B.E. Degree

in

CIVIL ENGINEERING

CURRICULUM & SYLLABUS (CBCS)

(For students admitted from the Academic Year 2022-2023)

DEPARTMENT OF CIVIL ENGINEERING

St. XAVIER'S CATHOLIC COLLEGE OF ENGINEERING

CHUNKANKADAI, NAGERCOIL – 629 003.

KANYAKUMARI DISTRICT, TAMILNADU, INDIA

St. XAVIER'S CATHOLIC COLLEGE OF ENGINEERING

Chunkankadai, Nagercoil – 629 003.

AUTONOMOUS COLLEGE AFFILIATED TO ANNA UNIVERSITY

ACADEMIC REGULATIONS 2022

B. E. CIVIL ENGINEERING CURRICULUM

CHOICE BASED CREDIT SYSTEM

INTRODUCTION

In consonance to the vision of our College,

An engineering graduate we form would be a person with optimal human development, i.e. physical, mental, emotional, social and spiritual spheres of personality.

He/she would be also a person mature in relationships, especially knowing how to treat everyone with respect, including persons of complementary gender with equality and gender sensitivity guided by clear and pro-social values.

He/she would be patriotic and would hold the Indian Constitution and all the precepts it outlays close to his/her heart and would have a secular spirit committed to safeguard and cherish the multi-cultural, multi-religious and multi-linguistic ethos of the Indian Society.

Academically, he/she would be a graduate with a strong engineering foundation with proficient technical knowledge and skills. He/she would have enough exposure and experience into the ethos of relevant industry and be industry ready to construct a successful career for himself/herself and for the benefit of the society.

He/She would have been well trained in research methodology and would have established himself/herself as a researcher having taken up many research projects, with sound ethical standards and social relevance. He/She would be a person with a passion for technical innovations committed to lifelong learning and research.

He/She would be well prepared and confident to develop ingenuous solutions to the problems people face as an individual and as a team and work for the emancipation of our society with leadership and courage.

Civil Engineering being one of the oldest and broadest engineering disciplines, involves protecting the public and environmental health as well as improving existing infrastructure. The curriculum equips the students to understand real-life situations, problems, and to plan, develop and maintain infrastructure and facilities essential to modern life.Students get an opportunity to participate in field trips to get into real world as a part of Civil Engineering syllabus and curriculum.

I. PROGRAMME EDUCATIONAL OBJECTIVES (PEOs)

I.	Graduates will become professionals with social responsibility adapting emerging technical innovations to safeguard sustainable environment.
II.	Graduates will be proficient in coordinating multivocational projects to achieve professional excellence.
III.	Graduates will engage in continuous learning and research to arrive at high level intelligent and imaginative solutions to problems.
IV.	Graduates will apply their advanced knowledge and skills to make sufficient contributions to industry practices and innovation driven Civil activities.
V.	Graduates will collaborate across disciplines applying their expertise involving themselves in various inter disciplinary research projects to address multifaceted challenges of the society.

II. PROGRAMME OUTCOMES (POs)

PO#	Graduate Attribute
1	**Engineering knowledge**: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
2	**Problem analysis**: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
3	**Design/development of solutions**: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
4	**Conduct investigations of complex problems**: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
5	**Modern tool usage**: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modelling to complex engineering activities with an understanding of the limitations.
6	**The engineer and society**: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
7	**Environment and sustainability**: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
8	**Ethics**: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
9	**Individual and team work**: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
10	**Communication:** Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and

	write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
11	**Project management and finance:** Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
12	**Life-long learning**: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

III. PROGRAMME SPECIFIC OUTCOMES (PSOs)

1	Demonstrate knowledge in core areas of Civil Engineering such as planning, designing, estimating and carrying out construction.
2	Apply the concept of sustainable development in the context of environment, economic and social requirements.
3	Develop research activities, consultancy services with critical thinking, professional development and lifelong learning.

PEO's – PO's & PSO's MAPPING:

PEO	PO												PSO		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
I.	2	1	3	3	3	2	2	1	3	3	3	2	3	2	2
II.	3	3	-	1	1	2	-	-	1	3	3	3	2	1	3
III.	1	-	-	-	-	-	2	3	1	3	3	3	2	1	3
IV.	-	3	1	2	3	1	1	-	1	1	-	3	1	1	3
V.	2	2	2	2	1	1	2	2	3	3	3	3	1	3	1

PROGRAMME ARTICULATION MATRIX

Year	Semester	Course Code	PO												PSO		
			1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
I	I	MA22101	3	2	-	-	-	-	-	-	-	-	-	1	1	-	1
		PH22101	2	1	-	-	-	-	-	-	-	-	-	1	-	1	-
		CH22101	3	2	2	1	-	-	2	-	-	-	-	1	-	1	-
		CS22101	3	3	3	3	-	-	-	-	-	-	-	1	-	-	3
		EN22101	-	-	-	-	-	-	-	-	2	2	-	2	-	1	-
		BS22101	3	1	-	-	-	2	2	-	2	1	-	1	-	1	-
		CS22102	3	3	3	3	2	-	-	-	-	-	-	1	1	-	2

		HS22101	3	2	2	1	-	-	2	-	2	-	1	1	-	-	3
		HS22102	1	-	-	-	-	2	2	3	1	1	-	1	-	-	3
		GE3152	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-
	II	MA22201	3	2	-	-	-	-	-	-	-	-	-	1	1	-	1
		ES22202	3	2	2	2	-	-	-	-	-	-	-	1	1	-	-
		CE22201	2	2	2	-	2	2	2	2	2	2	2	2	2	1	3
		ME22201	3	1	-	-	-	-	-	-	-	2	-	-	2	-	-
		EN22201	-	-	-	-	-	-	-	-	2	3	-	2	-	1	-
		PH22201	2	1	-	-	-	-	-	-	2	1	-	1	-	1	-
		CH22201	3	-	-	-	-	-	3	-	1	1	-	1	-	3	1
		CE22202	2	2	2	2	2	2	2	2	2	2	2	2	3	-	2
		ES22203	3	-	-	-	-	-	-	-	3	1	-	1	-	1	-
		GE3252	-	-	-	-	-	1	1	-	-	-	-	-	-	-	-
II	III	MA22304	3	2	1	-	-	-	-	-	-	-	-	-	1	-	-
		CE22301	3	3	3	2	-	-	-	2	2	2	2	3	3	-	1
		CE22302	3	3	2	2	2	2	2	2	-	2	2	3	-	2	2
		CE22303	3	2	2	2	2	2	-	-	2	2	2	2	2	-	1
		CE22304	3	3	3	3	2	2	2	2	2	2	2	3	3	-	3
		CE22305	3	2	3	1	3	2	1	-	-	2	2	3	2	3	3
		SD22301	3	2	2	-	2	-	-	-	-	-	-	2	-	1	1
		AC22301	-	1	1	1	1	1	1	1	1	1	1	1	-	-	-
		HS22301	-	-	-	-	-	2	-	1	1	2	-	2	-	1	-
	IV	CE22401	3	2	2	2	1	2	-	-	1	1	-	3	2	2	1
		CE22402	3	3	2	2	2	2	2	1	2	1	2	2	2	-	1
		CE22403	3	2	2	2	2	2	2	2	2	2	2	2	2	1	1
		CE22404	3	2	2	2	1	1	1	-	1	-	-	2	3	2	2
		CE22405	3	2	3	2	-	2	2	1	-	-	-	1	3	2	2
		CE22406	3	2	1	2	2	1	-	1	2	-	2	3	3	-	1
		CE22407	2	2	3	2	2	2	-	-	1	-	1	2	3	1	1
		CE22408	3	2	2	2	2	2	-	-	2	2	2	2	2	-	1
		SD22401	3	2	2	-	2	-	-	-	-	-	-	2	-	1	1
		AC22401	2	1	2	-	-	2	1	-	-	-	-	1	-	2	-

III	V	CE22501	2	2	2	2	2	2	2	2	-	2	2	3	2	2	2
		CE22502	3	3	3	3	-	2	2	3	2	-	-	3	3	2	2
		CE22503	2	2	1	3	3	3	2	2	3	2	2	3	1	2	3
		CE22504	2	2	2	2	2	1	1	-	-	2	-	1	2	2	2
		CE22505	2	2	2	2	2	1	1	-	-	2	-	1	2	2	2
		AC22501	1	1	1	1	1	2	1	2	1	1	1	1	-	2	-
		HS22501	-	-	-	-	-	2	-	1	1	2	-	2	-	1	-
	VI	HS22601	-	-	-	-	-	2	2	3	2	1	-	2	-	-	-
		CE22601	3	3	3	2	-	-	-	2	2	2	2	3	3	-	1
		CE22602	2	2	2	2	2	2	2	2	-	2	2	3	2	2	2
		CE22603	2	2	1	2	2	1	1	-	3	3	-	2	3	1	3
		SD22603	2	2	2	-	2	-	-	-	1	-	-	2	-	1	-
IV	VII	CE22701	3	-	-	2	3	-	-	-	1	2	3	2	3	-	1
		CE22702	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
		SD22703	2	2	2	-	2	-	-	-	1	-	-	2	-	1	-
	VIII	CE22801	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3

SEMESTER I

SL. NO.	COURSE CODE	COURSE TITLE	CATE-GORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
THEORY COURSES								
1	MA22101	Matrices and Calculus	BSC	3	1	0	4	4
2	PH22101	Engineering Physics	BSC	3	0	0	3	3
3	CH22101	Engineering Chemistry	BSC	3	0	0	3	3
4	CS22101	Problem Solving and Python Programming	ESC	3	0	0	3	3
5	GE3152	Heritage of Tamil, தமிழர் மரபு	MC	1	0	0	1	1
THEORY COURSES WITH PRACTICAL COMPONENT								
6	EN22101	Communicative English	HSMC	2	0	2	4	3

PRACTICAL COURSES								
7	BS22101	Physics & Chemistry Laboratory	BSC	0	0	4	4	2
8	CS22102	Python Programming Laboratory	ESC	0	0	4	4	2
MANDATORY COURSES								
9	IP22101	Induction Programme	-	-	-	-	-	0
10	HS22101	Higher Order Thinking	MC	1	0	0	1	1
11	HS22102	Universal Human Values : Understanding Harmony and Ethical Human Conduct	HSMC	2	0	0	2	2
TOTAL				18	1	10	29	24

SEMESTER II

SL. NO.	COURSE CODE	COURSE TITLE	CATE-GORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
THEORY COURSES								
1	MA22201	Statistics and Numerical Methods	BSC	3	1	0	4	4
2	ES22202	Basic Electrical and Electronics Engineering	ESC	3	0	0	3	3
3	CE22201	Building Materials and Techniques	ESC	3	0	0	3	3
4	ME22201	Engineering Graphics	ESC	2	0	2	4	3
5	GE3252	Tamils And Technology, தமிழரும் தொழில்நுட்பமும்	MC	1	0	0	1	1
THEORY COURSES WITH PRACTICAL COMPONENT								
6	EN22201	Technical English	HSMC	2	0	2	4	3
7	PH22201	Physics for Civil	BSC	2	0	2	4	3

		Engineers						
8	CH22201	Environment and Sustainability	BSC	2	0	2	4	3
PRACTICAL COURSES								
9	CE22202	Building Materials Laboratory	ESC	0	0	4	4	2
10	ES22203	Engineering Practices Laboratory	ESC	0	0	4	4	2
TOTAL				19	1	14	34	27

SEMESTER III

SL. NO.	COURSE CODE	COURSE TITLE	CATE-GORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
THEORY COURSES								
1	MA22304	Transforms and Partial Differential Equations	BSC	3	1	0	4	4
2	CE22301	Strength of Materials	PCC	3	1	0	4	4
3	CE22302	Soil Mechanics	PCC	3	0	0	3	3
THEORY COURSES WITH PRACTICAL COMPONENT								
4	CE22303	Surveying	PCC	3	0	2	5	4
5	CE22304	Concrete Technology	PCC	2	0	2	4	3
PRACTICAL COURSES								
6	CE22305	Computer Aided Building Drawing	PCC	0	0	4	4	2
EMPLOYABILITY ENHANCEMENT COURSES								
7	SD22301	Coding Skills and Soft Skills Training – Phase I	EEC	0	0	4	4	2
MANDATORY COURSES								
8	AC22301	Constitution of India	AC	2	0	0	2	0
9	HS22301	Value Education I	MC	1	0	0	1	0
TOTAL				17	2	12	31	22

SEMESTER IV

SL. NO.	COURSE CODE	COURSE TITLE	CATE-GORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
THEORY COURSES								
1	CE22401	Structural Analysis	PCC	3	1	0	4	4
2	CE22402	Foundation Engineering	PCC	3	0	0	3	3
3	CE22403	Highway and Railway Engineering	PCC	3	0	0	3	3
4	CE22404	Fluid Mechanics & Hydraulic Machines	PCC	3	0	0	3	3
5	CE22405	Environmental Engineering	PCC	3	0	0	3	3
PRACTICAL COURSES								
6	CE22406	Strength of Materials Laboratory	PCC	0	0	4	4	2
7	CE22407	Hydraulic Engineering Laboratory	PCC	0	0	4	4	2
8	CE22408	Survey Camp (2 weeks – During Winter Vacation)	PCC	-	-	-	-	1
EMPLOYABILITY ENHANCEMENT COURSES								
9	SD22401	Coding Skills and Soft Skills Training – Phase II	EEC	0	0	4	4	2
MANDATORY COURSES								
10	AC22401	Industrial Safety Engineering	AC	2	0	0	2	0
TOTAL				17	1	12	30	23

SEMESTER V

SL. NO.	COURSE CODE	COURSE TITLE	CATE-GORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		

THEORY COURSES								
1	CE22501	Irrigation Engineering	PCC	3	0	0	3	3
2		Professional Elective I	PEC	3	0	0	3	3
3		Professional Elective II	PEC	3	0	0	3	3
THEORY COURSES WITH PRACTICAL COMPONENT								
4	CE22502	Design of Reinforced Concrete Elements	PCC	3	0	2	5	4
PRACTICAL COURSES								
5	CE22503	Soil Mechanics Laboratory	PCC	0	0	4	4	2
6	CE22504	Environmental Engineering Laboratory	PCC	0	0	4	4	2
7	CE22505	Inplant / Industrial Training (2 weeks - During 4^{th} semester Summer Vacation)	EEC	0	0	0	0	1
EMPLOYABILITY ENHANCEMENT COURSES								
8	SD22501	Coding Skills and Soft Skills Training – Phase III	EEC	0	0	4	4	2
MANDATORY COURSES								
9	AC22501	Entrepreneurship Development	AC	2	0	0	2	0
10	HS22501	Value Education II	MC	1	0	0	1	0
TOTAL				15	0	14	29	20

SEMESTER VI

SL. NO.	COURSE CODE	COURSE TITLE	CATE - GORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
THEORY COURSES								
1	HS22601	Professional Ethics	HSMC	3	0	0	3	3
2		Open Elective – I	OEC	3	0	0	3	3

3		Professional Elective III	PEC	3	0	0	3	3
4		Professional Elective IV	PEC	3	0	0	3	3
THEORY COURSES WITH PRACTICAL COMPONENT								
5	CE22601	Design of Steel Structures	PCC	3	0	2	5	4
6	CE22602	Estimation and Costing	PCC	2	0	2	4	3
EMPLOYABILITY ENHANCEMENT COURSES								
7	CE22603	Technical Seminar	EEC	0	0	2	2	1
8	SD22603	Coding Skills and Quantitative Aptitude – Phase I	EEC	0	0	4	4	2
TOTAL				17	0	10	27	22

SEMESTER VII

SL. NO.	COURSE CODE	COURSE TITLE	CATE - GORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
THEORY COURSES								
1		Professional Elective V	PEC	3	0	0	3	3
2		Professional Elective VI	PEC	3	0	0	3	3
3		Open Elective – II	OEC	3	0	0	3	3
4		Open Elective – III	OEC	3	0	0	3	3
THEORY COURSES WITH PRACTICAL COMPONENT								
5	CE22701	Construction Planning and Project management	PCC	2	0	2	4	3
EMPLOYABILITY ENHANCEMENT COURSES								
6	CE22702	Mini Project	EEC	0	0	6	6	3
7	SD22703	Coding Skills and Quantitative Aptitude – Phase II	EEC	0	0	4	4	2
TOTAL				14	0	12	26	20

SEMESTER VIII

SL. NO.	COURSE CODE	COURSE TITLE	CATE - GORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
EMPLOYABILITY ENHANCEMENT COURSES								
1	CE22801	Project Work	EEC	0	0	16	16	8
TOTAL				0	0	16	16	8

(Total Credits = 166)

SUMMARY

B.E.Civil Engineering										
S.No.	Subject Area	Credits per Semester								Total Credits
		I	II	III	IV	V	VI	VII	VIII	
1	HSMC	5	3	-	-	-	3	-	-	11
2	BSC	12	10	4	-	-	-	-	-	26
3	ESC	5	13	-	-	-	-	-	-	18
4	PCC	-	-	16	21	11	7	3	-	58
5	PEC	-	-	-	-	6	6	6	-	18
6	OEC	-	-	-	-	-	3	6	-	9
7	EEC	-	-	2	2	3	3	5	8	23
9	Non-Credit/(Mandatory)	2	1	-	-	-	-	-	-	3
Total		24	27	22	23	20	22	20	8	166

PROFESSIONAL ELECTIVE COURSES

LIST OF IDENTIFIED VERTICALS	
1.	Construction Engineering and Management
2.	Environment Engineering
3.	Hydraulics and Hydrology
4.	Structural Engineering
5.	Diversified Courses

Sl.No.	Vertical 1: Construction Engineering and Management	Vertical 2: Environment Engineering	Vertical 3: Hydraulics and Hydrology	Vertical 4: Structural Engineering	Vertical 5: Diversified Courses
1	Construction Management and Safety	Air and Noise Pollution Control	Surface Water Hydrology	Design of Prestressed Concrete Structures	Remote Sensing and GIS
2	Repair and Rehabilitation of Structures	Solid and Hazardous Waste Management	Groundwater Engineering	Structural Dynamics and Earthquake Engineering	Advanced Surveying
3	Prefabricated Structures	Industrial Wastewater Management	Participatory Water Resources Management	Basics of Finite Element Analysis	Pavement Engineering
4	Smart Materials and Measuring Technology	Environmental Impact Assessment	Open Channel Flow	Modern Methods of Structural Analysis	Airport, Docks and Harbour Engineering
5	Housing Planning and Management	Environmental Health and Safety	Advanced Fluid Mechanics	Bridge Engineering	Ground Improvement Techniques
6	Structural Geology	Geo Environmental Engineering	Coastal Zone Management	Geotechnical Engineering	Applications of AI in Civil Engineering

VERTICAL 1: Construction Engineering and Management (6 Courses)

Sl. No.	Course Code	Course Title	Category	Periods per Week			Total Contact Periods	Credits
				L	T	P		
1.	CE22511	Construction Management and Safety	PEC	3	0	0	3	3
2.	CE22512	Repair and Rehabilitation of Structures	PEC	3	0	0	3	3
3.	CE22613	Prefabricated Structures	PEC	3	0	0	3	3
4.	CE22614	Smart Materials and Measuring Technology	PEC	3	0	0	3	3
5.	CE22715	Housing Planning and Management	PEC	3	0	0	3	3
6.	CE22716	Structural Geology	PEC	3	0	0	3	3

VERTICAL 2: Environment Engineering (6 Courses)

Sl. No.	Course Code	Course Title	Category	Periods per Week			Total Contact Periods	Credits
				L	T	P		
1.	CE22521	Air and Noise Pollution Control	PEC	3	0	0	3	3
2.	CE22522	Solid and Hazardous Waste Management	PEC	3	0	0	3	3
3.	CE22623	Industrial Wastewater Management	PEC	3	0	0	3	3
4.	CE22624	Environmental Impact Assessment	PEC	3	0	0	3	3
5.	CE22725	Environmental Health and Safety	PEC	3	0	0	3	3
6.	CE22726	Geo Environmental Engineering	PEC	3	0	0	3	3

VERTICAL 3: Hydraulics and Hydrology (6 Courses)

Sl. No.	Course Code	Course Title	Category	Periods per Week			Total Contact Periods	Credits
				L	T	P		
1.	CE22531	Surface water Hydrology	PEC	3	0	0	3	3
2.	CE22532	Ground Water Engineering	PEC	3	0	0	3	3
3.	CE22633	Participatory Water Resources Management	PEC	3	0	0	3	3
4.	CE22634	Open Channel Flow	PEC	3	0	0	3	3
5.	CE22735	Advanced Fluid Mechanics	PEC	3	0	0	3	3
6.	CE22736	Coastal Zone Management	PEC	3	0	0	3	3

VERTICAL 4: Structural Engineering (6 Courses)

Sl. No.	Course Code	Course Title	Category	Periods per Week			Total Contact Periods	Credits
				L	T	P		
1.	CE22541	Design of Prestressed Concrete Structures	PEC	3	0	0	3	3
2.	CE22542	Structural Dynamics and Earthquake Engineering	PEC	3	0	0	3	3

3.	CE22643	Basics of Finite Element Analysis	PEC	3	0	0	3	3
4.	CE22644	Modern Methods of Structural Analysis	PEC	3	0	0	3	3
5.	CE22745	Bridge Engineering	PEC	3	0	0	3	3
6.	CE22746	Geotechnical Engineering	PEC	3	0	0	3	3

VERTICAL 5: Diversified Courses (6 Courses)

Sl. No.	Course Code	Course title	Category	Periods per Week			Total Contact Periods	Credits
				L	T	P		
1.	CE22551	Remote Sensing and GIS	PEC	3	0	0	3	3
2.	CE22552	Advanced Surveying	PEC	3	0	0	3	3
3.	CE22653	Pavement Engineering	PEC	3	0	0	3	3
4.	CE22654	Airport Docks and Harbour Engineering	PEC	3	0	0	3	3
5.	CE22755	Ground Improvement Techniques	PEC	3	0	0	3	3
6.	CE22756	Applications of AI in Civil Engineering	PEC	3	0	0	3	3

OPEN ELECTIVE COURSES

OPEN ELECTIVE – I

(TO BE OFFERED TO OTHER DEPARTMENT)

Sl. No.	Course Code	Course Title	Category	Periods per Week			Total Contact Periods	Credits
				L	T	P		
1.	CE22681	Climate Change and its Impact	OEC	3	0	0	3	3
2.	CE22682	Selection of Materials	OEC	3	0	0	3	3

OPEN ELECTIVE – II

(TO BE OFFERED TO OTHER DEPARTMENT)

Sl. No.	Course Code	Course Title	Category	Periods per Week			Total Contact Periods	Credits
				L	T	P		
1.	CE22781	Environment and Agriculture	OEC	3	0	0	3	3
2.	CE22782	Drinking Water Supply and Treatment	OEC	3	0	0	3	3

OPEN ELECTIVE – III

(TO BE OFFERED TO OTHER DEPARTMENT)

Sl. No.	Course Code	Course Title	Category	Periods per Week			Total Contact Periods	Credits
				L	T	P		
1.	CE22783	Green Building	OEC	3	0	0	3	3
2.	CE22784	Air Pollution and Control Engineering	OEC	3	0	0	3	3

SEMESTER I

MA22101	MATRICES AND CALCULUS	L	T	P	C
		3	1	0	4

COURSEOBJECTIVES:

- 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 acquaint the student with mathematical tools needed in evaluating multiple integrals and their applications.
- To make the students understand various techniques of ODE.

UNITI	MATRICES	12

Characteristic equation – Eigenvalues and Eigenvectors of a real matrix – Properties of eigenvalues and eigenvectors – Problem solving using Cayley-Hamilton method – Orthogonal transformation of a symmetric matrix to Diagonal form – Reduction of a quadratic form to canonical form by orthogonal transformation – Nature, rank, index.

UNIT II	DIFFERENTIAL CALCULUS	12

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

UNIT III	FUNCTIONS OF SEVERAL VARIABLES	12

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

UNIT IV	MULTIPLE INTEGRALS	12

Double integrals – Double integrals in Cartesian and polar coordinates –Area enclosed by plane curves - Change of order of integration – Triple integrals – Volume of solids: cube, rectangular parallelopiped.

UNIT V	ORDINARY DIFFERENTIAL EQUATIONS	12

Linear differential equations of second and higher order with constant coefficients when the R.H.S is e^{ax}, x^n , sin ax, cos ax, $e^{ax}\,x^n$, e^{ax} sinbx, e^{ax} cosbx – Linear differential equations of second and third order with variable coefficients: Cauchy's and Legendre's linear equations – Method of variation of parameter .

TOTAL: 60 PERIODS

COURSE OUTCOMES:

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

CO1:	Define the basic concepts of matrices, limit and continuity of a function, differentiation, ODE and integration.
CO2:	Explain the properties of matrices and nature of the quadratic form.
CO3:	Interpret the techniques of differentiation, partial differentiation, ODE and integration.

CO4:	Apply diagonalization of matrices in quadratic form and apply Cayley Hamilton theorem to find the inverse of matrices.
CO5:	Solve problems on differentiation, partial differentiation, integration and ODE using different methods.
TEXT BOOKS:	
1.	Narayanan, S. and ManicavachagomPillai, T. K., "Calculus" Volume I and II, S. Viswanathan Publishers Pvt. Ltd., Chennai, Reprint 2017.
2.	Grewal B.S., "Higher Engineering Mathematics", Khanna Publishers, New Delhi, 43rd Edition, 2014.
REFERENCES:	
1.	Ramana. B.V., "Higher Engineering Mathematics", McGraw Hill Education Pvt. Ltd, New Delhi, 2016.
2.	Anton. H, Bivens. I and Davis. S, "Calculus", Wiley, 10th Edition, 2016.
3.	Jain R.K. and Iyengar S.R.K., "Advanced Engineering Mathematics", Narosa Publications, New Delhi, 3rd Edition, 2007.
4.	Kreyszig.E, "Advanced Engineering Mathematics", John Wiley and Sons, 10th Edition, New Delhi, 2016.
5.	Bali. N., Goyal. M. and Watkins. C., "Advanced Engineering Mathematics", Firewall Media (An imprint of Lakshmi Publications Pvt., Ltd.,), New Delhi, 7th Edition, 2009.

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

Table of Specification (ToS) for End Semester Question Paper

Unit No. and Title	**Total 2 Marks Qns.**	**Total 16 Marks Qns.**	**Bloom's Taxonomy (Cognitive) Level**			
			Remember (Kn)	**Understand (Un)**	**Apply (Ap)**	**Analyse(An) Evaluate (Ev)**
Unit-I: Matrices	2	1 either or	1(2)-CO1	1(2)-CO2	1either or (16)-CO4	-
Unit-II: Differential Calculus	2	1 either or	-	2(2)-CO3	1either or (16)-CO5	-
Unit-III: Functions of Several Variables	2	1 either or	-	2(2)-CO3	1either or (16)-CO5	-
Unit-IV: Multiple Integrals	2	1 either or	-	2(2)-CO3	1either or (16)-CO5	-

Unit-V: Ordinary differential equations	2	1 either or	-	2(2)-CO3	1either or (16)-CO5	-
Total Qns. Matrices and Calculus	10	5 either or	1(2)	9(2)	5 either or(16)	-
Total Marks	20	80	2	18	80	-
Weightage	20%	80%	2%	18%	80%	-

Weightage for COs					
	CO1	**CO2**	**CO3**	**CO4**	**CO5**
Total Marks	2	2	16	16	64
Weightage	2%	2%	16%	16%	64%

PH22101	**ENGINEERING PHYSICS**	**L**	**T**	**P**	**C**
		3	**0**	**0**	**3**

COURSEOBJECTIVES:

- To enhance the fundamental knowledge in Physics and its applications relevant to various streams of Engineering and Technology.
- To help the students to interrelate the topics such as properties of matter, thermal.physics, ultrasonics, quantum theory and crystals, learned in the course.
- To motivate students to compare and contrast the available equipment in the respective fields.
- To induce the students to design new devices that serve humanity by applying the knowledge gained during the course.

UNITI	**PROPERTIES OF MATTER**	**9**

Elasticity – Types of elastic moduli – Factors affecting elasticity - Stress-strain diagram and its uses - Beams - Bending moment – Cantilever: Theory and experiment – Uniform and non-uniform bending: Determination of Young's Modulus – I-shaped Girders - Twisting couple - Torsion pendulum: Determination of Rigidity Modulus and Moment of Inertia – Torsion springs - Other states of matter.

UNIT II	**THERMAL PHYSICS**	**9**

Modes of Heat transfer – Thermal conductivity – Newton's law of cooling – Linear heat flow – Thermal conductivity in compound media - Lee's Disc method – Radial heat flow – Rubber tube method – Solar water heater - Thermodynamics – Isothermal and adiabatic process – Otto cycle – Diesel cycle.

UNIT III	**ULTRASONICS**	**9**

Sound waves – Ultrasonics – Properties - Production: Magnetostriction method - Piezoelectric method – Cavitation - Acoustic grating: Wavelength and velocity of ultrasonic waves in liquids – Applications: welding, machining, cleaning, soldering and mixing (qualitative) -SONAR – Ultrasonic flaw detector - Ultrasonography.

UNIT IV	**QUANTUM PHYSICS**	**9**

Black body radiation – Planck's radiation law – Deduction of Wien's displacement law and Rayleigh Jean's law - Compton effect, Photoelectric effect (qualitative) – Matter waves – Concept of wave function and its physical significance – Schrödinger's wave equation – Time

independent and time dependent equations – Particle in a one-dimensional rigid box – Scanning tunneling microscope.		
UNIT V	**CRYSTAL PHYSICS**	**9**
Crystalline and amorphous materials – Unit cell, Crystal systems, Bravais lattices, Crystal planes, Directions and Miller indices – Characteristics of crystal structures: SC, BCC, FCC and HCP structures - Crystal imperfections: point, line and surface defects – Crystal growth : epitaxial and lithography techniques.		
TOTAL: 45 PERIODS		

COURSE OUTCOMES:

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

CO1:	Recall the basics of properties of matter, thermal physics and ultrasonics, to improve their engineering knowledge.
CO2:	Define the advanced physics concepts of quantum theory and the characteristics of crystalline materials.
CO3:	Illustrate Bending of beams, thermal behavior and ultrasonic devices to assess societal and safety issues.
CO4:	Summarize the dual aspects of matter, crystal structures and imperfections of crystals.
CO5:	Apply the moduli of elasticity of different materials, thermal energy, ultrasonics, scanning tunneling microscope and crystal growth techniques in engineering fields.

TEXT BOOKS:

1.	Gaur, R.K & Gupta.S.L, Engineering Physics, Dhanpat Rai Publishers, 2016.
2.	Shatendra Sharma & Jyotsna Sharma, Engineering Physics, Pearson India Pvt Ltd., 2018.

REFERENCES:

1.	Halliday.D, Resnick, R. & Walker. J, "Principles of Physics", Wiley, 2015.
2.	Bhattacharya, D.K. & Poonam.T., "Engineering Physics", Oxford University Press, 2015.
3.	Pandey.B.K, & Chaturvedi.S, "Engineering Physics", Cengage Learning India. 2012.
4.	Malik H K & Singh A K, "Engineering Physics", McGraw Hill Education (India Pvt. Ltd.), 2nd edition, 2018.
5.	Serway.R.A. & Jewett, J.W, "Physics for Scientists and Engineers", Cengage Learning India. 2010.

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

Table of Specification (ToS) for End Semester Question Paper

Unit No.andTitle	Total2 Marks Qns.	Total16 Marks Qns.	Bloom's Taxonomy (Cognitive) Level			
			Remember (Kn)	Understand (Un)	Apply (Ap)	Analyse(An) Evaluate(Ev)
			No.ofQns.(marks)andCO			
Unit I - Properties of Matter	2	1 either or	1(2)-CO1	1(2)-CO3	1 either or (16)- CO5	-
Unit II - Thermal Physics	2	1 either or	1(2)-CO1	1(2)- CO3	1 either or (16)- CO5	-
Unit III - Ultrasonics	2	1 either or	2(2)- CO1	-	1 either or (16)- CO5	-
Unit IV - Quantum Physics	2	1 either or	1(2)-CO2	1 (2)- CO4 1either or (16)-CO4	-	-
Unit V - Crystal Physics	2	1 either or	2(2)-CO2	1 either or (16)- CO4	-	-
TotalQns.Engineering Physics	10	5 either or	7(2)	3(2) 2 either or(16)	3 either or (16)	-
Total Marks	20	80	14	38	48	-
Weightage	20%	80%	14%	38%	48%	-

Weightage for COs					
	CO1	**CO2**	**CO3**	**CO4**	**CO5**
Total Marks	8	6	4	34	48
Weightage	8%	6%	4%	34%	48%

CH22101	**ENGINEERING CHEMISTRY**	**L**	**T**	**P**	**C**
		3	**0**	**0**	**3**

COURSEOBJECTIVES:

- To make the students conversant with water treatment methods and electrochemistry concept.
- To gain basic knowledge of corrosion and protection methods.
- To understand the basic concepts and synthesis of various engineering materials, nano-materials and fuels.
- To familiarise the students with the principles, working process and application of energy storage devices.

UNITI	**WATER TREATMENT**	**9**

Water: Sources, impurities - Hardness of water: Types - Estimation of hardness (EDTA method) - Disadvantages of hard water in boilers (Scale, Sludge) – Softening methods: Internal treatment (Calgon, Sodium Aluminate) and External treatment (Demineralisation process). Domestic water treatment – Desalination of brackish water:RO and Solar desalination method.

UNIT II	**ELECTROCHEMISTRY AND CORROSION**	**12**

Electrochemical cell – Free energy and emf – Nernst equation and applications – Oxidation and reduction potential – Standard electrodes: Standard hydrogen electrode, Saturated calomel electrode, Glass electrode – pH measurement – Conductometric titration (acid-base, precipitation) and Potentiometric titrations: Redox titration (Fe^{2+} x $Cr_2O_7^{2-}$).

Corrosion – Types: Chemical corrosion and Electrochemical corrosion – Corrosion control methods: Sacrificial anodic and Impressed current cathodic protection method.		
UNIT III	**FUELS AND COMBUSTION**	**8**
Fuels - Classification of fuels – Comparison of solid, liquid and gaseous fuel - Solid fuel - Coal - Analysis of coal (proximate only) – Liquid fuel - Petroleum – Refining of petroleum - Manufacture of synthetic petrol (Bergius process) –Biodiesel – Preparation, properties and uses. Gaseous fuel – CNG, LPG. Combustion – Calorific value – Types (Gross and Net calorific value) – Dulong's formula – GCV and LCV calculation using Dulong's formula. Flue gas – Analysis of flue gas by Orsat method.		
UNIT IV	**ENERGY STORAGE DEVICES**	**8**
Batteries – Types (Primary and Secondary) - Lead acid battery, Lithium ion battery - Super capacitors – Storage principle, types and examples – Electric vehicle – Working principle - Fuel cells – Microbial fuel cell and polymer membrane fuel cell. Nanomaterials in energy storage – CNT –Types, properties and applications.		
UNIT V	**ENGINEERING MATERIALS**	**8**
Abrasives – Types: Natural and Artificial – SiC – Preparation, properties and uses. Refractories – Types Acidic, Basic, Neutral – Refractoriness, RUL. Cement – Manufacture – Special cement – White cement and water proof cement. Glass – Manufacture, properties and uses.		
		TOTAL: 45 PERIODS

COURSE OUTCOMES:

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

CO1:	Recall the basic concepts of water softening, nano materials and batteries.
CO2:	Summarize the types of corrosion, fuels and energy storage devices.
CO3:	Explain the basic principles of electrochemistry and engineering materials.
CO4:	Identify suitable methods for water treatment, fuel and corrosion control.
CO5:	Apply the knowledge of engineering materials, fuels and energy storage devices for material selection and also in energy sectors.

TEXT BOOKS:

1.	P. C. Jain and Monika Jain, "Engineering Chemistry", Dhanpat Rai Publishing Company (P) LTD, New Delhi, 2015.
2.	S. S. Dara and S. S. Umare, "A Textbook of Engineering Chemistry", S. Chand & Company LTD, New Delhi, 2015.

REFERENCES:

1.	Friedrich Emich, "Engineering Chemistry", Scientific International PVT, LTD, New Delhi, 2014.
2.	Shikha Agarwal, "Engineering Chemistry-Fundamentals and Applications", Cambridge University Press, Delhi 2015.
3.	Sivasankar B. "Engineering Chemistry", Tata McGraw Hill Publishing Company Ltd, New Delhi, 2008.
4.	B.S. Murty, P.Shankar, Baldev Raj, B. B. Rath and James Murday, "Text Book of Nano Science and Technology", Universities Press, 2011.

5.	O.G. Palanna, "Engineering Chemistry", McGraw Hill Education (India) Private Limited, 2nd Edition, 2017.

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

Table of Specification (ToS) for End Semester Question Paper

Unit No.andTitle	Total2 Marks Qns.	Total16 Marks Qns.	Bloom's Taxonomy (Cognitive) Level			
			Remember (Kn)	Understand (Un)	Apply (Ap)	Analyse(An) Evaluate(Ev)
			No.ofQns.(marks)andCO			
Unit I – Water Treatment	2	1eitheror	1(2)-CO1	1(2)-CO2	1 either or (16)- CO4	-
Unit II - Electrochemistry and Corrosion	2	1eitheror		1(2)-CO2 1(2)- CO3 1 either or (16) – CO3	-	-
Unit III – Fuels and Combustion	2	1eitheror		2(2)- CO2	1 either or (16)- CO5	-
Unit IV – Energy Storage Devices	2	1eitheror	1(2)-CO1	1 (2)- CO2	1 either or (16)- CO5	-
Unit V – Engineering Materials	2	1eitheror	1(2)-CO1	1(2)- CO3 1 either or (16)- CO3	-	-
Total Qns. Engineering Chemistry	10	5eitheror	3 (2)	4 (2) 2 either or (16)	3 either or (16)	-
Total Marks	20	80	6	46	48	-
Weightage	20%	80%	6%	46%	48%	-

Weightage for COs					
	CO1	CO2	CO3	CO4	CO5
Total Marks	6	10	36	16	32
Weightage	6%	10%	36%	16%	32%

CS22101	PROBLEM SOLVING AND PYTHON PROGRAMMING	L	T	P	C
		3	0	0	3

COURSEOBJECTIVES:

- To understand the basics of algorithmic problem solving.
- To learn to solve problems using Python conditionals and loops.

- To define Python functions and use function calls to solve problems.
- To use Python data structures - lists, tuples, and dictionaries to represent complex data.

UNITI	**INTRODUCTION TO COMPUTERS AND PROBLEM SOLVING STRATEGIES**	**9**

Introduction- Components and functions of a computer system- Hardware and Software. Problem solving strategies- Program design tools: Algorithms, Flow charts, Pseudo code.

UNIT II	**DATA TYPES, EXPRESSIONS, STATEMENTS AND CONTROL FLOW**	**9**

Features of Python -Variables and Identifiers – Data types: Numbers, Strings, Boolean, Tuples, List, Dictionary, Sets - Input operation - Comments, Reserved words, Indentation - Operators and Expressions – Type Conversion - Selection / Conditional Branching Statements - Basic Loop Structures / Iterative Statements - Nested Loops – Break statement – Continue statement – Pass statement.

UNIT III	**FUNCTIONS AND STRINGS**	**9**

Functions: Function definition, Function call- Variable scope and lifetime – return statements. Strings: Definition, Operations (concatenation, appending, multiply, slicing) - Immutability, comparison, iterations, string methods.

UNIT IV	**LIST, TUPLES AND DICTIONARIES**	**9**

Lists: Access, Updating values- nested, cloning- List operations- List methods- Looping in list. Tuples: Tuple operations- Nested tuple; Dictionaries - Creating, accessing, adding, modifying, deleting items.

UNIT V	**FILES, EXCEPTIONS AND PACKAGES**	**9**

Files: Types of files, Opening and closing files, Reading and writing files, File positions, Renaming and deleting files. Exceptions: Errors and exceptions, Handling exceptions, Packages.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

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

CO1:	Describe the algorithmic solutions to simple and complex computational problems.
CO2:	Apply functions, modules and packages in Python program and use conditionals and loops for solving problems.
CO3:	Analyze conditional branching statements.
CO4:	Evaluate python programs.
CO5:	Develop programs using compound data types and files.

TEXT BOOKS:

1.	Reema Thareja, "Python Programming using Problem Solving Approach", 13th Edition, Oxford University Press, 2022.
2.	Allen B. Downey, "Think Python: How to Think like a Computer Scientist", 2nd Edition, O'Reilly Publishers, 2016.

REFERENCES:

1.	Karl Beecher, “Computational Thinking: A Beginner's Guide to Problem Solving and Programming”, 1st Edition, BCS Learning & Development Limited, 2017.
2.	Paul Deitel and Harvey Deitel, “Python for Programmers”, Pearson Education, 1st Edition, 2021.
3.	John V Guttag, "Introduction to Computation and Programming Using Python: With Applications to Computational Modeling and Understanding Data”, Third Edition, MIT Press, 2021.
4.	Eric Matthes, “Python Crash Course, A Hands-on Project Based Introduction to Programming”, 2nd Edition, No Starch Press, 2019.
5.	Martin C. Brown, “Python: The Complete Reference”, 4th Edition, Mc-Graw Hill, 2018.

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

TableofSpecification (ToS) for EndSemester Question Paper

Unit No.andTitle	Total2 Marks Qns.	Total16 Marks Qns.	Bloom’s Taxonomy (Cognitive) Level					
			Remember (Kn)	Understand (Un)	Apply (Ap)	Analyse (An)	Evaluate (Ev)	Create (Cr)
			No.ofQns.(marks)andCO					
Unit-I: Introduction to Computers and Problem SolvingStrategies	2	1 either or	1(2)-CO1	1(2)-CO1 1 either or (16)- CO1	-	-	-	-
Unit-II: Data Types, Expressions, Statements and ControlFlow	2	1 either or	1(2)-CO2	1(2)-CO2	-	1 either or (16)- CO3	-	-
Unit-Ill: Functions and Strings	2	1 either or	1(2)- CO3	1(2)- CO3	1 either or (16)- CO2	-	-	-
Unit-IV: List, Tuples and Dictionaries	2	1 either or	1(2)-CO4	1(2)-CO4	-	-	1 either or (16)- CO4	-
Unit-V: Files, Exceptions and Packages	2	1 either or	1(2)-CO5	1(2)-CO5	-	-	-	1 either or (16)- CO5
Total Qns.Problem Solving and Python Programming	10	5 either or	5(2)	5(2) 1 either or (16)	1 either or (16)	1 either or (16)	1 either or (16)	1 either or (16)
Total Marks	20	80	10	26	16	16	16	16
Weightage	20%	80%	10%	26%	16%	16%	16%	16%
WeightageforCOs								

	CO1	CO2	CO3	CO4	CO5
TotalMarks	20	20	20	20	20
Weightage	20%	20%	20%	20%	20%

GE3152	**HERITAGE OF TAMIL**	**L**	**T**	**P**	**C**
		1	**0**	**0**	**1**

COURSE OBJECTIVES:

- To help students understand the values of Tamil Language, basic language families in India and types of Tamil literature.
- To facilitate the students to understand Tamil heritage of rock arts, paintings and musical instruments in their economic life.
- To facilitate the students in understanding the harmony existing in Tamils martial arts.
- To create an awareness on concept ofThinai Tamils and its values.
- To understand the contribution and Influence of Tamils in Indian culture.

UNIT I	**LANGUAGE AND LITERATURE**	**3**

Environment – Ecosytem – Structure and function of an ecosystem – Energy flow in an ecosystem – Food chain and food web –. Biodiversity – Types – Values, threats and conservation of biodiversity – Endangered and endemic species – Hot spot of biodiversity – Biodiversity at state level, national level and global level.

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

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

UNIT III	**FOLK AND MARTIAL ARTS**	**3**

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

UNIT IV	**THINAI CONCEPT OF TAMILS**	**3**

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

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

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

TOTAL: 15 PERIODS

COURSE OUTCOMES:

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

CO1:	Describe the importance of Tamil Language and types of Tamil literature.
CO2:	Illustrate their knowledge in rock art paintings to modern art.

CO3:	Demonstrate a strong foundational knowledge in martial arts.
CO4:	Explain the concept of Thinai Tamils and its values
CO5:	Describe the contribution of Tamils in Indian culture.

TEXT &REFERENCE BOOKS:

1.	தமிழக வரலாறு – மக்களும் பண்பாடும் – கே. கே. பிள்ளை (வெளியீடு : தமிழ்நாடு பாடநூல் மற்றும் கல்வியல் பணிகள் கழகம்.
2.	Dr.K.K.Pillay, "Social Life of Tamils", A joint publication of TNTB & ESC and RMRL.
3.	Dr.S.Singaravelu, "Social Life of the Tamils - The Classical Period", International Institute of Tamil Studies.
4.	Dr.S.V.Subatamanian, Dr.K.D. Thirunavukkarasu, "Historical Heritage of the Tamils", International Institute of Tamil Studies.
5.	Dr.M.Valarmathi, "The Contributions of the Tamils to Indian Culture", International Institute of Tamil Studies.
6.	Dr.K.K.Pillay, "Studies in the History of India with Special Reference to Tamil Nadu".

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

COURSEOBJECTIVES:

- தமிழ் மொழியின் மதிப்புகள், இந்தியாவில் உள்ள அடிப்படை மொழிக்குடும்பங்கள் மற்றும் தமிழ் இலக்கிய வகைகளை மாணவர்கள் புரிந்துகொள்ள உதவுதல்.
- மாணவர்கள் பாறை ஓவியங்கள், சிற்பக்கலைகள் மற்றும் இசைக்கருவிகளின் வழி தமிழ் பாரம்பரியத்தைப் புரிந்துகொள்ள வசதி செய்தல்
- தமிழர்களின் கலை மற்றும் வீர விளையாட்டுகளைப் புரிந்து கொள்வதற்கு மாணவர்களுக்கு உதவுதல்.
- தமிழர்களின் திணைக் கருத்துக்கள் மற்றும் அவர்களின் வாழ்க்கை நெறிகளைப் பற்றி மாணவர்களுக்கு விழிப்புணர்வை ஏற்படுத்துதல்
- இந்திய கலாச்சாரத்தில் தமிழர்களின் பங்களிப்பையும் அதன் தாக்கத்தையும் மாணவர்கள் புரிந்துகொள்ள செய்தல்.

UNIT I	**மொழி மற்றும் இலக்கியம்**	**3**

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

UNIT II	**மரபு – பாறை ஓவியங்கள் முதல் நவீன ஓவியங்கள் வரை – சிற்பக் கலை**	**3**

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

UNIT III	**நாட்டுப்புறக் கலைகள் மற்றும் வீர விளையாட்டுகள்**	**3**

தெருக்கூத்து, கரகாட்டம், வில்லுப்பாட்டு, கணியான் கூத்து, ஒயிலாட்டம், தோல்பாவைக் கூத்து, சிலம்பாட்டம், வளரி, புலியாட்டம், தமிழர்களின் விளையாட்டுக்கள்.		
UNIT IV	**தமிழர்களின் திணைக் கோட்பாடுகள்**	**3**
துமிழகத்தின் தாவரங்களும், விலங்குகளும் – தொல்காப்பியம் மற்றும் சங்க இலக்கியத்தில் அகம் மற்றும் புறக்கோட்பாடுகள் – தமிழர்கள் போற்றிய அறக்கோட்பாடு – சங்ககாலத்தில் தமிழகத்தில் எழுத்தறிவும், கல்வியும் – சங்ககால நகரங்களும் துறை முகங்களும் – சங்க காலத்தில் ஏற்றுமதி மற்றும் இறக்குமதி – கடல் கடந்த நாடுகளில் சோழர்களின் வெற்றி.		
UNIT V	**இந்திய தேசிய இயக்கம் மற்றும் இந்திய பண்பாட்டிற்கு தமிழர்களின் பங்களிப்பு**	**3**
இந்திய விடுதலைப்போரில் தமிழர்களின் பங்கு – இந்தியாவின் பிறப்பகுதிகளில் தமிழ்ப் பண்பாட்டின் தாக்கம் – சுயமரியாதை இயக்கம் – இந்திய மருத்துவத்தில் சித்த மருத்துவத்தின் பங்கு – கல்வெட்டுகள், கையெழுத்துப்படிகள் – தமிழ்ப் புத்தகங்களின் அச்சு வரலாறு.		
		TOTAL: 15 PERIODS

COURSE OUTCOMES:

இப்பாடத் திட்டத்தின் மூலம் மாணவர்கள் பெறும் பயன்கள்:

CO1:	தமிழ் மொழியின் முக்கியத்துவம் மற்றும் இலக்கிய வகைகளை விவரிக்க முடியும்.
CO2:	பாறை ஓவியங்கள் முதல் நவீன கலைகள் வரை அவர்களின் அறிவை விவரிக்க முடியும்.
CO3:	தற்காப்புக் கலைகளின் வலுவான அடித்தள அறிவை விவரிக்க முடியும்.
CO4:	தமிழர்களின் திணைக் கருத்துக்கள் மற்றும் அதன் மதிப்புகளை விளக்க முடியும்.
CO5:	இந்திய கலாச்சாரத்தில் தமிழர்களின் பங்களிப்பை விவரிக்க இயலும்.

TEXT &REFERENCE BOOKS:

1.	தமிழக வரலாறு – மக்களும் பண்பாடும் – கே. கே. பிள்ளை (வெளியீடு : தமிழ்நாடு பாடநூல் மற்றும் கல்வியல் பணிகள் கழகம்.
2.	Dr.K.K.Pillay, “Social Life of Tamils”, A joint publication of TNTB & ESC and RMRL.
3.	Dr.S.Singaravelu, “Social Life of the Tamils - The Classical Period”, International Institute of Tamil Studies.
4.	Dr.S.V.Subatamanian, Dr.K.D. Thirunavukkarasu, “Historical Heritage of the Tamils”, International Institute of Tamil Studies.
5.	Dr.M.Valarmathi, “The Contributions of the Tamils to Indian Culture”, International Institute of Tamil Studies.
6.	Dr.K.K.Pillay, “Studies in the History of India with Special Reference to Tamil Nadu”.

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

CO	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-

Table of Specification (ToS) for End Semester Question Paper

Unit No. and Title	Total 2 Marks Qns.	Total 16 Marks Qns.	Bloom's Taxonomy (Cognitive) Level			
			Remember (Kn)	Understand (Un)	Apply (Ap)	Analyse (An) Evaluate (Ev)
			No. of Qns. (marks) and CO			
Unit-I: Language and Literature	2	1 either or	2(2)-CO1	1 either or (16)- CO1	-	-
Unit-II: Heritage - Rock Art Paintings to Modern Art – Sculpture	2	1 either or	2(2)-CO2	1 either or (16)- CO2	-	-
Unit-III: Folk and Martial Arts	2	1 either or	1(2)- CO3	1(2)- CO3 1 either or(16)- CO3	-	-
Unit-IV: Thinai Concept of Tamils	2	1 either or	1(2)-CO4	1(2)- CO4 1 either or (16)-CO4	-	-
Unit-V: Contribution of Tamils to Indian National Movement and Indian Culture	2	1 either or	1(2)-CO5	1(2)-CO5 1 either or (16)- CO5	-	-
Total Qns. Heritage of Tamil	10	5 either or	7(2)	3(2) 5 either or (16)	-	-
Total Marks	20	80	14	86	-	-
Weightage	20%	80%	14%	86%	-	-

Weightage for COs					
	CO1	**CO2**	**CO3**	**CO4**	**CO5**
Total Marks	20	20	20	20	20
Weightage	20%	20%	20%	20%	20%

EN22101	**COMMUNICATIVE ENGLISH**	**L**	**T**	**P**	**C**
		2	**0**	**2**	**3**

COURSEOBJECTIVES:

- To guide the learners on the basics of language including vocabulary and grammar.
- To develop the receptive skills of the learners: Reading and Listening.
- To develop the productive skills of the learners: Writing and Speaking.
- To make the learners realize the importance of accuracy and fluency.
- To help the learners use the language in real situations.

UNITI	**VOCABULARY AND LANGUAGE STUDY**	**6**

Vocabulary–Synonyms and Antonyms, Word building – Prefixes and Suffixes–Word formation-Definitions - One word substitutes - Reading for vocabulary and language development-Note making and Summarising-Developing hints.

