NANDHA ENGINEERING COLLEGE

(An Autonomous Institution affiliated to Anna University Chennai and approved by AICTE, New Delhi)
Erode-638 052, Tamilnadu, India, Phone: 04294 – 225585

Curriculum and Syllabi

for

B.E – Civil Engineering [R22]

[CHOICE BASED CREDIT SYSTEM]

(This Curriculum and Syllabi are applicable to Students admitted from the Academic Year 2024-2025 onwards)

APRIL 2025

INSTITUTE VISION AND MISSION	
VISION	• To be an Institute of excellence providing quality Engineering, Technology and Management education to meet the ever changing needs of the society.
MISSION	• To provide quality education to produce ethical and competent professionals with social Responsibility • To excel in the thrust areas of Engineering, Technology and Entrepreneurship by solving real- world problems. • To create a learner centric environment and improve continually to meet the changing global needs.

B.E – CIVIL ENGINEERING	
VISION	• To foster academic excellence by imparting knowledge in civil engineering and allied disciplines to meet the ever growing needs of the society.
MISSION	• To impart quality education to produce professionals with social responsibility. • To excel in the thrust areas of civil and allied engineering to solve real world problems. • To create a learner centric environment with continual progress to meet the global engineering needs.
PROGRAMME EDUCATIONAL OBJECTIVES (PEO)	The graduates of civil engineering will be **PEO1: Core Competency:** Successful professionals with core competency and inter-disciplinary skills to satisfy the industrial needs. **PEO2: Research, Innovation and Life-long Learning:** Capable of identifying technological requirements for the society and providing innovative ideas for real time problems. **PEO3: Ethics, Human values and Entrepreneurship:** Able to demonstrate ethical practices and managerial skills through continuous learning.
PROGRAMME SPECIFIC OUTCOMES (PSO)	The students of civil engineering will be able to • Plan, analyze, design and prepare technical reports for civil engineering structures • Apply advanced techniques and management skills for the execution of civil engineering projects.

PROGRAM OUTCOMES:

At the end of this programme the students will be able to

a-l	GRADUATE ATTRIBUTES	PO No.	PROGRAMME OUTCOMES
a	Engineering Knowledge	PO1	Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
b	Problem Analysis	PO2	Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
c	Design and Development of Solutions	PO3	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.
d	Conduct Investigation of Complex Problems	PO4	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.
e	Modern Tool Usage	PO5	Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
f	The Engineer and Society	PO6	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.
g	Environment and Sustainability	PO7	Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
h	Ethics	PO8	Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
i	Individual and Team Work.	PO9	Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
j	Communication	PO10	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.
k	Project Management and Finance	PO11	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.
l	Lifelong Learning	PO12	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.

MAPPING OF PROGRAMME EDUCATIONAL OBJECTIVES WITH PROGRAMME OUTCOMES

A broad relation between the programme educational objectives and the programme outcomes is given in the following table

PROGRAMME EDUCATIONAL OBJECTIVES	PROGRAMME OUTCOMES											
	A	B	C	D	E	F	G	H	I	J	K	L
1	3	1	3	3	3	2	3	3	2	3	2	3
2	3	2	3	3	3	2	3	2	2	3	2	3
3	2	2	3	2	3	3	2	3	3	3	3	3

MAPPING OF PROGRAM SPECIFIC OUTCOMES WITH PROGRAMME OUTCOMES

A broad relation between the program specific outcomes and the programme outcomes is given in the following table

PROGRAM SPECIFIC OUTCOMES	PROGRAMME OUTCOMES											
	A	B	C	D	E	F	G	H	I	J	K	L
1	2	1	3	2	3	2	2	3	3	3	3	3
2	1	1	2	2	3	2	2	3	3	3	3	3

Contribution 1: Reasonable 2: Significant 3: Strong

NANDHA ENGINEERING COLLEGE (AUTONOMOUS), ERODE – 638 052

REGULATIONS - 2022 CHOICE BASED CREDIT SYSTEM

B.E. CIVIL ENGINEERING

SEMESTER: I									
S. NO.	**COURSE CODE**	**COURSE TITLE**	**CATEGORY**	**PRE REQUISITE**	**CONTACT PERIODS**	**L**	**T**	**P**	**C**
THEORY									
1	22EYA01	Professional Communication - I	HSMC	-	4	2	0	2	3
2	22MYB01	Calculus and Linear Algebra*	BSC	-	4	3	1	0	4
3	22CYB02	Chemistry for Engineers	BSC	-	3	3	0	0	3
4	22EEC01	Basic Electrical and Electronics Engineering	ESC	-	3	3	0	0	3
5	22MEC01	Engineering Graphics	ESC	-	4	2	0	2	3
6	22GYA01	□□□□□□ □□□□ / Heritage of Tamils	HSMC	-	1	1	0	0	1
PRACTICAL									
7	22GEP01	Engineering Practices Laboratory	ESC	-	4	0	0	4	2
8	22CYP01	Chemistry Laboratory*	BSC	-	2	0	0	2	1
Mandatory Non Credit Courses									
9	22MAN01	Induction Programme	MC	-	0	0	0	0	0
10	22MAN03	Yoga - I*	MC	-	1	0	0	1	0
				TOTAL	**26**	**14**	**1**	**11**	**20**

*Ratified by Eleventh Academic Council

SEMESTER: II									
S. NO.	**COURSE CODE**	**COURSE TITLE**	**CATEGORY**	**PRE REQUI SITE**	**CONTACT PERIODS**	**L**	**T**	**P**	**C**
THEORY									
1	22EYA02	Professional Communication- II	HSMC	22EYA01	4	2	0	2	3
2	22MYB02	Partial Differential Equations and Transform Techniques*	BSC	-	4	3	1	0	4
3	22PYB02	Advanced Materials and Nanotechnology	BSC	-	3	3	0	0	3
4	22CSC01	Problem Solving and C Programming*	ESC	-	3	3	0	0	3
5	22CEC01	Fundamentals of Engineering Mechanics	ESC	-	3	2	1	0	3
6	22CYB08	Environment and Sustainability*	BSC	-	2	2	0	0	2
7	22GYA02	□□□□□□□□ □□□□□□□□□□□ □□□□ / Tamils and Technology	HSMC	-	1	1	0	0	1
PRACTICAL									
6	22PYP01	Physics Laboratory*	BSC	-	2	0	0	2	1
7	22CSP01	Problem Solving and C Programming Laboratory*	ESC	-	4	0	0	4	2
Mandatory Non Credit Courses									
8	22MAN02R	Soft /Analytical Skills - I	MC	-	3	1	0	2	0
9	22MAN05	Yoga - II*	MC	-	1	0	0	1	0
				TOTAL	**30**	**17**	**2**	**11**	**22**

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SEMESTER: III									
S. NO.	**COURSE CODE**	**COURSE TITLE**	**CATEGORY**	**PRE REQUISITE**	**CONTACT PERIODS**	**L**	**T**	**P**	**C**
THEORY									
1	22MYB03	Statistics and Numerical Methods	BSC	-	4	3	1	0	4
2	22CEC02	Mechanics of Materials	ESC	22CEC01	3	3	0	0	3
3	22CEC03	Highway and Railway Engineering	PCC	-	3	3	0	0	3
4	22CEC04	Surveying	PCC	-	3	3	0	0	3
5	22CEC05	Construction Materials and Practices	PCC	-	5	3	0	2	4
6	22CEC06	Fluid Mechanics and Hydraulics Engineering	PCC	-	5	3	0	2	4
PRACTICAL									
7	22CEP01	Surveying Laboratory	PCC	-	4	0	0	4	2
8	22CEP02	Computer Aided Building Drawing - I	PCC	-	4	0	0	4	2
Mandatory Non Credit Courses									
9	22MAN04R	Soft / Analytical Skills - II	MC	-	3	1	0	2	0
				TOTAL	**34**	**19**	**1**	**14**	**25**

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SEMESTER: IV									
S. NO.	**COURSE CODE**	**COURSE TITLE**	**CATEGORY**	**PRE REQUI SITE**	**CONTACT PERIODS**	**L**	**T**	**P**	**C**
THEORY									
1	22CEC07	Structural Analysis	PCC	22CEC02	4	3	1	0	4
2	22CEC08	Water Resources and Irrigation Engineering	PCC	-	3	3	0	0	3
3	22CEC09	Soil Mechanics	PCC	-	5	3	0	2	4
4	22CEC10	Design of Reinforced Concrete Elements	PCC	-	3	3	0	0	3
5	22CEC11	Concrete Technology	PCC	22CEC05	3	3	0	0	3
6	22CEC12	Environmental Engineering	PCC	-	5	3	0	2	4
PRACTICAL									
7	22CEP03	Computer Aided Building Drawing - II	PCC	-	4	0	0	4	2
Mandatory Non Credit Courses									
8	22MAN07R	Soft/Analytical Skills -III	MC	-	5	3	0	2	0
9	22MAN09	Indian Constitution	MC	-	1	1	0	0	0
10	22GED01	Personality and Character Development	EEC	-	0	0	0	1	0
				TOTAL	**33**	**22**	**1**	**11**	**23**

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SEMESTER: V									
S. NO.	**COURSE CODE**	**COURSE TITLE**	**CATEGORY**	**PRE REQUISITE**	**CONTACT PERIODS**	**L**	**T**	**P**	**C**
THEORY									
1	22CEC13	Design of Reinforced Concrete Structures	PCC	22CEC10	3	3	0	0	3
2	22CEC14	Foundation Engineering	PCC	22CEC09	3	3	0	0	3
3	22CEC15	Design of Steel Structures	PCC	-	3	3	0	0	3
4	E1	Elective (PEC)	PEC	-	3	3	0	0	3
5	E2	Elective (PEC)	PEC	-	3	3	0	0	3
6	E3	Elective (PEC)	PEC	-	3	3	0	0	3
PRACTICAL									
7	22CEP04	Concrete Technology Laboratory	PCC	-	4	0	0	4	2
8	22CEP05	Design and Drawing Laboratory	PCC	-	4	0	0	4	2
Mandatory Non Credit Courses									
9	22MAN08R	Soft/Analytical Skills - IV	MC	-	3	1	0	2	0
				TOTAL	**29**	**19**	**0**	**10**	**22**

