	1	1	1	3	3	2
PO3	Design / development of solutions	1	1	1	3	3	2
PO4	Investigation	1	1	1	3	3	2
PO5	Modern Tool Usage	2	1	1	3	3	2
PO6	Individual and Team work	1	1	2	3	2	2
PO7	Communication	1	1	1	2	2	2
PO8	Engineer and Society	1	2	2	2	2	2
PO9	Ethics	2	2	2	3	3	3
PO10	Environment and Sustainability	2	2	2	2	2	2
PO11	Project Management and Finance	1	2	2	3	2	2
PO12	Life Long Learning	3	2	2	3	2	3
PSO1	Knowledge of Civil Engineering discipline	2	2	2	3	2	2
PSO2	Critical analysis of Civil Engineering problems and innovation	2	2	2	3	2	2
PSO3	Conceptualization and evaluation of engineering solutions to Civil Engineering Issues	1	2	2	3	2	2

CE5512 **SOIL MECHANICS LABORATORY** **L T P C**
0 0 4 2

OBJECTIVE:

- To develop skills to test the soils for their index and engineering properties and to characterize the soil based on their properties.

EXERCISES:

1. DETERMINATION OF INDEX PROPERTIES **20**

a. Specific gravity of soil solids
b. Grain size distribution – Sieve analysis
c. Grain size distribution - Hydrometer analysis
d. Liquid limit and Plastic limit tests
e. Shrinkage limit and Differential free swell tests

2. DETERMINATION OF INSITU DENSITY AND COMPACTION CHARACTERISTICS **8**

a. Field density Test (Sand replacement method)
b. Determination of moisture – density relationship using standard proctor compaction test.

3.DETERMINATION OF ENGINEERING PROPERTIES **28**

a. Permeability determination (constant head and falling head methods)
b. One dimensional consolidation test (Determination of co-efficient of consolidation only)
c. Direct shear test in cohesionless soil
d. Unconfined compression test in cohesive soil
e. Laboratory vane shear test in cohesive soil
f. Tri-axial compression test in cohesionless soil (Demonstration only)
g. California Bearing Ratio Test

4. TEST ON GEOSYNTHETICS (Demonstration only) **4**

Determination of tensile strength and interfacial friction angle.

a. Determination of apparent opening sizes and permeability.

TOTAL: 60 PERIODS

OUTCOME:

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

CO1	Students are able to conduct tests to determine the index properties of soils
CO2	Students are be to determine the insitu density and compaction characteristics.
CO3	Students are able to conduct tests to determine the compressibility, permeability and shear strength of soils.
CO4	Students are able to understand the various tests on Geosynthetics.

REFERENCES:

1. Soil Engineering Laboratory Instruction Manual" published by Engineering College Co-operative Society, Anna University, Chennai, 2010.
2. "Saibaba Reddy, E. Ramasastri, K. "Measurement of Engineering Properties of Soils", New age International (P) limited publishers, New Delhi, 2008.
3. Lambe T.W., "Soil Testing for Engineers", John Wiley and Sons, New York, 1951. Digitized 2008.
4. IS Code of Practice (2720) Relevant Parts, as amended from time to time, Bureau of Indian Standards, New Delhi.
5. G.Venkatappa Rao and Goutham .K. Potable, "Geosynthetics Testing – A laboratory Manual", Sai Master Geoenvironmental Services Pvt. Ltd., 1st Edition 2008.
6. Braja M.Das., "Soil Mechanics: Laboratory Manual", Oxford University Press, eighth edition, 2012.

CO – PO Mapping – SOIL MECHANICS LABORATORY

PO/PSO		Course Outcome				Overall Correlation of CO s to POs
		CO1	CO2	CO3	CO4	
PO1	Knowledge of Engineering Sciences	2	1	3	1	1
PO2	Problem analysis	2	2	3	2	2
PO3	Design / development of solutions	3	3	3	2	3
PO4	Investigation	3	3	3	3	3
PO5	Modern Tool Usage	1	1	1	2	1
PO6	Individual and Team work	3	3	3	3	3
PO7	Communication	1	2	1	1	1
PO8	Engineer and Society	1	1	1	1	1
PO9	Ethics	1	1	1	1	1
PO10	Environment and Sustainability	1	1	1	1	1
PO11	Project Management and Finance	1	1	1	1	1
PO12	Life Long Learning	3	3	3	3	3

PSO1	Knowledge of Civil Engineering discipline	3	2	2	2	2
PSO2	Critical analysis of Civil Engineering problems and innovation	3	3	3	2	3
PSO3	Conceptualization and evaluation of Engineering solutions to Civil engineering issues	3	2	3	3	3

CE5601 DESIGN OF STEEL STRUCTURES L T P C
3 0 0 3

OBJECTIVE

- To introduce the students to limit state design of structural steel members subjected to compressive, tensile and bending loads, including connections.
- To provide the students the tools necessary for designing structural systems such as roof trusses and gantry girders as per provisions of current code (IS 800 - 2007) of practice.

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 TENSION AND COMPRESSION MEMBERS 9

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

UNIT III BEAMS 9

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

UNIT IV INDUSTRIAL STRUCTURES 9

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

UNIT V PLASTIC ANALYSIS AND DESIGN 9

Introduction to plastic analysis - Theorems of plastic Analysis - Design of continuous beams and portal frames using plastic design approach.

TOTAL ; 45PERIODS

OUTCOME:

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

CO1	Recognize the design philosophy of steel structures and identify the different failure modes of bolted and welded connections, and determine their design strengths
CO2	Select the most suitable section shape and size for tension and compression members and beams according to specific design criteria
CO3	Apply the principles, procedures and current code requirements to the analysis

	and design of steel tension members, columns, column bases and beams
CO4	Identify and compute the design loads on Industrial structures, and gantry girder
CO5	Find out ultimate load of steel beams and portal frames using plastic analysis

TEXT BOOKS

1. Duggal S.K., Design of Steel Structures, Tata McGraw Hill, Publishing Co. Ltd., New Delhi, 2010
2. Bhavikatti S.S, Design of Steel Structures, Ik International Publishing House, New Delhi, 2017.

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. Subramanian N, Design of Steel Structures, Oxford University Press, New Delhi, 2016

CO – PO Mapping –Design of Steel Structures

PO/PSO		Course Outcome					Overall Correlation of CO s to POs
		CO1	CO2	CO3	CO4	CO5	
PO1	Knowledge of Engineering Sciences	2	2	2	3	2	2
PO2	Problem analysis	2	2	2	2	3	2
PO3	Design / development of solutions	3	3	3	3	3	3
PO4	Investigation					2	2
PO5	Modern Tool Usage		2	2	2		2
PO6	Individual and Team work				2		2
PO7	Communication					1	1
PO8	Engineer and Society				2		2
PO9	Ethics				2		2
PO10	Environment and Sustainability	2			2		2
PO11	Project Management and Finance		2	2	2		2
PO12	Life Long Learning	2	2	2	3	3	2
PSO1	Knowledge of Civil Engineering discipline	3	2	2	2	2	2
PSO2	Critical analysis of Civil Engineering problems and innovation	2	2	2	2	2	2
PSO3	Conceptualization and evaluation of engineering solutions to Civil Engineering Issues				3	3	3

CE5602 RAILWAYS, AIRPORTS AND HARBOUR ENGINEERING L T P C
3 0 0 3

OBJECTIVE:

- To introduce the students about planning, design, construction and maintenance and design principles of Railways, Airport and Harbour.

UNIT I RAILWAY PLANNING AND CONSTRUCTION 10

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

UNIT II RAILWAY CONSTRUCTION AND MAINTENANCE 8

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 7

Air transport characteristics-airport classification-air port planning: objectives, components, layout characteristics, socio-economic characteristics of the Catchment area, airport site selection-Orientation of Runways and correction factors as ICAO stipulations, typical Airport Layouts, , parking and Circulation Area.

UNIT IV AIRPORT DESIGN 10

Runway Design: Orientation, Wind Rose Diagram, Problems on basic and Actual Length, Geometric Design, Configuration and Pavement Design Principles – Elements of Taxiway Design – Airport Zones – Passenger Facilities and Services – Runway and Taxiway Markings.

UNIT V HARBOUR ENGINEERING 10

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 – Inland Water Transport – Wave action on Coastal Structures and Coastal Protection Works – Environmental concern of Port Operations – Coastal Regulation Zone, 2011

TOTAL: 45 PERIODS

OUTCOMES:

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. Mundrey J S, Railway Track Engineering, McGraw Hill Education (India) Private Ltd, New Delhi, 2013.

REFERENCES:

1. Saxena Subhash, C.and Satyapal Arora, ACourse in Railway Engineering, Dhanapat Rai and Sons, Delhi, 1998
2. Khanna.S.K. Arora.M.G and Jain.S.S, Airport Planning and Design, Nemachand andBros, Roorkee, 1994

CO-PO -RAILWAYS, AIRPORTS AND HARBOUR ENGINEERING

PO/PSO		Course Outcome					Overall Correlation of CO s to POs
		CO1	CO2	CO3	CO4	CO5	
PO1	Knowledge of Engineering Sciences	3	3	3	3	3	3
PO2	Problem analysis						
PO3	Design / development of solutions						
PO4	Investigation	3	3	3	3	3	3
PO5	Modern Tool Usage	3	3	3	3	3	3
PO6	Individual and Team work	2	2	2	2	2	2
PO7	Communication	1	1	1	1	1	1
PO8	Engineer and Society	3	3	3	3	3	3
PO9	Ethics						
PO10	Environment and Sustainability						
PO11	Project Management and Finance						
PO12	Life Long Learning	3	3	3	3	3	3
PSO1	Knowledge of Civil Engineering discipline	3	3	3	3	3	3
PSO2	Civil engineering Performance Evaluation and coordination	3	3	3	3	3	3
PSO3	Conceptualization of Civil Engineering Systems	3	3	3	3	3	3

CE5611 BUILDING AND STRUCTURAL DRAWING LT P C
0 0 4 2

OBJECTIVES:

- To impart knowledge and skill relevant to Building and Structural detailed drawing 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. Industrial buildings – North light roof truss
5. Building information modeling.
6. Reinforcement details of RCC structural elements (slab,beam and column)
7. Reinforcement details of footings (Isolated, stepped, combined footing)
8. Reinforcement details of RCC water tanks (circular, rectangular)
9. Reinforcement details of retaining walls (cantilever, counterfort)
10. Steel structures (beam column connection,beam to beam connection, steel water tank with hemispherical bottom, steel foot over bridge, steel chimney)

TOTAL : 60 PERIODS

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

CO – PO Mapping

PO/PSO		Course Outcome					Overall Correlation of CO s to POs
		CO1	CO2	CO3	CO4	CO5	
PO1	Knowledge of Engineering Sciences	3	3	3	3	3	3
PO2	Problem analysis						
PO3	Design / development of solutions						
PO4	Investigation	3	3	3	3	3	3
PO5	Modern Tool Usage	3	3	3	3	3	3
PO6	Individual and Team work	2	2	2	2	2	2
PO7	Communication	1	1	1	1	1	1
PO8	Engineer and Society	3	3	3	3	3	3
PO9	Ethics						
PO10	Environment and Sustainability						
PO11	Project Management and Finance						
PO12	Life Long Learning	3	3	3	3	3	3
PSO1	Knowledge of Civil Engineering discipline	3	3	3	3	3	3
PSO2	Civil engineering Performance Evaluation and coordination	3	3	3	3	3	3
PSO3	Conceptualization of Civil Engineering Systems	3	3	3	3	3	3

CE5612 HIGHWAY ENGINEERING LABORATORY L T P C
0 0 4 2

OBJECTIVE :

- To learn the principles and procedures of testing of materials used in the construction of highways

EXCERCISES:

I TEST ON AGGREGATES

a) Sieve Analysis
b) Flakiness and Elongation Test of Aggregates.
c) Specific Gravity of Aggregates.
d) Aggregate Impact Value

e) Los Angeles Abrasion Test
f) Water Absorption of Aggregates

II TEST ON BITUMEN

a) Specific Gravity of Bitumen
b) Penetration Test
c) Viscosity Test
d) Softening Point Test
e) Ductility Test

III BITUMINOUS MIXES – Demonstration classes only.

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

IV DEMONSTRATION OF FIELD TESTING EQUIPMENT

TOTAL: 60 PERIODS

OUTCOMES:

- Student would have knowledge to characterize various pavement materials and learn the concept and of testing the highway materials as per the IRC specifications through hands on experience.

REFERENCES:

1. Highway Materials and Pavement Testing, Nem Chand and Bros., Roorkee, Revised Fifth Edition, 2009
2. Methods for testing tar and bituminous materials, IS 1201–1978 to IS 1220– 1978, Bureau of Indian Standards
3. Methods of test for aggregates, IS 2386 – 1978, Bureau of Indian Standards
4. Mix Design Methods Asphalt Institute Manual Series No. 2, Sixth Edition, 1997, Lexington, KY, USA.

CO – PO Mapping – Highway Engineering Laboratory

PO/PSO		Course Outcome					Overall Correlation of CO s to POs
		CO1	CO2	CO3	CO4	CO5	
PO1	Knowledge of Engineering Sciences						
PO2	Problem analysis			3	3	2	3
PO3	Design / development of solutions		3	3	2	1	3
PO4	Investigation			2	2	1	2
PO5	Modern Tool Usage		2	3	2	2	2
PO6	Individual and Team work	2	2				2
PO7	Communication					1	1
PO8	Engineer and Society	3			3	3	3
PO9	Ethics			3	3	3	3
PO10	Environment and Sustainability	1	1	2	3	1	2
PO11	Project Management and Finance			2	3	3	3
PO12	Life Long Learning		2	3	3	3	3
PSO1	Knowledge of Civil Engineering discipline	3	3	3	3	2	3
PSO2	Critical analysis of Civil Engineering problems and innovation	2	3	3	3	2	3
PSO3	Conceptualization and evaluation of engineering solutions to Civil Engineering Issues	2	3	2	3	3	3

CE5613 **SURVEY CAMP (2 Weeks)** **L T P C**
0 0 0 1

OBJECTIVE:

- To provide practical knowledge for implementation of different survey works.

EXERCISES

1. Preparation of Topographic Map
    - Reconnaissance Survey for selection of Control Framework, Observation Stations
    - Establishment of Horizontal Control Network (Traversing and Triangulation methods)
    - Establishment of Vertical Control Network using Level Net
    - Adjustment of Weighted Observations
    - Measurement of Coordinates (X,Y and Z) of Features
    - Preparation of Topographic Map using CAD software
2. Setting out work and Computation work.
    - Setting out simple Road curve by linear method (Degree of Curve: 1 - 20°)
    - Setting out simple Railway curve by Instrument method (Degree of Curve: 1 - 5°)
    - Spread Footing Foundation marking for residential building.
    - Column Footing Foundation marking for commercial / industrial building.
    - Cut and fill volume calculation using profile levelling and Cross sectioning.

OUTCOMES:

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

CO1	Familiarize in handling different survey instruments.
CO2	Apply modern surveying techniques in field to establish horizontal control.
CO3	Understand the surveying techniques in field to establish vertical control network.
CO4	Exposed to different survey adjustment techniques.
CO5	Familiarize in setting out work different computation process.

CO – PO Mapping – SURVEY CAMP

PO/PSO		Course Outcome					Overall Correlation of CO s to POs
		CO1	CO2	CO3	CO4	CO5	
PO1	Knowledge of Engineering Sciences						
PO2	Problem analysis	1	1	1	3	1	1
PO3	Design / development of solutions	1	1	2	2	2	2
PO4	Investigation						
PO5	Modern Tool Usage	3	3	3	2	3	3
PO6	Individual and Team work	2	2	3	2	2	2
PO7	Communication						
PO8	Engineer and Society	1	1	2	1	1	1
PO9	Ethics						
PO10	Environment and Sustainability						
PO11	Project Management and Finance						
PO12	Life Long Learning	3	1	2	1	2	2
PSO1	Knowledge of Civil Engineering discipline						
PSO2	Critical analysis of Civil Engineering problems and innovation						
PSO3	Conceptualization and evaluation of engineering solutions to Civil Engineering Issues						

MG5451 **PRINCIPLES OF MANAGEMENT** **L T P C**
3 0 0 3

OBJECTIVES:

- Sketch the Evolution of Management.
- Extract the functions and principles of management.
- Learn the application of the principles in an organization.
- Study the various HR related activities.
- Analyze the position of self and company goals towards business.

UNIT I INTRODUCTION TO MANAGEMENT AND ORGANIZATIONS 9

Definition of Management – Science or Art – Manager Vs Entrepreneur- types of managers-managerial roles and skills – Evolution of Management –Scientific, human relations , system and contingency approaches– Types of Business organization- Sole proprietorship, partnership, company-public and private sector enterprises- Organization culture and Environment – Current trends and issues in Management.

UNIT II PLANNING 9

Nature and purpose of planning – Planning process – Types of planning – Objectives – Setting objectives – Policies – Planning premises – Strategic Management – Planning Tools and Techniques – Decision making steps and process.

UNIT III ORGANISING 9

Nature and purpose – Formal and informal organization – Organization chart – Organization structure – Types – Line and staff authority – Departmentalization – delegation of authority – Centralization and decentralization – Job Design - Human Resource Management – HR Planning, Recruitment, selection, Training and Development, Performance Management , Career planning and management.

UNIT IV DIRECTING 9

Foundations of individual and group behaviour– Motivation – Motivation theories – Motivational techniques – Job satisfaction – Job enrichment – Leadership – types and theories of leadership – Communication – Process of communication – Barrier in communication – Effective communication – Communication and IT.

UNIT IV CONTROLLING 9

System and process of controlling – Budgetary and non - Budgetary control techniques – Use of computers and IT in Management control – Productivity problems and management – Control and performance – Direct and preventive control – Reporting.

TOTAL: 45 PERIODS

OUTCOMES:

CO1: Upon completion of the course, students will be able to have clear understanding of managerial functions like planning, organizing, staffing, leading & controlling.
CO2: Have same basic knowledge on international aspect of management.
CO3: Ability to understand management concept of organizing.
CO4: Ability to understand management concept of directing.
CO5: Ability to understand management concept of controlling.

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	✓					✓			✓	✓	✓	
CO2						✓			✓		✓	
CO3						✓			✓		✓	
CO4						✓			✓		✓	
CO5						✓			✓		✓	

TEXT BOOKS:

1. Harold Koontz and Heinz Weihrich “Essentials of management” Tata McGraw Hill,1998.
2. Stephen P. Robbins and Mary Coulter, “ Management”, Prentice Hall (India)Pvt. Ltd., 10th Edition, 2009.

REFERENCES:

1. Robert Kreitner and MamataMohapatra, “ Management”, Biztantra, 2008.
2. Stephen A. Robbins and David A. Decenzo and Mary Coulter, “Fundamentals of Management” Pearson Education, 7th Edition, 2011.
3. Tripathy PC and Reddy PN, “Principles of Management”, Tata Mcgraw Hill, 1999

CE5701 IRRIGATION ENGINEERING L T P C
3 0 0 3

OBJECTIVES:

- To introduce the students to the concept of soil-plant characteristics and their water requirements and to understand the necessity of planning an irrigation system to provide water at the right time and right place.

UNIT I IRRIGATION PRINCIPLES 9

Need for irrigation – Advantages and ill effects – Development of irrigation – National Water Policy – Tamil Nadu scenario - Physical properties of soil that influence soil moisture characteristics – Concept of soil water potential and its components: Gravitational and Osmotic pressures- Retention of water in soils - Concept of available water – Movement of water into and within the soils – Measurement of soil moisture content.

UNIT II CROP WATER REQUIREMENT 8

Necessity and importance– Crop and crop seasons in India –Duty, Delta, Base Period– Factors affecting Duty-Irrigation efficiencies– Consumptive use of water-Irrigation requirements of crops - Standards for irrigation water- Planning and Development of irrigation projects.

UNIT III DIVERSION AND IMPOUNDING STRUCTURES 9

Head works –Weirs and Barrages –Types of impounding structures - Factors affecting, location of dams -Forces on a dam -Design of Gravity dams; Earth dams, Arch dams – Spillways -Energy dissipaters.

UNIT IV CANAL IRRIGATION 11

Classification of canals- Alignment of canals – Design of irrigation canals– Regime theories - Canal Head works – Canal regulators - Canal drops – Cross drainage works – Canal Outlets, Escapes –Lining and maintenance of canals – Other methods of Irrigation: Surface, Subsurface – Merits and Demerits.

UNIT V IRRIGATION WATER MANAGEMENT 8

Modernization techniques – Rehabilitation – Command Area Development - Systems of rice intensification - Water delivery systems - Participatory Irrigation Management – Farmers’ organization and turn over – Water users’ associations - Economic aspects of irrigation.

TOTAL: 45 PERIODS

OUTCOMES:

CO1	Describe the national water policy structure and soil plant water characteristics
CO2	Describe the basics of requirements and estimation of crop water
CO3	Design the various types of hydraulic structure includes dams, spillways and dissipaters

CO4	Design the components of irrigation canal includes canal drops and cross drainage works
CO5	Apply the concepts of Irrigation water management, water user association for participatory irrigation management

TEXTBOOKS:

1. Sharma, R.K., and Sharma, T.K., “Irrigation Engineering”, S. Chand and Company, New Delhi, 2008.
2. Michael, A.M., “Irrigation Engineering”, Vikas Publishers, New Delhi, 2008.
3. Garg, S.K., “Irrigation Engineering,” Laxmi Publications, New Delhi, 2008.

REFERENCES:

1. Arora, K.R., “Irrigation, Water Power and Water Resources Engineering”, Standard Publishers Distributors, New Delhi, 2009.
2. Basak, N.N., “Irrigation Engineering”, Tata McGraw-Hill Publishing Co, New Delhi, 2008.
3. Dilip Kumar Majumdar, “Irrigation Water Management”, Prentice-Hall of India, New Delhi, 2008.
4. Punmia, B.C., “Irrigation and Water Power Engineering”, Laxmi Publishers, New Delhi, 2008.

PO/PSO		Course Outcome					Overall Correlation of COs to POs
		CO1	CO2	CO3	CO4	CO5	
PO1	Knowledge of Engineering Sciences			3	3		3
PO2	Problem analysis		1	3	3	1	2
PO3	Design / development of solutions						
PO4	Investigation	2		3		2	2
PO5	Modern Tool Usage		2			2	2
PO6	Individual and Team work					3	3
PO7	Communication					3	3
PO8	Engineer and Society			3	3	3	3
PO9	Ethics					1	1
PO10	Environment and Sustainability		3			1	2
PO11	Project Management and Finance		2	3	3	3	3
PO12	Life Long Learning	2	2				2
PSO1	Knowledge of Civil Engineering discipline	3	3	3	3	3	3
PSO2	Critical analysis of Civil Engineering problems and innovation	2	3	3	3	2	3
PSO3	Conceptualization and evaluation of engineering solutions to Civil Engineering Issues			2	2	2	2

CE5801 ESTIMATION, COSTING AND VALUATION ENGINEERING L T P C
3 0 0 3

OBJECTIVE:

- To impart knowledge in estimation, tender practices, contract procedures, and valuation of Civil Engineering works.

UNIT I QUANTITY ESTIMATION 9

Philosophy – Purpose – Methods of estimation – Types of estimates – Approximate estimates – Detailed estimate – Estimation of quantities for buildings, roads, canals and hydraulic structures using computer softwares.

UNIT II RATE ANALYSIS AND COSTING 9

Standard Data – Observed Data – Schedule of rates – Market rates – Assessment of Man Hours and Machineries for common civil works – Rate Analysis – Cost Estimates using Computer softwares.

UNIT III SPECIFICATIONS, REPORTS AND TENDERS 9

Specifications – Detailed and general specifications – Constructions – Sources – Types of specifications – Principles for report preparation – report on estimate of residential building – Culvert – Roads - TTT Act 2000 – Tender notices – types – tender procedures – Drafting model tenders , E-tendering-Digital signature certificates- Encrypting -Decrypting – Reverse auctions.

UNIT IV CONTRACTS 9

Contract – Types of contracts – Formation of contract – Contract conditions – Contract for labour, material, design, construction – Drafting of contract documents based on IBRD / MORTH Standard bidding documents – Construction contracts – Contract problems – Arbitration and legal requirements.

UNIT V VALUATION 9

Definitions – Various types of valuations – Valuation methods – Valuation of land – Buildings – Valuation of plant and machineries - Calculation of Standard rent – Mortgage – Lease.