UNIT II	**READING AND LANGUAGE DEVELOPMENT**	**6**

Parts of speech, Types of sentences –Statement, Interrogative, Imperative, Exclamatory, Wh-

questions, Yes or No questions and tag questions, Formal Letters – Academic, Official, and Business Letters.		
UNIT III	**GRAMMAR AND LANGUAGE DEVELOPMENT**	**6**
Tense and Voice, Auxiliary verbs (be, do, have), Modal verbs - Types of Reading : Intensive reading and Extensive reading- Strategies: Predicting- Skimming and Scanning -Reading for facts- Understanding the parts of paragraph- Learning the transitional signals used in the passage to classify the text.		
UNIT IV	**FUNDAMENTALS OF WRITING**	**6**
Punctuation and Capitalization- Sentence formation: Word order- Completion of sentence – Conjunctions-Transitional signals- Sentence and sentence structures- Informal letters.		
UNIT V	**EXTENDED WRITING**	**6**
Degrees of Comparison – Reported speech-Paragraph writing-Topic sentence, supporting sentences and concluding sentences - Informal and Formal expressions.		
		TOTAL : 30 PERIODS
PRACTICAL EXERCISES		
Listening (Receptive skill**)**Intensive Listening: Effective and Attentive Listening		
Exercises		
1) Listening for gist from recorded speeches.		
2) Listening for specific information from recorded conversations.		
3) Listening for strengthening vocabulary skills.		
4) Listening to variety of situations and voices-Listening for language development.		
5) Listening for pronunciation: syllables, stress and intonation.		
Speaking (Productive Skill)		
Exercises		
1) Introducing oneself and others.		
2) Asking for / giving personal information.		
3) Practicing dialogues in pairs.		
4) Giving directions-Informal and formal dialogues.		
5) Speaking in connected speech.		
6) Responding to questions.		
7) Short presentations.		
8) Speaking in small and big groups.		
9) Learning and practicing the essential qualities of a good speaker.		
		TOTAL: 30 PERIODS
		TOTAL(T+P): 60 PERIODS
COURSE OUTCOMES:		
At the end of the course, the students will be able to:		
CO1:	Apply and practice the correct usages of language.	
CO2:	Receive the language effectively and meaningfully through receptive skills.	
CO3:	Produce the language appropriate to the needs and situations exercising productive skills.	

CO4:	Transfer or interpret any piece of information with accuracy and fluency.
CO5:	Apply the language intellectually and confidently.

TEXT BOOKS:

1.	Shobha. K.N, Rayen, Joavani, Lourdes, "Communicative English", Cambridge University Press, 2018.
2.	Sudharshana.N.P and Saveetha. C,"English for Technical Communication", Cambridge University Press: New Delhi, 2016.

REFERENCES:

1.	Kumar, Suresh. E., "Engineering English", Orient Blackswan, Hyderabad, 2015.
2.	Means, L. Thomas and Elaine Langlois, "English& Communication for Colleges", Cengage Learning, USA, 2007.
3.	Greendaum, Sydney and Quirk, Randolph, "A Student's Grammar of the English Language", Pearson Education, 2009.
4.	Wood F.T, "Remedial English Grammar", Macmillan, 2007.
5.	Kumar, Sanjay and Pushp Lata, "Communication Skills: A Workbook", New Delhi: OUP, 2018.

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

Table of Specification (ToS) for End Semester Question Paper

Unit No.andTitle	**Total2 Marks Qns.**	**Total16 Marks Qns.**	**Bloom's Taxonomy (Cognitive) Level**		
			Remember (Kn)	**Understand** (Un)	**Apply** (Ap)
			No. of Qns. (marks) and CO		
Unit-I:Vocabulary and Language Study	2	1 compulsory	2(2)-CO1	1 Compulsory (16)- CO1	-
Unit-II:Reading and Language Development	2	1 either or	2(2)-CO2	1 either or (16)- CO2	-
Unit-Ill:Grammar and Language Development	2	1 either or	1(2)- CO3	1(2)-CO3	1 eitheror (16)-CO3
Unit-IV:Fundamentals of Writing	2	1 either or	1(2)-CO4	1(2)-CO4	1 either or (16)-CO4
Unit-V:Extended Writing	2	1 either or	1(2)-CO5	1(2)-CO5	1 either or (16)- CO5

Total Qns. Communicative English	10	1 Compulsory & 4 either or	7(2)	3(2) 1 Compulsory & 1 either or (16)	3 either or (16)
Total Marks	20	80	14	38	48
Weightage	20%	80%	14%	38%	48%

Weightage for COs

	CO1	CO2	CO3	CO4	CO5
Total Marks	20	20	20	20	20
Weightage	20%	20%	20%	20%	20%

BS22101	**PHYSICS & CHEMISTRY LABORATORY**	**L**	**T**	**P**	**C**
		0	**0**	**4**	**2**

PHYSICS LABORATORY

COURSE OBJECTIVES:

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

LIST OF EXPERIMENTS

1.	Non-uniform bending – Determination of Young's Modulus.
2.	SHM of Cantilever – Determination of Young's Modulus.
3.	Poiseuille's flow – Coefficient of viscosity of liquid.
4.	Torsional pendulum - Determination of Rigidity Modulus.
5.	Newton's ring – Radius of curvature of convex lens.
6.	Lee's Disc – Determination of coefficient of thermal conductivity of bad conductor.

TOTAL:30PERIODS

CHEMISTRY LABORATORY

COURSE OBJECTIVES:

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

LIST OF EXPERIMENTS

1.	Determination of total hardness of water by EDTA method.
2.	Conductometric titration of strong acid and strong base.
3.	Determination of strength of given hydrochloric acid using pH meter.
4.	Conductometric precipitation titration using $BaCl_2$ and Na_2SO_4.

5.	Determination of alkalinity in water sample.
6.	Estimation of iron content of the given solution using potentiometer.
	TOTAL: 30 PERIODS
	TOTAL: 60 PERIODS

COURSEOUTCOMES:	
At the end of the course, the students will be able to:	
CO1:	Determine different moduli of elasticity used in day to day engineering applications.
CO2:	Calculate the viscosity of liquids and radius of curvature of convex lens.
CO3:	Estimate the coefficient of thermal conductivity of bad conductors.
CO4:	Determine the water quality parameters of the given water sample.
CO5:	Analyze quantitatively the metals (Fe, Ni) in the any sample volumetrically as well as by using spectro-analytical methods.

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

CS22102	**PYTHON PROGRAMMING LABORATORY**	**L**	**T**	**P**	**C**
		0	**0**	**4**	**2**

COURSE OBJECTIVES:

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

LIST OF EXPERIMENTS

1. Identification and solving of simple real life or scientific or technical problems, and developing algorithms and 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 programmes using Functions.
7. Implementing programmes using Strings.
8. Implementing real-time/technical applications using File handling.
9. Implementing real-time/technical applications using Exception handling.
10. Exploring Pygame tool.
11. Developing a game activity using Pygame like bouncing ball.
TOTAL: 60PERIODS

COURSE OUTCOMES:	
At the end of the course, the students will be able to:	
CO1:	Develop algorithmic solutions to simple computational problems.
CO2:	Develop and execute simple Python programmes.
CO3:	Implement programmes in Python using conditionals, loops and functions for solving problems.
CO4:	Process compound data using Python data structures.
CO5:	Utilize Python packages in developing software applications.

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

HS22101	**HIGHER ORDER THINKING**	**L**	**T**	**P**	**C**
		1	**0**	**0**	**1**

COURSEOBJECTIVES:
• Teaching the students the sources and dynamics of thinking.
• Teaching the students the basics of systematic and scientific thinking.
• Initiating the students into critical thinking and to use critical thinking in practical life.

• Initiating students into creative thinking.		
UNITI	**INTRODUCTION TO COGNITION, KNOWLEDGE AND THINKING**	**3**
Cognition - Different Cognitive functions - Cognition and intelligence - Cognitive development: till adolescence and post adolescence - Possibility of true knowledge - The sources of knowledge. Sensation, perception. Reality of perception - Concept formation, abstraction. Memory and retrieving - Introduction to thinking and types of thinking. Systematic thinking.		
UNIT II	**LOGIC AND REASONING**	**3**
Commonsense and scientific knowledge. Pursuit of truth - Syllogistic Logic. Greek and Indian. – Exercises.		
UNIT III	**CRITICAL THINKING SKILLS AND DISPOSITIONS**	**3**
Critical Thinking Skills & Dispositions. Critical Thinking Exercises.		
UNIT IV	**ANALYSIS OF ARGUMENTS**	**3**
Propositions and fallacies - Analyzing arguments - Exercises.		
UNIT V	**CREATIVE THINKING AND INNOVATIVE THINKING**	**3**
Evolution of Scientific Thinking and Paradigm Shift - Dynamics of Thoughts: Hegel - Convergent thinking and divergent thinking (out of the box thinking) - Problem solving and planning.		
TOTAL: 15 PERIODS		
COURSE OUTCOMES:		
At the end of the course, the students will be able to:		
CO1:	Demonstrate the sources of knowledge and the process of thinking.	
CO2:	Demonstrate critical thinking skills and dispositions of critical thinking.	
CO3:	Confidently engage in creative thinking and problem solving.	
REFERENCES:		
1	Irving M. Copi, Carl Cohen and Kenneth McMahon, "Introduction to Logic", 14th Edition, Pearson Education Limited, 2014.	
2	Joan Boykoff Baron and Robert J. Sternberg, "Teaching Thinking Skills: Theory and Practice", W.H. Freeman and Company, New York, 2016.	
3	Robert J. Sternberg, "Cognitive Psychology", Third Edition, Thomson Wadsworth, UK, 2010.	

Course Outcomes	PO												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	2	2	1	-	-	-	-	-	-	-	1	-	-	3
CO2	3	2	2	1	-	-	-	-	-	-	-	1	-	-	3
CO3	3	2	2	1	-	-	1	-	1	-	1	1	-	-	3
CO	3	2	2	1	-	-	2	-	2	-	1	1	-	-	3

Table of Specification (ToS) for End Semester Question Paper

Unit No. and Title	Total 2 Marks Qns.	Total 16 Marks Qns.	Bloom's Taxonomy (Cognitive) Level			
			Remember (Kn)	Understand (Un)	Apply (Ap)	Analyse(An) Evaluate(Ev)
Unit-I: Introduction to Cognition, Knowledge and Thinking	2	1 either or	2(2)-CO1	1 either or (16)-CO1	-	-
Unit-II:Logic and Reasoning	2	1 either or	2(2)-CO1	1 either or (16)-CO1	-	-
Unit-III:Critical Thinking Skills and Dispositions	2	1 either or	2(2)-CO2	1 either or (16)-CO2	-	-
Unit-IV:Analysis of Arguments	2	1 either or	2(2)-CO2	1 either or (16)-CO2	-	-
Unit-V:Creative Thinking and Innovative Thinking	2	1 either or	2(2)-CO3	-	1 either or (16)-CO3	-
Total Qns.Higher Order Thinking	10	5 either or	10 (2)	4 either or (16)	1 either or (16)	
Total Marks	20	80	20	64	16	
Weightage	20%	80%	20%	64%	16%	

Weightage for COs			
	CO1	**CO2**	**CO3**
Total Marks	40	40	20
Weightage	40%	40%	20%

HS22102	**UNIVERSAL HUMAN VALUES: UNDERSTANDING HARMONY AND ETHICAL HUMAN CONDUCT**	**L**	**T**	**P**	**C**
		2	**0**	**0**	**2**

COURSE OBJECTIVES:

- To help students distinguish between values and skills, and understand the need, basic guidelines, content and process of value education.
- To facilitate the students to understand harmony at all the levels of human living, and live accordingly.
- To create an awareness on Engineering Ethics and human values.
- To understand social responsibility of an engineer.

UNIT I	**INTRODUCTION TO VALUE EDUCATION**	**6**

Value Education - Definition, Concept and Need for Value Education, Basic Guidelines - The Content and Process of Value Education - Basic Guidelines for Value Education - Self exploration as a means of Value Education - Happiness and Prosperity as parts of Value Education.

UNIT II	**HARMONY IN THE HUMAN BEING**	**6**

Human Being is more than just the Body- Harmony of the Self ('I') with the Body - Understanding Myself as Co-existence of the Self and the Body - Understanding Needs of the Self and the needs of the Body - Understanding the activities in the Self and the activities in the Body.

UNIT III	**HARMONY IN THE FAMILY, SOCIETY AND HARMONY IN THE NATURE**	**6**

Family as a basic unit of Human Interaction and Values in Relationships - The Basics for Respect and today's crisis: Affection, Guidance, Reverence, Glory, Gratitude and Love - Comprehensive

Human Goal: The Five Dimensions of Human Endeavour - Harmony in Nature: The Four Orders in Nature - The Holistic Perception of Harmony in Existence.		
UNIT IV	**SOCIAL ETHICS**	**6**
The Basics for Ethical Human Conduct - Defects in Ethical Human Conduct - Holistic Alternative and Universal Order - Universal Human Order and Ethical Conduct - Human Rights violation and Social Disparities.		
UNIT V	**PROFESSIONAL ETHICS**	**6**
Universal Human Values - Value based Life and Profession - Professional Ethics and Right Understanding - Competence in Professional Ethics - Issues in Professional Ethics – The Current Scenario - Vision for Holistic Technologies - Production System and Management Models.		
TOTAL: 30 PERIODS		

COURSE OUTCOMES:

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

CO1:	Illustrate the significance of value inputs in a classroom and start applying them in their life and profession.
CO2:	Explain the role of a human being in ensuring harmony in society and nature.
CO3:	Demonstrate the value of harmonious relationship based on trust and respect in their life and profession.
CO4:	Compare values, skills, happiness and accumulation of physical facilities, the Self and the Body, Intention and Competence of an individual, etc.
CO5:	Classify ethical and unethical practices, and start working out the strategy to actualize a harmonious environment wherever they work.

TEXT BOOKS:

1	R R Gaur, R Sangal, G P Bagaria, "Human Values and Professional Ethics", Excel Books, New Delhi, 2010.
2	A.N. Tripathy, "Human Values", New Age International Publishers, New Delhi, 2004.

REFERENCES:

1.	Gaur. R.R., Sangal. R, Bagaria. G.P, "A Foundation Course in Value Education", Excel Books, 2009.
2.	Gaur. R.R., Sangal. R, Bagaria. G.P, "Teachers Manual" Excel Books, 2009.
3.	Gaur R R, R Sangal, G P Bagaria, "A Foundation Course in Human Values and Professional Ethics", 2009.
4.	William Lilly, "Introduction to Ethic", Allied Publisher, 2005.
5.	Nagarajan, R.S., "Professional Ethics and Human values", New Age International Publishers, 2006.

Course Outcomes	**PO**												**PSO**		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO1	1	-	-	-	-	2	2	3	1	1	-	1	-	-	3
CO2	1	-	-	-	-	2	2	3	1	1	-	1	-	-	3
CO3	1	-	-	-	-	2	2	3	1	1	-	1	-	-	3
CO4	1	-	-	-	-	2	2	3	1	1	-	1	-	-	3

CO5	1	-	-	-	-	2	2	3	1	1	-	1	-	-	3
CO	1	-	-	-	-	2	2	3	1	1	-	1	-	-	3

Table of Specification (ToS) for End Semester Question Paper

Unit No. and Title	Total 2 Marks Qns.	Total 16 Marks Qns.	Bloom's Taxonomy (Cognitive) Level			
			Remember (Kn)	Understand (Un)	Apply (Ap)	Analyse(An) Evaluate(Ev)
Unit I: Introduction to Value Education	2	1 either or	2(2)-CO1	1 either or (16)-CO1	-	-
Unit II:Harmony in the Human Being	2	1 either or	2(2)-CO2	1 either or (16)-CO2	-	-
Unit III:Harmony in the Family, Society and Harmony in the Nature	2	1 either or	1(2)-CO3	1(2)-CO3 1 either or (16)-CO3	-	-
Unit IV:Social Ethics	2	1 either or	1(2)-CO4	1(2)-CO4	1 either or (16)-CO4	-
Unit-V:Professional Ethics	2	1 either or	1(2)-CO5	1(2)-CO5	1 either or (16)-CO5	-
Total Qns. Universal Human Values:Understanding Harmony and Ethical Human Conduct	10	5 either or	7(2)	3(2) 3 either or (16)	2 either or (16)	-
Total Marks	20	80	14	54	32	-
Weightage	20%	80%	14%	54%	32%	-

Weightage for COs					
	CO1	**CO2**	**CO3**	**CO4**	**CO5**
Total Marks	20	20	20	20	20
Weightage	20%	20%	20%	20%	20%

SEMESTER II

MA22201	STATISTICS AND NUMERICAL METHODS	L	T	P	C
		3	1	0	4

COURSEOBJECTIVES:

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

UNITI	TESTING OF HYPOTHESIS	12
Statistical hypothesis -Type I and Type II errors - Large sample tests based on Normal distribution for single mean and difference of means -Tests based on t distribution for single mean and equality of means - Test based on F distribution for equality of variances - Chi square test for single variance and goodness of fit - Independence of attributes - Contingency table: Analysis of r × c tables.		
UNIT II	**DESIGN OF EXPERIMENTS**	**12**
General principles – Analysis of variance (ANOVA) - One way classification - Completely randomized design (CRD) – Two way classification - Randomized block design (RBD) – Three way classification -Latin square design(LSD) – Two factor experiments: 2^2 factorial design.		
UNIT III	**NUMERICAL SOLUTION OF EQUATIONS**	**12**
Solution of algebraic and transcendental equations - Fixed point iteration method – Newton Raphson method - Solution of linear system of equations - Gauss elimination method - Gauss Jordan method – Iterative methods of Gauss Jacobi and Gauss Seidel .		
UNIT IV	**INTERPOLATION, NUMERICAL DIFFERENTIATION AND INTEGRATION**	**12**
Newton's forward and backward interpolation – Interpolation with unequal intervals - Lagrange's interpolation- Divided differences - Newton's divided difference - Approximation of derivates using interpolation polynomials – Numerical integration using Trapezoidal and Simpson's 1/3, 3/8 rules- Numerical double integration: Trapezoidal and Simpson's rules.		
UNIT V	**NUMERICAL SOLUTION OF ORDINARY DIFFERENTIAL EQUATIONS**	**12**
Single step methods : Taylor's series method - Euler's method - Modified Euler's method - Fourth order Runge-Kutta method for solving first order equations - Multi step methods : Milne's and Adams - Bash forth predictor corrector methods for solving first order equations.		
		TOTAL: 60 PERIODS

COURSE OUTCOMES:

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

CO1:	Define the basic concepts of statistical tests, ANOVA, iterative methods, interpolations and ODE.
CO2:	Discuss the techniques of statistical tests and design of experiments.
CO3:	Explain the solution of equations, ODE, single and multistep methods, interpolations, differentiation and integration.
CO4:	Apply the concept of testing of hypothesis and design of experiment in real life.
CO5:	Apply numerical techniques in system of equations,differential equations, interpolation, differentiation and integration.

TEXT BOOKS:

1.	Grewal. B.S. and Grewal. J.S., "Numerical Methods in Engineering and Science ", 10^{th} Edition, Khanna Publishers, New Delhi, 2015.

2.	Johnson, R.A., Miller, I and Freund J., "Miller and Freund's Probability and Statistics for Engineers", Pearson Education, Asia, 9th Edition, 2016.
REFERENCES:	
1.	Burden, R.L and Faires, J.D, "Numerical Analysis", 9th Edition, Cengage Learning, 2016.
2.	Devore. J.L., "Probability and Statistics for Engineering and the Sciences", Cengage Learning, New Delhi, 8th Edition, 2014.
3.	Gerald. C.F. and Wheatley. P.O. "Applied Numerical Analysis" Pearson Education, Asia, New Delhi, 2006.
4.	Spiegel. M.R., Schiller. J. and Srinivasan. R.A., "Schaum's Outlines on Probability and Statistics, 4th Edition, Tata McGraw Hill Edition, 2012.
5.	Walpole. R.E., Myers. R.H., Myers. S.L. and Ye. K., "Probability and Statistics for Engineers and Scientists", 9th Edition, Pearson Education, Asia, 2012.

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

Table of Specification (ToS) for End Semester Question Paper

Unit No. and Title	Total 2 Marks Qns.	Total 16 Marks Qns.	Bloom's Taxonomy (Cognitive) Level			
			Remember (Kn)	Understand (Un)	Apply (Ap)	Analyse (An) Evaluate (Ev)
Unit-I: Testing of Hypothesis	2	1 either or	1(2)-CO1	1(2)-CO2	1 either or (16)-CO4	-
Unit-II: Design of Experiments	2	1 either or	2(2)-CO1	-	1 either or (16)-CO4	-
Unit-III: Numerical Solution of Equations	2	1 either or	1(2)-CO1	1(2)-CO3	1 either or (16)-CO5	-
Unit-IV: Interpolation, Numerical Differentiation and Integration	2	1 either or	1(2)-CO1	1(2)-CO3	1 either or (16)-CO5	-
Unit-V: Numerical Solution of Ordinary Differential Equations	2	1 either or	1(2)-CO1	1(2)-CO3	1 either or (16)-CO5	-
Total Qns. Statistics and Numerical Methods	10	5 either or	6(2)	4(2)	5 either or (16)	-
Total Marks	20	80	12	8	80	-
Weightage	20%	80%	12%	8%	80%	-

Weightage for COs					
	CO1	CO2	CO3	CO4	CO5

Total Marks	12	2	6	32	48
Weightage	12%	2%	6%	32%	48%

ES22202	**BASIC ELECTRICAL AND ELECTRONICS ENGINEERING**	**L**	**T**	**P**	**C**
		3	**0**	**0**	**3**

COURSEOBJECTIVES:

- To introduce the basic circuit components.
- To educate on the working principles and applications of electrical machines.
- To explain the construction and working of semiconductor devices.
- To educate on logic gates, flip flops and registers.
- To introduce the functional elements and working of measuring instruments.

UNITI	**INTRODUCTION TO ELECTRICAL ENGINEERNG**	**9**

Introduction-Conductors, semiconductors and insulators - Electrostatics – Electric Current – Electromotive force - Electric Power - Ohm's Law - Basic circuit components - Electromagnetism related laws - Kirchhoff's Laws.

UNIT II	**ELECTRICAL MACHINES**	**9**

Construction, working principle and types of DC Generator – Motor - Single phase transformer - Single phase and three phase induction motor – Applications.

UNIT III	**ANALOG ELECTRONICS**	**9**

Classification of Semiconductors – Construction, characteristics and working - PN junction Diode - Zener Diode - Bipolar Junction Transistor – IGBT - SCR- MOSFET.

UNIT IV	**DIGITAL ELECTRONICS**	**9**

Review of number systems, binary codes- Boolean Algebra - Logic gates - Implementation of Boolean expression using K-map – Types of flip flops, Registers.

UNIT V	**MEASUREMENTS AND INSTRUMENTATION**	**9**

Functional elements of an instrument – Static and dynamic characteristics of instruments, Errors, Principles of electrical indicating instruments - Types of indicating instruments - Moving Coil and Moving Iron instruments - DSO – Transducers - Resistive Transducers.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

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

CO1:	Apply the basic laws to determine circuit parameters.
CO2:	Explain the construction, working and application of electrical machines.
CO3:	Explain the construction and working of semiconductor devices.
CO4:	Interpret the function of combinational and sequential circuits.
CO5:	Interpret the operating principles of measuring instruments.

TEXT BOOKS:

1.	M.S.Sukhja, T.K.Nagsarkar, "Basic Electrical and Electronics Engineering", Oxford Higher Education, First Edition, 2018.

2.	S. Salivahanan, R.Rengaraj, "Basic Electrical and Instrumentation Engineering", McGraw Hill Education, First Edition, 2019.
REFERENCES:	
1.	Kothari DP and I.J Nagrath, "Basic Electrical and Elecronics Engineering", Fourth Edition, McGraw Hill Education, 2019.
2.	H.S. Kalsi, "Electronic Instrumentation", Tata McGraw-Hill, New Delhi, 2010.
3.	V. K. Mehta, Rohit Mehta, "Basic Electrical Engineering", S.Chand& Company Pvt. Ltd, New Delhi, 2012.
4.	S.K.Sahdev, "Basic of Electrical Engineering", Pearson, 2015.
5.	B.L Theraja, "Fundamentals of Electrical Engineering and Electronics", Chand & Co, 2008.

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

Table of Specification (ToS) for End Semester Question Paper

Unit No. and Title	Total 2 Marks Qns.	Total 16 Marks Qns.	Bloom's Taxonomy (Cognitive) Level			
			Remember (Kn)	Understand (Un)	Apply (Ap)	Analyse (An) Evaluate (Ev)
Unit-I : Introduction to Electrical Engineering	2	1either or	2 compulsory	-	1 either or (16)-CO1	-
Unit-II: Electrical Machines	2	1either or	2 compulsory	1 either or (16)-CO2	-	-
Unit-III:Analog Electronics	2	1either or	2 compulsory	1 either or (16)-CO3	-	-
Unit-IV: Digital Electronics	2	1either or	2 compulsory	1 either or (16)-CO4		-
Unit-V:Measurements and Instrumentation	2	1either or	2 compulsory	1 either or (16)-CO5	-	-
Total Qns. Basic Electrical and Electronics Engineering	10	5either or	2 compulsory	4 either or (16)	1 either or (16)	-
Total Marks	20	80	20	64	16	-
Weightage	20%	80%	20%	64%	16%	-

Weightage for COs					
	CO1	CO2	CO3	CO4	CO5
Total Marks	20	20	20	20	20
Weightage	20%	20%	20%	20%	20%

CE22201	BUILDING MATERIALS AND TECHNIQUES	L	T	P	C
		3	0	0	3

COURSE OBJECTIVE:

- To learn the various construction materials and the techniques that are commonly used in Civil Engineering construction.

UNITI	BASIC CONSTRUCTION MATERIALS	9

Stones: Classification - Composition and mineral constituents - Properties and tests - Artificial stones. Bricks: Brick earth - Composition and harmful constituents - Manufacturing process, Classification - Sampling and testing - Properties - Brick substitutes- Concrete blocks.

UNIT II	MISCELLANEOUS MATERIALS	9

Weather proofing: Paints and varnishes, Polymers and plastics. Timber: Market forms - Physical properties, seasoning and preservative treatment. Ferrous metals: Iron and steel - Market forms - Structural steel - Composition - Materials properties and behaviour. Non-ferrous metals: Aluminium, copper, brass and glass products - Properties - Applications.

UNIT III	CONSTRUCTION PRACTICES	9

Specifications - Construction co-ordination - Site clearance and marking - Earthwork - Earth moving operations -Foundations and basements - Mortar - Types - Masonry - Brick masonry - Bonds - Stone masonry - Concrete hollow block masonry.

UNIT IV	CONSTRUCTION TECHNIQUES	9

Flooring - Damp proof courses - Construction joints - Movement and expansion joints - Contraction joints - Roofing - Form works - Centering and shuttering - Scaffoldings, shoring and underpinning - Shoring for deep cutting - Cable anchoring and grouting.

UNIT V	CONSTRUCTION EQUIPMENT	9

Selection of equipment - Earthwork equipment - Tractors and earth movers - Equipment for soil compaction - Material handling and hoisting - Dewatering and pumping - Trenching, tunnelling and dredging.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

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

CO1:	List the various building materials, techniques and equipment.
CO2:	Demonstrate the construction practices and techniques in the field of Civil Engineering.
CO3:	Apply the suitable construction materials, techniques and equipment.
CO4:	Analyze the suitability of modern building materials and equipment.
CO5:	Evaluate the quality of materials and construction practices.

TEXT BOOKS:

1.	Edward Allen and Joseph Iano, "Fundamentals of Building Construction: Materials and Methods", John Wiley & Sons; 7th edition, 2019.

2.	Arora S.P. and Bindra S.P., "Building Construction, Planning Techniques and Method of Construction", DhanpatRai and Sons, 2010.
REFERENCES:	
1.	Varghese, P.C., "Building Construction", Prentice Hall of India Pvt. Ltd, New Delhi, 2016.
2.	Peurifoy, Schexnayder, Shapira, "Construction Planning, Equipment and Methods", Tata McGraw Hill Education Private Ltd, 9th edition, 2018.
3.	National Building Code of India, Part V, Building Materials, 2016.
4.	Duggal.S.K., "Building Materials", 4th Edition, New Age International Publishers, 2012.
5.	Arora S.P. and Bindra. S.P., "The Text Book of Building Construction", Dhanpat Rai and Sons, 2019.

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

Table of Specification (ToS) for End Semester Question Paper

Unit No. and Title	**Total 2 Marks Qns.**	**Total 16 Marks Qns.**	**Bloom's Taxonomy (Cognitive) Level**			
			Remember (Kn)	**Understand (Un)**	**Apply (Ap)**	**Analyse (An) Evaluate(Ev)**
			No. of Qns. (marks) and CO			
Unit-I:Basic Construction Materials	2	1 either or	2 (2)- CO1	-	1either or (16)-CO3	-
Unit-II:Miscellaneous Materials	2	1 either or	2 (2)- CO1	-	-	1 either or (16)-CO4
Unit-III:Construction Practices	2	1 either or	2 (2)- CO1	-	-	1 either or (16)-CO5
Unit-IV:Construction Techniques	2	1 either or	2 (2)- CO1	1 either or (16)-CO2		-
Unit-V:Construction Equipment	2	1 either or	2 (2)- CO1		1 either or (16)-CO3	-
Total Qns. Building Materials &Techniques	10	5 either or	10 (2)	1 either or (16)	2 either or (32)	2 either or (32)
Total Marks	20	80	20	16	32	32
Weightage	20%	80%	20%	16%	32%	32%

Weightage for COs					
	CO1	**CO2**	**CO3**	**CO4**	**CO5**
Total Marks	20	16	32	16	16
Weightage	20%	16%	32%	16%	16%

ME22201	**ENGINEERING GRAPHICS**	**L**	**T**	**P**	**C**
		2	**0**	**2**	**3**

COURSEOBJECTIVES:

- To draw the engineering curves.
- To draw orthographic projection of points and lines.
- To draw orthographic projection of solids and section of solids.
- To draw the development of surfaces.

CONCEPTS AND CONVENTIONS:

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	**PLANECURVES**	**12**

Basic g eometrical constructions, Curves used in engineering practices: Conics — Construction of ellipse, parabola and hyperbola by eccentricity method — Construction of involutes of square and circle — Drawing of tangents and normal to the above curves.

UNIT II	**PROJECTION OF POINTS, LINES AND PLANES**	**12**

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

UNIT III	**PROJECTION OF SOLIDS**	**12**

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

UNIT IV	**SECTION OF SOLIDS AND DEVELOPMENTOF SURFACES**	**12**

Sectioning of solids (Prisms, pyramids cylinder sand cones) 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. Developmentof lateral surfaces of simple and sectioned solids— Prisms, pyramids cylinders and cones.

UNIT V	**ISOMETRIC PROJECTIONS AND FREEHAND SKETCHING**	**12**

Principles of isometric projection — Isometric scale - Isometric projections of simple solids and truncated solids - Prisms, pyramids & cylinders, in simple vertical positions.Representation of Three Dimensional objects — Layout of views - Freehand sketching of multiple views from pictorial views of objects.Practicing three dimensional modeling of projection of simple objects by CAD Software (Demonstration purpose only).

TOTAL: 60 PERIODS

COURSE OUTCOMES:

At the end of the course, the students will be able to:	
CO1:	Recall the existing national standards and interpret a given three dimensional drawing.
CO2:	Interpret graphics as the basic communication and methodology of the design process.
CO3:	Acquire visualization skills through the concept of projection.
CO4:	Develop the sectioned solids and discover its true shape .
CO5:	Develop imagination of physical objects to be represented on paper for engineering communication.
TEXT BOOKS:	
1.	Natrajan K.V., "A Text Book of Engineering Graphics", Dhanalakshmi Publishers, Chennai, 2018.
2.	Jeyapoovan T., "Engineering Graphics using AutoCAD", Vikas Publishing House, 7th Edition, 2015.
REFERENCES:	
1.	Venugopal K. and Prabhu Raja V., "Engineering Graphics", New Age International (P) Limited, 2008.
2.	Julyes Jai Singh S., "Engineering Graphics", SRM Tri Sea Publishers, Nagercoil, 7th Edition, 2015.
3.	Bhatt N.D. and Panchal V.M., "Engineering Drawing", Charotar Publishing House, 53rd Edition, 2019.
4.	Gopalakrishna K.R., "Engineering Drawing" (Vol. I&II combined), Subhas Publications, Bangalore, 27th Edition, 2017.
5.	Luzzader, Warren.J. and Duff,John M., "Fundamentals of Engineering Drawing with an Introduction to Interactive Computer Graphics for Design and Production, Eastern Economy Edition, Prentice Hall of India Pvt. Ltd, New Delhi, 2005.

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

Table of Specification (ToS) for End Semester Question Paper

Unit No. and Title	Total 20 Marks Qus.	Bloom's Taxonomy (Cognitive) Level			
		Remember (Kn)	Understand (Un)	Apply (Ap)	Analyse (An) Evaluate (Ev)
Unit-I: Plane Curves	1 either or	-	1 either or (20)-CO1	-	-
Unit-II: Projection of Points, Lines and Planes	1 either or	-	1 either or (20)-CO2	-	-
Unit-III: Projection of Points, Lines and Planes	1 either or	-	-	1 either or	-

Unit-IV: Section of Solids and Development of Surfaces		1either or	-	-	1 either or	-
Unit-V: Isometric Projections and Freehand Sketching		1 either or	-	-	1 either or	-
Total Qns. EngineeringGraphics		5 either or	-	2 either or (20)	3 either or	-
Total Marks		100	-	40	60	-
Weightage		100%	-	40%	60%	-
WeightageforCOs						
	CO1	**CO2**	**CO3**	**CO4**	**CO5**	
Total Marks	20	20	20	20	20	
Weightage	20%	20%	20%	20%	20%	

GE3252	**TAMILS AND TECHNOLOGY**	**L**	**T**	**P**	**C**
		1	**0**	**0**	**1**

COURSEOBJECTIVES:

- To facilitate the students to understand weaving and ceramic technology of sangam Age.
- To create an awareness on structural design of Tamils during sangam age.
- To help students to distinguish between all the levels of manufacturing technology in ancient period.
- To understand the ancient knowledge of agriculture and irrigation technology.
- To enable the students to understand the digitalization of Tamil language.

UNIT I	**WEAVING AND CERAMIC TECHNOLOGY**	**3**

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

UNIT II	**DESIGN AND CONSTRUCTION TECHNOLOGY**	**3**

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

UNIT III	**MANUFACTURING TECHNOLOGY**	**3**

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

UNIT IV	**AGRICULTURE AND IRRIGATION TECHNOLOGY**	**3**

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

UNIT V	**SCIENTIFIC TAMIL & TAMIL COMPUTING**	**3**

Development of Scientific Tamil - Tamil computing – Digitalization of Tamil Books – Development ofTamil Software – Tamil Virtual Academy – Tamil Digital Library – Online

Tamil Dictionaries – Sorkuvai Project.	
TOTAL: 15 PERIODS	
COURSE OUTCOMES:	
At the end of the course, the students will be able to:	
CO1:	Describe the importance of weaving and ceramic technology of Sangam Age.
CO2:	Illustrate the knowledge on structural design of Tamils during Sangam age.
CO3:	Demonstrate a strong foundational knowledge in manufacturing technology of ancient Tamils.
CO4:	Describe the importance of ancient agriculture and irrigation technology of Tamils.
CO5:	Explain the concept of digitalization of Tamil language.
TEXT & REFERENCE BOOKS:	
1.	கணிணித்தமிழ் – முனைவர் இல. சுந்தரம். (விகடன் பிரசுரம்)
2.	கீழடி – வைகை நதிக்கரயில் சங்ககால நகர நாகரீகம் (தொல்லியல் துறை வெளியீடு)/ Keeladi - 'Sangam City Civilization on the banks of river Vaigai', Department of Archaeology & Tamil Nadu Text Book and Educational Services Corporation, Tamil Nadu.
3.	பொருநை– ஆற்றங்கரை நாகரீகம். (தொல்லியல் துறை வெளியீடு)/ "Porunai Civilization", Department of Archaeology & Tamil Nadu Text Book and Educational Services Corporation, Tamil Nadu.
4.	Dr.K.K.Pillay, "Social Life of Tamils", A joint publication of TNTB & ESC and RMRL.
5.	Dr.S.Singaravelu, "Social Life of the Tamils - The Classical Period", International Institute of Tamil Studies.
6.	R.Balakrishnan, "Journey of Civilization Indus to Vaigai", RMRL.

GE3252	**தமிழரும் தொழில் நுட்பமும்**	**L**	**T**	**P**	**C**
		1	**0**	**0**	**1**

COURSEOBJECTIVES:

- சங்க காலத்தின் நெசவு மற்றும் பீங்கான் தொழில் நுட்பத்தை மாணவர்கள் புரிந்துகொள்ள வசதி செய்தல்.
- சங்க காலத் தமிழர்களின் வடிவமைப்பு தொழில்நுட்பம் பற்றிய விழிப்புணர்வை ஏற்படுத்துதல்.
- பண்டைய கால உற்பத்தி தொழில்நுட்பத்தின் அனைத்து நிலைகளையும் வேறுபடுத்தி அறிய மாணவர்களுக்கு உதவுதல்.
- விவசாயம் மற்றும் நீர்ப்பாசன தொழில்நுட்பத்தின் பண்டைய அறிவைப் புரிந்துக் கொள்ள செய்தல்.
- தமிழ் மொழியின் டிஜிட்டல் மயமாக்கல் பற்றிப் புரிந்துக் கொள்ள செய்தல்.

UNIT I	**நெசவு மற்றும் பானைத் தொழில்நுட்பம்**	**3**

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

UNIT II	**வடிவமைப்பு மற்றும் கட்டிடத் தொழில்நுட்பம்**	**3**

சங்க காலத்தில் வடிவமைப்பு மற்றும் கட்டுமானங்கள் ரூ சங்க காலத்தில் வீட்டுப் பொருட்களில் வடிவமைப்பு – சங்க காலத்தில் கட்டுமான பொருட்களும் நடுகல்லும் – சிலப்பதிகாரத்தில் மேடை அமைப்பு பற்றிய விவரங்கள் – மாமல்லபுரச் சிற்பங்களும், கோவில்களும் – சோழர் காலத்து பெருங்கோயில்கள் மற்றும் பிற வழிபாட்டுத் தலங்கள் – நாயக்கர் காலக் கோவில்கள் – மாதிரி கட்டமைப்புகள் கற்றி அறிதல், மதுரை மீனாட்சி அம்மன் ஆலயம் மற்றும் திருமலை நாயக்கர் மஹால் – செட்டிநாட்டு வீடுகள் – பிரிட்டிஷ் காலத்தில் சென்னையில் இந்தோ –சாரோசெனிக்

கட்டிடக் கலை.		
UNIT III	**உற்பத்தித் தொழில் நுட்பம்**	**3**
கப்பல் கட்டும் கலை – உலோகவியல் – இரும்புத் தொழிற்சாலை – இரும்பை உருக்குதல், எ.ஃகு – வரலாற்றுச் சான்றுகளாக செம்பு மற்றும் தங்க நாணயங்கள் – நாணயங்கள் அச்சடித்தல் – மணி உருவாக்கும் தொழிற்சாலைகள் – கல்மணிகள்- கண்ணாடி மணிகள் – சுடுமண் மணிகள் – சங்கு மணிகள் - எலும்புத்துண்டுகள் – தொல்லியல் சான்றுகள் – சிலப்பதிகாரத்தில் மணிகளின் வகைகள்.		
UNIT IV	**வேளாண்மை மற்றும் நீர்பாசனத் தொழில்நுட்பம்**	**3**
அணை, ஏரி, குளங்கள், மதகு – சோழர்காலக் குமுழித் தூம்பின் முக்கியத்துவம் – கால்நடை பராமரிப்பு – கால்நடைகளுக்கான வடிவமைக்கபட்ட கிணறுகள் – வேளாண்மை மற்றும் வேளாண்மைச் சார்ந்த செயல்பாடுகள் – கடல்சார் அறிவு – மீன்வளம் – முத்து மற்றும் முத்துக்குளித்தல் – பெருங்கடல் குறித்த பண்டைய அறிவு – அறிவுசார் சமூகம்.		
UNIT V	**அறிவியல் தமிழ் மற்றும் கணினித்தமிழ்**	**3**
அறிவியல் தமிழின் வளர்ச்சி – கணினித்தமிழ் வளர்ச்சி – தமிழ் நூல்களை மின்பதிப்பு செய்தல் – தமிழ் மென்பொருட்கள் உருவாக்கம் – தமிழ் இணையக் கல்விக்கழகம் – தமிழ் மின் நூலகம் – இணையத்தில் தமிழ் அகராதிகள் – சொற்குவைத் திட்டம்.		
		TOTAL: 15 PERIODS

COURSE OUTCOMES:

இப்பாடத் திட்டத்தின் மூலம் மாணவர்கள் பெறும் பயன்கள்:

CO1:	சங்க காலத்தின் நெசவு மற்றும் பீங்கான் தொழில் நுட்பத்தின் முக்கியத்துவத்தை விவரிக்க முடியும்.
CO2:	சங்க காலத் தமிழர்களின் வடிவமைப்பு தொழில்நுட்பம் பற்றிய அறிவை விளக்க முடியும்.
CO3:	பண்டைய தமிழர்களின் உற்பத்தி தொழில்நுட்பம் பற்றிய வலுவான அடித்தள அறிவை வெளிப்படுத்த முடியும்.
CO4:	தமிழர்களின் விவசாயம் மற்றும் நீர்ப்பாசன தொழில்நுட்பத்தின் பண்டைய அறிவை விவரிக்க முடியும்.
CO5:	தமிழ் மொழியின் டிஜிட்டல் மயமாக்கல் பற்றிய கருத்தை விளக்க முடியும்.

TEXT & REFERENCE BOOKS:

1	கணிணித்தமிழ் – முனைவர் இல. சுந்தரம். (விகடன் பிரசுரம்)
2	கீழடி – வைகை நதிக்கரயில் சங்ககால நகர நாகரீகம் (தொல்லியல் துறை வெளியீடு)/ Keeladi - 'Sangam City Civilization on the banks of river Vaigai', Department of Archaeology & Tamil Nadu Text Book and Educational Services Corporation, Tamil Nadu.
3	பொருநை– ஆற்றங்கரை நாகரீகம். (தொல்லியல் துறை வெளியீடு)/ "Porunai Civilization", Department of Archaeology & Tamil Nadu Text Book and Educational Services Corporation, Tamil Nadu.
4	Dr.K.K.Pillay, "Social Life of Tamils", A joint publication of TNTB & ESC and RMRL.
5	Dr.S.Singaravelu, "Social Life of the Tamils - The Classical Period", International Institute of Tamil Studies.
6	R.Balakrishnan, "Journey of Civilization Indus to Vaigai", RMRL.

Course Outcomes	**PO**												**PSO**		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO1	-	-	-	-	-	1	1	-	-	-	-	-	-	-	-
CO2	-	-	-	-	-	1	1	-	-	-	-	-	-	-	-

CO3	-	-	-	-	-	1	1	-	-	-	-	-	-	-	-
CO4	-	-	-	-	-	1	1	-	-	-	-	-	-	-	-
CO5	-	-	-	-	-	1	1	-	-	-	-	-	-	-	-
CO	-	-	-	-	-	1	1	-	-	-	-	-	-	-	-

Table of Specification (ToS) for End Semester Question Paper

Unit No.andTitle	Total2 Marks Qns.	Total16 Marks Qns.	Bloom's Taxonomy (Cognitive) Level			
			Remember (Kn)	Understand (Un)	Apply (Ap)	Analyse(An) Evaluate(Ev)
			No. of Qns. (marks) and CO			
Unit-I:Weaving and Ceramic Technology	2	1 either or	2(2)-CO1	1 either or (16)- CO1	-	-
Unit-II:Design and Construction Technology	2	1 either or	2(2)-CO2	1 either or (16)- CO2	-	-
Unit-III:Manufacturing Technology	2	1 either or	1(2)- CO3	1(2)- CO3 1 either or (16)-CO3	-	-
Unit-IV:Agriculture and Irrigation Technology	2	1 either or	1(2)-CO4	1(2)- CO4 1 either or (16)-CO4	-	-
Unit-V: Scientific Tamil & Tamil Computing	2	1 eithe or	1(2)-CO5	1(2)-CO5 1 either or (16)- CO5	-	-
Total Qns. Tamils and Technology	10	5 either or	7(2)	3(2) 5 either or (16)	-	-
Total Marks	20	80	14	86	-	-
Weightage	20%	80%	14%	86%	-	-

Weightage for COs					
	CO1	**CO2**	**CO3**	**CO4**	**CO5**
Total Marks	20	20	20	20	20
Weightage	20%	20%	20%	20%	20%

EN22201	**TECHNICAL ENGLISH**	**L**	**T**	**P**	**C**
		2	**0**	**2**	**3**

COURSEOBJECTIVES:

- To widen strategies and skills to augment ability to read and comprehend engineering and technology texts.
- To develop writing skill to make technical presentations.
- To draft convincing job applications and effective reports.
- To strengthen listening skills to comprehend technical lectures and talks in their areas of specialization.
- To cultivate speaking skills both technical and general.

UNITI	**LANGUAGE STUDY**	**12**

Technical Vocabulary- Synonyms, antonyms, prefix and suffix, Word formation, Homonyms and Homophones–Puzzles -Reading: Skimming a reading passage – Scanning for specific information – Instruction- Interpreting – Writing: Recommendation- Checklist.		
UNIT II	**READING AND STUDY SKILLS**	**6**
Active and Passive voice- Extended Definitions – Imperatives- Numerical Adjectives- Purpose Statement – Reading: Critical reading- Newspaper articles- Journal reports- Editorials and opinion blogs-Report Writing: Fire Accident, Industrial visit, Project report, feasibility report, survey report, business report.		
UNIT III	**WRITING SKILLS- INTRODUCTION TO PROFESSIONAL WRITING**	**6**
Error Spotting/Common Errors – Concord - Compound words - Abbreviations and Acronyms - Discourse Markers - Finding key information – Shifting facts from opinion- Interpreting visual material - Making inference from the reading passage - Interpretation of charts - Minutes of the meeting - Paraphrasing- Proposal writing.		
UNIT IV	**TECHNICAL WRITING AND GRAMMAR**	**6**
If Conditional Clauses- Prepositional Phrases- Fixed and semi fixed expressions - e-mail communication- Reading the attachment files having a poem /joke / proverb/sending their responses through e-mail - Job application letter and Resume/CV/ Bio-data.		
UNIT V	**EXTENDED WRITING AND LANGUAGE STUDY**	**6**
Articles- Cause and Effect expressions – Collocations- Sequencing words- Reading longer technical texts and taking down notes - Structure of Essay - Types of Essay: Narrative essay - Descriptive Essay - Analytical Essay - Cause and Effect Essay – Compare and contrast essays.		
TOTAL: 30 PERIODS		
PRACTICAL EXERCISES		
Listening Skills – Listening for professional development Listening to UPSC Toppers Mock Interviews- Listening to debates/discussions/different viewpoints /scientific lectures/event narrations/documentaries/telephonic conversations.		
Speaking Skills – Emphasizing communicative establishment Seeking Information - Asking and giving directions- Narrating personal experiences/ events- Answering interview questions- Picture description- Presenting a product and giving instruction to use a product – Mini presentations- Role plays- Speaking in formal and informal situations- Speaking about one's locations - Speaking about great personalities – Describing a simple process- Telephone skills and etiquette.		
TOTAL: 30 PERIODS		
TOTAL (T+P) = 60 PERIODS		
COURSE OUTCOMES:		
At the end of the course, the students will be able to:		
CO1:	Infer advanced technical texts from varied technical genres to expand engineering knowledge and explore more ideas.	
CO2:	Analyze technical contents written on par with international standards and rewrite	

	contents using the right vocabulary without grammatical errors to make their articles published in reputed journals.
CO3:	Present reports and job letters utilizing the required format prescribed on par with international standards using the exact vocabulary to make their works worthy to be read.
CO4:	Employ the language tones and styles appropriately in interviews and Group Discussions effortlessly following the strategies expected by the corporate world.
CO5:	Appraise the need for new products and write feasibility and survey reports following the format prescribed in a way to create awareness.
TEXT BOOKS:	
1.	Mike Markrl, "Technical Communication", Palgrave Macmillan, London, 2012.
2.	Sumant, S and Joyce Pereira, "Technical English II", Chennai: Vijay Nicole Imprints Private Limited, 2014.
REFERENCES:	
1.	Raman, Meenakshi & Sangeetha Sharma, "Communication Skills", New Delhi: OUP, 2018.
2.	Rizvi M, Ashraf, "Effective Technical Communication", New Delhi: Tata McGraw-Hill Publishing Company Limited, 2007.
3.	Kumar, Sanjay and Pushp Lata, "Communication Skills: A Workbook", New Delhi: OUP, 2018.
4.	Means, L. Thomas and Elaine Langlois, "English & Communication for Colleges", Cengage Learning, USA: 2007.
5.	Greendaum, Sydney and Quirk, Randolph, "A Student's Grammar of the English Language", Pearson Education.

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

Table of Specification (ToS) for End Semester Question Paper

Unit No. and Title	**Total 2 Marks Qns.**	**Total 16 Marks Qns.**	**Bloom's Taxonomy (Cognitive) Level**		
			Remember (Kn)	**Understand (Un)**	**Apply (Ap)**
			No. of Qns. (marks) and CO		
Unit-I: Language Study	2	1 compulsory	1(2)-CO1	1(2)-CO1 1Compulsory (16)- CO1	-

Unit-II:Reading and Study Skills	2	1 either or	2(2)-CO2	1 either or (16)- CO2	-
Unit-III: Writing Skills	2	1 either or	1(2)- CO3	1(2)-CO3	1 either or (16)-CO3
Unit-IV:Technical Writing and Grammar	2	1 either or	1(2)-CO4	1(2)-CO4	1 either or (16)-CO4
Unit-V:Extended Writing And Language Study	2	1 either or	1(2)-CO5	1(2)-CO5	1 either or (16)- CO5
Total Qns.Technical English	10	1 Compulsory & 4 either or	6(2)	4(2) 1 Compulsory & 1 either or (16)	3 either or (16)
Total Marks	20	80	12	40	48
Weightage	20%	80%	12%	40%	48%

Weightage for COs

	CO1	CO2	CO3	CO4	CO5
Total Marks	20	20	20	20	20
Weightage	20%	20%	20%	20%	20%

PH22201	**PHYSICS FOR CIVIL ENGINEERS**	**L**	**T**	**P**	**C**
		2	**0**	**2**	**3**

COURSEOBJECTIVES:

- To understand the concepts of light, electron transport properties and the essential principles of semiconductors.
- To become proficient in factors affecting buildings.
- To know the basics of the functioning of advanced engineering materials.
- To induce the students to design new devices that serve humanity by applying the knowledge gained during the course.

UNITI	**PHOTONICS**	**6**

Interference – Air wedge – LASER – Population inversion - Einstein coefficient's –NdYAG Laser - CO_2 laser – Semiconductor laser – Optical fibre – Total internal reflection – Propagation of light – Numerical Aperture and Acceptance angle – Fiber optic communication system – Endoscopy.

UNIT II	**ELECTRICAL PROPERTIES OF MATERIALS**	**6**

Classical free electron theory - Expression for electrical conductivity and thermal conductivity, Wiedemann-Franz law – Success and failures - Fermi- Dirac statistics – Density of energy states – Electron in periodic potential – Band theory of solids - Electron effective mass – Concept of hole.

UNIT III	**SEMICONDUCTING MATERIALS**	**6**

Semiconductors – Direct and indirect band gap semiconductors – Intrinsic semiconductors Carrier concentration, band gap in intrinsic semiconductors – Extrinsic semiconductors - N-type & P-type semiconductors – Variation of carrier concentration and Fermi level with temperature - Hall effect - Measurement of Hall coefficient –Applications.