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SEMESTER: VI									
S. NO.	**COURSE CODE**	**COURSE TITLE**	**CATEGORY**	**PRE REQUI SITE**	**CONTACT PERIODS**	**L**	**T**	**P**	**C**
THEORY									
1	22CEC16	Estimation and Costing	PCC	-	5	3	0	2	4
2	22CEC17	Pre Engineering Buildings	PCC	-	3	3	0	0	3
3	EM1	Elective (Management)	HSMC	-	3	3	0	0	3
4	E4	Elective (PEC)	PEC	-	3	3	0	0	3
5	E5	Elective (PEC)	PEC	-	3	3	0	0	3
6	E6	Elective (PEC / OEC)	PEC / OEC	-	3	3	0	0	3
PRACTICAL									
7	22CEP06	Computer Aided Structural Design Laboratory	PCC	-	4	0	0	4	2
8	22CEP07	Survey Camp	PCC	-	2	0	0	2	1
				TOTAL	**26**	**18**	**0**	**8**	**22**

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SEMESTER: VII									
S. NO.	**COURSE CODE**	**COURSE TITLE**	**CATEGORY**	**PRE REQUISITE**	**CONTACT PERIODS**	**L**	**T**	**P**	**C**
THEORY									
1	22GEA01	Universal Human Values	HSMC	-	2	2	0	0	2
2	E7	Elective (PEC)	PEC	-	3	3	0	0	3
3	E8	Elective (PEC / OEC)	PEC / OEC	-	3	3	0	0	3
4	E9	Elective (OEC)	OEC	-	3	3	0	0	3
5	E10	Elective (OEC)	OEC	-	3	3	0	0	3
PRACTICAL									
6	22CED01	Design Project	EEC	-	4	0	0	4	2
7	22GED02	Internship / Industrial Training	EEC	-	-	0	0	0	2
				TOTAL	**18**	**14**	**0**	**4**	**18**

SEMESTER: VIII									
S. NO.	**COURSE CODE**	**COURSE TITLE**	**CATEGORY**	**PRE REQUISITE**	**CONTACT PERIODS**	**L**	**T**	**P**	**C**
PRACTICAL									
1	22CED02	Project Work	EEC	-	20	0	0	20	10
				TOTAL	**20**	**0**	**0**	**20**	**10**

Total Credits: 20+22+25+23+22+22+18+10 = **162**

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(A) HSMC, BSC and ESC									
(a) Humanities and Social Sciences including Management Courses (HSMC)									
S. NO.	**COURSE CODE**	**COURSE TITLE**	**CATEGORY**	**PRE REQUI SITE**	**CONTACT PERIODS**	**L**	**T**	**P**	**C**
1.	22EYA01	Professional Communication - I	HSMC	-	4	2	0	2	3
2.	22GYA01	□□□□□□ □□□□ / Heritage of Tamils	HSMC	-	1	1	0	0	1
3.	22EYA02	Professional Communication- II	HSMC	22EYA01	4	2	0	2	3
4.	22GYA02	□□□□□□□□ □□□□□□□□□□□□□□ □□ / Tamils and Technology	HSMC	-	1	1	0	0	1
5.	22GEA01	Universal Human Values	HSMC	-	2	2	0	0	2
(b) Basic Science Courses (BSC)									
S. NO.	**COURSE CODE**	**COURSE TITLE**	**CATEGORY**	**PRE REQUI SITE**	**CONTACT PERIODS**	**L**	**T**	**P**	**C**
1.	22MYB01	Calculus and Linear Algebra	BSC	-	4	3	1	0	4
2.	22CYB02	Chemistry for Engineers	BSC	-	3	3	0	0	3
3.	22CYP01	Chemistry Laboratory	BSC	-	2	0	0	2	1
4.	22MYB02	Partial Differential Equations and Transform Techniques	BSC	-	4	3	1	0	4
5.	22PYB02	Advanced Materials and Nanotechnology	BSC	-	3	3	0	0	3
6.	22CYB08	Environment and Sustainability	BSC	-	2	2	0	0	2
7.	22PYP01	Physics Laboratory	BSC	-	2	0	0	2	1
8.	22MYB03	Statistics and Numerical Methods	BSC	-	4	3	1	0	4

(c) Engineering Science Courses (ESC)									
S. NO.	**COURSE CODE**	**COURSE TITLE**	**CATEGORY**	**PRE REQUI SITE**	**CONTACT PERIODS**	**L**	**T**	**P**	**C**
1.	22EEC01	Basic Electrical and Electronics Engineering	ESC	-	3	3	0	0	3
2.	22MEC01	Engineering Graphics	ESC	-	4	2	0	2	3
3.	22GEP01	Engineering Practices Laboratory	ESC	-	4	0	0	4	2
4.	22CSC01	Problem Solving and C Programming	ESC	-	3	3	0	0	3
5.	22CEC01	Fundamentals of Engineering Mechanics	ESC	-	3	2	1	0	3
6.	22CSP01	Problem Solving and C Programming Laboratory	ESC	-	4	0	0	4	2
7.	22CEC02	Mechanics of Materials	ESC	22CEC01	3	3	0	0	3

(B) Program Core Courses (PCC)									
S. NO.	**COURSE CODE**	**COURSE TITLE**	**CATEGORY**	**PRE REQUI SITE**	**CONTACT PERIODS**	**L**	**T**	**P**	**C**
1.	22CEC03	Highway and Railway Engineering	PCC	-	3	3	0	0	3
2.	22CEC04	Surveying	PCC	-	3	3	0	0	3
3.	22CEC05	Construction Materials and Practices	PCC	-	5	3	0	2	4
4.	22CEC06	Fluid Mechanics and Hydraulics Engineering	PCC	-	5	3	0	2	4
5.	22CEP01	Surveying Laboratory	PCC	-	4	0	0	4	2
6.	22CEP02	Computer Aided Building Drawing - I	PCC	-	4	0	0	4	2
7.	22CEC07	Structural Analysis	PCC	22CEC02	4	3	1	0	4

8.	22CEC08	Water Resources and Irrigation Engineering	PCC	-	3	3	0	0	3
9.	22CEC09	Soil Mechanics	PCC	-	5	3	0	2	4
10.	22CEC10	Design of Reinforced Concrete Elements	PCC	-	3	3	0	0	3
11.	22CEC11	Concrete Technology	PCC	22CEC05	3	3	0	0	3
12.	22CEC12	Environmental Engineering	PCC	-	5	3	0	2	4
13.	22CEC13	Design of Reinforced Concrete Structures	PCC	-	3	3	0	0	3
14.	22CEC14	Foundation Engineering	PCC	22CEC09	3	3	0	0	3
15.	22CEC15	Design of Steel Structures	PCC	-	3	3	0	0	3
16.	22CEP04	Concrete Technology Laboratory	PCC	-	4	0	0	4	2
17.	22CEP05	Design and Drawing Laboratory	PCC	-	4	0	0	4	2
18.	22CEC16	Estimation and Costing	PCC	-	5	3	0	2	4
19.	22CEC17	Pre Engineering Buildings	PCC	-	3	3	0	0	3
20.	22CEP06	Computer Aided Structural Design Laboratory	PCC	-	4	0	0	4	2
21.	22CEP07	Survey Camp	PCC	-	2	0	0	2	1

(C) EEC & MC									
(a) Employability Enhancement Courses (EEC)									
S. NO.	**COURSE CODE**	**COURSE TITLE**	**CATEGORY**	**PRE REQUISITE**	**CONTACT PERIODS**	**L**	**T**	**P**	**C**
1.	22CED01	Design Project	EEC	-	4	0	0	4	2
2.	22GED02	Internship / Industrial Training	EEC	-	-	0	0	0	2
3.	22CED02	Project Work	EEC	-	20	0	0	20	10
(b) Mandatory Courses (MC)									
1.	22MAN01	Induction Programme	MC	-	0	0	0	0	0
2.	22MAN02R	Soft /Analytical Skills - I	MC	-	3	1	0	2	0
3.	22MAN03	Yoga - I	MC	-	1	0	0	1	0
4.	22MAN04R	Soft / Analytical Skills - II	MC	-	3	1	0	2	0
5.	22MAN05	Yoga - II	MC	-	1	0	0	1	0
6.	22MAN07R	Soft/Analytical Skills - III	MC	-	5	3	0	2	0
7.	22MAN08R	Soft/Analytical Skills - IV	MC	-	3	1	0	2	0
8.	22MAN09	Indian Constitution	MC	-	1	1	0	0	0
9.	22GED01	Personality and Character Development	MC	-	0	0	0	1	0

(D) Programme Elective Courses (PEC)									
S. NO.	**COURSE CODE**	**COURSE TITLE**	**CATEGORY**	**PRE REQUISITE**	**CONTACT PERIODS**	**L**	**T**	**P**	**C**
VERTICAL I - STRUCTURES									
1.	22CEX01	Advanced Steel Design	PEC	22CEC15	3	3	0	0	3
2.	22CEX02	Prefabricated Structures	PEC	-	3	3	0	0	3
3.	22CEX03	Prestressed Concrete Structures	PEC	-	3	3	0	0	3
4.	22CEX04	Distress Monitoring and Rehabilitation of Structures	PEC	-	3	3	0	0	3
5.	22CEX05	Dynamics and Earthquake Resistant Structures	PEC	-	3	3	0	0	3

6.	22CEX06	Introduction to Finite Element Method	PEC	-	3	3	0	0	3
7.	22CEX07	Advanced Structural Analysis	PEC	22CEC07	3	3	0	0	3
8.	22CEX08	Steel Concrete Composite Structures	PEC	-	3	3	0	0	3
VERTICAL 2 - CONSTRUCTION ENGINEERING AND MANAGEMENT									
1.	22CEX11	Construction Equipment and Management	PEC	-	3	3	0	0	3
2.	22CEX12	Sustainable and Lean Construction	PEC	-	3	3	0	0	3
3.	22CEX13	Safety in Construction Practices	PEC	-	3	3	0	0	3
4.	22CEX14	Advanced Construction Techniques	PEC	-	3	3	0	0	3
5.	22CEX15	Energy Efficient Buildings	PEC	-	3	3	0	0	3
6.	22CEX16	Construction Planning and Scheduling	PEC	-	3	3	0	0	3
7.	22CEX17	Architecture and Town Planning	PEC	-	3	3	0	0	3
8.	22CEX18	Contract Management	PEC	-	3	3	0	0	3
VERTICAL 3 - INFRASTRUCTURE ENGINEERING									
1.	22CEX21	Airports and Harbours	PEC	-	3	3	0	0	3
2.	22CEX22	Traffic Engineering and Management	PEC	-	3	3	0	0	3
3.	22CEX23	Urban Planning and Development	PEC	-	3	3	0	0	3
4.	22CEX24	Smart cities	PEC	-	3	3	0	0	3
5.	22CEX25	Intelligent Transport Systems	PEC	-	3	3	0	0	3
6.	22CEX26	Pavement Engineering	PEC	-	3	3	0	0	3
7.	22CEX27	Transportation Planning Process	PEC	-	3	3	0	0	3
8.	22CEX28	Transportation Economics	PEC	-	3	3	0	0	3