TOTAL: 45 PERIODS

OUTCOMES:

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

CO1	Explain the basic concept of quantity estimation for building, roads, canals and hydraulic structures by manual and software packages.
CO2	Acquire the knowledge to calculate rate analysis and man-hours required for the common civil works by manual and software packages.
CO3	Develop the specification for the materials used in construction, online and offline tender procedures and tender document preparation and report preparation.
CO4	Acquire the knowledge of construction contracts and contract document preparation.
CO5	Identify the valuation for building, land and plant and machineries, calculation of rent, mortgage and lease.

TEXTBOOKS:

1. B.N Dutta ‘Estimating and Costing in Civil Engineering’, UBS Publishers & Distributors (P) Ltd, 2010.
2. B.S.Patil, ‘Civil Engineering Contracts and Estimates’, University Press, 2006

REFERENCES:

1. Hand Book of Consolidated Data – 8/2000, Vol.1, TNPWD
2. Tamil Nadu Transparencies in Tenders Act, 2000
3. Standard Databook for analysis and rates
4. Standard Bid Evaluation Form, Procurement of Good or Works, The World Bank, April 1996

CO – PO Mapping - ESTIMATION, COSTING AND VALUATION ENGINEERING

PO/PSO		Course Outcome					Overall Correlation of CO s to POs
		CO1	CO2	CO3	CO4	CO5	
PO1	Knowledge of Engineering Sciences	3	3	3	3	3	3
PO2	Problem analysis	3	2	1	1	2	2
PO3	Design / development of solutions	3	3	2	1	2	3
PO4	Investigation	3	3	3	3	3	3
PO5	Modern Tool Usage	3	3	1	1	3	3
PO6	Individual and Team work	3	3	3	3	3	3
PO7	Communication	2	2	2	2	2	2
PO8	Engineer and Society	3	3	3	3	3	3
PO9	Ethics	2	2	2	2	2	2
PO10	Environment and Sustainability	3	3	2	2	2	2
PO11	Project Management and Finance	3	3	2	2	2	2
PO12	Life Long Learning	3	3	3	3	3	3
PSO1	Knowledge of Civil Engineering discipline	3	3	3	3	3	3
PSO2	Critical analysis of Civil Engineering problems and innovation	3	3	3	3	3	3
PSO3	Conceptualization and evaluation of engineering solutions to Civil Engineering Issues	3	3	3	3	3	3

CE5711 **SUMMER INTERNSHIP/ SUMMER TRAINING** **L T P C**
(4 Weeks During VI Semester – Summer) **0 0 0 2**

OBJECTIVE:

- To train the students in field work so as to have a firsthand knowledge of practical problems in carrying out engineering tasks. To develop skills in facing and solving the field problems.

STRATEGY:

The students individually undertake training in reputed civil engineering companies for the specified duration. At the end of the training, a report on the work done will be prepared and presented. The students will be evaluated through a viva-voce examination by a team of internal staff.

OUTCOMES:

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

- The intricacies of implementation textbook knowledge into practice
- The concepts of developments and implementation of new techniques

CO – PO Mapping – Summer Internship and summer training

PO/PSO		Course Outcome				Overall Correlation of CO s to POs
		CO1	CO2	CO3	CO4	
PO1	Knowledge of Engineering Sciences	2	2	1	3	2
PO2	Problem analysis	3	3	2	3	3
PO3	Design / development of solutions	3	3	2	3	3
PO4	Investigation	3	2	1	2	2
PO5	Modern Tool Usage	2	2	1	3	2
PO6	Individual and Team work	3	3	2	3	3
PO7	Communication	3	3	2	2	3
PO8	Engineer and Society	2	2	2	2	2
PO9	Ethics	2	2	3	2	2
PO10	Environment and Sustainability	1	1	1	1	1
PO11	Project Management and Finance	1	1	2	2	2
PO12	Life Long Learning	3	3	3	3	3
PSO1	Knowledge of Geotechnical Engineering discipline	3	3	3	3	3
PSO2	Critical analysis of Geotechnical Engineering problems and innovation	3	3	3	3	3
PSO3	Conceptualization and evaluation of engineering solutions to geotechnical engineering issues	2	3	3	3	3

CE5712 IRRIGATION AND ENVIRONMENTAL ENGINEERING DRAWING L T P C
0 0 4 2

OBJECTIVE:

- At the end of the semester, the student shall conceive, design and draw the irrigation and environmental engineering structures in detail showing the plan, elevation and sections.

PART A: IRRIGATION ENGINEERING

1. TANK COMPONENTS **9**

Fundamentals of design - Tank surplus weir – Tank sluice with tower head - Drawings showing foundation details, plan and elevation.

2. IMPOUNDING STRUCTURES **6**

Design principles - Earth dam – Profile of Gravity Dam

3. CROSS DRAINAGE WORKS **6**

General design principles - Aqueducts – Syphon aqueduct (Type III) – Canal drop (Notch Type) – Drawing showing plan, elevation and foundation details.

4. CANAL REGULATION STRUCTURES **9**

General Principles - Direct Sluice - Canal regulator - Drawing showing detailed plan, elevation and foundation details.

PART B: ENVIRONMENTAL ENGINEERING

1. WATER SUPPLY AND TREATMENT **10**

Design and Drawing of flash mixer, clari-flocculator – Rapid sand filter – Pressure sand filter- Service reservoirs – House service connection for water supply and drainage.

2. SEWAGE TREATMENT & DISPOSAL **20**

Design and Drawing of screen chamber - Grit channel - Primary clarifier - Activated sludge process – Sequencing Batch reactor – Trickling filter – Waste stabilization ponds -Anaerobic sludge digester – Sludge drying beds –- Septic tanks and disposal arrangements.

TOTAL: 60 PERIODS

OUTCOMES:

- The students after completing this course will be able to design and draw various units of municipal water treatment plants and sewage treatment plants.

TEXTBOOKS:

1. Satya Narayana Murthy Challa, “Water Resources Engineering: Principles and Practice”, New Age International Publishers, New Delhi, 2002.
2. Garg, S.K., “Irrigation Engineering and Design of Structures”, New Age International Publishers, New Delhi, 1997.
3. Manual on Water Supply and Treatment, CPHEEO, Government of India, New Delhi, 1999.
4. Manual on “Sewerage and Sewage Treatment Systems- Part A, B and C” CPHEEO, Ministry of Urban Development, Government of India, New Delhi, 2013.

REFERENCES:

1. Mohanakrishnan. A, “A few Novel and Interesting Innovative Irrigation Structures: Conceived, Designed and Executed in the Plan Projects in Tamil Nadu”, Publ. No. 44 and Water Resources Development & Management Publ.No.43, IMTI Thuvakudy, Trichy, 2011.
2. Raghunath, H.M. “Irrigation Engineering”, Wiley India Pvt. Ltd., New Delhi, 2011.
3. Sharma R.K., “Irrigation Engineering and Hydraulic Structures”, Oxford and IBH Publishing Co., New Delhi, 2002.
4. Peary, H.S., ROWE, D.R., Tchobanoglous, G., “Environmental Engineering”, McGraw- Hill Book Co., New Delhi, 1995.
5. Metcalf and Eddy, “Wastewater Engineering, Treatment and Reuse”, Tata McGraw-Hill, New Delhi, 2010.
6. Qasim,S.R., Motley, E.M and Zhu.G. "Water works Engineering – Planning, Design and Operation", Prentice Hall, New Delhi, 2009.
7. Qasim, S. R. "Wastewater Treatment Plants, Planning, Design & Operation", CRC Press, New York, 2010

CE5713 **PROJECT I** **L T P C**
0 0 6 3

OBJECTIVE:

- To develop the ability to solve a specific problem right from its identification and literature review till the successful solution of the same. To train the students in preparing project reports and to face reviews and viva voce examination.

SYLLABUS:

The student works on a topic relevant to civil engineering under the guidance of a faculty member and prepares a comprehensive project report after completing the work to the satisfaction of the supervisor. The student will be evaluated based on the report and the viva voce examination by a team of examiners including one external examiner.

TOTAL: 90 PERIODS

OUTCOME:

At the end of the course, students are able to;

CO1	Identify civil engineering problems reviewing available literature.
CO2	Identify appropriate techniques to analyze complex civil engineering problems.
CO3	Apply engineering and management principles through efficient handling of project have a clear idea of his/her area of work and they are in a position to carry out the work in a systematic way.

CO – PO Mapping – PROJECT I

PO/PSO		Course Outcome			Overall Correlation of CO s to POs
		CO1	CO2	CO3	
PO1	Knowledge of Engineering Sciences	3	3	2	3
PO2	Problem analysis	1	3	2	2
PO3	Design / development of solutions	1	1	2	1
PO4	Investigation	3	3		3
PO5	Modern Tool Usage				
PO6	Individual and Team work	3	3	2	3
PO7	Communication	2		2	2
PO8	Engineer and Society	2		2	2
PO9	Ethics	2		2	2
PO10	Environment and Sustainability	1	1	1	1
PO11	Project Management and Finance	1	1	1	1
PO12	Life Long Learning	3	3	3	3
PSO1	Knowledge of Civil Engineering discipline	3	3	1	3
PSO2	Critical analysis of Civil Engineering problems and innovation	3	3	1	3
PSO3	Conceptualization and evaluation of engineering solutions to Civil engineering issues	3	3	1	3

CE5811 **PROJECT II** **L T P C**

0 0 16 8

OBJECTIVE:

- To develop the ability to solve a specific problem right from its identification and literature review till the successful solution of the same. To train the students in preparing project reports and to face reviews and viva voce examination.

SYLLABUS:

The student works on a topic relevant to civil engineering under the guidance of a faculty member and prepares a comprehensive project report after completing the work to the satisfaction of the supervisor. The student will be evaluated based on the report and the viva voce examination by a team of examiners including one external examiner.

TOTAL: 240 PERIODS

OUTCOME:

At the end of the course, students are able to;

CO1	Identify civil engineering problems reviewing available literature.
CO2	Identify appropriate techniques to analyze complex civil engineering problems.
CO3	Apply engineering and management principles through efficient handling of project have a clear idea of his/her area of work and they are in a position to carry out the work in a systematic way.

CO – PO Mapping – PROJECT II

PO/PSO		Course Outcome			Overall Correlation of CO s to POs
		CO1	CO2	CO3	
PO1	Knowledge of Engineering Sciences	3	3	2	3
PO2	Problem analysis	1	3	2	2
PO3	Design / development of solutions	1	1	2	1
PO4	Investigation	3	3		3
PO5	Modern Tool Usage				
PO6	Individual and Team work	3	3	2	3
PO7	Communication	2		2	2
PO8	Engineer and Society	2		2	2
PO9	Ethics	2		2	2
PO10	Environment and Sustainability	1	1	1	1
PO11	Project Management and Finance	1	1	1	1
PO12	Life Long Learning	3	3	3	3
PSO1	Knowledge of Civil Engineering discipline	3	3	1	3
PSO2	Critical analysis of Civil Engineering problems and innovation	3	3	1	3
PSO3	Conceptualization and evaluation of engineering solutions to Civil engineering issues	3	3	1	3

CE5001 REMOTE SENSING L T P C
3 0 0 3

OBJECTIVES:

- To make the students to understand the concepts, components and source of remote sensing
- To gain knowledge about different types of remote sensing platforms and sensors
- To explain the concept of satellite image interpretation
- To understand the applications of remote sensing in Civil Engineering

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 INTERPRETATION AND CIVIL ENGINEERING APPLICATIONS 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 – Civil Engineering applications: highway and railway alignments, site selection for dams, town and regional planning

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 atmosphere 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 and civil engineering applications

TEXTBOOKS:

1. Thomas M.Lillesand, Ralph W. Kiefer and Jonathan W. Chipman, Remote Sensing and Image interpretation, John Wiley and Sons, Inc, New York, 2009.
2. George Joseph and C Jeganathan, Fundamentals of Remote Sensing, 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, American Society of Photogrametry, Virginia, USA, 2002.
2. Verbyla, David, Satellite Remote Sensing of Natural Resources. CRC Press, 1995
3. Paul Curran P.J. Principles of Remote Sensing. Longman, RLBS, 2003.
4. Introduction to Physics and Techniques of Remote Sensing , Charles Elachi and Jacob Van Zyl, 2006 Edition II, Wiley Publication.
5. Basudeb Bhatta, Remote Sensing and GIS, Oxford University Press, 2011

CO – PO Mapping – REMOTE SENSING

PO/PSO		Course Outcome					Overall Correlation of CO s to POs
		CO1	CO2	CO3	CO4	CO5	
PO1	Knowledge of Engineering Sciences	3		2	2	2	2
PO2	Problem analysis					3	3
PO3	Design / development of solutions				2	2	2
PO4	Investigation					3	3
PO5	Modern Tool Usage					3	3
PO6	Individual and Team work			3		2	2
PO7	Communication			3		3	3
PO8	Engineer and Society					3	3
PO9	Ethics					1	1

PO10	Environment and Sustainability	1	3				2
PO11	Project Management and Finance				1		1
PO12	Life Long Learning				2		2
PSO1	Knowledge of Civil Engineering discipline					2	2
PSO2	Critical analysis of Civil Engineering problems and innovation					2	2
PSO3	Conceptualization and evaluation of engineering solutions to Civil Engineering issues					2	2

CE5002 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 INTRODUCTION TO MAPS AND GIS 9

Maps – Definition – Scale - Types of Maps – Elements of Map – Projection – purpose - types – Coordinate Systems: Geographic, Rectangular and Polar – Transformations - types and application – GIS: Introduction - History– Components – Applications of GIS - Popular GIS software – Opensource GIS software

UNIT II DBMS AND GIS DATA MODEL 9

Database Management system – function – types – advantages - Entity Relationship Model - Normalization - GIS Data Model - Introduction- Data Encoding - Vector Data Structure - Raster Data structure – Network Data Structure - Comparison of Vector and Raster Data Structure - ODBC

UNIT III GIS DATA INPUT 9

Sources for GIS Data - Vector Data Input – Georeferencing – Topology – Topological Relationship - Raster Data Input – Errors in input – Data Editing – Linking Attribute Data – Raster File Formats – Vector File Formats – Raster to Vector and Vector to Raster Conversion - OGC standards

UNIT IV GIS DATA ANALYSIS 9

Introduction to spatial analysis - Raster Data Spatial Analysis: Local, Neighbourhood, Zonal Operations - Vector Operations and Analysis: Topological and Non-topological operations - Network Analysis – DEM – Surface Analysis

UNIT V GIS OUTPUT DESIGN AND PRESENTATION 9

Introduction - Spatial and Non-spatial Data presentation - Map layout – Charts, Graphs and Multimedia output – Elements of Spatial Data Quality – Meta Data - Introduction to Web GIS – Applications in Civil Engineering

TOTAL: 45 PERIODS

OUTCOMES:

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

CO1	Understand the fundamentals of maps, their characteristics and GIS, its components
CO2	Appreciate various spatial data models and their advantages
CO3	Produce a error free GIS database for civil engineering applications
CO4	Apply various spatial analysis tools for deriving GIS based outcome
CO5	Present the spatial information along with quality assessment for applications

TEXT BOOKS

1. Jonathan Campbell and Michael Shin, Essentials of Geographic Information Systems, 2011, Saylor Foundation, ISBN: 9781453321966
2. Michael N. DeMers, Fundamentals of Geographic Information Systems, 4th Edition, 2009, Wiley, ISBN: 9780470129067
3. Ian Heywood, Sarah Cornelius, Steve Carver, An Introduction to Geographical Information Systems, 4th Edition, 2011, Prentice Hall, ISBN: 9780273722595
4. Longley, P. A., Goodchild, M. F., Maguire, D. J., and Rhind, D. W., Geographical Information Systems: Principles, Techniques, Management and Applications, 2nd Edition, 2005, John Wiley & Sons, ISBN: 9780471735458
5. Kang-tsung Chang, "Introduction to Geographic Information Systems", 9th Edition, 2019, McGraw-Hill Book Company, ISBN: 9781259929649

REFERENCES

1. Paul A. Longley, Michael F. Goodchild, David J. Maguire, David W. Rhind, Geographic Information Science and Systems, 4th Edition , 2015, Wiley, ISBN: 9781118676950
2. David Smith, Understanding GIS - An ArcGIS Pro Project Workbook, 4th Edition, 2018, Environmental Systems Research, ISBN: 9781589485266

CO – PO Mapping –GEOGRAPHIC INFORMATION SYSTEM

		CO1	CO2	CO3	CO4	CO5	Overall
PO1	Knowledge of Engineering Sciences	2	2				2
PO2	Problem analysis				3	3	3
PO3	Design / development of solutions			1		1	1
PO4	Investigation						
PO5	Modern Tool Usage				3	3	3
PO6	Individual and Team work		1				1
PO7	Communication					2	2
PO8	Engineer and Society					2	2
PO9	Ethics					1	1
PO10	Environment and Sustainability	2				1	2
PO11	Project Management and Finance			1	1		1
PO12	Life Long Learning						
PSO1	Knowledge of Civil Engineering discipline					1	1
PSO2	Critical analysis of Civil Engineering problems and innovation			2		2	2
PSO3	Conceptualization and evaluation of engineering solutions to Civil Engineering Issues				2	2	2

CE5003 GEOINFORMATICS APPLICATIONS FOR CIVIL ENGINEERS L T P C
3 0 0 3

OBJECTIVE:

- To solve the Civil Engineering problems with the help of Geoinformatics technique**.**

UNIT I MAP PRODUCTION CONCEPTS 9

Maps - uses –– Types of Maps – Map Scales – Map projections –– Map co-ordinate systems – Elements of a map - Map Layout principles – Map Design fundamentals – symbols and conventional signs - colours and patterns in symbolization – map lettering - map production – map printing– colours and visualization – map reproduction - Map generalization - geometric transformations – bilinear and affine transformations.

UNIT II GIS AND SPATIAL DATA 9

Data – Information – Primary and Secondary data sources – GIS - Components of a GIS – Hardware, Software, Data, People, Methods - Types of data – Spatial, Attribute data – scales/ levels of measurements - spatial data models - Raster vs Vector Models - Raster Data Structures - TIN and GRID data models.

UNIT III RASTER AND VECTOR DATA ANALYSIS 9

Raster Data analysis: Query Analysis – Local, Focal and Zonal Operations – Cost-Distance Analysis - Least Cost Path **–** Vector data analysis – attribute data analysis - query, calculations – Integrated data analysis - Reclassification, Aggregation, Overlay analysis: Point-in-polygon, Line-in-Polygon, Polygon-on-Polygon: Clip, Erase, Identity, Union, Intersection – Proximity Analysis: Buffering

UNIT IV NETWORK ANALYSIS 9

Network – Introduction - Network Data Model – Elements of Network - Building a Network database - Geocoding – Address Matching - Shortest Path in a Network – Time and Distance Based shortest path analysis – Driving Directions – Closest Facility Analysis – Catchment / Service Area Analysis-Location-Allocation Analysis.

UNIT IV MODELLING AND APPLICATIONS 9

Land Information studies - Building information system – Digital Infrastructure management - Watershed modelling for sustainable development - modelling of reservoir siltation – soil degradation assessment - Highway alignment studies – Intelligent transportation systems - Solid Waste management - Air quality monitoring - Disaster management.

TOTAL: 45 PERIODS

OUTCOMES:

On completion of this course, the student shall be able to

CO1	Understand the concepts of map making process.
CO2	Gain knowledge on spatial data and Geographic Information System
CO3	Impart the required skills for analyzing the spatial data useful modelling the real world problems
CO4	Impart the required skills for analyzing the spatial data useful modelling transportation networks and resource transport.
CO5	Gain knowledge on the applicability of Geoinfomatics technology on diverse Civil Engineering Problems

TEXT BOOKS:

1. C.P. Lo Albert K.W. Yeung, Concepts and Techniques of Geographic Information Systems, Second edition, PHI Learning Private Limited, Delhi, 2014.
2. Jonathan E. Campbell, Michael Shin, Essential of Geographic Information System, Saylor Foundation, 2011.

REFERENCES

1. Ian Heywood, Sarah Cornelius, Steve Carver, Srinivasa Raju, "An Introduction to Geographical Information Systems, Pearson Education, 2nd Edition, 2007.
2. Michael N. DeMers, Fundamentals of geographic information systems, Wiley,2009
3. John Peter Wilson, The handbook of geographic information science, Blackwell Pub.,2008
4. Harvey J.Miller, Shih-Lung Shaw, Geographic Information System for Transportation-Principle and Applications, Oxford University Press,2001.
5. Kang-Tsung Chang, "Introduction to Geographic Information Systems", McGraw Hill Publishing, 2nd Edition, 2011.

PO/PSO		Course Outcome					Overall Correlation of COs to POs
		CO1	CO2	CO3	CO4	CO5	
PO1	Knowledge of Engineering Sciences				2		2
PO2	Problem Analysis	1		2	2	3	2
PO3	Design / development of Solutions		2	2	3	3	3
PO4	Investigation			3	3	3	3
PO5	Modern tool usage		2		3	2	3
PO6	Individual and Team work	1	2	2	2	3	2
PO7	Communication			3	3	3	
PO8	Engineer and Society					2	2
PO9	Ethics				3	3	3
PO10	Environment and Sustainability				3	3	3
PO11	Project Management and Finance	2	2			3	2
PO12	Life Long Learning			3	3		3
PSO1	Knowledge of Civil Engineering discipline				3	3	3
PSO2	Critical analysis of Civil Engineering problems and innovation				3	3	3
PSO3	Conceptualization and evaluation of engineering solutions to Civil Engineering Issues					3	3

GI5551 TOTAL STATION AND GPS SURVEYING L T P C

3 0 0 3

OBJECTIVE :

- To understand the working of Total Station and GPS and solve the surveying problems.

UNIT I FUNDAMENTALS OF TOTAL STATION AND ELECTROMAGNETIC WAVES 9

Methods of Measuring Distance, Basic Principles of Total Station, Historical Development, Classifications, applications and comparison with conventional surveying. Classification - applications of Electromagnetic waves, Propagation properties, wave propagation at lower and higher frequencies

UNIT II DISTANCE AND ATMOSPHERIC CORRECTION 9

Refractive index (RI) - factors affecting RI-Computation of group for light and near infrared waves at standard and ambient conditions-Computation of RI for microwaves at ambient condition - Reference refractive index- Real time application of first velocity correction. Measurement of atmospheric parameters- Mean refractive index- Second velocity correction -Total atmospheric correction- Use of temperature and pressure transducers.

UNIT III ELECTRO OPTICAL AND MICRO WAVE SYSTEM 9

Electro-optical system: Measuring principle, Working principle, Sources of Error, Infrared and Laser Total Station instruments. Microwave system: Measuring principle, working principle, Sources of Error, Microwave Total Station instruments. Comparison between Electro-optical and Microwave system. Care and maintenance of Total Station instruments – Traversing and Trilateration-COGO functions, offsets and stake out-land survey applications.

UNIT IV GPS SATELLITE SYSTEM 9

Basic concepts of GPS - Historical perspective and development - applications - Geoid and Ellipsoid- satellite orbital motion - Keplerian motion – Kepler‘s Law - Perturbing forces - Geodetic satellite - Doppler effect - Positioning concept –GNSS, IRNSS and GAGAN - Different segments - space, control and user segments - satellite configuration – GPS signal structure - Orbit determination and representation - Anti Spoofing and Selective Availability - Task of control segment - GPS receivers.

UNIT V GPS DATA PROCESSING 9

GPS observables - code and carrier phase observation - linear combination and derived observables - concept of parameter estimation – downloading the data RINEX Format – Differential data processing – software modules -solutions of cycle slips, ambiguities, Concepts of rapid, static methods with GPS - semi Kinematic and pure Kinematic methods -satellite geometry & accuracy measures - applications- long baseline processing- use of different softwares.

TOTAL: 45 PERIODS

OUTCOMES:

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

CO1	Learn the fundamentals of Total station.
CO2	Provides knowledge about electromagnetic waves and its usage in Total station and GPS.
CO3	Understand the measuring and working principle of electro optical and Microwave Total station and GPS
CO4	Learn the basic concepts of GPS
CO5	Gains knowledge about Total station and GPS data downloading and processing

TEXTBOOKS:

1. Rueger, J.M. Electronic Distance Measurement, Springer-Verlag, Berlin, 4th Edition,1996.
2. Satheesh Gopi, rasathishkumar, N.madhu, — Advanced Surveying , Total Station GPS and Remote Sensing — Pearson education , 2nd Edition,2017. isbn: 978-81317 00679

REFERENCES :

1. R.Subramanian, Surveying and Levelling, Oxford University Press, Second Edition, 2012.
2. Laurila, S.H. Electronic Surveying in Practice, John Wiley and Sons Inc, 1983.
3. Guocheng Xu, GPS Theory, Algorithms and Applications, Springer - Verlag, Berlin,3rd Edition,2016.
4. Alfred Leick, GPS satellite surveying, John Wiley & Sons Inc., 4th Edition, 2015.
5. Seeber G, Satellite Geodesy, Walter De Gruyter, Berlin,2nd Edition,2003.