UNIT IV	**THERMAL, ACOUSTIC AND OPITICAL EFFECT IN BUILDINGS**	**6**

Thermal comfort - Factors affecting the thermal performance of buildings - Thermal insulation

and its benefits – Reverberation time – Sabine's formula (Qualitative) - Sound absorbing materials - Factors affecting acoustics of buildings and their remedies – Day-light design of windows, measurement of day-light - Artificial lighting - Green building – Features – Benefits.		
UNIT V	**ADVANCED ENGINEERING MATERIALS**	**6**
Composites - Definition and classification - Fibre reinforced plastics (FRP) and fiber reinforced metals (FRM) - Metallic glasses - Shape memory alloys - Ceramics - Classification - Properties – Nanomaterials – Structural and design applications.		
		TOTAL: 30 PERIODS
LIST OF EXPERIMENTS		
1	Uniform bending – Determination of Young's modulus.	
2	Air-wedge – Thickness of thin wire.	
3	Spectrometer – Grating.	
4	LASER – Wavelength and particle size determination.	
5	Optical fibre – Acceptance angle and Numerical aperture.	
6	Band gap determination.	
	TOTAL:30 PERIODS	
	TOTAL (T+P) = 60 PERIODS	
COURSE OUTCOMES:		
At the end of the course, the students will be able to:		
CO1:	Recall the basic concepts of light, electron transport properties of conductors and basic principles of semiconductors.	
CO2:	List the factors affecting the buildings and the principles of advanced engineering materials.	
CO3:	Illustrate laser and fibre optics, classical and quantum concepts of conducting materials, physics of semiconducting materials.	
CO4:	Explain the impact of heat, sound and light in buildings and functioning of smart materials.	
CO5:	Develop the applications of optics, fibre optics, moduli of elasticity and thermal energy, behavior of conductors, semiconductors and advanced engineering materials and also the influence of various factors in building constructions.	
TEXT BOOKS:		
1.	Gaur R.K. and Gupta S.L., "Engineering Physics". Dhanpat Rai Publishers, 2016.	
2.	Kasap, S.O., "Principles of Electronic Materials and Devices", McGraw-Hill Education, 2017.	
REFERENCES:		
1.	Jasprit Singh, "Semiconductor Devices: Basic Principles", Wiley 2012.	
2.	Budinski, K.G. & Budinski, M.K. "Engineering Materials Properties and Selection", Prentice Hall, 2009.	
3.	Jadhav, Nilesh Y., "Green and Smart buildings", Springer, 2016.	
4.	Stevens, W.R., "Building Physics: Lighting: Seeing in the Artificial Environment, Pergaman Press, 2013.	

5.	Kittel, C., “Introduction to Solid State Physics”, Wiley, 2017.

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

Table of Specification (ToS) for End Semester Question Paper

Unit No.andTitle	Total 2 Marks Qns.	Total 16 Marks Qns.	Bloom’s Taxonomy (Cognitive) Level			
			Remember (Kn)	Understand (Un)	Apply (Ap)	Analyse (An) Evaluate (Ev)
			No. of Qns. (marks) and CO			
Unit I - Photonics	2	1 either or	1(2)-CO1	1(2)-CO3	1 either or (16)- CO5	-
Unit II - Electrical Properties of Materials	2	1 either or	1(2)-CO1	1(2)- CO3 1 either or (16)- CO3	-	-
Unit III - Semiconducting Materials	2	1 either or	2(2)- CO1	-	1 either or (16)- CO5	-
Unit IV - Thermal, Acoustic and Opitical Effect in Buildings	2	1 either or	1(2)-CO2	1 (2)- CO4 1 either or (16)-CO4	-	-
Unit V - Advanced Engineering Materials	2	1 either or	2(2)-CO2	-	1 either or (16)- CO5	-
Total Qns. Physics for Civil Engineers	10	5 either or	7(2)	3(2) 2 either or (16)	3 either or (16)	-
Total Marks	20	80	14	38	48	-
Weightage	20%	80%	14%	38%	48%	-

Weightage for COs					
	CO1	CO2	CO3	CO4	CO5
Total Marks	8	6	20	18	48
Weightage	8%	6%	20%	18%	48%

CH22201	ENVIRONMENT AND SUSTAINABILITY	L	T	P	C
		2	0	2	3

COURSEOBJECTIVES:

- To understand the concept of ecosystem and biodiversity.
- To conversant with various types of pollution and its effects.
- To obtain knowledge on natural resources and its exploitation.

• To understand the social issues related to environment and methods to protect.		
• To gain knowledge on sustainability and environment.		
UNITI	**ECOSYSTEM AND BIODIVERSITY**	**6**
Environment – Ecosytem – Structure and function of an ecosystem – Energy flow in an ecosystem – Food chain and food web – Biodiversity – Types – Values, threats and conservation of biodiversity – Endangered and endemic species – Hot spot of biodiversity – Biodiversity at state level, national level and global level.		
UNIT II	**NATURAL RESOURCES**	**6**
Introduction – Forest resources – Uses and Overexploitation - Deforestation – causes and consequences – Water resources – effect of over utilisation of water – Food resources – Impacts of modern agriculture (pesticides, fertilizers, water logging, salinity) – Sustainable Energy resources – Wind, Solar, hydroelectric power, geothermal – Land resources – Desertification, soil erosion – Role of an individual in the conservation of natural resources. Case study – Deforestation, water conflicts, fertilizer and pesticide problem.		
UNIT III	**ENVIRONMENTAL POLLUTION AND MANAGEMENT**	**7**
Definition, causes, effects and control measures of air pollution, water pollution, noise pollution, thermal pollution and marine pollution – Waste water treatment - Waste management – solid waste, biowaste, e-waste - Disaster management – Flood, cyclone, earthquake.		
UNIT IV	**SOCIAL ISSUES AND HUMAN HEALTH**	**6**
Population explosion and its effects on environment — Variation of population among nations - Environmental issues and Human health – Food adulteration – Risk of food adulteration – Detection and prevention of food adulteration - COVID-19 – Human rights – Value education.		
UNIT V	**SUSTAINABLE DEVELOPMENT AND ENVIRONMENT**	**5**
Sustainable development – Needs and challenges — Goals – Aspects of sustainable development – Assessment of sustainability - Environmental ethics – Green chemistry – Eco mark, Eco products – EIA – Regional and local environmental issues and possible solutions - Role of engineering in environment and human health.		
		TOTAL: 30 PERIODS
LIST OF EXPERIMENTS		
1.	Determination of DO content of waste water sample (Winkler's method).	
2.	Determination of chloride content of water sample by Argentometric method	
3.	Estimation of copper content in water by Iodometry.	
4.	Determination of Ca / Mg in waste water sample.	
5.	Detection of adulterant in ghee/edible oil/coconut oil.	
6.	Detection of adulterant in sugar/honey/chilli powder.	
		TOTAL:30 PERIODS
		TOTAL (T+P) = 60 PERIODS
COURSE OUTCOMES:		
At the end of the course, the students will be able to:		
CO1:	Recall the basic concepts of environment and sustainable development.	
CO2:	Summarize the types of pollution, various natural resources and food adulterants.	

CO3:	Explain the methods for waste management and detection of adulterants.
CO4:	Apply the gained knowledge to overcome various issues related to health and environment.
CO5:	Identify suitable methods for local environmental issues and sustainability.
TEXT BOOKS:	
1.	Benny Joseph, "Environmental Science and Engineering", Tata McGraw Hill, New Delhi, 2017.
2.	Gilbert M. Masters, "Introduction to Environmental Engineering and Science", 2nd Edition, Pearson Education, 2015.
REFERENCES:	
1.	Erach Bharucha, "Text book of Environmental studies", Universities Press (I) PVT LTD, Hyderabad, 2015.
2.	Rajagopalan. R, "Environmental Studies - From Crisis to Cure", Oxford University Press, 2015.
3.	G. Tyler Miller and Scott E. Spoolman, "Environmental Science", Cengage Learning India PVT LTD, 2014.
4.	Ruth F. Weiner and Robin A. Matthews. Butterworth, "Environmental Engineering", Heineman Publications, 4th Edition.
5.	Dash M.C, "Concepts of Environmental Management for Sustainable Development", Wiley Publications, 2019.

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

Table of Specification (ToS) for End Semester Question Paper

Unit No. and Title	**Total 2 Marks Qns.**	**Total 16 Marks Qns.**	**Bloom's Taxonomy (Cognitive) Level**			
			Remember (Kn)	**Understand (Un)**	**Apply (Ap)**	**Analyse(An) Evaluate(Ev)**
			No. of Qns. (marks) and CO			
Unit I – Ecosystem and Biodiversity	2	1 either or	1(2)-CO1	1(2)-CO2	1 either or (16)- CO4	-
Unit II – Natural Resources	2	1 either or	1(2)-CO1	1(2)- CO2	1 either or (16)- CO4	-
Unit III – Environmental Pollution and Management	2	1 either or	-	1(2)- CO2 1(2)- CO3 1 either or	-	-

				(16)- CO3		
Unit IV – Social Issues and Human Health	2	1 either or	-	1(2)- CO2 1(2)- CO3	1 either or (16)- CO4	-
Unit V – Sustainable Development and Environment	2	1 either or	2(2)-CO1	-	1 either or (16)- CO5	-
Total Qns. Environment and Sustainability	10	5 either or	4 (2)	6 (2) 1 either or (16)	4 either or(16)	-
Total Marks	20	80	8	28	64	-
Weightage	20%	80%	8%	28%	64%	-

Weightage for COs

	CO1	**CO2**	**CO3**	**CO4**	**CO5**
Total Marks	8	8	20	48	16
Weightage	8%	8%	20%	48%	16%

CE22202	**BUILDING MATERIALS LABORATORY**	**L**	**T**	**P**	**C**
		0	**0**	**4**	**2**

COURSE OBJECTIVES:

- To assess the strength of various materials experimentally.
- To apply the concepts of mechanics of materials to determine the behaviour of materials under load.

LIST OF EXPERIMENTS

1. Determination of Grading of fine aggregates using sieve analysis.
2. Determination of specific gravity of fine and coarse aggregates.
3. Determination of compacted and loose bulk density of fine aggregate.
4. Determination of impact value of coarse aggregate.
5. Determination of elongation and flakiness index of coarse aggregate.
6. Determination of normal consistency of cement.
7. Determination of initial and final setting time of cement.
8. Determination of soundness of cement.
9. Determination of compressive strength of bricks and blocks.
10. Determination of water absorption of bricks and blocks.
11. Determination of ductility grade and tensile strength of bitumen using ductility test.
12. Determination of viscosity of bitumen.

TOTAL: 60PERIODS

COURSE OUTCOMES:

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

CO1:	Choose a testing method for a particular material.
CO2:	Demonstrate experiments as per standard codes.
CO3:	Study the behaviour of material properties experimentally.

CO4:	Interpret the properties of construction materials.
CO5:	Evaluate the strength of building materials.
REFERENCE BOOKS	
1	IS 4031 (Part 1) – 1996 – Indian Standard Method for Determination of Fineness by Dry Sieving.
2	IS 2386 (Part 1 to Part 6) – 1963 – Indian Standard Methods for Test for Aggregate for Concrete.
3	IS 383– 1970 - Indian Standard Specification for Coarse and Fine Aggregates from Natural Sources for Concrete.
4	Construction Materials Laboratory Manual, Anna University, Chennai-600 025.
5	National Building Code of India, Part V, Building Materials, 2016.

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

ES22203	**ENGINEERING PRACTICES LABORATORY**	**L**	**T**	**P**	**C**
		0	**0**	**4**	**2**
COURSE OBJECTIVES:					
• Drawing pipeline plan; laying and connecting various pipe fittings used in common household plumbing work; Sawing; planning; making joints in wood materials used in common household wood work.					
• Wiring various electrical joints in common household electrical wire work.					
• Welding various joints in steel plates using arc welding work; Machining various simple processes like turning, drilling, tapping in parts; Assembling simple mechanical assembly of common household equipment; Making a tray out of metal sheet using sheet metal work.					
• Soldering and testing simple electronic circuits; Assembling and testing simple electronic components on PCB.					
GROUP - A (CIVIL & MECHANICAL)					

PART I	**CIVIL ENGINEERINGPRACTICES**	**15**
PLUMBING WORK	❖ Connecting various basic pipe fittings like valves, taps, coupling, unions, reducers, elbows and other components which are commonly used in household.	
	❖ Preparing plumbing line sketches.	
	❖ Laying pipe connection to the suction side of a pump.	
	❖ Laying pipe connection to the delivery side of a pump.	
	❖ Connecting pipes of different materials: Metal, plastic and flexible pipes used in household appliances.	
WOODWORK	❖ Sawing	
	❖ Planning	
	❖ Making joints likeT-Joint, Mortise joint and Tenon joint and Dove tail joint.	
PART II	**MECHANICAL ENGINEERING PRACTICES**	**15**
WELDINGWORK	❖ Welding of Butt Joints, Lap Joints, and Tee Joints using arc welding.	
	❖ Practicing gas welding.	
BASICMACHININGWORK	❖ Perform turning operation in the given work piece.	
	❖ Perform drilling operation in the given work piece.	
	❖ Performing tapping operation in the given work piece.	
ASSEMBLY WORK	❖ Assembling a centrifugal pump.	
	❖ Assembling a household mixer.	
SHEETMETAL WORK	❖ Making of a square tray.	
GROUP - B (ELECTRICAL AND ELECTRONICS)		
PART-I	**ELECTRICAL ENGINEERING PRACTICES**	**15**
❖ One lamp controlled by one switch.		
❖ Series and parallel wiring.		
❖ Staircase wiring.		
❖ Fluorescent Lamp wiring.		
❖ Residential wiring		
❖ Iron Box wiring and assembly.		
PART-II	**ELECTRONIC ENGINEERING PRACTICES**	**15**
❖ Introduction to electronic components and equipment.		
❖ Calculation of resistance using colour coding.		
❖ Verify the logic gates AND, OR, EX-OR and NOT.		
❖ Measurement of AC signal parameters using CRO.		
❖ Soldering simple electronic circuits on a small PCB and checking continuity.		

	TOTAL: 60PERIODS
COURSE OUTCOMES:	
At the end of the course the students will be able to	
CO1:	Preparevariouspipe and furniturefittingsusedincommonhousehold.
CO2:	Perform the given metal joining and metal removal operation in the given work piece as per the dimensions.
CO3:	Apply the fundamental concepts involved in Electrical Engineering.
CO4:	Explain the basic electrical wiring procedures.
CO5:	Assemble basic electronic components.

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

SEMESTER III

MA22304	**TRANSFORMS AND PARTIAL DIFFERENTIAL EQUATIONS**	**L**	**T**	**P**	**C**
		3	**1**	**0**	**4**

COURSE OBJECTIVES:

- To introduce the basic concepts of PDE for solving standard partial differential equations.
- To introduce Fourier series analysis this is central to many applications in engineering apart from its use in solving boundary value problems.
- To acquaint the student with Fourier series techniques in solving heat flow problems used in various situations.
- To familiarize the basic concepts of Laplace transform and inverse Laplace transform techniques used in wide variety of situations.

UNIT I	**PARTIAL DIFFERENTIAL EQUATIONS**	**12**

Degree and order of partial differential equations -First order linear partial differential equations - Lagrange's linear equation: Method of grouping and method of multipliers - Homogeneous linear partial differential equations of second and higher order with constant coefficients with functions $e^{ax+by}, \sin(ax+by), \cos(ax+by)$.

UNIT II	FOURIER SERIES	12
Conditions for a Fourier expansion: Dirichlet's conditions –Fourier series - Euler's Formulae– General Fourier series for functions of polynomials in the interval $(0,2\pi)$ and $(0,2l)$ - Functions having points of continuity and discontinuity - Half range series: Half range sine and cosine series (polynomials only) – Root mean square value.		
UNIT III	**APPLICATIONS OF PARTIAL DIFFERENTIAL EQUATIONS**	**12**
Classification of PDE of second order – One-dimensional wave equation: Fourier series solutions of one-dimensional wave equation with zero initial velocity– Fourier series solutions of one-dimensional wave equation with zero initial displacement - One dimensional equation of heat conduction – Steady state conditions with zero boundary conditions.		
UNIT IV	**LAPLACE TRANSFORM**	**12**
Definition of the Laplace Transform -Existence conditions – Transforms of elementary functions $t^n, e^{at}, e^{-at}, sinat, cosat, sinhat, coshat$ – Transform of unit step function and unit impulse function – Basic properties : Linear, Change of scale, First Shifting theorem (Statement only) –Problems based on properties- Differentiation of Transform: $L[t\,f(t)]$- Integration of Transform: $L\left[\frac{f(t)}{t}\right]$–Initial and final value theorems(Statement only)– Problems based on Initial and final value theorems - Laplace Transform of periodic functions.		
UNIT V	**INVERSE LAPLACE TRANSFORM**	**12**
Inverse Laplace Transform– Inverse Laplace Transform of elementary functions – Basic properties: Linear, First Shifting theorem, Change of scale (Statement only) - Problems based on properties - Convolution theorem(Statement only) – Inverse Laplace Transform using Convolution theorem.		
		TOTAL: 60 PERIODS

COURSE OUTCOMES:

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

CO1:	Solve the standard partial differential equations.
CO2:	Find the Fourier series for periodic functions.
CO3:	Apply Fourier series in one dimensional heat and wave equations.
CO4:	Determine the Laplace transforms for functions.
CO5:	Apply inverse Laplace transforms in engineering fields.

TEXT BOOKS:

1.	Grewal B.S., "Higher Engineering Mathematics", 44th Edition, Khanna Publishers, New Delhi,2018.
2.	Ramana. B.V., "Higher Engineering Mathematics", McGraw Hill Education Pvt. Ltd,New Delhi, 2018.

REFERENCES:

1.	James. G., "Advanced Modern Engineering Mathematics", 4th Edition, Pearson Education, New Delhi, 2016.
2.	Veerarajan. T., "Transforms and Partial Differential Equations", Tata McGraw Hill Education Pvt. Ltd., New Delhi, Second reprint, 2012.

3.	Srimanta Pal, Suboth C. Bhunia, " Engineering Mathematics", Oxford University Press, New Delhi, 2015,
4.	R.K.Jain, S.R.K.Iyengar, "Advanced Engineering Mathematics", 5th Edition, Narosa Publishing House Pvt.Ltd., New Delhi, 2016.
5.	Narayanan. S., ManicavachagomPillay.T.K and Ramanaiah.G, "Advanced Mathematics for Engineering Students", Vol. II & III, S.Viswanathan Publishers Pvt. Ltd, Chennai, 1998.

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

Table of Specification (ToS) for End Semester Question Paper

Unit No. and Title	Total 2 Marks Qns.	Total 16 Marks Qns.	Bloom's Taxonomy (Cognitive) Level			
			Remember (Kn)	Understand (Un)	Apply (Ap)	Analyse(An) Evaluate(Ev)
			No. of Qns. (marks) and CO			
Unit-I: Partial Differential Equations	2	1 either or	2(2) –CO1	1 either or (16) – CO1	-	-
Unit-II: Fourier Series	2	1 either or	2(2) - CO2	1 either or (16) — CO2	-	-
Unit-III: Applications of Partial Differential Equations	2	1 either or	1(2) — CO3	1(2) — CO3	1 either or (16) — CO3	-
Unit-IV: Laplace Transforms	2	1 either or	1(2) - CO4	1(2) — CO4	1 either or (16) — CO4	-
Unit-V: Inverse Laplace Transforms	2	1 either or	1(2) – CO5	1(2) — CO5	1 either or (16) — CO5	-
Total Qns. Transforms and Partial Differential Equations	10	1 either or	7(2)	3(2) 2 either or (16)	3 either or (16)	-
Total Marks	20	80	14	38	48	-
Weightage	20%	80%	14%	38%	48%	-

Weightage for COs					
	CO1	CO2	CO3	CO4	CO5
Total Marks	20	20	20	20	20
Weightage	20%	20%	20%	20%	20%

CE22301	STRENGTH OF MATERIALS	L	T	P	C
		3	1	0	4

COURSE OBJECTIVE:

- This course imparts knowledge about stresses, strains, shear force, bending moment, slope and deflection in beams, concept of torsion in circular shaft and theory of columns.

UNIT I	STRESSES AND STRAIN	12

Types of loads –Types of Stresses and strains – Stress, strain diagram for mild steel – Elastic limit – Hooke's law – Poisson's ratio – Factors of safety – Elastic constants – Young's Modulus – Shear Modulus – Bulk Modulus – Thermal stresses – Deformation of simple and compound bars.

UNIT II	SHEAR FORCE AND BENDING MOMENTS IN BEAMS	12

Types of beams, supports and loads– Bending moment and Shear force – Point of contraflexure – Clockwise and anti-clockwise moments – Shear force and bending moment diagrams for beams subjected to different loads and couples. Calculation of shear stress and bending stress of beams of various sections.

UNIT III	DEFLECTION OF BEAMS	12

Beam Deflection – Slope –Macaulay's method – Mohr's theorems – Moment area method – Conjugate beam theorems – Conjugate beam method.

UNIT IV	THEORY OF COLUMN AND TORSION	12

Euler's column theory – Critical load for prismatic columns with different end conditions – Effective length – Limitations – Rankine – Gordon formula – Simple torsion –Torsion equation for circular shafts and hollow circular shafts – Assumptions – Torsional rigidity – Power transmission – Modulus of rupture.

UNIT V	ANALYSIS OF TRUSSES	12

Analysis of pin jointed plane determinate trusses by method of joints, method of sections and tension coefficient method.

TOTAL: 60 PERIODS

COURSE OUTCOMES:

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

CO1:	State the theory of stress, strain, forces, moment, torsion and deflection.
CO2:	Explain the concept of simple bending and theory of column and torsion.
CO3:	Draw shear force and bending moment diagram for beams.
CO4:	Compute shear stress, bending stress, elastic constants, deflection of beams and stresses in thin cylinder.
CO5:	Determine torsional behavior of shaft and forces in determinate trusses.

TEXT BOOKS:

1.	Rajput R.K., "Strength of Materials", 7th Edition, S. Chand & Company Ltd, New Delhi, 2018.

2.	Rattan.S.S., "Strength of Materials", Tata McGraw Hill Education Pvt. Ltd., New Delhi, 2011.
REFERENCES:	
1.	Subramanian R., "Strength of Materials", 2nd Edition, Oxford University Press, 2014.
2.	R K Bansal, "A text book of Strength of Materials", Lakshmi Publications (P) Limited, New Delhi, Sixth Edition, 2018.
3.	Singh D.K, "Mechanics of Solids", Pearson Education, 2012.
4.	Ferdinand Pierre Beer, Elwood Russell Johnston, John T. De Wolf and David Francis Mazurek, "Mechanics of Materials", 7th Edition, McGrawHill Education, 2015.
5.	Srinath, L.S, "Advanced Mechanics and Solids", Tata-McGraw Hill Publishing Company ltd, 2005.

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

Table of Specification (ToS) for End Semester Question Paper

Unit No. and Title	Total 2 Marks Qns.	Total 16 Marks Qns.	Bloom's Taxonomy (Cognitive) Level			
			Remember (Kn)	Understand (Un)	Apply (Ap)	Analyse(An) Evaluate(Ev)
			No. of Qns. (Marks) and CO			
Unit-I: Stresses and Strain	2	1 Either or	2(2) –CO1	-	1 Either or (16) – CO3	-
Unit-II: Shear Force and Bending Moments in Beams	2	1 Either or	2(2) –CO1	-	1 Either or (16) — CO5	-
Unit-III: Deflection of Beams	2	1 Either or	1(2) — CO1	1(2) — CO3	1 Either or (16) — CO3	-
Unit-IV: Theory of Column and Torsion	2	I Either or	1 (2) –CO1	1(2) — CO4 1 Either or (16) — CO2	-	-
Unit-V: Analysis of Trusses	2	1 Either or	2(2) – CO5	-	1 Either or (16) — CO4	-
Total Qns. Strength of Materials	10	5 Either or	8 (2)	2(2) 1 Either or (16)	4 Either or (16)	-
Total Marks	20	80	16	20	64	-
Weightage	20%	80%	16%	20%	64%	-

Weightage for COs					
	CO1	**CO2**	**CO3**	**CO4**	**CO5**
Total Marks	12	16	34	18	20
Weightage	12%	16%	34%	18%	20%

CE22302	**SOIL MECHANICS**	**L**	**T**	**P**	**C**
		3	**0**	**0**	**3**

COURSE OBJECTIVES:

- To impart knowledge on engineering behaviour and performance of soil.
- To attain adequate knowledge in assessing the physical, engineering, and compaction and strength properties of soils.

UNIT I	**BASIC PROPERTIES OF SOILS**	**9**

Soil formation – Soil problems in Engineering – Physical properties of soil – Phase relations – Index properties of soil – Grain size distribution – Atterberg limits – Soil classification - Different methods and their significance – BIS classification system – Field identification – Simple tests.

UNIT II	**STRESSES IN SOILS**	**9**

Soil water statics – Concept of effective and neutral stresses – Capillary phenomenon – Vertical stress distribution in soils – Boussinesq equation – Line load – Uniformly distributed loads – Newmarks chart – Construction and use–Approximate methods – Pressure bulb – Westergaards equation.

UNIT III	**PERMEABILITY AND SEEPAGE**	**9**

One dimensional flow through soil – Permeability – Darcy‘s law – Field and laboratory permeability tests – Flow through stratified soil – Seepage pressure – Quick sand condition – Soil liquefaction – Two dimensional flow – Laplace equation – Electrical analogy – Flow net – Methods of construction – Properties – Applications – Phreatic line.

UNIT IV	**COMPACTION AND CONSOLIDATION**	**9**

Compaction – Factors affecting compaction – Laboratory and Field compaction methods – Compaction control - Consolidation – Consolidation settlement – Laboratory tests – Determination of C_v by curve fitting methods – Terzaghi’s one dimensional consolidation — Normally, over, under consolidated clay – Pre consolidation pressure – e- log p curve.

UNIT V	**SHEAR STRENGTH**	**9**

Shear strength of soil – Importance and use – Mohr – Coulomb’s theory – Factors affecting the shear strength – Laboratory tests – Direct shear test – Triaxial compression test – Triaxial tests based on drainage conditions – Cyclic loading – Pore pressure parameters – UCC test – Vane shear test – Insitu vane shear test.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

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

CO1:	State the basic concept of stress distribution in loaded soil medium and soil settlement due to consolidation.

CO2:	Demonstrate the flow through soil medium and its impact in engineering solution.
CO3:	Identify various types of soils and its properties, formulate and solve engineering problems.
CO4:	Determine the stress, permeability, compaction and consolidation of soil.
CO5:	Compute the shear strength of soils using laboratory test methods.
TEXT BOOKS:	
1.	Murthy, V.N.S., "Soil Mechanics and Foundation Engineering", CBS Publishers Distribution Ltd., New Delhi. 2015.
2.	Gopal Ranjan and Rao, A.S.R., "Basic and Applied Soil Mechanics", New Age Ltd. International Publisher New Delhi (India), 2006.
REFERENCES:	
1.	McCarthy, D.F., "Essentials of Soil Mechanics and Foundations", Prentice-Hall, 2006.
2.	Coduto, D.P., "Geotechnical Engineering – Principles and Practices", Prentice Hall of India Pvt. Ltd., New Delhi, 2010.
3.	Das, B.M., "Principles of Geotechnical Engineering". Brooks / Coles / Thompson Learning Singapore, 8th Edition, 2013.
4.	Punmia, B.C., "Soil Mechanics and Foundations", Laxmi Publications Pvt. Ltd. New Delhi, 2005.
5.	Venkatramaiah.C., "Geotechnical Engineering", New Age International Pvt. Ltd., New Delhi, 2017.

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

Table of Specification (ToS) for End Semester Question Paper

Unit No. and Title	**Total 2 Marks Qns.**	**Total 16 Marks Qns.**	**Bloom's Taxonomy (Cognitive) Level**			
			Remember (Kn)	**Understand (Un)**	**Apply (Ap)**	**Analyse(An) Evaluate(Ev)**
			No. of Qns. (marks) and CO			
Unit-I: Basic Properties of Soils	2	1 either or	2(2) –CO1		1 either or (16) – CO3	-

Unit-II: Stresses in Soils	2	1 either or	2(2) – CO1	1 either or (16) — CO2	-	-
Unit-III: Permeability and Seepage	2	1 either or	1(2) — CO3	1(2) — CO3	1 either or (16) — CO3	-
Unit-IV: Compaction and Consolidation	2	1 either or	1(2) –CO1	1(2) — CO4	1 either or (16) — CO4	-
Unit-V: Shear Strength	2	1 either or	I(2) – CO5	1(2) — CO5	1 either or (16) — CO5	-
Total Qns. Soil Mechanics	10	5 either or	7(2)	3(2) 1 either or (16)	4 either or (16)	-
Total Marks	20	80	14	22	64	-
Weightage	20%	80%	14%	22%	64%	-

Weightage for COs

	CO1	**CO2**	**CO3**	**CO4**	**CO5**
Total Marks	10	16	36	18	20
Weightage	10%	16%	36%	18%	20%

CE22303	**SURVEYING**	**L**	**T**	**P**	**C**
		3	**0**	**2**	**4**

COURSE OBJECTIVES:

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

UNIT I	**INTRODUCTION**	**9**

Surveying definition – Classification - Principles of surveying - Plans and maps - Scales - Distances and direction: Distance measurement – Useofchainandtape, Electronic distance measurements – Bearings - Computation ofangles - Compass surveying -Local attraction - Calculation of corrected angles and bearings.

UNIT II	**LEVELLING**	**9**

Definition - Methods of leveling - Levelling instruments - Temporary adjustments of a level – Terms and abbreviations - Differential leveling - Height of instrument method - Rise andfall method -Profile leveling - Contouring – Methods – Characteristics and uses of contours.

UNIT III	**THEODOLITE AND TACHEOMETRIC SURVEYING**	**9**

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

Tacheometric Surveying: Stadia and tangential methods of Tacheometry - Distance and Elevationformulaefor Staffvertical position.

UNIT IV	**MODERN SURVEYING**	**9**

Total Station: Fundamental quantities measured – Parts and accessories – Working principle – Field procedure – Errors and Good practices.

GPSSurveying: Different segments –Satellite configuration – Signal structure – Orbit determination and representation – Anti Spoofing and Selective Availability – Hand Held and Geodetic receivers – Data processing – Traversing and triangulation - Drone surveying.

UNIT V	**MISCELLANEOUS**	**9**

Curves - Simple curves – Compound and reverse curves – Transition curves - Vertical curves Astronomical Surveying –Astronomical terms and definitions – Celestial coordinate systems – Different time systems – Field observations and determination of time, longitude, latitude and azimuth by altitude and hour angle method.

TOTAL: 45 PERIODS

LIST OF EXPERIMENTS

Chain Surveying

1. Study of chains and its accessories, Aligning, Ranging, Chaining, Marking Perpendicular offset and Setting out of Foundation.

Compass Surveying

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

Levelling

3. Fly leveling and Check levelling using a Dumpy level &Tilting level.

Theodolite

4. Measurements of horizontal angles by reiteration and repetition and vertical angles.
5. Determination of elevation of an object using the single plane method when base is accessible/inaccessible.

Tacheometry

6. Determination of Tacheometric Constants.
7. Heights and distances by stadia Tacheometry.

Total Station

8. Study of Total Station, Measuring Horizontal and vertical angles, distance and difference in elevation.

TOTAL: 30 PERIODS

TOTAL(T + P) : 75 PERIODS

COURSE OUTCOMES:

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

CO1:	Define the basics and principles of conventional and modern surveying.
CO2:	Describe the principles of surveying and the working of surveying instruments.
CO3:	Compute the bearings, levels, distances, latitude and longitude.
CO4:	Apply the principle of surveying in the field to determine azimuth and corrected values from the observed error.
CO5:	Make use of total station, GPS and drone for surveying.

TEXT BOOKS:

1.	Dr. B. C. Punmia, Ashok K. Jain and Arun K Jain, “Surveying”, Vol. I & II, Lakshmi Publications Pvt Ltd, New Delhi, Sixteenth Edition, 2016.
2.	T. P. Kanetkarand S. V. Kulkarni, “Surveying and Levelling”, Parts 1 & 2, Pune VidyarthiGrihaPrakashan, Pune, 2008.

REFERENCES:

1.	R. Subramanian, “Surveying and Levelling”, Oxford University Press, Second Edition, 2012.
2.	James M. Anderson and Edward M. Mikhail, “Surveying: Theory and Practice”,

	Seventh Edition, McGraw Hill 2001.
3.	Bannister and S. Raymond, "Surveying", Seventh Edition, Longman 2004.
4.	S. K. Roy, "Fundamentals of Surveying", Second Edition, Prentice Hall of India, 2010.
5.	K. R. Arora, "Surveying", Vol I & II, Standard Book house, Twelfth Edition 2013.

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

Table of Specification (ToS) for End Semester Question Paper

Unit No. and Title	Total 2 MarksQ ns.	Total 16 MarksQ ns.	Bloom's Taxonomy (Cognitive) Level			
			Remember (Kn)	Understand (Un)	Apply (Ap)	Analyse(An) Evaluate(Ev)
			No. of Qns. (marks) and CO			
Unit-I: Introduction	2	1 either or	2(2) -CO1	1 either or (16) - CO2	-	-
Unit-II: Levelling	2	1 either or	2(2) - CO2	-	1 either or (16) -CO3	-
Unit-III: Theodolite and Tacheometric Surveying	2	1 either or	1(2) - CO1	1(2) — CO3	1 either or (16) - CO3	-
Unit-IV: Modern Surveying	2	1 either or	1(2) – CO1	1(2) — CO4	1 either or (16) - CO4	-
Unit-V: Miscellaneous	2	1 either or	1(2) – CO1	1(2) — CO5	1 either or (16) - CO5	-
Total Qns. Surveying	10	5 either or	7(2)	3(2) 1 either or (16)	4 either or (16)	-
Total Marks	20	80	14	22	64	-
Weightage	20%	80%	14%	22%	64%	-

Weightage for COs					
	CO1	CO2	CO3	CO4	CO5
Total Marks	10	20	34	18	18
Weightage	10%	20%	34%	18%	18%

CE22304	CONCRETE TECHNOLOGY	L	T	P	C
		2	0	2	3

COURSE OBJECTIVES:

- To impart knowledge to the students on the properties of materials of concrete.
- To test and mix design for concrete and special concretes.

UNIT I	CONSTITUENT MATERIALS	6

Cement – Types – Chemical composition and properties – Hydration of cement – Tests on cement –Aggregates – Classification –Mechanical properties and tests as perBIS –Water – Quality of water for use in concrete.

UNIT II	CHEMICAL AND MINERAL ADMIXTURES	6

Accelerators – Retarders – Plasticizers – Superplasticizers – Waterproofers – Mineral admixtures like Fly ash, Silica fume, Ground Granulated Blast Furnace Slag and Metakaolin – Effects on concrete properties.

UNIT III	PROPORTIONING OF CONCRETE MIX	6

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

UNIT IV	FRESH AND HARDENED PROPERTIES OF CONCRETE	6

Workability – Tests for workability of concrete – Segregation and Bleeding – Determination of strength Properties of Hardened concrete – Compressive strength – Split tensile strength – Flexural strength – Non-destructive test – Durability of concrete– Corrosion test.

UNIT V	SPECIAL CONCRETES	6

Lightweight concrete – Foam concrete- Self compacting concrete – Vacuum concrete – High strength concrete – Fibre reinforced concrete – Ferrocement – Ready mixed concrete –Polymer concrete – High performance concrete – Geopolymer concrete.

TOTAL: 30 PERIODS

TOTAL(T + P) : 60 PERIODS

LIST OF EXPERIMENTS:

1. Workability of fresh concrete by Compaction Factor test, Slump Test, Vee Bee Consistometer test, Flow table test.
2. Compressive strength of concrete at 7days.
3. Split tensile strength of concrete at 7days.
4. Flexural strength of concrete at 7days.
5. Non-destructive testing of concrete (Rebound hammer test, Ultrasonic Pulse Velocity test).
6. Test on self-compacting concrete (L box, V Funnel, J ring tests).

TOTAL: 30 PERIODS

COURSE OUTCOMES:

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

CO1:	List the types of cement, special concretes and properties of fresh and hardened concrete.
CO2:	Demonstrate the properties and types of concrete and its ingredients.
CO3:	Make use of suitable materials, admixtures and mix proportion required for the preparation of concrete.
CO4:	Compute concrete mix design, properties and strength of concrete.
CO5:	Select suitable types of special concretes based on the type of construction.
TEXT BOOKS:	
1.	Gupta.B.L., Amit Gupta, "Concrete Technology", Jain Book Agency, 2010.
2.	Shetty, M.S, "Concrete Technology", S.Chand and Company Ltd, New Delhi, 2003.
REFERENCES:	
1.	IS10262-2019 Recommended Guidelines for Concrete Mix Design, Bureau of Indian Standards, New Delhi.
2.	Job Thomas., "Concrete Technology", Cencage learning India Private Ltd, New Delhi, 2015.
3.	Gambhir. M.L., "ConcreteTechnology",Fifth Edition, McGraw Hill Education,2017.
4.	Neville, A.M, "Properties of Concrete", Pitman Publishing Limited, London, 2015.
5.	S. S. Bhavikatti, "Concrete Technology",I K International Publishing House Pvt. Ltd, 2019.

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

Table of Specification (ToS) for End Semester Question Paper

UnitNo.andTitle	**Total 2 Marks Qns.**	**Total 16 Marks Qns.**	**Bloom's Taxonomy (Cognitive) Level**			
			Remember (Kn)	**Understand (Un)**	**Apply (Ap)**	**Analyse(An) Evaluate(Ev)**
			No. of Qns. (marks) and CO			
Unit-I:Constituent Materials	2	1 either or	2(2)–CO1	1 either or (16) – CO2	-	-
Unit-II:Chemical and Mineral Admixtures	2	1 either or	2(2)– CO3	1 either or (16) — CO3	-	-
Unit-III:Proportioning of Concrete Mix	2	1 either or	1(2)—CO3	-	1 either or (16)—CO4	-

			1(2) – CO4			
Unit-IV:Fresh and Hardened Properties of Concrete	2	1either or	1(2)–CO1	1(2) — CO4	1 either or (16)—CO2	-
Unit-V:Special Concretes	2	1 either or	1(2)–CO1	1(2) — CO2	1 either or (16)—CO5	-
Total Qns: Concrete Technology	10	5 either or	8(2)	2(2) 2 either or (16)	3 either or (16)	-
Total Marks	20	80	16	36	48	-
Weightage	20%	80%	16%	36%	48%	-

Weightage for COs

	CO1	**CO2**	**CO3**	**CO4**	**CO5**
Total Marks	16	34	28	18	16
Weightage	16%	34%	18%	18%	16%

CE22305	**COMPUTER AIDED BUILDING DRAWING**	**L**	**T**	**P**	**C**
		0	**0**	**4**	**2**

COURSE OBJECTIVE:

- To introduce the students to draft the plan, elevation and sectional views of buildings in accordance with development and control rules satisfying orientation and functional requirements as per National Building Code.

LIST OF DRAWINGS

1. Principles of planning, orientation and complete joinery details (Paneled and Glazed Doors and Windows).
2. Layout plan
3. Different types of staircases – Dog legged, Open well.
4. Steel truss
5. Single and double story residential building.
6. Hostel building
7. Hospital building
8. School building.

TOTAL: 60 PERIODS

COURSE OUTCOMES:

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

CO1:	Label the plan, elevation and sectional views of the buildings, industrial structures, and framed buildings.
CO2:	Demonstrate the plan of a structure using AutoCAD.
CO3:	Model a building using BIM software.
CO4:	Choose AutoCAD for drafting and designing a building.
CO5:	Develop new models using BIMsoftware.

TEXT BOOKS:

1.	Sikka V.B., "A Course in Civil Engineering Drawing", 4th Edition, S.K.Kataria and

	Sons, 2015.
2.	George Omura, “Mastering in Autocad 2005 and Autocad LT 2005”, BPB Publications, 2008.
REFERENCES:	
1.	Chuck Eastman, Paul Teicholz, Rafael Sacks, Kathleen Liston, “BIM Handbook:A Guide to Building Information Modeling for Owners, Managers, Designers, Engineers, and Contractors”, John Wiley and Sons. Inc., 2011.
2.	Marimuthu V.M., Murugesan R. and Padmini S., “Civil Engineering Drawing – I”, Pratheeba Publishers, 2008.
3.	Shah. M.G., Kale. C.M. and Patki. S.Y., “Building Drawing with an Integrated Approach to Built Environment”, Tata McGraw Hill Publishers Limited, 2007.
4.	Verma. B.P., “Civil Engineering Drawing and House Planning”, Khanna Publishers, 2010.
5.	Ibrahim Zeid, "Mastering CAD/CAM", McGraw Hill, 2nd Edition, 2006.

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

SD22301	**CODING SKILLS AND SOFT SKILLS TRAINING – PHASE I**	**L**	**T**	**P**	**C**
		0	**0**	**4**	**2**
COURSE OBJECTIVES:					
• To make the students to solve basic programming logics.					
• To help the students develop logics using decision control statements.					
• To make them develop logics using looping statements and arrays.					
• To train the students for effective communication and identify the common errors in formalwritings.					
• To guide and motivate the students for setting their goals with positive thinking.					
UNIT I	**FUNDAMENTALS IN PROGRAMMING**				**8**
Output of Programs: I/O Functions, Data types, Constants, Operators – Mathematical Problems – Debugging – Puzzles - Company Specific Programming examples.					
UNIT II	**DECISION CONTROL STATEMENTS**				**8**

Logic Building Using Conditional Control Statements – Output of Programs – Mathematical Problems - Puzzles – Company Specific Programming examples.

UNIT III	LOOPING STATEMENTS AND ARRAYS	14

Logic building using looping statements – Number programs – Programs on patterns – Array programs – Programs on sorting and searching - Matrix programs – Puzzles - Output of programs - Company Specific Programming examples.

UNIT IV	COMMUNICATION IN GENERAL	15

Introduction to communication-Types of communication – Effective Communication-Barriers tocommunication. Language Study: Vocabulary-Formation of sentences-Sentence and sentencestructures-Common errors – Writing paragraphs & essays. Professional writing: Job application &Resume writing.

UNIT V	PERSONALITY DEVELOPMENT	15

Study of personality & ways to improve. Soft Skills: Self-evaluation / self-awareness – Goal setting andpositive thinking – Self-esteem and confidence – Public speaking – Extempore – Body language andObservation skills.

TOTAL: 60 PERIODS

SUGGESTIVE ASSESSMENT METHODS

1. Pre Assessment Test – To check the student's previous knowledge in Programming skills.
2. Internal Assessment I for Coding Skills will be conducted for 100 marks which are thencalculated to 20.
3. Internal Assessment II for Coding Skills will be conducted for 100 marks which are thencalculated to 20.
4. Model Exam for Coding Skills will be conducted for 100 marks which are then calculated to 20.
5. A test for Communication skills will be conducted for 100 marks which will be then calculatedto 40.
6. For assignments, students should attend all the practice tests conducted online on Hacker Rank. Each assignment will be for 100 marks and finally the total marks obtained by a student in alltests will be reduced to 40 marks.
7. The total of 100 marks obtained from the tests will be then calculated to 60 marks and additional of 40 marks will be given for assignments which will make it a total of 100.

COURSE OUTCOMES:

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

CO1:	Solve problems on basic I/O constructs.
CO2:	Develop problem solving skills using decision control statements.
CO3:	Develop logics using looping statements and arrays.
CO4:	Avoid / fix the common errors they commit in academic and professional writings and prepare standard resumes and update the same for future career.
CO5:	Recognize the value of self-evaluation and grow with self-confidence.

TEXT BOOKS:

1.	ReemaThareja, "Programming in C", Oxford University Press, Second Edition, 2016.
2.	Kernighan, B.W and Ritchie, D.M, "The C Programming language", Second Edition, Pearson Education, 2015.
REFERENCES:	
1.	Anita Goel and Ajay Mittal, "Computer Fundamentals and Programming in C", 1st Edition, Pearson Education, 2013.
2.	Paul Deitel and Harvey Deitel, "How to Program with an Introduction to C++", Eighth edition, Pearson Education, 2018.
3.	E. Balagurusamy, "Programming in ANSI C", Eighth edition, McGrawHill Publications, 2019.
4.	S.Sobana, R.Manivannan, G.Immanuel, "Communication and Soft Skills", VK Publications, 2016.
5.	Zed Shaw, "Learn C the Hard Way: Practical Exercises on the Computational Subjects You Keep Avoiding", Zed Shaw's Hardway Series, 2015.

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

AC22301	CONSTITUTION OF INDIA	L	T	P	C
		2	0	0	0

COURSEOBJECTIVES:

- 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	6

History of Making of the Indian Constitution - Drafting Committee - Philosophy of the Indian Constitution - Preamble - Salient features.

UNIT II	CONTOURS OF CONSTITUTIONAL RIGHTS & DUTIES	6

Fundamental Rights - Right to Equality - Right to Freedom - Right against Exploitation - Right to

Freedom of Religion - Cultural and Educational Rights - Fundamental Duties.		
UNIT III	**ORGANISATIONS OF GOVERNANCE**	**7**
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**	**4**
Emergency Provisions - National Emergency, President Rule, Financial Emergency.		
UNIT V	**LOCAL ADMINISTRATION**	**7**
District's Administration Head - Role and importance -Municipalities – Introduction - Mayor and role of Elected Representative - CEO of Municipal Corporation - Pachayati raj - Introduction – PRI – ZilaPachayat - Elected officials and their roles.		
TOTAL: 30 PERIODS		

COURSE OUTCOMES:	
At the end of the course, the students will be able to:	
CO1:	Understand history and philosophy of Indian Constitution.
CO2:	Understand the premises informing the twin themes of liberty and freedom from a civil rights perspective.
CO3:	Understand powers and functions of Indian government.
CO4:	Understand emergency rule.
CO5:	Understand structure and functions of local administration.
TEXT BOOKS:	
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.
REFERENCES:	
1.	Jain M P, "Indian Constitution Law", 7th Edn, Lexis Nexis, 2014.
2.	The Constitution of India (Bare Act), Government Publication, 1950.
3.	M.V.Pylee, "Introduction to the Constitution of India", 4th Edition, Vikas Publication, 2005.
4.	Durga Das Basu, "Introduction to the Constitution of India", (Student Edition), 19th Edition, Prentice-Hall EEE, 2008.
5.	Merunandan, "Multiple Choice Questions on Constitution of India", 2nd Edition, Meraga publication, 2007.

Course Outcomes	**PO**												**PSO**		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO1	-	1	-	-	1	1	-	1	-	-	-	1	-	-	-
CO2	-	1	1	-	-	1	-	1	-	1	-	-	-	-	-
CO3	-	1	1	-	-	1	-	1	-	1	-	-	-	-	-
CO4	-	-	-	1	-	-	1	-	1	1	1	1	-	-	-
CO5	-	-	1	-	-	-	1	-	-	1	-	1	-	-	-

CO	-	1	1	1	1	1	1	1	1	1	1	1	-	-	-

HS22301	**VALUE EDUCATION I**	**L**	**T**	**P**	**C**
		1	**0**	**0**	**0**

COURSEOBJECTIVES:

- To give the students a deeper understanding about the purpose of life.
- To animate the students to have a noble vision and a right value system for their life.
- To help the students to set short-term and long-term goals in their life.

UNIT I	**MY LIFE AND MY PLACE IN THE UNIVERSE**	**4**

Value of my life – My uniqueness, strengths and weakness – My self-esteem andconfidence – My identity in the universe.

UNIT II	**MY LIFE AND THE OTHER**	**4**

Realising the need to relate with other persons and nature – My refined manners andconduct in relationships – Basic communication and relationship skills – Mature relationshipattitudes.

UNIT III	**MY LIFE IS MY RESPONSIBILITY**	**3**

Personal autonomy – Developing a value system and moral reasoning skills – Setting goals for life.

UNIT IV	**UNDERSTANDING MY EDUCATION AND DEVELOPINGMATURITY**	**4**

Importance of my Engineering education – Managing emotions - Personal problem solving skills.

TOTAL: 15 PERIODS

COURSE OUTCOMES:

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

CO1:	Explain the importance of value based living.
CO2:	Set realistic goals and start working towards them.
CO3:	Apply the interpersonal skills in their personal and professional life.
CO4:	Emerge as responsible citizens with a clear conviction to be a role model in the society.

REFERENCES:

1.	David Brooks, "The Social Animal: The Hidden Sources of Love, Character, and Achievement", Random House, 2011.
2.	Mani Jacob, "Resource Book for Value Education", Institute of Value Education, 2002.
3.	Eddie de Jong, "Goal Setting for Success", CreateSpace Independent Publishing, 2014.
4.	Dr.Abdul Kalam, "My Journey-Transforming Dreams into Actions", Rupa Publications, 2013.

Course Outcomes	**PO**												**PSO**		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO1	-	-	-	-	-	2	-	1	1	2	-	2	-	1	-
CO2	-	-	-	-	-	2	-	1	1	2	-	2	-	1	-
CO3	-	-	-	-	-	2	-	1	1	2	-	2	-	1	-

CO4	-	-	-	-	-	2	-	1	1	2	-	2	-	1	-
CO	-	-	-	-	-	2	-	1	1	2	-	2	-	1	-

SEMESTER IV

CE22401	**STRUCTURAL ANALYSIS**	**L**	**T**	**P**	**C**
		3	**1**	**0**	**4**

COURSE OBJECTIVE:

- To introduce the students to basic theory and concepts of Structural Analysis and the classical methods for the analysis of buildings.

UNIT I	**INDETERMINATE FRAMES**	**12**

Degree of static and kinematic indeterminacies for plane frames - Analysis of indeterminate pin-jointed frames - Rigid frames (Degree of statistical indeterminacy upto two) - Energy and consistent deformation methods.

UNIT II	**SLOPE DEFLECTION METHOD**	**12**

Continuous beams and rigid frames (with and without sway) – Symmetry and antisymmetry – Simplification for hinged end – Support displacements– Spreadsheet.

UNIT III	**MOMENT DISTRIBUTION METHOD**	**12**

Distribution and Carryover of moments – Stiffness and Carry over factors – Analysis of continuous beams – Plane rigid frames with and without sway – Neylor's simplification.

UNIT IV	**MOVING LOADS AND INFLUENCE LINES**	**12**

Influence lines for reactions, shear force and bending moment in statically determinate structures –Muller Breslau's principle – Influence lines for reactions, shear force and bending moment in continuous beams.

UNIT V	**ARCHES AND CABLES**	**12**

Arches as structural forms – Examples of arch structures – Types of arches and cables – Analysis of three hinged, two hinged, parabolic and circular arches – Settlement and temperature effects-Analysis of cables with stiffening girder.

TOTAL: 60 PERIODS

COURSE OUTCOMES:

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

CO1:	Recall the methods of analysing a structure and its basic terms.
CO2:	Illustrate the position of shear force and maximum bending moment in the structural elements.
CO3:	Explain the analysing techniques based on its ease and application.
CO4:	Solve with beams, pin-jointed and rigid jointed plane frames using alternate methods.
CO5:	Determine the bending moment and shear force of Arch and Cable structures.

TEXT BOOKS:	
1.	Vaidyanadhan, R and Perumal, P, “Comprehensive Structural Analysis – Vol. 1 & Vol. 2”, Laxmi Publications Pvt. Ltd, New Delhi, 2019.
2.	Punmia.B.C, Ashok Kumar Jain and Arun Kumar Jain, “Theory of Structures", LaxmiPublicationsPvt. Ltd., New Delhi, 2019.
REFERENCES:	
1.	Wang C.K., “Indeterminate Structural Analysis”, Tata McGraw Hill Education Pvt. Ltd., New Delhi, 2010.
2.	Reddy. C.S., “Basic Structural Analysis”, Tata McGraw Hill Education Pvt. Ltd., New Delhi, 2013.
3.	Ghali.A., Nebille and Brown. T.G., "Structural Analysis - A Unified Classical and Matrix Approach”, Sixth Edition, SPON press, New York, 2013.
4.	Gambhir. M.L., “Fundamentals of Structural Mechanics and Analysis”, PHI Learning Pvt. Ltd., New Delhi, 2011.
5.	Bhavaikatti, S.S, “Structural Analysis – Vol. 1 & Vol. 2”, Vikas Publishing Pvt Ltd., NewDelhi, 2013.