VERTICAL 4 - ENVIRONMENT AND WATER RESOURCES									
1.	22CEX31	Climate Change Adaptation and Mitigation	PEC	-	3	3	0	0	3
2.	22CEX32	Air and Noise Pollution Control Engineering	PEC	-	3	3	0	0	3
3.	22CEX33	Environmental Impact Assessment	PEC	22CEC12	3	3	0	0	3
4.	22CEX34	Industrial Wastewater Management	PEC	-	3	3	0	0	3
5.	22CEX35	Solid and Hazardous Waste Management	PEC	-	3	3	0	0	3
6.	22CEX36	Plumbing (Water & Sanitation)	PEC	-	3	3	0	0	3
7.	22CEX37	Transport and Environment	PEC	-	3	3	0	0	3
8.	22CEX38	Groundwater Engineering	PEC	-	3	3	0	0	3
VERTICAL 5 - GEO TECHNICAL									
1.	22CEX41	Ground Improvement Techniques	PEC	-	3	3	0	0	3
2.	22CEX42	Engineering Geology	PEC	-	3	3	0	0	3
3.	22CEX43	Site Investigation and Soil Exploration	PEC	-	3	3	0	0	3
4.	22CEX44	Slope Stability and Landslides	PEC	-	3	3	0	0	3
5.	22CEX45	Rock mechanics	PEC	-	3	3	0	0	3
6.	22CEX46	Geo Environmental Engineering	PEC	-	3	3	0	0	3
7.	22CEX47	Offshore Engineering	PEC	-	3	3	0	0	3
8.	22CEX48	Advanced Foundation Engineering	PEC	-	3	3	0	0	3
VERTICAL 6 - DIVERSIFIED COURSE									
1.	22CEX51	Green Buildings	PEC	-	3	3	0	0	3
2.	22CEX52	Building Information Modeling	PEC	-	3	3	0	0	3
3.	22CEX53	Advanced Surveying	PEC	-	3	3	0	0	3
4.	22CEX54	Remote Sensing and GIS	PEC	-	3	3	0	0	3
5.	22CEX55	AI in Civil Engineering	PEC	-	3	3	0	0	3
6.	22CEX56	Rainwater Harvesting	PEC	-	3	3	0	0	3
7.	22CEX57	Disaster Preparedness and Planning	PEC	-	3	3	0	0	3
8.	22CEX58	Construction Economics and Finance	PEC	-	3	3	0	0	3

(E) Management Elective Courses									
S. NO.	**COURSE CODE**	**COURSE TITLE**	**CATEGORY**	**PRE REQUI SITE**	**CONTACT PERIODS**	**L**	**T**	**P**	**C**
1.	22GEA02	Principles of Management	HSMC	-	3	3	0	0	3
2.	22GEA03	Total Quality Management	HSMC	-	3	3	0	0	3
3.	22GEA04	Professional Ethics	HSMC	-	3	3	0	0	3
4.	22GEZ01	Entrepreneurship Development	HSMC	-	4	2	0	2	3

(F) Open Elective Courses (OEC)									
S. NO.	**COURSE CODE**	**COURSE TITLE**	**CATEGORY**	**PRE REQUI SITE**	**CONTACT PERIODS**	**L**	**T**	**P**	**C**
1.	22CEZ01	Drinking Water Supply and Treatment	OEC	-	3	3	0	0	3
2.	22CEZ02	Waste Management	OEC	-	3	3	0	0	3
3.	22CEZ03	Building Services	OEC	-	3	3	0	0	3
4.	22CEZ04	Energy Conservation in Buildings	OEC	-	3	3	0	0	3

(G) Minor Degree Courses									
S. NO.	**COURSE CODE**	**COURSE TITLE**	**CATEGORY**	**PRE REQUI SITE**	**CONTACT PERIODS**	**L**	**T**	**P**	**C**
ENVIRONMENT AND SUSTAINABILITY									
1.	22CEM01	Introduction to Sustainability	OEC	-	3	3	0	0	3
2.	22CEM02	Environment Ecology	OEC	-	3	3	0	0	3
3.	22CEM03	Environmental Health and Safety	OEC	-	3	3	0	0	3
4.	22CEM04	Green Technology	OEC	-	3	3	0	0	3
5.	22CEM05	Functional Efficiency in Buildings	OEC	-	3	3	0	0	3
6.	22CEM06	Water Conservation and Sustainability	OEC	-	3	3	0	0	3
7.	22CEM07	Sustainability and Lifecycle Assessment	OEC	-	3	3	0	0	3
8.	22CEM08	Global Warming and Climate Change	OEC	-	3	3	0	0	3

*Ratified by thirteenth Academic Council

SUMMARY

Semester/ Category	HSMC	BSC	ESC	PCC	EEC	PEC	OEC	Total
1	4	8	8					**20**
2	4	10	8					**22**
3		4	3	18				**25**
4				23				**23**
5				13		9		**22**
6	3			10		6	3	**22**
7	2				4	3	9	**18**
8					10			**10**
Total	13	22	19	64	14	18	12	**162**
%	**8.0**	**13.6**	**11.7**	**39.5**	**8.6**	**11.1**	**7.5**	**100**
AICTE Credits Recommended	06	24	20	62	16	20	12	**160**
	3.8%	**15%**	**12.4%**	**38.8%**	**10%**	**12.5%**	**7.5%**	**100**

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22EYA01 - PROFESSIONAL COMMUNICATION I (Common to All Branches)					
		L	**T**	**P**	**C**
		2	**0**	**2**	**3**
PREREQUISITE : NIL					
Course Objective:	• To build essential English skills to address the challenges of communication • To enhance communication employing LSRW skills				

Course Outcomes The Student will be able to		**Cognitive Level**	**Weightage of COs in End Semester Examination**
CO1	Communicate effectively in various work environments.	R	20%
CO2	Involve in diverse discourse forms utilizing LSRW Skills.	U	20%
CO3	Participate actively in communication activities that enhance the creative skill.	U	20%
CO4	Associate with the target audience and contexts using varied types of communication.	Ap	20%
CO5	Convey the ideas distinctly both in verbal and non-verbal communication in work culture.	U	20%

UNIT I - INTRODUCTORY SKILLS	**(6+6)**
Grammar - Parts of Speech - Verb (Auxiliaries - Primary & Modal, Main Verb) - **Listening** - Listening to Short Conversations or Monologues - Listening to Experiences - Listening to Descriptions - **Speaking** - Introducing Oneself - Exchanging Personal information -Talking about food and culture - **Reading** - Reading for Interrogation - Reading Newspaper, Advertisements and Interpreting - **Writing** - Seeking Permission for Industrial Visit & In-plant Training	
UNIT II - LANGUAGE ACUMEN	**(6+6)**
Grammar - Word Formation - Tenses (Present Tense) - Synonyms & Antonyms - **Listening** - Listening to Announcements - Listening to Interviews - Listening and Note-taking - **Speaking** - Talking about Holidays & Vacations - Narrating Unforgettable Anecdotes - **Reading** - Skimming - Scanning (Short Texts and Longer Passages) - Critical Reading - **Writing** - Instruction - Process Description	
UNIT III - COMMUNICATION ROOTERS	**(6+6)**
Grammar - Cause and Effect -Tenses (Past Tense) - Discourse Markers - **Listening** - Listening to Telephonic Conversations - Listening to Podcasts - **Speaking** - Talking about neoteric Technologies - Eliciting information to fill a form - **Reading** - Book Reading(Motivational) - Practicing Speed Reading (reading newspaper reports & biographies) - **Writing** - Checklist - Circular, Agenda & Minutes of the Meeting	
UNIT IV - DISCOURSE FORTE	**(6+6)**
Grammar - Tenses (Future Tense) - Yes/No & WH type questions - Negatives - **Listening** - Listening to TED/ Ink talks -**Speaking** - Participating in Short Conversations - **Reading** - Reading Comprehension (Multiple Choice / Short / Open Ended Questions) - **Writing** - E-Mail Writing	

UNIT V - LINGUISTIC COMPETENCIES	(6+6)
Grammar - Articles - Homophones & Homonyms - Single line Definition - Phrasal Verb - **Listening** - Intensive listening to fill in the gapped text - **Speaking** - Expressing opinions through Situations & Role play **Reading** - Cloze Texts - **Writing** - Paragraph Writing	

LIST OF SKILLS ASSESSED IN THE LABORATORY

1. Grammar
2. Listening Skills
3. Speaking Skills
4. Reading Skills
5. Writing Skills

TOTAL (L:30, P:30) = 60 PERIODS

TEXT BOOK:

1. Shoba K N., Deepa Mary Francis. "English for Engineers and Technologists", Volume 1, 3rd Edition, Orient BlackSwan Pvt.Ltd, Telangana, 2022.

REFERENCES:

1. Koneru, Aruna," English Language Skills" Tata McGraw Hill Education (India) Private Limited, Chennai, 2006.
2. Hewings, M. Advanced English Grammar. Cambridge University Press, Chennai, 2000.
3. Jack C Richards, Jonathan Hull and Susan Proctor. Interchange. Cambridge University Press, New Delhi, 2015 (Reprint 2021).