PO/PSO		Course Outcome					Overall Correlation of CO s to POs
		CO1	CO2	CO3	CO4	CO5	
PO1	Knowledge of Engineering Sciences	3	3		2	2	3
PO2	Problem Analysis			3		3	3
PO3	Design / development of Solutions			3		3	3
PO4	Investigations			1		1	1
PO5	Usage of Modern Technology			3		3	3

PO6	Individual and Team work						
PO7	Communication						
PO8	Engineer and Society			3		3	3
PO9	Ethics			3		3	3
PO10	Environment and Sustainability						
PO11	Project Management and Finance		2			2	2
PO12	Life Long Learning			3		3	3
PSO1	Knowledge of Civil Engineering discipline	3				3	3
PSO2	Critical analysis of Civil Engineering problems and innovation					3	3
PSO3	Conceptualization and evaluation of engineering solutions to Civil Engineering Issues					3	3

CE5004 AIR POLLUTION AND CONTROL AND ENGINEERING L T P C
3 0 0 3

OBJECTIVE:

- To impart knowledge on the principle and design of control of Indoor/ particulate/ gaseous air pollutant and its emerging trends.

UNIT I AIR QULALITY 9

Structure and composition of Atmosphere – Definition, Scope and Scales of Air Pollution – Sources and classification of air pollutants and their effect on human health, vegetation, animals, property, aesthetic value and visibility- Ambient Air Quality and Emission standards – Ambient and stack sampling and Analysis of Particulate and Gaseous Pollutants.

UNIT II ATMOSPHERIC DISPERSION OF AIR POLLUTANT 8

Effects of meteorology on Air Pollution - Fundamentals, Atmospheric stability, Inversion, Wind profiles and stack plume patterns- Atmospheric Diffusion Theories – Dispersion models, Plume rise.

UNIT III CONTROL OF PARTICULATE CONTAMINANTS 9

Gas Particle Interaction – Working principle, Design and performance equations of Gravity Separators, Centrifugal separators Fabric filters, Particulate Scrubbers, Electrostatic Precipitators – Operational Considerations- Factors affecting Selection of Control Equipment

UNIT IV CONTROL OF GASEOUS CONTAMINANTS 10

Working principle, Design and performance equations of absorption, Adsorption, condensation, Incineration, Bio scrubbers, Bio filters – Process control and Monitoring - Operational Considerations- Factors affecting Selection of Control Equipment –CO_2 capturing.

UNIT V INDOOR AIR QUALITY MANAGEMENT 9

Sources types and control of indoor air pollutants, sick building syndrome types –Sources and Effects of Noise Pollution – Measurement – Standards–Control and Preventive measures.

TOTAL: 45 PERIODS

OUTCOMES:

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

CO1	understand the chemistry of atmosphere, characterize the air pollutants ,know the effects of air pollution, identify the criteria air pollutants and know about NAAQS
CO2	apply the knowledge of mathematics ,science and engineering fundamentals to understand the concept of meteorology, air pollution dispersion and Gaussian plume dispersion model
CO3	select suitable method and design the particulate pollutant control equipment
CO4	select appropriate method for control of gaseous pollutant by due consideration of sources of emission
CO5	understand the source of indoor air pollution, effects and control methods as well as to identify the source of noise ,and select suitable method for measuring and control of noise pollution

TEXTBOOKS:

1. Lawrence K. Wang, Norman C. Pareira, Yung Tse Hung, Air Pollution Control Engineering, Tokyo, 2004.
2. Noel de Nevers, Air Pollution Control Engineering, Mc Graw Hill, New York, 1995.
3. Anjaneyulu. Y, "Air Pollution and Control Technologies" , Allied Publishers (P) Ltd., India 2002.

REFERENCES:

1. David H.F. Liu, Bela G. Liptak „Air Pollution" , Lweis Publishers, 2000.
2. Arthur C.Stern, „Air Pollution (Vol.I – Vol.VIII)" , Academic Press, 2006.
3. Wayne T.Davis, „Air Pollution Engineering Manual" , John Wiley & Sons, Inc.,2000.

CO – PO Mapping - AIR POLLUTION AND CONTROL ENGINEERING

PO/PSO		Course Outcome					Overall Correlation of CO s to POs
		CO1	CO2	CO3	CO4	CO5	
PO1	Knowledge of Engineering Sciences	3			3	3	3
PO2	Problem analysis	2			3		3
PO3	Design / development of solutions			3		3	3
PO4	Investigation	3				3	3
PO5	Modern Tool Usage	1	1				1
PO6	Individual and Team work	2				2	2
PO7	Communication		2		3		3
PO8	Engineer and Society	3					3
PO9	Ethics				3		3
PO10	Environment and Sustainability	3			3	3	3
PO11	Project Management and Finance	2					2
PO12	Life Long Learning	3					3
PSO1	Knowledge of Civil Engineering discipline				3	3	3
PSO2	Critical analysis of Civil Engineering problems and innovation				3		3
PSO3	Conceptualization and evaluation of engineering solutions to Civil Engineering Issues				3	3	3

CE5005 ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT L T P C
3 0 0 3

OBJECTIVE:

- To impart the knowledge and skills to identify, assess and mitigate the environmental and social impacts of developmental projects

UNIT I INTRODUCTION 9

Impacts of Development on Environment –Sustainable Development and Environmental Impact Assessment (EIA) – Objectives – Historical development – EIA Types EIA in project cycle –EIA Notification and Legal Framework in India– Selection & Registration Criteria for EIA Consultants Stakeholders and their Role in EIA

UNIT II ENVIRONMENTAL ASSESSMENT 9

Screening and Scoping in EIA – Drafting of Terms of Reference -Baseline monitoring, Prediction and Assessment of Impact on land, water, air, noise and energy, flora and fauna - Matrices – Networks – Checklist Methods - Mathematical models for Impact prediction – Analysis of alternatives

UNIT III ENVIRONMENTAL MANAGEMENT PLAN 9

Plan for mitigation of adverse impact on water, air and land, water, energy, flora and fauna – Environmental Monitoring Plan – EIA Report Preparation – Review of EIA Reports – Environmental Clearance – Post Project Audit

UNIT IV SOCIO ECONOMIC ASSESSMENT 9

Baseline monitoring of Socio economic environment – Identification of Project Affected Personal – Rehabilitation and Resettlement Plan- Economic valuation of Environmental impacts – Cost benefit Analysis- Public Consultation

UNIT V CASE STUDIES 9

EIA case studies pertaining to Infrastructure Projects – Real Estate Development - Roads and Bridges – Mass Rapid Transport Systems - Ports and Harbor – Airports - Dams and Irrigation projects - Waste Processing and Disposal facilities Mining Projects.

TOTAL: 45 PERIODS

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	plan environmental impact assessments and environmental management plans
CO4	asses socioeconomic investigation of the environment in a project
CO5	knowledge to prepare environmental impact assessment reports

TEXTBOOKS:

1. Canter, R.L (1995). Environmental impact Assessment, 2nd Edition, McGraw Hill Inc., New Delhi.
2. Lohani, B., J.W. Evans, H. Ludwig, R.R. Everitt, Richard A. Carpenter, and S.L. Tu. (1997). Environmental Impact Assessment for Developing Countries in Asia. Volume 1 – Overview, Asian Development Bank
3. Peter Morris, Riki Therivel (2009)," Methods of Environmental Impact Assessment", Routledge Publisher

REFERENCES:

1. Becker H. A., Frank Vanclay (2003), The International handbook of social impact assessment: conceptual and methodological advances, Edward Elgar Publishing

2. Barry Sadler and Mary McCabe (2002), “Environmental Impact Assessment Training Resource Manual”, United Nations Environment Programme.
3. Judith Petts, Handbook of Environmental Impact Assessment Vol. I and II, Blackwell Science, New York, 1998.
4. Ministry of Environment and Forests (2010), EIA Notification and Sectoral Guides, Government of India, New Delhi.

CO – PO Mapping - ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT

PO/PSO		Course Outcome					Overall Correlation of CO s to POs
		CO1	CO2	CO3	CO4	CO5	
PO1	Knowledge of Engineering Sciences	2	3	3	2	1	3
PO2	Problem analysis	1	2		2		2
PO3	Design / development of solutions			3	2		3
PO4	Investigation		2	3	3		3
PO5	Modern Tool Usage		3			2	3
PO6	Individual and Team work					2	2
PO7	Communication	2					2
PO8	Engineer and Society	2					2
PO9	Ethics	3		2			3
PO10	Environment and Sustainability	2		2	1		2
PO11	Project Management and Finance			3	2	1	3
PO12	Life Long Learning	2				2	2
PSO1	Knowledge of Civil Engineering discipline			3		2	3
PSO2	Critical analysis of Civil Engineering problems and innovation			3			3
PSO3	Conceptualization and evaluation of engineering solutions to Civil Engineering Issues		3	3			3

CE5006 INDUSTRIAL WASTEWATER TREATMENT L T P C
3 0 0 3

OBJECTIVE:

- To provide knowledge on sources and characteristics of Industrial Wastewaters, Techniques and approaches for minimizing the generation of wastewaters at the source and application of physico-chemical, biological and advanced treatment methods for recovery, reuse and disposal of wastewaters in Indian Industries.

UNIT I INDUSTRIAL POLLUTION PREVENTION 8

Industrial scenario in India – Uses of water by Industry – sources, generation rates and characteristics of Industrial wastewaters – Toxicity of Industrial Effluents and Bioassay Tests – Environmental Impacts of Industrial Wastewaters – Regulatory requirements for Industrial wastewaters- Prevention Vs Control of Industrial Pollution – Benefits and Barriers – Waste Minimization Strategies – Evaluation of Pollution Prevention Options – Cost benefit analysis – Pay back period.

UNITII INDUSTRIALWASTEWATER TREATMENT 9

Physico–Chemical Treatment Processes – Equalisation, Neutralisation, Oil Seperation, Flotation – Precipitation, Aerobic and Anaerobic Biological Treatment Processes – Sequencing batch reactors, membrane bioreactors, Advanced oxidation and Tertiary Treatment processes for removal of dissolved organics and inorganics- Ozonation, photocatalysis, Evaporation and membrane Technologies

UNIT III ZERO LIQUID DISCHARGE 9

Individual and Common Effluent Treatment Plants –Zero Effluent Discharge Systems and Management of RO Rejects, Quality requirements for wastewater reuse – Industrial reuse, Disposal on water and land.

UNIT IV SLUDGE AND HAZARDOUS WASTE MANAGEMENT 9

Residuals of Industrial Wastewater treatment – Quantification and Characteristics of Sludge – Thickening, Digestion, Conditioning, Dewatering and Disposal of Sludge – Solidification – Incineration – Secured Landfills-Hazardous waste management.

UNIT V CASE STUDIES 10

Industrial manufacturing process description, Wastewater characteristics, Pollution Prevention Options and Treatment Flow sheets for selected Industries – Tanneries- Textiles- Pulp and Paper-Metal finishing – Sugar and Distilleries.

TOTAL: 45 PERIODS

OUTCOME:

On Completion of the course, the student 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	apply knowledge and skills to design industrial wastewater treatment schemes
CO3	design facilities for the processing and reclamation of industrial wastewater
CO4	Plan and develop sludge management scheme for sludge generated from industries
CO5	conduct research to develop effective management systems for industrial wastewater that are technically sound, economically feasible and socially acceptable

TEXTBOOKS:

1. S.C.Bhatia, Handbook of Industrial Pollution and Control, Volume I & II, CBS Publishers, New Delhi, 2003.
2. Mahajan, S.P.Pollution Control in Process Industries, Tata McGraw Hill Publishing Co., New Delhi, 1991.

REFERENCES:

1. Eckenfelder, W.W., „Industrial Water Pollution Control" , Mc-Graw Hill, 2000.
2. Nelson Leonard Nemerow, "Industrial waste treatment – contemporary practice and vision for the future", Elsevier, Singapore, 2007.
3. Frank Woodard, „ Industrial waste treatment Handbook" , Butterworth Heinemann, NewDelhi,2001.
4. World Bank Group, „ Pollution Prevention and Abatement Handbook – Towards Cleaner Production" , World Bank and UNEP, Washington D.C., 1998
5. Paul L. Bishop, „ Pollution Prevention:- Fundamentals and Practice" , Mc-Graw Hill International, Boston,2000.
6. Wang L.K., Yung-Tse Hung, Howard H.Lo and Constantine Yapijakis, „Handbook of Industrial and Hazardous Wastes Treatment" , Marcel Dekker, Inc., USA, 2004.

CO-PO Mapping

PO/PSO		Course Outcome					Overall Correlation of CO s to POs
		CO1	CO2	CO3	CO4	CO5	
PO1	Knowledge of Engineering Sciences	3		3	3	2	3
PO2	Problem analysis		3	3		3	3
PO3	Design / development of solutions		3	2	3	2	3
PO4	Investigation		2			3	3
PO5	Modern Tool Usage				2		2
PO6	Individual and Team work					1	1
PO7	Communication				2	2	2
PO8	Engineer and Society		3		3		3
PO9	Ethics		2			3	3
PO10	Environment and Sustainability	2			2	2	2
PO11	Project Management and Finance		3	2	3		3
PO12	Life Long Learning				2		2
PSO1	Knowledge of Civil Engineering discipline	2	3	3		2	3
PSO2	Critical analysis of Civil Engineering problems and innovation		2	2		2	2
PSO3	Conceptualization and evaluation of engineering solutions to Civil Engineering Issues	2		3		3	3

CE5007 MUNICIPAL SOLID WASTE MANAGEMENT L T P C
3 0 0 3

OBJECTIVE:

- To make the students conversant with the types, sources, generation, storage, collection, transport, processing and disposal of municipal solid waste.

UNIT I SOURCES AND CHARACTERISTICS 8

Sources and types of municipal solid wastes-waste generation rates-factors affecting generation, characteristics-methods of sampling and characterization; Effects of improper disposal of solid wastes-Public health and environmental effects. Elements of solid waste management –Social and Financial aspects – l solid waste (M&H) rules – integrated solidwaste management-Public awareness; Role of NGO‟ s- Public Private participation

UNIT II ON-SITE STORAGE AND PROCESSING 8

On-site storage methods – Effect of storage, materials used for containers – segregation of solid wastes – Public health and environmental aspects of open storage – waste segregation and storage – case studies under Indian conditions – source reduction of waste – Reduction, Reuse and Recycling of plastic waste –Construction and Demolishing waste.

UNIT III COLLECTION AND TRANSFER 8

Methods of Residential and commercial waste collection – Collection vehicles – Manpower – Collection routes – Analysis of collection systems; Transfer stations – Selection of location, operation & maintenance; options under Indian conditions – Field problems- solving.

UNIT IV OFF-SITE PROCESSING 12

Objectives of waste processing – Physical Processing techniques and Equipment; Resource recovery from solid waste composting and biomethanation; Thermal processing options – case studies under Indian conditions.

UNIT V DISPOSAL 9

Land disposal of solid waste; Sanitary landfills – site selection, design and operation of sanitary landfills – Landfill liners – Management of leachate and landfill gas- Landfill bioreactor – Dumpsite capping –Biomining.

TOTAL: 45 PERIODS

OUTCOMES:

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

CO1	understand the nature and characteristics of municipal solid wastes and the regulatory requirements regarding municipal solid waste management
CO2	explains the segregation of solid waste and the onsite storage methods
CO3	explains the various transfer methods and to know the site condition for the transfer station
CO4	select appropriate methods for processing and disposal of solid and hazardous wastes, taking into account the impact of the solutions in a sustainability context
CO5	knowledge about selection of appropriate disposal methods and its handling in an efficient manner

TEXTBOOKS

1. Cherry P M, Solid and Hazardous Waste Management, CBS publishers and distributors Pvt Ltd, 2018
2. Rao M.N, Razia Sultana, Sri Harsha Kota, solid and hazardous waste management – Science and Engineering , Butterworth-Heinemann, 2016

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. Michael D. LaGrega, Philip L Buckingham, Jeffrey C. E vans and "Environmental Resources Management, Hazardous waste Management", Mc-Graw Hill International edition, New York,2010.
5. John Pitchtel,Waste Management Practices, CRC Press,Taylor and Francis Group,2014.
6. Gary C. Young, Municipal Solid Waste to Energy Conversion Processes: Economic, Technical, and Renewable Comparisons, Wiley, 2010

CO – PO Mapping - MUNICIPAL SOLID WASTE MANAGEMENT

PO/PSO		Course Outcome					Overall Correlation of CO s to POs
		CO1	CO2	CO3	CO4	CO5	
PO1	Knowledge of Engineering Sciences	2	2			2	2
PO2	Problem analysis	2		3			2
PO3	Design / development of solutions	2			3	2	2
PO4	Investigation		1			2	2
PO5	Modern Tool Usage				2		2
PO6	Individual and Team work		2			3	3
PO7	Communication		3				3
PO8	Engineer and Society		2				2
PO9	Ethics	2					2
PO10	Environment and Sustainability	3	3			3	3

PO11	Project Management and Finance	2		3	2		2
PO12	Life Long Learning	2			2		2
PSO1	Knowledge of Civil Engineering discipline		3				3
PSO2	Critical analysis of Civil Engineering problems and innovation			2			2
PSO3	Conceptualization and evaluation of engineering solutions to Civil Engineering Issues	2		3		3	3

CE5071 HYDROLOGY AND WATER RESOURCES ENGINEERING L T P C
3 0 0 3

OBJECTIVES

- To introduce the student to the concept of hydrological aspects of water availability and requirements and should be able to quantify, control and regulate the water resources.

UNIT I PRECIPITATION AND ABSTRACTIONS 10

Hydrological cycle - Meteorological measurements – Requirements, types and forms of precipitation - Rain gauges - Spatial analysis of rainfall data using Thiessen and Isohyetal methods - Interception - Evaporation. Horton‟s equation, pan evaporation measurements and evaporation suppression - Infiltration-Horton‟s equation - double ring infiltrometer, infiltration indices.

UNIT II RUNOFF 8

Watershed, catchment and basin - Catchment characteristics - factors affecting runoff - Run off estimation using empirical - Strange‟s table and SCS methods – Stage discharge relationships flow measurements- Hydrograph – Unit Hydrograph – IUH

UNIT III FLOOD AND DROUGHT 9

Natural Disasters-Flood Estimation- Frequency analysis- Flood control- Definitions of droughts Meteorological, hydrological and agricultural droughts- IMD method-NDVI analysis- Drought Prone Area Programme (DPAP)

UNIT IV RESERVOIRS 8

Classification of reservoirs, General principles of design, site selection, spillways, elevation – area - capacity - storage estimation, sedimentation - life of reservoirs – rule curve

UNIT V GROUNDWATER AND MANAGEMENT 10

Origin- Classification and types - properties of aquifers- governing equations – steady and unsteady flow - artificial recharge - RWH in rural and urban areas

TOTAL: 45 PERIODS

OUTCOMES

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

CO1	Define the key drivers on water resources, hydrological processes and their integrated behaviour in catchments
CO2	Apply the knowledge of hydrological models to surface water problems including basin characteristics, runoff and Hydrograph
CO3	Explain the concept of hydrological extremes such as Flood and Drought and management strategies
CO4	Describe the importance of spatial analysis of rainfall and design water storage reservoirs
CO5	Apply the concepts of groundwater for water resources management

TEXTBOOKS

1. Subramanya .K. "Engineering Hydrology"- Tata McGraw Hill, 2010
2. Jayarami Reddy .P. "Hydrology", Tata McGraw Hill, 2008.

REFERENCES

1. David Keith Todd. "Groundwater Hydrology", John Wiley & Sons, Inc. 2007
2. Ven Te Chow, Maidment, D.R. and Mays, L.W. "Applied Hydrology", McGraw Hill International Book Company, 1998.
3. Raghunath .H.M., "Hydrology", Wiley Eastern Ltd., 1998.
4. Chahar BR, Groundwater hydrology, McGraw Hill Education (India) Pvt Ltd, New Delhi, 2015.

CO – PO HYDROLOGY AND WATER RESOURCES ENGINEERING

PO/PSO		Course Outcome					Overall Correlation of COs to POs
		CO1	CO2	CO3	CO4	CO5	
PO1	Knowledge of Engineering Sciences	2	3	3	3	2	3
PO2	Problem analysis	2	2	3	3	3	3
PO3	Design / development of solutions	2	3	2	3	3	3
PO4	Investigation	2	3	3	3	2	3
PO5	Modern Tool Usage	2	3	2	3	3	3
PO6	Individual and Team work	1	2	2	3	2	2
PO7	Communication	2		2			2
PO8	Engineer and Society	2	3	2	3	3	3
PO9	Ethics					2	2
PO10	Environment and Sustainability		2	2	2	3	2
PO11	Project Management and Finance		2	3	2	3	3
PO12	Life Long Learning	2	2	2	3	3	2
PSO1	Knowledge of Civil Engineering Discipline	2	2	1	3	2	2
PSO2	Critical analysis of Civil Engineering problems and innovation	2	3	2	3	2	2
PSO3	Conceptualization and evaluation of engineering solutions to Civil Engineering issues	2	2	3	3	3	3

CE5072 INTEGRATED WATER RESOURCES MANAGEMENT L T P C

3 0 0 3

OBJECTIVE

- Students will be introduced to the concepts and principles of IWRM, which is inclusive of the economics, public-private partnership, water & health, water & food security and legal & regulatory settings.

UNIT I CONTEXT FOR IWRM 9

Water as a global issue: key challenges – Definition of IWRM within the broader context of development – Key elements of IWRM - Principles – Paradigm shift in water management - Complexity of the IWRM process – UN World Water Assessment - SDGs.

UNIT II WATER ECONOMICS 9

Economic view of water issues: economic characteristics of water good and services – Non-market monetary valuation methods – Water economic instruments – Private sector involvement in water resources management: PPP objectives, PPP models, PPP processes, PPP experiences through case studies.

UNIT III LEGAL AND REGULATORY SETTINGS 9

Basic notion of law and governance: principles of international and national law in the area of water management - Understanding UN law on non-navigable uses of international water courses – International law for groundwater management – World Water Forums – Global Water Partnerships - Development of IWRM in line with legal and regulatory framework.

UNIT IV WATER AND HEALTH WITHIN THE IWRM CONTEXT 9

Links between water and health: options to include water management interventions for health – Health protection and promotion in the context of IWRM – Global burden of Diseases - Health impact assessment of water resources development projects – Case studies.

UNIT V AGRICULTURE IN THE CONCEPT OF IWRM 9

Water for food production: 'blue' versus 'green' water debate – Water foot print - Virtual water trade for achieving global water and food security –- Irrigation efficiencies, irrigation methods - current water pricing policy– scope to relook pricing.

TOTAL: 45 PERIODS

OUTCOMES

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

CO1	Describe the context and principles of IWRM; Compare the conventional and integrated ways of water management.
CO2	Select the best economic option among the alternatives; illustrate the pros and cons of PPP through case studies.
CO3	Apply law and governance in the context of IWRM.
CO4	Discuss the linkages between water-health; develop a HIA framework.
CO5	Analyse how the virtual water concept pave way to alternate policy options.

TEXTBOOKS:

1. Cech Thomas V., Principles of water resources: history, development, management and policy. John Wiley and Sons Inc., New York. 2003.
2. Mollinga .P. etal " Integrated Water Resources Management", Water in South Asia Volume I, Sage Publications, 2006

REFERENCES: .

1. Technical Advisory Committee, Integrated Water Resources management, Technical Advisory Committee Background Paper No: 4. Global water partnership, Stockholm, Sweden. 2002.
2.. Technical Advisory Committee, Dublin principles for water as reflected in comparative assessment of institutional and legal arrangements for Integrated Water Resources Management, Technical Advisory Committee Background paper No: 3. Global water partnership, Stockholm, Sweden. 1999.
3. Technical Advisory Committee, Effective Water Governance". Technical Advisory Committee Background paper No: 7. Global water partnership, Stockholm, Sweden, 2003.