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

Table of Specification (ToS) for End Semester Question Paper

Unit No. and Title	Total 2 Marks Qns.	Total 16 Marks Qns.	Bloom’s Taxonomy (Cognitive) Level					
			Remember (Re)	Understand (Un)	Apply (Ap)	Analyse (An)	Evaluate (Ev)	Create (Cr)
			No. of Qns. (marks) and CO					
Unit-I: Indeterminate Frames	2	1 either or	2(2) –CO1	-	1 either or (16) – CO4	-	-	-
Unit-II: Slope Deflection Method	2	1 either or	2(2) – CO1	-	1 either or (16) — CO5	-	-	-
Unit-III: Moment Distribution Method	2	1 either or	1(2) — CO1	1(2) — CO3 1 either or (16) — CO2	-	-	-	-
Unit-IV: Moving Loads and Influence Lines	2	1 either or	1(2) - CO4	1(2) — CO4 1 either or (16) — CO3	-	-	-	-

Unit-V: Arches and Cables	2	1 either or	1(2) – CO5	1(2) — CO2	1 either or (16) — CO5	-	-	-
Total Qns. Structural Analysis	10	5 either or	7(2)	3(2) 2 either or (16)	3 either or (16)	-	-	-
Total Marks	20	80	14	38	48	-	-	-
Weightage	20%	80%	14%	38%	48%	-	-	-

Weightage for COs

	CO1	**CO2**	**CO3**	**CO4**	**CO5**
Total Marks	10	18	18	20	34
Weightage	10%	18%	18%	20%	34%

CE22402	**FOUNDATION ENGINEERING**	**L**	**T**	**P**	**C**
		3	**0**	**0**	**3**

COURSE OBJECTIVE:

- To gain knowledge on field investigation of soil, types of foundation and design based on bearing capacity and settlement.
- To study about the concept of earth pressure and stability of slopes in retaining wall.

UNIT I	**SELECTION OF FOUNDATION AND SOIL EXPLORATION**	**9**

Types of foundation – Requirements of good foundation – Factors governing location and depth — Choice of types of foundation - Soil exploration – Methods – Augering and boring – Wash boring and rotary drilling–Disturbed and undisturbed samples– Samplers – Number and spacing of bore holes – Sounding tests – SPT – SCPT – DCPT – Bore log.

UNIT II	**BEARING CAPACITY**	**9**

Bearing capacity – Terzaghi‘s formula – Types of failure – Effect of water table – Shape of foundation –Inclination of load and eccentricity of load on bearing capacity – BIS formula - Bearing capacity based on N’ value - Allowable bearing pressure — Plate load test – Seismic consideration in bearing capacity evaluation – Methods of improving bearing capacity.

UNIT III	**SETTLEMENT AND DESIGN OF FOUNDATION**	**9**

Settlement – Immediate and time dependent settlements – Differential settlement – Causes – Effect – Control – Permissible settlement – BIS code provisions – Contact pressure distribution – Design – Proportioning – Isolated footing, combined footing and strap footing - Raft foundation – Types – Floating foundation.

UNIT IV	**PILE FOUNDATIONS**	**9**

Classification of piles – Functions– Load carrying capacity – Dynamic analysis – Hammers – Static analysis – Pile load test – Capacity from penetration test - Pile group (Feld’s rule, Converse – Labarre formula and block failure criterion) – Spacing and group action – Efficiency of pile group – Settlement – Negative skin friction –Under reamed pile foundation.

UNIT V	**STABILITY OF SLOPES AND EARTH PRESSURE**	**9**

Stability of slopes – Infinite and finite slopes – Types of failure – Slip circle and Friction circle method - Lateral earth pressure – Rankine’s theory – Surcharge – Inclined and Stratified backfill – Coulomb’s theory – Earth pressure on retaining walls of simple configurations- Stability analysis of retaining wall – Drainage of backfill - Culmann’s Graphical Method.

TOTAL: 45 PERIODS

COURSE OUTCOMES:	
At the end of the course, the students will be able to:	
CO1:	List the types of foundations and piles, soil exploration methods, bearing capacity failures and settlement of foundation.
CO2:	Summarize the soil exploration methods, importance of bearing capacity of soil regarding the design of foundation and stability of slopes.
CO3:	Design the footings in soil according to the codal provisions.
CO4:	Identify the factors governing design of foundations and retaining walls.
CO5:	Calculate the stability of pile foundations, slopes and retaining walls.
TEXT BOOKS:	
1.	Arora, K.R., "Soil Mechanics and Foundation Engineering", Standard Publishers and Distributors, New Delhi, 7th Edition, 2017 (Reprint).
2.	Punmia, B.C., "Soil Mechanics and Foundations", Laxmi Publications Pvt. Ltd. New Delhi, 16th Edition, 2017.
REFERENCES:	
1.	Kaniraj, S.R. "Design aids in Soil Mechanics and Foundation Engineering", Tata McGraw Hill Publishing Company Ltd., New Delhi, 2014.
2.	Joseph E.Bowles, "Foundation Analysis and Design", McGraw Hill Education, 5th Edition, 2015.
3.	IS Code 6403: 1981 (Reaffirmed 1997) "Bearing Capacity of Shallow Foundation", Bureau of Indian Standards, New Delhi.
4.	IS Code 8009 (Part 1):1976 (Reaffirmed 1998) "Shallow Foundations Subjected to Symmetrical Static Vertical Loads", Bureau of Indian Standards, New Delhi.
5.	GopalRanjan and A. S. Rao, "Basic and Applied Soil Mechanics", New Age International Publishers, 2010.

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

Table of Specification (ToS) for End Semester Question Paper

Unit No. and Title	Total 2 Marks Qns.	Total 16 Marks Qns.	Bloom's Taxonomy (Cognitive)Level					
			Remember (Re)	Understand (Un)	Apply (Ap)	Analyse (An)	Evaluate (Ev)	Create (Cr)
			No. of Qns. (marks) and CO					
Unit-I: Selection of Foundation and Soil Exploration	2	1 either or	2(2) – CO1	1 either or (16) – CO2	-	-		
Unit-II: Bearing Capacity	2	1 either or	2(2) – CO1	1 either or (16) — CO2	-	-	-	-
Unit-III: Settlement and Design of Foundation	2	1 either or	2(2) — CO1	-	1 either or (16) — CO3	-	-	-
Unit-IV: Pile Foundations	2	1 either or	2(2) – CO1	-	1 either or (16) — CO4	-	-	-
Unit-V: Stability of Slopes And Earth Pressure	2	1 either or	1(2) – CO4	1(2) – CO2	1 either or (16) — CO5	-	-	-
Total Qns.	10	5 either or	9(2)	1(2) 2 either or (16)	3 either or (16)	-	-	-
Total Marks	20	80	18	34	48	-	-	-
Weightage	20%	80%	14%	38%	48%	-	-	-

Weightage for COs					
	CO1	**CO2**	**CO3**	**CO4**	**CO5**
Total Marks	16	34	16	18	16
Weightage	18%	34%	16%	18%	16%

CE22403	**HIGHWAY AND RAILWAY ENGINEERING**	**L**	**T**	**P**	**C**
		3	**0**	**0**	**3**

COURSE OBJECTIVES:

- To know about the highway and railway systems of transportation.
- To know about the basic concepts of planning and design of highways and railways.

UNIT I	**HIGHWAY PLANNING AND ALIGNMENT**	**9**

Significance of highway planning – Modal limitations towards sustainability – History of road development in India – Factors influencing highway alignment – Soil suitability analysis – Road ecology – Engineering surveys for alignment, objectives, conventional and modern methods - Classification of highways – Locations and functions – Typical cross sections of Urban and Rural roads.

UNIT II	**DESIGN OF HIGHWAY ELEMENTS**	**9**

Cross-sectional elements – Sight distances - Horizontal curves, Superelevation, Transition curves, Widening of curves – Vertical curves, Gradients – Pavement components and their role – Design practice for flexible and rigid pavements (IRC methods only).

UNIT III	**HIGHWAY CONSTRUCTION AND MAINTENANCE**	**9**

Highway construction materials, properties, testing methods – Construction practice of flexible and rigid pavements - Highway drainage – Pavement distress in flexible and rigid pavements - Types of maintenance - Pavement evaluation by deflection measurements – Strengthening of pavements.

UNIT IV	**RAILWAY PLANNING AND DESIGN**	**9**

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, Superelevation, Widening of gauge on curves - Points and crossings.		
UNIT V	**RAILWAY CONSTRUCTION, MAINTENANCE AND OPERATION**	**9**
Earthwork – Stabilization of track on poor soil – Track drainage – Calculation of materials required for track laying – Construction and maintenance of tracks – Conventional and modern methods - Railway stations and yards - Passenger amenities – Signalling – Urban transportation systems.		
		TOTAL: 45 PERIODS
COURSE OUTCOMES:		
At the end of the course, the students will be able to:		
CO1:	Define the concepts of planning, design and construction of highways and railways.	
CO2:	Describe the planning, design and construction aspects of highways and railways.	
CO3:	Demonstrate the structural components, testings and design aspects of highways and railways.	
CO4:	Make use of conventional and modern methods for construction and maintenance of highways and railways.	
CO5:	Design the geometrics of highways and railways.	
TEXT BOOKS:		
1.	S.K. Khanna, and C.E.G. Justo and A. Veeraragavan, "Highway Engineering", New Chand and Bros, Roorkee, 10th edition, 2015.	
2.	S.C. Saxena, S.P. Arora, "Text Book of Railway Engineering", DhanpatRaiPublications, 2015.	
REFERENCES:		
1.	Kadiyali, L.R., "Principles and Practice of Highway Engineering", KhannaPublishers Ltd., New Delhi, 2011.	
2.	Satishchandra, Agarwal M.M, "Railway Engineering", Oxford University Press, 2010.	
3.	VenkatappaRao. G, "Principles of Transportation and Highway Engineering", Tata McGraw Hill Pub.Co. Ltd, New Delhi, 2007.	
4.	Indian Road Congress (IRC), Guidelines for the Design of Flexible Pavements (Third Revision), IRC: 37-2012.	
5.	The Indian Road Congress (IRC), Guidelines for the Design of Rigid Pavements for Highways, New Delhi, IRC 58-2012.	

Course Outcomes	**PO**												**PSO**		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO1	2	-	1	2	2	2	2	-	-	-	2	2	2	-	-
CO2	3	1	2	2	2	2	2	2	-	-	2	2	2	-	-

CO3	3	1	2	2	2	2	2	2	-	2	2	2	2	1	-
CO4	3	2	3	2	2	2	2	-	-	-	2	2	2	1	-
CO5	3	3	3	3	2	3	3	3	2	2	2	2	2	1	
CO	3	2	2	2	2	2	2	2	2	2	2	2	2	1	1

Table of Specification (ToS) for End Semester Question Paper

Unit No. and Title	Total 2 Marks Qns.	Total 16 Marks Qns.	Bloom's Taxonomy (Cognitive) Level			
			Remember (Kn)	Understand (Un)	Apply (Ap)	Analyse(An) Evaluate(Ev)
			No. of Qns. (marks) and CO			
Unit-I: Highway Planning and Alignment	2	1 either or	2(2)–CO1	1 either or (16) – CO2	-	-
Unit-II: Design of Highway Elements	2	1 either or	2(2)– CO1	-	1 either or (16) – CO5	-
Unit-III: Highway Construction and Maintenance	2	1 either or	1(2)– CO1	1(2)– CO3, 1 either or (16) – CO3	-	-
Unit-IV: Railway Planning and Design	2	1 either or	1(2)– CO1	1(2) – CO4	1 either or (16) – CO4	-
Unit-V: Railway Construction, Maintenance and Operation	2	1 either or	1(2)–CO1	1(2) – CO5	1 either or (16) – CO5	-
Total Qns. Highway and Railway Engineering	10	5 either or	7(2)	3(2) 2 either or (16)	3 either or (16)	-
Total Marks	20	80	14	38	48	-
Weightage	20%	80%	14%	38%	48%	-

Weightage for COs					
	CO1	**CO2**	**CO3**	**CO4**	**CO5**
Total Marks	14	16	18	18	34
Weightage	14%	16%	18%	18%	34%

CE22404	**FLUID MECHANICS & HYDRAULIC MACHINES**	**L**	**T**	**P**	**C**
		3	**0**	**0**	**3**

COURSE OBJECTIVE:

- To impart idea about the properties of fluids, concept of control volume, conservation laws, dimensional analysis, and hydraulic machines.

UNIT I	**FLUID PROPERTIES AND FLOW CHARACTERISTICS**	**9**

Units and dimensions- Properties of fluids- Mass density, Specific weight, Specific volume, Specific gravity, Viscosity, Compressibility, Vapour pressure, Surface tension and Capillarity. Flow characteristics – Applications of continuity equation, energy equation and momentum equation.

UNIT II	**FLOW THROUGH CIRCULAR CONDUITS**	**9**

Hydraulic and energy gradients - Laminar flow through circular conduits and circular annuli - Boundary layer concepts – Types of boundary layer thickness – Darcy Weisbach equation – Friction factor- Commercial pipes- Minor losses – Flow through pipes in series and parallel.		
UNIT III	**DIMENSIONAL ANALYSIS**	**9**
Need for dimensional analysis – Methods of dimensional analysis – Similitude – Types of similitude - Dimensionless parameters- Application of dimensionless parameters – Model analysis.		
UNIT IV	**TURBINES**	**9**
Classification of turbines – Pelton wheel – Francis turbine – Kaplan turbine - Specific speed – Characteristic curves of turbines - Draft tube and Cavitation.		
UNIT V	**PUMPS**	**9**
Classification of pumps - Centrifugal pumps – Work done - Minimum speed to start the pump - NPSH - Multistage pumps – Characteristics curve - Reciprocating pumps - Negative slip - Indicator diagrams and its variations – Air vessels - Savings in work done.		
TOTAL: 45 PERIODS		

COURSE OUTCOMES:

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

CO1:	List the fluid properties, its flow, dimensional analysis, and hydraulic machines.
CO2:	Summarize the characteristics of different turbines and pumps.
CO3:	Experiment with fluids flow, its parameters and different hydraulic machines.
CO4:	Model a prototype using dimensional analysis.
CO5:	Determine the efficiency of hydraulic machines.

TEXT BOOKS:

1.	Modi P.N. and Seth, S.M. “Hydraulics and Fluid Mechanics”, Standard Book House, New Delhi, 2013.
2.	Chandramouli P.N., “Applied Hydraulic Engineering”, Yes Dee Publishing Pvt. Ltd., 2017.

REFERENCES:

1.	Graebel. W.P, “Engineering Fluid Mechanics”, Taylor & Francis, Indian Reprint, 2011.
2.	Kumar K. L., “Engineering Fluid Mechanics”, Eurasia Publishing House(P) Ltd., New Delhi, 2016.
3.	Robert W. Fox, Alan T. McDonald, Philip J.Pritchard, “Fluid Mechanics and Machinery”, Wiley Publications, 2011.
4.	Streeter, V. L. and Wylie E. B., "Fluid Mechanics", McGraw Hill Publishing Co., 2010.
5.	R. K. Bansal, “A Textbook of Fluid Mechanics and Hydraulic Machines”, Laxmi Publications, 2010.

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

Table of Specification (ToS) for End Semester Question Paper

Unit No. and Title	Total 2 Marks Qns.	Total 16 Marks Qns.	Bloom's Taxonomy (Cognitive) Level			
			Remember (Kn)	Understand (Un)	Apply (Ap)	Analyse(An) Evaluate(Ev)
			No. of Qns. (marks) and CO			
Unit-I: Fluid Properties and Flow Characteristics	2	1 either or	2(2) –CO1	-	1 either or (16) – CO3	-
Unit-II: Flow Through Circular Conduits	2	1 either or	2(2) – CO1	-	1 either or (16) — CO3	-
Unit-III: Dimensional Analysis	2	1 either or	2(2) –CO1		1 either or (16) – CO4	-
Unit-IV: Turbines	2	1 either or	1(2) – CO1	1(2) –CO2	1 either or (16) – CO5	-
Unit-V: Pumps	2	1 either or	1(2) – CO1	1(2)–CO2 1 either or (16) – CO2	-	-
Total Qns. Fluid Mechanics & Hydraulic Machines	10	5 either or	8(2)	2(2) 1 either or (16)	4 either or (16)	-
Total Marks	20	80	16	20	64	-
Weightage	20%	80%	16%	20%	64%	-

Weightage for COs					
	CO1	**CO2**	**CO3**	**CO4**	**CO5**
Total Marks	16	20	32	16	16
Weightage	16%	20%	32%	16%	16%

CE22405	ENVIRONMENTAL ENGINEERING	L	T	P	C
		3	0	0	3

COURSE OBJECTIVE:

- To introduce students to various components and design of water supply scheme, water treatment methods, water storage distribution system, sewage treatment and disposal and design of intake structures and sewerage system.

UNIT I	WATER SUPPLY	9

Estimation of surface and subsurface water resources - Predicting demand for water – Impurities of water and their significance - Physical, chemical and bacteriological analyses - Standards for potable water - Intake of water: Pumping and gravity schemes.		
UNIT II	**WATER TREATMENT**	**9**
Objectives - Unit operations and processes - Surface water treatment: Coagulation and flocculation – Clariflocculator - Sand filters – Disinfection - Sub-surface water treatment: Aeration – Softening - Removal of iron and manganese - Defluoridation - Desalination - Advanced water treatment: Membrane filtration, Reverse Osmosis - Residue Management.		
UNIT III	**WATER STORAGE AND DISTRIBUTION**	**9**
Storage and balancing reservoirs - Types, location and capacity - Distribution system: Layout, Hydraulics of pipe lines, Pipe fittings, Valves including check and pressure reducing valves, Meters - Analysis of distribution systems - Leak detection - Maintenance of distribution systems - House service connections.		
UNIT IV	**PLANNING AND DESIGN OF SEWERAGE SYSTEM**	**9**
Characteristics and composition of sewage - Population equivalent - Sanitary sewage flow estimation - Sewer materials - Hydraulics of flow in sanitary sewers - Sewer design – Storm drainage - Storm runoff estimation - Sewer appurtenances - Corrosion in sewers – Preventionand control – Sewage pumping - Drainage in buildings - Plumbing systems for drainage.		
UNIT V	**SEWAGE TREATMENT AND DISPOSAL**	**9**
Objectives - Septic tanks - Layout of treatment plants - Biological treatment system of waste water - Suspended growth process - Attached growth process - Trickling filter – Waste Stabilization Ponds - Advanced wastewater treatment techniques - Anaerobic treatment of wastewater - Reclamation and Reuse of sewage - Sludge treatment - Disposal of sludge.		
		TOTAL: 45 PERIODS
COURSE OUTCOMES:		
At the end of the course, the students will be able to:		
CO1:	Outline the fundamentals of water supply and sewerage systems.	
CO2:	Explain the properties, standards and treatment process of water and wastewater.	
CO3:	Identify a suitable treatment method for water supply and sewage disposal.	
CO4:	Plan a water distribution system and sewage disposal system for a community.	
CO5:	Design a water treatment unit and sewage disposal system.	
TEXT BOOKS:		
1.	Garg, S.K., “Environmental Engineering”, Vol. I & II, Khanna Publishers, New Delhi, 2010.	
2.	Modi, P.N., “Water Supply Engineering”, Vol.I, Standard Book House, New Delhi, 2016.	
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, 1999.
3.	Syed R. Qasimand Edward, M. Motley Guang Zhu, "Water Works Engineering: Planning, Design and Operation", Prentice Hall of India Learning Private Limited, New Delhi, 2009.
4.	Metcalf and Eddy, "Wastewater Engineering – Treatment and Reuse", Tata McGraw Hill Company, New Delhi, 2010.
5.	N.N. Basak, "Environmental Engineering", McGraw Hill Education, 2017.

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

Table of Specification (ToS) for End Semester Question Paper

Unit No. and Title	Total 2 MarksQ ns.	Total 16 MarksQ ns.	Bloom's Taxonomy (Cognitive) Level			
			Remember (Kn)	Understand (Un)	Apply (Ap)	Analyse(An) Evaluate(Ev)
			No. of Qns. (marks) and CO			
Unit-I: Water Supply	2	1 either or	2(2) - CO1	1 either or (16) - CO2	-	-
Unit-II: Water Treatment	2	1 either or	2(2) - CO1	1 either or (16) – CO3	-	-
Unit-III:Water Storage and Distribution	2	1 either or	1(2) - CO1	1(2) – CO2	1 either or (16) – CO4	-
Unit-IV: Planning and Design of Sewerage System	2	1 either or	2(2) - CO1	-	1 either or (16) –CO5	-
Unit-V: Sewage Treatment and Disposal	2	1 either or	1(2) - CO1	1(2) –CO2	1 either or (16) – CO3	-
Total Qns. Environmental Engineering	10	5 either or	8(2)	2(2) 2 either or (16)	3 either or (16)	-
Total Marks	20	80	16	36	48	-
Weightage	20%	80%	16%	36%	48%	-

Weightage for COs					
	CO1	CO2	CO3	CO4	CO5
Total Marks	16	20	32	16	16
Weightage	16%	20%	32%	16%	16%

CE22406	STRENGTH OF MATERIALS LABORATORY	L	T	P	C

		0	**0**	**4**	**2**

COURSE OBJECTIVE:

- To expose the students to the testing of different materials under the action of various forces and determination of their characteristics experimentally.

LIST OF EXPERIMENTS

1. Tension test on metal specimen.
2. Compression test on wooden specimen.
3. Shear test on metal specimen.
4. Torsion test on metal specimen.
5. Impact tests on metal specimen.
6. Hardness tests on metal specimen.
7. Bending test – Determination of Young's Modulus and Flexural Rigidity.
8. Tests on open coil helical springs.
9. Tests on closed coil helical springs.
10. Study on mechanical and electrical strain gauges.

TOTAL: 60 PERIODS

LIST OF EQUIPMENT

1. UTM
2. Torsion testing machine
3. Izod impact testing machine
4. Hardness testing machine
5. Beam deflection test apparatus
6. Extensometer
7. Compressometer
8. Dial gauges
9. LeChatelier's apparatus
10. Vicat's apparatus
11. Mortar cube moulds

COURSE OUTCOMES:

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

CO1:	Understand the basic concept of stress, strain, deformation and material behaviour under different types of loading(axial, torsion and bending).
CO2:	Demonstrate the testing of different materials under the action of tensile load, compressive load, double shear and torsion.
CO3:	Calculate the Young's Modulus of steel and wooden materials by considering deflection testing.
CO4:	Determine the stiffness of open coil and closed coil springs by applying compressive and tensile loads respectively.
CO5:	Make use of equipment to assess special strength characteristics such as toughness and hardness experimentally.

TEXT BOOKS:

1.	Kazimi. S.M.A, "Solid Mechanics", Tata McGraw-Hill Publishing Co., New Delhi, 2003.

2.	Punmia. B.C., "Theory of Structures (SMTS)", Vol.I &II, Laxmi Publishing Pvt. Ltd., New Delhi, 2004.
REFERENCES:	
1.	Rattan. S.S., "Strength of Materials", Tata McGraw Hill Education Pvt. Ltd., New Delhi, 2011.
2.	Srinath, L.S, "Advanced Mechanics and Solids", Tata-McGraw Hill Publishing Company Ltd., 2005.
3.	IS 432-1 (1982) and IS 1810-38 (1984).
4.	IS1786-2008 (Fourth Revision, Reaffirmed 2013), High strength deformed bars and wires for concrete reinforcement – Specification, 2008.
5.	Strength of Materials Lab Manual, Notion Press,2020.

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

CE22407	**HYDRAULIC ENGINEERING LABORATORY**	**L**	**T**	**P**	**C**
		0	**0**	**4**	**2**

COURSE OBJECTIVE:

- To explore the fundamental principles of fluid mechanics through experimentation.

LIST OF EXPERIMENTS

A. Flow measurements

1. Determination of coefficient of discharge in a pipe using Rotameter.
2. Determination of coefficient of discharge in a pipe using Venturimeter/ Orificemeter.
3. Bernoulli's experiment.

B.Losses in pipes

1. Determination of friction factor in pipes.
2. Determination of minor losses.

C. Pumps

1. Characteristics study of Centrifugal pump/ Gear pump.
2. Characteristics study of Submersible pump/ Reciprocating pump.

D. Turbines

1. Characteristics study of Pelton wheel turbine.

2. Characteristics study of Francis turbine/Kaplan turbine.

E. Determination of metacentric height

1. Determination of metacentric height of floating bodies.

TOTAL: 60 PERIODS

LIST OF EQUIPMENT

1. One set up of Rotameter.
2. One set up of Venturimeter/Orificemeter.
3. One Bernoulli's experiment set up.
4. One set up of Centrifugal pump.
5. One set up of Gear pump.
6. One set up of Submersible pump.
7. One set up of Reciprocating pump.
8. One set up of Pelton Wheel turbine.
9. One set up of Francis turbine/ one set of Kaplan turbine.
10. One set up of equipment for determination of metacentric height of floating bodies.
11. One set up for determination of friction factor in pipes.
12. One set up for determination of minor losses.

COURSE OUTCOMES:

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

CO1:	Explain the concept of flow measuring devices.
CO2:	Calculate the discharge and losses in pipes and fittings.
CO3:	Find the efficiency of pumps for specific applications.
CO4:	Determine the efficiency of turbines based on flow and head.
CO5:	Compute the metacentric height of floating body.

TEXT BOOKS:

1.	Sarbjit Singh, "Experiments in Fluid Mechanics", PHILearning Private Limited, Delhi, 2009.
2.	"Hydraulic Laboratory Manual", Centre for Water Resources, Anna University, 2004.

REFERENCES:

1.	Modi P.N. and Seth S.M., "Hydraulics and Fluid Mechanics", Standard Book House, New Delhi, 2000.
2.	Subramanya, K., "Flow in Open Channels", Tata McGraw Hill Publishing Company, 2001.
3.	Chandramouli. P.N., "Applied Hydraulic Engineering", Yes Dee Publishing Pvt. Ltd., 2017.
4.	Graebel. W.P, "Engineering Fluid Mechanics", Taylor & Francis, Indian Reprint, 2011.
5.	Robert W.Fox, Alan T. McDonald, Philip J.Pritchard, "Fluid Mechanics and Machinery", Wiley Publications, 2011.

Course Outcomes	**PO**												**PSO**		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**

CO1	3	2	2	1	2	-	-	-	-	-	-	-	3	-	-
CO2	2	3	3	2	2	2	-	-	1	-	-	1	3	1	-
CO3	2	3	3	2	2	2	-	-	1	-	1	2	3	1	-
CO4	2	2	3	2	2	2	-	-	1	-	1	2	3	1	1
CO5	2	2	3	2	2	-	-	-	1	-	-	-	3	1	1
CO	2	2	3	2	2	2	-	-	1	-	1	2	3	1	1

CE22408	**SURVEY CAMP**	**L**	**T**	**P**	**C**
		0	**0**	**0**	**1**

COURSE OBJECTIVE:

The objective of the survey camp is to enable the students to get practical training in the field work. Groups of not more than six members will carry out each exercise in Survey Camp. The camp must involve work on a large area of not less than 40 acres outside the campus (Survey Camp should not be conducted inside the campus). At the end of the camp, each student shall have mapped and contoured the area. The camp record shall include all original field observations, calculations and plots.

LIST OF EXPERIMENTS

1. Traverse – Area measurement for irregular field using Total station.
2. Contouring
   (i) Radial tachometric contouring - Radial line at every 45 degrees and length not less than 60 meters on each radial line.
   (ii) Block Level/ By squares of size at least 100 meters x 100 meters atleast 20 meters interval.
3. L.S & C.S - Road and canal alignment for a length of not less than 1 kilometer, atleast L.S at every 30 m and C.S at every 90 m.
4. Offsets of buildings and plotting the location.
5. Sun observation to determine azimuth (Guidelines to be given to the students).
6. Traversing using GPS.
7. Curve setting by deflection angle.

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

TOTAL: 2 WEEKS

COURSE OUTCOMES:

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

CO1:	Plot the ground profile by finding out the reduced levels of various salient points on the ground.
CO2:	Surveying the field length, area, volume, countering and traversing.
CO3:	Easy handling of modern survey equipment.

TEXT BOOKS:

1.	T. P. Kanetkar, S.V. Kulkarni, "Surveying and Levelling", Parts 1 & 2, Pune VidyarthiGrihaPrakashan, Pune, 24th Reprint, 2015.
2.	Dr. B. C. Punmia, Ashok K. JainandArun K Jain, "Surveying", Vol. I & II, Lakshmi Publications Pvt. Ltd., New Delhi, 17th Edition, 2016.
REFERENCES:	
1.	James M. Anderson, Edward M. Mikhail, "Surveying: Theory and Practice", Seventh Edition, McGraw Hill Pvt. Ltd., 2001.
2.	Bannisterand S. Raymond, "Surveying", Seventh Edition, Longman,2004.
3.	David Clark, James Clendinning, "Plane and Geodetic Surveying for Engineers", Volume I & II, Constable and Company Ltd., London, CBS, 6th Edition, 2004.
4.	S. K. Roy, "Fundamentals of Surveying", Second Edition, Prentice Hall of India, 2004.
5.	K. R. Arora, "Surveying", Vol. I & II, Standard Book House, Eleventh Edition, 2013.

Course Outcomes	**PO**												**PSO**		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO1	3	2	2	2	2	2	-	-	2	2	2	2	2	-	1
CO2	3	2	2	2	2	2	-	-	2	2	2	2	2	-	1
CO3	3	2	2	2	2	2	-	-	2	2	2	2	2	-	1
CO	3	2	2	2	2	2	-	-	2	2	2	2	2	-	1

SD22401	**CODING SKILLS AND SOFT SKILLS TRAINING – PHASE II**	**L**	**T**	**P**	**C**
		0	**0**	**4**	**2**

COURSE OBJECTIVES:

- To help students in developing modular applications using functions.
- To train students on building logics using strings and pointers.
- To make students develop applications using user-defined data types.
- To train the students on speaking skills for group discussions.
- To set students correctly on the track of presentation skills and management skills.

UNIT I	**FUNCTIONS**	**12**

Logic Building Using Functions – Programs on Recursion – Puzzles - Output of Programs – Company Specific Programming Examples.

UNIT II	**STRINGS AND POINTERS**	**12**

Logic Building Using Strings – Programs on Strings - Logic Building Using Pointers – Puzzles - Output of Programs - Company Specific Examples.

UNIT III	**USER DEFINED DATATYPES**	**6**

Working with User Defined Datatypes – Puzzles - Output of Programs - Company Specific Examples.

UNIT IV	**COMMUNICATION SKILLS / LANGUAGE SKILLS**	**15**

Receptive Skills and productive skills - Skills together - Integration of skills - Input and output. Receptive Skills: Listening and Reading - Lead-in - Pre-existent knowledge - General understanding of the audio or the written text - Discussion in pairs or small groups – Feedback - Text-related task in detail - Focus on aspects of language in the text. Productive Skills: Speaking and Writing - Lead-in - Engaging students with the topic - Setting the task - Role-play - Monitoring the task - Giving the feedback-positive- task-related follow up - repetition / re-setting of task. Activities: Pronunciation: syllable, stress, intonation - Writing memos, e-mails and formal letters - Oral presentations / seminars - Written and Oral Descriptions Group discussions.

UNIT V	**SOFT SKILLS: SEARCH AND FIND FOR CAREER DEVELOPMENT**	**15**

Self-motivation: Interpersonal relationship - Attitudes and interpersonal integrity – Time management – Prioritizing - Leadership quality – In the team: Team building and Team work - Memory technique. Problem solving: – Emotional intelligence – Positive attitude towards life – Taking up initiatives – Developing mind set – Openness to feed back – Adaptability – Active listening – Work ethics. Presentation of skills: Creative thinking – Critical thinking – Logical thinking - Decision making. Management ability: Empathy – Selflessness – Humility – Cultural respectfulness – Versatility – Generosity – Trustworthiness – Planning and executing – Target achievement – Listening to others' views – Friendliness - Active participation – Empowering healthy atmosphere – Exchange of ideas – Mediation – Negotiation – Qualities – Updating the knowledge – Pre-work for performance – Respect forrules and regulations.

TOTAL: 60 PERIODS

SUGGESTIVE ASSESSMENT METHODS

1) Pre Assessment Test – To check the student's previous knowledge in Programming skills.
2) Internal Assessment I for Coding Skills will be conducted for 100 marks which are thencalculated to 20.
3) Internal Assessment II for Coding Skills will be conducted for 100 marks which are thencalculated to 20.
4) Model Exam for Coding Skills will be conducted for 100 marks which are then reduced to 20.
5) A test for Communication skills will be conducted for 100 marks which will be thencalculated to 40.
6) For assignments, students should attend all the practice tests conducted online onHackerRank. Each assignment will be for 100 marks and finally the total marks obtained bya student in all tests will be reduced to 40 marks.
7) The total of 100 marks obtained from the tests will be then reduced to 60 marks andadditional of 40 marks will be given for assignments which will make it a total of 100.

COURSE OUTCOMES:

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

CO1:	Develop and implement modular applications using functions.
CO2:	Develop logics using strings and pointers.
CO3:	Develop applications in C using user-defined datatypes.
CO4:	Practice both receptive skills (listening and reading) and productive skills (writing and speaking) and speak English with standard pronunciation using correct stress and intonation.

CO5:	Practice team building and team work procedures and develop memory techniques and manage abilities like empathy, selflessness, cultural respectfulness and trustworthiness preparing themselves for target achievement.
TEXT BOOKS:	
1.	ReemaThareja, "Programming in C", Oxford University Press, Second Edition, 2016.
2.	Kernighan, B.W and Ritchie, D.M, "The C Programming Language", Second Edition, Pearson Education, 2015.
REFERENCES:	
1.	Anita Goel and Ajay Mittal, "Computer Fundamentals and Programming in C", 1st Edition, Pearson Education, 2013.
2.	Paul Deitel and Harvey Deitel, "How to Program with anIntroduction to C++", Eighth edition, Pearson Education, 2018.
3.	E. Balagurusamy, "Programming in ANSI C", Eighth edition, McGrawHill Publications, 2019.
4.	S.Sobana, R.Manivannan, G.Immanuel, "Communication and Soft Skills", VK Publications, 2016.
5.	Zed Shaw, "Learn C the Hard Way: Practical Exercises on the Computational Subjects You Keep Avoiding", Zed Shaw's Hardway Series, 2015.

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

AC22401	**INDUSTRIAL SAFETY ENGINEERING**	**L**	**T**	**P**	**C**
		2	0	0	0

COURSEOBJECTIVES:

- To explain the fundamental concept and principles of industrial safety.
- To apply the principles of maintenance engineering.
- To analyze the wear and its reduction.
- To evaluate faults in various tools, equipment and machines.
- To apply periodic maintenance procedures in preventive maintenance.

UNIT I	**INDUSTRIAL SAFETY**	**6**

Accident - Causes, types, results and control - Mechanical and electrical hazards -Types, causes and preventive steps/procedure -Salient points of Factories Act 1948 for health and safety -Wash rooms, drinking water layouts, light, cleanliness, fire, guarding, pressure vessels, etc. - Safety

color codes - Fire prevention and firefighting -Equipment and methods.

UNIT II	MAINTENANCE ENGINEERING	6

Definition and aim of maintenance engineering - Primary and secondary functions and responsibility of maintenance department - Types of maintenance - Types and applications of tools used for maintenance - Maintenance cost and its relation with replacement economy - Service life of equipment.

UNIT III	WEAR AND CORROSION AND THEIR PREVENTION	6

Wear- Types, causes, effects -Wear reduction methods –Lubricants- Types and applications - Lubrication methods, general sketch, working and applications - i. Screw down grease cup, ii. Pressure grease gun, iii. Splash lubrication, iv. Gravity lubrication, v. Wick feed lubrication vi. Side feed lubrication, vii. Ring lubrication - Definition, principle and factors affecting the corrosion - Types of corrosion - Corrosion prevention methods.

UNIT IV	FAULT TRACING	6

Fault tracing- Concept and importance -Decision tree concept -Need and applications - Sequence of fault finding activities, show as decision tree-Draw decision tree for problems in machine tools, hydraulic, pneumatic, automotive, thermal and electrical equipment's like, i. Any one machine tool, ii. Pump, iii. Air compressor, iv. Internal combustion engine, v. Boiler, vi. Electrical motors - Types of faults in machine tools and their general causes.

UNIT V	PERIODIC AND PREVENTIVE MAINTENANCE	6

Periodic inspection- Concept and need -Degreasing, cleaning and repairing schemes -Overhauling of mechanical components -Overhauling of electrical motor -Common troubles and remedies of electric motor -Repair complexities and its use -Definition, need, steps and advantages of preventive maintenance - Steps/procedure for periodic and preventive maintenance of: i. Machine tools, ii. Pumps, iii. Air compressors, iv. Diesel generating (DG) sets - Program and schedule of preventive maintenance of mechanical and electrical equipment - Advantages of preventive maintenance - Repair cycle concept and importance.

TOTAL: 30 PERIODS

COURSE OUTCOMES:

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

CO1:	Explain the fundamental concept and principles of industrial safety.
CO2:	Apply the principles of maintenance engineering.
CO3:	Apply periodic maintenance procedures in preventive maintenance.
CO4:	Analyze the wear and its reduction.
CO5:	Evaluate faults in various tools, equipment and machines.

TEXT BOOKS:

1.	L M Deshmukh, "Industrial Safety Management", Tata McGraw-Hill Education, 2005.
2.	Charles D. Reese, "Occupational Health and Safety Management: A Practical Approach", CRC Press, 2003.

REFERENCES:

1.	Edward Ghali, V. S. Sastri, M. Elboujdaini, "Corrosion Prevention and Protection: Practical Solutions", John Wiley & Sons, 2007.
2.	Garg, H.P, "Maintenance Engineering", S. Chand Publishing, 2008.
3.	J Maiti, Pradip Kumar Ray, "Industrial Safety Management: 21st Century Perspectives of

	Asia", Springer, 2017.
4.	R. Keith Mobley, "Maintenance Fundamentals", Elsevier, 2011.
5.	W. E. Vesely, F. F. Goldberg, "Fault Tree Handbook", Create Space Independent Pub, 2014.

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

SEMESTER V

CE22501	IRRIGATION ENGINEERING	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

- To know the basics of irrigation and drip, sprinkler and lift irrigation.
- To study the relationship between soil, plant and water.
- To learn about importance, location and function of various conveyance and distribution systems like weirs, sluices, barrages, drops, escapes, shutters.
- To study the water logging problem, salinity, and drainage systems.
- To learn about irrigation water management, on-farm development and command area development.

UNIT I	IRRIGATION	9

Irrigation - Definition - Need - Advantages and disadvantages - Sources of irrigation - Irrigation methods - Surface and subsurface - Pressurized irrigation -Drip, Sprinkler, Lift irrigation.

UNIT II	SOIL-PLANT-WATER RELATIONSHIP	9

Soil-Water relationship - Field capacity - Permanent wilting point –Evapotranspiration and Consumptive use - Measurements - Crop and cropping seasons - Assessment of crop water requirement - Net irrigation requirement -Duty and delta relationship.

UNIT III	IMPOUNDING STRUCTURES, DRAINAGE AND SALINITY	9

Types of impounding structures - Gravity dam - Forces on a dam -Design of Gravity dams - Water logging – Causes and control - Salinity - Reclamation - Types – Drainage systems -

Types.		
UNIT IV	**CONVEYANCE AND DISTRIBUTION SYSTEM**	**9**
Canal - Types of canals - Canal alignment - Canal losses - Canal lining -Design of prismatic canal-Distribution system - Weirs, Sluices, Barrages - Canal head works – Control structures - Drops, Escapes, Shutters - Opening devices and Diversion boxes -Cross drainage works.		
UNIT V	**IRRIGATION WATER MANAGEMENT**	**9**
Irrigation efficiencies - Need for optimization - Management and productivity - Participatory approach – On-farm development - Command area development.		
		TOTAL: 45 PERIODS

COURSE OUTCOMES:	
At the end of the course, the students will be able to:	
CO1:	Define the need, development, merits, and demerits of irrigation, Regime theory and crop season.
CO2:	Demonstrate the types of irrigation, irrigation structures, drainage systems, and Soil-Water relationship.
CO3:	Describe the modernization and management techniques in the irrigation field.
CO4:	Calculate irrigation efficiencies and the forces acting on irrigation structures.
CO5:	Design the irrigation structures.
TEXT BOOKS:	
1.	Garg, S.K., "Irrigation Engineering and Hydraulic Structures," KH Publications, New Delhi, 2023.
2.	Sharma, R.K., and Sharma, T.K., "Irrigation Engineering", S. Chand and Company, New Delhi, 2016.
REFERENCES:	
1.	Punmia, B.C., "Irrigation and Water Power Engineering", Laxmi Publishers, New Delhi, 2021.
2.	Arora, K.R., "Irrigation, Water Power and Water Resources Engineering", Standard Publishers Distributors, New Delhi, 2018.
3.	Basak, N.N., "Irrigation Engineering", Tata McGraw-Hill Publishing Co, New Delhi, 2017.
4.	Dilip Kumar Majumdar, "Irrigation Water Management", Prentice-Hall of India, New Delhi, 2013.
5.	Raghunath, H.M. "Irrigation Engineering", Wiley India Pvt. Ltd., New Delhi, 2011.

Course Outcomes	**PO**												**PSO**		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO1	2	-	2	2	1	2	2	-	-	-	-	3	3	2	2
CO2	2	-	1	2	2	2	2	-	-	2	-	3	2	1	1
CO3	2	2	2	2	3	2	2	-	-	-	-	3	1	1	3

CO4	2	2	3	3	2	2	2	2	-	2	2	3	1	2	1
CO5	1	1	2	2	3	2	2	2	-	-	-	3	2	2	1
CO	2	2	2	2	2	2	2	2	-	2	2	3	2	2	2

Tableof Specification (ToS) for End Semester Question Paper

Unit No. and Title	Total 2 MarksQns.	Total 16 MarksQns.	Bloom's Taxonomy (Cognitive) Level					
			Remember (Re)	Understand (Un)	Apply (Ap)	Analyse (An)	Evaluate (Ev)	Create (Cr)
			No. of Qns. (marks) and CO					
Unit-I: Irrigation	2	1 either or	2(2) –CO1	1 either or (16) – CO1	-	-	-	-
Unit-II: Soil-Plant-Water Relationship	2	1 either or	2(2) – CO2	1 either or (16) — CO2	-	-	-	-
Unit-III:Impounding Structures, Drainage and Salinity	2	1 either or	1(2) — CO5	1(2) — CO5	1 either or (16) — CO5	-	-	-
Unit-IV: Conveyance and Distribution System	2	1 either or	1(2) - CO4	1(2) — CO4	1 either or (16) — CO4	-	-	-
Unit-V: Irrigation Water Management	2	1 either or	2(2) – CO3	1 either or (16) — CO3	-	-	-	-
Total Qns. Irrigation Engineering	10	5 either or	8(2)	2(2) 3 either or (16)	2 either or (16)	-	-	-
Total Marks	20	80	16	52	32	-	-	-
Weightage	20%	80%	16%	52%	32%	-	-	-

Weightage for COs					
	CO1	**CO2**	**CO3**	**CO4**	**CO5**
Total Marks	20	20	20	20	20
Weightage	20%	20%	20%	20%	20%

CE22502	**DESIGN OF REINFORCED CONCRETE ELEMENTS**	**L**	**T**	**P**	**C**
		3	**0**	**2**	**4**

COURSE OBJECTIVE:

- This course gives the detailed design philosophies for reinforcement concrete design, design of different types of conventional slabs, determinate beams for various forces, short columns, long columns and isolated footing.

UNIT I	**FUNDAMENTAL CONCEPTS**	**9**

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

UNIT II	**LIMIT STATE DESIGN OF BEAMS**	**9**
Assumptions – Design of singly reinforced rectangular beams for flexure - Design of shear reinforcement – Design for combined bending, shear and torsion–Design requirement for bond and anchorage as per IS code.		
UNIT III	**LIMIT STATE DESIGN OF SLABS**	**9**
Types of slabs – Behaviour of one-way slab – Behaviour of two-way slab –Design considerations - Types of staircases – Design of dog-legged staircase.		
UNIT IV	**DESIGN OF COLUMNS**	**9**
Classification of columns - Axial, uniaxial and biaxial bending - Braced and unbraced columns - Orientation of columns in buildings - Design of short columns - Square, rectangular and circular columns subjected to axial and uniaxial loadings.		
UNIT V	**DESIGN OF FOOTINGS**	**9**
Types of footings - Behaviour of concentric and eccentric footings - Design of axially and eccentrically loaded square footing - Behaviour of combined rectangular footing (two columns only).		
TOTAL: 45 PERIODS		

LIST OF EXPERIMENTS:

1. Design of Continuous beam using software.
2. Design of Doubly reinforced beam using MS Excel.
3. Design of One way slab using MS Excel.
4. Design of Two way slab using MS Excel.
5. Design of Biaxial column using MS Excel.
6. Design of rectangular footing using software.

TOTAL: 30 PERIODS

TOTAL (T+P): 75 PERIODS

COURSE OUTCOMES:

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

CO1:	State the various design concepts and behaviour of RCC elements under working and ultimate loads.
CO2:	Describe the methods of design, use of design aids, types of staircases, types of columns and concept of proportioning footings.
CO3:	Design the structural elements such as beams, slabs and staircases based on IS code specifications and using MS Excel and other design software.
CO4:	Design the structural elements such as columns and footings based on IS code specifications and using MS Excel and other design software.
CO5:	Analyse the beams and columns based on limit state design and provide safe economic design.

TEXT BOOKS:

1.	Krishnaraju.N, "Design of Reinforced Concrete Structurres", CBS Publishers & Distributors Pvt. Ltd., New Delhi, 2015.
2.	Gambhir. M.L., "Fundamentals of Reinforced Concrete Design", Prentice Hall of India Private Limited, New Delhi, 2006.
REFERENCES:	
1.	Unnikrishna Pillai S. and Devdas Menon, "Reinforced Concrete Design", 4th Edition, Tata McGraw-Hill, New Delhi, 2021.
2.	Varghese. P.C., "Limit State Design of Reinforced Concrete", 2nd Edition, Prentice Hall of India, New Delhi, 2013.
3.	Subramanian. N., "Design of Reinforced Concrete Structures", 1st Edition, Oxford University Press, 2014.
4.	IS 456-2000: "Plain and Reinforced Concrete" - Code of Practice
5.	SP 16 (1980): "Design Aids for Reinforced Concrete" to IS 456 -2000.

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

Tableof Specification (ToS) for End Semester Question Paper

Unit No. and Title	**Total 2 Marks Qns.**	**Total 16 Marks Qns.**	**Bloom's Taxonomy (Cognitive) Level**					
			Remember (Re)	**Understand (Un)**	**Apply (Ap)**	**Analyse (An)**	**Evaluate (Ev)**	**Create (Cr)**
			No. of Qns. (marks) and CO					
Unit-I: Fundamental Concepts	2	1 either or	2(2) –CO1	1 either or (16) – CO2		-	-	-
Unit-II: Limit State Design of Beams	2	1 either or	2(2) – CO1	-	1 either or (16) — CO3	-	-	-
Unit-III: Limit State Design of Slabs	2	1 either or	2(2) — CO1	-	1 either or (16) — CO3	-	-	-
Unit-IV: Design of Columns	2	1 either or	2(2) - CO1		1 either or (16) — CO4	-	-	-
Unit-V: Design of Footings	2	1 either or	2(2) – CO1	-	1 either or (16) — CO5	-	-	-
Total Qns. Design of Reinforced Concrete Elements	10	5 either or	10(2)	1 either or (16)	4 either or (16)	-	-	-
Total Marks	20	80	20	16	64	-	-	-
Weightage	20%	80%	20%	16%	64%	-	-	-

Weightage for COs					
	CO1	**CO2**	**CO3**	**CO4**	**CO5**
Total Marks	20	16	32	16	16
Weightage	20%	16%	32%	16%	16%

CE22503	**SOIL MECHANICS LABORATORY**	**L**	**T**	**P**	**C**
		0	**0**	**4**	**2**

COURSE OBJECTIVE:

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

LIST OF EXPERIMENTS

1. Specific gravity of soil solids.
2. Atterberg's Limits.
3. Field density-Core cutter and Sand replacement methods.
4. Relative density of sand.
5. Grain size analysis - Sieve analysis and Hydrometer analysis.
6. Permeability of soil - Constant and Variable head tests.
7. Compaction test.
8. CBR test.
9. Unconfined Compression test.
10. Direct Shear test.
11. Vane Shear test.
12. Differential free swell (DFS).

LIST OF EQUIPMENT

1. Casagrande's liquid limit apparatus.
2. Apparatus for plastic and shrinkage limits.
3. Field density apparatus for
   a) Core cutter method
   b) Sand replacement method.
4. Set of sieves: 4.75mm, 2mm, 1mm, 0.6mm, 0.42mm, 0.3mm, 0.15mm, and 0.075mm.
5. Hydrometer
6. Permeability apparatus for
   a) Constant head test
   b) Variable head test.
7. Universal auto compactor for I.S light and heavy compaction tests.
8. Shaking table, funnel for sand draining technique.
9. Apparatus for CBR test

10. Box shear test apparatus 11. Laboratory vane shear apparatus. 12. Hot air ovens (range of temperature 500 - 1500°C).	
TOTAL: 60 PERIODS	
COURSE OUTCOMES:	
At the end of the course, the students will be able to:	
CO1:	Assess the properties of soil and testing methods.
CO2:	Demonstrate soil tests to identify physical and mechanical properties of soils.
CO3:	Determine soil grain proficiency for evaluation of index properties.
CO4:	Apply the laboratory results to problem identification, quantification, and basic soil mechanics related design problem.
CO5:	Analyse the properties of the soil samples based on the codal provisions.
TEXT BOOKS:	
1.	"Soil Engineering Laboratory Instruction Manual" published by Engineering College Cooperative Society, Anna University, Chennai, 2010.
2.	Saibaba Reddy. E, Ramasastri, K., "Measurement of Engineering Properties of Soils", Newage International (P) Limited Publishers, New Delhi, 2008.
REFERENCES:	
1.	Lambe. T.W., "Soil Testing for Engineers", John Wiley and Sons, New York, 2008.
2.	IS Code of Practice (2720), Bureau of IndianStandards, New Delhi.
3.	G.Venkatappa Rao and Goutham. K. Potable, "Geosynthetics Testing – A LaboratoryManual", Sai Master Geoenvironmental Services Pvt. Ltd., 2nd Edition, 2021.
4.	Braja M. Das., "Soil Mechanics: Laboratory Manual", Oxford University Press, Eighth edition, 2012.
5.	V.N.S. Murthy, "A Text Book of Soil Mechanics and Foundation Engineering in SI units", UBS Publishers and Distributors Ltd., Fourth edition, 2003.

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

CE22504	ENVIRONMENTAL ENGINEERING LABORATORY	L	T	P	C
		0	0	4	2

COURSE OBJECTIVES:

- To conduct tests for characterization of water and wastewater.
- To quantify the quality parameters of water and wastewater.

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 Optimum Coagulant Dosage by Jar test apparatus.
6. Determination of available chlorine in bleaching powder and residual chlorine in water.

ANALYSIS OF WASTEWATER SAMPLE

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

TOTAL: 60 PERIODS

COURSE OUTCOMES:

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

CO1:	Determine the physical, chemical and biological characteristics of water and wastewater.
CO2:	Compute the dosage requirement for coagulation process.
CO3:	Identify the pollution concentration in water and wastewater.
CO4:	Experiment with the physico-chemical and biological parameters of water with regard to the water quality requirements.
CO5:	Examine the growth of micro-organisms in wastewater.

REFERENCES:

1.	APHA, "Standard Methods for the Examination of Water and Wastewater", 22nd Edition, Washington, 2012.
2.	Rump, H.H. and Krist, H., "Laboratory Manual for the Examination of Water, Wastewater and Soil", VCH, Germany, 3rd Edition, 2001.

3.	James P.Lodge, "Methods of Air Sampling &Analysis", 3rd Edition, Lewis Publishers Inc., USA, 2017.

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

CE22505	IN-PLANT/INDUSTRIAL TRAINING	L	T	P	C
		0	0	0	1

COURSE OBJECTIVES:

- To provide possible opportunities to learn, understand and sharpen the real time technical/ managerial skills required.
- To apply the technical knowledge in real industrial situations.
- To gain experience in writing technical reports/projects.
- To expose the students to experience the engineer's responsibilities and ethics.
- To promote academic, professional and/or personal development.

In-plant/Industrial Training Duration

The students may undergo Industrial Training for a period as specified in the Curriculum during the summer vacation. In this case, the training has to be undergone continuously for a period of at least two weeks in an organization.

METHOD OF EVALUATION

The student will give a seminar based on his/her training report, before an expert committee constituted by the concerned department as per norms of the institute. The evaluation will be based on the following criteria:

- Quality of content presented
- Proper planning for presentation
- Effectiveness of presentation
- Depth of knowledge and skills.