WEB REFERENCE:

1. https://youtu.be/f0uqUzEf3A8?si=vyzu5KGIfbu35_IQ

Mapping of COs with POs / PSOs

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1									2	3				2
2									2	3				
3									2	3				
4									2	3				2
5									2	3				
CO (W.A)									**2**	**3**				**2**

22MYB01-CALCULUS AND LINEAR ALGEBRA
(Common to All Branches)

	L	T	P	C
	3	1	0	4

PREREQUISITE : NIL

Course Objective:	• To understand the mathematical concepts of matrices and analytical geometry in real time problems. • To formulate differential and integral equations to model physical, biological, and engineering systems

Course Outcomes The Student will be able to		**Cognitive Level**	**Weightage of COs in End Semester Examination**
CO1	Apply the concepts of matrix theory for find solutions to complex problems efficiently.	Ap	20%
CO2	Analyze the geometric configurations and relationships by using Analytical geometry.	An	20%
CO3	Interpret the partial derivatives which involve heat conduction problems modeled by the heat equation.	Ap	20%
CO4	Apply the differential and integral techniques to solve the differential equations and multiple integrals in heat conduction, fluid mechanics and potential theory.	Ap	40%
CO5	Demonstrate the importance of matrix theory, analytical geometry and integral methods using programming tools.	Ap	Internal Assessment

UNIT I - MATRICES	**(9+3)**
Characteristic Equation - Eigen values and Eigen vectors of a matrix - Cayley Hamilton Theorem (excluding proof) and its applications - Quadratic form-Reduction of a Quadratic form to canonical form by orthogonal transformation.	
UNIT II - ANALYTICAL GEOMETRY OF THREE DIMENSIONS	**(9+3)**
Equation of plane - Angle between two planes - Equation of straight lines - Coplanar lines - Equation of sphere - Orthogonal spheres.	
UNIT III - GEOMETRICAL APPLICATIONS OF DIFFERENTIAL CALCULUS	**(9+3)**
Curvature - Curvature in Cartesian co-ordinates - Centre and Radius of curvature - Circle of curvature - Evolutes and Involutes.	
UNIT IV - FUNCTIONS OF SEVERAL VARIABLES	**(9+3)**
Partial derivatives - Euler's theorem on homogeneous function - Jacobian - Maxima and Minima of functions of two variables - Constrained Maxima and Minima by Lagrange's multiplier method.	
UNIT V - MULTIPLE INTEGRALS	**(9+3)**
Double integration in Cartesian Co-ordinates - Change of order of integration - Area as double integral - Triple integration in Cartesian Co-ordinates - Volume as triple integrals.	
TOTAL (L:45+T:15) :60 PERIODS	

LIST OF PROGRAMS USING MATLAB (Assignment/Online Test**)**:

1. Introduction to MATLAB
2. Matrix operations - Addition, Multiplication, Transpose and Inverse
3. Characteristic equation of a Matrix
4. Eigen values and Eigen vectors of Higher order Matrices.
5. Curve Tracing
6. Determining Maxima and Minima of a function of one variable.
7. Determining Maxima and Minima of a function of two variables.
8. Evaluating double integrals
9. Evaluating triple integrals
10. Finding area between two curves.

TEXT BOOKS:

1. Dr.B.S.Grewal, "Higher Engineering Mathematics", 42nd Edition, Khanna publications, 2012.
2. Erwin Kreyszig , "Advanced Engineering Mathematics", 9th Edition, John Wiley & sons, 2013
3. Veerarajan.T, "Engineering Mathematics of Semester I & II", 3rd Edition, Tata McGraw Hill., 2016

REFERENCES:

1. N.P.Bali, Manish Goyal, "A Text book of Engineering Mathematics - Sem - II", 6th Edition, Laxmi Publications, 2014.
2. Kandasamy.P, Thilagavathy.K, Gunavathy .K, "Engineering Mathematics for First Year", 9th Rev.Edition, S.Chand & Co Ltd, 2013.
3. Glyn James, "Advanced Engineering Mathematics", 7th Edition, Wiley India, 2007.

Mapping of COs with POs / PSOs

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	3													2
2		2												
3		2												
4	3													
5	3				2				3			2		2
CO (W.A)	**3**	**2**			**2**				**3**			**2**		**2**

*Ratified by Eleventh Academic Council

22CYB02 - CHEMISTRY FOR ENGINEERS (Common to CIVIL and MECH Branches)				
	L	**T**	**P**	**C**
	3	**0**	**0**	**3**

PREREQUISITE : NIL

Course Objective:	• To make the students conversant with water treatment, boiler feed water techniques, energy storage devices and corrosive nature of metals. • To impart knowledge on the basic principles, preparatory methods of nanomaterials and combustion nature of fuels.

Course Outcomes The Student will be able to		**Cognitive Level**	**Weightage of COs in End Semester Examination**
CO1	Predict the nature, oxidation and reduction potential of an electrode.	An	20%
CO2	Investigate on renewable energy sources like nuclear, solar, wind energy and also on storage devices.	E	20%
CO3	Identify the types of hardness in water and its removal by various water treatment techniques.	Ap	20%
CO4	Explore the type of corrosion and its control measures.	An	20%
CO5	Recommend suitable fuels for engineering processes and applications.	E	20%

UNIT I - ELECTROCHEMISTRY	**(9)**
Electrode potential - Nernst equation - derivation and problems - reference electrodes - standard hydrogen electrode - calomel electrode - electrochemical series - significance - Types of cell - electrolytic and electrochemical cells - reversible and irreversible cells - potentiometric titrations (redox) - conductometric titrations (acid-base).	
UNIT II - ENERGY SOURCES AND STORAGE DEVICES	**(9)**
Nuclear energy - nuclear fission - nuclear fusion - light water nuclear power plants - breeder reactor - solar energy conversion - solar cells - solar water heater - Recent developments in solar cell materials - wind energy - batteries - types of batteries - lead acid storage battery - lithium-ion battery, Electric vehicles - working principles.	
UNIT III - WATER TECHNOLOGY AND NANO MATERIALS	**(9)**
Municipal water treatment - disinfection methods (uv, ozonation, chlorination) - desalination of brackish water - reverse osmosis - boiler troubles (scale, sludge , priming, foaming and caustic embrittlement) - treatment of boiler feed water - internal treatment (carbonate, phosphate and calgon conditioning) - external treatment - demineralization process. Nanomaterials - synthesis (laser ablation, and chemical vapour deposition method) and applications of nanomaterials.	
UNIT IV - CORROSION AND ITS CONTROL	**(9)**
Corrosion - types - chemical corrosion - pilling bedworth rule - electrochemical corrosion - mechanism-galvanic corrosion - differential aeration corrosion - factors influencing corrosion - corrosion control - sacrificial anode and impressed cathodic current methods - corrosion inhibitors - protective coatings - paints - constituents and their functions	

UNIT V - FUELS AND COMBUSTION	(9)
Fuels: Introduction: Classification of fuels: Coal and coke: Analysis of coal (Proximate) - Carbonization - Manufacture of metallurgical coke (Otto Hoffmann method). Petroleum and Diesel: Manufacture of synthetic petrol (Bergius process) - Knocking - octane number - diesel oil - cetane number: Power alcohol and biodiesel. Combustion of fuels: Introduction: Calorific value - higher and lower calorific values, Flue gas analysis - ORSAT method. CO2 emission and carbon foot print.	
TOTAL (L:45) : 45 PERIODS	

TEXT BOOKS:

1. Dr.Ravikrishnan, A,"Engineering Chemistry I & Engineering Chemistry II", Sri Krishna Hitech Publishing chem., Co. Pvt Ltd., 13th Edition, Chennai, 2020.
2. S.S. Dara," A Text book of Engineering Chemistry", S.Chand & Co.Ltd. New Delhi, 2019.

REFERENCES:

1. P.C.Jain and Monica Jain, "Engineering Chemistry", Vol I &II, Dhanpat Rai Pub, Co, New Delhi, 15th Edition, 2018.
2. B.Sivasankar, "Engineering Chemistry", Tata McGraw- Hill Pub.Co.Ltd., New Delhi, 2018

Mapping of COs with POs / PSOs

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	3								2					
2		2												
3														2
4			2				2							
5		2				2						2		
CO (W.A)	3	2	2			2	2		2			2		2

22EEC01 - BASIC ELECTRICAL AND ELECTRONICS ENGINEERING *(Common to CHEMICAL and CIVIL Branches)*				
	L	**T**	**P**	**C**
	3	**0**	**0**	**3**

PREREQUISITE : NIL

Course Objective:	• To impart knowledge on the concepts of electrical circuit laws, measuring instruments, AC and DC machines. • To Gain information on the basic principles of semiconductor devices with applications and digital systems.

Course Outcomes The Student will be able to		**Cognitive Level**	**Weightage of COs in End Semester Examination**
CO1	Apply principles of semiconductor physics to predict the behavior of electrical circuits, diodes, bipolar junction transistors (BJTs) in different circuit configurations and basics of digital systems using logic gates.	Ap	25%
CO2	Illustrate the operation and types of electrical circuits and machines including measuring instruments.	Ap	25%
CO3	Analyze the Characteristics for various diodes, AC machines and DC machines.	An	25%
CO4	Design digital circuits that meet specified needs with appropriate consideration and develop a simple electronic circuit using diodes and transistors	Ap	25%
CO5	Achieve as an independent learner in a team to build an authentic application of electrical and electronics engineering and make an effective oral presentation.	C	Internal Assessment (Seminar)

UNIT I - ELECTRICAL CIRCUITS AND MEASURMENTS	**(9)**
Introduction to DC circuits - Ohm's Law - Kirchhoff's Laws - Resistive circuits - Resistors in Series and parallel - Introduction to AC circuits - Power and Power factor - Classification of measuring instruments - Dynamometer type wattmeter - Induction type energy meter	
UNIT II - DC MACHINES	**(9)**
DC Generator: Construction, Types, Principle of operation, EMF equation, Characteristics. DC Motor: Principle of operation, Types, Torque equation, Characteristics and Applications.	
UNIT III - AC MACHINES	**(9)**
Single phase induction motor: Construction, Types, working principle - Three phase induction motor: Construction, Types, Torque - Slip Characteristics - Synchronous motor: Construction, working principle.	
UNIT IV - SEMICONDUCTOR DEVICES AND ITS APPLICATIONS	**(9)**
Introduction - Characteristics of PN junction diode and Zener diode - Half wave rectifier - Bipolar junction transistor: CB, CE, CC configurations and characteristics.	
UNIT V - DIGITAL SYSTEMS	**(9)**
Number System - Binary, Decimal, Octal, Hexadecimal - Binary arithmetic - Boolean Algebra - Logic Gates - Applications: Half Adder.	
	TOTAL (L:45) : 45 PERIODS

TEXT BOOKS:

1. D P Kothari and I.J Nagarath, "Basic Electrical Engineering", McGraw Hill Education (India) Private Limited, 4th Edition, Third Reprint, 2019.
2. R Muthusubramaian, S.Salivahanan and K.A.Muraleedharan, "Basic Electrical, Electronics and Computer Engineering", 2nd Edition, Tata McGraw Hill publishers, New Delhi, 2012

REFERENCES:

3. Jr.,William H. Hayt,Kemmerly, Jack E.Phillips, Jamie D.Durbin, Steven M. "Engineering Circuits Analysis," 9th Edition, Tata McGraw Hill publishers, New Delhi, 2020
4. S.K.Bhattacharya, "Basic Electrical and Electronics Engineering", 2nd Edition, Pearson India, New Delhi, 2017.