CO – PO Mapping- INTEGRATED WATER RESOURCES MANAGEMENT

POs/PSOs		Course Outcome					Overall Correlation of COs to POs
		CO1	CO2	CO3	CO4	CO5	
PO1	Knowledge of Engineering Sciences	3	2	2	2	2	2
PO2	Problem analysis	1	3	2	2	2	2
PO3	Design / development of solutions		2	2	2	2	2
PO4	Investigation	1	2			1	1
PO5	Modern Tool Usage	1	1	2	1	1	1
PO6	Individual and Team work		2	2			2
PO7	Communication		2	2			2
PO8	Engineer and Society	2	2	3	2	3	3
PO9	Ethics		2	3	2	2	2
PO10	Environment and Sustainability	3	3	3	3	3	3
PO11	Project Management and Finance	1	1	1		1	1
PO12	Life Long Learning		2	2	2	2	2
PSO1	Knowledge of Civil Engineering discipline	3	2	2	2	2	2
PSO2	Critical analysis of Civil Engineering problems and innovation	2	2	2	2	2	2
PSO3	Conceptualization and evaluation of engineering solutions to Civil Engineering Issues	2	2	2	2	2	2

CE5073 PARTICIPATORY WATER RESOURCES MANAGEMENT L T P C
3 0 0 3

OBJECTIVES:

- To enable the students to understand the regional and global experiences of participatory ideology in irrigation water management
- To help students acquire knowledge on paradigms shifts and reorientations with regard to stakeholder participation in water management in general and in irrigation management in particular.

UNIT I FUNDAMENTALS OF SOCIOLOGY AND PARTICIPATORY APPROACH 6

Basic Sociological concepts and Definitions - Objectives – Perspectives- Social stratification – Sociological understanding - Irrigation as a Sociotechnical Process - paradigm shift and Participatory approach

UNIT II UNDERSTANDING FARMERS PARTICIPATION 12

Need of farmers participation –Benefits of farmers participation – Comparisons of cost and benefit – Water User Association –- Membership - Kinds of participation – National and International Experiences -Activities on Water towards Organization and Structure - Context of participation-factors in the environment.

UNIT III ROLE OF STAKEHOLDERS AND THE UNDERLYING ISSUES 12

Multiple use of water – Issues in sectoral Water Allocation - Domestic, Irrigation, Industrial sectors – Woman as a water user –Constraints and Opportunities. Role of Community Organisers – Constraints in Organising farmers Organisation.

UNIT IV IMPROVING AGENCY RELATIONS AND INSTITUTIONAL REFORMS 10

Supporting farmer organization and participation -Decision Making- Leadership and responsibilities – Development strategy – Channels for implementation — Equity and Equality- Agency Incentives- Technical co-operation – Special roles – Agency Roles- Institutional Reforms

UNIT V POLICY CONSIDERATIONS AND EMERGING CHALLENGES 5

Water Policy-Irrigation Governance-Building from Below-Non-political Associations-Bureaucratic Reorientation- Policy options and Alternatives and Sustainability.

TOTAL: 45 PERIODS

OUTCOMES:

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

CO1	Capture to fundamental concepts and terms which are to be applied and understood all through the study.
CO2	Acquire a clear insight into the subject matter of participatory ideology with its rudiments under the light of both national and international illustrative cases.
CO3	Comprehend the roles of different players as stakeholders with the ground reality of the underlying issues in farm community.
CO4	Articulate as how reforms can help build up institutional and irrigation agencies with the support obtained from the existing farm network in irrigation Management
CO5	Gain an overarching understanding of recommendation for improved irrigation management with a vision to transform the existing governance and policies with the novel approach of sustainability.

TEXT BOOKS

1. Desai A.R., Rural sociology in India, Popular Prakashan, Bombay, 1969.
2. Michael C.M., Putting people first, Sociology variables in Rural Development, Oxford University press, London 1985.
3. Uphoff. N., Improving International Irrigation management with Farmer Participation – Getting the process Right – Studies in water Policy and management, New West - View press, Boulder and London, 1986.
4. Chambers R., Managing canal irrigation, Oxford IBM publishing Co. Pvt. Ltd., New Delhi, 1998.
5. Korten F.F and Robert Y. Siy, Jr. Transforming a Bureaucracy – The experience of the Philippines National Irrigation Administration, Ateneo De Manila University Press, Manila, 1989.

REFERENCES:

1. Sivasubramanium K., Water Management SIMRES Publication, Chennai 2009.
2. http://irapindia.org/IMTInIndia-Pa
3. http://mowr.gov.in/writereaddata/mainlinkFile/File421.pdf

CO-PO mapping- PARTICIPATORY WATER RESOURCES MANAGEMENT

PO/PSO		Course Outcome					Overall Correlation of COs to POs
		CO1	CO2	CO3	CO4	CO5	
PO1	Knowledge of Engineering Sciences	1	2	2	2	1	2
PO2	Problem analysis			2			2
PO3	Design / development of solutions				3	3	3
PO4	Investigation				2	2	2
PO5	Modern Tool Usage			1	1	1	1
PO6	Individual and Team work			2	1	2	2
PO7	Communication			3	2	2	2
PO8	Engineer and Society		3	3	3	1	3
PO9	Ethics			1	2	2	2
PO10	Environment and Sustainability					1	1
PO11	Project Management and Finance					1	1
PO12	Life Long Learning	2	3	2	3	3	3
PSO1	Knowledge of Civil Engineering discipline			3	3	3	3
PSO2	Critical analysis of Civil Engineering problems and innovation			1	1		1
PSO3	Conceptualization and evaluation of engineering solutions to Civil Engineering Issues			3	3	2	3

CE5008 GROUNDWATER ENGINEERING L T P C

3 0 0 3

OBJECTIVES:

- The objective of this course is enable the student to understand the principles of Groundwater governing Equations, Characteristics of different aquifers and techniques of groundwater model development and management.

UNIT I HYDROGEOLOGICAL PARAMETERS 9

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

UNIT II WELL HYDRAULICS 9

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

UNIT III GROUNDWATER MANAGEMENT 9

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

UNIT IV GROUNDWATER QUALITY 9

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

UNIT V GROUNDWATER CONSERVATION 9

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

TOTAL: 45 PERIODS

OUTCOMES:

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

CO1	Define the groundwater system basic, types of aquifers, aquifer parameters, movement and its potential for confined and unconfined aquifers
CO2	Apply the knowledge of groundwater flow in steady and unsteady flow characteristics of well hydraulics
CO3	Explain the concept of groundwater model development and data base management for groundwater management
CO4	Describe the importance of artificial recharge and groundwater quality concepts
CO5	Apply the creative and innovative technique on conservation of groundwater

TEXTBOOKS

1. Raghunath H.M., "Ground Water Hydrology", New Age International (P) Limited, New Delhi, 2010.
2. Todd D.K., "Ground Water Hydrology", John Wiley and Sons, New York, 2000.

REFERENCES

1. Fitts R Charles, "Groundwater Science". Elsevier, Academic Press, 2002.
2. Ramakrishnan, S, Ground Water, K.J. Graph arts, Chennai, 1998.
3. Chahar BR, Groundwater hydrology, McGraw Hill Education (India) Pvt Ltd, New Delhi, 2015.
4. Rastogi A.K. , Numerical Groundwater Hydrology, 2011

CO – PO MAPPING- GROUNDWATER ENGINEERING

PO/PSO		Course Outcome					Overall Correlation of COs to POs
		CO1	CO2	CO3	CO4	CO5	
PO1	Knowledge of Engineering Sciences	3	3	2	2	2	2
PO2	Problem analysis	3	3	2	2	2	2
PO3	Design / development of solutions	3	3	3	2	2	3
PO4	Investigation					3	3
PO5	Modern Tool Usage	1	2	3	3	3	3
PO6	Individual and Team work	1	2	2	3	3	3
PO7	Communication	2	2	2	2	2	2
PO8	Engineer and Society	3	3	2	3	3	3
PO9	Ethics					3	3
PO10	Environment and Sustainability			3	3	3	3

PO11	Project Management and Finance	1	2	3	2	2	2
PO12	Life Long Learning	2	2	2	3	3	2
PSO1	Knowledge of Civil Engineering Discipline	2	2	3	3	3	3
PSO2	Critical analysis of Civil Engineering problems and innovation	2	3	3	3	3	3
PSO3	Conceptualization and evaluation of engineering solutions to Civil Engineering issues	2	2	3	3	3	3

CE5009 WATER RESOURCES SYSTEMS ENGINEERING L T P C
3 0 0 3

OBJECTIVES:

- To introduce the student to the concept of Mathematical approaches for managing the water resources system and apply to operate a water resource system optimally.

UNIT I SYSTEM APPROACH 9

Definition, classification, and characteristics of systems - Philosophy of modelling – Goals and Objectives – Basics of system analysis concept – steps in systems engineering.

UNIT II LINEAR PROGRAMMING 9

Introduction to Operation research - Linear programming Problem Formulation-graphical solution Simplex method –Sensitivity analysis - application to operation of single purpose reservoir

UNIT III DYNAMIC PROGRAMMING 9

Bellman's optimality criteria, problem formulation and solutions – Water Allocation for three state (user), Forward and Backward Recursion techniques in Dynamic Programming - Shortest pipe line route problem - Application to reservoirs capacity expansion

UNIT IV SIMULATION 9

Basic principles and concepts – Monte Carlo techniques – Model development – Inputs and outputs – Single and multipurpose reservoir simulation models – Deterministic simulation – Rule Curve development for reservoir

UNIT V ADVANCED OPTIMIZATION TECHNIQUES 9

Integer and parametric linear programming – Goal programming types – Applications to reservoir release optimization – application of evolutionary algorithms like Genetic algorithm, Particle swarm, Simulated Annealing to reservoir release optimization

TOTAL: 45 PERIODS

OUTCOMES:

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

CO1	Define the economic aspects and analysis of water resources systems for comprehensive and integrated planning of a water resources project.
CO2	Apply the concept of linear programming for optimisation of water resources problems.
CO3	Explain the concept of dynamic programming and apply in water resource system.
CO4	Develop the simulation model based on deterministic and stochastic simulation for reservoir operating policy
CO5	Apply advance optimisation techniques like goal programming, heuristic algorithm in the field of water resources planning and management.

TEXT BOOKS

1. Vedula, S., and Majumdar, P.P. Water Resources Systems – Modeling Techniques and Analysis Tata McGraw Hill, New Delhi, Fifth reprint, 2010.
2. Bhave PR, Water Resources Systems, Narosa Publishers, 2011

REFERENCES:

1. Gupta, P.K., and Man Mohan, "Problems in Operations Research", (Methods and Solutions), Sultan Chand and Sons, New Delhi, 1995.
2. Chaturvedi, M.C., "Water Resources Systems Planning and Management", Tata McGraw Hill, New Delhi, 1997.
3. Taha, H.A., "Operations Research", McMillan Publication Co., New York, 1995.
4. Hiller, F.S., and Liebermann, G.J., "Operations Research", CBS Publications and Distributions, New Delhi, 1992.

CO – PO MAPPING- WATER RESOURCES SYSTEMS ENGINEERING

PO/PSO		Course Outcome					Overall Correlation of COs to POs
		CO1	CO2	CO3	CO4	CO5	
PO1	Knowledge of Engineering Sciences	3	3	3	3	3	3
PO2	Problem analysis		2	3	3	3	3
PO3	Design / development of solutions			2	3	3	3
PO4	Investigation					3	3
PO5	Modern Tool Usage			2	3	3	3
PO6	Individual and Team work		3	2	3	3	3
PO7	Communication	2					2
PO8	Engineer and Society		3	2	3	3	3
PO9	Ethics					2	2
PO10	Environment and Sustainability				2		2
PO11	Project Management and Finance		2	3	2	3	3
PO12	Life Long Learning	3	2	2	3	3	3
PSO1	Knowledge of Civil Engineering Discipline	2	2	1	3	3	3
PSO2	Critical analysis of Civil Engineering problems and innovation	2	3	3	3	3	3
PSO3	Conceptualization and evaluation of engineering solutions to Civil Engineering issues	2	2	3	3	3	3

CE5010 **PAVEMENT ENGINEERING** **L T P C**
3 0 0 3

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 evaluate the serviceability conditions of pavements.

UNIT I PAVEMENT TYPES AND STRESS DISTRIBUTION 8

Introduction – Pavement as layered structure – Pavement types rigid and flexible. Resilient modulus - Stress and deflections in pavements under repeated loading.

UNIT II DESIGN OF FLEXIBLE PAVEMENTS 10

Flexible pavement design 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 of pavements – Construction Equipments-Methods of construction. 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

OUTCOMES:

CO1	Explain concepts and standards adopted in Planning, Design and construction of Pavements.
CO2	Apply the knowledge of science and engineering fundamentals in designing flexible pavement. by adopting various design standards
CO3	Apply the standards adopted in designing rigid pavement.
CO4	select appropriate methods for construction and evaluation of Pavements
CO5	Address the problem statement in construction of pavement and to impart knowledge in stabilization techniques.

TEXTBOOKS:

1. Khanna, S.K. and Justo C.E.G.and Veeraragavan, A, “Highway Engineering”, New Chand and Brothers, Revised 10th Edition, 2014.
2. Yoder, R.J. and Witchak M.W. “Principles of Pavement Design”, John Wiley 2000.
3. R.Srinivasa Kumar., “Pavement Engineering” Universities Press (India) Private Limited, Hyderabad, 2013.
4. Prithvi Singh Kandhal,” Bituminous Road Construction in India”, PHI Learning Private Limited, New Delhi, 2016.

REFERENCES:

1. Rajib B.Mallick and Tahar El-Korchi, “Pavement Engineering Principles and Practice:, CRC Press, 2009
2. Kadiyali, L.R., “Principles and Practice of Highway Engineering”, Khanna tech. Publications, New Delhi, 2005
3. Guidelines for the Design of Flexible Pavements,IRC-37–2012,The Indian roads Congress, New Delhi.
4. Guideline for the Design of Rigid Pavements for Highways, IRC 58-1998, The Indian Road Congress, New Delhi.

CO – PO Mapping – PAVEMENT ENGINEERING

PO/PSO		Course Outcome					Overall Correlation of COs to POs
		CO1	CO2	CO3	CO4	CO5	
PO1	Knowledge of Engineering Sciences						
PO2	Problem analysis			3	3	2	3
PO3	Design / development of solutions		3	3	2	1	3
PO4	Investigation			2	2	1	2
PO5	Modern Tool Usage		2	3	2	2	2
PO6	Individual and Team work	2	2				2
PO7	Communication					1	1
PO8	Engineer and Society	3			3	3	3
PO9	Ethics			3	3	3	3
PO10	Environment and Sustainability	1	1	2	3	1	2
PO11	Project Management and Finance			2	3	3	3
PO12	Life Long Learning		2	3	3	3	3
PSO1	Knowledge of Civil Engineering discipline	3	3	3	3	2	3
PSO2	Critical analysis of Civil Engineering problems and innovation	2	3	3	3	1	3
PSO3	Conceptualization and evaluation of engineering solutions to Civil Engineering Issues		1	1	2	2	2

CE5011 TRAFFIC ENGINEERING AND MANAGEMENT L T P C
3 0 0 3

OBJECTIVE:

- To give an overview of Traffic engineering, various surveys to be conducted, traffic Regulation, management and traffic safety.

UNIT I TRAFFIC CHARACTERISTICS 10

Road Characteristics – Classification – Functions and standards – Road user characteristics – PIEV theory – Vehicle – Performance characteristics – Fundamentals of Traffic Flow – Urban Traffic problems in India.

UNIT II TRAFFIC SURVEYS 7

Traffic Surveys – Speed, journey time and delay surveys – Vehicle Volume Survey – Methods and interpretation – Origin Destination Survey – Methods and presentation – Parking Survey – Methods, interpretation and presentation – Statistical applications in traffic studies and traffic forecasting – level of service – Concept, application and significance.

UNIT III TRAFFIC ENGINEERING REGULATION AND CONTROL 8

Capacity of Rotary intersection and Design – Capacity of signalized intersections – Traffic signals, warrants, type – Design and coordination – Intersection channelization – Grade separation - Traffic signs and road markings.

UNIT IV TRAFFIC SAFETY AND ENVIRONMENT 10

Road accidents – Causes, effect, prevention, and cost – street lighting – Traffic and environment hazards – Air and Noise Pollution, causes, health effects and abatement measures.

UNIT V TRAFFIC MANAGEMENT 10

Area Traffic Management System – One way street system, exclusive traffic lanes, tidal flow operation, staggering of work hours and road pricing – Non road pricing options _ Parking charges, Public transport, Subsidies, Vehicle License fees, Road Building, Permit system, Physical Traffic Management Transport System Management (TSM) and Transport Demand Management (TDM)- - Introduction to Intelligent Transportation Systems (ITS)- ITS Applications in Traffic Management.

TOTAL: 45 PERIODS

OUTCOME

CO1	Understand the principles and standards adopted in Planning and Design of Traffic system.
CO2	Apply the knowledge of science and engineering fundamentals in conducting traffic surveys and analyze the problems.
CO3	Designing various types of control and regulatory measures to meet an efficient traffic network.
CO4	Select appropriate methods to ensure the safety of the road users and analyze the environmental issues related to traffic network.
CO5	Understand various traffic management measures in addressing the demand, pricing and ITS applications.

TEXTBOOKS:

1. Kadiyali. L.R. Traffic Engineering and Transport Planning, Khanna Publishers, Delhi,2008.
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,

REFERENCES:

1. Indian Roads Congress (IRC) Specifications: Guidelines and special publications on Traffic Planning and Management.
2. C. Jotin Khisty, Kent Lall, Transportation Engineering: An Introduction, Prentice Hall, 1998

3. Hobbs. F.D. Traffic Planning and Engineering, University of Brimingham, Peragamon Press Ltd, 1994.
4. Taylor MAP and Young W, Traffic Analysis – New Technology and New Solutions, Hargreen Publishing Company , 1998.
5. Jason C.Yu Transportation Engineering, Introduction to Planning, Design and Operations, Elsevier, 1992.
6. Salter. R.I and Hounsell N.B, Highway Traffic Analysis and design, Macmillan Press Ltd.1996.
7. Roger P.Roess, William R.Mcshane and Elena S.Prassas, Traffic Engineering-Second Edition, Prentice Hall Publishers,, Upper Saddle River, New Jersey 1998.

CO-PO - TRAFFIC ENGINEERING AND MANAGEMENT

PO/PSO		Course Outcome					Overall Correlation of COs to POs
		CO1	CO2	CO3	CO4	CO5	
PO1	Knowledge of Engineering Sciences	3	3		2		3
PO2	Problem analysis			3	3	2	3
PO3	Design / development of solutions		3	3	2	1	3
PO4	Investigation		3	2	2	1	2
PO5	Modern Tool Usage		2	3	2	2	2
PO6	Individual and Team work	2	2				2
PO7	Communication					1	1
PO8	Engineer and Society	3			3	3	3
PO9	Ethics			3	3	3	3
PO10	Environment and Sustainability	1	1	2	3	1	2
PO11	Project Management and Finance			2	2	1	2
PO12	Life Long Learning		2	3	3	3	3
PSO1	Knowledge of Civil Engineering discipline	3	3	3	3	2	3
PSO2	Critical analysis of Civil Engineering problems and innovation	2	3	3	3	1	3
PSO3	Conceptualization and evaluation of engineering solutions to Civil Engineering Issues		1	1	2	2	2

CE5012 TRANSPORT AND ENVIRONMENT L T P C
3 0 0 3

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, 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 EIA CASE STUDIES 9

EIA Case Studies on Highway, Railway, Airways and Waterways Projects

TOTAL: 45 PERIODS

OUTCOME:

CO1	Understand the Environmental Impact of Transportation Projects
CO2	Apply various methods of analyzing environmental Impact Analysis.
CO3	Stage wise Assessment and Prediction of impact of transportation projects
CO4	Select appropriate Mitigation methods and Environmental Management Plan.
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. P. Meenakshi, Elements of Environmental Science and Engineering, Prentice Hall of India, New Delhi, 2006
4. 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, 2003.
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

CO-PO- TRANSPORT AND ENVIRONMENT

PO/PSO		Course Outcome					Overall Correlation of COs to POs
		CO1	CO2	CO3	CO4	CO5	
PO1	Knowledge of Engineering Sciences	3	3				3
PO2	Problem analysis		3	3	3	2	3

PO3	Design / development of solutions		3	3	2	1	3
PO4	Investigation			2	2	1	2
PO5	Modern Tool Usage		2	3	2	2	2
PO6	Individual and Team work	2	2				2
PO7	Communication					1	1
PO8	Engineer and Society	3			3	3	3
PO9	Ethics			3	3	3	3
PO10	Environment and Sustainability	1	1	2	3	1	2
PO11	Project Management and Finance			2	2	3	2
PO12	Life Long Learning	2		2	1	1	2
PSO1	Knowledge of Civil Engineering discipline	3	3	3	3	2	3
PSO2	Critical analysis of Civil Engineering problems and innovation	2	1	2	3		2
PSO3	Conceptualization and evaluation of engineering solutions to Civil Engineering Issues		2	3	2	3	3

CE5013 TRANSPORTATION PLANNING AND SYSTEMS L T P C
3 0 0 3

OBJECTIVE:

- To give an exposure on overview of the principles of the bus and rail transportation planning and evaluation of the transportation projects.

UNIT I STUDY AREA AND SURVEYS 10

Importance of planning and integrated transport facilities in urban areas – Delineation of study area and zoning – Conducting various surveys – Travel patterns, transport facilities and planning parameters.

UNIT II MODES 7

Basics of trip generation – Trip distribution – Trip assignment and modal split models – Validation of the model.

UNIT III PLAN PREPARATION AND EVALUATION 8

Preparation of alternative plans – Evaluation techniques – Economic and financial evaluation – Environment Impact Assessment (EIA) – Case Studies.

UNIT IV BUS TRANSPORTATION 10

Characteristics and bus transportation in urban areas – Fare policy – Route planning – Planning of terminals – Break even point and its relevance.

UNIT V RAIL TRANSPORTATION 10

Characteristics of suburban, IRT and RRT systems – Planning of rail terminals – Fare policy – Unified traffic and transport authority.

TOTAL: 45 PERIODS

OUTCOME

CO1	Understand the concepts and surveys adopted in Transportation planning
CO2	Knowledge on modelling of trip generation assigning and distribution techniques in transportation system.
CO3	Planning and evaluating transportation projects through various case studies.
CO4	Knowledge on planning of bus transportation system in urban areas.
CO5	Planning of various rail transportation and fare policies adopted.

TEXTBOOKS:

1. Michael J.Bruton, Introduction to Transportation Planning, Hutchinson, London, 1995.
2. Kadiyali. L.R., Traffic Engineering and Transport Planning, Khanna Publishers, Delhi, 2008.

REFERENCES:

1. John W. Dickey, Metropolitan Transportation Planning, Tata McGraw Hill Publishing Company Ltd., New Delhi, 1990.
2. C. Jotin Khisty, Kent Lall, Transportation Engineering: An Introduction, Prentice Hall, 1998
3. Juan de Dios Ort zar and Luis G. Willumsen, Modelling Transport, John Wiley & Sons 2001
4. Chennai Comprehensive Traffic Study, Chennai Metropolitan Development Authority, 2007.

PO/PSO		Course Outcome					Overall Correlation of CO s to POs
		CO1	CO2	CO3	CO4	CO5	
PROGRAM OUTCOMES (PO)							
PO1	Knowledge of Engineering Sciences	2		2	2		2
PO2	Problem analysis			3	3	2	3
PO3	Design / development of solutions		3	3	2	1	3
PO4	Investigation			2	2	1	2
PO5	Modern Tool Usage		2	3	2		2
PO6	Individual and Team work	2	2				2
PO7	Communication					1	1
PO8	Engineer and Society	3			3	3	3
PO9	Ethics			3	3	3	3
PO10	Environment and Sustainability	1	1	2	3	1	2
PO11	Project Management and Finance			3		3	3
PO12	Life Long Learning		2	3		3	3
PROGRAM SPECIFIC OUTCOMES (PSO)							
PSO1	Knowledge of Civil Engineering discipline	3	3	2	2	3	3
PSO2	Critical analysis of Civil Engineering problems and innovation	1	2	3	3	1	3
PSO3	Conceptualization and evaluation of engineering solutions to Civil Engineering Issues		2	1	2	1	2

CE5014 TRANSPORTATION PLANNING AND SYSTEMS URBAN PLANNING AND DEVELOPMENT

L	T	P	C
3	0	0	3

OBJECTIVES:

- 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 BASIC ISSUES 8

Definition of Human settlement, Urban area, Town, City, Urbanisation, Suburbanisation, Urban sprawl, Peri-urban areas, Central Business District (CBD), Classification of urban areas – Trend of Urbanisation at International, National, Regional and State level.

UNIT II PLANNING PROCESS 8

Principles of Planning – Types and Level of Plan, Stages in Planning Process – Goals, Objectives, Delineation of Planning Areas, Surveys and Questionnaire Design.