COURSE OUTCOMES:

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

CO1:	Interpret how the theoretical aspects learned in classes are integrated into the practical world.
CO2:	Make use of the opportunity to learn new skills and supplement knowledge.
CO3:	Develop communication and teamwork skills.
CO4:	Motive the student for higher education.

CO5:	Formulate to learn strategies like time management, multi-tasking, etc. in an industrial setup.

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

SD22501	**CODING SKILLS AND SOFT SKILLS TRAINING – PHASE III**	**L**	**T**	**P**	**C**
		0	**0**	**4**	**2**

COURSE OBJECTIVES:

- To make the students develop logics using basic Programming Logics, Decisional Statements, Arrays and Strings.
- To help the students know how to use classes and objects.
- To enable the students to implement programs using OOPs Concepts.
- To train the students on interview skills with mock interviews and updated / enhanced resumes.
- To prepare students for taking initiatives and decision making with critical thinking.

UNIT I	**BASIC PROGRAMMING CONSTRUCTS & SOFT SKILLS: TIME MANAGEMENT**	**12**

Structured vs Object oriented programming language – Output of programs on basic I/O functions – Logic building using Decisional Statements – Programs on Patterns and Numbers - Debugging – Puzzles - Company specific programming examples.

Soft Skills: Time management: Prioritizing – Delegation - Decision-making - Goal setting – Multitasking - Problem solving - Strategic thinking - Scheduling – Planning - to-do lists and checklists - Evaluating urgent tasks - Auditing and improving workflows - Filtering notifications - Setting thoughtful deadlines – Evaluating the work done schedules – Grouping similar tasks – Learn to say ‘no’.

UNIT II	**PROGRAMMING USING FUNCTIONS AND ARRAYS & SOFT SKILLS: STRESS MANAGEMENT AND EMOTIONAL QUOTIENT**	**12**

Logic building using modular approach – Programming using Friend Function – Programs on Matrices and strings – Puzzles – Output of programs - Company specific programming examples.

Soft Skills: Stress management: Using guided meditation - Maintain physical exercise and good nutrition - Manage social media time - Connect with others – read and relax. Emotional Quotient:

Overcoming challenges – defusing conflict - Self-awareness - Self-regulation - Professional etiquette – Avoiding doubt – Introducing others – Courteousness – Non-interruption – Avoiding gossip.

UNIT III	IMPLEMENTING OOPS CONCEPTS & SOFT SKILLS: VALUES OF LIFE AND BEHAVIOURAL ATTITUDES	12

Discussion on basics of OOPs Concepts – Solving problems based on Data Members and Member Functions – Programs based on Construction and Destruction of Objects - Puzzles - Output of Programs – Understanding Access Specifiers – Company specific programming examples.

Soft Skills: Values of life: Loyalty to others and responsibilities – Living with Spirituality – Maintaining humility – Possessing compassion – Proving being honest – developing kindness – Learning to have integrity – Embracing responsibility. Behavioural attitudes: Behaving with sportive attitude – Respecting the freedom of the others – Being bold – Enhancing fun and joy.

UNIT IV	LOGIC BUILDING USING INHERITANCE AND ABSTRACTION & SOFT SKILLS: EMPLOYERS EXPECTATIONS AND RESUME ENHANCEMENT	12

Understanding Super class and Derived Class – Logic building based on inheritance – Programming using Pure Virtual Function and Abstract Classes- The Final Keyword – Puzzles - Output of Programs – Company specific programming examples.

Soft Skills: Employers expectations: Contributing to the team – Being with stability – Developing the ability to grow - Improving the productivity. Resume enhancement: Select the best template for your skills, experience, and goals Adding skills to be an expert - Robusting and compelling objective – Displaying online presence - Quantifying accomplishments various roles.

UNIT V	PROGRAMMING USING ENCAPSULATION AND POLYMORPHISM & SOFT SKILLS: INTERVIEW SKILLS	12

Understanding how Encapsulation works – Understanding the term Polymorphism – Programming using Function Overloading and Overriding – Puzzles – Output of programs – Company specific programming examples.

Soft Skills: Interview Skills: Clarifying interview questions - Communicate nonverbally - Knowing the resume thoroughly - Leveraging knowledge of the company and interviewer - Mock interviews – Getting rehearsed before moving for interviews.

TOTAL: 60 PERIODS

SUGGESTIVE ASSESSMENT METHODS:

1) Pre Assessment Test – To check the student's previous knowledge in Programming skills.
2) Internal AssessmentI for Coding Skills will be conducted for 100 marks which are then calculated to 20.
3) Internal Assessment II for Coding Skills will be conducted for 100 marks which are then calculated to 20.
4) Model Exam for Coding Skills will be conducted for 100 marks which are then calculated to 20.
5) A test for Soft Skills will be conducted for 100 marks which will be then calculated to 40.
6) For assignments, students should attend all the practice tests conducted online on Hacker Rank. Each assignment will be for 100 marks and finally the total marks obtained by a

student in all tests will be reduced to 40 marks.

7) The total of 100 marks obtained from the tests will be then calculated to 60 marks and additional of 40 marks will be given for assignments which will make it a total of 100.

COURSE OUTCOMES:

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

CO 1:	Develop programs using Functions, Strings and Arrays.
CO 2:	Write programs using Classes and Objects.
CO 3:	Develop applications using OOPs Concepts.
CO4:	Apply all the interview skills learned with updated resumes and language skills balancing technical skills and interpersonal skills.
CO5:	Attend different job interviews with emotional balance and achieve the target with right planning and unique solutions.

TEXT BOOKS:

1.	Balagurusamy E, "Object Oriented Programing with C++", Tata McGraw Hill Education Pvt. Ltd., Eighth Edition, 2020.
2.	Anthony Williams, "C++ Concurrency in Action", Manning Publications, Second Edition, 2019.

REFERENCE BOOKS:

1.	Bjarne Stroustrup, "A Tour of C++", Pearson Education, Second Edition 2018.
2.	Scott Meyers, "Effective Modern C++", O'Reilly Publication, December 2014.
3.	Stanely Lippman, Josee Lajoie, Barbara Moo, "C++ Primer", Pearson Education, Fifth Edition, 2012.
4.	Bjarne Stroustrup, "The C++ Programming Language", Pearson Education, Fourth Edition, 2013.
5.	S.Sobana, R.Manivannan, G. Immanuel, "Communication and Soft Skills", VK Publications, 2016.

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

AC22501	ENTREPRENEURSHIP DEVELOPMENT	L	T	P	C
		2	0	0	0

COURSEOBJECTIVES:

- Explaining the types, characteristics of entrepreneurship and its role in economic development.
- Applying the theories of achievement motivation and the principles of entrepreneurship development program to enterprise.
- Selecting the appropriate form of business ownership in setting up an enterprise.
- Applying the fundamental concepts of finance and accounting to enterprise.
- Identifying sickness in industry, selecting the appropriate corrective measures, and identifying the growth strategies in enterprise.

UNIT I	ENTREPRENEURSHIP	6

Entrepreneur – Characteristics – Types of Entrepreneurs – Difference between Entrepreneur and Intrapreneur - Entrepreneurial Competencies – Role of Entrepreneurship in Economic Development – Factors Affecting Entrepreneurial Growth.

UNIT II	BUSINESS PLAN	6

Sources of business ideas and tests of feasibility: Significance of writing the business plan/ project proposal; Contents of business plan/ project proposal; Designing business processes, location, layout, operation; Project Appraisal, preparation of project report.

UNIT III	SMALL SCALE INDUSTRIES	6

Legal formalities in setting up of SSIs, Business Laws, Governmental Setup in promoting small industries, Status of Small Scale Industrial Undertakings, Steps in starting a small industry, Ownership Structures.

UNIT IV	FINANCING AND ACCOUNTING	6

Finance: Need, Sources, Capital Structure, Term Loans – Accounting: Need, Objectives, Process, Journal, Ledger, Trial Balance, Final Accounts – Working Capital Management.

UNIT V	SUPPORT TO ENTREPRENEURS	6

Government Policy for Small Scale Enterprises – Institutional Support to Entrepreneurs: Need and Support – Taxation Benefits to Small Scale Industry, Social Responsibility of Business.

TOTAL: 30 PERIODS

COURSE OUTCOMES:

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

CO1:	Explain the types, characteristics of entrepreneurship and its role in economic development.
CO2:	Apply the theories of achievement motivation and the principles of entrepreneurship development program.
CO3:	Select the appropriate form of business ownership in setting up an enterprise.
CO4:	Apply the fundamental concepts of finance and accounting to enterprise.

CO5:	Identify sickness in industry, select the appropriate corrective measures, and identify the growth strategies in enterprise.

TEXT BOOKS:

1.	S.S.Khanka, "Entrepreneurial Development", S.Chand& Co. Ltd., NewDelhi, 2006.
2.	Kurahko&Hodgetts, "Entrepreneurship – Theory, Process and Practices", Thomson learning, 9th edition, 2014.

REFERENCES:

1.	Charantimath, P. M., "Entrepreneurship Development and Small Business Enterprises", Pearson, 2010.
2.	Hisrich R D and Peters M P, "Entrepreneurship", 11th Edition, Tata McGraw-Hill, 2020.
3.	Mathew J Manimala, "Entrepreneurship Theory at Cross Roads: Paradigms and Praxis" Dream Tech, 2nd edition, 2005.
4.	Rabindra N. Kanungo, "Entrepreneurship and Innovation", Sage Publications, New Delhi, 1998.
5.	Singh, A. K., "Entrepreneurship Development and Management", University Science Press, 2019.

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

HS22501	**VALUE EDUCATION II**	**L**	**T**	**P**	**C**
		1	**0**	**0**	**0**

COURSEOBJECTIVES:

- To impart knowledge on essential qualities to become a good leader.
- To prepare them to have the ability to relate with others and contribute to industrial and human development.

- To teach the significance of being responsible citizens of the society.

UNIT I	UNDERSTANDING THE SOCIETY AND BECOMING A LEADER	3

Problems of our society and their causes – Styles of leadership – Qualities and skills of leadership.

UNIT II	PRACTICING LEADERSHIP FOR SOCIAL CHANGE	4

Possible areas of changes in the society with education – Utilising Engineering education to create social changes – Strategies and people movement for the change.

UNIT III	BALANCING PROFESSIONAL, PERSONAL, FAMILY FOR FULLNESS OF LIFE	4

Healthy adult as an individual and family – Stages of life – Strategies to balance life.

UNIT IV	INNOVATIVE SOCIAL COMMITMENT, SPIRITUALITY AND SOCIAL NETWORKING	4

Social commitment as a healthy spirituality – Systematic contribution to society and industry – Networking professional for growth and change.

TOTAL: 15 PERIODS

COURSE OUTCOMES:

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

CO1:	Demonstrate the essential steps to become good leaders.
CO2:	Identify the various societal problems and also the solution.
CO3:	Realise their role and contribution to nation building.
CO4:	Apply the essential steps to become value based professionals.

TEXT BOOKS:

1.	Warren G. Bennis, "On Becoming a Leader", Basic Books, 2009.
2.	Suresh Agarwal, "Social Problems in India", Rajat Publications, 2015.

REFERENCES:

1.	Biswaranjan Mohanty, "Constitution, Government and Politics in India", New Century Publication, 2009.
2.	Myles Munroe, "Releasing Your Potential", Destiny Image, 2007.
3.	Kelsang Gyatso, "How to Solve Our Human Problems: The Four Noble Truths", Tharpa Publications, 2012.
4.	Ifeanyi Enoch Onuoha, "Overcoming the Challenges of Life", Authorhouse, 2011.
5.	John C. Maxwell, "Five Levels of Leadership, the Proven Steps to Maximize Your Potential", Center Street, 2021.

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

SEMESTER VI

HS22601	PROFESSIONAL ETHICS	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

- To identify and analyze ethical issues in engineering
- To recognize the code of ethics with appropriate perspective as per industrial standards
- To understand the ethical situations in risky situation
- To provide services in their areas of expertise
- To be aware of the role of engineers in solving global issues

UNIT I	ENGINEERING ETHICS, MORAL REASONING AND ETHICAL THEORIES	10

Senses of 'Engineering Ethics' – Variety of Moral Issues – Types of Inquiry – Social Ethics vs Scientific Ethics vs Experiential Ethics – Moral Dilemmas – Moral Autonomy – Kohlberg's Theory – Gilligan's Theory – Professions and Professionalism – Professional Ideals and Virtues – Theories about Right Action – Uses of Ethical Theories.

UNIT II	ENGINEERING AS SOCIAL EXPERIMENTATION	8

Role of Professional Ethics in Engineering Based Product Development – Engineering as Experimentation – Engineers as Responsible Experimenters – Codes of Ethics – A Balanced Outlook on Law – Case Study.

UNIT III	ENGINEERS' RESPONSIBILITY FOR SAFETY AND RISK	8

Safety and Risk – Assessment of Safety and Risk – Risk Benefit Analyses and Reducing Risk – Case Studies.

UNIT IV	RESPONSIBILITIES AND RIGHTS	9

Collegiality and Loyalty – Respect for Authority – Collective Bargaining – Confidentiality – Conflicts of Interest – Occupational Crime – Professional Rights – Whistle Blowing – Employee Rights – Discrimination – Intellectual Property Rights (IPR).

UNIT V	GLOBAL ISSUES AND ROLE OF ENGINEERS	10

Multinational Corporations – Environmental Ethics – Computer Ethics – Ethics of AI – Engineers as Managers – Consulting Engineers – Engineers as Expert Witnesses and Advisors – Moral Leadership – Corporate Social Responsibility – Ethics in Engineering Practice and Research –

Ethical Audit.	
TOTAL: 45 PERIODS	
COURSE OUTCOMES:	
At the end of the course, the students will be able to:	
CO1:	Visualize the scope of engineering ethics and ethical decision making.
CO2:	Develop a perspective on engineering as an experiment.
CO3:	Detail the importance of assessing safety and risk and reducing the risk.
CO4:	Realize the responsibilities and rights of engineers, employees, employers and public.
CO5:	Recognize the role of ethics related to MNC, Environment, Computer, AI, and while acting as manager, consultant, and experts.
TEXT BOOKS:	
1.	Mike W. Martin and Roland Schinzinger, "Ethics in Engineering", McGraw Hill Education, 2017.
2.	Govindarajan M, Natarajan S and Senthil Kumar V.S, "Engineering Ethics", Prentice Hall of India Pvt. Ltd., 2015.
REFERENCES:	
1.	Robert McGinn R., "The Ethical Engineer: Contemporary Concepts & Cases", Princeton University Press, February 2018.
2.	Mark Coeckelbergh, "AI Ethics", The MIT Press, April 2020.
3.	Qin Zhu, Mike Martin and Roland Schinzinger, "Ethics in Engineering", McGraw Hill, 5th Edition, 2022.
4.	Deborah C. Poff and Alex C. Michalos, "Encyclopedia of Business and Professional Ethics", Springer Nature, Switzerland AG, May 2023.
5.	Frederic G. Reamer, "Social Work Values and Ethics", Columbia University Press, New York, Sixth Edition, May 2024.

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

Table of Specification for End Semester Question Paper

Unit No. and Title	**Total 2 Marks Qns.**	**Total 16 Marks Qns.**	**Bloom's Taxonomy (Cognitive) Level**			
			Remember (Re)	**Understand (Un)**	**Apply (Ap)**	**Analyze (An) Evaluate (Ev)**

			No. of Qns. (marks) and CO			
Unit-I:Engineering Ethics, Moral Reasoning and Ethical Theories	2	1 either or	1 (2) CO1	1 (2) 1 either or (16) CO1	-	-
Unit-II:Engineering as Social Experimentation	2	1 either or	1 (2) CO2	1 (2) 1 either or (16) CO2	-	-
Unit-III:Engineers' Responsibility for Safety and Risk	2	1 either or	1 (2) CO3	1 (2) 1 either or (16) CO3	-	-
Unit-IV:Responsibilities and Rights	2	1 either or	1 (2) CO4	1 (2) 1 either or (16) CO4	-	-
Unit-V:Global Issues and Role of Engineers	2	1 either or	1 (2) CO5	1 (2) 1 either or (16) CO5	-	-
Total Qns. Professional Ethics	10	5 either or	5	5 & 5 either or	-	-
Total Marks	20	80	10	90	-	-
Weightage	20%	80%	10%	90%	-	-

Weightage for COs

	CO1	CO2	CO3	CO4	CO5
Total Marks	20	20	20	20	20
Weightage	20%	20%	20%	20%	20%

CE22601	DESIGN OF STEEL STRUCTURES	L	T	P	C
		3	0	2	4

COURSE OBJECTIVE:

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

UNIT I	INTRODUCTION TO STRUCTURAL STEEL AND DESIGN OF CONNECTIONS	9

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

UNIT II	DESIGN OF TENSION MEMBERS	9

Types of sections - Net area - Net effective sections for angles and Tee in tension - Behaviour and design of tension members - Use of lug angles - Design of tension splice - Concept of shear lag.

UNIT III	DESIGN OF COMPRESSION MEMBERS	9

Types of compression members - Euler's column theory - Slenderness ratio - Design of single and compound compression members - Laced and battened columns - Column bases - Slab base - Gusseted base.

UNIT IV	DESIGN OF BEAMS AND INTRODUCTION TO INDUSTRIAL STRUCTURES	9

Design of laterally supported and unsupported beams - Built up beams - Beams subjected to uniaxial and biaxial bending - Intermediate and bearing stiffeners - Flange and web splices - Introduction to Industrial Structures - Types Roof Trusses - Loads on trusses.

UNIT V	**PLASTIC ANALYSIS**	**9**

Introduction to plastic analysis - Theory of plastic analysis - Shape factor - Moment redistribution - Combined mechanisms - Effect of axial force-Effect of shear force on plastic moment- Analysis of continuous beams and portal frames using plastic approach.

TOTAL: 45 PERIODS

LIST OF EXPERIMENTS

1. Design of lap joint and butt joint using MS Excel.
2. Design of tension member using MS Excel.
3. Design of compression member using MS Excel.
4. Analysis and design of roof truss using analysis and design software.
5. Analysis of portal frame using analysis and design software.
6. Analysis of an industrial structure for various load combinations using analysis and design software

TOTAL: 30 PERIODS

TOTAL (T+P): 75 PERIODS

COURSE OUTCOMES:

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

CO1:	State the basics of steel structural systems, its elements, classification and its advantages over reinforced concrete elements.
CO2:	Interpret the differences between the concepts of various design philosophies.
CO3:	Calculate the load carrying capacity of types of connections, tensile as well as compressive members, moment carrying capacity of flexural members and collapse load of beams and frames.
CO4:	Design the types of connections and tension members for the various design parameters and examine its safety level manually and by using MS Excel.
CO5:	Design of compression and flexural members under various circumstances manually and using software and examine its safety level.

TEXT BOOKS:

1.	N. Subramanian, "Design of Steel Structures: Theory and Practice", Oxford University Press, 2018.
2.	Duggal, "Design of Steel Structures", Tata McGraw Hill Education, 2019.

REFERENCES:

1.	S.S. Bhavikatti, "Design of Steel Structures", I. K. International Publishing House, 2019.

2.	Jack C. McCormac and Stephen F Csernak, “Structural Steel Design”, Pearson Education Limited, 2024.
3.	Sarwar Alam Raz, “Structural Design in Steel”, New Age International Publishers, 2020.
4.	IS800:2007, General Construction in Steel - Code of Practice, (Third Revision), Bureau of Indian Standards, New Delhi, 2007
5.	SP 6(1) Hand Book on Structural Steel Sections.

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

Table of Specification (ToS) for End Semester Question Paper

Unit No. and Title	Total 2 Marks Qns.	Total 16 Marks Qns.	Bloom’s Taxonomy (Cognitive) Level					
			Remember (Re)	Understand (Un)	Apply (Ap)	Analyse (An)	Evaluate (Ev)	Create (Cr)
			No. of Qns. (marks) and CO					
Unit-I: Introduction to Structural Steel and Design of Connections	2	1 either or	2(2) – CO1	1 either or (16) – CO2		-	-	-
Unit-II: Design of Tension Members	2	1 either or	2(2) – CO1	-	1 either or (16) — CO4	-	-	-
Unit-III: Design of Compression Members	2	1 either or	1(2) — CO1	1(2) — CO2	1 either or (16) — CO5	-	-	-
Unit-IV:Design of Beams and Introduction to Industrial Structures	2	1 either or	1(2) — CO1	1(2) — CO2	1 either or (16) — CO5	-	-	-
Unit-V: Plastic Analysis	2	1 either or	2(2) – CO1	-	1 either or (16) — CO3	-	-	-
Total Qns. Design of Steel Structural Elements	10	5 either or	8(2)	2(2) 1 either or (16)	4 either or (16)	-	-	-

Total Marks	20	80	16	20	64	-	-	-
Weightage	20%	80%	16%	20%	64%	-	-	-

Weightage for COs

	CO1	CO2	CO3	CO4	CO5
Total Marks	16	20	16	16	32
Weightage	16%	20%	16%	16%	32%

CE22602	**ESTIMATION AND COSTING**	**L**	**T**	**P**	**C**
		2	0	2	3

COURSE OBJECTIVE:

- The students will acquire knowledge in estimation, tender practices, contract procedures, and valuation and will be able to prepare estimates, call for tenders and execute works.

UNIT I	**BUILDING ESTIMATE**	**6**

Philosophy – Purpose – Methods of estimation – Types of estimates – Approximate estimates – Detailed estimate – Centre line method - Long wall method and Short wall method– Deductions for openings - Preparation of bills of quantities.

UNIT II	**ESTIMATE FOR OTHER STRUCTURES**	**6**

Types of arches – Calculation of brick work and RCC works in arches - Estimation of Water supply and sanitary works – Manhole – Estimation of R.C.C. slab culvert, pipe culvert.

UNIT III	**RATE ANALYSIS AND COSTING**	**6**

Standard Data – Observed Data – Schedule of rates – Market rates – Standard Data for man hours and machineries for common civil works – Cost Estimates – Preparation of bar bending schedule and its advantages.

UNIT IV	**VALUATION**	**6**

Definitions – Various types of valuations – Valuation methods - Necessity – Capitalised value – Depreciation – Escalation – Valuation of land – Buildings – Calculation of Standard rent – Mortgage – Lease.

UNIT V	**TENDERS CONTRACT AND REPORT PREPARATION**	**6**

Tender notices – Types – Tender procedures- e-tendering- Contract – Types of contracts – Formation of contract – Contract conditions Arbitration and legal requirements- Principles for report preparation – Report on estimate of residential building, culvert and roads.

TOTAL: 30 PERIODS

LIST OF EXPERIMENTS

1. Estimation of buildings (long wall and short wall method) using MS Excel.
2. Estimation of buildings (center line method) using MS Excel.
3. Estimation of quantities for septic tank and soak pit using MS Excel.
4. Preparation for approximate estimate for road project using MS Excel.
5. Analysis of rate for concrete and Brick work using MS Excel.

6. Bar Bending Schedule using analysis and design software.	
TOTAL: 30 PERIODS	
TOTAL (T+P): 60 PERIODS	
COURSE OUTCOMES:	
At the end of the course, the students will be able to:	
CO1:	Outline the methods of estimation, types of specifications, principles for report preparation and types of tender notices.
CO2:	Explain the methods of estimation, schedule of rates, types of valuation, tenders and contract.
CO3:	Calculate the quantity of works for buildings, septic tank, soak pit, roads and rate analysis for concrete and brick work using MS Excel.
CO4:	Calculate the quantity of works, cost, present value of buildings, standard rent and the depreciation rate of buildings.
CO5:	Prepare specification, bar bending schedule, tender and contract document and report for different types of works.
TEXT BOOKS:	
1.	Dutta B.N., "Estimating and Costing in Civil Engineering", 25th Edition, UBS Publishers & Distributors Pvt. Ltd., Chennai, 2022.
2.	B.S.Patil, "Civil Engineering Contracts and Estimates", Fourthedition, University Press, 2015.
REFERENCES:	
1.	Upadhyay A.K., "Civil Estimating & Costing: Including Quality Surveying, Tendering and Valuation", S K Kataria and Sons, New Delhi, 2013.
2.	Kohli D.D. &Kohli R.C., "A Textbook of Estimating and Costing (Civil)", 13th Edition, S Chand Publishing, 2013.
3.	Standard Data Book for Analysis and Rates, IRC, New Delhi, 2019.
4.	Hand Book of Consolidated Data – 8/2000, Vol.1, TNPWD.
5.	Tamil Nadu Transparencies in Tenders Act, 1998 and Rules 2000.

Course outcomes	**PO**												**PSO**		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO1	2	-	2	2	1	2	2	-	-	-	-	3	3	2	2
CO2	2	-	1	2	2	2	2	-	-	2	-	3	2	1	1
CO3	2	2	2	2	3	2	2	-	-	-	-	3	1	1	3
CO4	2	2	3	3	2	2	2	2	-	2	2	3	1	2	1

CO5	1	1	2	2	3	2	2	2	-	-	-	3	2	2	1
CO	2	2	2	2	2	2	2	2	-	2	2	3	2	2	2

Table of Specification (ToS) for End Semester Question Paper

Unit No. and Title	Total 2 Marks Qns.	Total 16 Marks Qns.	Bloom's Taxonomy (Cognitive) Level					
			Remember (Re)	Understand (Un)	Apply (Ap)	Analyse (An)	Evaluate (Ev)	Create (Cr)
			No. of Qns. (marks) and CO					
Unit – I: Building Estimate	2	1 either or	2(2) –CO1	1 either or (16) – CO2		-	-	-
Unit – II: Estimate for Other Structures	2	1 either or	2(2) – CO1		1 either or (16) – CO3	-	-	-
Unit – III: Rate Analysis and Costing	2	1 either or	1(2) - CO1	1(2) — CO2	1 eitheror (16) - CO5	-	-	-
Unit - IV: Valuation	2	1 either or	1(2) – CO1	1(2) — CO2	1 either or (16) - CO4	-	-	-
Unit - V: Tenders Contract and Report Preparation	2	1 either or	2(2) – CO1		1 either or (16) – CO5	-	-	-
Total Qns. Estimation and Costing	10	5 either or	8(2)	2(2) 1 either or (16)	4 either or (16)	-	-	-
Total Marks	20	80	16	20	64	-	-	-
Weightage	20%	80%	16%	52%	32%	-	-	-

Weightage for COs					
	CO1	**CO2**	**CO3**	**CO4**	**CO5**
Total Marks	16	20	16	16	32
Weightage	16%	20%	16%	16%	32%

CE22603	**TECHNICAL SEMINAR**	**L**	**T**	**P**	**C**
		0	**0**	**2**	**1**

COURSE OBJECTIVE:

- To work on a specific technical topic in Civil Engineering in order to acquire the skills of oral presentation and to acquire technical writing abilities for seminars and

conferences.
SYLLABUS:
The students will work for two hours per week guided by a group of faculty members. They will be asked to talk on any topic of their choice related to Civil Engineering and to engage in dialogue with the audience. A brief copy of their talk also should be submitted. Similarly, the students will have to present a seminar of not less than fifteen minutes and not more than thirty minutes on the technical topic. They will also answer the queries on the topic. The students as audience also should interact. Evaluation will be based on the technical presentation and the report and also on the interaction during the seminar.
TOTAL: 30 PERIODS
COURSE OUTCOMES:
At the end of the course, the students will be able to:

CO1:	Identify latest developments in the field of Civil Engineering.
CO2:	Develop technical writing abilities for seminars, conferences and journal publications.
CO3:	Make use of modern tools to present the technical details.

Course Outcomes	**PO**												**PSO**		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO1	2	2	1	2	1	1	1	-	3	-	-	2	3	1	3
CO2	-	-	-	-	-	-	-	-	3	3	-	2	-	-	3
CO3	-	-	-	-	3	-	-	-	3	3	-	2	-	-	1
CO	2	2	1	2	2	1	1	-	3	3	-	2	3	1	3

SD22603	**CODING SKILLS AND QUANTITATIVE APTITUDE – PHASE I**	**L**	**T**	**P**	**C**
		0	**0**	**4**	**2**

COURSE OBJECTIVES:		
• To equip the students with the foundational knowledge and practical skills in HTML and CSS.		
• To empower students with the knowledge and skills of JavaScript effectively for Web Development.		
• To gain hands-on experience with real-world React Applications.		
• To improve aptitude, problem solving skills and reasoning ability of the students.		
• To demonstrate the use of mathematical reasoning by justifying through numerical skills.		
UNIT I	**UNDERSTAND HTML FUNDAMENTALS & QA & LR**	**12**

A Dive into Web Creation - Basic HTML Tags - Semantic Tags - Miscellaneous Tags - Text Formatting Tags - Lists - Links and Images - Forms.

Quants: Numbers – Number Systems, Types of Numbers, Series (Arithmetic Progression, Geometric Progression), HCF & LCM, Decimal Fractions, Simplification (Including Expression & Evaluation).

Logical Reasoning: Analogy - Blood Relations/Family Tree.

UNIT II	**MASTER CSS BASICS & QA & LR**	**12**

Unveiling the Art of CSS - Selectors and Specificity - Box Model and Layout - Typography and Fonts - Colors and Backgrounds.

Quants: Average - Problem on Ages.

Logical Reasoning: Coding - Decoding.

UNIT III	**JAVASCRIPT EXPEDITION & ROUTING & QA & LR**	**12**

JavaScript Expedition - Variables and Data Types - Control Flow - Loops - Functions - Arrays & Objects - DOM Manipulation.

Quants: Ratio & Proportions - Partnership-Mixtures and Alligations.

Logical Reasoning: Cryptarithmetic Problems, Syllogisms.

UNIT IV	**LEARN REACT.JS FUNDAMENTALS & QA & LR**	**12**

Creating first React Application - JSX - React Components - State and Props - Event Handling.

Quants: Time & Work - Chain Rule-Pipes and Cisterns.

Logical Reasoning: Calendar – Clocks - Images (Mirror & Water).

UNIT V	**BUILD INTERACTIVE WEB APPLICATIONS & QA & LR**	**12**

React Lifecycle Methods - Using Lists and Keys - React in CAD: Interactive CAD Model Viewer - Customizable Design Parameters - CAD Model Comparison and Versioning - Project Work.

Quants: Time, Speed & Distance - Problems on Trains, Boats & Streams.

Logical Reasoning: Cubes and Dices - Data Sufficiency.

TOTAL: 60 PERIODS

SUGGESTIVE ASSESSMENT METHODS:

1) Pre-Assessment Test – To check the student's previous knowledge in Programming skills and quantitative aptitude and logical reasoning.
2) Internal Assessment I for coding skills and quantitative aptitude will be conducted for 100 marks whichare then calculated to 30.
3) Internal Assessment II for coding skills and quantitative aptitude will be conducted for 100 marks which are then calculated to 30.
4) For assignments, students should attend all the practice tests conducted online on Hacker Rank and google form. Each assignment will be for 100 marks and finally the total marks obtained by a student in all assignments will be reduced to 40 marks.
5) Thus 60 marks from internal and 40 marks from assignments will make it a total of 100.

COURSE OUTCOMES:

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

CO1:	Construct webpages using HTML and CSS.
CO2:	Construct interactive and dynamic web applications using JavaScript.
CO3:	Construct a real-world React application.

CO4:	Apply quantitative techniques to solve a variety of problems and can enhance their employability quotient and to establish a stronger connection with the technical environment in which they operate.
CO5:	Interpret solutions for problems within short duration and can also think critically and apply basic mathematics skills to interpret data, draw conclusions and solve problems.
TEXT BOOKS:	
1.	Robin Wieruch, "The Road to React: with React 18 and React Hooks", Create Space Independent Publishing Platform, 2024.
2.	Stoyan Stefanov, "React: Up & Running: Building Web Applications", Second Edition, O'Reilly Publications, 2021.
3.	Agarwal R.S, "Quantitative Aptitude," S.Chand and Company Pvt. Ltd., New Delhi, Reprint, 2023.
4.	Agarwal R.S, "A Modern Approach to Verbal and Non-Verbal Reasoning", S.Chand and Company Pvt. Ltd.,New Delhi, Reprint, 2016.
REFERENCES:	
1.	Zac Gordan, Mikall Angela Hill, RobbieAddair, "React Explained: Your Step-By-Step Guide to React", OS Training Publishers, 2020.
2.	Alex Banks, Eve Porcello, "Learning React: Functional Web Development with React and Redux", O'Reilly Publications, 2017.
3.	Anand P A, "Quantitative Aptitude", Wiley India Pvt. Ltd., New Delhi, 2016
4.	Arun Sharma, "How to Prepare for Logical Reasoning," Tata-McGraw Hill Education Series, New Delhi, 2016.
5.	Sharon Weiner Green, Ira K Wolf, "Barron's GRE", Barron Publishers, Reprint, 2016.

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

SEMESTER VII

CE22701	CONSTRUCTION PLANNING AND PROJECT MANAGEMENT	L	T	P	C
		2	0	2	3

COURSE OBJECTIVES:

- To know about construction planning and project management.
- To know about optimizing time of construction of a project by project planning tools.
- To give knowledge on risk management and organization of project information.

UNIT I	PROJECT MANAGEMENT	6

Introduction - Project planning, scheduling, controlling - Role of decision in project management - Project management process - Role of Project Manager - Project monitoring and control - Quality control in construction.

UNIT II	PROJECT PLANNING TOOLS	6

Bar Charts: Introduction - Development of bar chart. CPM & PERT: Elements of network - Time estimates - Mean - Variance - Standard deviation. Network Analysis: Slack, Float, Critical path - Crashing of activity.

UNIT III	COST ANALYSIS AND UPDATING	6

Introduction - Project cost: Direct cost - Indirect cost - Total project cost and optimum duration - Cost optimization. Project Updating: Introduction - Updating process - Data required for updating - Steps in process updating.

UNIT IV	RISK ANALYSIS AND RESOURCE ALLOCATION	6

Certainty - Risk and uncertainty - Risk management - Identification and nature of construction risks - Types of risks - Minimizing risks and mitigating losses - Decision trees - Sensitivity analysis.

Resource Allocation: Resource usage profiles - Resource smoothing and levelling.

UNIT V	ORGANIZATION AND USE OF PROJECT INFORMATION	6

Types of project information – Computerized organization and use of information – Organizing information in databases – Relational model of databases – Other conceptual models of databases – Centralized Database Management Systems.

TOTAL: 30 PERIODS

LIST OF EXERCISES:

1. Introduction and understanding of construction project planning software.
2. Prepare bar chart for a small construction project.
3. Using project planning software, schedule a construction project.
4. Determine the critical path of a construction project using software.
5. Update the schedule of a construction project using project planning software.
6. Update resources for a construction project in project planning software.

TOTAL: 30 PERIODS

TOTAL (T+P): 60 PERIODS

COURSE OUTCOMES:	
At the end of the course, the students will be able to:	
CO1:	State planning, scheduling, and cost and risk analysis in construction project management.
CO2:	Explain project management, project planning tools, project cost analysis, and organization of project information.
CO3:	Illustrate the risk analysis and resource allocation in construction projects.
CO4:	Select suitable remedial measures based on the network analysis, cost analysis and risk analysis.
CO5:	Develop project schedule, CPM and PERT networks, and estimate the duration of construction projects.
TEXT BOOKS:	
1.	B. C. Punmia, K.K. Khandelwal, "Project Planning and Control with PERT and CPM", Laxmi Publications, 2023.
2.	Chitkara K K., "Construction Project Management, Planning, Scheduling and Control", McGraw Hill (INDIA) publishers, New Delhi, 4t^{h} edition 2014.
REFERENCES:	
1.	Peurifoy, R.L., Ledbetter. W.B and Schexnayder, C, "Construction Planning and Equipment Methods", McGraw Hill, 2010.
2.	Choudhury S, "Project Management", McGraw-Hill Publishing Company, 2017.
3.	Cleland, D.I. and Ireland, L.R., "Project Management: Strategic Design and Implementation", McGrawHill, New York, 2006.
4.	Fisk, D.R., "Construction Project Administration", Pearson Education India, 10th Edition, 2013.
5.	Sengupta. B, Guha. H, "Construction Management and Planning", Tata McGraw Hill Publishing Company Ltd., New Delhi, 2004.

Mapping of Course Outcomes to Program Outcomes & Program Specific Outcomes

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

Table of Specification (ToS) for End Semester Question Paper

Unit No. and Title	Total 2 Marks Qns.	Total 16 Marks Qns.	Bloom's Taxonomy (Cognitive) Level					
			Remember (Re)	Understand (Un)	Apply (Ap)	Analyse (An)	Evaluate (Ev)	Create (Cr)
			No. of Qns. (marks) and CO					
Unit-I: Project Management	2	1 either or	2(2) –CO1	1 either or (16) — CO2	-	-	-	-
Unit-II: Project Planning Tools	2	1 either or	1(2) – CO1	1(2) – CO2	1 either or (16) — CO5	-	-	-
Unit-III: Cost Analysis and Updating	2	1 either or	1(2) — CO1	1(2) — CO2	1 either or (16) — CO4	-	-	-
Unit-IV: Risk Analysis and Resource Allocation	2	1 either or	2(2) – CO1	1 either or (16) — CO3	-	-	-	-
Unit-V: Organization and Use of Project Information	2	1 either or	2(2) – CO1	1 either or (16) — CO2	-	-	-	-
Total Qns. Construction Planning and Project Management	10	5 either or	8(2)	2(2) 3 either or (16)	2 either or (16)	-	-	-
Total Marks	20	80	16	52	32	-	-	-
Weightage	20%	80%	16%	52%	32%	-	-	-

Weightage for COs					
	CO1	**CO2**	**CO3**	**CO4**	**CO5**
Total Marks	16	36	16	16	16
Weightage	16%	36%	16%	16%	16%

"either or" represents two questions, students need to answer any one, the two questions should be in the same cognitive level and should measure the attainment of same CO.
i(2)-COj represents i number of 2 mark questions which measure the attainment of COj.

CE22702	MINI PROJECT	L	T	P	C
		0	0	6	3

COURSE OBJECTIVE:

- To use the knowledge acquired in Civil Engineering to do a mini project, which allows the students to come up with designs, fabrication or algorithms and programs expressing their ideas in a novel way.

STRATEGY:

The students identify a topic of interest in consultation with Faculty/Supervisor. Review the literature and gather information pertaining to the chosen topic. State the objectives and develop a methodology to achieve the objectives. Carryout the design / fabrication or develop computer code. Demonstrate the novelty of the project through the results and outputs. The students will be evaluated through a viva-voce examination.

TOTAL: 90 PERIODS

COURSE OUTCOME:	
At the end of the course, the students will be able to:	
CO1:	Take up any challenging practical problems and find solution by formulating proper methodology.

Mapping of Course Outcomes to Program Outcomes & Program Specific Outcomes

Course Outcome	PO												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
CO	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3

SD22703	CODING SKILLS AND QUANTITATIVE APTITUDE – PHASE II	L	T	P	C
		0	0	4	2

COURSE OBJECTIVES:

- To help students to work with Database.
- To help students create a simple Spring Boot application and gain foundational skills in Spring Boot by exploring Spring Boot Starters, RESTful web services, Dependency Injection, and Perform Basic CRUD operations.
- To understand applications of Spring Boot in Safety and Compliance Systems.
- To improve aptitude, problem solving skills and reasoning ability of the students.
- Demonstrate the use of mathematical reasoning by justifying through numerical skills.

UNIT I	DATABASE BASICS & QUANTS – TIME, SPEED AND DISTANCE	12

Introduction to Database- Database Design Principles – SQL Basics – Querying a Database.
Quants: Time, Speed and Distance - Time, Speed & Distance - Problems on Trains-Boats & Stream.

UNIT II	DEVELOPING BACK END USING SPRING BOOT & QUANTS – PERCENTAGE & INTEREST	12

Introduction to Spring Boot – Creating a simple Spring Boot Application- Bean Scopes and Life Cycle.
Quants: Percentage & Interest - Percentage-Interest (Simple Interest, Compound Interest)-Profit & Loss.

UNIT III	BUILDING RESTFUL WEB SERVICES & QUANTS – PROBABILITY	12

Spring Boot Starters – Introduction to REST - Dependency Injection – Handling HTTP Methods.
Quants: Probability - Probability-Permutations & Combinations.

UNIT IV	DATA PERSISTENCE WITH SPRING DATA JPA, REPOSITORIES & LOGICAL REASONING	12

Path Variables and Request Parameters – Overview of JPA and Hibernate – Setting up Spring Data JPA in a Spring Boot project - Creating and using Repositories – Basic CRUD operations with JPA Repository.

Logical Reasoning: Data Interpretation (Tabulation, Bar Chart, Pie Chart, Line Graphs) - Direction sense test - Linear/Seating Arrangements - Series completion.

UNIT V	SAFETY AND COMPLIANCE SYSTEM USING SPRING BOOT & LOGICAL REASONING	12

Safety Inspection Management – Incident Reporting – Compliance Tracking – Risk Assessment – Audit Trial – Notifications and Alerts.

Logical Reasoning: Logical Venn Diagram/Syllogisms - Odd man out/Finding missing elements - Crypt arithmetic Questions – Puzzles.

SUGGESTIVE ASSESSMENT METHODS:

1) Pre-Assessment Test – To check the student's previous knowledge in Programming skills and quantitative aptitude and logical reasoning.
2) Internal Assessment I for coding skills and quantitative aptitude will be conducted for 100 marks which are then calculated to 30.
3) Internal Assessment II for coding skills and quantitative aptitude will be conducted for 100 marks which are then calculated to 30.
4) Post-Assessment: Evaluating students' knowledge gained from the Coding Skill and Quantitative Aptitude – Phase II Skill Development Course.
5) For assignments, students should attend all the practice tests conducted online on Hacker Rank and google form. Each assignment will be for 100 marks and finally the total marks obtained by a student in all tests will be reduced to 40 marks.

The total of 100 marks obtained from the tests will be then reduced to 60 marks and additional of 40 marks will be given for assignments which will make it a total of 100.

TOTAL: 60 PERIODS

COURSE OUTCOMES:

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

CO1:	Design and Query a Database.
CO2:	Apply Data Persistence and CRUD operations using Spring Boot.
CO3:	Implement a hands-on project using Spring Boot.
CO4:	Apply quantitative techniques to solve variety of problems and can enhance their employability quotient and to establish a stronger connect with the technical environment in which they operate.
CO5:	Find solutions for problems within short duration and can also think critically and apply basic mathematics skills to interpret data, draw conclusions and solve problems.

TEXT BOOKS:

1.	Craig Walls, “Spring Boot in Action”, Manning Publishers, Sixth Edition, March 2022.
2.	Felipe Gutierrez, “Pro Spring Boot 2: An authorative Guide to Building Microservices, Web and Enterprise Applications, and Best Practices”, ApressPublishers, Second Edition, January 2018.
3.	Agarwal R.S, “Quantitative Aptitude,” S.Chand and Company Pvt. Ltd., New Delhi, First Edition 1989, Reprint, 2016.
4.	Agarwal R.S, “A Modern Approach to Verbal and Non-Verbal Reasoning,” S.Chand and Company Pvt. Ltd.,New Delhi, First Edition 1994, Reprint, 2016.
REFERENCES:	
1.	Alex Antonov, “Spring Boot 2.0 Cookbook”, Packt Publishers, Second Edition, February 2018.
2.	John Carnell, “Spring Microservices in Action”, Manning Publishers, Second Edition, June 2021.
3.	Anand P A, “Quantitative Aptitude,” Wiley India Pvt. Ltd., New Delhi, Edition, 2016.
4.	Arun Sharma, “How to Prepare for Logical Reasoning,” Tata-McGraw Hill Education Series, New Delhi, First Edition, 2016.
5.	Sharon Weiner Green, Ira K Wolf, “Barron’s GRE,” Barron Publishers, First Edition 1995, Reprint, 2016.

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

SEMESTER VIII

CE22801	**PROJECT WORK**	**L**	**T**	**P**	**C**
		0	**0**	**16**	**8**
COURSE OBJECTIVES:					

• To develop the ability to solve a specific problem right from its identification and literaturereview till the successful solution of the same.
• To train the students in preparing project reportsand to face reviews and viva voce examination.
STRATEGY:
The student works on a topic approved by the head of the department under the guidance of a faculty member and prepares a comprehensive project report after completing the work to the satisfaction. 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
COURSE OUTCOME:
At the end of the course, the students will be able to:

CO1:	Apply engineering principles to identify, formulate, analyse, design, and develop technical solutions for real-world engineering problems.
CO2:	Employ analytical and experimental methods, and modern engineering tools, software, and modeling techniques to solve the engineering problems.
CO3:	Demonstrate the ability to manage project resources, timelines, quality,and communicateeffectively through reports and presentations.
CO4:	Exhibit effective teamwork and multidisciplinary collaborationwhile embracing lifelong learning to continuously improve and contribute to project objectives.
CO5:	Assess the social, ethical, environmental, and legal impacts of engineering solutions, demonstrating ethical responsibility by adhering to professional standards, ensuring integrity, safety, and sustainability throughout project execution.

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

PROFESSIONAL ELECTIVES

Vertical 1: Construction Engineering and Management

CE22511	CONSTRUCTION MANAGEMENT AND SAFETY	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

- To know about construction accidents and the methods of safety against construction accidents.

UNIT I	CONSTRUCTION ACCIDENTS	9

Accidents and causes - Accident prevention - Definition and principles - Potential hazards/risks associated with construction sites - High risk activities - Use of hoists - Working at height & in confined space - Equipment safety - Costs of construction injuries - Accident management.

UNIT II	SAFETY MANAGEMENT	9

Role of various parties, duties and responsibilities of top management, site managers, supervisors etc. - Role of safety officers -Responsibilities of general employees -Safety committee -Safety training, incentives and monitoring - Writing safety manuals, preparing safety checklists and inspection reports - Safety inspection - Safety audit.

UNIT III	CONTRACTUAL OBLIGATIONS	9

Government's policy in industrial safety - Safety & health legislation in India - The Factories Act, 1948 - Equipment Safety - Safety provisions in construction contracts - Sub contractual obligation - Workers compensation - Substance abuse - Safety record keeping.

UNIT IV	PLANNING FOR SAFETY MANAGEMENT	9

Project coordination and safety procedures - Safety culture - Safe workers - Company activities on safety - Principles of risk and loss control - Machinery safety - Machine guarding - Workplace ergonomics - Personal protective equipment - First aid and emergency preparedness - Fire safety - Electrical hazards.

UNIT V	OCCUPATIONAL HEALTH PRACTICE	9

Statutory requirements and regulations related to health hazards - Legal Implications - Dust hazards and control - Occupational and safety hazard assessment - Noise assessment and control measures - Impact and vibration - ISO 18001 & ISO 14001 codal provisions - Case Studies.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

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

CO1:	State the causes of accidents, human factors in safety, safety and health legislations in India, safety procedures and regulations related to health hazards.
CO2:	Explain safety precaution using different technologies with the help of design safety plan.
CO3:	Demonstrate the construction safety programmes, contractual obligations and occupational health practice.
CO4:	Identify the correct and proper method of managing accidents by analysing the actual situations and provide appropriate safety programmes at the site to make accident-

	free construction.
CO5:	Select safety provisions based on job safety analysis, contractual obligations, risks and loss control.
TEXT BOOKS:	
1.	Richard J. Coble, Jimmie Hinze and Theo C. Haupt, "Construction Safety and Health Management", Prentice Hall Inc., 2011.
2.	Tim Howarth and Paul Watson, "Construction Safety management", Wiley – Blawel, 2008.
REFERENCES:	
1.	Jimmy W. Hinze, "Construction Safety", Prentice Hall Inc., 2015.
2.	Tamil Nadu Factory Act, Department of Inspectorate of Factories, Tamil Nadu.
3.	Construction safety manual published by National Safety Commission of India.
4.	Construction Safety Handbook by Davies V.S.Thomasin K, Thomas Telford, London.
5.	Kumar Neeraj Jha, Dilip A Patel, Amarjit Singh,"Construction Safety Management", Pearson, 2022.

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

Table of Specification (ToS) for End Semester Question Paper

Unit No. and Title	Total 2 MarksQns.	Total 16 MarksQns.	Bloom's Taxonomy (Cognitive) Level					
			Remember (Re)	Understand (Un)	Apply (Ap)	Analyse (An)	Evaluate (Ev)	Create (Cr)
			No. of Qns. (marks) and CO					
Unit-I: Construction Accidents	2	1 either or	2(2) –CO1	-	1 either or (16) – CO4	-	-	-
Unit-II: Construction Safety Programme	2	I either or	1(2) – CO1	1(2) — CO4 1 either or (16) — CO3		-	-	-
Unit-III: Contractual Obligations	2	1 either or	1(2) — CO1	1(2) — CO3 I either or (16) — CO2	-	-	-	-
Unit-IV: Designing for Safety	2	1 either or	2(2) - CO4		1 either or (16) — CO5	-	-	-

Unit-V: Occupational Health Practice	2	1 either or	1(2) – CO5	1(2) — CO2	1 either or (16) — CO5	-	-	-
Total Qns. Construction Management and Safety	10	5 either or	7(2)	3(2) 2 either or (16)	3 either or (16)	-	-	-
Total Marks	20	80	14	38	48	-	-	-
Weightage	20%	80%	14%	38%	48%	-	-	-

Weightage for COs

	CO1	**CO2**	**CO3**	**CO4**	**CO5**
Total Marks	10	18	18	20	34
Weightage	10%	18%	18%	20%	34%

CE22512	**REPAIR AND REHABILITATION OF STRUCTURES**	**L**	**T**	**P**	**C**
		3	**0**	**0**	**3**

COURSE OBJECTIVE:

- To impart knowledge on the strategies of repair and maintenance, importance of assessment of serviceability and durability of concrete, suitable repair material.

UNIT I	**MAINTENANCE AND REPAIR STRATEGIES**	**9**

Maintenance - Repair and Rehabilitation - Facets of Maintenance -Importance of maintenance - Various aspects of inspection - Assessment procedure for evaluating damaged structure -Causes of deterioration.

UNIT II	**STRENGTH AND DURABILITY OF CONCRETE**	**9**

Quality assurance for concrete – Strength - Durability- Cracks, different types, causes – Effects due to climate, temperature - Sustained elevated temperature – Corrosion.

UNIT III	**PROTECTION METHODS AND STRUCTURAL HEALTH MONITORING**	**9**

Concrete protection methods – Reinforcement protection methods- Cathodic protection – Sacrificial anode - Corrosion protection techniques – Corrosion inhibitors, concrete coatings- Corrosion resistant steels - Coatings to reinforcement - Structural health monitoring.

UNIT IV	**REPAIR MATERIALS AND TECHNIQUES**	**9**

Repair materials- Criteria for material selection - Methodology of selection - Non-destructive Testing Techniques - Load Test for Stability - Epoxy injection – Shoring - Underpinning.

UNIT V	**REPAIR, REHABILITATION AND RETROFITTING OF STRUCTURES**	**9**

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

TOTAL: 45 PERIODS

COURSE OUTCOMES:

At the end of the course, the students will be able to:	
CO1:	Summarize the importance of maintenance, effects in structures due to climate and temperature variations, techniques for repair and their protection methods.
CO2:	Demonstrate the causes for deterioration and the repairing techniques to improve the service life of the structures elements.
CO3:	Identify the damaged structure and maintain the engineering structures safely and effectively.
CO4:	Utilize the suitable repair techniques and corrosion protection methods.
CO5:	Discriminate suitable method of strengthening the structures and the modern techniques for the demolition of large and hazardous structure in safe manner.
TEXT BOOKS:	
1.	Shetty.M.S., "ConcreteTechnology-Theory and Practice", S.Chandand Company, 2018.
2.	Varghese. P.C. "Maintenance, Repair and Rehabilitation & Minor Works of Buildings", Prentice Hall India Pvt, Ltd., 2015.
REFERENCES:	
1.	Kominetzky.M.S., "Design and Construction Failures", Galgotia, PublicationsPvt.Ltd., 2001.
2.	Ravishankar.K., Krishnamoorthy.T.S, "Structural Health Monitoring, Repair and Rehabilitation of Concrete Structures", Allied Publishers, 2004.
3.	"Hand book on Seismic Retrofit of Buildings", CPWD and Indian Buildings Congress, Narosa Publishers, 2010.
4.	Hand Book on "Repair and Rehabilitation of RCC Buildings", Director General works, CPWD, Govt of India, New Delhi, 2002.
5.	Dodge Woodson.R "Concrete Structures, Protection, Repair and Rehabilitation", Butterworth- Heinemann, Elsevier, New Delhi, 2012.