Mapping of COs with POs / PSOs

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	3													2
2	3													2
3		3												2
4	3													
5									3	3	3	3		
CO (W.A)	**3**	**3**							**3**	**3**	**3**	**3**		**2**

22MEC01 - ENGINEERING GRAPHICS *(Common to AGRI, CIVIL, CHEMICAL and EEE Branches)*				
L	**T**	**P**	**C**
2	**0**	**2**	**3**

PREREQUISITE : Nil

Course Objective:	• To Construct various plane curves • To Construct the concept of projection of points, lines and plane • To Develop the projection of solids • To Solve problems in sectioning of solids and developing the surfaces • To Apply the concepts of orthographic and isometric

Course Outcomes The Student will be able to		**Cognitive Level**	**Weightage of COs in End Semester Examination**
CO1	Apply the knowledge of engineering drawing standards to drawn 2D Engineering drawings.	Ap	40%
CO2	Apply the knowledge of engineering drawing standards to solve the given 2D problem using first angle of projection.	Ap	20%
CO3	Apply the knowledge of engineering drawing standards solve the 3D problem using first angle of projection	Ap	20%
CO4	Analyze the given problem to create 3D drawing	An	20%
CO5	Engage independent study as a member of team and make effective oral presentation on engineering graphics	U	Internal Assessment

CONCEPTS AND CONVENTIONS (Not for Examination)	
Importance of graphics in engineering applications - use of drafting instruments - BIS conventions and specifications - size, layout and folding of drawing sheets - lettering and dimensioning - scales.	
UNIT I - PLANE CURVES	**(6+6)**
Basic geometrical constructions, curves used in engineering practices - conics - construction of ellipse, parabola and hyperbola by eccentricity method - construction of cycloid - construction of involutes of square and circle - drawing of tangents and normal to the above curves - theory of projection - principle of multi-view orthographic projection - profile plane and side views - multiple views - representation of three dimensional objects - layout of views.	
UNIT II - PROJECTION OF POINTS, LINES AND PLANES	**(6+6)**
Principal planes - first angle projection - projection of points - projection of straight lines (only first angle projections) inclined to both the principal planes - determination of true lengths and true inclinations by rotating line method - projection of planes (polygonal and circular surfaces) inclined to both the principal planes by rotating object method.	
UNIT III - PROJECTION OF SOLIDS	**(6+6)**
Projection of simple solids like prisms, pyramids, cylinder and cone when the axis is inclined to anyone of the principal plane and parallel to another by rotating object method.	
UNIT IV - SECTION OF SOLIDS AND DEVELOPMENT OF SURFACES	**(6+6)**
Sectioning of solids (prism, cube, pyramid, cylinder and cone) in simple vertical position when the cutting plane is inclined to the one of the principal planes and perpendicular to the other - obtaining true shape of section - development of lateral surfaces of simple and sectioned solids - prisms, pyramids cylinder and cone.	

UNIT V - ISOMETRIC AND ORTHOGRAPHIC PROJECTIONS	(6+6)
Principles of isometric projection - isometric scale - isometric projections of lines, plane figures, simple solids and truncated solids - prisms, pyramids, cylinders, cones – free hand sketching of orthographic views from isometric views of objects.	
TOTAL (L:30+P:30) : 60 PERIODS	

TEXT BOOKS:

1. K.Venugopal and V.Prabhu Raja, "Engineering Graphics", New Age International (P) Limited, 2022.
2. N.S Parthasarathy and Vela Murali, "Engineering Drawing", Oxford University Press, 2015.

REFERENCES:

1. N.D.Bhatt and V.M.Panchal, "Engineering Drawing", Charotar Publishing House, 53rd Edition, 2014.
2. K.R.Gopalakrishna, "Computer Aided Engineering Drawing" (Vol I and II combined) Subhas Stores, Bangalore, 2017.
3. K. V.Natarajan, "A text book of Engineering Graphics", Dhanalakshmi Publishers, Chennai, 2018.
4. Luzzader, Warren.J, and Duff, John M, "Fundamentals of Engineering Drawing with an introduction to Interactive Computer Graphics for Design and Production", Eastern Economy Edition, Prentice Hall of India Pvt Ltd, New Delhi, 2005.
5. M.B.Shah and B.C.Rana, "Engineering Drawing", Pearson, 2nd Edition, 2009.

Mapping of COs with POs / PSOs

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	3			3								1	3	
2	3			3								1	3	
3	3			3								1	3	
4	3			3								1	3	
5	3			3					2			1	3	
CO (W.A)	**3**			**3**					**2**			**1**	**3**	

22GEP01 - ENGINEERING PRACTICES LABORATORY *(Common to AGRI, BME, CHEM, CIVIL, ECE, EEE and MECH Branches)*				
	L	**T**	**P**	**C**
	0	**0**	**4**	**2**

PREREQUISITE : NIL

Course Objective:	• To provide hands on training on various basic engineering practices in civil engineering • To provide hands on training on welding in mechanical engineering • To provide hands on training on various basic engineering practices in mechanical engineering • To understand the basic working principle of electric components • To understand the basic working principle of electronic components

Course Outcomes The Student will be able to		**Cognitive Level**
CO1	Design new layouts of civil work for residential and industrial buildings.	Ap
CO2	Apply the concepts of welding in repairing works and making various components	Ap
CO3	Design new components using machining processes in real life and industries	Ap
CO4	Apply the skills of basic electrical engineering for wiring in different areas and Measure various electrical quantities	Ap
CO5	Apply electronic principles to measure various parameters of a signal.	Ap

GROUP-A (MECHANICAL AND CIVIL ENGINEERING)

I - CIVIL ENGINEERING PRACTICE (15)

Buildings:

a. Study of plumbing and carpentry components of residential and industrial buildings, Safety aspects

Plumbing:

a. Study of tools and operations
b. Hands-on-exercise: External thread cutting and joining of pipes

Carpentry:

a. Study of tools and operations
b. Hands-on-exercise: "L" joint and "T" joint

II - MECHANICAL ENGINEERING PRACTICE (15)

Welding:

a. Study of arc welding, gas welding tools and equipments
b. Arc welding- Butt joints, Lap joints and Tee joints
c. Practicing gas welding

Basic Machining:

a. Study of lathe and drilling machine
b. Facing and turning
c. Drilling and Tapping

Sheet Metal Work:

a. Study of tools and operations
b. Rectangular tray
c. Cone

GROUP - B (ELECTRICAL AND ELECTRONICS)

I - ELECTRICAL ENGINEERING PRACTICE (15)

a. Residential house wiring using Switches ,fuse, indicator and lamp
b. Fluorescent lamp wiring
c. Stair Case Wiring
d. Measurement of electrical quantities - Voltage, current ,power in R Circuit
e. Study of Electrical apparatus-Iron box & water heater
f. Study of Electrical Measuring instruments - Megger

II - ELECTRONICS ENGINEERING PRACTICE (15)

a. Study of Electronic components and various use of multi meter.
b. Measurement of AC signal parameter (peak-peak, RMS period, frequency) using CRO.
c. Study of logic gates AND, OR, XOR and NOT.
d. Study of Clock Signal.
e. Soldering practice -Components Devices and Circuits - Using general purpose PCB.
f. Study of Half Wave Rectifier (HWR) and Full Wave Rectifier (FWR).
g. Study of Telephone, FM Radio and Cell Phone.

TOTAL (P: 60) = 60 PERIODS

Mapping of COs with POs / PSOs

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	3													
2		3												
3			2											
4	3												1	
5	3												1	
CO (W.A)	3	3	2										1	

22CYP01 CHEMISTRY LABORATORY (Common to AGRI, BME, CHEM, CIVIL, ECE, EEE and MECH Branches)				
	L	**T**	**P**	**C**
	0	**0**	**2**	**1**

PREREQUISITE : NIL

Course Objective:	• To determine the copper in brass in the given solution and explain the origin of hardness, alkalinity, chloride and dissolved oxygen in water. • To perform a potentiometric, conductometric titration and pH of an acidic solution of known Normality.

The Student will be able to **Course Outcomes**		**Cognitive Level**
CO1	Predict the various water quality parameters by volumetric analysis.	An
CO2	Evaluate the amount of copper in the given solution by titration method.	E
CO3	Analyze the conductance and emf of the different solutions.	An
CO4	Analyze and gain experimental skill about potential of hydrogen ion.	An
CO5	Examine the pH of various acidic, basic and neutral solutions.	An

LIST OF EXPERIMENTS (Any Five)

1. Determination of total, temporary & permanent hardness of water by EDTA method.
2. Determination of alkalinity in water sample.
3. Determination of chloride content of water sample by Argentometric method.
4. Determination of DO content of water sample by Winkler's method.
5. Estimation of copper in brass by EDTA.
6. Conductometric titration of strong acid Vs strong base.
7. Estimation of iron content of the given solution using potentiometer.
8. Determination of strength of given hydrochloric acid using pH meter.

Total (P:30) = 30 periods

Mapping of COs with POs / PSOs														
COs	**POs**												**PSOs**	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1					3									
2							2							
3							2							
4					3									
5							2							
CO (W.A)					**3**		**2**							

- Ratified by Eleventh Academic Council

22MAN01 INDUCTION PROGRAMME
(For Common To All Branches)

	L	T	P	C
	-	-	-	-

PRE REQUISITE : NIL

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

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

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

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

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

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

(i) Physical Activity

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

(ii) Creative Arts

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

(iii) Universal Human Values

This is the anchoring activity of the Induction Programme. It gets the student to explore oneself and allows one to experience the joy of learning, stand up to peer pressure, take decisions with courage, be aware of relationships with colleagues and supporting stay in the hostel and department, be sensitive to others, etc. A module in Universal Human Values provides the base. Methodology of teaching this content is extremely important. It must not be through do's and dont's, but get students to explore and think by engaging them in a dialogue. It is best taught through group discussions and real life activities rather than lecturing.

Discussions would be conducted in small groups of about 20 students with a faculty mentor each. It would be effective that the faculty mentor assigned is also the faculty advisor for the student for the full duration of the UG programme.