UNIT III DEVELOPMENT PLANS, PLAN FORMULATION AND EVALUATION 10

Scope and Content of Regional Plan, Master Plan, Detailed Development Plan, Development Control Rules, Transfer of Development Rights , Special Economic Zones- Development of small town and smart cities-case studies,

UNIT IV PLANNING AND DESIGN OF URBAN DEVELOPMENT PROJECTS 9

Site Analysis, Layout Design, Planning Standards, Project Formulation – Evaluation, Plan Implementation, Constraints and Implementation, Financing of Urban Development Projects.

UNIT V LEGISLATION, DEVELOPMENT AND MANAGEMENT OF URBAN SYSTEM 10

Town and Country Planning Act, Land Acquisition and Resettlement Act etc., Urban Planning Standards and Regulations, Involvement of Public, Private, NGO, CBO and Beneficiaries.

TOTAL : 45 PERIODS

OUTCOMES:

The students completing the course will have the ability to

CO1	Understand the basic concepts in urban planning and development.
CO2	Knowledge on principles of planning, surveys and analysis. in developing an urban area.
CO3	Knowledge on development of regional, master plan and norms for development of smart cities.
CO4	Planning of standards, implanting and financing of Urban projects.
CO5	Understand the norms, legal aspects and stakeholders role in planning an urban area.

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, Government of Tamil Nadu, Chennai
2. Goel S.L., Urban Development and Management, Deep and Deep Publications, New Delhi,2002
3. Thooyavan, K.R., Human Settlements – A Planning Guide to Beginners, M.A Publications, Chennai, 2005
4. CMDA, Second Master Plan for Chennai, Chennai 2008

CO-PO URBAN PLANNING AND DEVELOPMENT

PO/PSO		Course Outcome					Overall Correlation of CO s to POs
		CO1	CO2	CO3	CO4	CO5	
PROGRAM OUTCOMES (PO)							
PO1	Knowledge of Engineering Sciences	3	3	3			3
PO2	Problem analysis		3	1	1		1
PO3	Design / development of solutions		3	2	2		2
PO4	Investigation		3		3		3
PO5	Modern Tool Usage	2	2				2
PO6	Individual and Team work			2	2		2
PO7	Communication					1	1
PO8	Engineer and Society	3		3	3	3	3
PO9	Ethics		3		3	3	3
PO10	Environment and Sustainability	3		2		3	3
PO11	Project Management and Finance				3		3
PO12	Life Long Learning			3	3		3
PROGRAM SPECIFIC OUTCOMES (PSO)							
PSO1	Knowledge of Civil Engineering discipline	3	3	3	2		3
PSO2	Critical analysis of Civil Engineering problems and innovation	3			2	3	3
PSO3	Conceptualization and evaluation of engineering solutions to Civil Engineering Issues		2		3	2	2

CE5015 DESIGN OF PLATE AND SHELL STRUCTURES L T P C
3 0 0 3

OBJECTIVE:

- To learn the design of plate and shell and spatial structures

UNIT I THIN PLATES WITH SMALL DEFLECTION 10

Laterally loaded thin plates - Governing differential equation, various boundary conditions.

UNIT II RECTANGULAR PLATES 10

Simply supported rectangular plates - Navier solution and Levy's method – Loading.

UNIT III ANALYSIS OF THIN SHELLS 5

Shells of revolution – Spherical dome, Conical shell and ellipsoid of revolution – Shells of translation – Cylindrical shell and hyperbolic paraboloid - Classification of shells - Types of shells - Structural action.

UNIT IV DESIGN OF SHELLS 10

Spherical dome, conical shell and Cylindrical shell.

UNIT V SPACE FRAMES **10**

Space Frames – Configuration – Node connector- Types – General principles of design philosophy – Behaviour.

TOTAL: 45 PERIODS

OUTCOMES:

Students will be able to

CO1	Assess the strength of thin plates under different types of loads.
CO2	Analyze thin plates using Navier's method and Levy's method.
CO3	Analyze circular plates under axis - symmetric deflection.
CO4	Classify different types of shells and study their behavior.
CO5	Analyze space frame.

TEXTBOOKS:

1. P.C.Varghese, Design of Reinforced Concrete Shells and Folded Plates, PHI Learning Private Limited, New Delhi, 2010.
2. R.Szilard, Theory and Analysis of Plates, Prentice Hall Inc., 1995.

REFERENCES:

1. Billington D.P. Thin Shell Concrete Structures, McGraw Hill, 1995.
2. Chatterjee B.K. Theory and design of Concrete Shells, Oxford and IBH Publishing Co., New Delhi 1998.
3. N.Subramanian, Principles of Space Structures, Wheeler Publishing Co. 1999.
4. Maan Jawad, Theory and Design of Plate and Shell Structures, 1994.

CO – PO Mapping - DESIGN OF PLATE AND SHELL STRUCTURES

PO/PSO		Course Outcome					Overall Correlation of CO s to POs
		CO1	CO2	CO3	CO4	CO5	
PO1	Knowledge of Engineering Sciences	3	3	3	2	2	3
PO2	Problem analysis	2	2	2	2	2	2
PO3	Design / development of solutions	3	3	3	3	3	3
PO4	Investigation	-	-	-	-	-	-
PO5	Modern Tool Usage	-	-	-	-	-	-
PO6	Individual and Team work	2	1	1	1	1	1
PO7	Communication	-	-	-	-	-	-
PO8	Engineer and Society	-	-	-	-	-	-
PO9	Ethics	1	1	1	1	1	1
PO10	Environment and Sustainability	1	1	1	1	1	1
PO11	Project Management and Finance	-	-	-	-	-	-
PO12	Life Long Learning	1	1	1	1	1	1
PSO1	Knowledge of Civil Engineering discipline	-	1	1	-	-	1
PSO2	Critical analysis of Civil Engineering problems and innovation	-	1	-	1	2	1
PSO3	Conceptualization and evaluation of engineering solutions to Civil Engineering Issues	-	1	2	-	2	2

CE5016 DESIGN OF PRESTRESSED CONCRETE STRUCTURES L T P C
3 0 0 3

OBJECTIVE:

- To understand the behaviour and performance of prestressed concrete structures. Compare the behaviour of prestressed concrete members with that of the normal reinforced concrete structures. Understand the performance of composite members. Finally to learn the design of prestressed concrete structures.

UNIT I INTRODUCTION 9

Historical developments – Basic principles of prestressing – Classification and types – Advantages over ordinary reinforced concrete – Materials – High strength concrete and high tensile steel – Methods of prestressing – Freyssinet, Magnel, Lee-McCall and Gifford Udall anchorage systems – Analysis of sections of stresses by stress concept, strength concept and load balancing concept – Losses of prestress in post -tensioned and pre-tensioned members.

UNIT II DESIGN FOR FLEXURE AND SHEAR 9

Basic assumptions for calculating flexural stresses – Permissible stresses in steel and concrete as per I.S.1343 Code – Design of sections of Type I and Type II post-tensioned and pre-tensioned beams – Check for strength limit based on I.S. 1343 Code – Layout of cables in post-tensioned beams – Location of wires in pre-tensioned beams – Design for shear based on I.S. 1343 Code.

UNIT III DEFLECTION AND DESIGN OF ANCHORAGE ZONE 9

Factors influencing deflections – Short term deflections of uncracked members – Prediction of long term deflections due to creep and shrinkage – Check for serviceability limit state of deflection. Determination of anchorage zone stresses in post-tensioned beams by Magnel's method, Guyon's method and I.S. 1343 code – design of anchorage zone reinforcement – Check for transfer bond length in pre-tensioned beams.

UNIT IV COMPOSITE BEAMS AND CONTINUOUS BEAMS 9

Analysis and design of composite beams - Shrinkage strain and its importance – Methods of achieving continuity in continuous beams – Analysis for secondary moments – Concordant cable and linear transformation – Calculation of stresses – Principles of design.

UNIT V MISCELANEOUS STRUCTURES 9

Design of tension and compression members – Design of sleepers, pipes and poles – Partial prestressing – Definition, methods of achieving partial prestressing, merits and demerits of partial prestressing.

TOTAL: 45 PERIODS

OUTCOMES:

Students will be able to

CO1	Design a prestressed concrete beam accounting for losses.
CO2	Design for flexure and shear.
CO3	Design the anchorage zone for post tensioned members and deflection in beams.
CO4	Design composite members and continuous beams.
CO5	Design water tanks, pipes and poles.

TEXTBOOKS:

1. Krishna Raju N., Prestressed concrete, Tata McGraw Hill Company, fifth edition, 2012.
2. Pandit.G.S. And Gupta.S.P. Prestressed Concrete, CBS Publishers and Distributers Pvt. Ltd., Second edition, 2014.

REFERENCES:

1. Lin T.Y. and Ned.H.Burns, Design of prestressed Concrete Structures, John Wiley and Sons, Third Edition, 1981.
2. Rajagopalan.N, Prestressed Concrete, Narosa Publishing House, 2002.
3. Dayaratnam.P., Sarah P, Prestressed Concrete Structures, Seventh Edition, Oxford and IBH, 2017.
4. Sinha.N.C. And Roy.S.K. Fundamentals of Prestressed Concrete, S.Chand and Co. Ltd., 2011.

CO – PO Mapping - DESIGN OF PRESTRESSED CONCRETE STRUCTURES

PO/PSO		Course Outcome					Overall Correlation of CO s to POs
		CO1	CO2	CO3	CO4	CO5	
PO1	Knowledge of Engineering Sciences	3	3	3	2	2	3
PO2	Problem analysis	2	2	2	2	2	2
PO3	Design / development of solutions	3	3	3	3	3	3
PO4	Investigation	-	-	-	-	-	-
PO5	Modern Tool Usage	-	-	-	-	-	-
PO6	Individual and Team work	2	1	1	1	1	1
PO7	Communication	-	-	-	-	-	-
PO8	Engineer and Society	-	-	-	-	-	-
PO9	Ethics	1	1	1	1	1	1
PO10	Environment and Sustainability	1	1	1	1	1	1
PO11	Project Management and Finance	-	-	-	-	-	-
PO12	Life Long Learning	1	1	1	1	1	1
PSO1	Knowledge of Civil Engineering discipline	-	1	1	-	-	1
PSO2	Critical analysis of Civil Engineering problems and innovation	-	1	-	1	2	1
PSO3	Conceptualization and evaluation of engineering solutions to Civil Engineering Issues	-	1	2	-	2	2

CE5017 INDUSTRIAL STRUCTURES L T P C
3 0 0 3

OBJECTIVE:

- To gain knowledge about analyze, design and detailing of industrial structures.

UNIT I PLANNING 9

Classification of industries and industrial structures – General requirements of various industries – Planning and layout of buildings and components.

UNIT II FUNCTIONAL REQUIREMENTS 9

Lighting – Ventilation - Acoustics – Fire safety – Guidelines from factories act.

UNIT III DESIGN OF STEEL STRUCTURES 9

Industrial roofs – Crane girders – pre-engineered and Mills buildings - Bunkers and Silos – pipe/cable racks - Chimney.

UNIT IV DESIGN OF R.C. STRUCTURES 9

Corbels, Brackets and Nibs - Silos and bunkers – Chimney - Principles of folded plates and shell roofs.

UNIT V PREFABRICATION 9

Principles of prefabrication – Prestressed precast roof trusses - Construction of roof and floor slabs - Wall panels - Storage/transportation/handling in yard/site and erection – Joints in precast structures.

TOTAL: 45 PERIODS

OUTCOMES:

Students will be able to

CO1	Develop knowledge on planning of industrial structures.
CO2	Describe the functional requirements of structures.
CO3	Analyze and Design steel industrial structures.
CO4	Analyze and Design R.C. industrial structures.
CO5	Explain the concepts of Prefabrication.

TEXTBOOKS:

1. Ramamrutham.S. Design of Reinforced Concrete Structures, Dhanpat Rai Publishing Company, 2007.
2. Bhavikatti.S.S. Design of Steel Structures, J.K. International Publishing House Pvt. Ltd., 2009.

REFERENCES:

1. Ramachandra and VirendraGehlot, Design of steel structures -2, Scientific Publishers 2012.
2. Varghese.P.C. Advanced Reinforced Concrete Design, PHI, Eastern Economy Editions, Second Edition, 2005.
3. Handbook on Functional Requirements of Industrial buildings, SP32–1986, Bureau of Indian Standards, 1990.
4. Koncz, J., Manual of Precast Construction Vol. I and II, Bauverlay GMBH, 1971.

CO – PO Mapping – INDUSTRIAL STRUCTURES

PO/PSO		Course Outcome					Overall Correlation of CO s to POs
		CO1	CO2	CO3	CO4	CO5	
PO1	Knowledge of Engineering Sciences	3	3	3	2	2	3
PO2	Problem analysis	2	2	2	2	2	2
PO3	Design / development of solutions	3	3	3	3	3	3
PO4	Investigation	-	-	-	-	-	-
PO5	Modern Tool Usage	-	-	-	-	-	-
PO6	Individual and Team work	2	1	1	1	1	1
PO7	Communication	-	-	-	-	-	-
PO8	Engineer and Society	-	-	-	-	-	-
PO9	Ethics	1	1	1	1	1	1

PO10	Environment and Sustainability	1	1	1	1	1	1
PO11	Project Management and Finance	-	-	-	-	-	-
PO12	Life Long Learning	2	1	2	2	1	2
PSO1	Knowledge of Civil Engineering discipline	-	1	1	-	-	1
PSO2	Critical analysis of Civil Engineering problems and innovation	-	1	-	2	2	2
PSO3	Conceptualization and evaluation of engineering solutions to Civil Engineering Issues	-	1	2	-	2	2

CE5018 MAINTENANCE, REPAIR AND REHABILITATION OF STRUCTURES L T P C
3 0 0 3

OBJECTIVE:

- To acquire the knowledge on quality of concrete, durability aspects, causes of deterioration, assessment of distressed structures, repairing of 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, Durability, of concrete - Cracks, different types, causes – Effects due to climate, temperature, Sustained elevated, Corrosion - - Effects of cover thickness.

UNIT III SPECIAL CONCRETES 9

Polymer concrete - Sulphur infiltrated concrete - Fibre reinforced concrete - High strength concrete - High performance concrete - Vacuum concrete - Self compacting concrete - Geopolymer concrete - Reactive powder concrete - Concrete made with industrial wastes.

UNIT IV TECHNIQUES FOR REPAIR 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 REPAIR, REHABILITATION AND RETROFITTING OF STRUCTURES 9

Strengthening of Structural elements, Repair of structures distressed due to corrosion, fire, leakage and earthquake - Demolition techniques - Engineered demolition methods - Case studies.

TOTAL: 45 PERIODS

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 High Performance concrete.

CO4	Understand the materials and techniques needed for repairs.
CO5	Know the failures of the structures and demolition techniques.

TEXT BOOKS:

1. Shetty.M.S. Jain A K., Concrete Technology - Theory and Practice, S.Chand and Company, Eighth Edition, 2019.
2. B.Vidivelli, Rehabilitation of Concrete Structures Standard Publishes Distribution.1st edition 2009.

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. R. Dodge Woodson, Concrete Structures, Protection, Repair and Rehabilitation, Butterworth-Heinemann, Elsevier,New Delhi 2012.

CO – PO Mapping - MAINTENANCE, REPAIR AND REHABILITATION OF STRUCTURES

PO/PSO		Course Outcome					Overall Correlation of CO s to POs
		CO1	CO2	CO3	CO4	CO5	
PO1	Knowledge of Engineering Sciences	3	3	3	2	2	3
PO2	Problem analysis	2	2	2	2	2	2
PO3	Design / development of solutions	3	3	3	3	3	3
PO4	Investigation	-	-	-	-	-	-
PO5	Modern Tool Usage	-	-	-	-	-	-
PO6	Individual and Team work	2	1	1	1	1	1
PO7	Communication	-	-	-	-	-	-
PO8	Engineer and Society	-	-	-	-	-	-
PO9	Ethics	1	1	1	1	1	1
PO10	Environment and Sustainability	1	1	1	1	1	1
PO11	Project Management and Finance	-	-	-	-	-	-
PO12	Life Long Learning	1	1	1	1	1	1
PSO1	Knowledge of Civil Engineering discipline	-	1	1	-	-	1
PSO2	Critical analysis of Civil Engineering problems and innovation	-	1	-	1	2	1
PSO3	Conceptualization and evaluation of engineering solutions to Civil Engineering Issues	-	1	2	-	2	2

CE5019 **POWER PLANT STRUCTURES** **L T P C**
3 0 0 3

OBJECTIVE

- To gain knowledge about principles, planning, layout, structural requirements and analysis of power plants.

UNIT I FUNDAMENTALS OF POWER PLANTS 9

Introduction – Classification of Power Plants – Principles of Power Plant – Lay out of Power Plant Building – Selection of type of generation – Resources for power generation – Machine foundation.

UNIT II HYDRO ELECTRIC POWER PLANTS 9

Elements of hydro-electric power plants – Advantages and disadvantages of water power - General and essential elements of Hydro electric Power Plant – Structural requirements – Selection of site for hydroelectric plant – Penstocks and surge Tanks in Power Station.

UNIT III THERMAL POWER PLANTS 9

Planning, Analysis of thermal power plants – Layout – Ash handling – Dust collection – Induced draught and natural cooling towers – Air/water pollution by thermal power plants.

UNIT IV NUCLEAR POWER PLANTS 9

General characteristics of Nuclear Power Plants – Classification of reactors – Pressurized Water Reactor, Boiling Water Reactor, Fusion Power Reactor, Heavy Water Reactor - Selection criteria of materials for different systems – Containment structures – Nuclear power plant safety measures –Safety systems and support systems.

UNIT V NON CONVENTIONAL POWER PLANTS 9

Types – Wind power plants – Selection of wind mill – Tidal power plants – Solar thermal power plants – Geothermal power plants – Principles and essential features.

TOTAL: 45 PERIODS

OUTCOMES:

Students will be able to

CO1	Explain the principles, layout and functional aspects of a power plant structure.
CO2	Analyze and design the layout and components of hydroelectric power plant.
CO3	Explain, analyze and design the layout and components of Thermal power plant.
CO4	Explain the functioning of a nuclear power plant and design its components.
CO5	Develop an understanding of the various non-conventional sources of energy and design the layout and components.

TEXT BOOKS:

1. S.C. Sharma and G.R. Nagpal, Power Plant Engineering, Khanna Publishers, 2013.
2. Raja A.K, Amit Prakash Srivastava and Manish Dwivedi, Power Plant Engineering, New Age International Publishers, 2013.

REFERENCES:

1. R.K Rajput, Power Plant Engineering, Fifth Edition, 2016.
2. P.C Sharma, power Plant Engineering, S.K. Kataria & Sons; 2013.
3. Wei Tong, Wind Power Generation and Wind Turbine Design, WIT Press / Computational Mechanics, First edition, 2010.
4. Dipak k Sarkar,Thermal Power plant: Design and Operation,Elsevier Publisher 2015.

CO – PO Mapping - POWER PLANT STRUCTURES

PO/PSO		Course Outcome					Overall Correlation of CO s to POs
		CO1	CO2	CO3	CO4	CO5	
PO1	Knowledge of Engineering Sciences	3	3	3	2	2	3
PO2	Problem analysis	2	2	2	2	2	2
PO3	Design / development of solutions	3	3	3	3	3	3
PO4	Investigation	-	-	-	-	-	-
PO5	Modern Tool Usage	-	-	-	-	-	-
PO6	Individual and Team work	2	1	1	1	1	1
PO7	Communication	-	-	-	-	-	-
PO8	Engineer and Society	-	-	-	-	-	-
PO9	Ethics	1	1	1	1	1	1
PO10	Environment and Sustainability	1	1	1	1	1	1
PO11	Project Management and Finance	-	-	-	-	-	-
PO12	Life Long Learning	1	1	1	1	1	1
PSO1	Knowledge of Civil Engineering discipline	-	1	1	-	-	1
PSO2	Critical analysis of Civil Engineering problems and innovation	-	1	-	1	2	1
PSO3	Conceptualization and evaluation of engineering solutions to Civil Engineering Issues	-	1	2	-	2	2

CE5020 PREFABRICATED STRUCTURES L T P C
3 0 0 3

OBJECTIVE:

- To understand the principles of prefabrication, behavior and design of prefabricated components and structural connections.

UNIT I INTRODUCTION 10

Need for prefabrication - Principles - Materials - Modular co-ordination – Standardization – Systems Production – Transportation – Erection - Disuniting of Structures.

UNIT II PREFABRICATED COMPONENTS 10

Behavior of structural components – Large panel constructions – Construction of roof, floor slabs and Wall panels – Columns – Shear walls.

UNIT III DESIGN PRINCIPLES 10

Design of Structural components – Beam, Column and Corbel - Stress limitations – Handling without cracking, handling with controlled cracking – Design for stripping forces.

UNIT IV JOINTS IN STRUCTURAL MEMBERS 8

Joints for different structural connections – Beam to Column, Beam to Beam, Column to Column, Column to Foundation, Connections between wall panels, Connections between floor panels - Dimensions and detailing – Design of expansion joints- Jointing Materials.

UNIT V DESIGN FOR EARTHQUAKES AND CYCLONES 7

Progressive collapse – Codal provisions – Equivalent design loads for considering abnormal effects such as earthquakes, cyclones etc. - Importance of avoidance of progressive collapse.

TOTAL: 45 PERIODS

OUTCOMES:

Students will be able to

CO1	Understand the principles of modular coordination
CO2	Know the construction of roof and floors
CO3	Design for stripping forces
CO4	Identify the different types of connections between structural members
CO5	Understand the concept of progressive collapse

TEXTBOOKS:

1. Hubert Bachmann and Alfred Steinle , Precast Concrete Structures, 2012..
2. Laszlo Mokk, Prefabricated Concrete for Industrial and Public Structures, Akademiai Kiado, Budapest, 1964.

REFERENCES:

1. PCI Design Hand Book, 6th Edition, 2004.
2. Handbook on Precast Concrete for Buildings, ICI Bulletin 02, First Edition, 2016.
3. A.S.G. Bruggeling and G.F.Huyghe, Prefabrication with concrete, Netherlands: A.A. Balkema Publishers, 1991.
4. Glover C.W, Structural Precast Concrete, Asia Publishing House, 1965.

CO – PO Mapping - PREFABRICATED STRUCTURES

PO/PSO		Course Outcome					Overall Correlation of CO s to POs
		CO1	CO2	CO3	CO4	CO5	
PO1	Knowledge of Engineering Sciences	3	3	3	2	2	3
PO2	Problem analysis	2	2	2	2	2	2
PO3	Design / development of solutions	3	3	3	3	3	3
PO4	Investigation	-	-	-	-	-	-
PO5	Modern Tool Usage	-	-	-	-	-	-
PO6	Individual and Team work	2	1	1	1	1	1
PO7	Communication	-	-	-	-	-	-
PO8	Engineer and Society	-	-	-	-	-	-
PO9	Ethics	1	1	1	1	1	1
PO10	Environment and Sustainability	1	1	1	1	1	1
PO11	Project Management and Finance	-	-	-	-	-	-
PO12	Life Long Learning	1	1	1	1	1	1
PSO1	Knowledge of Civil Engineering discipline	-	1	1	-	-	1
PSO2	Critical analysis of Civil Engineering problems and innovation	-	1	-	1	2	1
PSO3	Conceptualization and evaluation of engineering solutions to Civil Engineering Issues	-	1	2	-	2	2

CE5021 **TALL STRUCTURES** **L T P C**
3 0 0 3

OBJECTIVE:

- To understand the design philosophy of tall buildings, the loading and behaviour of structural systems.

UNIT I DESIGN CRITERIA AND MATERIALS 9

Design Philosophy - Modern concepts – Materials used - High Performance Concrete, Fibre Reinforced Concrete, Light weight concrete, Self-Compacting Concrete, High strength steel, Composites.

UNIT II LOADING 9

Gravity Loading – Dead load, Live load – Live load reduction techniques, Impact load, Construction load, Sequential loading. Wind Loading – Static and Dynamic Approach, Analytical method, Wind Tunnel Experimental methods. Earthquake Loading – Equivalent lateral Load analysis, Dynamic Analysis, Combination of Loads.

UNIT III BEHAVIOUR OF STRUCTURAL SYSTEMS 9

Factors affecting the growth, height and structural form, Behaviour of Braced frames, Rigid Frames, in filled frames, Shear walls, Coupled Shear walls, Wall – Frames, Tubular and Outrigger – Hybrid systems.

UNIT IV ANALYSIS 9

Modeling for approximate analysis, accurate analysis and reduction techniques, Analysis of structures as an integral unit, Analysis for drift and twist. Computerized 3D analysis.