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

Table of Specification (ToS) for End Semester Question Paper

Unit No. and Title	Total 2 Marks Qns.	Total 16 Marks Qns.	Bloom's Taxonomy (Cognitive) Level					
			Remember (Re)	Understand (Un)	Apply (Ap)	Analyse (An)	Evaluate (Ev)	Create (Cr)
			No. of Qns. (marks) and CO					
Unit-I: Maintenance and Repair Strategies	2	1 either or	2(2) –CO1	-	1 either or (16) – CO4	-	-	-
Unit-II: Strength and Durability of Concrete	2	1 either or	2(2) – CO1	-	1 either or (16) — CO5	-	-	-
Unit-III: Protection Methods and Structural Health Monitoring	2	1 either or	1(2) — CO1	1(2) — CO3 1 either or (16) — CO2	-	-	-	-
Unit-IV: Repair Materials and Techniques	2	1 either or	1(2) - CO4	1(2) — CO4 1 either or (16) — CO3	-	-	-	-
Unit-V: Repair, Rehabilitation and Retrofitting of Structures	2	1 either or	1(2) – CO5	1(2) — CO2	1 either or (16) — CO5	-	-	-
Total Qns. Repair and Rehabilitation of Structures	10	5 either or	7(2)	3(2) 2 either or (16)	3 either or (16)	-	-	-
Total Marks	20	80	14	38	48	-	-	-
Weightage	20%	80%	14%	38%	48%	-	-	-

Weightage for COs					
	CO1	**CO2**	**CO3**	**CO4**	**CO5**
Total Marks	10	18	18	20	34
Weightage	10%	16%	18%	20%	20%

CE22613	**PREFABRICATED STRUCTURES**	**L**	**T**	**P**	**C**
		3	**0**	**0**	**3**

COURSE OBJECTIVE:

- To impart knowledge on the basic principles of prefabrication, calculation of handling and erection stresses, dimensioning and detailing of joint, erection of structures and design principles of prefabricated units.

UNIT I	**INTRODUCTION**	**9**

Need for prefabrication – Principles of prefabrication – Modular coordination – Standardization – Materials – Systems – Production – Transportation – Erection.

UNIT II	**PREFABRICATED COMPONENTS**	**9**

Behaviour and types of structural components – Large panel systems – roof and floor slabs – Walls panels - Beams - Columns - Shear walls.

UNIT III	**DESIGN PRINCIPLES**	**9**

Design philosophy- Design of cross section based on efficiency of material used – Problems in design because of joint flexibility – Allowance for joint deformation - Demountable precast concrete systems - Design of cross section based on efficiency of material used - Introduction to Progressive collapse - Codal provisions.

UNIT IV	**JOINTS AND CONNECTIONS IN STRUCTURAL MEMBERS**	**9**

Types of Joints- Based on action of forces - Compression joints,Shear joints,Tension joints - Based on function - Construction, contraction, expansion - Design of expansion joints - Dimensions and detailing - Types of sealants - Types of structural connections - Beam to Column - Column to Column - Beam to Beam - Column to foundation.		
UNIT V	**SELECTION OF PRE FABRICATION UNITS**	**9**
Prefabricated units for industrial structures - Multi-storied buildings and water tanks etc., - Application of pre stressed concrete in prefabrication – Case studies on prefabricated skyscraper, modular house and bridge - Prefabricated construction in IoT.		
		TOTAL: 45 PERIODS
COURSE OUTCOMES:		
At the end of the course, the students will be able to:		
CO1:	Define prefabricated structures, the methods of prefabrication, connections, joints and its design under abnormal loading.	
CO2:	Explain prefabricated structures, its production, components, dimension and detailing and progressive collapse.	
CO3:	Model prefabricated components, connection of joints and equivalent design for abnormal loading.	
CO4:	Design precast concrete elements.	
CO5:	Analyse prefabrication design, joints and connections, progressive collapse and its efficient design.	
TEXT BOOKS:		
1.	Bruggeling A.S.G and Huyghe G.F., “Prefabrication with Concrete”, A.A. BalkemaPublishers, USA, 2001.	
2.	Lewitt, M., “Precast Concrete- Materials, Manufacture, Properties And Usage”, Applied Science Publishers, London and New Jersey, 2000.	
REFERENCES:		
1.	Bachmann, H. and Steinle, A., “Precast Concrete Structures”, Ernst &Sohn, Berlin, 2011.	
2.	Koncz T., “Manual of Precast Concrete Construction”, Vol. I, II and III, Bauverlag, GMBH, 2006.	
3.	“Handbook on Precast Concrete Buildings”, Indian Concrete Institute, 2016.	
4.	Structural Design Manual, Precast Concrete Connection Details, Society for the Studies in the use of Precast Concrete, Netherland BetorVerlag, 2009.	
5.	Gerostiza C.Z., Hendrikson C. and Rehat D.R., “Knowledge based process planning for Construction and Manufacturing”, Academic Press Inc.,2006.	

Course	PO	PSO

Outcomes	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	2	-	1	-	-	2	-	-	-	-	-	3	1	3	2
CO2	2	-	2	-	-	2	-	-	-	-	-	3	1	1	-
CO3	2	-	3	-	-	2	2	-	-	-	-	3	1	1	-
CO4	2	2	3	-	-	2	2	-	-	-	-	3	-	-	-
CO5	2	2	3	2	-	2	2	-	-	-	-	3	1	1	2
CO	2	2	2	2	-	2	2	-	-	-	-	3	1	1	2

Table of Specification (ToS) for End Semester Question Paper

Unit No. and Title	Total 2 Marks Qns.	Total 16 Marks Qns.	Bloom's Taxonomy (Cognitive) Level					
			Remember (Re)	Understand (Un)	Apply (Ap)	Analyse (An)	Evaluate (Ev)	Create (Cr)
			No. of Qns. (marks) and CO					
Unit-I: Introduction	2	1 either or	2(2) –CO1	-	1 either or (16) – CO4	-	-	-
Unit-II: Prefabricated Components	2	1 either or	2(2) – CO1	-	1 either or (16) — CO5	-	-	-
Unit-III: Design Principles	2	1 either or	1(2) - CO1	1(2) — CO3 1 either or (16) — CO2	-	-	-	-
Unit-IV: Joints and Connections in Structural Members	2	1 either or	1(2) - CO4	1(2) — CO4 1 either or (16) — CO3	-	-	-	-
Unit-V: Selection of Prefabrication Units	2	1 either or	1(2) – CO5	1(2) — CO2	1 either or (16) — CO5	-	-	-
Total Qns. Prefabricated Structures	10	5 either or	7(2)	3(2) 2 either or (16)	3 either or (16)	-	-	-
Total Marks	20	80	14	38	48	-	-	-
Weightage	20%	80%	14%	38%	48%	-	-	-

Weightage for COs					
	CO1	**CO2**	**CO3**	**CO4**	**CO5**
Total Marks	10	18	18	20	34
Weightage	10%	18%	18%	20%	34%

CE22614	SMART MATERIALS AND MEASURING TECHNOLOGY	L	T	P	C
		3	0	0	3

COURSE OBJECTIVE:

- To impart knowledge on the fundamentals of the smart materials, the measuring techniques using smart materials, selecting suitable sensor for analyzing problems, the usage of different actuator material and the signal processing and control system in smart structures.

UNIT I	**INTRODUCTION**	**9**
Introduction to smart materials and structures - Instrumented structures, functions and response - Sensing systems - Self-diagnosis - Signal processing consideration - Actuation systems and effectors.		
UNIT II	**MEASURING TECHNIQUES**	**9**
Strain measuring techniques using electrical strain gauges - Types - Resistance - Capacitance - Inductance - Wheatstone bridges - Pressure transducers - Load cells - Temperature Compensation - Strain Rosettes - Self regulating heating elements.		
UNIT III	**SENSORS**	**9**
Sensing Technology - Types of Sensors - Physical Measurement using Piezo Electric Strain measurement - Inductively Read Transducers - The LVDT - Fibre optic techniques - Accelerometers - Force Sensors - Torque Sensors - Pressure Sensors - Microphones - Impact Hammers - MEMS Sensor - Chemical and biochemical sensing in structural assessment.		
UNIT IV	**ACTUATOR**	**9**
Actuator Techniques - Actuator and actuator materials - Piezoelectric and Electro strictive material - Magneto structure material - Shape Memory Alloys - Electro rheological fluids - Electromagnetic actuation - Role of actuators and actuator materials - Displacement Actuators, Force Actuators, Power Actuators, Vibration Dampers.		
UNIT V	**SIGNAL PROCESSING AND CONTROL SYSTEMS**	**9**
Data acquisition and processing - Signal Processing and Control for Smart Structures - Sensors as Geometrical Processors - Signal Processing - Signal, Conditioning Devices- Control System - Linear and Non-Linear, Passive, Semi-Active and Active Control, Feedback and Feed forward Control Strategies - Structural Health Monitoring applications.		
		TOTAL: 45 PERIODS
COURSE OUTCOMES:		
At the end of the course, the students will be able to:		
CO1:	State smart materials, strain measuring techniques, sensors, actuators and control system.	
CO2:	Explain the smart structures, measuring techniques sensor technology, actuator techniques and signal processing using smart materials for solving civil engineering problems.	
CO3:	Describe suitable smart materials for analyzing various measurements.	
CO4:	Choose and adapt the different sensors and actuator material in structural components.	
CO5:	Apply signal processing and control system in smart structures.	
TEXT BOOKS:		
1.	Brain Culshaw, “Smart Structure and Materials”, Artech House – Boston, London, 2004.	

2.	J. W. Dally & W. F. Riley, "Experimental Stress Analysis", College House Enterprises, 2005.
REFERENCES:	
1.	L. S. Srinath, "Experimental Stress Analysis", Tata McGraw-Hill, 2008.
2.	M.V. Gandhi and B.S. Thompson, "Smart Materials and Structures", Chapman & Hall, London, 2002.
3.	G. Gautschi, "Piezoelectric Sensorics: Force, Strain, Pressure, Acceleration and Acoustic Emission Sensors, Materials and Amplifiers, Springer-Verlag Berlin Heidelberg", 2011.
4.	L. Gorton, "Biosensors and Modern Biospecific Analytical Techniques", Elsevier, 2005.
5.	J. Park and R.S.Lakes, "Biomaterials - An Introduction", 3rd Edn., Springer Science, New York, 2007.

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

Table of Specification (ToS) for End Semester Question Paper

Unit No. and Title	**Total 2 MarksQns.**	**Total 16 MarksQns.**	**Bloom's Taxonomy (Cognitive) Level**					
			Remember (Re)	**Understand (Un)**	**Apply (Ap)**	**Analyse (An)**	**Evaluate (Ev)**	**Create (Cr)**
			No. of Qns. (marks) and CO					
Unit-I:Introduction	2	1 either or	2(2) –CO1	1 either or (16) – CO2	-	-	-	-
Unit-II: Measuring Techniques	2	1 either or	2(2) – CO1	1 either or (16) — CO3	-	-	-	-
Unit-III: Sensors	2	1 either or	1(2) — CO1	1(2) — CO1	1 either or (16) — CO4	-	-	-
Unit-IV: Actuator	2	1 either or	1(2) – CO1	1(2) — CO1	1 either or (16) — CO4	-	-	-
Unit-V: Signal Processing and Control Systems	2	1 either or	1(2) – CO1	1(2) — CO1	1 either or (16) — CO5	-	-	-
Total Qns. Smart Materials and Measuring Technology	10	5 either or	7(2)	3(2) 2 either or (16)	3 either or (16)	-	-	-
Total Marks	20	80	14	38	48	-	-	-
Weightage	20%	80%	14%	38%	48%	-	-	-
Weightage for COs								

	CO1	CO2	CO3	CO4	CO5
Total Marks	20	16	16	32	16
Weightage	20%	16%	16%	32%	16%

CE22715	HOUSING PLANNING AND MANAGEMENT	L	T	P	C
		3	0	0	3

COURSE OBJECTIVE:

- To impart knowledge on the housing projects and DC regulations, existing housing programmes, effective planning and designing of housing projects,cost effective construction materials and methods and appraisal of housing projects.

UNIT I	INTRODUCTION TO HOUSING	9

Definition of basic terms - House, Home, Household - Row houses, Apartments, Multistoried Buildings, Special Buildings - Objectives and strategies of National Housing Policies - Principle of Sustainable Housing - Housing Laws at State level - Bye-laws at Urban and Rural Local Bodies - DC Regulations - Institutions for Housing at National, State and Local levels.

UNIT II	HOUSING REGULATIONS	9

Housing approvals - Preparation of approval plans - Line plans for a residential building - Building by-laws - Minimum standard dimensions - Provisions of NBC and HVAC.

UNIT III	PLANNING AND DESIGN OF HOUSING PROJECT	9

Formulation of Housing Projects - Site Analysis - Layout Design - Design of Housing Units (Simple design problems) - Procedure for site analysis and layout planning.

UNIT IV	CONSTRUCTION TECHNIQUES AND COST-EFFECTIVE MATERIALS	9

New Constructions Techniques - Cost Effective Modern Construction Materials - Building Centres – Concept - Functional Performance Evaluation.

UNIT V	HOUSING FINANCE AND PROJECT APPRAISAL	9

Appraisal of Housing Projects - Housing Finance, Cost Recovery - Cash Flow Analysis, Subsidy and Cross Subsidy, Pricing of Housing Units, Rents, Recovery Pattern (Problems).

TOTAL: 45 PERIODS

COURSE OUTCOMES:

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

CO1:	State the fundamentals of housing projects, programmes, planning and designing, construction and appraisal of housing projects.
CO2:	Describe the housing regulations with sustainability concepts.
CO3:	Explain the suitability of various cost effective construction materials and techniques.
CO4:	Design the housing layouts through site analysis.

CO5:	Perform the economic analysis based on project appraisal of housing projects.
TEXT BOOKS:	
1.	Meera Mehta and Dinesh Mehta, "Metropolitan Housing Markets", Sage Publications Pvt. Ltd., New Delhi, 2009.
2.	Francis Cherunilam and Odeyar D Heggade, "Housing in India", Himalaya Publishing House, Bombay, 2007.
REFERENCES:	
1.	Development Control Rules for Chennai Metropolitan Area, CMA, Chennai, 2019.
2.	National Housing Policy, 2007, Government of India.
3.	Walter Martin Hosack, "Land Development Calculations", McGrawHill, 2nd Edition, USA, 2010.
4.	Government of India, National Housing Policy, 1998.
5.	Gurcharan Singh, Jagdish Singh, "Building Planning Designing and Scheduling", Standard Publishers, 2020.

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

Table of Specification (ToS) for End Semester Question Paper

Unit No. and Title	**Total 2 Marks Qns.**	**Total 16 Marks Qns.**	**Bloom's Taxonomy (Cognitive) Level**					
			Remember (Re)	**Understand (Un)**	**Apply (Ap)**	**Analyse (An)**	**Evaluate (Ev)**	**Create (Cr)**
			No. of Qns. (marks) and CO					
Unit-I: Introduction to Housing	2	1 either or	2(2) –CO1	1 either or (16) – CO3		-	-	-
Unit-II: Housing Programme	2	1 either or	1(2) – CO1	1(2) — CO3 1 either or (16) — CO3		-	-	-
Unit-III: Planning and Design of Housing Project	2	1 either or	1(2) — CO1	1(2) — CO3	1 either or (16) — CO4	-	-	-
Unit-IV: Construction Techniques and Cost-Effective Materials	2	1 either or	1(2) – CO1	1(2) — CO2 1 either or (16) — CO2	-	-	-	-
Unit-V: Housing Finance and Project Appraisal	2	1 either or	2(2) – CO1	-	1 either or (16) — CO5	-	-	-
Total Qns. Housing Planning and Management	10	5 either or	7(2)	3(2) 3 either or (16)	2 either or (16)	-	-	-

Total Marks	20	80	14	54	32	-	-	-
Weightage	20%	80%	14%	54%	32%	-	-	-

Weightage for COs					
	CO1	**CO2**	**CO3**	**CO4**	**CO5**
Total Marks	14	18	36	16	16
Weightage	14%	18%	36%	16%	16%

CE22716	**STRUCTURAL GEOLOGY**	**L**	**T**	**P**	**C**
		3	**0**	**0**	**3**

COURSE OBJECTIVE:

- To impart knowledge on the concepts of geological agents and their processes, topography, geological investigations and their engineering significance.

UNIT I	**PHYSICAL GEOLOGY**	**9**

Geology in Civil Engineering – Branches of Geology – Structure of earth and its composition- Weathering of rocks – Scale of weathering – Soils - Landforms and processes associated with river, wind, groundwater and sea – Relevance to Civil Engineering - Plate tectonics – Earthquakes – Seismic zones in India.

UNIT II	**STRUCTURE AND TOPOGRAPHY**	**9**

Effects of topography on structural features -Topographic and structural maps - Important representative factors of the map - Planar and linear structures - Concept of dip and strike - Outcrop patterns of different structures - Unconformity: Concept, classification and recognition.

UNIT III	**FOLDS**	**9**

Fold morphology - Geometric and genetic classification of folds - Introduction to the mechanics of folding: Buckling, Bending, Flexural slip and Flow folding.

UNIT IV	**FRACTURES AND FAULTS**	**9**

Geometric and genetic classification of fractures and faults - Effects of faulting on the outcrops - Geologic/geomorphic criteria for recognition of faults and fault plane solutions.

UNIT V	**APPLICATION OF GEOLOGICAL INVESTIGATIONS**	**9**

Remote Sensing for Civil Engineering applications - Geological conditions necessary for design and construction of dams, reservoirs, tunnels, and road cuttings - Hydrogeological investigations and Mineralogy - Coastal protection structures - Investigation of landslides, causes and mitigation.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

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

CO1:	Identify geological agents and their processes, topography, geological investigations and their engineering significance.
CO2:	Describe the concepts of geological agents and their processes, topography, geological investigations and their engineering significance.

CO3:	Explain the different geological features and their engineering importance.
CO4:	Perform geological investigations and mapping for construction projects.
CO5:	Apply the geological concepts in Civil Engineering projects.
TEXT BOOKS:	
1.	Parbin Singh. A, "Text Book of Engineering and General Geology", Katson Publishing House, Ludhiana, 2013.
2.	Duggal S.K., Pandey H.K. and Rawal N., "Engineering Geology", McGraw Hill Education Private Limited, 2017.
REFERENCES:	
1.	Varghese P. C, "Engineering Geology for Civil Engineers", PHI Learning Private Limited, Delhi, 2012.
2.	Blyth F.G.H. and M.H.de Freitas, "Geology for Engineers", CRC Press, Boca Raton, 2017.
3.	Bangar, K.M, "Principles of Engineering Geology", Standard Publishers Distributors, New Delhi, 2021.
4.	Marland P. Billings, "Structural Geology", Prentice-Hall India, New Delhi, 2016.
5.	VenkatReddy.D, "Engineering Geology for Civil Engineers", Vikas Publishing, 2013.

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

Table of Specification (ToS) for End Semester Question Paper

Unit No. and Title	Total 2 Marks Qns.	Total 16 Marks Qns.	Bloom's Taxonomy (Cognitive) Level					
			Remember (Re)	Understand (Un)	Apply (Ap)	Analyse (An)	Evaluate (Ev)	Create (Cr)
			No. of Qns. (marks) and CO					
Unit-I: Physical Geology	2	1 either or	2(2) –CO1	1 either or (16) – CO2	-	-	-	-
Unit-II: Structure and Topography	2	1 either or	2(2) – CO1	-	1 either or (16) — CO4	-	-	-
Unit-III: Folds	2	1 either or	2(2) — CO1	1 either or (16) — CO2	-	-	-	-
Unit-IV: Fractures and Faults	2	1 either or	1(2) – CO1	1(2) — CO3 1 either or (16) — CO3	-	-	-	-

Unit-V: Application of Geological Investigations	2	1 either or	1(2) – CO1	1(2) — CO2	1 either or (16) — CO5	-	-	-
Total Qns. Structural Geology	10	5 either or	8(2)	2(2) 3 either or (16)	2 either or (16)	-	-	-
Total Marks	20	80	16	52	32	-	-	-
Weightage	20%	80%	16%	52%	32%	-	-	-

Weightage for COs					
	CO1	**CO2**	**CO3**	**CO4**	**CO5**
Total Marks	16	34	18	16	16
Weightage	16%	34%	18%	16%	16%

Vertical 2: Environment Engineering

CE22521	**AIR AND NOISE POLLUTION CONTROL**	**L**	**T**	**P**	**C**
		3	**0**	**0**	**3**

COURSE OBJECTIVE:

- To impart knowledge on the sources effects of air pollution, the principles of dispersion characteristics of air pollution and the concepts of design of control of air pollution.

UNIT I	**SOURCES AND EFFECTS OF AIR POLLUTANTS**	**9**

Classification of air pollutants - Particulates and gaseous pollutants - Sources of air pollution - Source inventory - Effects of air pollution on human beings, materials, vegetation, animals - Global warming - Ozone layer depletion - Sampling and analysis - Basic Principles of sampling - Source and ambient sampling - Analysis of pollutants -Principles.

UNIT II	**METEOROLOGICAL FACTORS**	**9**

Elements of atmosphere-Meteorological factors - Wind roses - Lapse rate - Atmospheric stability and turbulence -Plume rise - Dispersion of pollutants - Dispersion models.

UNIT III	**AIR POLLUTION CONTROL**	**9**

Concepts of control - Principles and design of control measures - Particulates control by gravitational, centrifugal, filtration, scrubbing, and electrostatic precipitation - Selection criteria for equipment- Gaseous pollutant control by adsorption, absorption, condensation, and combustion - Pollution control for specific major industries.

UNIT IV	**AIR QUALITY MANAGEMENT**	**9**

Air quality standards - Emission standards - Industrial plant locations - City planning - Air pollution legislation and regulations - Air pollution monitoring software.

UNIT V	**NOISE POLLUTION**	**9**

Basics of acoustics and specification of sound - Sound power, sound intensity and sound pressure levels - Plane, point and line sources - Multiple sources - Outdoor and indoor noise propagation - Psychoacoustics and noise criteria - Effects of noise on health - Annoyance rating schemes - Special noise environments: Infrasound, ultrasound, impulsive sound and sonic boom - Noise standards and limit values - Noise monitoring procedure - Noise indices - Noise control

methods.	
	TOTAL: 45 PERIODS
COURSE OUTCOMES:	
At the end of the course, the students will be able to:	
CO1:	Define the sources, factors, effects, control and management of air and noise pollution.
CO2:	Describe the standards, sources and effects of air and noise pollution.
CO3:	Demonstrate the control and management of air and noise pollution.
CO4:	Identify the sources, factors, effects and standards of air and noise pollution.
CO5:	Make use of appropriate methods of control and management of air and noise pollution.
TEXT BOOKS:	
1.	Rao, C.S., "Environmental Pollution Control Engineering", New Age International Publishers, New Delhi, 3rd Edition, 2018.
2.	Rao. M.N., and Rao H.V.N., "Air Pollution Control", Tata McGraw Hill, NewDelhi, 2017.
REFERENCES:	
1.	Lawrence K. Wang, Norman C. Pereira, Yung-Tse Hung, "Air Pollution Control Engineering", Humana Press Inc, 2010.
2.	W.L. Heumann, "Industrial Air Pollution Control Systems", McGraw Hill, NewYork, 2007.
3.	Mahajan. S.P., "Pollution Control in Process Industries", Tata McGraw Hill Company, NewDelhi, 2017.
4.	Anjaneyulu D., "Air Pollution and Control Technologies", Allied Publishers, Mumbai, 2019.
5.	Cunniff P.F, "Environmental Noise Pollution", John Wiley & Sons, New York, 2019.

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

Table of Specification (ToS) for End Semester Question Paper

Unit No. and Title	Total 2 Marks Qns.	Total 16 Marks Qns.	Bloom's Taxonomy (Cognitive) Level					
			Remember (Re)	Understand (Un)	Apply (Ap)	Analyse (An)	Evaluate (Ev)	Create (Cr)
			No. of Qns. (marks) and CO					
Unit-I: Sources and Effects of Air pollutants	2	1 either or	2(2) –CO1	1 either or (16) — CO3			-	-
Unit-II: Meteorological factors	2	1 either or	1(2) – CO1	1(2) – CO2 1 either or (16) — CO2			-	-
Unit-III: Air pollution Control	2	1 either or	1(2) — CO1	1(2) — CO2	1 either or (16) — CO5	-	-	-
Unit-IV: Air quality Management	2	1 either or	1(2) – CO1	1(2) — CO2	1 either or (16) — CO4	-	-	-
Unit-V: Noise Pollution	2	1 either or	1(2) – CO1	1(2) — CO2	1 either or (16) — CO5	-	-	-
Total Qns. Air and Noise Pollution Control	10	5 either or	6(2)	4(2) 2 either or (16)	3 either or (16)		-	-
Total Marks	20	80	12	40	48		-	-
Weightage	20%	80%	12%	40%	48%		-	-

Weightage for COs					
	CO1	CO2	CO3	CO4	CO5
Total Marks	12	24	16	16	32
Weightage	12%	24%	16%	16%	32%

CE22522	SOLID AND HAZARDOUS WASTE MANAGEMENT	L	T	P	C
		3	0	0	3

COURSE OBJECTIVE:

- To impart knowledge and skills in the collection, storage, transport, treatment, disposal and recycling options for solid wastes including the related engineering principles, design criteria, methods and equipment.

UNIT I	SOURCES, CLASSIFICATION AND REGULATORY FRAMEWORK	9

Types and Sources of solid and hazardous wastes - Need for solid and hazardous waste management – Salient features of Indian legislations on management and handling of municipal solid wastes, hazardous wastes, biomedical wastes, nuclear wastes - Lead acid batteries, electronic wastes, plastics and fly ash – Elements of integrated waste management and roles of stakeholders - Financing and Public Private Participation for waste management.

UNIT II	WASTE CHARACTERIZATION AND SOURCE REDUCTION	9

Waste generation rates and variation - Composition, physical, chemical and biological properties of solid wastes – Hazardous characteristics – TCLP tests – Waste sampling and characterization plan - Source reduction of wastes –Waste exchange - Extended producer responsibility - Recycling and reuse.

UNIT III	STORAGE, COLLECTION AND TRANSPORT OF WASTES	9

Handling and segregation of wastes at source – Storage and collection of municipal solid wastes – Analysis of collection systems - Need for transfer and transport – Transfer stations - Optimizing waste allocation– Compatibility, storage, labeling and handling of hazardous wastes – Hazardous waste manifests and transport.		
UNIT IV	**WASTE PROCESSING TECHNOLOGIES**	**9**
Objectives of waste processing – Material separation and processing technologies – Biological and chemical conversion technologies – Methods and controls of composting - Thermal conversion technologies and energy recovery – Incineration – Solidification and stabilization of hazardous wastes - Treatment of biomedical wastes - Health considerations in the context of operation of facilities, handling of materials and impact of outputs on the environment.		
UNIT V	**WASTE DISPOSAL**	**9**
Waste disposal options – Disposal in landfills - Landfill - Classification, types and methods – Site selection - Design and operation of sanitary landfills, secure landfills and landfill bioreactors – Leachate and landfill gas management – Landfill closure and environmental monitoring – Rehabilitation of open dumps – Landfill remediation.		
		TOTAL: 45 PERIODS

COURSE OUTCOMES:	
At the end of the course, the students will be able to:	
CO1:	Recall the classification, collection, characteristics, storage and transport of solid waste.
CO2:	Summarize the sources, types, collection methods and transport modes of generated solid waste.
CO3:	Interpret the various storage, transport, processing technologies and disposal for municipal solid waste management.
CO4:	Design the disposal facility for municipal solid waste generated by a community.
CO5:	Identify advance techniques in hazardous waste management.
TEXT BOOKS:	
1.	George Tchobanoglous et.al, “Integrated Solid Waste Management”, McGraw Hill Publishers, 2014.
2.	B.Bilitewski, G.HardHe, K.Marek, A.Weissbach, and H.Boeddicker, “Waste Management”, Springer, 2010.
REFERENCES:	
1.	“Manual on Municipal Solid Waste Management”, CPHEEO, Ministry of Urban Development, Government of India, New Delhi, 2016.
2.	R.E.Landreth and P.A.Rebers, “Municipal Solid Wastes – Problems and Solutions”, Taylor and Francis Inc., 2019.
3.	Bhide A.D. and Sundaresan, B.B., “Solid Waste Management in Developing Countries”, INSDOC, 2003.

4.	M. N. Rao, Razia Sultana, "Solid and Hazardous Waste Management", Second Edition, BS Publications, 2023.
5.	S. Bhatia, "Solid and Hazardous Waste Management", Atlantic Publishers, 2023.

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

Table of Specification (ToS) for End Semester Question Paper

Unit No. and Title	Total 2 Marks Qns.	Total 16 Marks Qns.	Bloom's Taxonomy (Cognitive) Level					
			Remember (Re)	Understand (Un)	Apply (Ap)	Analyse (An)	Evaluate (Ev)	Create (Cr)
			No. of Qns. (marks) and CO					
Unit-I:Sources, Classification and Regulatory Framework	2	1 either or	1(2) –CO1	1(2) — CO3 1 either or (16) — CO2		-	-	-
Unit-II: Waste Characterization and Source Reduction	2	1 either or	1(2) – CO1	1(2) — CO4 1 either or (16) — CO3		-	-	-
Unit-III: Storage, Collection and Transport of Wastes	2	1 either or	2(2) — CO1	-	1 either or (16) – CO4	-	-	-
Unit-IV: Waste Processing Technologies	2	1 either or	2(2) - CO4	-	1 either or (16) — CO5	-	-	-
Unit-V: Waste Disposal	2	1 either or	1(2) – CO5	1(2) — CO2	1 either or (16) — CO5	-	-	-
Total Qns. Solid and Hazardous Waste Management	10	5 either or	7(2)	3(2) 2 either or (16)	3 either or (16)	-	-	-
Total Marks	20	80	14	38	48	-	-	-
Weightage	20%	80%	14%	38%	48%	-	-	-

Weightage for COs					
	CO1	CO2	CO3	CO4	CO5
Total Marks	10	18	18	20	34
Weightage	10%	18%	18%	20%	34%

CE22623	INDUSTRIAL WASTEWATER MANAGEMENT	L	T	P	C
		3	0	0	3

COURSE OBJECTIVE:

- To provide knowledge on sources and characteristics of industrial wastewater techniques

	and approaches for minimizing the generation of wastewater at the source and application of physico-chemical, biological and advanced treatment methods for recovery, reuse and disposal of wastewater in Indian Industries.	
UNIT I	**INDUSTRIAL POLLUTION PREVENTION**	**9**
Industrial scenario in India – Uses of water by industry – Sources, generation rates and characteristics of industrial wastewaters–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 – Payback period		
UNIT II	**INDUSTRIAL WASTE SURVEY**	**9**
Process flow charts, condition of waste stream - Sampling – Grab, composite and integrated samples - Continuous monitoring – pH, Conductivity, Biomonitoring		
UNIT III	**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 IV	**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 V	**CASE STUDIES**	**9**
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
COURSE OUTCOMES:		
At the end of the course, the students will be able to:		
CO1:	List the source and types of industrial wastewater and their environmental impacts and choose the regulatory laws pertaining to environmental protection.	
CO2:	Explain the characteristics, treatment processes, disposal methods of sewage and their environmental impacts.	
CO3:	Explain facilities for the processing and reclamation of industrial wastewater.	
CO4:	Choose effluent management scheme for waste generated from industriesandprocessing of industrial waste.	
CO5:	Construct effective management systems for industrial wastewaterthat are technically sound, economically feasible and socially acceptable.	
TEXT BOOKS:		
1.	Metcalf & Eddy, “Wastewater Engineering Treatment Disposal Reuse”, Tata	

	McGraw Hill,2005.
2.	Eckenfelder, W.W., "Industrial Water Pollution Control", McGraw-Hill,2017
REFERENCES:	
1.	Rao,M.N., Mrs. Anjali Datta,"Waste Water Treatment", Oxford &Ibh, 2017.
2.	Mark J. Hammer, Mark J. Hammer, "Water & Wastewater Technology", Prentice Hall of India, 2013.
3.	N.L. Nemerrow, "Theories and Practices of Industrial Waste Engineering", Addison-Wesley Publishing Company, 2007.
4.	A.D. Patwardhan, "Industrial Waste Water Treatment", Eastern Economy Edition, 2017.
5.	N.G. Wun Jem, "Industrial Wastewater Treatment", World Scientific, 2020.

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

Table of Specification (ToS) for End Semester Question Paper

Unit No. and Title	Total 2 Marks Qns.	Total 16 Marks Qns.	Bloom's Taxonomy (Cognitive) Level					
			Remember (Re)	Understand (Un)	Apply (Ap)	Analyse (An)	Evaluate (Ev)	Create (Cr)
			No. of Qns. (marks) and CO					
Unit-I: Industrial Pollution Prevention	2	1 either or	2(2) –CO1	1 either or (16) – CO2	-	-	-	-
Unit-II: Industrial Waste Survey	2	I either or	1(2) – CO1	1(2) – CO2	1 either or (16) — CO4	-	-	-
Unit-III: Industrial Wastewater Treatment	2	1 either or	1(2) — CO1	1(2) — CO3 1 either or (16) — CO3	-	-	-	-
Unit-IV: Zero Liquid Discharge	2	1 either or	1(2) – CO3	1(2) — CO4 1 either or (16) — CO4	-	-	-	-
Unit-V: Case studies	2	1 either or	1(2) – CO5	1(2) — CO2	1 either or (16) — CO5	-	-	-
Total Qns. Industrial Wastewater Management	10	5 either or	6(2)	4(2) 3 either or (16)	2 either or (16)	-	-	-
Total Marks	20	80	12	56	32	-	-	-
Weightage	20%	80%	12%	56%	32%	-	-	-
Weightage for COs								
	CO1	**CO2**	**CO3**	**CO4**	**CO5**			

Total Marks	8	20	20	34	18
Weightage	8%	20%	20%	34%	18%

CE22624	**ENVIRONMENTAL IMPACT ASSESSMENT**	**L**	**T**	**P**	**C**
		3	**0**	**0**	**3**

COURSE OBJECTIVE:

- To impart knowledge on the need, methodology, documentation and preparation ofEnvironmental Impact Assessment report, environmental risk and cost benefitanalysis.

UNIT I	**FUNDAMENTALS OF EIA**	**9**

Historical Development of Environmental Impact Assessment - EIA in Project Cycle - Legal and Regulatory Aspects in India - Types and Limitations of EIA - Cross Sectorial Issues and terms of References in EIA.

UNIT II	**RISK AND COST- BENEFIT ANALYSIS**	**9**

Definition of Risk - Environmental Risk Analysis - Matrix Method - Checklist method – Faulttreeanalysis - Consequence Analysis - Cost benefit analysis - Analysis of Alternative – SoftwarePackages for EIA and Expert Systemsin EIA.

UNIT III	**PREDICTION AND ASSESSMENT**	**9**

Prediction tools for EIA - Mathematical modelling for impact prediction - Assessment of Impactson Air and Water -Assessment of Impacts on Soil and Noise - Assessment of Impacts onBiological Community - Cumulative Impact Assessment-Documentation of EIA Findings - Report Preparation.

UNIT IV	**LIFE CYCLE ASSESSMENT**	**9**

Life Cycle Assessment - Resource Balance - Energy Balance - Management Review – OperationalControl - Case Studies on EIA.

UNIT V	**SOCIO-ECONOMIC IMPACT ASSESSMENT**	**9**

Definition of Social Impact Assessment - Social Impact Assessment model - The Planningprocess-Relationship between social impacts and change in community and institutionalarrangements - Individual and family level impacts -Communities in transition environmental riskassessment framework.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

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

CO1:	Interpret the EIA risk, lifecycle, assessment and limitation and issues.
CO2:	Outline risk mitigation plan by assessing the potential hazards for any project.
CO3:	Choose the methods and tools to predict the impact on environment.
CO4:	Develop energy balance and life cycle assessment.

CO5:	Experiment with the Social Impact Assessment and Life cycle Assessment.
TEXT BOOKS:	
1.	Pannirselvam. R., Navaneetha Gopalakirshnan. A., Karthikeyan. S., "Environmental and Social Impact Assessment", SPGS Publishers, Chennai 2014.
2.	Canter, L.W., "Environmental Impact Assessment", McGraw Hill, New York, 2006.
REFERENCES:	
1.	Lawrence, D.P., "Environmental Impact Assessment – Practical Solutions to Recurrent Problems", Wiley Interscience, New Jersey, 2003.
2.	World Bank, "Source Book on EIA".
3.	Charles H. Eccleston, "Environmental Impact Assessment: A guide to Best Professional Practices", CRC Press, 2017.
4.	Petts, J., "Handbook of Environmental Impact Assessment", Vol., I and II, Blackwell Science, London, 2009.
5.	Anji Reddy, "Environmental Impact Assessment Theory and Practice", BSP Books, 2016.

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

Table of Specification (ToS) for End Semester Question Paper

Unit No. and Title	**Total 2 MarksQns.**	**Total 16 MarksQns.**	**Bloom's Taxonomy (Cognitive) Level**					
			Remember (Re)	**Understand (Un)**	**Apply (Ap)**	**Analyse (An)**	**Evaluate (Ev)**	**Create (Cr)**
			No. of Qns. (marks) and CO					
Unit-I: Fundamentals of EIA	2	1 either or	2(2) –CO1	1 either or (16) – CO4	-	-	-	-
Unit-II: Risk and Cost-Benefit Analysis	2	1 either or	2(2) – CO2	1 either or (16) — CO5	-	-	-	-
Unit-III: Prediction and Assessment	2	1 either or	1(2) — CO3	1(2) — CO3	1 either or (16) – CO4	-	-	-
Unit-IV: Life Cycle Assessment	2	1 either or	1(2) - CO4	1(2) — CO4	1 either or (16) — CO5	-	-	-
Unit-V: Socio-Economic Impact Assessment	2	1 either or	1(2) – CO5	1(2) — CO5	1 either or (16) — CO5	-	-	-
Total Qns. Environmental Impact Assessment	10	5 either or	7(2)	3(2) 2 either or (16)	3 either or (16)	-	-	-

Total Marks	20	80	14	38	48	-	-	-
Weightage	20%	80%	14%	38%	48%	-	-	-

Weightage for COs					
	CO1	**CO2**	**CO3**	**CO4**	**CO5**
Total Marks	20	20	20	20	20
Weightage	20%	20%	20%	20%	20%

CE22725	**ENVIRONMENTAL HEALTH AND SAFETY**	**L**	**T**	**P**	**C**
		3	**0**	**0**	**3**

COURSE OBJECTIVE:

- To educate overview of EHS in industries and related Indian regulations, types of Healthhazards, effect, assessment and control methods and EHS Management System.

UNIT I	**INTRODUCTION**	**9**

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

UNIT II	**OCCUPATIONAL HEALTH AND HYGIENE**	**10**

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

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

Features of satisfactory and safe design of work premises – Good housekeeping - Lighting and color, Ventilation and Heat Control, Noise, Chemical and Radiation Safety – Electrical Safety – Fire Safety– Safety at Construction sites, ETP – Machine guarding – Process Safety - Working at different levels.

UNIT IV	**HAZARDS AND RISK MANAGEMENT**	**8**

Safety appraisal – Job Safety Analysis-Control techniques – Plant safety inspection – Accidentinvestigation - Analysis and Reporting – Hazard and Risk Management Techniques – Onsite andOffsite emergency Plans, Employee Participation- Education and Training- Case Studies.

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

Concept of Environmental Health and Safety Management – Elements of Environmental Health andSafety Management Policy -Implementation and review – ISO 45001-Strucure and Clauses-CaseStudies.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

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

CO1:	Explain the environment health and safety systems and regulations.
CO2:	Identify the health hazards, its assessment and protection process.

CO3:	Experiment with workplace safety and safety systems.
CO4	Organize the job safety analysis and the control techniques.
CO5:	Select suitable health amd safety management methods.
TEXT BOOKS:	
1.	"Industrial Health and Safety Acts and Amendments", Ministry of Labour and Employment, Government of India.
2.	"Fundamentals of Industrial Safety and Health", Dr.K.U.Mistry, Siddharth Prakashan, 2012.
REFERENCES:	
1.	"The Facility Manager's Guide to Environmental Health and Safety", Brian Gallant, GovernmentInst. Publ., 2007.
2.	"Environmental and Health and Safety Management", Nicholas P.Cheremisinoff and Madelyn L. Graffia, William Andrew Inc., NY, 2003.
3.	"Effective Environmental, Health, and Safety Management Using the Team Approach", BillTaylor, Culinary and Hospitality Industry Publications Services, 2005.
4.	M.N. Rao, Razia Sultana and Sri Harsha Kota, "Solid and Hazardous Waste Management - Science and Engineering", BS Publications, 2023.
5.	Fried, J.J., "Ground Water Pollution", Elsevier, 2000.

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

Tableof Specification (ToS) forEndSemester Question Paper

Unit No. and Title	**Total 2 MarksQns.**	**Total 16 MarksQns.**	**Bloom's Taxonomy (Cognitive) Level**					
			Remember (Re)	**Understand (Un)**	**Apply (Ap)**	**Analyse (An)**	**Evaluate (Ev)**	**Create (Cr)**
			No. of Qns. (marks) and CO					
Unit-I: Introduction	2	1 either or	2(2) –CO1	1 either or (16) – CO1		-	-	-
Unit-II: Occupational Health and Hygiene	2	1 either or	2(2) – CO2	-	1 either or (16) — CO2	-	-	-
Unit-III: Workplace Safety And Safety Systems	2	1 either or	1(2) — CO3	1(2) — CO3	1 either or (16) — CO3	-	-	-

Unit-IV: Hazards And Risk Management	2	1 either or	1(2) - CO4	1(2) — CO4	1 either or (16) — CO4	-	-	-
Unit-V: Environmental Health and Safety Management	2	1 either or	1(2) – CO5	1(2) — CO5	1 either or (16) — CO5	-	-	-
Total Qns. Environmental Health and Safety	10	5 either or	7(2)	3(2) 2 either or (16)	4 either or (16)	-	-	-
Total Marks	20	80	14	22	64	-	-	-
Weightage	20%	80%	14%	22%	64%	-	-	-

Weightage for COs

	CO1	CO2	CO3	CO4	CO5
Total Marks	20	20	20	20	20
Weightage	20%	20%	20%	20%	20%

CE22726	**GEO ENVIRONMENTAL ENGINEERING**	**L**	**T**	**P**	**C**
		3	**0**	**0**	**3**

COURSE OBJECTIVE:

- The student acquires the knowledge on the Geotechnical engineering problems associated with soil contamination, safe disposal of waste and remediate the contaminated soils by different techniques, 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.

UNIT II	**SITE SELECTION AND SAFE DISPOSAL OF WASTE**	**9**

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**	**9**

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 – Case studies.

UNIT V	**REMEDIATION OF CONTAMINATED SOILS**	**9**

Exsitu and Insitu remediation - Solidification, bio-remediation, incineration, soil washing, phyto-remediation, soil heating, vetrification, bio-venting.	
TOTAL: 45 PERIODS	
COURSE OUTCOMES:	
At the end of the course, the students will be able to:	
CO1:	Explain the source, production, classification and causes of contamination in the soil.
CO2:	Identify the safe site and method of disposal and stabilization of waste.
CO3:	Experiment with the transport of contaminants in sub surface.
CO4	Organize the safe disposal of waste and other wastestablizationmethods.
CO5:	Select suitable remediation methods based on contamination.
TEXT BOOKS:	
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, 2003.
REFERENCES:	
1.	Westlake, K, "Landfill Waste pollution and Control", Albion Publishing Ltd., England, 2015.
2.	P.M.Cherry., "Hazardous Waste Management", CBS HB, Singapore, 2016.
3.	Proceedings of the International Symposium on "Environmental Geotechnology" (Vol.I and II), Environmental Publishing Company, 2016.
4.	M.N. Rao, Razia Sultana and Sri HarshaKota, "Solid and Hazardous Waste Management. Science and Engineering", BS Publications / BSP Books, 2023.
5.	Fried, J.J., "Ground Water Pollution", Elsevier, 2000.

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

Tableof Specification (ToS) for EndSemester Question Paper

Unit No. and Title	Total 2 MarksQns.	Total 16 MarksQns.	Bloom's Taxonomy (Cognitive) Level					
			Remember (Re)	Understand (Un)	Apply (Ap)	Analyse (An)	Evaluate (Ev)	Create (Cr)
			No. of Qns. (marks) and CO					
Unit-I: Generation of Wastes and Consquences of Soil Pollution	2	1 either or	2(2) –CO1	1 either or (16) – CO1		-	-	-
Unit-II: Site Selection and Safe Disposal of Waste	2	1 either or	2(2) – CO2	-	1 either or (16) — CO2	-	-	-
Unit-III: Transport of Contaminants	2	1 either or	1(2) — CO3	1(2) — CO3	1 either or (16) — CO3	-	-	-
Unit-IV: Waste Stabilization	2	1 either or	1(2) - CO4	1(2) — CO4	1 either or (16) — CO4	-	-	-
Unit-V: Remediation of Contaminated Soils	2	1 either or	1(2) – CO5	1(2) — CO5	1 either or (16) — CO5	-	-	-
Total Qns. Geo Environmental Engineering	10	5 either or	7(2)	3(2) 2 either or (16)	4 either or (16)	-	-	-
Total Marks	20	80	14	22	64	-	-	-
Weightage	20%	80%	14%	22%	64%	-	-	-

Weightage for COs					
	CO1	**CO2**	**CO3**	**CO4**	**CO5**
Total Marks	20	20	20	20	20
Weightage	20%	20%	20%	20%	20%

Vertical 3: Hydraulics and Hydrology

CE22531	SURFACE WATER HYDROLOGY	L	T	P	C
		3	0	0	3

COURSE OBJECTIVE:

- This course imparts knowledge about various hydrological components and runoff analysis.

UNIT I	HYDROMETEOROLOGY	9

Concept of hydrology–Hydrologic cycle– Components of hydrologic cycle – Annual water resources balance of India – Triple cell air circulation – Recording and non-recording rain gauges – Density and adequacy of rain gauges – Optimum number of rain gauges.

UNIT II	PRECIPITATION	9

Forms and types of Precipitation – Measurement of precipitation – Mean aerial depth of precipitation –Competition of missing data, double mass analysis, computation of rainfall data network density– DAD curves.

UNIT III	ABSTRACTIONS FROM PRECIPITATION	9
Evaporation process – Evaporimeters – Empirical evaporation equations – BlaneyCriddle equation – Modified Penman equation – Reservoir evaporation and reduction methods – Transpiration– Evapotranspiration – Measurements of evapotranspiration,equations – Potential evapotranspiration – Actual evapotranspiration – Interception – Depression storage – Infiltration – Infiltrometer - Infiltration indices - Horton's curve.		
UNIT IV	**RUNOFF AND HYDROGRAPH ANALYSIS**	**9**
Runoff volume – Flow duration curve – Flow mass curve – Droughts – Surface water resources in India – Hydrograph – Factors affecting flood hydrograph – Components - Base flow separation – Effective rainfall – Unit hydrograph, derivation, uses, limitations, duration – Synthetic unit hydrograph.		
UNIT V	**FLOODS**	**9**
Flood routing: Muskingum method of channel Routing – Reservoir routing – Modified pulse method– Flood estimation and flood frequency: Rational method – Empirical formulae – Unit hydrograph method – Flood frequency studies – Gumbel's method – Log-Pearson type III distribution – Partial duration series – Regional flood frequency analysis – Design flood – Storm – Risk reliability and safety factor.		
		TOTAL: 45 PERIODS

COURSE OUTCOMES:	
At the end of the course, the students will be able to:	
CO1:	Find the hydrological cycle, precipitation, and evaporation of surface water.
CO2:	Explain the various field measurement methods and empirical formulae used to estimate precipitation and runoff losses.
CO3:	Summarize the various types of rain gauges and evapotranspiration measurements.
CO4:	Apply the hydraulic design, stream flow, flood, risk reliability, and safety factor equations.
CO5:	Develop a flood equation and flood routing systems for frequency analysis.

TEXT BOOKS:	
1.	Subramanya K., "Engineering Hydrology", 4th Edition, McGraw Hill Publishing Company, New Delhi, 2020.
2.	Chow, V. T., Maidment, D. R., Mays, L. W., "Applied Hydrology", McGraw Hill, 2008.

REFERENCES:	
1.	Jaya Rami Reddy, P., "A text book of Hydrology", Laxmi publications,2009.
2.	VenTe Chow, David R. Maidment, Larry W.Mays., "Applied Hydrology", Revised Edition, Tata McGraw HillPublishing Company, New Delhi, 2010.
3.	Wilfried Brutsaert., "Hydrology: An Introduction", Cambridge University Press,

	2012.
4.	Garg, S. K., "Irrigation Engineering and Hydraulic Structures, KhannaPublishers, 2006.
5.	Subramanya, K., "Engineering Hydrology", McGraw Hill Education, 2021.

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

Table of Specification (ToS) for End Semester Question Paper

Unit No. and Title	Total 2 Marks Qns.	Total 16 Marks Qns.	Bloom's Taxonomy (Cognitive) Level					
			Remember (Re)	Understand (Un)	Apply (Ap)	Analyse (An)	Evaluate (Ev)	Create (Cr)
			No. of Qns. (marks) and CO					
Unit-I:Hydrometeorology	2	1 either or	2(2) –CO1	1 either or (16) – CO2		-	-	-
Unit-II:Precipitation	2	1 either or	1(2) – CO1	1(2) — CO2 1 either or (16) — CO3		-	-	-
Unit-III: Abstractions from Precipitation	2	1 either or	1(2) — CO1	1(2) — CO2	1 either or (16) — CO5	-	-	-
Unit-IV: Runoff and Hydrograph Analysis	2	1 either or	1(2) – CO1	1(2) — CO2	1 either or (16) — CO5	-	-	-
Unit-V: Floods	2	1 either or	2(2) – CO1		1 either or (16) — CO4	-	-	-
Total Qns. Surface Water Hydrology	10	5 either or	7(2)	3(2) 2 either or (16)	3 either or (16)	-	-	-
Total Marks	20	80	14	38	48	-	-	-
Weightage	20%	80%	14%	38%	48%	-	-	-

Weightage for COs					
	CO1	CO2	CO3	CO4	CO5
Total Marks	14	22	16	16	32
Weightage	14%	22%	16%	16%	32%

CE22532	GROUNDWATER ENGINEERING	L	T	P	C
		3	0	0	3

COURSE OBJECTIVE:

- To introduce the student to the principles of groundwater governing equations and characteristics of different aquifers, techniques of development and management of groundwater.

UNIT I	INTRODUCTION	9

Ground water utilization - Historical background–Ground water in hydrologic cycle–Ground water budget–Ground water level fluctuations - Environmental influence.

UNIT II	OCCURRENCE AND MOVEMENT OF GROUND WATER	9

Origin and age of ground water– Rock properties affecting groundwater–Groundwater column–Zones of aeration and saturation–Aquifers and their characteristics, Classification–Groundwater basins and springs– Darcy's Law– Permeability & its determination– Dupuit assumptions–Heterogeneity and anisotropy– Ground water flow rates and flow directions– General flow equations through porous media.

UNIT III	ADVANCED WELL HYDRAULICS	9

Steady, unsteady, uniform, radial flow to a well in a confined,unconfined, leaky aquifer–Well flow near aquifer boundaries for special conditions– Partially penetrating– Horizontal wells &multiple well systems–Well completion –Development, protection, rehabilitation–Testing for yield.

UNIT IV	POLLUTION AND QUALITY ANALYSIS OF GROUND WATER	9

Municipal,Industrial, Agricultural, Miscellaneous sources and causes of pollution–Attenuation–Underground distribution– Potential evaluation of pollution–Physical, chemical, biological analysis of ground water quality–Criteria and measures of ground water quality–Ground water salinity and samples–Graphical representations of ground water quality.

UNIT V	SUB-SURFACE INVESTIGATION OF GROUND WATER	9

Geological, Geophysical exploration–Remote sensing –Electric resistivity –Seismic refraction based methods for surface investigation of ground water– Test drilling and ground water level measurement–Sub-surface ground water investigation through geophysical –Resistivity –Spontaneous potential – Radiation –Temperature –Caliper –Fluid conductivity –Fluid velocity–Miscellaneous logging.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

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

CO1:	List the occurrence of groundwater in various types of aquifers and aquifer properties in various geological environments.