(iv) Literary Activity

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

(v) Proficiency Modules

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

(vi) Lectures by Eminent People

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

(vii) Visits to Local Area

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

(viii) Familiarization to Dept./Branch & Innovations

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

(ix) Department Specific Activities

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

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

REFERENCE:

1.Guide to Induction program from AICTE

22MAN03 YOGA – I (For Common To All Branches)				
	L	T	P	C
	0	0	I	0

PREREQUISITE : NIL

Course Objective:	• To make students in understanding the importance of yoga in shaping mental and physical wellness. • To provide awareness about the significance of leading a peaceful life by following yoga exercises and principles. • To develop mental wellbeing through meditation and breathing exercises. • To strengthen the body through physical exercises. • To inculcate the knowledge about different types of Asanas and their benefits

Course Outcomes The Student will be able to		Cognitive Level	Weightage of COs in End Semester Examination
CO1	Understand the importance of yoga for physical and mental goodness.	U	Internal Assessment
CO2	Perform the yoga exercises for hand, leg, eye and sun salutation etc.	Ap	
CO3	Learn and practice meditation techniques for keeping good mental health	Ap	
CO4	Develop their body by performing yoga exercises.	Ap	
CO5	Demonstrate different types of yoga Asanas for improving their personal fitness.	Ap	

UNIT I - INTRODUCTION TO YOGA	**(3)**
Meaning and Importance of Yoga - Elements of Yoga - Introduction - Asanas, Pranayama, Meditation and Yogic Kriyas - Yoga for concentration & related Asanas (Sukhasana; Tadasana; Padmasana and Shashankasana) - Relaxation Techniques for improving concentration - Yog-nidra.	
UNIT II - YOGA AND LIFE STYLE	**(3)**
Asanas as Preventive measures - Hypertension:Tadasana, Vajrasana, Pavan Muktasana, Ardha Chakrasana, Bhujangasana, Sharasana - Obesity: Procedure, Beneits and contraindications for Vajrasana, Hastasana, Trikonasana, Ardh Matsyendrasana - Back Pain: Tadasana, Ardh Matsyendrasana, Vakrasana, Shalabhasana, Bhujangasana - Diabetes: Procedure, Benefits and contraindications for Bhujangasana, Paschimottasana, Pavan Muktasana, Ardh Matsyendrasana - Asthema: Procedure, Benfits and contraindications for Sukhasana, Chakrasana, Gomukhasana, Parvatasana, Bhujangasana, Paschimottasana, Matsyasana.	
UNIT III - MIND EXERCISES	**(3)**
Naadi sudhi - Thanduvada sudhi - Breathing meditation - Silent meditation - Relax meditation.	
UNIT IV - PHYSICAL EXERCISES (PART- I)	**(3)**
Hand Exercises - Leg Exercises - Eye Exercises - Sun Salutation.	
UNIT V - ASANAS (PART-I)	**(3)**
Asanas - Tadasana - Yegapadhasana - Chakrasana - Udkaddasana - Thirikosana - Thandasana - Paschimottanasana.	
TOTAL (P:15) : 15 PERIODS	

TEXT BOOK / REFERENCE:

1. Light on Yoga by B.K.S. Iyengar.

Mapping of COs with POs / PSOs														
COs	**POs**												**PSOs**	
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
1								3	2			3		
2								3	2			3		
3								3	2			3		
4								3	2			3		
5								3	2			3		
CO (W.A)								3	2			3		

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22EYA02- PROFESSIONAL COMMUNICATION- II (Common to All Branches)				
	L	**T**	**P**	**C**
	2	**0**	**2**	**3**
PREREQUISITE : 22EYA01				
Course Objective:	• To enhance the students with necessary English language skills • To enable students to communicate effectively in an academic setting			

Course Outcomes The Student will be able to		**Cognitive Level**	**Weightage of COs in End Semester Examination**
CO1	Frame sentences both in written and spoken forms with accuracy and fluency.	R	20%
CO2	Use linguistic structures to read and understand well-structured texts encountered in academic or social contexts.	U	20%
CO3	Gain essential competency to express one's thoughts orally and in writing in a meaningful way.	U	20%
CO4	Attain and enhance competence in the four modes of literacy: Listening, Speaking, Reading and Writing.	Ap	20%
CO5	Perform various tasks, such as role plays, debates, group discussions apart from the use of correct spelling and punctuation.	U	20%

UNIT I - LANGUAGE RUDIMENTS	**(6+6)**
Grammar - Active and Passive Voice - Impersonal Passive Voice - Numerical Expressions - **Listening** - Listening for Specific Information and Match / Choose / Fill in the texts - **Speaking** - Describing a Person - Making Plans -**Reading** - Intensive Reading -**Writing** - Job Application with Resume	
UNIT II - RHETORIC ENHANCERS	**(6+6)**
Grammar - Reported Speech – Infinitive and Gerund - **Listening** - Listening to Iconic Speeches and making notes - Listening news / documentaries - **Speaking** -Talking over Phone - Narrating Incidents - **Reading** - Extensive Reading (Motivational Books) - **Writing** - Recommendation	
UNIT III -TECHNICAL CORRESPONDENCE	**(6+6)**
Grammar - If Conditionals - Blended Words - **Listening** - Listening to business conversation on audio and video of Short Films, News, Biographies - **Speaking** - Synchronous communication and Asynchronous communication - Opportunities and threats in using digital platform - **Reading** - Finding key information in a given text - **Writing** - Netiquettes - Inviting Dignitaries - Accepting & Declining Invitation	
UNIT IV - CORPORATE COMMUNICATION	**(6+6)**
Grammar - Concord - Compound Words - **Listening** - Listening to Roles and Responsibilities in Corporate - Listening to technical videos - **Speaking** - Introduction to Technical Presentation - Story Telling - **Reading** - Reading and Understanding Technical Articles - **Writing** - Report Writing (Accident, Survey and feasibility)	
UNIT V - LANGUAGE BOOSTERS	**(6+6)**
Grammar - Idiomatic Expressions – Relative Clauses - Confusable words - **Listening** - Listening to different kinds of Interviews - Listening to Group Discussion - **Speaking** - Group Discussion - **Reading** - Reading and Interpreting Visual Materials - **Writing** - Analytical Paragraph Writing	

LIST OF SKILLS ASSESSED IN THE LABORATORY

1. **Grammar**
2. **Listening Skills**
3. **Speaking Skills**
4. **Reading Skills**
5. **Writing Skills**

TOTAL (L:30 , P:30) = 60 PERIODS

TEXT BOOK:

1. Sudharshana, N.P and Saveetha.C, "English for Technical Communication", Cambridge University Press, New Delhi, 2016 (Reprint 2017).

REFERENCES:

1. Rizvi, M Ashraf, "Effective Technical Communication", 2nd Edition, McGraw Hill Education India Pvt Ltd, 2017.
2. Rodney Huddleston, Geoffrey K. Pullum and Brett Reynolds, "A Student's Introduction to English Grammar", 2nd Edition, Cambridge University Press, New Delhi, 2022

WEB REFERENCE:

1. http://youtu.be/URtdGiutVew

Mapping of COs with POs / PSOs

Cos	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1									2	3				
2									2	3				
3									2	3				2
4									2	3				2
5									2	3				
CO (W.A)									2	3				2

22MYB02 - PARTIAL DIFFERENTIAL EQUATIONS AND TRANSFORM TECHNIQUES *(Common to AGRI,CIVIL,CHEMICAL, MECH Branches)*				
	L	**T**	**P**	**C**
	3	**1**	**0**	**4**

PREREQUISITE : NIL

Course Objective:	• To make the conversant with concepts of Laplace transforms, Fourier series, Fourier Transforms to represent periodical physical problems in engineering analysis. • To provide adequate knowledge in partial differential equation and to analyze the boundary value problems.

Course Outcomes The Student will be able to		**Cognitive Level**	**Weightage of COs in End Semester Examination**
CO1	Apply the various techniques of Fourier series to obtain solution for different functions.	Ap	20%
CO2	Interpret the methods of partial differential equations in fluid mechanics and water resource management.	Ap	20%
CO3	Solve the initial and boundary value problems by using Fourier series.	Ap	20%
CO4	Analyze the concepts of Transform Techniques to solve the problems in stability analysis, Structural Analysis, control system design and analysis.	An	40%
CO5	Demonstrate the importance of Transform Techniques and partial differential equations in engineering using modern tools.	Ap	Internal Assessment

UNIT I - FOURIER SERIES	**(9+3)**
Dirichlet's condition - Fourier series: Half range sine series - Half range cosine series - Parseval's identity for half range series - Root mean square value of a function - Harmonic analysis.	
UNIT II - PARTIAL DIFFERENTIAL EQUATIONS	**(9+3)**
Formulation of partial differential equations by eliminating arbitrary constants and functions - Solution of standard types first order partial differential equations of the type f(p,q)=0,Clairaut's form - Lagrange's linear equations - Linear partial differential equation of second and higher order with constant coefficient of homogeneous types.	
UNIT III - APPLICATIONS OF PARTIAL DIFFERENTIAL EQUATIONS	**(9+3)**
Classification of second order quasi linear partial differential equations - Solution of one dimensional wave equation (Zero and non-zero velocity) - One dimensional heat equation (Temperature reduced to zero and non zero boundary conditions) - Steady state solution of two dimensional heat equation(Finite and infinite plate).	
UNIT IV - FOURIER TRANSFORM	**(9+3)**
Fourier integral theorem(Statement only) - Fourier transform pair - Sine and Cosine transforms - Properties -Transforms of simple functions – Convolution theorem - Parseval's identity(Excluding proof).	
UNIT V - LAPLACE TRANSFORM	**(9+3)**
Condition for existence - Transforms of Elementary functions - Basic Properties - First & Second Shifting Theorems (Statement only) - Initial and Final value Theorems. Inverse Laplace transforms - Convolution theorem (Excluding proof) - Solution of linear second order ordinary differential equations with constant coefficients using Laplace transform.	
TOTAL (L:45+T:15) : 60 PERIODS	

TEXT BOOKS:

1. Veerarajan.T, "Engineering Mathematics (for semester III)", 3rd Edition, Tata McGraw Hill, New Delhi.
2. Kandasamy.P, Thilagavathy.K, and Gunavathy.K., "Engineering Mathematics; Volume III", S.Chand&Coltd., 2008.
3. GrewalB.S,"Higher Engineering Mathematics", 42nd Edition, Khanna publishers, New Delhi, 2012.

REFERENCES:

1. Goyal Manish and Bali.N.P, "A Text book of Engineering mathematics", 6th Edition, Laxmi Publication (P) Ltd, New Delhi, 2012.
2. Kreyszig, Erwin, "Advanced Engineering Mathematics", 9th Edition, Wiley Publications, New Delhi, 2006.
3. Singaravelu.A,"Transforms and Partial Differential Equations", Reprint Edition 2013, Meenakshi Publications, Tamilnadu.