UNIT V DESIGN PARAMETERS 9

Design for differential movement, Creep and Shrinkage effects, Temperature Effects and Fire Resistance, Stability of Tall Structures - PΔ Effects, Buckling analysis Of Tall Buildings.

TOTAL: 45 PERIODS

OUTCOMES:

Students will be able to

CO1	Explain the design aspects and the various innovative materials which can be used for the construction of tall buildings
CO2	Apply the knowledge of engineering fundamentals to characterize various types of loading which could be considered for the analysis of tall building.
CO3	Identify various structural systems, their behavior and performance under different loading conditions.
CO4	Analyze the structures as an integral unit for drift and twist.
CO5	Design tall structures under different conditions like stability considerations, creep, shrinkage, and temperature and fire resistance.

TEXTBOOKS:

1. Bryan Stafford Smith and Alex Coull, Tall Building Structures, Analysis and Design, John Wiley and Sons, Inc., 2011.
2. Taranath B.S, Structural Analysis and Design of Tall Buildings: Steel and Composite Construction, McGraw Hill, 2011.

REFERENCES:

1. Lin T.Y. and Burry D.Stotes, Structural Concepts and Systems for Architects and Engineers, John Wiley, 1994.
2. Lynn S.Beedle, Advances in Tall Buildings, CBS Publishers and Distributors, Delhi, 1996.
3. Wolfgang Schuler, High Rise Building Structures, John Wiley & Sons, New York, 1986.
4. Kolousek V, Pimer M, Fischer O and Naprstek J, Wind effects on Civil Engineering Structures. Elsevier Publications.1984.

CO – PO Mapping – Tall Structures

PO/PSO		Course Outcome					Overall Correlation of COs to POs
		CO1	CO2	CO3	CO4	CO5	
PO1	Knowledge of Engineering Sciences	-	3	-	-	-	3
PO2	Problem analysis	-	3	2	3	3	3

PO3	Design / development of solutions	-	2	2	2	3	2
PO4	Investigation	-	-	1	-	-	1
PO5	Modern Tool Usage	-	2	2	3	2	2
PO6	Individual and Team work	-	-	-	2	2	2
PO7	Communication	-	-	-		2	2
PO8	Engineer and Society	-	3	-	2	2	2
PO9	Ethics	-	-	-	-	1	1
PO10	Environment and Sustainability	3	-	-	-	-	3
PO11	Project Management and Finance	-	-	-	1	1	1
PO12	Life Long Learning	-	-	-	1	1	1
PSO1	Knowledge of Civil Engineering discipline	-	2	3	3	3	3
PSO2	Critical analysis of Civil Engineering problems and innovation	-	2	-	3	2	2
PSO3	Conceptualization and evaluation of engineering solutions to Civil Engineering Issues	2	2	3	2	2	2

CE5022 STRUCTURAL DYNAMICS AND EARTHQUAKE ENGINEERING L T P C
3 0 0 3

OBJECTIVE:

- To understand the behaviour of structures under dynamic, earthquake loading and design the structures as earthquake resistant as per codal provisions.

UNIT I SINGLE DEGREE OF FREEDOM SYSTEM 9

Definition of degree of freedom – Idealization of structure as Single Degree of Freedom (SDOF) system – Formulation of equation of motion for various SDOF system –
D'Alemberts Principles - Effect of damping – Free and forced vibration of damped and undamped structures – Response to harmonic forces and periodic loading.

UNIT II MULTI DEGREE OF FREEDOM SYSTEM 9

Formulation of equation of motion for multidegree of freedom (MDOF) system – Evaluation of natural frequencies and modes – Eigen values and Eigen vectors – Orthogonality and normality principles – Response to free and forced vibration of undamped and damped MDOF systems – Modal superposition methods.

UNIT III INTRODUCTION TO EARTHQUAKE ENGINEERING 9

Elements of Engineering Seismology – Definitions, Introduction to Seismic hazard, Earthquake phenomenon – Seismotectonics – Seismic Instrumentation – Characteristics of Strong Earthquake motion – Estimation of Earthquake Parameters – Soil Structure Interaction.

UNIT IV EARTHQUAKE EFFECTS ON STRUCTURES 9

Effect of earthquake on different types of structures – Behaviour of RCC, Steel and prestressed Concrete Structures under earthquake loading – Pinching Effect – Bouchinger Effects – Liquefaction of soil – Response Spectra – Causes of damage – Lessons learnt from past earthquakes.

UNIT V CONCEPTS OF EARTHQUAKE RESISTANT DESIGN 9

Planning considerations and Architectural concepts – Evaluation of Earthquake forces – Lateral load analysis – Guidelines for Earthquake resistant design – Earthquake resistant design of masonry and RCC buildings - Design considerations – Guidelines– Design and detailing.

TOTAL: 45 PERIODS

OUTCOMES:

Students will be able to

CO1	Apply the knowledge of science and engineering fundamentals to idealize and formulate the equations of motion for SDOF system.
CO2	Develop the equations of motion for MDOF system and to evaluate the natural frequencies and mode shapes.
CO3	Explain the elements of engineering seismology, characteristics of earthquake and seismic instrumentation.
CO4	To identify the various causes and effects of earthquakes on structures due to past earthquakes.
CO5	To analyze the structures subjected to dynamic loading and to design for seismic loading as per codal provisions.

TEXTBOOKS:

1. Mario Paz, Structural Dynamics – Theory and Computations, Fifth Edition 2nd printing, CBS publishers, 2006.
2. Agarwal.P and Shrikhande.M. Earthquake Resistant Design of Structures, Prentice Hall of India Pvt. Ltd. 2011.

REFERENCES:

1. Clough.R.W, and Penzien.J, Dynamics of Structures, Second Edition, McGraw Hill International Edition, 1995.
2. Minoru Wakabayashi, Design of Earthquake Resistant Buildings, Mc Graw – Hill Book Company, 1986.
3. Anil K Chopra, Dynamics of structures – Theory and applications to Earthquake Engineering, Prentice Hall Inc., 2007.
4. Moorthy.C.V.R., Earthquake Tips, NICEE, IIT Kanpur,2002.

Publication of Bureau of Indian Standards:

1. IS 4326: 2013 Earthquake Resistant Design And Construction Of Buildings – Code Of Practice
2. IS 1893: 2016 Criteria For Earthquake Resistant Design Of Structures – Part 1 General Provisions And Buildings.
3. IS 13920:2016 Ductile Design And Detailing Of Reinforced Concrete Structures Subjected To Seismic Forces – Code Of Practice.

CO – PO Mapping –Structural Dynamics and Earthquake Engineering

PO/PSO		Course Outcome					Overall Correlation of COs to POs
		CO1	CO2	CO3	CO4	CO5	
PO1	Knowledge of Engineering Sciences	3	-	-	-	-	3
PO2	Problem analysis	-	-	-	2	3	2
PO3	Design / development of solutions	-	-	-	2	3	3
PO4	Investigation	-	-	-	-	2	2
PO5	Modern Tool Usage	-	-	-	-	3	3
PO6	Individual and Team work	-	-	-	2	2	2
PO7	Communication	-	-	-	2	2	2
PO8	Engineer and Society	3	-	-	2	2	2
PO9	Ethics	-	-	-	-	1	1
PO10	Environment and Sustainability	-	-	-	-	1	1
PO11	Project Management and Finance	-	-	-	-	1	1
PO12	Life Long Learning	-	-	-	-	1	1
PSO1	Knowledge of Civil Engineering discipline	3	3	2	3	3	3

PSO2	Critical analysis of Civil Engineering problems and innovation	3	3	2	2	2	2
PSO3	Conceptualization and evaluation of engineering solutions to Civil Engineering Issues	2	2	3	3	3	3

CE5023 GEO-ENVIRONMENTAL ENGINEERING L T P C
3 0 0 3

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 thereby protecting environment.

UNIT I GENERATION OF WASTES AND CONSQUENCES OF SOIL POLLUTION 8

Introduction to Geo environmental engineering – Environmental cycle – Sources, production and classification of waste – Causes of soil pollution – Factors governing soil pollution interaction clay minerals - Failures of foundation due to waste movement.

UNIT II SITE SELECTION AND SAFE DISPOSAL OF WASTE 10

Safe disposal of waste – Site selection for landfills – Characterization of land fill sites and waste – Risk assessment – Stability of landfills – Current practice of waste disposal – Monitoring facilities – Passive containment system – Application of geosynthetics in solid waste management – Rigid or flexible liners.

UNIT III TRANSPORT OF CONTAMINANTS 8

Contaminant transport in sub surface – Advection, Diffusion, Dispersion – Governing equations – Contaminant transformation – Sorption – Biodegradation – Ion exchange – Precipitation – Hydrological consideration in land fill design – Ground water pollution.

UNIT IV WASTE STABILIZATION 10

Stabilization - Solidification of wastes – Micro and macro encapsulation – Absorption, Adsorption, Precipitation – Detoxification – Mechanism of stabilization – Organic and inorganic stabilization – Utilization of solid waste for soil improvement.

UNIT V REMEDIATION OF CONTAMINATED SOILS 9

Exsitu and insitu remediation-Solidification, bio-remediation, incineration, soil washing, electro kinetics, soil heating, vetrification, bio-venting.

TOTAL:45 PERIODS

OUTCOME:

- On completion of the course, the student is expected to

CO1	understand basic knowledge of concepts and principles of Geo-environmental Engineering.
CO2	in capable of selecting site for safe disposal of waste.
CO3	aware of soil stabilization by utilizing solid waste.
CO4	assess the contamination in the soil and to select suitable remediation methods based on contamination.
CO5	prepare the suitable disposal system for particular waste.

TEXTBOOKS:

1. Manoj Datta," Waste Disposal in Engineered landfills", Narosa Publishing House, 1997.
2. Manoj Datta, B.P. Parida, B.K. Guha, "Industrial Solid Waste Management and Landfilling Practice", Narosa Publishing House, 1999.

REFERENCES:

1. Hari D. Sharma and Krishna R. Reddy, "Geo-Environmental Engineering" –John Wiley and Sons, INC, USA, 2004.
2. Daniel B.E., "Geotechnical Practice for waste disposal", Chapman & Hall, London 1993.
3. Westlake, K, "Landfill Waste pollution and Control", Albion Publishing Ltd., England, 1995.
4. Wentz, C.A., "Hazardous Waste Management", McGraw Hill, Singapore, 1989.

CO – PO Mapping – GEO-ENVIRONMENTAL ENGINEERING

PO/PSO		Course Outcome					Overall Correlation of CO s to POs
		CO1	CO2	CO3	CO4	CO5	
PO1	Knowledge of Engineering Sciences	2	3	3	2	3	3
PO2	Problem analysis	1	1	2	1	1	1
PO3	Design / development of solutions	2	3	2	3	3	3
PO4	Investigation	1	3	3	3	2	3
PO5	Modern Tool Usage	1	2	2	3	3	2
PO6	Individual and Team work	1	1	1	1	1	1
PO7	Communication	1	1	1	1	1	1
PO8	Engineer and Society	3	3	3	3	3	3
PO9	Ethics	1	3	3	3	3	3
PO10	Environment and Sustainability	3	3	3	3	3	3
PO11	Project Management and Finance	2	1	1	1	1	1
PO12	Life Long Learning	3	3	3	3	3	3
PSO1	Knowledge of Civil Engineering discipline	3	2	2	2	2	2
PSO2	Critical analysis of Civil Engineering problems and innovation	3	2	2	2	3	2
PSO3	Conceptualization and evaluation of engineering solutions to Civil Engineering Issues	2	3	3	3	2	3

CE5024 GROUND IMPROVEMENT TECHNIQUES L T P C
3 0 0 3

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 PROBLEMATIC SOIL AND IMPROVEMENT TECHNIQUES 8

Role of ground improvement in foundation engineering – Methods of ground improvement – Geotechnical problems in alluvial, lateritic and black cotton soils – Selection of suitable ground improvement techniques based on soil conditions.

UNIT II DEWATERING 10

Dewatering Techniques - Well points – Vacuum and electroosmotic methods – Seepage analysis for two dimensional flow for fully and partially penetrated slots in homogeneous deposits – Design for simple cases.

UNIT III INSITU TREATMENT OF COHESIONLESS AND COHESIVE SOILS 10

Insitu densification of cohesionless soils - Dynamic compaction - Vibroflotation, Sand compaction piles and deep compaction. Consolidation of cohesionless soils - Preloading with sand drains, and fabric drains, Stabilization of soft clay ground using stone columns and Lime piles-Installation techniques – Simple design - Relative merits of above methods and their limitations. separation, road works and containment applications

UNIT IV EARTH REINFORCEMENT 9

Concept of reinforcement – Types of reinforcement material – Reinforced earth wall – Mechanism – Simple design - Applications of reinforced earth; Functions of Geotextiles in filtration, drainage, separation, road works and containment applications.

UNIT V GROUTING TECHNIQUES 8

Types of grouts – Grouting equipments and machinery – Injection methods – Grout monitoring Stabilization with cement, lime and chemicals – Stabilization of expansive soil.

TOTAL: 45 PERIODS

OUTCOME:

- On completion of the course, the student is expected to

CO1	identify various problems associated with soil deposits, formulate and methods to evaluate them.
CO2	demonstrate an ability to design a dewatering system, component or process as per needs and specifications.
CO3	understand the concept involved for insitu treatment of cohesive and cohesionless soils and ability required to design an appropriate techniques to implement ground improvement methods.
CO4	understand of soil reinforcement and its uses in various engineering structure. Also, graduate will demonstrate an ability to design reinforced earth retaining structure.
CO5	demonstrate an ability to design retaining walls, its component or process as per the needs and specifications.

TEXTBOOKS:

1. Purushothama Raj. P, “Ground Improvement Techniques”, Firewall Media, 2005.
2. Bikash Chandra chattopadhyay and Joyanta Maity, “ Ground Improvement Techniques”, PHI Learning Pvt. Ltd., 2017

REFERENCES:

1. Koerner, R.M. “Construction and Geotechnical Methods in Foundation Engineering”, McGraw Hill, 1994.
2. Moseley, M.P., “Ground Improvement Blockie Academic and Professional”, Chapman and Hall, Glasgow, 2004.
3. Winterkorn, H.F. and Fang, H.Y. “Foundation Engineering Hand Book”. Van Nostrand Reinhold, 1994.
4. Koerner, R.M., “Designing with Geosynthetics” (Fourth Edition), Prentice Hall, Jersey, 2012.

CO – PO Mapping – GROUND IMPROVEMENT TECHNIQUES

PO/PSO		Course Outcome					Overall Correlation of CO s to POs
		CO1	CO2	CO3	CO4	CO5	
PO1	Knowledge of Engineering Sciences	3	3	2	3	3	3
PO2	Problem analysis	3	3	3	2	3	3
PO3	Design / development of solutions	2	2	3	3	2	2
PO4	Investigation	3	2	2	3	2	3

PO5	Modern Tool Usage	2	2	3	3	3	3
PO6	Individual and Team work	2	2	1	1	1	1
PO7	Communication	2	2	2	1	1	2
PO8	Engineer and Society	3	3	3	3	3	3
PO9	Ethics	1	1	1	1	1	1
PO10	Environment and Sustainability	2	2	3	2	2	2
PO11	Project Management and Finance	2	2	2	3	2	2
PO12	Life Long Learning	3	3	3	3	3	3
PSO1	Knowledge of Civil Engineering discipline	2	2	3	3	2	2
PSO2	Critical analysis of Civil Engineering problems and innovation	2	1	3	3	2	3
PSO3	Conceptualization and evaluation of engineering solutions to Civil engineering issues	1	2	3	2	3	3

CE5025 SOIL DYNAMICS AND MACHINE FOUNDATIONS L T P C
3 0 0 3

OBJECTIVE:

- To understand the basics of dynamics – dynamic behaviour of soils – effects of dynamic loads and the various design methods.

UNIT I THEORY OF VIBRATION 9

Nature dynamic loads – Vibrations of single degree freedom system – Free vibrations of spring – mass systems – Forced vibrations – Viscous damping - Transmissibility – Principles of vibration measuring instruments – Effect of Transient and Pulsating loads

UNIT II WAVE PROPAGATION 9

Elastic waves in rods of infinite length – Longitudinal and Torsional – Effect of end conditions – Longitudinal and torsional vibrations of rods of finite length – Wave Propagation in infinite, homogeneous isotropic and elastic medium - Wave propagation in elastic half space – Typical values of compression wave and shear wave velocity – Wave propagation due to Machine foundation – Surface wave – Typical values – Particle movements and velocity.

UNIT III DYNAMIC PROPERTIES OF SOILS 9

Dynamic stress – Strain characteristics – Principles of measuring dynamic properties – Laboratory Techniques – Field tests – Factors affecting dynamic properties – Typical values – Dynamic bearing capacity – Dynamic earth pressure.

UNIT IV FOUNDATION FOR DIFFERENT TYPES OF MACHINES 9

Types of machines and foundation – General requirements – Modes of vibration of a rigid foundation – Method of analysis – Linear elastic weightless spring method – Elastic half space method – Analog Method – Design of block foundation – Special consideration for rotary, Impact type of machines – Codal Provisions.

UNIT V INFLUENCE OF VIBRATION AND REMEDIATION 9

Mechanism of Liquefaction – Influencing factors – Evaluation of Liquefaction potential based on SPT-Force Isolation – Motion Isolation – Use of spring and damping materials – Vibration control of existing machine foundation – Screening of vibration – Open trenches – Pile Barriers – Salient construction aspects of machine Foundations.

TOTAL: 45 PERIODS

OUTCOME:

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

CO1	have the basic knowledge about the theory of vibration.
CO2	understand the different types of waves and its behaviour.
CO3	have enough knowledge about various laboratory and field tests to determine the dynamic soil properties and its interpretation.
CO4	assess the contamination in the soil and to select suitable remediation methods based on contamination.
CO5	assess the influence of vibrations and selection of remediation methods based on the nature of vibration, properties and behaviour of soil.

TEXT BOOKS:

1. Swamisaran, "Soil Dynamics and Machine Foundations", Galgotia Publications Pvt.Ltd. (Second Edition) 2006, (Reprint 2010), New Delhi-110002
2. Srinivasulu. P, and Vaidyanathan. C. V, "Handbook of Machine Foundations", Tata McGraw-Hill, 2007

REFERENCES:

1. Kamaswara Rao., "Vibration Analysis and Foundation Dynamics", Wheeler Publishing, New Delhi, 1998.
2. Kameswara Rao., "Dynamics Soil Tests and Applications", Wheeler Publishing, New Delhi, 2003.
3. Moore, P.J., "Analysis and Design of Foundation for Vibration", Oxford and IBH, 2005
4. Steven L. Kramer, "Geotechnical Earthquake Engineering", Prentice Hall, 2014.

CO – PO Mapping – SOIL DYNAMICS AND MACHINE FOUNDATIONS

PO/PSO		Course Outcome					Overall Correlation of CO s to POs
		CO1	CO2	CO3	CO4	CO5	
PO1	Knowledge of Engineering Sciences	3	3	3	3	3	3
PO2	Problem analysis	3	3	2	3	1	3
PO3	Design / development of solutions	1	1	3	3	3	3
PO4	Investigation	1	1	3	3	2	3
PO5	Modern Tool Usage	1	1	3	1	1	1
PO6	Individual and Team work	1	1	1	1	1	1
PO7	Communication	1	1	1	1	1	1
PO8	Engineer and Society	3	3	3	3	3	3
PO9	Ethics	1	1	1	1	2	1
PO10	Environment and Sustainability	3	3	3	3	2	3
PO11	Project Management and Finance	2	1	1	1	1	1
PO12	Life Long Learning	3	3	3	3	3	3
PSO1	Knowledge of Civil Engineering discipline	3	2	2	2	2	2
PSO2	Critical analysis of Civil Engineering problems and innovation	3	2	2	2	3	2
PSO3	Conceptualization and evaluation of Engineering solutions to Civil engineering issues	2	3	3	3	2	3

CE5026 **ROCK MECHANICS** **LT P C**
3 0 0 3

OBJECTIVE:

- To impart knowledge on fundamentals of rock mechanics and its application in solving simple problems associated with rock slopes and underground openings. Student gains the knowledge on the mechanics of rock and its applications in underground structures and rock slope stability analysis.

UNIT I CLASSIFICATION AND INDEX PROPERTIES OF ROCKS 6
Geological classification – Index properties of rock systems – Classification of rock masses for engineering purpose – Rock Mass Rating and Q System.

UNIT II ROCK STRENGTH AND FAILURE CRITERIA 12
Modes of rock failure – Strength of rock – Laboratory measurement of shear, tensile and compressive strength. Stress - strain behaviour of rock under compression – Mohr -Coulomb failure criteria and empirical criteria.

UNIT III INITIAL STRESSES AND THEIR MEASUREMENTS 10
Estimation of initial stresses in rocks – influence of joints and their orientation in distribution of stresses – measurements of in-situ stresses – Hydraulic fracturing – Flat jack method – Over coring method.

UNIT IV APPLICATION OF ROCK MECHANICS IN ENGINEERING 10
Simple engineering application – Underground openings – Rock slopes – Foundations and mining subsidence.

UNIT V ROCK STABILISATION *7*
Introduction – Rock support and Rock reinforcement – Principles – Support reaction curves – Shotcreting.

TOTAL: 45 PERIODS

OUTCOME:

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

CO1	have the knowledge in characterizing and rating the rock mass.
CO2	arrive at the behaviour of rock for the given project.
CO3	calculate the insitu stresses of rock.
CO4	design underground excavation, open excavation and sub-structures.
CO5	design suitable support system under unstable condition.

TEXTBOOKS:

1. Goodman, P.E. “Introduction to Rock Mechanics”, John Wiley and Sons, 1999.
2. Ramamurthy. T., “Engineering in Rocks for Slopes, Foundation and Tunnels: (Third Edition), PHI Learning Private Limited, New Delhi, 2014.

REFERENCES:

1. Brown, E.T. “Rock Characterization Testing and Monitoring”. Pergaman Press 1991.
2. Arogyaswamy, R.N.P., Geotechnical Application in Civil Engineering”, Oxford and IBH, 1991.
3. Hook E.and Bray J., Rock slope Engineering, Institute of Mining and Metallurgy”, U.K. 2004.
4. Brady, B.H.G. and Brown, E.T., Rock mechanics for underground mining (Third Edition), Kluwer Academic Publishers, Dordrecht, 2006.

CO – PO Mapping – ROCK MECHANICS

PO/PSO		Course Outcome					Overall Correlation of CO s to POs
		CO1	CO2	CO3	CO4	CO5	
PO1	Knowledge of Engineering Sciences	3	3	3	3	3	3
PO2	Problem analysis	3	3	3	3	3	3
PO3	Design / development of solutions	2	3	3	3	3	3
PO4	Investigation	3	3	3	2	2	3
PO5	Modern Tool Usage	1	2	3	3	3	3
PO6	Individual and Team work	2	1	1	1	1	1
PO7	Communication	1	1	1	1	1	1
PO8	Engineer and Society	3	3	3	3	3	3
PO9	Ethics	1	1	1	1	2	1
PO10	Environment and Sustainability	3	3	3	3	3	3
PO11	Project Management and Finance	2	1	1	1	1	1
PO12	Life Long Learning	3	3	3	3	3	3
PSO1	Knowledge of Civil Engineering discipline	3	2	2	2	2	2
PSO2	Critical analysis of Civil Engineering problems and innovation	3	2	2	2	3	2
PSO3	Conceptualization and evaluation of Engineering solutions to Civil engineering issues	2	3	3	3	2	3

CE5027 COASTAL ENGINEERING L T P C
3 0 0 3

OBJECTIVES:

- To provide an overview of the analysis and design procedures used in the field of coastal engineering
- To enable students to determine the characteristics of waves, coastal structures and shore protection and modeling in coastal engineering

UNIT I INTRODUCTION TO COASTAL ENGINEERING 9

Introduction - Wind and waves – Sea and Swell - Introduction to small amplitude wave theory – use of wave tables- Mechanics of water waves – Linear (Airy) wave theory – Wave measurement.

UNIT II WAVE PROPERTIES AND ANALYSIS 9

Introduction to non-linear waves and their properties – Waves in shallow waters – Wave Refraction, Diffraction and Shoaling – Hindcasting of waves - Short term wave analysis – wave spectra and its utilities - Long term wave analysis- Statistical analysis of grouped wave data.