CO2:	Describe the origins, characteristics, division, and sources of groundwater as well as the measurement of its quality and pollution.
CO3:	Illustrate the different approaches to groundwater in the hydrologic cycle, well systems, and groundwater exploration, replenishment, and harvesting.
CO4:	Apply flow and yield equations for wells to investigate the groundwater and its quality.
CO5:	Utilize a water budget, permeability, flow rates, and aquifer boundaries for special conditions, as well as test drilling and ground water level measurements to assess ground water quality.
TEXT BOOKS:	
1.	Raghunath. H M, "Groundwater", New Age International Publishers, 2000.
2.	Todd D.K., "Groundwater Hydrology", Wiley India Pvt. Ltd., 2014.
REFERENCES:	
1.	Karanth K R, "Groundwater Assessment and Management", Tata McGraw Hill Education, 2017.
2.	Bouwer H, "Groundwater Hydrology", McGraw Hill Book Company, 2013.
3.	Willis R and W.W.G. Yeh, "Groundwater Systems Planning and Management", Prentice Hall Inc., 2007.
4.	Garg, S.P, "Groundwater and Tube Wells", Oxford and IBH Publishing, New Delhi, 2013.
5.	Todd, David Keith, "Ground Water Hydrology, Wiley India Edition, New Delhi, 2007.

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

Table of Specification (ToS) for End Semester Question Paper

Unit No. and Title	Total 2 MarksQns.	Total 16 MarksQns.	Bloom's Taxonomy (Cognitive) Level					
			Remember (Re)	Understand (Un)	Apply (Ap)	Analyse (An)	Evaluate (Ev)	Create (Cr)
			No. of Qns. (marks) and CO					
Unit-I: Introduction	2	1 either or	2(2) –CO1	1 either or (16) – CO3		-	-	-

Unit-II: Occurrence and movement of ground water	2	1 either or	2(2) – CO1	-	1 either or (16) — CO5	-	-	-
Unit-III: Advanced Well Hydraulics	2	1 either or	1(2) — CO1	1(2) — CO2	-	-	-	-
Unit-IV: Pollution and Quality Analysis of Ground Water	2	1 either or	1(2) - CO1	1(2) — CO2 1 either or (16) — CO2	1 either or (16) — CO4	-	-	-
Unit-V: Surface/ Sub-Surface Investigation of Ground Water	2	1 either or	1(2) – CO1	1(2) — CO2	1 either or (16) — CO4	-	-	-
Total Qns. Ground Water Engineering	10	5 either or	7(2)	3(2) 2 either or (16)	3 either or (16)	-	-	-
Total Marks	20	80	14	38	48	-	-	-
Weightage	20%	80%	14%	38%	48%	-	-	-

Weightage for COs

	CO1	CO2	CO3	CO4	CO5
Total Marks	14	22	16	32	16
Weightage	14%	22%	16%	32%	16%

CE22633	**PARTICIPATORY WATER RESOURCES MANAGEMENT**	**L**	**T**	**P**	**C**
		3	**0**	**0**	**3**

COURSE OBJECTIVE:

- To gain an insight on local and global perceptions and approaches on participatory water resource management.

UNIT I	**FUNDAMENTALS**	**9**

Sociology – Basic concepts – Perspectives- Social Stratification – Irrigation as a Socio technical process - Participatory concepts– Objectives of participatory approach.

UNIT II	**UNDERSTANDING FARMERS PARTICIPATION**	**9**

Farmers participation – Need and benefits – Comparisons of cost and benefit -Sustained system performance - Kinds of participation – Context of participation - Factors in the environment – WUA - Constraints in organizing FA – Role of Community Organizer – Case Studies.

UNIT III	**ISSUES IN WATER MANAGEMENT**	**9**

Multiple use of water – Issues in Inter-sectoral Water Allocation - Domestic, irrigation, industrial sectors - Modernization techniques – Rehabilitation – Command Area Development - Water delivery systems.

UNIT IV	**PARTICIPATORY WATER CONSERVATION**	**9**

Global Challenges -Social – Economic – Environmental - Political -Solutions –Water Marketing – Water Rights -Consumer education – Success Stories - Case Studies.

UNIT V	**PARTICIPATORY WATERSHED DEVELOPMENT**	**9**

Concept and significance of watershed - Factors influencing watershed development – Principles of watershed management – Identification of problems - Watershed approach in Government programmes – People's participation – Entry point activities - Evaluation of watershed management measures.	
TOTAL: 45 PERIODS	
COURSE OUTCOMES:	
At the end of the course, the students will be able to:	
CO1:	State the basics of water-related issues and participatory water conservationand watershed development in a political, economic, environmental and societal context.
CO2:	Describe the concepts of participatory water conservationand watershed development.
CO3:	Explain the water-related issues and farmers participation in water management.
CO4:	Choose the appropriate water delivery system for the issues in water management.
CO5:	Apply the principles of watershed management for watershed development.
TEXT BOOKS:	
1.	Tideman, E.M., "Watershed Management", Omega Scientific Publishers, New Delhi, 2013.
2.	M.C. Chaturvedi, "Water Resources System Planning", Tata McGraw Hill Management, New Delhi, 2019.
REFERENCES:	
1.	Sivasubramaniyan, K., "Water Management", SIMRES Publication, Chennai, 2011.
2.	Uphoff.N.,"Improving International Irrigation management with Farmer Participation – Getting the process Right – Studies in water Policy and management", No.11, Westview press, 2006.
3.	Chambers Robert, "Managing Canal Irrigation", Cambridge University Press, 2009.
4.	Rodolfo S S, Weber E, "Integrated and Participatory Water Resources Management – Theory", Elsevier, 2007.
5.	Griffin, R.C., "Water Resource Economics", MITPress, 2006.

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

Table of Specification (ToS) for End Semester Question Paper

Unit No. and Title	Total 2 Marks Qns.	Total 16 Marks Qns.	Bloom's Taxonomy (Cognitive) Level					
			Remember (Re)	Understand (Un)	Apply (Ap)	Analyse (An)	Evaluate (Ev)	Create (Cr)
			No. of Qns. (marks) and CO					
Unit-I: Fundamentals	2	1 either or	2(2) –CO1	1 either or (16) – CO2	-	-	-	-
Unit-II: Understanding Farmers Participation	2	1 either or	2(2) – CO1	1 either or (16) — CO3	-	-	-	-
Unit-III: Issues in Water Management	2	1 either or	2(2) — CO1	-	1 either or (16) — CO4	-	-	-
Unit-IV: Participatory Water Conservation	2	1 either or	1(2) – CO1	1(2) — CO2 1 either or (16) — CO2	-	-	-	-
Unit-V: Participatory Watershed Development	2	1 either or	1(2) – CO1	1(2) — CO2	1 either or (16) — CO5	-	-	-
Total Qns. Participatory Water Resources Management	10	5 either or	8(2)	2(2) 3 either or (16)	2 either or (16)	-	-	-
Total Marks	20	80	16	52	32	-	-	-
Weightage	20%	80%	16%	52%	32%	-	-	-

Weightage for COs					
	CO1	**CO2**	**CO3**	**CO4**	**CO5**
Total Marks	16	34	18	16	16
Weightage	16%	34%	18%	16%	16%

CE22634	**OPEN CHANNEL FLOW**	**L**	**T**	**P**	**C**
		3	**0**	**0**	**3**

COURSE OBJECTIVES:

- To impart basic knowledge of the open channel through the uniform flow approach and to expose to the applications of the conservation laws.

UNIT I	**BASIC FLOW CONCEPTS**	**9**

Types of channels and flows - Basic equations - Velocity distribution and coefficients - Pressure distribution. Energy and momentum principles - Specific energy - Critical flow - Section factor for critical flow computation - First hydraulic exponent - Computation of critical flow - Specific force - Channel transitions.

UNIT II	**UNIFORM FLOW IN RIGID BOUNDARY CHANNELS**	**9**

Chezy's equation - Manning's equation - Section factor for uniform flow computation - Second hydraulic exponent - Computation of uniform flow - Most economical rectangular, trapezoidal and circular channels.

UNIT III	**DESIGN OF CHANNELS**	**9**

Rigid boundary channels - Non-scouring channels - Alluvial channels.		
UNIT IV	**GRADUALLY VARIED FLOW**	**9**
Differential equation of GVF - Classification and analysis of flow profiles - Computation of GVF.		
UNIT V	**HYDRAULIC JUMP**	**9**
Types of jumps - General equation for jump in prismatic channels - Jump in horizontal and slopping rectangular channels - Location of hydraulic jump- Rapidly varied flow: Flow over sharp crested weir, spillways, flow under sluice gate.		
		TOTAL: 45 PERIODS

COURSE OUTCOMES:

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

CO1:	State the basic flow properties of fluids in an open channel flow.
CO2:	Illustrate the concepts ofboundary layer flow and its applications.
CO3:	Explain types of flow in open channel, velocity and pressure distribution.
CO4:	Design hydraulically most efficient channel sections.
CO5:	Solve non-uniform flow problems, hydraulic jump phenomenon in open channel flows and gradually varied flow profiles in various types of slopes in channel.

TEXT BOOKS:

1.	Subramanya.K, "Flow in Open Channels", Tata McGraw Hill, New Delhi, 2000.
2.	Modi P.N and Seth.S.M, "Hydraulics and Fluid Mechanics including Hydraulic Machines", Standard Book House, New Delhi, 2009.

REFERENCES:

1.	Ven Te Chow, "Open Channel Hydraulics", McGraw Hill, New York, 2009.
2.	Hanif Chaudhry. M., "Open Channel Flow", Second Edition, Springer, 2007.
3.	Rajesh Srivastava, "Flow through Open Channels", Oxford University Press, New Delhi, 2008.
4.	Graebel. W.P, "Engineering Fluid Mechanics", Taylor & Francis, Indian Reprint, 2011.
5.	Streeter, V. L. and Wylie E. B., "Fluid Mechanics", McGraw Hill Publishing Co., 2010.

Course Outcomes	PO												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	1	2	1	1	2	2	1	1	1	1	2	1	3	2
CO2	1	2	1	1	1	2	2	1	1	1	1	-	1	1	-

CO3	3	1	1	2	1	2	-	1	1	-	1	2	1	1	-
CO4	2	3	3	2	1	3	2	1	1	1	1	3	-	-	-
CO5	3	3	2	1	1	3	2	1	1	1	1	3	1	1	2
CO	3	2	2	1	1	2	2	1	1	1	1	2	1	1	2

Table of Specification (ToS) for End Semester Question Paper

Unit No. and Title	Total 2 Marks Qns.	Total 16 Marks Qns.	Bloom's Taxonomy (Cognitive) Level					
			Remember (Re)	Understand (Un)	Apply (Ap)	Analyse (An)	Evaluate (Ev)	Create (Cr)
			No. of Qns. (marks) and CO					
Unit-I: Basic Flow Concepts	2	1 either or	1(2) –CO1	1(2) — CO3 1 either or (16) – CO3	-	-	-	-
Unit-II: Uniform Flow in Rigid Boundary Channels	2	1 either or	1(2) – CO1	1(2) – CO2 1 either or (16) – CO2	-	-	-	-
Unit-III: Design of Channels	2	1 either or	2(2) — CO1	-	1 either or (16) — CO4	-	-	-
Unit-IV: Gradually Varied Flow	2	1 either or	2(2) – CO1	-	1 either or (16) — CO5	-	-	-
Unit-V: Hydraulic Jump	2	1 either or	1(2) – CO1	1(2) — CO2	1 either or (16) — CO5	-	-	-
Total Qns. Open Channel Flow	10	5 either or	7(2)	3(2) 2 either or (16)	3 either or (16)	-	-	-
Total Marks	20	80	14	38	48	-	-	-
Weightage	20%	80%	16%	38%	48%	-	-	-

Weightage for COs					
	CO1	**CO2**	**CO3**	**CO4**	**CO5**
Total Marks	14	20	18	16	32
Weightage	14%	20%	18%	16%	32%

CE22735	**ADVANCED FLUID MECHANICS**	**L**	**T**	**P**	**C**
		3	**0**	**0**	**3**

COURSE 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, flow measurements.

UNIT I	**INTRODUCTION & BACKGROUND**	**9**

Continuum hypothesis -Fluid properties -Basic thermodynamic relations -Perfect gas -Scalars and vectors -Cartesian tensors - Gauss's theorem - Stokes theorem - Lagrangian and Eulerian description, material derivative and stream function.

UNIT II	**COMPRESSIBLE FLUID FLOW**	**9**

One dimensional compressible fluid flow – Flow through variable area passage – Nozzles and

diffusers – Fundamentals of supersonics – Normal and oblique shock waves and calculation of flow and fluid properties over solid bodies (like flat plate, wedge, diamond) using gas tables.		
UNIT III	**DYNAMICS OF IDEAL FLUID MOTION**	**9**
Applications - Integrations of Euler's Equation of Motion - Generalized form of Bernoulli Equation - Potential flows - Principle of Superposition.		
UNIT IV	**CONSERVATION LAWS AND DIMENSIONAL ANALYSIS**	**9**
Control volume concepts - Reynolds transport theorem -Conservation of mass, momentum and energy - Navier-Stokes equation -Non-dimensional parameters determined from differential equations - Buckingham's Pi theorem, similitude and model testing.		
UNIT V	**HIGH REYNOLDS NUMBER APPROXIMATION**	**9**
Prandtl's Boundary Layer Equations - Laminar Boundary Layer over a flat plat - Blausius solution - Falkner – Skan solution - Approximation method for solution of Boundary Layer Equation - Momentum Integral methods - Holstein and Bohlen method - Thermal Boundary Layer - Reynolds Analogy.		
		TOTAL: 45 PERIODS
COURSE OUTCOMES:		
At the end of the course, the students will be able to:		
CO1:	Define the concepts of fluid mechanics from both theoretical and applications perspective.	
CO2:	Understand the laws of fluid flow for ideal and viscous fluids.	
CO3:	Describefluid phenomenon and the performances of prototype by model studies.	
CO4:	Solve the fluid flow concepts, boundary layer concepts and changes in properties in compressible flow and potential flow.	
CO5:	Experiment with sufficient mathematical and physical background to formulate real life problems in fluid mechanics.	
TEXT BOOKS:		
1.	R.K.Bansal, "Fluid Mechanics and Hydraulic Machines", Laxmi publications, New Delhi 2018.	
2.	Er. R.K. Rajput, "Fluid Mechanics and Hydraulic Machines", S.Chand&Co., 2016.	
REFERENCES:		
1.	Subramanya. K, "1000 solved problems in Fluid Mechanics including Hydraulic Machines", Tata McGraw – HillEducation (India), 2009.	
2.	Modi P.N and Seth, "Hydraulics and Fluid Mechanics including Hydraulic Machines", Standard Book House, NewDelhi, 2017.	

3.	Jain A. K., "Fluid Mechanics including Hydraulic Machines", Khanna Publishers, 2008.
4.	Schlichting H. and Gersten K. "Boundary Layer Theory", 8th edition. Springer-Verlag 2016.
5.	William Graebel, "Advanced Fluid Mechanics", Academic Press, 2007.

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

Table of Specification (ToS) for End Semester Question Paper

Unit No. and Title	Total 2 Marks Qns.	Total 16 Marks Qns.	Bloom's Taxonomy (Cognitive) Level					
			Remember (Re)	Understand (Un)	Apply (Ap)	Analyse (An)	Evaluate (Ev)	Create (Cr)
			No. of Qns. (marks) and CO					
Unit-I: Introduction & Background	2	1 either or	2(2) –CO1	-	1 either or (16) – CO4	-	-	-
Unit-II: Compressible Fluid Flow	2	1 either or	2(2) – CO1	-	1 either or (16) — CO5	-	-	-
Unit-III: Dynamics Of Ideal Fluid Motion	2	1 either or	1(2) — CO1	1(2) — CO3 1 either or (16) — CO2	-	-	-	-
Unit-IV Conservation Laws And Dimensional Analysis	2	1 either or	1(2) - CO4	1(2) — CO4 1 either or (16) — CO3	-	-	-	-
Unit-V: High Reynolds Number Approximation	2	1 either or	1(2) – CO5	1(2) — CO2	1 either or (16) — CO5	-	-	-
Total Qns. Advanced Fluid Mechanics	10	5 either or	7(2)	3(2) 2 either or (16)	3 either or (16)	-	-	-
Total Marks	20	80	14	38	48	-	-	-
Weightage	20%	80%	14%	38%	48%	-	-	-

Weightage for COs					
	CO1	CO2	CO3	CO4	CO5
Total Marks	10	18	18	20	34
Weightage	10%	18%	18%	20%	34%

CE22736	COASTAL ZONE MANAGEMENT	L	T	P	C
		3	0	0	3

COURSE OBJECTIVE:

- To be able to interpretation and analysis the features and components of the natural, engineering and human aspects of the coast, the function of component and relationship between them.

UNIT I	COASTAL ZONE	9

Coastal zone – Coastal zone regulations – Beach profile – Surf zone – Off shore – Coastal waters – Estuaries – Wet lands and Lagoons – Living resources – Non-living resources.

UNIT II	WAVE DYNAMICS	9

Wave classification – Airy's Linear Wave theory – Deep water waves – Shallow water waves – Wave pressure – Wave energy – Wave Decay – Reflection, Refraction and Diffraction of waves – Breaking of waves – Wave force on structures.

UNIT III	WAVE FORECASTING AND TIDES	9

Need for forecasting - SMB and PNJ methods of wave forecasting – Classification of tides – Darwin's equilibrium theory of tides – Effects on structures - Surges and Tsunamis

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

COURSE OUTCOMES:

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

CO1:	Define the features and components of the natural, engineering and human aspects of the coast, the function of component and relationship between them.
CO2:	Explain about coastal regulations, its laws and policies.
CO3:	Illustrate wave dynamics, coastal processes and coastal regulations.
CO4:	Choose the appropriate method for wave forecasting.
CO5:	Apply appropriate approaches in coastal management for coastal issues.

TEXT BOOKS:

1.	V.Sundar, "Ocean Wave Mechanics: Applications in Marine Structures", Wiley, 2017.

2.	J.S. Mani, “Coastal Hydrodynamics”, PHI Learning pvt.Ltd., 2012.
REFERENCES:	
1.	US Army Corps of Engineers, “Coastal Engineering Manual, Vol. I-VI”, Coastal Engineering Research Centre,Department of the Army, Washington DC, 2006.
2.	Kamphuis, J.W., “Introduction to Coastal Engineering and Management”, 2020.
3.	Richard Sylvester, “Coastal Engineering, Volume I and II”, Elseiner Scientific Publishing Co., 2009.
4.	NCSCM straigies and Guidelines for National Implementation of Integrated Coastal Zone Management, 2013.
5.	Dwivedi, S.N., Natarajan, R And Ramachandran, S., “Coastal Zone Management In Tamil Nadu”, Madras, 2011.

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

Table of Specification (ToS) for End Semester Question Paper

Unit No. and Title	Total 2 Marks Qns.	Total 16 Marks Qns.	Bloom’s Taxonomy (Cognitive) Level					
			Remember (Re)	Understand (Un)	Apply (Ap)	Analyse (An)	Evaluate (Ev)	Create (Cr)
			No. of Qns. (marks) and CO					
Unit-I: Coastal Zone	2	1 either or	2(2) –CO1	1 either or (16) – CO2	-	-	-	-
Unit-II: Wave Dynamics	2	1 either or	2(2) – CO1	1 either or (16) – CO3	-	-	-	-
Unit-III: Wave Forecasting And Tides	2	1 either or	1(2) — CO1	1(2) — CO3	1 either or (16) — CO4	-	-	-
Unit-IV: Coastal Processes	2	1 either or	1(2) – CO1	1(2) — CO3	1 either or (16) — CO5	-	-	-
Unit-V: Coastal Regulations	2	1 either or	1(2) – CO1	1(2) — CO2 1 either or (16) — CO3	-	-	-	-
Total Qns. Coastal Zone Management	10	5 either or	7(2)	3(2) 3 either or (16)	2 either or (16)	-	-	-
Total Marks	20	80	14	54	32	-	-	-
Weightage	20%	80%	14%	54%	32%	-	-	-
Weightage for COs								

	CO1	CO2	CO3	CO4	CO5
Total Marks	14	18	36	16	16
Weightage	14%	18%	36%	16%	16%

Vertical 4: Structural Engineering

CE22541	DESIGN OF PRESTRESSED CONCRETE STRUCTURES	L	T	P	C
		3	0	0	4

COURSE OBJECTIVE:

- To introduce the need for prestressing as well as the methods, types and advantages of prestressing to the students.

UNIT I	INTRODUCTION – THEORY AND BEHAVIOUR	9

Basic concepts – Advantages – Materials required – Systems and methods of prestressing – Analysis of sections – Stress concept – Strength concept – Load balancing concept – Effect of loading on the tensile stresses in tendons – Effect of tendon profile on deflections – Factors influencing deflections – Calculation of deflections – Short term and long term deflections – Losses of prestress – Estimation of crack width.

UNIT II	DESIGN FOR FLEXURE AND SHEAR	9

Basic assumptions for calculating flexural stresses – Permissible stresses in steel and concrete asper 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'smethod and IS1343 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 – Methods of achieving continuity in continuous beams – Analysis for secondary moments – Concordant cable and linear transformation – Calculation of stresses – Principles of design.

UNIT V	MISCELLANEOUS STRUCTURES	9

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

TOTAL: 45 PERIODS

COURSE OUTCOMES:

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

CO1:	Define the principle, types and systems of prestressing and its design.
CO2:	Compare the flexural, shear and deflection of prestressed concrete structure.
CO3:	Analyze the statically indeterminate structures and design the continuous beam.
CO4:	Design of prestressed concrete structures.
CO5:	Develop the prestressed members in real time.
TEXT BOOKS:	
1.	Krishna Raju N., "Prestressed Concrete", 5th Edition, Tata McGraw Hill Company, NewDelhi, 2012.
2.	Pandit.G.S. and Gupta.S.P., "Prestressed Concrete", CBS Publishers and Distributers Pvt. Ltd., 2012.
REFERENCES:	
1.	Rajagopalan.N, "Prestressed Concrete", Narosa Publishing House, 2002.
2.	Dayaratnam.P., "Prestressed Concrete Structures", Oxford and IBH, 2013.
3.	Lin T.Y. and Ned.H.Burns, "Design of Prestressed Concrete Structures", Third Edition, Wiley India Pvt. Ltd., New Delhi, 2013.
4.	IS1343:1980, Code of Practice for Prestressed Concrete, Bureau of Indian Standards, New Delhi, 2012.
5.	Dr.Praveen Nagarajan, "Prestressed Concrete Design", Pearson Education India, 2013.

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

Table of Specification (ToS) for End Semester Question Paper

Unit No. and Title	**Total 2 MarksQns.**	**Total 16 MarksQns.**	**Bloom's Taxonomy (Cognitive) Level**					
			Remember (Re)	**Understand (Un)**	**Apply (Ap)**	**Analyse (An)**	**Evaluate (Ev)**	**Create (Cr)**
			No. of Qns. (marks) and CO					
Unit-I: Introduction – Theory and Behaviour	2	1 either or	2(2) –CO1	1 either or (16) – CO4		-	-	-

Unit-II: Design for Flexure and Shear	2	1 either or	2(2) – CO1	1 either or (16) — CO5	-	-	-	-
Unit-III: Deflection and Design of Anchorage Zone	2	1 either or	1(2) — CO1	1(2) — CO3	1 either or (16) — CO2	-	-	-
Unit-IV: Composite Beams and Continuous Beams	2	1 either or	1(2) – CO4	1(2) — CO4	1 either or (16) — CO3	-	-	-
Unit-V: Miscellaneous Structures	2	1 either or	1(2) – CO5	1(2) — CO2	1 either or (16) — CO5	-	-	-
Total Qns. Design of Prestressed Concrete Structures	10	5 either or	7(2)	3(2) 2 either or (16)	3 either or (16)	-	-	-
Total Marks	20	80	14	38	48	-	-	-
Weightage	20%	80%	14%	38%	48%	-	-	-

Weightage for COs

	CO1	**CO2**	**CO3**	**CO4**	**CO5**
Total Marks	10	18	18	20	34
Weightage	10%	18%	18%	20%	34%

CE22542	**STRUCTURAL DYNAMICS AND EARTHQUAKE ENGINEERING**	**L**	**T**	**P**	**C**
		3	**0**	**0**	**3**

COURSE OBJECTIVES:

- To understand the behaviour of structures under dynamic earthquake loading.
- To make the students understand the basics of earthquake engineering.
- To be aware of earthquake effects on various kinds of structures.
- To design the structures as earthquake resistant as per codal provisions.

UNIT I	**INTRODUCTION TO DYNAMICS AND SDOF**	**9**

Mathematical models of single degree of freedom systems – Free and forced vibration of SDOF systems, Response of SDOF to special forms of excitation, Effect of damping, Evaluation of damping, Transmissibility, vibration control, Tuned mass damper.

UNIT II	**DYNAMIC RESPONSE OF MULTI-DEGREE OF FREEDOM SYSTEMS**	**9**

Mathematical models of two-degree of freedom systems and multi-degree of freedom systems, free and forced vibrations of two-degree and multi-degree of freedom systems -Normal modes of vibration –Applications - Orthogonality of normal modes, free and forced vibrations of multi-degree of freedom systems - Mode superposition technique - Applications.

UNIT III	**ENGINEERING SEISMOLOGY**	**9**

Elements of Engineering Seismology – Seismic hazard – Earthquake phenomenon – Seismic Plate Tectonic theory – Seismic Instrumentation – Characteristics of Strong Earthquake motion – Estimation of Earthquake Parameters – Seismic Magnitude and Intensity, Soil Structure Interaction – Liquefaction of soil – Seismic zone map – Response spectra - Design spectra – Codal provision – Different methods of earthquake analysis – Analysis of structure by

Equivalent static method – Analysis of structure by Response spectrum method – Introduction to time-history method of analysis.		
UNIT IV	**EARTHQUAKE EFFECTS ON STRUCTURES**	**9**
Inertia force on structures – Load transfer path – Effect of architectural features on behavior of structures – Hysteretic Behaviour of RCC, steel and prestressed concrete – Pinching Effect – Bouchinger Effects – Energy dissipation – P-delta effect – Storey drift – Behavior of brick masonry, stone masonry and reinforced concrete structures under past earthquakes – Typical failures – Causes of damage – Lessons learnt from past earthquakes.		
UNIT V	**EARTHQUAKE RESISTANT DESIGN**	**9**
Philosophy of earthquake resistant design – Planning considerations and architectural concepts – Design and detailing as per codal provisions – Design and detailing of typical flexural member and column member - Ductile detailing of beam-column joints and footing – Concept and principle of shear wall – Introduction to performance based seismic design – Seismic isolation principles and methods.		
		TOTAL: 45 PERIODS

COURSE OUTCOMES:	
At the end of the course, the students will be able to:	
CO1:	Develop the equations of motion for SDOF and MDOF system and to evaluate the natural frequencies and mode shapes.
CO2:	Explain the elements of engineering seismology, characteristics of earthquake and seismic instrumentation.
CO3:	Explain theearthquakeeffects on various types of structures.
CO4:	Determine the lateral loads in a structure due to earthquake by adopting suitable method.
CO5:	Design various types of structures as earthquake resistantas per codal provisions.
TEXT BOOKS:	
1.	Anil K Chopra, "Dynamics of structures – Theory and applications to Earthquake Engineering", Prentice Hall Inc., 2007.
2.	Agarwal.P and Shrikhande.M.,"Earthquake Resistant Design of Structures", Prentice Hall of India Pvt. Ltd., 2011.
REFERENCES:	
1.	J Humar, "Dynamics of Structures", Second Edition, Canada publication, 2002.
2.	Minoru Wakabayashi, "Design of Earthquake Resistant Buildings", McGraw Hill Book Company, 2015.
3.	Moorthy. C.V.R., "Earthquake Tips", NICEE, IIT Kanpur, 2002.
4.	Mario Paz, "Structural Dynamics – Theory and Computations", Fifth Edition, 2nd printing, CBS publishers, 2006.
5.	**Publication of Bureau of Indian Standards:** a. IS 4326: 2013 Earthquake Resistant Design And Construction Of Buildings – Code of Practice

	b. IS 1893: 2016 Criteria For Earthquake Resistant Design Of Structures – Part 1 General Provisions and Buildings. c. IS 13920:2016 Ductile Design And Detailing Of Reinforced Concrete Structures Subjected to Seismic Forces – Code of Practice.

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

Table of Specification (ToS) for End Semester Question Paper

Unit No. and Title	Total 2 Marks Qns.	Total 16 Marks Qns.	Bloom's Taxonomy (Cognitive) Level					
			Remember (Re)	Understand (Un)	Apply (Ap)	Analyse (An)	Evaluate (Ev)	Create (Cr)
			No. of Qns. (marks) and CO					
Unit I: Introduction to Dynamics and SDOF	2	1 either or	2(2) – CO1	-	1 either or (16) – CO1	-	-	-
Unit II: Dynamic Response of Multi-Degree of Freedom Systems	2	1 either or	2(2) – CO1	-	1 either or (16) — CO1	-	-	-
Unit III: Engineering Seismology	2	1 either or	1(2) – CO2	1(2) – CO4 1 either or (16) — CO2	-	-	-	-
Unit IV: Earthquake Effects on Structures	2	1 either or	2(2) – CO3	1 either or (16) — CO4	-	-	-	-
Unit V: Earthquake Resistant Design	2	1 either or	2(2) – CO5	1 either or (16) — CO5	-	-	-	-
Total Qns. Structural Dynamic and Earthquake Engineering	10	5 either or	9(2)	3 either or (16)	2 either or (16)	-	-	-
Total Marks	20	80	18	50	32	-	-	-
Weightage	20%	80%	20 %	52%	16 %	-	-	-

Weightage for COs					
	CO1	CO2	CO3	CO4	CO5
Total Marks	40	18	4	18	20
Weightage	40%	18%	4%	18%	20%

CE22643	BASICS OF FINITE ELEMENT ANALYSIS	L	T	P	C
		3	0	0	3
COURSE OBJECTIVES:					

- To understand the fundamental concepts of Finite Element Analysis (FEA).
- To master the Matrix Methods in Structural Analysis.
- To explore element properties in FEA.
- To analyze frame structures Using FEA.
- To apply FEA techniques to two and three-dimensional solids.

UNIT I	**INTRODUCTION TO FINITE ELEMENT ANALYSIS**	**9**

Introduction – Basic Concepts of Finite Element Analysis - Importance of Finite Element Analysis - Advantages and Disadvantages of Finite Element Analysis- Introduction to Elasticity - Steps in Finite Element Analysis – Finite Element Formulation Techniques - Virtual Work and Variational Principle - Galerkin Method.

UNIT II	**ONE DIMENSIONAL ELEMENTS**	**9**

One Dimensional Second Order Equations — Discretization — Element types- Linear and Higher order Elements — Derivation of Shape functions and Stiffness matrices and force vectors, stiffness and flexibility matrices - Element and global stiffness matrices – Analysis of one dimensional bar elements, continuous beams — Transformations of stiffness matrices.

UNIT III	**ANALYSIS OF FRAMED STRUCTURES**	**9**

Stiffness of Truss Members - Analysis of Truss - Finite Element Analysis of rigidly jointed plane frame - Analysis of Grid and Space Frame.

UNIT IV	**ELEMENT PROPERTIES AND NUMERICAL INTEGRATION**	**9**

Natural Coordinates - Triangular Elements - Rectangular Elements - Lagrange and Serendipity Elements - Solid Elements - Iso-parametric Formulation - Stiffness Matrix of Isoparametric Elements - Numerical Integration: One Dimensional, Two and Three Dimensional.

UNIT V	**TWO AND THREE DIMENSIONAL SOLIDS**	**9**

Constant Strain Triangle - Linear Strain Triangle - Rectangular Elements - Numerical Evaluation of Element Stiffness - Computation of Stresses - Geometric Nonlinearity and Static, Condensation, Axisymmetric Element - Finite Element Formulation of Axisymmetric Element - Finite Element Formulation for 3 Dimensional Elements.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

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

CO1:	Define and explain the basic concepts of FEA, including virtual work, variational principles, and the Galerkin method.
CO2:	Describe matrix methods to analyze determinate and indeterminate structures such as continuous beams and pin-jointed frames.
CO3:	Demonstrate knowledge of element properties, including natural coordinates of various types of elements, Iso-parametric formulation, and numerical integration techniques.

CO4:	Apply FEA to analyze frame structures such as beam member, plane frames, grids, and space frames.
CO5:	Utilize FEA for the analysis of two and three-dimensional solids, including the consideration of geometric nonlinearity, and the analysis of axi-symmetric elements.
TEXT BOOKS:	
1.	Singaresu S Rao, "Finite Element Analysis in Engineering", US Publication, 2017
2.	C.S.Krishnamoorty, "Finite ElementAnalysis", Tata McGraw-Hill, 2017.
REFERENCES:	
1.	Tirupathi R. Chandrupatla, Ashok D. Belegundu, "Introduction to Finite Elements in Engineering", Pearson Publication, 2021.
2.	David V. Hutton, "Fundamentals of Finite ElementAnalysis", McGraw Hill, 2017.
3.	D. Maity, "Computer Analysis of Framed Structures", I.K. International Pvt. Ltd., New Delhi, 2009.
4.	Erik G. Thompson, "Introduction to the Finite Element Method: Theory, Programming and Applications", John Wiley, 2004.
5.	H. C. Martin and G. F. Carey, "Introduction to Finite ElementAnalysis– Theory andApplication", New York, McGraw Hill, 2015.

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

Table of Specification (ToS) for End Semester Question Paper

Unit No. and Title	**Total 2 Marks Qns.**	**Total 16 Marks Qns.**	**Bloom's Taxonomy (Cognitive) Level**					
			Remember (Re)	**Understand (Un)**	**Apply (Ap)**	**Analyse (An)**	**Evaluate (Ev)**	**Create (Cr)**
			No. of Qns. (marks) and CO					
Unit-I: Introduction to Finite Element Analysis	2	1 either or	2(2) – CO1	1 either or (16) – CO1		-	-	-
Unit-II:One Dimensional Elements	2	1 either or	2(2) – CO2	1 either or (16) — CO2		-	-	-
Unit-III: Analysis of Frame Structures	2	1 either or	2(2) - CO3	1 either or (16) — CO3		-	-	-
Unit-IV: Element Properties and Numerical	2	1 either or	2(2) - CO4		1 either or (16) — CO4	-	-	-

Integration								
Unit-V : Two and Three Dimensional Solids	2	1 either or	2(2) – CO5			1 either or (16) — CO5	-	-
Total Qns. Basics of Finite Element Analysis	10	5 either or	10 (2)	3 either or (16)	1 either or (16)	1 either or (16)	-	-
Total Marks	20	80	20	48	16	16	-	-
Weightage	20%	80%	20 %	52%	16 %	16 %	-	-

Weightage for COs					
	CO1	**CO2**	**CO3**	**CO4**	**CO5**
Total Marks	20	20	20	20	20
Weightage	20%	20%	20%	20%	20%

CE22644	**MODERN METHODS OF STRUCTURAL ANALYSIS**	**L**	**T**	**P**	**C**
		3	**0**	**0**	**3**

COURSE OBJECTIVE:

- To introduce the students to advanced methods of Structural Analysis.

UNIT I	**FLEXIBILITY METHOD**	**9**

Equilibrium and compatibility – Determinate vs Indeterminate structures – Indeterminacy – Primary structure – Compatibility conditions – Analysis of indeterminate pin-jointed plane frames, continuous beams, rigid jointed plane frames (with redundancy restricted to two).

UNIT II	**STIFFNESS MATRIX METHOD**	**9**

Element and global stiffness matrices – Analysis of continuous beams – Co-ordinate transformations – Rotation matrix – Transformations of stiffness matrices, load vectors and displacements vectors – Analysis of pin-jointed plane frames and rigid frames (with redundancylimited to two).

UNIT III	**PLASTIC ANALYSIS OF STRUCTURES**	**9**

Statically indeterminate axial problems – Beams in pure bending – Plastic moment of resistance – Plastic modulus – Shape factor – Load factor – Plastic hinge and mechanism – Upper and lower bound theorems – Plastic analysis of indeterminate beams and frames.

UNIT IV	**SPACE STRUCTURES**	**9**

Introduction – 3D structures - Method of tension coefficient - Analysis of Space trusses and Space frames.

UNIT V	**INTRODUCTION TO MATLAB**	**9**

Introduction – Creating variables – Input and output - Vectors, Arrays – Matrices, Mathematical Operations with Arrays, Script Files and Managing Data, Plots – Simple programming in matrixformation - Introduction to MATLAB toolboxes for Structural Analysis.

TOTAL: 45 PERIODS

COURSE OUTCOMES:	
At the end of the course, the students will be able to:	
CO1:	Recall the methods of analysing 2D and 3D structures and its basic terms.
CO2:	Describe plastic analysis, flexibility, stiffness methods of analysis.
CO3:	Apply MATLAB in analysis of structural elements.
CO4:	Solve beams, trusses, frames and space structures using alternate methods.
CO5:	Generate stiffness and flexible matrices for structural elements.
TEXT BOOKS:	
1.	Vaidyanadhan, R and Perumal, P, "Comprehensive Structural Analysis – Vol. 1 & Vol. 2", Laxmi Publications Pvt. Ltd, New Delhi, 2019.
2.	Punmia.B.C, Ashok Kumar Jain and Arun Kumar Jain, "Theory of structures", LaxmiPublicationsPvt. Ltd., New Delhi, 2019.
REFERENCES:	
1.	Bhavai Katti, S.S, "Structural Analysis – Vol. 1 & Vol. 2", Vikas Publishing Pvt. Ltd., NewDelhi, 2013.
2.	Pandit G.S. & Gupta S.P., "Structural Analysis – A Matrix Approach", Tata McGraw Hill 2008.
3.	Ghali.A., Nebille and Brown. T.G., "Structural Analysis - A unified classical and matrix approach", Sixth Edition, SPON press, New York, 2013.
4.	Wang C.K., "Indeterminate Structural Analysis", Tata McGraw Hill Education Pvt. Ltd., New Delhi, 2010.
5.	John Wiley & Sons, "MATLAB® An Introduction with Applications", Fourth Edition, 2011.

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

Table of Specification (ToS) for End Semester Question Paper

Unit No. and Title	Total 2 MarksQns.	Total 16 MarksQns.	Bloom's Taxonomy (Cognitive) Level					
			Remember (Re)	Understand (Un)	Apply (Ap)	Analyse (An)	Evaluate (Ev)	Create (Cr)
			No. of Qns. (marks) and CO					

Unit-I: Flexibility Method	2	1 either or	1(2) –CO1	1(2) — CO2	1 either or (16) – CO5	-	-	-
Unit-II: Stiffness Matrix Method	2	1 either or	1(2) – CO1	1(2) – CO2	1 either or (16) — CO5	-	-	-
Unit-IV: Plastic Analysis of Structures	2	1 either or	2(2) — CO1	-	1 either or (16) — CO3	-	-	-
Unit-IV: Space Structures	2	1 either or	2(2) – CO1	-	1 either or (16) — CO3	-	-	-
Unit-V: Introduction to MATLAB	2	1 either or	1(2) – CO1	1(2) — CO2 1 either or (16) — CO4	-	-	-	-
Total Qns. Modern Methods of Structural Analysis	10	5 either or	7(2)	3(2) 1 either or (16)	4 either or (16)	-	-	-
Total Marks	20	80	14	22	64	-	-	-
Weightage	20%	80%	14%	22%	48%	-	-	-

Weightage for COs

	CO1	**CO2**	**CO3**	**CO4**	**CO5**
Total Marks	14	6	32	16	32
Weightage	14%	6%	32%	16%	32%

CE22745	**BRIDGE ENGINEERING**	**L**	**T**	**P**	**C**
		3	**0**	**0**	**3**

COURSE OBJECTIVE:

- To make the student to know about various bridge structures, selection of appropriatebridge structures and its design for given site conditions.

UNIT I	**INTRODUCTION**	**9**

History of bridges - Components of a bridge - Classification of road bridges - Selection of site and initial decision process - River Bridge: Collection of bridge design data – Hydrological calculation Road Bridges - IRC codes - Standard Loading for Bridge Design - Load combinations for different working state and limit state designs- Loadings for Railway Bridges.

UNIT II	**SUPERSTRUCTURES**	**9**

Bridge decks – Structural forms and behaviour – Choices of superstructure types – Behaviour and modeling of bridge decks – Simple beam model – Plate model – Grillage method – Finite Element method - Different types of superstructure (RCC and PSC) - Longitudinal Analysis of Bridge- Transverse Analysis of Bridge - Temperature Analysis - Distortional Analysis - Effects of Differential settlement of supports - Reinforced earth structures.

UNIT III	**DESIGN OF STEEL BRIDGES**	**9**

Design of Truss Bridges – Design of Plate girder bridges.

UNIT IV	**DESIGN OF RC AND PSC BRIDGES**	**9**

Design of slab bridges – T beam bridges – PSC bridges.

UNIT V	SUBSTRUCTURE, BEARINGS AND EXPANSION JOINTS, PARAPETS AND RAILINGS	9
Substructure –Pier, Abutment - Wing walls- Importance of Soil-Structure Interaction - Types of foundations - Open foundation- Pile foundation- Well foundation- Simply supported bridge- Continuous Bridge - Bearings and Expansion Joints - Different types of bridge bearings and expansion joints - Parapets and Railings for Highway Bridges.		
TOTAL: 45 PERIODS		

COURSE OUTCOMES:	
At the end of the course, the students will be able to:	
CO1:	Explain the types of bridges, its components, loads acting and distribution.
CO2:	Develop the super structure by various methods.
CO3:	Design the trussed bridge and plate girder bridges.
CO4:	Design reinforced concrete slab, T beam bridges and prestressed concrete bridges.
CO5:	Experiment with the appropriate sub structural systems, bearings and expansion joints for the structure.

TEXT BOOKS:	
1.	Johnson Victor D., “Essentials of Bridge Engineering”, Oxford and IBH Publishing Co., NewDelhi, 2009.
2.	Jagadeesh. T.R. and Jayaram. M.A., "Design of Bridge Structures", Prentice Hall of India Pvt. Ltd, 2013.

REFERENCES:	
1.	Phatak D.R., “Bridge Engineering”, SatyaPrakashan, New Delhi, 2016.
2.	Ponnuswamy S., “Bridge Engineering”, Tata McGraw-Hill, New Delhi, 2008.
3.	Rajagopalan. N. “Bridge Superstructure”, Alpha Science International, 2006.
4.	M.A.Jayaram, T.R. Jagadeesh, “Design of Bridge Structures”, 2nd Edition, 2021.
5.	V.K.Raina, "Concrete Bridge Practice: Construction, Maintenance and Rehabilitation", Tata McGraw – Hill, 2003.

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

CO	2	2	2	2	2	2	2	2	2	2	2	3	1	-	2

Tableof Specification (ToS) forEndSemesterQuestion Paper

Unit No. and Title	Total 2 Marks Qns.	Total 16 Marks Qns.	Bloom's Taxonomy (Cognitive) Level					
			Remember (Re)	Understand (Un)	Apply (Ap)	Analyse (An)	Evaluate(Ev)	Create (Cr)
			No. of Qns. (marks) and CO					
Unit-I: Introduction	2	1 either or	2(2) –CO1	1 either or (16) – CO1		-	-	-
Unit-II: Superstructures	2	1 either or	2(2) – CO2	-	1 either or (16) — CO2	-	-	-
Unit-III: Design of Steel Bridges	2	1 either or	1(2) — CO3	1(2) — CO3	1 either or (16) — CO3	-	-	-
Unit-IV: Design of RC and PSC Bridges	2	1 either or	1(2) - CO4	1(2) — CO4	1 either or (16) — CO4	-	-	-
Unit-V: Substructure, Bearings and Expansion Joints, Parapets and Railings	2	1 either or	1(2) – CO5	1(2) — CO5	1 either or (16) — CO5	-	-	-
Total Qns. Bridge Engineering	10	5 either or	7(2)	3(2) 2 either or (16)	4 either or (16)	-	-	-
Total Marks	20	80	14	22	64	-	-	-
Weightage	20%	80%	14%	22%	64%	-	-	-

Weightage for COs					
	CO1	**CO2**	**CO3**	**CO4**	**CO5**
Total Marks	20	20	20	20	20
Weightage	20%	20%	20%	20%	20%

CE22746	**GEOTECHNICAL ENGINEERING**	**L**	**T**	**P**	**C**
		3	**0**	**0**	**3**

COURSE OBJECTIVE:

- To introduce the students about advance topics in soil mechanics and its application.

UNIT I	**EARTH PRESSURE**	**9**

Earth pressure – Rankine, Columb and Graphical Methods - Retaining walls structures - Gravity cantilever and counter fort retaining walls: Stability checks and design.

UNIT II	**SOIL ANCHORS**	**9**

Soil Anchors: Inclusions and Installation Techniques - Design of Soil Anchors - Application Criteria: Advantages and Limitations.

UNIT III	**SUBSTRUCTURE**	**9**

Proportioning of footing, Inclined and Eccentric loads - Settlement of footings on stratified

deposits - Influence of adjacent footings - Foundations on Problematic soils: Problems and Remedies.		
UNIT IV	**EARTH RETAINING STRUCTURE**	**9**
Retaining wall - Types, material, method of construction, nature of forces acting - Comparison of different earth pressure theories and application in retaining wall - Stability analysis and design aspects -Application of theory of elasticity in analysis of earth pressure distribution.		
UNIT V	**FEM IN GEOTECHNICAL ENGINEERING**	**9**
Finite element: Potential Energy, shape function, linear, triangular and rectangular element - Fundamentals for one-dimensional, two dimensional structure -Isoparametric formulation - Simple two dimensional problems related to Geotechnical Engineering.		
		TOTAL: 45 PERIODS

COURSE OUTCOMES:

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

CO1:	Understand the concepts of earth pressure and proper designing of retaining wall.
CO2:	Apply the design concepts in substructures.
CO3:	Make use of the fundamentals of finite element analysis the software in analyzing soil.
CO4:	Develop the concepts of soil mechanics in structural engineering.
CO5:	Utilize the knowledge in geotechnical engineering in building construction.

TEXT BOOKS:

1.	J.L.Sherard, R.J.Woodward, S.F.Gizienski, and W.A. Clevenger, "Earth and Earth – Rock Dams Engineering Problems of Design and Construction", John Wiley and Sons, New York, 2003.
2.	Lakshmi N. Reddy, Hilary. I. Inyang, "Geo-Environmental Engineering – Principles and Applications", Makcel Dekker Ink, 2000.

REFERENCES:

1.	David M Potts. And Lidija, Zdravkovic, "Finite Element Analysis in Geotechnical Engineering", Vol 1 & 2, Thomas Telford, London, 2001.
2.	O. C. Zienkiewicz, R. L. Taylor & J. Z. Zhu,"Finite Element Method", 7th Edition, Elsevier India, 2014
3.	J.E. Bowles, "Physical and Geotechnical Properties of Soils", 2nd Edition, McGraw Hill, New York, 2014.
4.	C. Venkatramaiah, "Geotechnical Engineering", New age International Publishers, 2006.
5.	V.N.S. Murthy, "Geotechnical Engineering: Principles and Practices of Soil Mechanics and Foundation Engineering", Marcel Dekker, 2010.

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

Tableof Specification (ToS) for End Semester Question Paper

Unit No. and Title	Total 2 Marks Qns.	Total 16 Marks Qns.	Bloom's Taxonomy (Cognitive) Level					
			Remember (Re)	Understand (Un)	Apply (Ap)	Analyse (An)	Evaluate (Ev)	Create (Cr)
			No. of Qns. (marks) and CO					
Unit-I: Earth Pressure	2	1 either or	2(2) –CO1	1 either or (16) – CO1		-	-	-
Unit-II: Soil Anchors	2	1 either or	2(2) – CO2	-	1 either or (16) — CO2	-	-	-
Unit-III: Substructure	2	1 either or	1(2) — CO3	1(2) — CO3	1 either or (16) — CO3	-	-	-
Unit-IV: Earth Retaining Structure	2	1 either or	1(2) - CO4	1(2) — CO4	1 either or (16) — CO4	-	-	-
Unit-V FEM in Geotechnical Engineering	2	1 either or	1(2) – CO5	1(2) — CO5	1 either or (16) — CO5	-	-	-
Total Qns. Geotechnical Engineering	10	5 either or	7(2)	3(2) 2 either or (16)	4 either or (16)	-	-	-
Total Marks	20	80	14	22	64	-	-	-
Weightage	20%	80%	14%	22%	64%	-	-	-

Weightage for COs					
	CO1	CO2	CO3	CO4	CO5
Total Marks	20	20	20	20	20
Weightage	20%	20%	20%	20%	20%

Vertical 5: Diversified Courses

CE22551	REMOTE SENSING AND GIS	L	T	P	C
		3	0	0	3

COURSE OBJECTIVE:

- To impart knowledge on remote sensing technology and its application in various fields and Civil Engineering projects.

UNIT I	INTRODUCTION	9
Definition- Principle of Remote Sensing- History of Development of Remote Sensing- Stages in Remote Sensing- Electromagnetic Radiation and the Electromagnetic Spectrum- Interactions with the Atmosphere- Atmospheric Scattering- Atmospheric Absorption- Atmospheric Windows – Refraction- Interaction of EMR with the Earth's Surface- Reflection- Transmission- Spectral Signature.		
UNIT II	**PLATFORMS & SENSORS**	**9**
Remote Sensing Systems- Remote Sensing from Space- Remote Sensing Sensors – Resolution- Imaging Sensors - Optical Infrared (OIR) Imagers- Optical Sensors- Thermal Sensors- Microwave Sensors- Active Microwave Sensors - Data Preprocessing- Remote Sensing in India.		
UNIT III	**INTRODUCTION TO IMAGE INTERPRETATION**	**9**
Basic Principles of Image Interpretation- Elements of Image Interpretation- Techniques of Image Interpretation- Interpretation Keys- Introduction to Digital Image Processing- Digital Image- Image Rectification and Registration- Geometric Correction- Image Enhancement Techniques (Only Concepts) - Image Classification - Unsupervised Classification and Supervised Classification- Digital Photogrammetry - Stereo Images from Satellites - Data Merging.		
UNIT IV	**GEOGRAPHIC INFORMATION SYSTEMS (GIS)**	**9**
Definitions and related Technology- GIS Operations- GIS Elements- GIS Concepts and Practice- Map Projection and Coordinate System - Vector Data Model – Introduction- Vector Data Representation- Geometric Objects- Topology.		
UNIT V	**GIS MODELS AND MODELING**	**9**
Introduction- GIS Modeling- Binary Models- Index Models - Remote Sensing and GIS Application in Civil Engineering – Some Case Studies from Literature.		
		TOTAL: 45 PERIODS
COURSE OUTCOMES:		
At the end of the course, the students will be able to:		
CO1:	Recall remote sensing, its components and application in Civil Engineering.	
CO2:	Outline the principles, classification and advancements in remote sensing.	
CO3:	Illustrate a remote sensing tool and create models.	
CO4:	Apply GIS in Civil Engineering projects.	
CO5:	Make use of remote sensing by adapting in new projects.	
TEXT BOOKS:		
1.	Jensen, J.R, "Remote Sensing of the Environment: An Earth Resource Perspective", Prentice Hall, 2000.	
2.	Sabbins, F.F., "Remote Sensing Principles and interpretation", W.H.Freeman and company, 2000.	

REFERENCES:	
1.	X. Zhu, "GIS for Environmental Applications: A practical approach", Routledge, 2016.
2.	B. Tian, "GIS Technology Applications in Environmental and Earth Sciences", CRC Press, 2016.
3.	T.M. Lillesand and R.W. Kiefer, "Remote Sensing and Image Interpretation",John Wiley, 2011.
4.	Kali CharanSahu, "Textbook of Remote Sensing and Geographical Information Systems", Atlantic Publishers, 2007.
5.	G.S. Srivastava, "An Introduction to Geoinformatics", McGraw Hill Education, 2014.