Mapping of COs with POs / PSOs

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1		2												
2	3													
3	3													2
4	3													2
5	3				2				3			3		
CO (W.A)	**3**	**2**			**2**				**3**			**3**		**2**

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22PYB02 - ADVANCED MATERIALS AND NANO TECHNOLOGY (Common to CIVIL, CHEM & AGRI)				
	L	**T**	**P**	**C**
	3	**0**	**0**	**3**

PREREQUISITE:NIL

Course Objective:	• To gain adequate information about the properties of matter and nanomaterials. • To expose the concepts of Photonics, fiber optics and Advanced new engineering materials.

Course Outcomes The student will be able to		**Cognitive Level**	**Weightage of COs in End Semester Examination**
CO1	Correlate the stress and strain ratio to apply the elasticity for spring materials.	An	20%
CO2	Discriminate the thermal conductivity of the medium to employing in instrument applications.	An	20%
CO3	Articulate the role of nanotechnology in environmental sustainability for the field of agriculture.	Ap	20%
CO4	Operate the optical fibers in sensor devices.	Ap	20%
CO5	Appraise the classification of composites in the applications of aerospace components, automotive parts, and sports equipment.	Ev	20%

UNIT I -PROPERTIES OF MATTER	**(9)**
Elasticity - Hooke's law Stress-strain diagram and its uses - factors affecting elastic modulus and tensile strength - torsional stress and deformations - twisting couple - torsion pendulum: theory and experiment - bending of beams - bending moment - cantilever: theory and experiment - uniform and non-uniform bending: theory and experiment - I-shaped girders - stress due to bending in beams.	
UNIT II -THERMAL PHYSICS	**(9)**
Mode of heat transfer-thermal conductivity-Newton 's law of cooling - thermal conduction through compound media (bodies in series and parallel) - Thermal conductivity of a good conductor - Forbe's method - Thermal conductivity of bad conductor - Lee's disc - Hazards - Cyclone and flood hazards - Fire hazards and fire protection, fire - proofing of materials, fire safety regulations and firefighting equipment. Prevention and safety measures.	
UNIT III -SYNTHESIS AND PROPERTIES OF NANOSTRUCTURES	**(9)**
Introduction to Nanoscience - Types of nanostructure and properties of Nanomaterials - Synthesis and preparation of Nanomaterials - Nanosensors - Biosensors - Nanoscience and Environment.	
UNIT IV - PHOTONICS AND FIBER OPTICS	**(9)**
Photonics: Population of energy levels - Einstein's A and B coefficients derivation – Resonant cavity - Types of lasers - solid state laser (Neodymium) - gas laser (CO_2) Applications of lasers in science - Engineering - Medicine. **Fibre optics:** Principle, numerical aperture and acceptance angle - Types of optical fibres (Material, refractive index and mode) -Losses in optical fibre - Fibre optic communication Fibre optic sensors (pressure and displacement).	

UNIT V - ADVANCED NEW ENGINEERING MATERIALS	(9)
Ceramics - Types and applications - Composites: classification, role of matrix and reinforcement, processing of fiber reinforced plastics - Metallic glasses: types, glass forming ability of alloys, melt spinning process, applications - Shape memory alloys: phases, shape memory effect, pseudoelastic effect, NiTi alloy and application - Bio material - applications.	
TOTAL(L:45) = 45 PERIODS	

TEXT BOOKS:

1. Dattuprasad, Ramanlal Joshi, "Engineering Physics" Tata McGraw hill education, 2019.
2. V.Rajendran, "Engineering Physics", Tata McGraw-Hill. New Delhi.2017.
3. Marikani, "Materials Science", PHI Learning Private Limited, Eastern Economy Edition, 2018.

REFERENCES:

4. Subrahmanyam N, Brijlal, "A Text Book of Optics" S.Chand& Co. Ltd, New Delhi, 2017.
5. Kongbamchandramanisingh, "Basic Physics", PHI, 2018.
6. M.N.Avathanalu, P.G.Kshirsagar "A text book of engineering physics" S.Chand&company Ltd, 2017.

WEB LINKS:

1. https://bayanbox.ir/view/7764531208313247331/Kleppner-D.-Kolenkow-R.J.-Introduction-to-Mechanics-2014.pdf.
2. https://physicaeducator.files.wordpress.com/2017/11/electricity_and_magnetism-by-purcell-3ed-ed.pdf.
3. https://rajeshvcet.home.blog/regulation-2021/ph3151-engineering-physics-study-materials/
4. https://zenodo.org/record/243407#.ZEgPZXZBzIU
5. https://farside.ph.utexas.edu/teaching/qmech/qmech.pdf.
6. https://web.pdx.edu/~pmoeck/phy381/workbook%20nanoscience.pdf.

Mapping of COs with POs / PSOs

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	3	2												2
2	3	2												2
3	3						2							
4	3		2											
5	3					2	2					2		2
CO (W.A)	**3**	**2**	**2**			**2**	**2**					**2**		**2**

22CSC01 - PROBLEM SOLVING AND C PROGRAMMING *(Common to All Branches)*					
		L	**T**	**P**	**C**
		3	**0**	**0**	**3**
PREREQUISITE : NIL					
Course Objectives:	• To equip students with the essential skills and knowledge to solve computational problems using the C programming language.				

Course Outcomes The student will be able to		**Cognitive Level**	**Weightage of COs in End Semester Examination**
CO1	Apply basic syntax and semantics of C language to write clear and structured code.	Ap	20%
CO2	Make use of both conditional statements and iterative control structures for developing applications.	Ap	20%
CO3	Apply knowledge of arrays and strings to solve computational problems.	Ap	20%
CO4	Identify modular solutions that integrate problem-solving techniques to solve complex computational problems.	An	20%
CO5	Analyze the performance implications using pointers and to manage file operations efficiently.	An	20%

UNIT I - PROBLEM SOLVING AND C PROGRAMMING BASICS	**(9)**
General Problem Solving: Algorithms, Flowcharts and Pseudo-codes, implementation of algorithms **Basics of C Programming** : Introduction to C - Structure of C program - Programming Rules - Compilation - Errors - C Declarations: Tokens - keywords - identifiers - constants - data types - variable declaration and initialization - type conversion - constant and volatile variables - operators and expressions.	
UNIT II - DECISION CONTROL STATEMENTS	**(9)**
Managing Input and Output operations, Decision Control Statements: Decision control statements, Selection/conditional branching Statements: if, if-else, nested if, if-elif-else statements. Basic loop Structures/Iterative statements: while loop, for loop, selecting appropriate loop. Nested loops break and continue statements.	
UNIT III - ARRAYS AND STRINGS	**(9)**
Introduction to Array - Definition - Array initialization - Characteristics - One Dimensional Array - Array operations -Two dimensional arrays -Strings and String handling functions.	
UNIT IV - FUNCTIONS	**(9)**
Functions: Basics - definition - Elements of User defined Functions - return statement, Function types, Parameter Passing Techniques, Function returning more values - Passing Array to Functions - Recursion - Storage classes.	
UNIT V - POINTERS AND FILE MANAGEMENT	**(9)**
Pointer concepts - Pointers & Arrays, Structure concepts - Defining, Declaring, Accessing Member Variables, Structure within Structure - Union - File Management in C- Dynamic Memory Allocation.	
	TOTAL (L:45) = 45 PERIODS

TEXT BOOKS:
1. Ashok N. Kamthane, "Programming in C", 2nd Edition, Pearson Education, 2013. 2. Sumitabha Das, "Computer Fundamentals and C Programming", 1st Edition, McGraw Hill, 2018.
REFERENCES:
1. R. G. Dromey, "How to Solve it by Computer", Pearson Education India; 1st Edition, ISBN10: 8131705625, ISBN-13: 978-8131705629 2. Maureen Spankle, "Problem Solving and Programming Concepts", Pearson; 9th Edition, India, ISBN-10: 9780132492645, ISBN-13: 978- 0132492645 3. Yashavant Kanetkar, "Let us C", 16th Edition, BPB Publications, 2018. 4. ReemaThareja., "Programming in C ", 2nd Edition, Oxford University Press, New Delhi, 2018. 5. Balagurusamy E., "Programming in ANSI C", 7th Edition, Mc Graw Hill Education, 2017.

Mapping of COs with POs / PSOs														
COs	**POs**												**PSOs**	
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
1	3													
2	3													
3	3											3		2
4		3										3		
5		3												
CO (W.A)	**3**	**3**										**3**		**2**

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22CEC01 - FUNDAMENTALS OF ENGINEERING MECHANICS *(Common to All Branches)*				
	L	**T**	**P**	**C**
	2	**1**	**0**	**3**

PREREQUISITE : NIL

Course Objectives:	• To apply the principles of engineering mechanics to analyze and solve problems in statics and dynamics, including the calculation of forces, moments, and motions, and the design of simple mechanical systems.

Course Outcomes The student will be able to		**Cognitive Level**	**Weightage of COs in End Semester Examination**
CO1	Apply the principles of equilibrium to analyze forces acting on a particle.	Ap	20%
CO2	Apply the knowledge of free body diagrams to solve problems involving the equilibrium of rigid bodies in two dimensions.	Ap	20%
CO3	Analyze the properties of various sections using standard formulas.	An	20%
CO4	Analyze problems involving the principles of kinematics and kinetics to solve particle motion and force equilibrium problems.	An	40%
CO5	Analyze and solve problems related to mechanics, equilibrium, properties of materials, and friction through practical applications and critical understanding.	An	Internal Assessment

UNIT I - BASICS AND STATICS OF PARTICLES	**(6+3)**
Introduction - Units and Dimensions - Laws of Mechanics - Lame's theorem, Parallelogram and triangular Law of forces - Principle of Transmissibility - Coplanar Forces - Resolution and Composition of forces - Equilibrium of a particle - Forces in space - Equilibrium of a particle in space - Equivalent systems of forces.	
UNIT II - EQUILIBRIUM OF RIGID BODIES	**(6+3)**
Free body diagram - Types of supports and their reactions - requirements of stable equilibrium - Moments - Moment of a force about a point and about an axis - Varignon's theorem - Equilibrium of Rigid bodies in two dimensions.	
UNIT III - PROPERTIES OF SURFACES AND SOLIDS	**(6+3)**
Determination of Areas and Volumes - Centre of Gravity - First moment of area, Second moment of area and Centroid of sections - Rectangle, circle, triangle from integration - T section, I section, Angle section, Hollow section by using standard formula - Parallel axis theorem and perpendicular axis theorem - Principal moments of inertia of plane areas - Principal axes of inertia.	
UNIT IV - FRICTION	**(6+3)**
Surface Friction - Frictional force - Laws of Coulomb friction - Angle of friction - cone of friction - Simple contact friction - Ladder friction - Rolling Resistance - Problems involving the equilibrium of rigid bodies with frictional forces.	