UNIT III TYPES AND WAVE TRANSFORMATION 9

Tide analysis and prediction, storm surge, seiches and seasonal fluctuations - Long term water level fluctuations – Wave shoaling; wave refraction; wave breaking; wave diffraction

UNIT IV COASTAL STRUCTURES AND SHORE PROTECTION 9

Risk analysis – design wave – Break waters – Shore protection – groins, seal walls, offshore breakwaters, artificial nourishment

UNIT V MODELING IN COASTAL ENGINEERING 9

Physical modeling in Coastal Engineering – Limitations and advantages – Role of physical modeling in coastal engineering – Numerical modeling – Modeling aspects – limitations

TOTAL: 45 PERIODS

OUTCOME:

On successfully completing this course unit, students will be able to:

CO1	Describe the problems associated with Indian coast. Apply Linear wave theory and use wave tables for solving the dispersion equation.
CO2	Distinguish between linear and non-linear wave theories. Solve problems on wave transformations. Apply probability theory for wave analysis.
CO3	Types of waves, wave shoaling, diffraction, refraction
CO4	Model and design shore defense structures and describe the problems from reliability and risk perspective.
CO5	Compare and contrast physical and mathematical coastal models and critique the advantages and disadvantages between them.

TEXTBOOKS:

1. Kamphuis, J.W., Introduction to coastal engineering and management, 2000
2. Dean, R.G. and Dalrymple, R.A., Water wave mechanics for Engineers and Scientists, Prentice-Hall, Inc., Englewood Cliffs, New Jersey, 1994.
3. Mani, J. S. Coastal Hydrodynamics. PHI Learning Pvt. Ltd., 2012.

REFERENCES:

1. Ippen, A.T., Estuary and Coastline Hydrodynamics, McGraw-Hill Book Company, Inc., New York, 1978.
2. Sorenson, R.M., Basic Coastal Engineering, A Wiley-Interscience Publication, NewYork, 1978.
3. Coastal Engineering Manual, Vol. I-VI, Coastal Engineering Research Centre, Dept. of the Army, US Army Corps of Engineers, Washington DC, 2006.

CO-PO Mapping – COASTAL ENGINEERING

PO/PSO		Course Outcome					Overall Correlation of COs to POs
		CO1	CO2	CO3	CO4	CO5	
PO1	Knowledge of Engineering Sciences	3	3	3	3	3	3
PO2	Problem analysis		2	3	3	3	3
PO3	Design / development of solutions			2	3	3	3
PO4	Investigation					3	3
PO5	Modern Tool Usage			2	3	3	3
PO6	Individual and Team work		3	2	3	3	3
PO7	Communication	2					2
PO8	Engineer and Society		3	2	3	3	3
PO9	Ethics						
PO10	Environment and Sustainability			2	3	3	3
PO11	Project Management and Finance						
PO12	Life Long Learning	3	2	2	3	3	3
PSO1	Knowledge of Civil Engineering discipline	3	3	2	3	3	3
PSO2	Critical analysis of Civil Engineering problems and innovation	1	3	3	3	3	3
PSO3	Conceptualization and evaluation of Engineering solutions to Civil engineering issues	1	1	2	2	3	2

CE5028 **COASTAL ZONE MANAGEMENT** **L T P C**
3 0 0 3

OBJECTIVES

- To be able to "see" the features and components of the natural, engineering and human aspects of the coast, the function of component and relationship between them.
- To be able to interpretation and analysis of coastal issues to determine appropriate approaches in coastal management.
- To be able to understand the need for coastal zone management and to develop an ICM plan.

UNIT I COASTAL ZONE **9**

Coastal Zone – Beach Profile – Surf Zone – Off Shore – Coastal Waters – Coastal sediments-Estuaries – Wet Lands And Lagoons – Coastal dunes-Coastal Geomorphology.

UNIT II COASTAL RESOURCES **9**

Types and functions of coastal and marine resources- Renewable and Non- Renewable resources – living marine resources and Nonliving marine resources-Marine minerals-placer deposits-hydrocarbon deposits-polymetallic nodules.

UNIT III COASTAL ECOSYSTEM **9**

Marine ecosystem: Mangroves- Sea grass -seaweeds - coral reef- Large marine ecosystem-Climate effects on living marine resources- Biological monitoring of marine ecosystem- Human impacts on marine ecosystem.

UNIT IV COASTAL PROCESSES **9**

Erosion And Depositional Shore Features – Methods Of Protection – Littoral Currents – Coastal Aquifers – Sea Water Intrusion – Impact Of Sewage Disposal In Seas.

UNIT V COASTAL REGULATIONS **9**

Introduction- What is ICM- Developing an ICM framework- Principles-Goals-defining boundaries-Coastal regulations for main land India – coastal regulations for Islands- introduction to Environmental Law and policy.

TOTAL: 45 PERIODS

OUTCOMES:

The Students Completing the Course Will Have Ability to

CO1	Describe The Coastal Zone Regulations, Coastal Processes And to identify natural, engineering and human components on the coast.
CO2	Able to interpretation and analysis of coastal issues to determine appropriate approaches in coastal management and able to communicate effectively in speech and writings
CO3	Able to learn about different ecosystem available in coastal zones and their importance
CO4	Able to learn about coastal erosion and accretions, impacts of seawage disposal
CO5	Able to understand about coastal regulations, its laws and policies

TEXTBOOKS:

1. Richard Sylvester, "Coastal Engineering, Volume I And II", Elseiner Scientific Publishing Co., 1999
2. NCSCM straigies and guideline for National implementation of Integrated Coastal zone management, 2013
3. Ramesh R and Purvaja R , E- learning moduleon ICZM for UNESCO-IHE, The Netheralands, 2006
4. Dwivedi, S.N., Natarajan, R And Ramachandran, S.,"Coastal Zone Management In Tamilnadu", Madras, 1991

CO PO MAPPING - COASTAL ZONE MANAGEMENT

PO/PSO		Course Outcome					Overall Correlation of CO s to POs
		CO1	CO2	CO3	CO4	CO5	
PO1	Knowledge of Engineering Sciences	1	2	2			2
PO2	Problem analysis		2	3	3		3
PO3	Design / development of solutions		2	3			3
PO4	Investigation		2	2	2		2
PO5	Modern Tool Usage			3			3
PO6	Individual and Team work		3	3	2		3
PO7	Communication			3	2		2
PO8	Engineer and Society		2	2	2		2
PO9	Ethics				2		
PO10	Environment and Sustainability		3	3	3		3
PO11	Project Management and Finance		1				1
PO12	Life Long Learning			2			2
PSO1	Knowledge of Civil Engineering discipline		3	3	3		
PSO2	Critical analysis of Civil Engineering problems and innovation		3		3		3
PSO3	Conceptualization and evaluation of Engineering solutions to Civil engineering issues		3	3	3		3

CE5029 GLOBAL CLIMATE CHANGE L T P C
3 0 0 3

OBJECTIVE:

- To expose the students to the complexities, impacts on natural resources and initiatives to mitigate and adapt Global Climate Change

UNIT I INTRODUCTION TO WEATHER AND CLIMATE 9

Atmosphere – Climatology and Paleo climatology, Factors affecting global, regional and local climates, weather parameters. Tropical climate, Monsoons, Polar, Desert, Mid-latitude climates and their role in global climate change.

UNIT II ELEMENTS AND PROCESSES RELATED TO CLIMATE CHANGE 9

Structure and driving forces of the earth - Global energy balance. Earth's carbon reservoirs-marine and terrestrial, Carbon cycles, Global Ocean Circulation, Southern oscillation (El-Nino and La-Nina), Greenhouse gases and global warming - Industrialization and urbanization, Representative Concentration Pathways.

UNIT III CLIMATE CHANGE MITIGATION 9

Global and India emission status, Nationally Determined Contribution (NDC), International agreements and protocols, Future use of renewable energy, Carbon Capture and Carbon Sequestration.

UNIT IV CLIMATE CHANGE ADAPTATION 9

Impacts and Vulnerability on Water, Agriculture, Forestry, Coastal and Health. Traditional knowledge to cope with climate change impacts – Community and ecological based adaptation, Climate Adaptation Fund and Insurance.

UNIT V CONSERVATION OF NATURAL RESOURCES 9

Climate Change and Sustainable development, Water and Food Security, Need for Conservation of Natural Resources (Forestry and Coastal Eco-system), Climate Extreme events – heat wave, flood and droughts, Sea Level Rise and Ocean acidification and Natural based solution for conservation (NBS).

TOTAL = 45 PERIODS

OUTCOMES:

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

CO1	Understand the science and basic of weather and climate
CO2	Student will attain the knowledge on natural and anthropogenic activities, which accelerate the climate change
CO3	Acquire knowledge on various protocols and agreement that help to control and reduce climate change impacts
CO4	Know the adaptive techniques to build the climate resilience society.
CO5	Gain awareness about the stress on natural based resources and to conserve it from natural calamities

TEXTBOOKS:

1. Climate Change – The Science, Impacts and Solutions (2nd Edition) – A. Barrie Pittock, CSIRO Publishing, 2009.
2. Fundamentals of weather and climate (2nd Edition) – Robin McIlveen, Oxford University Press, 2009

REFERENCES:

1. Climate change – Mitigation of Climate, IPCC, 2013.
2. Atmosphere Weather and Climate – K Siddartha, Kisalaya Publications Pvt. Ltd, 2013
3. W. Neil Adger, Irene Lorenzoni and Karen L. O, Adapting to Climate Change: Thresholds, Values, Governance, Cambridge, 2009.
4. Vineet Kumar, Arjuna Srinidhi, Chandra Bhushan, Geetika Singh, Rising to the Call: Good Practices of Climate Change Adaptation in India, Centre For Science And Environment publisher, 2014.
5. Dan Gafta and John Akeroyd, Nature Conservation Concepts and Practice, Springer, 2006.

CO – PO Mapping – Global climate change

PO/PSO		Course Outcome					Overall Correlation of CO s to POs
		CO1	CO2	CO3	CO4	CO5	
PO1	Knowledge of Engineering Sciences	2	3				2
PO2	Problem analysis			3			3
PO3	Design / development of solutions				3		3
PO4	Investigation				2		2
PO5	Modern Tool Usage			2	2		2

PO6	Individual and Team work				3		3
PO7	Communication				3		3
PO8	Engineer and Society					2	2
PO9	Ethics					3	3
PO10	Environment and Sustainability				3	3	3
PO11	Project Management and Finance			2	2		2
PO12	Life Long Learning				3	3	3
PSO1	Knowledge of Civil Engineering discipline		2	2	2		2
PSO2	Critical analysis of Civil Engineering problems and innovation				2	3	2
PSO3	Conceptualization and evaluation of Engineering solutions to Civil engineering issues				3	3	3

CE5030 CLIMATE CHANGE AND VULNERABILITY ASSESSMENT L T P C
3 0 0 3

OBJECTIVE:

- To familiarize the methodologies of climate impacts and vulnerability assessment on Natural resources

UNIT I INTRODUCTION 9

Global, Regional and Local climates, Ocean Circulation, weather parameters. Tropical climate, Monsoons and their role in global climate change.

UNIT II NATIONAL ACTION PLAN ON CLIMATE CHANGE 9

National and State Action Plan on Climate Change, Significance on Sustainable development of Natural resources – National Water Mission, Sustainable Agriculture Mission, Green India Mission, Coastal Conservation.

UNIT III CLIMATE SCENARIOS 9

Global and Regional Climate Scenarios – Representative Concentration Pathways (RCP 2.6, 4.5, 6.0 and 8.5), Global Circulation Model (GCM) - Statistical and Dynamical Downscaling of GCM – Regional Climate Model (RCM).

UNIT IV IMPACTS AND VULNERABILITY ASSESSMENT – METHODOGLOGY 9

Definitions of Risk, Hazards, Exposure, Sensitivity and Vulnerability. Climate Risk Assessment, IPCC Methodology – Vulnerability indices.

UNIT V VALIDATION AND APPLICATION OF MODELS 9

Climate Projections and Validation– Uncertainty analysis – Bias Correction – Sectoral wise Case Studies in India.

TOTAL = 45 PERIODS

OUTCOMES:

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

CO1	Understand the basic and concept behind the climate change
CO2	Know the global and national policies to combat the climate change impacts
CO3	understand the basics of climate modelling and envisage the climate change impact based on different emission scenario
CO4	Able to assess the risk and vulnerability on different sectors due to climate change
CO5	Know the validation of climate models and correlate the climate related case studies

TEXTBOOKS:

1. IPCC Fifth Assessment Report - Impacts, Adaptation and Vulnerability, Cambridge University Press, 2014.
2. Neelin David J, “Climate Change and Climate Modelling”, Cambridge University Press, 2011.

REFERENCES:

1. Thomas Stocker, “Introduction to Climate Modelling”, Advances in Geophysical and Environmental Mechanics and Mathematics. Springer Publication, 2011.
2. India's National Action Plan on Climate Change (NAPCC), Government of India, 2018
3. Michele Companion and Miriam S. Chaiken, Responses to Disasters and Climate Change: Understanding Vulnerability and Fostering Resilience, CRC Press, 2017.
4. Climate Change – The Science, Impacts and Solutions (2nd Edition) – A. Barrie Pittock, CSIRO Publishing, 2009.

CO – PO Mapping – Climate Change and Vulnerability Assessment

PO/PSO		Course Outcome					Overall Correlation of COs to POs
		CO1	CO2	CO3	CO4	CO5	
PO1	Knowledge of Engineering Sciences	2		2	2	2	2
PO2	Problem analysis		3		3	2	3
PO3	Design / development of solutions				3	2	2
PO4	Investigation		2	2	3		2
PO5	Modern Tool Usage			3		3	3
PO6	Individual and Team work				3		3
PO7	Communication				3	2	2
PO8	Engineer and Society				3	2	2
PO9	Ethics				2		2
PO10	Environment and Sustainability		2		3	2	2
PO11	Project Management and Finance		3			2	2
PO12	Life Long Learning			3	2		2
PSO1	Knowledge of Civil Engineering discipline		2				2
PSO2	Critical analysis of Civil Engineering problems and innovation		2			2	2
PSO3	Conceptualization and evaluation of Engineering solutions to Civil engineering issues		3		2		2

AUDIT COURSES (AC)

AD5091 CONSTITUTION OF INDIA L T P C
3 0 0 0

OBJECTIVES:

- Teach history and philosophy of Indian Constitution.
- Describe the premises informing the twin themes of liberty and freedom from a civil rights perspective.
- Summarize powers and functions of Indian government.
- Explain emergency rule.
- Explain structure and functions of local administration.

UNIT I INTRODUCTION 9

History of Making of the Indian Constitution-Drafting Committee- (Composition & Working) - Philosophy of the Indian Constitution-Preamble-Salient Features

UNIT II CONTOURS OF CONSTITUTIONAL RIGHTS & DUTIES 9

Fundamental Rights-Right to Equality-Right to Freedom-Right against Exploitation Right to Freedom of Religion-Cultural and Educational Rights-Right to Constitutional Remedies Directive Principles of State Policy-Fundamental Duties

UNIT III ORGANS OF GOVERNANCE 9

Parliament-Composition-Qualifications and Disqualifications-Powers and Functions-Executive President-Governor-Council of Ministers-Judiciary, Appointment and Transfer of Judges, Qualifications Powers and Functions

UNIT IV EMERGENCY PROVISIONS 9

Emergency Provisions - National Emergency, President Rule, Financial Emergency

UNIT V LOCAL ADMINISTRATION 9

District's Administration head- Role and Importance-Municipalities- Introduction- Mayor and role of Elected Representative-CEO of Municipal Corporation-Pachayati raj- Introduction- PRI- Zila Pachayat-Elected officials and their roles- CEO ZilaPachayat- Position and role-Block level-Organizational Hierarchy (Different departments)-Village level- Role of Elected and Appointed officials-Importance of grass root democracy

TOTAL: 45 PERIODS

OUTCOMES:

CO1: Able to understand history and philosophy of Indian Constitution.
CO2: Able to understand the premises informing the twin themes of liberty and freedomfrom a civil rights perspective.
CO3: Able to understand powers and functions of Indian government.
CO4: Able to understand emergency rule.
CO5: Able to understand structure and functions of local administration.

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1									✓			✓
CO2									✓			✓
CO3									✓			✓
CO4									✓			✓
CO5									✓			✓

TEXTBOOKS:

1. Basu D D, Introduction to the Constitution of India, Lexis Nexis, 2015.
2. Busi S N, Ambedkar B R framing of Indian Constitution, 1st Edition, 2015.
3. Jain M P, Indian Constitution Law, 7th Edn., Lexis Nexis, 2014.
4. The Constitution of India (Bare Act), Government Publication,1950

AD5092 **VALUE EDUCATION**

L T P C
3 0 0 0

OBJECTIVES:

- Develop knowledge of self-development
- Explain the importance of Human values
- Develop the overall personality through value education
- Overcome the self-destructive habits with value education
- Interpret social empowerment with value education

UNIT I INTRODUCTION TO VALUE EDUCATION 9

Values and self-development –Social values and individual attitudes, Work ethics, Indian vision of humanism, Moral and non- moral valuation, Standards and principles, Value judgements

UNIT II IMPORTANCE OF VALUES 9

Importance of cultivation of values, Sense of duty, Devotion, Self-reliance, Confidence, Concentration, Truthfulness, Cleanliness. Honesty, Humanity, Power of faith, National Unity, Patriotism, Love for nature, Discipline

UNIT III INFLUENCE OF VALUE EDUCATION 9

Personality and Behaviour development - Soul and Scientific attitude. Positive Thinking, Integrity and discipline, Punctuality, Love and Kindness, Avoid fault Thinking, Free from anger, Dignity of labour, Universal brotherhood and religious tolerance, True friendship Happiness Vs suffering, love for truth.

UNIT IV REINCARNATION THROUGH VALUE EDUCATION 9

Aware of self-destructive habits, Association and Cooperation, Doing best for saving nature Character and Competence –Holy books vs Blind faith, Self-management and Good health, Science of reincarnation

UNIT V VALUE EDUCATION IN SOCIAL EMPOWERMENT 9

Equality, Nonviolence, Humility, Role of Women, All religions and same message, Mind your Mind, Self-control, Honesty, Studying effectively

TOTAL: 45PERIODS

OUTCOMES:

CO1 – Gain knowledge of self-development
CO2 – Learn the importance of Human values
CO3 – Develop the overall personality through value education
CO4 – Overcome the self destructive habits with value education
CO5 – Interpret social empowerment with value education

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1							✓	✓				✓
CO2							✓	✓	✓			✓
CO3							✓	✓	✓			✓
CO4							✓	✓				✓
CO5							✓	✓				✓

REFERENCES:

1. Chakroborty , S.K. “Values and Ethics for organizations Theory and practice”, Oxford University Press ,New Delhi

AD5093 **PEDAGOGY STUDIES** **L T P C**
3 0 0 0

OBJECTIVES:

- Understand the methodology of pedagogy.
- Compare pedagogical practices used by teachers in formal and informal classrooms in developing countries.
- Infer how can teacher education (curriculum and practicum) and the school curriculum and guidance materials best support effective pedagogy.
- Illustrate the factors necessary for professional development.
- Identify the Research gaps in pedagogy.

UNIT I INTRODUCTION AND METHODOLOGY: 9

Aims and rationale, Policy background, Conceptual framework and terminology - Theories of learning, Curriculum, Teacher education - Conceptual framework, Research questions **-** Overview of methodology and Searching.

UNIT II THEMATIC OVERVIEW 9

Pedagogical practices are being used by teachers in formal and informal classrooms in developing countries - Curriculum, Teacher education.

UNIT III EVIDENCE ON THE EFFECTIVENESS OF PEDAGOGICAL PRACTICES 9

Methodology for the in depth stage: quality assessment of included studies - How can teacher education (curriculum and practicum) and the school curriculum and guidance materials best support effective pedagogy? - Theory of change - Strength and nature of the body of evidence for effective pedagogical practices - Pedagogic theory and pedagogical approaches - Teachers' attitudes and beliefs and Pedagogic strategies.

UNIT IV PROFESSIONAL DEVELOPMENT 9

Professional development: alignment with classroom practices and follow up support - Peer support - Support from the head teacher and the community - Curriculum and assessment - Barriers to learning: limited resources and large class sizes

UNIT V RESEARCH GAPS AND FUTURE DIRECTIONS 9

Research design – Contexts – Pedagogy - Teacher education - Curriculum and assessment - Dissemination and research impact.

TOTAL: 45PERIODS

OUTCOMES:

- Understand the methodology of pedagogy.
- Understand Pedagogical practices used by teachers in formal and informal classrooms in developing countries.
- Find how can teacher education (curriculum and practicum) and the school curriculum and guidance materials best support effective pedagogy.
- Know the factors necessary for professional development.
- Identify the Research gaps in pedagogy.

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1												✓
CO2												✓
CO3												✓
CO4												✓
CO5												✓

REFERENCES:

1. Ackers J, Hardman F (2001) Classroom interaction in Kenyan primary schools, Compare, 31 (2): 245-261.
2. Agrawal M (2004) Curricular reform in schools: The importance of evaluation, Journal of Curriculum Studies, 36 (3): 361-379.
3. Akyeampong K (2003) Teacher training in Ghana - does it count? Multi-site teacher education research project (MUSTER) country report 1. London: DFID.
4. Akyeampong K, Lussier K, Pryor J, Westbrook J (2013) Improving teaching and learning of basic maths and reading in Africa: Does teacher preparation count? International Journal Educational Development, 33 (3): 272–282.
5. Alexander RJ (2001) Culture and pedagogy: International comparisons in primary education. Oxford and Boston: Blackwell.

AD5094 STRESS MANAGEMENT BY YOGA L T P C
3 0 0 0

OBJECTIVES:

- Develop healthy mind in a healthy body thus improving social health also improve efficiency
- Invent Do's and Don't's in life through Yam
- Categorize Do's and Don't's in life through Niyam
- Develop a healthy mind and body through Yog Asans
- Invent breathing techniques through Pranayam

UNIT I INTRODUCTION TO YOGA 9

Definitions of Eight parts of yog. (Ashtanga)

UNIT II YAM 9

Do`s and Don't's in life.
Shaucha, santosh, tapa, swadhyay, ishwarpranidhan

UNIT III NIYAM 9

Do`s and Don't's in life.
Ahinsa, satya, astheya, bramhacharya and aparigraha

UNIT IV ASAN 9

Various yog poses and their benefits for mind & body

UNIT V PRANAYAM 9

Regularization of breathing techniques and its effects-Types of pranayam

TOTAL: 45PERIODS

OUTCOMES:

CO1 – Develop healthy mind in a healthy body thus improving social health also improve efficiency
CO2 – Learn Do's and Don't's in life through Yam
CO3 – Learn Do's and Don't's in life through Niyam
CO4 – Develop a healthy mind and body through Yog Asans
CO5 – Learn breathing techniques through Pranayam

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1							✓	✓				✓
CO2							✓	✓				✓
CO3							✓	✓				✓
CO4							✓	✓				✓
CO5							✓	✓				✓

REFERENCES:

1. “Rajayoga or conquering the Internal Nature” by Swami Vivekananda, Advaita Ashrama (Publication Department), Kolkata
2. ‘Yogic Asanas for Group Tarining-Part-I” : Janardan Swami Yogabhyasi Mandal, Nagpur

AD5095 PERSONALITY DEVELOPMENT THROUGH LIFE ENLIGHTENMENT SKILLS

L T P C
3 0 0 0

OBJECTIVES:

- Develop basic personality skills holistically
- Develop deep personality skills holistically to achieve happy goals
- Rewrite the responsibilities
- Reframe a person with stable mind, pleasing personality and determination
- Discover wisdom in students

UNIT I NEETISATAKAM-HOLISTIC DEVELOPMENT OF PERSONALITY - I 9

Verses- 19,20,21,22 (wisdom) - Verses- 29,31,32 (pride & heroism) – Verses- 26,28,63,65 (virtue)

UNIT II NEETISATAKAM-HOLISTIC DEVELOPMENT OF PERSONALITY - II 9

Verses- 52,53,59 (dont’s) - Verses- 71,73,75,78 (do’s)

UNIT III APPROACH TO DAY TO DAY WORK AND DUTIES 9

Shrimad Bhagwad Geeta: Chapter 2-Verses 41, 47,48 - Chapter 3-Verses 13, 21, 27, 35 Chapter 6-Verses 5,13,17,23, 35 - Chapter 18-Verses 45, 46, 48

UNIT IV STATEMENTS OF BASIC KNOWLEDGE – I 9

Statements of basic knowledge - Shrimad Bhagwad Geeta: Chapter2-Verses 56, 62, 68 Chapter 12 -Verses 13, 14, 15, 16,17, 18

UNIT V PERSONALITY OF ROLE MODEL - SHRIMAD BHAGWADGEETA 9

Chapter2-Verses 17, Chapter 3-Verses 36,37,42 - Chapter 4-Verses 18, 38,39 Chapter18 – Verses 37,38,63

TOTAL: 45PERIODS

OUTCOMES:

CO1: To develop basic personality skills holistically
CO2: To develop deep personality skills holistically to achieve happy goals
CO3: To rewrite the responsibilities
CO4: To reframe a person with stable mind, pleasing personality and determination
CO5: To awaken wisdom in students

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1									✓			✓
CO2									✓			✓
CO3									✓			✓
CO4									✓			✓
CO5									✓			✓

REFERENCES:

1. Gopinath,Rashtriya Sanskrit Sansthanam P, Bhartrihari’s ThreeSatakam , Niti-sringar-vairagya, New Delhi,2010
2. Swami Swarupananda , Srimad Bhagavad Gita, Advaita Ashram,Publication Department, Kolkata,2016

AD5097 ESSENCE OF INDIAN KNOWLEDGE TRADITION L T P C
3 0 0 0

COURSE OBJECTIVES

The course will introduce the students to

- get a knowledge about Indian Culture
- Know Indian Languages and Literature religion and philosophy and the fine arts in India
- Explore the Science and Scientists of Ancient, Medieval and Modern India
- Understand education systems in India

UNIT I INTRODUCTION TO CULTURE 9

Culture, civilization, culture and heritage, general characteristics of culture, importance of culture in human literature, Indian Culture, Ancient India, Medieval India, Modern India.