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

Table of Specification (ToS) for End Semester Question Paper

Unit No. and Title	Total 2 Marks Qns.	Total 16 Marks Qns.	Bloom's Taxonomy (Cognitive) Level					
			Remember (Re)	Understand (Un)	Apply (Ap)	Analyse (An)	Evaluate (Ev)	Create (Cr)
			No. of Qns. (marks) and CO					
Unit I: Introduction	2	1 either or	2(2) –CO1	1 either or (16) – CO2		-	-	-
Unit-II: Platforms & Sensors	2	1 either or	2(2) – CO1	1 either or (16) — CO3		-	-	-
Unit-III: Introduction to Image Interpretation	2	1 either or	1(2) — CO1	1(2) — CO3	1 either or (16) — CO4	-	-	-
Unit-IV: Geographic Information Systems(GIS)	2	1 either or	1(2) - CO4	1(2) — CO4	1 either or (16) — CO5	-	-	-
Unit-V: GIS Models and Modeling	2	1 either or	1(2) – CO5	1(2) — CO2	1 either or (16) — CO5	-	-	-
Total Qns. Remote Sensing and GIS	10	5 either or	7(2)	3(2) 2 either or (16)	3 either or (16)	-	-	-
Total Marks	20	80	14	38	48	-	-	-
Weightage	20%	80%	14%	38%	48%	-	-	-
Weightage for COs								

	CO1	CO2	CO3	CO4	CO5
Total Marks	10	18	18	20	34
Weightage	10%	18%	18%	20%	34%

CE22552	ADVANCED SURVEYING	L	T	P	C
		3	0	0	3

COURSE OBJECTIVE:

- To impart knowledge on advanced surveying techniques and the equipment assisting in the process.

UNIT I	MODERN SURVEYING EQUIPMENT	9

Total stations- Importance, measurement of horizontal angles, vertical angles, horizontal distance, slope distance, height of object- Remote elevation measurement (REM) - remote distance measurement (RDM)- Radial and continuous distances for measuring the lengths and sides of the closed circuits -Areas and perimeters calculations.

UNIT II	GLOBAL POSITIONING SYSTEM	9

Principles of GPS - Components of GPS -Types of GPS and accuracy -Applications of GPS - Sources of error and limitations- DGPS.

UNIT III	GEODETIC SURVEYING	9

Definition, importance -Triangulation system -Order of triangulation, size and shape of triangulation - Strength of figure criterion -Triangulation fieldwork -Base line measurement- Tape corrections -Problems in baseline measurement -Measurement of angles.

UNIT IV	PHOTOGRAMMETRIC SURVEYING	9

Basic principles- Photo theodolite -Horizontal and vertical angles from terrestrial photographs - Elevation of a point by photographic measurement -Determination of focal length of the lens - Aerial camera- Scale of vertical photograph -Scale of tilted photograph -Combined effects of tilt and relief -Stereoscopic vision.

UNIT V	ASTRONOMICAL SURVEYING	9

Spherical Trigonometry -Latitude and longitude -Solar system –Astronomicalterms -Coordinate systems- Altitude, azimuth system, declination, hour angle system, time and astronomical work sidereal time, apparent solar time, mean solar time, standard time, standard time -Application of astronomy in surveying -Corrections to astronomical observations.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

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

CO1:	Define the modern tools and methods of advanced surveying.
CO2:	Describe new tools and surveying methodologies.

CO3:	Illustrate the appropriate application of instruments and methods of surveying.
CO4:	Develop a surveying procedure for a particular project.
CO5:	Apply the advanced surveying in projects.
TEXT BOOKS:	
1.	B.C.Punmia, "Surveying", Vol. I& II", Laxmi Publications, 2016.
2.	Satheesh Gopi, R.Sathikumar and N. Madhu, "Advanced Surveying -Total Station, GIS and Remote Sensing", Pearson publication, 2006.
REFERENCES:	
1.	T.P.Kanetkar, S.V.Kulkarni, "Surveying and Levelling", Vol. I& II, Pune Vidyarthi GrihaPrakashan, 2017.
2.	N.N. Basak, "Surveying", McGraw Hill, 2017.
3.	R. Agor, "Advanced Surveying" Khanna Publications, 2012.
4.	A. M. Chandra and S. K. Ghosh, "Remote sensing and Geographical Information System", Narosa Publishing House, 2006.
5.	Alfred Leick, "GPS Satelite Surveying", Wiley, 2015.

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

Table of Specification (ToS) for End Semester Question Paper

Unit No. and Title	**Total 2 Marks Qns.**	**Total 16 Marks Qns.**	**Bloom's Taxonomy (Cognitive) Level**					
			Remember (Re)	**Understand (Un)**	**Apply (Ap)**	**Analyse (An)**	**Evaluate (Ev)**	**Create (Cr)**
			No. of Qns. (marks) and CO					
Unit-I: Modern Surveying Equipment	2	1 either or	2(2) –CO1	-	1 either or (16) – CO4	-	-	-
Unit-II: Global Positioning System	2	1 either or	2(2) – CO1	-	1 either or (16) — CO5	-	-	-
Unit-III: Geodetic Surveying	2	1 either or	1(2) — CO1	1(2) — CO3 1 either or (16) — CO2	-	-	-	-
Unit-IV: Photogrammetric Surveying	2	1 either or	1(2) - CO4	1(2) — CO4 1 either or (16) — CO3	-	-	-	-

Unit-V: Astronomical Surveying	2	1 either or	1(2) – CO5	1(2) — CO2	1 either or (16) — CO5	-	-	-
Total Qns. Advanced Surveying	10	5 either or	7(2)	3(2) 2 either or (16)	3 either or (16)	-	-	-
Total Marks	20	80	14	38	48	-	-	-
Weightage	20%	80%	14%	38%	48%	-	-	-

Weightage for COs

	CO1	CO2	CO3	CO4	CO5
Total Marks	10	18	18	20	34
Weightage	10%	18%	18%	20%	34%

CE22653	**PAVEMENT ENGINEERING**	**L**	**T**	**P**	**C**
		3	**0**	**0**	**3**

COURSE OBJECTIVE:

- To impart knowledge on highway components, design elements and its geometric design with evaluation and stabilisation methods.

UNIT I	**GENERAL PRINCIPLES OF PAVEMENT DESIGN**	**9**

Introduction - Pavement as layered structure - Pavement types – Pavement stability -Stress and deflections in pavements under repeated loading.

UNIT II	**DESIGN OF FLEXIBLE PAVEMENT**	**9**

Empirical, semi empirical and theoretical Methods – Design procedure as per latest IRC guidelines - Design and specification of rural road.

UNIT III	**DESIGN OF RIGID PAVEMENT**	**9**

Cement concrete pavements - Modified Westergaard approach - Design procedure as per latest IRC guidelines - Joints in rigid pavements - Concrete roads and their scope in India.

UNIT IV	**PAVEMENT EVALUATION AND MAINTENANCE**	**9**

Pavement Evaluation (Condition and evaluation surveys) - Evaluations based on Surface Appearance, Cracks, Patches and Pot holes, Undulations, raveling, Roughness, Skid Resistance - Pavement maintenance (IRC Recommendations Only) - Road-side Development.

UNIT V	**STABILISATION OF PAVEMENTS**	**9**

Stabilisation with special reference to highway pavements - Choice of stabilisers -Testing and field control – Stabilisation for rural roads in India - Geosynthetics (geotextiles and geogrids) in roads.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

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

CO1:	Define the planning, design, construction, evaluation and maintenance aspects of highways.
CO2:	Demonstrate the design procedure as per IRC guidelines, evaluation, maintenance and stabilization of pavements.

CO3:	Design the geometrics and the layers of flexible and rigid pavements based on IRC recommendations.
CO4:	Apply the concepts of testing and evaluation for the construction and maintenance of pavements.
CO5:	Identify the conventional and modern materials and methods of construction of pavements.
TEXT BOOKS:	
1.	Kadiyali, L.R., "Principles and Practice of Highway Engineering", Khanna tech. Publications, New Delhi, 2005.
2.	Khanna, S.K. and Justo C.E.G.andVeeraragavan, A, "Highway Engineering", New Chand and Brothers, Revised 10th Edition, 2014.
REFERENCES:	
1.	Yoder, R.J. and Witchak M.W., "Principles of Pavement Design", John Wiley, 2011.
2.	Dr. Sharma S. K., "Principles, Practice and Design of Highway Engineering (Including Airports)", S. Chand & Company Ltd. 2011.
3.	Rao G.V.,"Principles of Transportation and Highway Engineering", Tata McGraw Hill Publishing Company Ltd., New Delhi, India, 2012.
4.	Guidelines for the Design of Flexible Pavements, IRC: 37 - 2001, The Indian roads Congress, New Delhi.
5.	Guideline for the Design of Rigid Pavements for Highways, IRC: 58-2002, The Indian Roads Congress, New Delhi.

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

Table of Specification (ToS) for End Semester Question Paper

Unit No. and Title	**Total 2 Marks Qns.**	**Total 16 Marks Qns.**	**Bloom's Taxonomy (Cognitive) Level**					
			Remember (Re)	**Understand (Un)**	**Apply (Ap)**	**Analyse (An)**	**Evaluate (Ev)**	**Create (Cr)**
			No. of Qns. (marks) and CO					
Unit-I: General Principles of Pavement Design	2	1 either or	2(2) –CO1	1 either or (16) – CO2		-	-	-
Unit-II: Design of Flexible	2	1 either or	2(2) – CO1	-	1 either or (16) — CO3	-	-	-

Pavement								
Unit-III: Design of Rigid Pavement	2	1 either or	2(2) — CO1	-	1 either or (16) — CO3	-	-	-
Unit-IV: Performance Evaluation and Maintenance	2	1 either or	-	2(2) - CO2	1 either or (16) — CO4	-	-	-
Unit-V: Stabilisation of Pavements	2	1 either or	2(2) – CO1	-	1 either or (16) — CO5	-	-	-
Total Qns. Pavement Engineering	10	5 either or	16(2)	1 either or (16)	4 either or (16)	-	-	-
Total Marks	20	80	16	20	64	-	-	-
Weightage	20%	80%	14%	38%	64%	-	-	-

Weightage for COs

	CO1	**CO2**	**CO3**	**CO4**	**CO5**
Total Marks	16	20	32	16	16
Weightage	16%	20%	32%	16%	16%

CE22654	**AIRPORT, DOCKS AND HARBOUR ENGINEERING**	**L**	**T**	**P**	**C**
		3	**0**	**0**	**3**

COURSE OBJECTIVE:

- To impart knowledge on airports, docks and harbour components, characteristics, and their planning and design.

UNIT I	**AIRPORT PLANNING**	**9**

Air transport characteristics – Airport classification – ICAO – Airport planning: Site selection - Typical Airport Layouts - Case Studies – Airport Zones – Passenger Facilities and Services - Vehicular parking and circulation area.

UNIT II	**AIRPORT DESIGN**	**9**

Runway Design: Orientation - Wind Rose Diagram - Problems on basic and actual length, Geometric Design – Elements of Taxiway Design – Runway and Taxiway Markings - Runway and Taxiway lighting.

UNIT III	**DOCKS**	**9**

Harbour docks –Purpose–Design considerations - Wet and Dry docks - Repair docks - Lift docks - Graving docks -Floating docks - Operation of lock gates and passage.

UNIT IV	**HARBOUR PLANNING**	**9**

Wind - Waves - Tides - Currents phenomena - Effects on marine structures - Silting - Erosion - Littoral drift – Harbours- Classification of Harbours - Major ports in India - Harbour components - Characteristics of good harbour - Site selection criteria - Layout of harbours.

UNIT V	**HARBOUR STRUCTURES**	**9**

General design aspects - Breakwaters - Wharves –Quays- Jetties - Piers - Pier heads - Dolphin Fenders - Mooring accessories - Floating landing stages - Inland Water Transport – Wave action on Coastal Structures and Coastal Protection Works – Coastal Regulation Zone.

TOTAL: 45 PERIODS

COURSE OUTCOMES:	
At the end of the course, the students will be able to:	
CO1:	Define the basic concepts of planning and designof airports, docks and harbours.
CO2:	Describe the planning and design aspects of airports, docks and harbours.
CO3:	Demonstrate the layouts and elements of airports and harbours.
CO4:	Design the geometrics of the components of airports.
CO5:	Make use of the design considerations for the site selection of airportsandharbours.
TEXT BOOKS:	
1.	Dr. S. K. Khanna, M.G.Arora and S.S.Jain, "Airport Planning & Design", Nem Chand & Brothers, Roorkee,2017.
2.	Dr.S.P.Bindra, "A Course in Docks and Harbour Engineering", DhanpatRai Publishing Co. Pvt. Ltd., 2012.
REFERENCES:	
1.	Horonjeff R and Mackelvey F.X, "Planning and Design of Airports", Fifth Edition, McGraw Hill Education, New Delhi, 2010.
2.	Alonzo Def. Quinn, "Design and Construction of Ports and Marine Structure", McGraw Hill Book Company, New York, 2008.
3.	R. Srinivasan and S. C. Rangwala, "Dock and Tunnel Engineering", Charotar Publishing House, 2016.
4.	G.V. Rao, "Airport Engineering", Tata McGraw Hill Pub. Co., New Delhi, 2012.
5.	Venkatramaiah. C., "Transportation Engineering-Vol.2 - Railways, Airports, Docks and Harbours, Bridges and Tunnels", Universities Press (India) Private Limited, Hyderabad, 2015.

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

Table of Specification (ToS) for End Semester Question Paper

Unit No. and Title	Total 2 Marks Qns.	Total 16 Marks Qns.	Bloom's Taxonomy (Cognitive) Level					
			Remember (Re)	Understand (Un)	Apply (Ap)	Analyse (An)	Evaluate (Ev)	Create (Cr)
			No. of Qns. (marks) and CO					
Unit-I: Airport Planning	2	1 either or	2(2) –CO1	1 either or (16) – CO3	-	-	-	-
Unit-II: Airport Design	2	1 either or	2(2) – CO1	-	1 either or (16) — CO4	-	-	-
Unit-III: Docks	2	1 either or	1(2) – CO1	1(2) – CO2 1 either or (16) — CO2	-	-	-	-
Unit-IV: Harbour Planning	2	1 either or	1(2) – CO1	1(2) — CO3	1 either or (16) — CO5	-	-	-
Unit-V: HarbourStructures	2	1 either or	1(2) – CO1	1(2) — CO2 1 either or (16) — CO2	-	-	-	-
Total Qns. Airport, Docks and Harbour Engineering	10	5 either or	7(2)	3(2) 3 either or (16)	2 either or (16)	-	-	-
Total Marks	20	80	14	54	32	-	-	-
Weightage	20%	80%	14%	54%	32%	-	-	-

Weightage for COs					
	CO1	**CO2**	**CO3**	**CO4**	**CO5**
Total Marks	14	36	18	16	16
Weightage	14%	36%	18%	16%	16%

CE22755	**GROUND IMPROVEMENT TECHNIQUES**	**L**	**T**	**P**	**C**
		3	**0**	**0**	**3**

COURSE OBJECTIVE:

- To impart knowledge on orientation of soil, its properties, behaviours and various stabilisation techniques to improve its characteristics.

UNIT I	**INTRODUCTION**	**9**

Need for engineered ground improvement, classification of ground modification techniques- Suitability, feasibility and desirability of ground improvement techniques - Objectives of improving soil –Scope and necessity of ground improvement - New Technologies – Basic concepts – Drainage methods– Ground water lowering by well points – Deep well, Vacuum and Electro – Osmosis methods.

UNIT II	**COMPACTION AND SAND DRAINS**	**9**

In-situ compaction of cohesion less and cohesive soil – Shallow and deep compaction – Vibration methods – Vibrocompaction, Blasting, Vibrating probe, Vibratory rollers, Vibroflotation – Concept, Factors influencing compaction –Heavy Tamping – Vertical drains – Preloading with sand drains, Fabric drains, Wick drains – Relative merits of different methods – Limitations.

UNIT III	**CONSOLIDATION AND EARTH REINFORCEMENT**	**9**

Precompression and consolidation – Dynamic consolidation – Electro-osmotic consolidation –

Stone column – Lime piles– Earth reinforcement – Soil Nailing - Geosynthetics.		
UNIT IV	**SOIL STABILIZATION**	**9**
Introduction – Stabilization methods – Mechanical, Chemical stabilization – Cement, Lime, Bitumen – Electrical stabilization– Stabilization of expansive clays – Prewetting.		
UNIT V	**GROUTING**	**9**
Introduction – applications – functions – characteristics of grouts – types of grout **–** Suspension and solution grouts –Basic requirements of grout – Displacement grouting – Compaction grouting - Permeation grouting – Grouting equipment– Grout monitoring.		
		TOTAL: 45 PERIODS

COURSE OUTCOMES:	
At the end of the course, the students will be able to:	
CO1:	Define the various techniques adopted to improve the stability of ground.
CO2:	Describe the ground improvements techniques suitable for particular ground condition.
CO3:	Apply a ground improvement technique for ground based on soil condition and load applied.
CO4:	Solve a problem based on soil instability by adopting a compatible ground improvement technique.
CO5:	Identify the conventional and modern methods of soil stabilisation and ground improvement technique.
TEXT BOOKS:	
1.	Dr. P. Purushotham Raj, "Ground Improvement Techniques, Laxmi Publications, NewDelhi, 1st edition (1999), Reprint (2013).
2.	Hausmann M.R., "Engineering Principles of Ground Modification", McGraw-HillInternational Edition, 2012.
REFERENCES:	
1.	Hardcover, Er. AnkitLaddha, Dr. D.G.M. Purohit., "Ground Improvement Techniques – GIT", Treasure Publications, New Delhi, 2019.
2.	Pappala, A.J., Huang, J., Han, J., and Hoyos, L.R., "Ground Improvement and Geosynthetics", Geotechnical special publication No.207, Geo Institute, ASCE, 2010.
3.	Rowe, R.K., "Geotechnical and Geo-environmental Engineering Handbook", Kluwer Academic Publishers, 2012.
4.	Koerner, R.M., "Designing with Geosynthetics", Third Edition, Prentice Hall 2007.
5.	Han, J., "Principles and Practice of Ground Improvement", John Wiley and Sons, New Jersey, Canada 2015.

Course Outcomes	**PO**												**PSO**		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**

CO1	3	1	-	-	1	2	-	-	-	-	-	1	1	-	2
CO2	3	1	-	-	1	2	-	-	-	-	-	1	-	-	1
CO3	3	2	1	1	1	1	2	-	1	-	-	1	-	-	2
CO4	3	2	2	1	1	1	2	-	1	-	-	1	1	-	1
CO5	3	2	2	1	1	1	2	-	1	-	-	1	1	-	2
CO	3	1	1	1	1	1	1	-	1	-	-	1	1	-	2

Table of Specification (ToS) for End Semester Question Paper

Unit No. and Title	Total 2 Marks Qns.	Total 16 Marks Qns.	Bloom's Taxonomy (Cognitive) Level					
			Remember (Re)	Understand (Un)	Apply (Ap)	Analyse (An)	Evaluate (Ev)	Create (Cr)
			No. of Qns. (marks) and CO					
Unit-I: Introduction	2	1 either or	2(2) –CO1	1 either or (16) – CO2		-	-	-
Unit-II: Compaction and Sand Drains	2	1 either or	2(2) – CO1	1 either or (16) — CO2		-	-	-
Unit-III: Consolidation and Earth Reinforcement	2	1 either or	2(2) — CO1	-	1 either or (16) — CO3	-	-	-
Unit-IV: Soil Stabilization	2	1 either or	2(2) - CO1	-	1 either or (16) — CO5	-	-	-
Unit-V: Grouting	2	1 either or	2(2) – CO1	-	1 either or (16) — CO4	-	-	-
Total Qns. Ground Improvement Techniques	10	5 either or	10(2)	2 either or (16)	3 either or (16)	-	-	-
Total Marks	20	80	20	32	48	-	-	-
Weightage	20%	80%	14%	38%	48%	-	-	-

Weightage for COs					
	CO1	**CO2**	**CO3**	**CO4**	**CO5**
Total Marks	20	32	16	16	16
Weightage	20%	32%	16%	16%	16%

CE22756	**APPLICATIONS OF AI IN CIVIL ENGINEERING**	**L**	**T**	**P**	**C**
		3	**0**	**0**	**3**

COURSE OBJECTIVE:

- The course is structured to give an overview of the area, as well as some important soft computing techniques which are essential to solve the complex problems in terms of the fundamentals. The attributes of human intelligence such as reasoning, planning, learning etc. will be attempted to be understood to incorporate in problem solving.

UNIT I	**INTRODUCTION**	**9**

Overview of AI - Introduction to AI– Projects and Implementation- Logical Agents- First order Logic- Classical Planning- Knowledge Representation- Quantifying Uncertainty- Probabilistic Reasoning- Making Simple decision- Making Complex Decision.

UNIT II	ARTIFICIAL NEURAL NETWORKS	9
Fundamentals of ANN – LMS learning rule – Applications - Back propagation ANN - Variation and Applications - Research Directions.		
UNIT III	**FUZZY SYSTEMS**	**9**
Fuzzy Set theory - Fuzzy Systems- Applications- Fuzzy Bayesian Decision Method – Fuzzy Outranking - Fuzzy Mathematical Programming.		
UNIT IV	**GENETIC ALGORITHMS**	**9**
Fundamentals of GA - GA Modeling – Applications- Parallel Genetic Algorithm - Wireless Networks-Feature Selection in Machine learning using GA.		
UNIT V	**ARTIFICIAL INTELIGENCE IN DESIGN OPTIMIZATION**	**9**
Automated design optimization using AI - AI applications for construction project management- AI applications in water resource management - Energy optimization in buildings.		
		TOTAL: 45 PERIODS

COURSE OUTCOMES:

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

CO1:	Define artificial intelligence and the concept behind it.
CO2:	Describe artificial intelligence, the neural networks, fuzzy systems, algorithms and its application.
CO3:	Apply artificial intelligence in civil engineering projects.
CO4:	Solve complex problems using artificial intelligence.
CO5:	Identify algorithms, networks for civil engineering projects.

TEXT BOOKS:

1.	Stuart J.Russell, Peter Norvig,"Artificial Intelligence A Modern Approach", Third Edition, Pearson Education, Inc., India.2015
2.	S. Rajasekaran, G.A.VijayalakshmiPai,"Neural Networks, Fuzzy logic, and Genetic Algorithms Synthesis and Applications", PHI, 2013.

REFERENCES:

1.	S.N.Sivanandam & S.N.Deepa, "Principles of Soft Computing", Wiley India Pvt Ltd, Delhi, 2007.
2.	Patterson, D.W, "Introduction to Artificial Intelligence & Expert Systems", Pearson Education India, 2015.
3.	Taha, H.A,"Operations Research, An introduction"Pearson Education 2019.
4.	Deb.K, "Multiobjective Optimization using Evolutionary Algorithms", John Wileyand sonslimited, 2003.
5.	Relevant Journal papers.

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

Table of Specification (ToS) for End Semester Question Paper

Unit No. and Title	Total 2 Marks Qns.	Total 16 Marks Qns.	Bloom's Taxonomy (Cognitive) Level					
			Remember (Re)	Understand (Un)	Apply (Ap)	Analyse (An)	Evaluate (Ev)	Create (Cr)
			No. of Qns. (marks) and CO					
Unit-I: Introduction	2	1 either or	2(2) –CO1	1 either or (16) – CO2		-	-	-
Unit-II: Artificial Neural Networks	2	1 either or	2(2) – CO1		1 either or (16) — CO3	-	-	-
Unit-III: Fuzzy Systems	2	1 either or	2(2) — CO1		1 either or (16) — CO3	-	-	-
Unit-IV: Genetic Algorithms	2	1 either or	2(2) - CO1		1 either or (16) — CO4	-	-	-
Unit-V: Artificial Intelligence in Design Optimization	2	1 either or	1(2) – CO1	1(2) – CO2	1 either or (16) — CO5	-	-	-
Total Qns. Applications of Artificial Intelligence in Civil Engineering	10	5 either or	9(2)	1(2) 1 either or (16)	4 either or (16)	-	-	-
Total Marks	20	80	18	18	64	-	-	-
Weightage	20%	80%	18%	18%	64%	-	-	-

Weightage for COs					
	CO1	CO2	CO3	CO4	CO5
Total Marks	18	18	32	16	16
Weightage	18%	18%	32%	16%	16%

OPEN ELECTIVES

CE22681	CLIMATE CHANGE AND ITS IMPACT	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

- To understand the basics of weather and climate.

- To have an insight on atmospheric dynamics and transport of heat.
- To develop simple climate models and evaluate climate changes using models.

UNIT I	BASICS OF WEATHER AND CLIMATE	9

Shallow film of Air – Stratified & disturbed atmosphere – Law –Constitution of atmosphere: Well stirred atmosphere – Ozone – Carbon Dioxide – Sulphur Dioxide – Aerosol –Water - State of atmosphere: Air temperature – Pressure – Hydrostatic – Chemistry – Distribution – Circulation.

UNIT II	ATMOSPHERIC DYNAMICS	9

Atmosphere dynamics: Law – Isobaric heating and cooling – Adiabatic lapse rates – Equation of motion. Thermal winds - Radiation, convection and advections: sun & solar radiation –Green house effect- Global warming - Global budget – Radiative fluxes - Heat transport.

UNIT III	GLOBAL CLIMATE	9

Components and phenomena in the climate system: Time and space scales – Interaction and parameterization problem – Atmospheric circulation - Ocean circulation: Latitude – Longitude dependence of climate features – Ocean vertical structure –Ocean thermohaline circulation.

UNIT IV	CLIMATE SYSTEM PROCESSES	9

Conservation of motion: Force – Coriolis– Application – Geotropic wind – Pressure co-ordinates. Equation of State – Atmosphere – Ocean. Application: Thermal circulation – Sea level rise - Temperature equation: Ocean – Air – Application – Decay of sea surface temperature.

UNIT V	CLIMATE CHANGE MODELS	9

Constructing a climate model – Climate system modeling – Climate simulation and drift – Evaluation of climate model simulation – Regional (RCM) – Global (GCM) – Global average response to warming – Climate change observed to date.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

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

CO1:	Recall fundamental knowledge on weather and climate.
CO2:	Describe the atmospheric dynamic law, greenhouse effect, global warming, and transport of heat and air mass.
CO3:	Explain the global climate.
CO4:	Illustrate climate change processes.
CO5:	Construct a climate model and to evaluate the climate model simulation.

TEXT BOOKS:

1.	Robin Moilveen, “Fundamentals of weather and climate”, Second Edition, Oxford University Press, 2010.
2.	J. David Neelin, “Climate change and climate modeling”, Cambridge University press, 2011.

REFERENCES:	
1.	L. D. Danny Harvey, "Climate and Global Environmental Change", Pearson Education, 2016.
2.	Trevor M. Letcher, "The Impacts of Climate Change", Elsevier, 2021.
3.	Maximilian Lackner, Baharak Sajjadi, and Wei-Yin Chen, "Handbook of Climate Change Mitigation and Adaptation", Third Edition, Springer, 2022.
4.	Alexa Ingram, "Climate Change: Simplified", Authentic Ecopress, 2023.
5.	Tristan Kershaw, "Climate change and its impacts", IOP Publishing Ltd, 2017.

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

Table of Specification (ToS) for End Semester Question Paper

Unit No. and Title	Total 2 Marks Qns.	Total 16 Marks Qns.	Bloom's Taxonomy (Cognitive) Level					
			Remember (Re)	Understand (Un)	Apply (Ap)	Analyse (An)	Evaluate (Ev)	Create (Cr)
			No. of Qns. (marks) and CO					
UNIT-I:Basics of Weather and Climate	2	1 either or	2(2) – CO1	1 either or (16) – CO1		-	-	-
UNIT-II:Atmospheric Dynamics	2	1 either or	2(2) – CO2	1 either or (16) — CO2		-	-	-
Unit –III:Global Climate	2	1 either or	2(2) — CO3	1 either or (16) — CO3		-	-	-
Unit- IV: Climate System Processes	2	1 either or	1(2) - CO4	1(2) — CO4	1 either or (16) — CO4	-	-	-
Unit -V : Climate Change Models	2	1 either or	1(2) – CO5	1(2) — CO5	1 either or (16) — CO5	-	-	-

Total Qns. Climate Change and its Impact	10	5 either or	8(2)	2(2) 3 either or (16)	2 either or (16)	-	-	-
Total Marks	20	80	16	52	32	-	-	-
Weightage	20%	80%	16%	52%	32%	-	-	-

Weightage for COs					
	CO1	**CO2**	**CO3**	**CO4**	**CO5**
Total Marks	20	20	20	20	20
Weightage	20%	20%	20%	20%	20%

CE22682	**SELECTION OF MATERIALS**	**L**	**T**	**P**	**C**
		3	**0**	**0**	**3**

COURSE OBJECTIVES:

- To classify and select appropriate engineering materials based on their properties and applications.
- To understand and analyze the mechanical, thermal, electrical, and optical properties of various materials.
- To gain knowledge of manufacturing processes and their impact on material selection and design.
- To familiarize students with testing methods and standards for evaluating material performance.
- To explore the applications and innovations of engineering materials in diverse industries

UNIT I	**ENGINEERING MATERIALS**	**9**

Introduction – Classification of engineering materials – Selection of materials for engineering purposes – Selection of materials and shape – Classification metal and alloys, polymers, ceramics and glasses, composites, natural materials,on metallic materials- Smart materials.

UNIT II	**MATERIAL PROPERTIES**	**9**

Mechanical properties – Fatigue strength – Fracture Toughness - Thermal Properties - Magnetic Properties - Fabrication Properties – electrical, optical properties - Environmental Properties, Corrosion properties – Shape and size - Material Cost and Availability– Failure analysis.

UNIT III	**MANUFACTURING PROCESSING**	**9**

Interaction of Materials Selection, Design, and Manufacturing Processes - Production Processes and Equipment for Metals - Metal Forming, Shaping, and Casting - Plastic Parts Processing - Composites Fabrication Processes - Advanced Ceramics Processing – Surface treatment.

UNIT IV	**MATERIALS SELECTION CHARTS AND TESTING**	**9**

Ashby material selection charts-Testing of Metallic Materials - Plastics Testing - Characterization and Identification of Plastics - Professional and Testing Organizations - Ceramics Testing - Nondestructive Inspection.

UNIT V	**APPLICATIONS AND USES**	**9**

Selection of Materials for Biomedical Applications - Medical Products - Materials in Electronic Packaging - Advanced Materials in Sports Equipment - Materials Selection for Wear Resistance -

Advanced Materials in Telecommunications.	
TOTAL: 45 PERIODS	
COURSE OUTCOMES:	
At the end of the course, the students will be able to:	
CO1:	Outline the different types of engineering materials and their classifications.
CO2:	Summarize the various properties of engineering materials, their cost and availability, and failure analysis.
CO3:	Interpret the manufacturing processes and economic analysis of various engineering materials.
CO4:	Prepare materials selection charts and their testing.
CO5:	Apply the engineering materials in various fields including biomedical, telecommunication, and electronics.
TEXT BOOKS:	
1.	Ashby, M. F., "Materials Selection in Mechanical Design", Fourth edition, Elsevier, 2011.
2.	Ashby, M. F. and Johnson, K., "Materials and Design – The Art and Science of Material Selection in Product Design", Elsevier, 2014.
REFERENCES:	
1.	Raghavan V, "Materials Science and Engineering", Sixth edition, Prentice Hall India Learning Private Limited, 2015.
2.	"Handbook of Materials Selection", Edited by Myer Kutz John Wiley & Sons, Inc., NewYork, 2002.
3	Kalpakjian, S & Schmid, K S, "Manufacturing Engineering and Technology", New York: Prentice Hall, 2018.
4	Robert Creese, "Introduction to Manufacturing Processes and Materials", CRC Press, Boca Raton, 2017.
5	Groover M.P, "Fundamentals of Modern Manufacturing: Materials, Processes and Systems", Hoboken, NJ: Wiley, 2010.

Course Outcomes	**PO**												**PSO**		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO1	3	-	-	-	-	3	3	-	-	-	-	-	3	3	-
CO2	3	2	2	-	-	3	3	-	-	-	-	-	3	3	-

CO3	3	2	2	-	2	3	3	-	-	-	-	-	3	3	3
CO4	3	2	3	3	3	3	3	-	-	-	-	-	3	3	-
CO5	3	3	3	3	3	3	3	-	-	-	-	-	3	3	3
CO	3	2	2	3	3	3	3	-	-	-	-	-	3	3	3

Table of Specification (ToS) for End Semester Question Paper

Unit No. and Title	Total 2 Marks Qns.	Total 16 Marks Qns.	Bloom's Taxonomy (Cognitive) Level					
			Remember (Re)	Understand (Un)	Apply (Ap)	Analyse (An)	Evaluate (Ev)	Create (Cr)
			No. of Qns. (marks) and CO					
Unit-I: Engineering Materials	2	1 either or	2(2) – CO1	1 either or (16) – CO1		-	-	-
Unit-II: Material Properties	2	1 either or	2(2) – CO2	1 either or (16) — CO2		-	-	-
Unit-III: Manufacturing Processing and Economic Analysis	2	1 either or	1(2) — CO5	1(2) — CO5	I either or (16) — CO5	-	-	-
Unit-IV: Materials Selection Charts And Testing	2	1 either or	1(2) - CO4	1(2) — CO4	1 either or (16) — CO4	-	-	-
Unit-V: Applications And Uses	2	1 either or	2(2) – CO3	1 either or (16) — CO3		-	-	-
Total Qns. Selection of Materials	10	5 either or	8(2)	2(2) 3 either or (16)	2 either or (16)	-	-	-
Total Marks	20	80	16	52	32	-	-	-
Weightage	20%	80%	16%	52%	32%	-	-	-

Weightage for COs					
	CO1	**CO2**	**CO3**	**CO4**	**CO5**
Total Marks	20	20	20	20	20
Weightage	20%	20%	20%	20%	20%

CE22781	ENVIRONMENT AND AGRICULTURE	L	T	P	C
		3	0	0	3

COURSE OBJECTIVE:

- To emphasize on the importance of environment and agriculture on changing global scenario and the emerging issues connected to it.

UNIT I	ENVIRONMENTAL CONCERNS	9
Environmental basis for agriculture and food – Land use and landscape changes – Water quality issues – Changing social structure and economic focus – Globalization and its impacts – Agro ecosystems.		
UNIT II	**ENVIRONMENTAL IMPACTS**	**9**
Irrigation development and watersheds – Mechanized agriculture and soil cover impacts – Erosion and problems of deposition in irrigation systems – Agricultural drainage and downstream impacts –Impacts of urban development on Agriculture.		
UNIT III	**CLIMATE CHANGE**	**9**
Global warming and changing environment – Ecosystem changes – Changing blue-green-grey water cycles – Water scarcity and water shortages – Desertification.		
UNIT IV	**ECOLOGICAL DIVERSITY AND AGRICULTURE**	**9**
Ecological diversity, wild life and agriculture – GM crops and their impacts on the environment – Insects and agriculture – Pollination crisis – Ecological farming principles – Forest fragmentation and agriculture – Agricultural biotechnology concerns.		
UNIT V	**EMERGING TECHNIQUES**	**9**
IoT in Agriculture – Methods – Applications – Smart farming –Modern agriculture policies – Sustainable agriculture - Vertical farming.		
		TOTAL: 45 PERIODS

COURSE OUTCOMES:	
At the end of the course, the students will be able to:	
CO1:	Explain the environmental concerns, water quality issues, globalization and agro ecosystem.
CO2:	Summarize the environmental impacts due to irrigation development and mechanized agriculture.
CO3:	Identify the impacts of climate change on environment and agriculture.
CO4:	Illustratethe relation between ecological diversity and agriculture.
CO5:	Make use of the agricultural environment policies for the emerging issues related to environment and agriculture.

TEXT BOOKS:	
1.	M.Lakshmi Narasaiah, "Environment and Agriculture", Discovery Publication House, 2006.
2.	Arvind Kumar, "Environment and Agriculture", ABH Publications, New Delhi, 2005.

REFERENCES:	
1.	T.C. Byerly, "Environment and Agriculture", United States. Dept. of Agriculture. Economic Research Service, 2006.
2.	Jason Clay, "World Agriculture and the Environment: A Commodity-By-Commodity Guide to Impacts and Practices", Island Press, 2004.
3.	Shiv Prasad, "Textbook of Environmental and Forestry Science", Indian Council of Agricultural Research, New Delhi, 2019.
4.	Tofael Ahamed, Ryozo Noguchi, Tomohiro Takigawa, "Sustainability: Integrating Environment, Agriculture and Renewable Energy for Food Security", NOVA Science Publishers, 2015.
5.	Mohamed Abdel-Raheem, Sadek Salem, J. Bhattacharyya, "Environment and Agriculture", Lambert Academic Publishing, 2011.

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

Table of Specification (ToS) for End Semester Question Paper

Unit No. and Title	Total 2 Marks Qns.	Total 16 Marks Qns.	Bloom's Taxonomy (Cognitive) Level					
			Remember (Re)	Understand (Un)	Apply (Ap)	Analyse (An)	Evaluate (Ev)	Create (Cr)
			No. of Qns. (marks) and CO					
UNIT - I : Environmental Concerns	2	1 either or	2(2) - CO1	1 either or (16) – CO1	-	-	-	-
UNIT - II: Environmental Impacts	2	1 either or	2(2) - CO2	1 either or (16) - CO2	-	-	-	-
Unit - III: Climate Change	2	1 either or	1(2) – CO3	1(2) - CO3	1 either or (16) - CO3	-	-	-
Unit - IV: Ecological Diversity and Agriculture	2	1 either or	1(2) - CO4	1(2) - CO4 1 either or (16) - CO4		-	-	-

Unit - V: Emerging Techniques	2	1 either or	2(2) – CO5	-	1 either or (16) - CO5	-	-	-
Total Qns.	10	5 either or	8(2)	2(2) 3 either or (16)	2 either or (16)	-	-	-
Total Marks	20	80	16	52	32	-	-	-
Weightage	20%	80%	16%	52%	32%	-	-	-

Weightage for COs

	CO1	**CO2**	**CO3**	**CO4**	**CO5**
Total Marks	20	32	16	16	16
Weightage	20%	32%	16%	16%	16%

CE22782	**DRINKING WATER SUPPLY AND TREATMENT**	**L**	**T**	**P**	**C**
		3	**0**	**0**	**3**

COURSE OBJECTIVES:

- To study about the sources of water and its characteristics.
- To learn about the conveyance of water from the source and its appurtenances.
- To study the various water treatment processes.
- To study the construction, operation and maintenance of advanced water treatment techniques.
- To learn about the various water distribution systems and its supply.

UNIT I	**SOURCES OF WATER**	**9**

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

UNIT II	**CONVEYANCE FROM THE SOURCE**	**9**

Water supply -Intake structures - Functions - Pipes and conduits for water - Pipe materials - Transmission main design - Laying, jointing and testing of pipes -Appurtenances - Types and capacity of pumps - Selection of pumps.

UNIT III	**WATER TREATMENT**	**9**

Sources of contamination in water- Point Source vs. Non-Point Source Pollution - Microbial contamination -Water treatment-Objectives - Unit operations and processes - Aerators of flash mixers - Sedimentation- Principle and operation - Factors affecting sedimentation - Coagulation and flocculation – Clarifloccuator- Sand filters - Disinfection - Residue Management.

UNIT IV	**ADVANCED WATER TREATMENT**	**9**

Water softening - Desalination- R.O. Plant - Demineralization - Adsorption - Ion exchange– Membrane Systems - Iron and Manganese removal - Defluoridation – Construction, Operation & Maintenance aspects - MBR process, Emerging water treatment technologies- Electrodialysis

(ED), Forward Osmosis (FO), Solar Desalination - Water reuse and recycling.		
UNIT V	**WATER DISTRIBUTION AND SUPPLY**	**9**
Requirements of water distribution - Components - Service reservoirs – Functions- Economics - Computer applications - Appurtenances - Leak detection - House service connection - Fixtures and fittings - Systems of plumbing and types of plumbing.		
		TOTAL: 45 PERIODS

COURSE OUTCOMES:	
At the end of the course, the students will be able to:	
CO1:	Enumerate the objectives, characteristics, sources and standards of water
CO2:	Explain the conveyance of water from the source, its appurtenances and laying of pipes.
CO3:	Describe the unit operations and processes involved in the treatment of drinking water.
CO4:	Identify the advanced water treatment techniques.
CO5:	Design the water supply and distribution network.
TEXT BOOKS:	
1.	Punmia B.C, Arun K.Jain, Ashok K.Jain, "Water supply Engineering", Lakshmi Publication Private Limited, New Delhi, 2016.
2.	Birdie G.S., "Water Supply and Sanitary Engineering", Dhanpat Rai and Sons, 2018.
REFERENCES:	
1.	Garg. S.K., "Water Supply Engineering", Khanna Publishers, Delhi, 2008.
2.	Harold E. Babbitt, James J. Doland, "Water Supply Engineering", McGraw Hill book Co., 1984.
3.	Steel. E.W., Terence J. Mcghee, "Water Supply Engineering", McGraw Hill International book Co., 1984.
4.	Duggal K.N., "Elememts of Public Health Engineering", S.Chand and Company Ltd, New Delhi, 1998.
5.	Mark J. Hammer, "Water and Waste Water Technology", Prentice Hall of India Pvt. Ltd., New Delhi, 2008.

Course Outcomes	**PO**												**PSO**		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO1	3	-	1	1	1	2	2	3	-	-	-	3	3	2	2
CO2	3	-	1	1	1	2	2	3	-	2	-	3	2	1	1

CO3	3	2	2	2	1	2	2	3	-	-	-	3	1	1	3
CO4	3	2	3	3	1	2	2	2	3	2	2	3	1	2	1
CO5	3	2	2	2	1	2	2	2	3	-	-	3	2	2	1
CO	**3**	**2**	**2**	**2**	**1**	**2**	**2**	**2**	**3**	**2**	**2**	**3**	**2**	**2**	**2**

Table of Specification (ToS) for End Semester Question Paper

Unit No. and Title	Total 2 Marks Qns.	Total 16 Marks Qns.	Bloom's Taxonomy (Cognitive) Level					
			Remember (Re)	Understand (Un)	Apply (Ap)	Analyse (An)	Evaluate (Ev)	Create (Cr)
			No. of Qns. (marks) and CO					
UNIT - I: Sources of Water	2	1 either or	2(2) –CO1	1 either or (16) – CO1	-	-	-	-
UNIT - II: Conveyance from the Source	2	I either or	2(2) – CO2	1 either or (16) - CO2	-	-	-	-
Unit - III: Water Treatment	2	1 either or	1(2) - CO3	1(2) - CO3 1 either or (16) - CO3	-	-	-	-
Unit - IV: Advanced Water Treatment	2	1 either or	1(2) - CO4	1(2) - CO4	1 either or (16) - CO4	-	-	-
Unit - V : Water Distribution And Supply	2	1 either or	2(2) – CO5	-	1 either or (16) - CO5	-	-	-
Total Qns. Drinking Water Supply and Treatment	10	5 either or	8(2)	2(2) 3 either or (16)	2 either or (16)	-	-	-
Total Marks	20	80	16	52	32	-	-	-
Weightage	20%	80%	16%	52%	32%	-	-	-

Weightage for COs					
	CO1	**CO2**	**CO3**	**CO4**	**CO5**
Total Marks	20	20	20	20	20
Weightage	20%	20%	20%	20%	20%

CE22783	**GREEN BUILDING**	**L**	**T**	**P**	**C**
		3	**0**	**0**	**3**

COURSE OBJECTIVES:

- To know the environmental impact of buildings, including energy use, carbon emissions,

water consumption, and waste disposal.		
• To study the concept and necessity of green construction, assessing its merits and demerits.		
• To learn principles and elements of green building design, considering climate responsiveness and sustainable practices.		
• To study sustainable materials and their role in reducing carbon emissions and waste during construction.		
• To learn about energy-efficient techniques in buildings for thermal comfort, daylighting, and ventilation.		
UNIT I	**ENVIRONMENTAL IMPLICATIONS OF BUILDINGS**	**9**
Energy use -Carbon emissions - Water use - Waste disposal - Building materials: Sources, Methods of production and environmental implications - Embodied energy in building materials: Transportation energy for building materials - Maintenance energy for buildings.		
UNIT II	**GREEN CONSTRUCTION**	**9**
Unsustainable use of materials - Global warming - Green building – Concept and necessity - Merits and demerits –Classification - Renewable energy in buildings - Basic concepts and efficiency -Green Building – Construction techniques- Case studies.		
UNIT III	**PRINCIPLES AND ELEMENTS OF GREEN BUILDING**	**9**
Climate responsive process of design - Standards and Specification- Climatic zones - Design sequence, Shelter or form, Land form, Vegetation, Water bodies, Street widths, Open spaces, Ground character, Plan form, Orientation, Roof form - Shading devices and their effects.		
UNIT IV	**SUSTAINABLE MATERIALS**	**9**
Sustainability - Material conservation: Concept of embodied energy, Low energy materials, Sustainable materials, Alternative materials – Handling non-process waste – Waste reduction during construction – Materials with recycled waste - Concept of carbon emission and its reduction.		
UNIT V	**UTILITY OF ENERGY IN BUILDINGS**	**9**
Concept - Solar passive cooling techniques – Solar passive heating techniques – Low energy cooling techniques – Case studies – Performance monitoring and IEQ of green building- Thermal comfort – Day lighting – Ventilation - Wind energy in urban buildings - Building Energy Management Systems (BEMS).		
		TOTAL: 45 PERIODS
COURSE OUTCOMES:		
At the end of the course, the students will be able to:		
CO1:	Outline the importance of Sustainable development and green building concepts in construction.	
CO2:	Enumerate the aspects of green construction.	
CO3:	Design a green building using the design principles and the elements of a green building.	

CO4:	Make use of sustainable materials, non-process waste and recycled waste thereby reducing carbon emission.
CO5:	Demonstrate the energy usage with the help of solar energy in buildings.
TEXT BOOKS:	
1.	K.S.Jagadish, B. V. Venkatarama Reddy and K. S. Nanjunda Rao, "Alternative Building Materials and Technologies", New Age International (P) Limited, 2023.
2.	Ursula Eicker, "Low Energy Cooling for Sustainable Buildings", John Wiley and Sons Ltd., 2009.
REFERENCES:	
1.	Bureau of Energy Efficiency, "Energy Conservation Building Code'', Ministry of Power, Government of India, 2017.
2.	Wright, R.T., and Nebel, B.J., "Environmental Science - Towards a Sustainable Future", Prentice-Hall of India Private Limited, New Delhi, 2016.
3.	H. Ravindranath, K Usha Rao, B Natarajan, P Monga, "Renewable Energy and Environment - A Policy Analysis for India", Tata McGraw Hill, 2002.
4.	Michael Bauer, Peter Mosle, Michael Schwarz, "Green Building: Guidebook for Sustainable Architecture", Springer Science & Business Media, 2010.
5.	Charles J. Kibert, "Sustainable Construction: Green Building Design and Delivery", John Wiley & Sons, 2022.

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

Table of Specification (ToS) for End Semester Question Paper

Unit No. and Title	**Total 2 Marks Qns.**	**Total 16 Marks Qns.**	**Bloom's Taxonomy (Cognitive) Level**					
			Remember (Re)	**Understand (Un)**	**Apply (Ap)**	**Analyse (An)**	**Evaluate (Ev)**	**Create (Cr)**
			No. of Qns. (marks) and CO					

UNIT - I: Environmental Implications of Buildings	2	1 either or	2(2) - CO1	1 either or (16) – CO1	-	-	-	-
UNIT - II: Green Construction	2	1 either or	2(2) - CO2	1 either or (16) - CO2	-	-	-	-
Unit - III: Principles and Elements of Green Building	2	1 either or	1(2) - CO3	1(2) - CO3	1 either or (16) - CO3	-	-	-
Unit - IV: Sustainable Materials	2	1 either or	1(2) - CO4	1(2) - CO4	1 either or (16) - CO4	-	-	-
Unit - V : Utility of Energy in Buildings	2	1 either or	2(2) - CO5	1 either or (16) - CO5		-	-	-
Total Qns. Green Building	10	5 either or	8(2)	2(2) 3 either or (16)	2 either or (16)	-	-	-
Total Marks	20	80	16	52	32	-	-	-
Weightage	20%	80%	16%	52%	32%	-	-	-

Weightage for COs

	CO1	**CO2**	**CO3**	**CO4**	**CO5**
Total Marks	20	20	20	20	20
Weightage	20%	20%	20%	20%	20%

CE22784	**AIR POLLUTION AND CONTROL ENGINEERING**	**L**	**T**	**P**	**C**
		3	0	0	3

COURSE OBJECTIVES:

- To learn the concept of air pollution, its types, sources and effects.
- To learn about meteorological factors that influence air pollution dispersion, stability, and diffusion.
- To study the selection and working principles of various particulate control equipment.
- To study the selection and functioning of control equipment for gaseous pollutants, including process control and monitoring techniques.
- To learn about techniquesfor managing indoor air quality, focusing on passive solar methods and thermal comfort.

UNIT I	**INTRODUCTION**	**7**

Structure and composition of atmosphere – Definition, Scope and Scales of air pollution – Sources and classification of air pollutants and their effects on human health, vegetation, animals, property, aesthetic value and visibility - Ambient air quality and emission standards.

UNIT II	**METEOROLOGY**	**6**

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**	**11**
Factors affecting selection of control equipment – Gas particle interaction – Working principle - Gravity separators, Centrifugal separators, Fabric filters, Particulate scrubbers, Electrostatic Precipitators.		
UNIT IV	**CONTROL OF GASEOUS CONTAMINANTS**	**11**
Factors affecting selection of control equipment – Working principle - Absorption, Adsorption, Condensation, Incineration, Bio filters – Process control and monitoring – Green techonology for pollution control.		
UNIT V	**AIR QUALITY MANAGEMENT**	**10**
Concept - Solar passive cooling techniques – Solar passive heating techniques – Low energy cooling techniques – Standards and legislation – Remote Sensing – Role of IoT in pollution control.		
		TOTAL: 45 PERIODS

COURSE OUTCOMES:	
At the end of the course, the students will be able to:	
CO1:	Explain about the atmosphere, air pollution, air pollutants and their emission standards.
CO2:	Demonstrate the effects of meteorology on air pollution, Atmospheric Diffusion Theories and Dispersion models
CO3:	Identify particulate air pollution control devices to meet applicable standards.
CO4:	Select proper equipment to control gaseous contaminants based on the intensity of pollution.
CO5:	Explain the concept of indoor air quality management and the techniques to maintain air quality using case studies.

TEXT BOOKS:	
1.	Lawrence K. Wang, Norman C. Pereira, Yung Tse Hung, "Air Pollution Control Engineering", Tokyo, Springer science + Business media LLC,2004.
2.	Anjaneyulu Yerramilli, "Air Pollution: Prevention and Control Technologies", BS publications, 2019.

REFERENCES:	
1.	David H.F. Liu, Bela G. Liptak, "Air Pollution", CRC Press, 2019.
2.	Wayne T.Davis, "Air Pollution Engineering Manual", John Wiley & Sons, Inc, 2000.
3.	M.N Rao and HVN Rao, "Air Pollution", Tata Mcgraw Hill Publishing Company limited, 2007.
4.	C.S.Rao, "Environmental Pollution Control Engineering", New Age International (P) Limited Publishers, 2021.

5.	Arthur C. Stern, "Air Pollution (Vol.I – Vol.VIII)", Academic Press, 2006.

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

Table of Specification (ToS) for End Semester Question Paper

Unit No. and Title	Total 2 Marks Qns.	Total 16 Marks Qns.	Bloom's Taxonomy (Cognitive) Level					
			Remember (Re)	Understand (Un)	Apply (Ap)	Analyse (An)	Evaluate (Ev)	Create (Cr)
			No. of Qns. (marks) and CO					
UNIT I: Introduction	2	1 either or	2(2) - CO1	1 either or (16) – CO1		-	-	-
UNIT II: Meteorology	2	I either or	2(2) - CO2	1 either or (16) - CO2		-	-	-
Unit III: Control of Particulate Contaminants	2	1 either or	1(2) – CO3	1(2) - CO3	1 either or (16) – CO3	-	-	-
Unit IV: Control of Gaseous Contaminants	2	1 either or	1(2) - CO4	1(2) - CO4	1 either or (16) - CO4	-	-	-
Unit V : Indoor Air Quality Management	2	1 either or	2(2) – CO5	1 either or (16) - CO5		-	-	-
Total Qns. Air Pollution and Control Engineering	10	5 either or	8(2)	2(2) 3 either or (16)	2 either or (16)	-	-	-
Total Marks	20	80	16	52	32	-	-	-
Weightage	20%	80%	16%	52%	32%	-	-	-
Weightage for COs								

	CO1	CO2	CO3	CO4	CO5
Total Marks	20	20	20	20	20
Weightage	20%	20%	20%	20%	20%

HOD **DEAN ACADEMICS** **PRINCIPAL**