UNIT II INDIAN LANGUAGES AND LITERATURE 9

Indian Languages and Literature – I: Languages and Literature of South India, – Indian Languages and Literature – II: Northern Indian Languages & Literature

UNIT III RELIGION AND PHILOSOPHY 9

Major religions practiced in India and Understanding their Philosophy – religious movements in Modern India (Selected movements only)

UNIT IV FINE ARTS IN INDIA (ART, TECHNOLOGY& ENGINEERING) 9

Indian Painting, Indian handicrafts, Music, divisions of Indian classic music, modern Indian music, Dance and Drama, Indian Architecture (ancient, medieval and modern), Science and Technology in India, development of science in ancient, medieval and modern India

UNIT V EDUCATION SYSTEM IN INDIA 9

Education in ancient, medieval and modern India, aims of education, subjects, languages, Science and Scientists of Ancient India, Science and Scientists of Medieval India, Scientists of Modern India

TOTAL: 45PERIODS

COURSE OUTCOMES

After successful completion of the course the students will be able to

- Understand philosophy of Indian culture.
- Distinguish the Indian languages and literature.
- Learn the philosophy of ancient, medieval and modern India.
- Acquire the information about the fine arts in India.
- Know the contribution of scientists of different eras.
- Understand education systems in India

REFERENCES:

1. Kapil Kapoor, “Text and Interpretation: The India Tradition”,ISBN: 81246033375, 2005
2. “Science in Samskrit”, Samskrita Bharti Publisher, ISBN 13: 978-8187276333, 2007
3. NCERT, “Position paper on Arts, Music, Dance and Theatre”, ISBN 81-7450 494-X, 200
4. Narain, “Examinations in ancient India”, Arya Book Depot, 1993
5. Satya Prakash, “Founders of Sciences in Ancient India”, Vijay Kumar Publisher, 1989
6. M. Hiriyanna, “Essentials of Indian Philosophy”, Motilal Banarsidass Publishers, ISBN 13: 978- 8120810990, 2014

AD5098 SANGATAMIL LITERATURE APPRECIATION LT P C
3 0 0 0

COURSE OBJECTIVES:
The main learning objective of this course is to make the students an appreciation for:
1. Introduction to Sanga Tamil Literature.
2.'Agathinai' and 'Purathinai' in Sanga Tamil Literature.
3.'Attruppadai' in Sanga Tamil Literature.
4.'Puranaanuru' in Sanga Tamil Literature.
5.'Pathitru paththu' in Sanga Tamil Literature.

UNIT I SANGA TAMIL LITERATURE AN INTRODUCTION 9
Introduction to Tamil Sangam–History of Tamil Three Sangams–Introduction to Tamil Sangam Literature–Special Branches in Tamil Sangam Literature- Tamil Sangam Literature's Grammar-Tamil Sangam Literature'sparables.

UNIT II 'AGATHINAI' AND 'PURATHINAI' 9
Tholkappiyar's Meaningful Verses–Three literature materials–Agathinai's message- History of Culture from Agathinai–Purathinai–Classification–Mesaage to Society from Purathinai.

UNITIII 'ATTRUPPADAI' 9
Attruppadai Literature–Attruppadai in'Puranaanuru'-Attruppadaiin 'Pathitru paththu'- Attruppadai in 'Paththu aattu'.

UNITIV 'PURANAANURU' 9
Puranaanuru on Good Administration,Ruler and Subjects–Emotion & its Effect in Puranaanuru.

UNITV 'PATHITRU PATHTHU' 9
Pathitrupaththu in'Ettuthogai'–Pathitru paththu's Parables–Tamil dynasty:Valor, Administration, Charity in Pathitru paththu- Mesaage to Society from Pathitru paththu.

Total (L:45) = 45 PERIODS

COURSE OUTCOMES:
Upon completion of this course, the students will be able to:
1. Appreciate and apply the messages in Sanga Tamil Literature in their life.
2. Differentiate 'Agathinai' and'Purathinai'in their personal and societal life.
3. Appreciate and apply the messages in 'Attruppadai' in their personal and societal life.
4. Appreciate and apply the messages in 'Puranaanuru' in their personal and societal life.
5. Appreciate and apply the messages in 'Pathitru paththu' in their personal and societal life.

REFERENCES:

1. Sivaraja Pillai,The Chronology of the Early Tamils,Sagwan Press,2018.
2. Hank Heifetz and George L. Hart, The Puranануru, Penguin Books,2002.
3. Kamil Zvelebil,The Smile of Murugan:On Tamil Literature of South India, Brill Academic Pub,1997.
4. George L. Hart, Poets of the Tamil Anthologies: Ancient Poems of Love and War, Princeton University Press,2015.
5. Xavier S.Thani Nayagam, Land scape and poetry:a study of nature in classical Tamil poetry, sia Pub.House, 1967.

CO	PO												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
1									0.9						0.6
2									0.9						0.6
3									0.9						0.6
4									0.9						0.6
5									0.9						0.6

HSMC– ELECTIVES – HUMANITIES I (ODD SEMESTER)

HU5171 LANGUAGE AND COMMUNICATION LT P C
3 0 0 3

COURSE DESCRIPTION

This course offers an introduction to language and communication. The primary goal of this course is to familiarize students with key ideas related to communication using language as well as non verbal means. Ideas related to the use of language and the underlying power structures are also examined. The course also examines the role of media in communication and in the dissemination of ideas as well as opinions.

Objectives

- ✓ To familiarize students with the concept of communication using linguistic and non linguistic resources.
- ✓ To help students ask critical questions regarding facts and opinions.
- ✓ To provide students with the material to discuss issues such as language and power structures.
- ✓ To help students think critically about false propaganda and fake news.

Learning Outcomes

- ➢ Students will be able to use linguistic and non linguistic resources of language in an integrated manner for communication.
- ➢ Students will be able to analyse communication in terms of facts and opinions.
- ➢ Students will be able to discuss, analyse and argue about issues related to language and power.

UNIT I LINGUISTIC AND NON-LINGUISTIC RESOURCE OF COMMUNICATION: 9

a) Writing and Speech
b) Distinction between language structure and language use, form and function, acceptability and grammaticality
c) Gestures and Body language, pictures and symbols, cultural appropriacy
d) Communicative Competency, context and situation, combination of linguistic and non-linguistic elements of communication

UNIT II STRUCTURE OF WRITING/CONVERSATION: 9

a) Language skills and the communication cycle; speaking and listening, writing and reading
b) Initiating and closing conversations, intervention, turn taking
c) Writing for target reader, rhetorical devices and strategies
d) Coherence and Cohesion in speech and writing

UNIT III POWER STRUCTURE AND LANGUAGE USE: 9

a) Gender and language use
b) Politeness expressions and their use
c) Ethical dimensions of language use
d) Language rights as part of human rights

UNIT IV MEDIA COMMUNICATION: 9

a) Print media, electronic media, social media
b) Power of media
c) Manufacturing of opinion, fake news and hidden agendas

UNIT V PERSUASIVE COMMUNICATION AND MISCOMMUNICATION: 9

a) Fundamentals of persuasive communication
b) Persuasive strategies
c) Communication barriers

TOTAL : 45 PERIODS

TEXT BOOKS:

1. Austin, 1962, J.L. How to do things with words. Oxford: Clarendon Press. Grice, P.1989. Studies in the way of words. Cambridge, M.A: Harvard University Press.

2. Chomsky, N.1966. Aspects of the theory of syntax, The MIT press, Cambridge. Chomsky, N.2006. Language and Mind, Cambridge University Press.
3. Hymes. D.N. 1972, On communication competence in J.B. Pride and J.Holmes (ed), Sociolinguistics, pp 269-293, London Penguin.
4. Gilbert, H.Harman, 1976. Psychological aspect of the theory of syntax in Journal of Philosophy, page 75-87.
5. Stephen. C. Levenson, 1983, Pragmatics, Cambridge University press.
6. Stangley, J. 2007. Language in Context. Clarendon press, Oxford. 7. Shannon, 1942. A Mathematical Theory of Communication. 8. Searle, J.R. 1969. Speech acts: An essay in the philosophy of language. Cambridge: Cambridge University Press.

HU5172 VALUES AND ETHICS L T P C
3 0 0 3

OBJECTIVES:

- Teach definition and classification of values.
- Explain Purusartha.
- Describe Sarvodaya idea.
- Summarize sustenance of life.
- Conclude views of hierarchy of values.

UNIT I DEFINITION AND CLASSIFICATION OF VALUES 9

Extrinsic values- Universal and Situational values- Physical- Environmental-Sensuous- Economic-Social-Aesthetic-Moral and Religious values

UNIT II CONCEPTS RELATED TO VALUES 9

Purusartha-Virtue- Right- duty- justice- Equality- Love and Good

UNIT III IDEOLOGY OF SARVODAYA 9

Egoism- Altruism and universalism- The Ideal of Sarvodaya and Vasudhaiva Kutumbakam

UNIT IV SUSTENANCE OF LIFE 9

The Problem of Sustenance of value in the process of Social, Political and Technological Changes

UNIT V VIEWS ON HIERARCHY OF VALUES 9

The Problem of hierarchy of values and their choice, The views of Pt. Madan Mohan Malviya and Mahatma Gandhi

TOTAL: 45 PERIODS

OUTCOMES:

CO1: Able to understand definition and classification of values.

CO2: Able to understand purusartha.

CO3: Able to understand sarvodaya idea.

CO4: Able to understand sustenance of life.

CO5: Able to understand views of hierarchy of values.

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1								✓	✓			✓
CO2								✓	✓			✓
CO3								✓	✓			✓
CO4								✓	✓			✓
CO5								✓	✓			✓

TEXTBOOKS:

1. AwadeshPradhan :MahamanakeVichara. (B.H.U., Vanarasi-2007)
2. Little, William, : An Introduction of Ethics (Allied Publisher, Indian Reprint 1955)
3. William, K Frankena : Ethics (Prentice Hall of India, 1988)

HU5173 HUMAN RELATIONS AT WORK L T P C
3 0 0 3

OBJECTIVES:

- Illustrate human relations at work its relationship with self.
- Explain the importance of interacting with people at work to develop teamwork.
- Infer the importance of physical health in maintaining human relations at work.
- Describe the importance of staying psychologically healthy.
- Identify the essential qualities for progressing in career.

UNIT I UNDERSTANDING AND MANAGING YOURSELF 9

Human Relations and You: Self-Esteem and Self-Confidence: Self-Motivation and Goal Setting; Emotional Intelligence, Attitudes, and Happiness; Values and Ethics and Problem Solving and Creativity.

UNIT II DEALING EFFECTIVELY WITH PEOPLE 9

Communication in the Workplace; Specialized Tactics for Getting Along with Others in the Workplace; Managing Conflict; Becoming an Effective Leader; Motivating Others and Developing Teamwork; Diversity and Cross-Cultural Competence.

UNIT III STAYING PHYSICALLY HEALTHY 9

Yoga, Pranayam and Exercise: Aerobic and anaerobic.

UNIT IV STAYING PSYCHOLOGICALLY HEALTHY 9

Managing Stress and Personal Problems, Meditation.

UNIT V DEVELOPING CAREER THRUST 9

Getting Ahead in Your Career, Learning Strategies, Perception, Life Span Changes, and Developing Good Work Habits.

TOTAL: 45 PERIODS

OUTCOMES:

Students will be able to
CO1: Understand the importance of self-management.
CO2: Know how to deal with people to develop teamwork.
CO3: Know the importance of staying healthy.
CO4: Know how to manage stress and personal problems.
CO5: Develop the personal qualities essential for career growth.

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1						✓		✓	✓			✓
CO2									✓	✓		✓
CO3						✓		✓	✓			✓
CO4								✓				✓
CO5								✓	✓	✓		✓

TEXT BOOK:

1. Dubrien, A. J. (2017). Human Relations for Career and Personal Success: Concepts, Applications, and Skills, 11th Ed. Upper Saddle River, NJ: Pearson.

REFERENCES:

1. Greenberg, J. S. (2017). Comprehensive stress management (14th edition), New York: McGraw Hill.
2. Udai, Y. (2015). Yogasanaurpranayam. New Delhi: N.S. Publications.

HU5174 PSYCHOLOGICAL PROCESSES L T P C
3 0 0 3

COURSE DESCRIPTION

Psychological Processes course is designed for students to be aware of the basic principles of psychology for the better understanding of people's psyche and behaviour around them. This course enables learners to use the optimal use of different forms of thinking skills and thereby results in effective communication in diverse situations. Every unit of the syllabus highlights the psychological process of people, the most powerful and constructive use of perceptions.

OBJECTIVES

The major objectives of this course is

- To develop students' awareness – on psychology, learning behavior and usage of perception effectively.
- To learn to use the various kinds of thinking in a formal context.
- To critically evaluate content and comprehend the message on the bases of perception, personality and intelligence.

UNIT 1: INTRODUCTION

What is psychology? - Why study psychology? - Psychology as science – Behavior and its role in human communication – socio-cultural bases of behaviour – Biological bases of behavior - Brain and its functions – Principles of Heredity – Cognition and its functions Fields of psychology – Cognitve and Perceptual – Industrial and Organizational.

UNIT 2: SENSORY & PERCEPTUAL PROCESSES

Some general properties of Senses: Visual system – the eye, colour vision – Auditory system – Hearing, listening, Sounds - Other senses - Selective attention; physiological correlates of attention; Internal influences on perception learning – set - motivation & emotion - cognitive styles; External influences on perception figure and ground separation – movement – organization – illusion; Internal- external interactions: Constancy - Depth Perception- Binocular & Monocular Perception; Perceptual defense & Perceptual vigilance; Sensory deprivation -Sensory bombardment; ESP - Social Perception.

UNIT 3: COGNITION & AFFECT

Learning and memory – philosophy of mind – concepts - words – images – semantic features – Association of words – Repetition – Retrieval – Chunking - Schemata - Emotion and motivation – nature and types of motivation – Biological & Psychosocial motivation – nature and types of emotions – physiological & cognitive bases of emotions – expressions of emotions – managing negative emotions - enhancing positive emotions.

UNIT 4: THINKING, PROBLEM-SOLVING & DECISION MAKING

Thinking skills – Types of thinking skills – Concrete & Abstract thinking – Convergent & Divergent - Analytical & Creative thinking – Problem & Possibility thinking – Vertical & Lateral thinking – Problem solving skills – stages of problem solving skills – Decision making - intuition and reasoning skills - Thinking and language - The thinking process- concepts, problem solving, decision-making, creative thinking; language communication.

UNIT 5: PERSONALITY & INTELLIGENCE

Psychological phenomena & Attributes of humans - cognition, motivation, and behavior - thoughts, feelings, perceptions, and actions – personality dimensions, traits, patterns - Specialized knowledge, performance accomplishments, automaticity or ease of functioning, skilled performance under challenge - generative flexibility, and speed of learning or behavior change.

References

1. Morgan, C.T.and King, R.A (1994) Introduction to Psychology, Tata McGraw Hill Co Ltd, New Delhi.
2. Robert A. Baron (2002), Psychology, 5th Edition, Prentice Hall, India.
3. Michael W.Passer, Ronald E.smith (2007), Psychology: The science of mind and Behavior,3rd Edition Tata McGraw-Hill Edition.
4. Robert S.Feldman (2004) Understanding Psychology 6th Edition Tata McGraw – Hill.
5. Endler, N. S., & Summerfeldt, L. J. (1995). Intelligence. personality. psychopathology. and adjustment. In D. H. Saklofske & M. Zeidner (Eds.). International handbook of personality and intelligence (pp. 249-284). New York: Plenum Press.
6. Ford, M. E. (1994). A living systems approach to the integration of personality and intelligence. In R. J. Sternberg. & P. Ruzgis (Eds.). Personality and intelligence (pp. 188-21 7). New York: Cambridge University Press.
6. De Bono, E (1990) Lateral Thinking, Harper Perennial, New York.

HU5175 EDUCATION, TECHNOLOGY AND SOCIETY L T P C

3 0 0 3

COURSE DESCRIPTION

This course introduces students to multidisciplinary studies in Education, Technology and Society. Students will get an understanding of the relationship between education, technology and society. They will also learn about the long lasting impact of good education in a technologically advanced society.

COURSE OBJECTIVES:

The course aims

- To help learners understand the basics of different types of technology utilised in the field of education
- To make them realize the impact of education in society
- To make them evolve as responsible citizen in a technologically advanced society

LEARNING OUTCOMES

By the end of the course, learners will be able to

- Understand the various apps of technology apps and use them to access, generate and present information effectively.
- Apply technology based resources and other media formats equitably, ethically and legally.
- Integrate their technical education for betterment of society as well as their personal life.

UNIT I INDIAN EDUCATION SYSTEM

Gurukul to ICT education – Teacher as facilitator – Macaulay's Minutes – English medium vs Regional medium – Importance of Education in Modern India - Challenges in Education

UNIT II LEARNING THEORIES

Learning Theories – Behaviorism – Cognitivism – Social Constuctivism – Humanism Learning Styles – Multiple Intelligences – Emotional Intelligence – Blooms Taxonomy

UNIT III TECHNOLOGICAL ADVANCEMENTS

Web tools – Social media in education – elearning – MOOCs – Mobile assisted learning – Learning Apps – Blended learning - Self-directed learning

UNIT IV EDUCATIONAL TECHNOLOGY

Technological implications on Education – Teaching, Learning & Testing with Technology - Advantages and drawbacks – Critical analysis on the use of technology

UNIT V ETHICAL IMPLICATIONS

Plagiarism – Online Copyright issues – Ethical and value implications of education and technology on individual and society.

TOTAL:45 PERIODS

TEACHING METHODS

Teaching modes include guest lectures, discussion groups, presentations, visual media, and a practicum style of learning.

EVALUATION

As this is course is not a content based course, it focuses more on the ethical use of technology in education and society, and so, evaluation can be based on assignments and discussions. So there is no need for an end semester examination. Internals marks can be taken for the total marks.

INTERNAL (100 % WEIGHTAGE)

(a) Written Test (40 marks)

(b) Assignment: Write a real time report of the technology use in any school / college (15 marks)

(c) Presentation: Students choose any one of the technological tools and present its relevance to education and society (15 marks)

(d) Group discussion: Students discuss in groups on case studies relating to various challenges in education and technology use in society (20 marks)

(e) Blog entry: Making weekly blog posts in Class Blog on the topics related to the course posted by the instructor and commenting on others' posts. (10 marks)

REFERENCES

1) Education and Social order by Bertrand Russel
2) Theories of learning by Bower and Hilgard
3) Technology and Society by Jan L Harrington

HU5176 PHILOSOPHY L T P C
3 0 0 3

OBJECTIVES

- To create a new understanding by teaching philosophy through a comparison of Indian and Western traditions.
- To Fosters critical thinking and imagination by dealing with inter-related concepts in literature and science.
- To bridge the gap between the sciences and humanities through introspective analyses.
- To nurture an understanding of the self and elucidates ways to progress towards a higher understanding of one's self and others.

UNIT I KNOWLEDGE 9

Knowledge (Vidya) Versus Ignorance (Avidya)- Brihadaranyaka Upanishad. Unity and Multiplicity – Isha Upanishad. What is True Knowledge? Ways to True Knowledge. Introduction to Philosophy of Yoga, Socratic Debate, Plato's Views. Asking and Answering Questions to Stimulate Critical Thinking and to Draw Ideas. Argumentative Dialogues. Dialectical Methods to Arrive at Conclusions.

UNIT II ORIGIN **9**

Origin of Universe And Creation – 'Nasidiya Sukta' in Relation With Big Bang Theory. Greek Concept of Chaos. The Concept of Space – Space as the Final Goal – Udgitha. Relationship Between Teacher And Student – The Knowledge Of Combinations, Body And Speech – Siksha Valli – Taittriya Upanishad.

UNIT III WORD **9**

Aum- Speech and Breath as Pair – Chandogya Upanishad and Brihadaryanaka Upanishad. Significance of Chants, Structure of Language and Cosmic Correspondences. The Non-Dual Word – Bhartrihari's Vakyapadiyam. Sphota-Ultimate Reality Expressed Through Language. Intention. Thought 'Sabdanaor' and Speaking.

UNIT IV KNOWLEDGE AS POWER/OPPRESSION **9**

Power- as Self-Realization in Gita. Krishna's Advice to Arjuna on How to Conquer Mind. Francis Bacon – Four Idols – What Prevents One From Gaining Knowledge? Michel Foucault- Knowledge as Oppression. Panopticon. Rtam (Truth) and Satyam (Eternal Truth).

UNIT V SELF KNOWLEDGE/BRAHMAN **9**

Knowledge about Self, Transcendental Self. The Different Chakras and the Stages of Sublimation. Philosophy of Yoga and Siva for Union of Mind and Body. Concept of Yin/Yang. Aspects of the Feminine / Masculine.

TOTAL : 45 PERIODS

OUTCOMES:

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

1. Think sceptically, ask questions and to arrive at deductions.
2. Connect and relate different branches of thought.
3. Comprehends the relation between language, thought and action.
4. Arrive at a better understanding of self and others and forms a new outlook.

REFERENCES:

1. Swami Nikhilananda: The Upanishads, Swami Nikhilananda, Advaita Ashrama, Kolkata.
2. Swamy Tapasyananda: Srimad Bhagavad Gita, The Scripture of Mankind, Sri Ramakrishna Math, Chennai.
3. Subrahmanyam, Korada: Vakyapadiyam of Bhartrhari Brahmakanda, Sri Garib Dass series.
4. Swami Lokeswarananda: Chandogya Upanishad, Swami Lokeswarananda, Ramakrishna Mission Institute of Culture, Kolkata.
5. Brahma, Apuruseya: The Four Vedas: Translated in English.
6. Haich, Elizabeth: Sexual Energy and Yoga.
7. Bacon, Francis: Power as Knowledge
8. Vlastos, Gregory: Socrates Ironist and Moral Philosopher.
9. Plato: The Republic, Penguin.
10. Gutting, Garry: Foucault A Very Short Introduction, Oxford.

HU5177 APPLICATIONS OF PSYCHOLOGY IN EVERYDAY LIFE **L T P C**
3 0 0 3

UNIT I INTRODUCTION **7**

Nature and fields.

UNIT II PSYCHOLOGY IN INDUSTRIES AND ORGANIZATIONS **9**

Job analysis; fatigue and accidents; consumer behavior.

UNIT III PSYCHOLOGY AND MENTAL HEALTH **11**

Abnormality, symptoms and causes psychological disorders

UNIT IV PSYCHOLOGY AND COUNSELING **7**

Need of Counseling, Counselor and the Counselee, Counseling Process, Areas of Counseling.

UNIT V PSYCHOLOGY AND SOCIAL BEHAVIOUR **11**

Group, group dynamics, teambuilding, Prejudice and stereotypes; Effective Communication, conflict and negotiation.

TOTAL: 45 PERIODS

TEXTBOOKS

1. Schultz, D. & Schultz, S.E. (2009). Psychology and Work Today (10th ed.). New Jersey:Pearson/Prentice Hall
2. Butcher, J. N., Mineka, S., & Hooley, J. M. (2010). Abnormal psychology (14th ed.). New York: Pearson
3. Gladding, S. T. (2014). Counselling: A comprehensive profession. New Delhi: Pearson Education
4. Aronson, E., Wilson, T. D., & Akert, R. M. (2010). Social Psychology (7th Ed.). Upper Saddle River, NJ: Prentice Hall