UNIT V - DYNAMICS OF PARTICLES	(6+3)
Kinematics - Relative motion - Curvilinear motion, Kinetics - Displacements, Velocity and acceleration, their relationship - Newton's laws of motion - Work Energy Equation.	
TOTAL (L:30+T:15) = 45 PERIODS	

TEXTBOOKS:

1. N. Koteeswaran, "Engineering Mechanics", Sri Balaji Publications, 2017.
2. R. K. Bansal, "A Textbook of Engineering Mechanics", Laxmi Publications (P) Ltd, New Delhi, 6th Edition, 2015

REFERENCES:

1. Beer Ferdinand P., Russel Johnston Jr., David F. Mazure, Philip J. Cornwell, Sanjeev Sanghi, "Vector Mechanics for Engineers: Statics and Dynamics", 12th Edition, McGraw Hill Education, Chennai, 2019.
2. Irving H. Shames, " Engineering Mechanics - Statics and Dynamics", 4th Edition, Pearson Education Asia Pvt. Ltd., 2005
3. M. S. Palanisamy and S. Nagan, "Engineering Mechanics - Statics & Dynamics", TMH Publishing Company, 2005

Mapping of COs with POs / PSOs

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	3													
2	3											2		
3	3	3	2									3	2	
4		3												2
5		2	2						2					2
CO (W.A)	3	2.7	3									2.5	2	2

22CYB08 - ENVIRONMENT AND SUSTAINABILITY				
	L	T	P	C
	2	0	0	2

PREREQUISITE : NIL

Course Objective:	• To impart knowledge on ecosystem, biodiversity, environmental pollution and familiarize about sustainable development, carbon credit and green materials. • To make the students conversant with the global and Indian scenario of renewable resources, causes of their degradation and measures to preserve them.

Course Outcomes The Student will be able to		**Cognitive Level**	**Weightage of COs in End Semester Examination**
CO1	Illustrate the values and conservation methods of biodiversity	Ap	20%
CO2	Predict the causes, effects of environmental pollution and contribute the preventive measures to the society.	An	20%
CO3	Analyse the renewable and non-renewable resources and preserve them for future generations.	An	20%
CO4	Examine the different goals of sustainable development and apply them for suitable technological advancement and societal development.	An	20%
CO5	Execute the sustainability practices, identify green materials and energy cycles.	Ap	20%

UNIT I - ENVIRONMENT AND BIODIVERSITY	**(6)**
Environment - scope and importance - Eco-system: Structure and function of an ecosystem - types of biodiversity - genetic - species and ecosystem diversity - values of biodiversity - hot-spots of biodiversity – conservation of biodiversity: In-situ and ex-situ.	
UNIT II - ENVIRONMENTAL POLLUTION	**(6)**
Pollution - Causes - Effects and Preventive measures of Water, Air and noise pollution - Solid waste management: methods of disposal of solid waste - Environmental protection act: Air act - Water act.	
UNIT III - RENEWABLE SOURCES OF ENERGY	**(6)**
Energy management and conservation - New Energy Sources: Different types of new energy sources - Solar energy - wind energy - Applications of Hydrogen energy, Ocean energy resources, Tidal energy conversion.	
UNIT IV - SUSTAINABILITY AND MANAGEMENT	**(6)**
Development - Factors affecting development - advantages - disadvantages - GDP - Sustainability - needs - concept - concept of carbon credit - carbon footprint - Environmental management.	
UNIT V - SUSTAINABILITY PRACTICES	**(6)**
Zero waste and R concept - ISO 14000 Series - Environmental Impact Assessment - Sustainable energy: Energy Cycles- carbon cycle and carbon emission - Green Engineering: Sustainable urbanization.	
TOTAL (L:30) : 30 PERIODS	

TEXT BOOKS:

1. Dr. A.Ravikrishan, "Envrionmental Science and Engineering", Sri Krishna Hitech Publishing co. Pvt.Ltd., Chennai,15th Edition, 2023.
2. Anubha Kaushik and C. P. Kaushik's "Perspectives in Environmental Studies", 6th Edition, New Age International Publishers, 2018.

REFERENCES:

1. Rajagopalan, R, "Environmental Studies-From Crisis to Cure", Oxford University Press, Third Edition, 2015.
2. Erach Bharucha, "Textbook of Environmental Studies for Undergraduate Courses" Orient Blackswan Pvt. Ltd. 2013.

WEBLINK:

1. http://www.jnkvv.org/PDF/08042020215128Amit1.pdf
2. https://www.conserve-energy-future.com/types-of-renewable-sources-of-energy.php
3. https://ugreen.io/sustainability-engineering-addressing-environmental-social-and-economic-issues/

Mapping of COs with POs / PSOs

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1		2												
2			2				3							
3	2							2						
4							3							
5						3			2			2		2
CO (W.A)	**2**	**2**	**2**			**3**	**3**	**2**	**2**			**2**		**2**

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22PYP01 - PHYSICS LABORATORY (Common to All Branches)				
	L	**T**	**P**	**C**
	0	**0**	**2**	**1**

PREREQUISITE : NIL

Course Objective:	• To infer the practical knowledge by applying the experimental methods to correlate with the Physics theory. • To introduce different experiments to test basics of physics concepts applied in optics and electronics

Course Outcomes The Student will be able to		**Cognitive Level**
CO1	Examine the effects of material type and loading conditions on the results of the non-uniform bending experiment.	An
CO2	Utilize principles of light interaction to determine the particle size of materials using laser diffraction techniques.	Ap
CO3	Evaluate the accuracy of the wavelength of different colors with the accepted values in the literature	Ev
CO4	Measure the effectiveness of the solar cell based on its V-I characteristics.	Ev
CO5	Analyze the principles underlying the air wedge method for the determination of the thickness of a thin wire,	An

LIST OF EXPERIMENTS:

1. Determination of Young's modulus by non-uniform bending method
2. Determination of (a) wavelength and (b) particle size using Laser.
3. Determination of thermal conductivity of a bad conductor - Lee's Disc method.
4. Determination of wavelength of mercury spectrum - spectrometer grating
5. Determination of band gap of a semiconductor.
6. Determination of thickness of a thin wire - Air wedge method.
7. Determination of V-I characteristics of solar cell.

TOTAL (P:30) : 30 PERIODS

Mapping of COs with POs / PSOs														
COs	**POs**												**PSOs**	
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
1	3	3												
2	3											2		
3	3	3												
4	3											2		
5	3	3												
CO (W.A)	**3**	**3**										**2**		

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22CSP01 - PROBLEM SOLVING AND C PROGRAMMING LABORATORY *(Common to All Branches)*				
	L	**T**	**P**	**C**
	0	**0**	**4**	**2**

PREREQUISITE : NIL

Course Objective:	• To develop programs to solve basic problems by understanding basic concepts in C language

Course Outcomes The student will be able to		**Cognitive Level**
CO1	Formulate the algorithms for simple problems	Ap
CO2	Apply the concept of pointers of different types	Ap
CO3	Apply and manipulate data with arrays, strings and structures	Ap
CO4	Apply the concept of functions and dynamic memory allocation	Ap
CO5	Analyse and correct logical errors encountered during execution	An

C - Programming:

1. Draw the flowchart for the following using Raptor tool.
    a) Simple interest calculation
    b) Greatest among three numbers
    c) Find the sum of digits of a number
2. Programs for demonstrating the use of different types of operators like arithmetic, logical, relational and ternary operators (Sequential and Selection structures)
3. Programs for demonstrating repetitive control statements like 'for', 'while' and 'do-while' (Iterative structures)
4. Programs for demonstrating one-dimensional and two-dimensional numeric array
5. Programs to demonstrate modular programming concepts using functions
6. Programs to implement various character and string operations with and without built-in library functions.
7. Programs to demonstrate the use of pointers
8. Programs to illustrate the use of user-defined data types
9. Programs to implement various file management.
10. Program Using Dynamic memory allocation functions

HARDWARE / SOFTWARE REQUIRED FOR A BATCH OF 30 STUDENTS:

Hardware:

- LAN System with 33 nodes (OR) Standalone PCs – 33 Nos.
- Printers – 3 Nos.

Software:

- RAPTOR Tool
- Compiler – C

TOTAL (P:60) : 60 PERIODS

Mapping of COs with POs / PSOs														
COs	**POs**												**PSOs**	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	3													
2	3													
3	3													
4	3													
5		3			2							2		2
CO (W.A)	**3**	**3**			**2**							**2**		**2**

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22MAN02R - SOFT/ANALYTICAL SKILLS – I (Common to All Branches)				
	L	**T**	**P**	**C**
	1	**0**	**2**	**0**

PREREQUISITE : NIL

Course Objective:	• To analyze wide range of texts, understand and express interpretations • To learn various methods for faster numerical computations and to develop logical reasoning skills

Course Outcomes The Student will be able to		**Cognitive Level**	**Weightage of COs in Continuous Assessment Test**
CO1	Respond to diverse texts, enhancing their comprehensive and expressive capabilities.	U	40%
CO2	Apply various techniques for quicker calculations.	Ap	30%
CO3	Solve mathematical problems by applying logical thinking.	An	30%

UNIT I - VERBAL ABILITY	**(5+10)**
Grammar- Synonyms - Antonyms - Articles - Preposition - **Listening -** IELTS Listening (Beginners) **- Speaking -** Presentation - JAM **- Reading -** Reading Comprehension **- Writing -** E-mail writing.	
UNIT II - APTITUDE	**(5+10)**
Square Root - Squaring of Numbers - Cube root - Cube of Numbers - Number Systems - L.C.M & H.C.F - Simplification - Problems on Numbers - Calendars - Clocks.	
UNIT III - REASONING	**(5+10)**
Odd Man Out & Number Series - Letter Series - Coding and Decoding - Analogy - Mirror and Water Images.	
TOTAL(L:45) = 45 PERIODS	

REFERENCES:

1. Rizvi, M.Ashraf. "Effective Technical Communication". Tata McGraw-Hill Education, 2017.
2. Aggarwal R S. "Quantitative Aptitude for Competitive Examinations", S.Chand Publishing Company Ltd(s)., 2022.
3. Sharma, Arun." How to Prepare for Quantitative Aptitude for the CAT", Tata McGraw - Hill Publishing, 2022.
4. Praveen R V. "Quantitative Aptitude and Reasoning", PHI Learning Pvt. Ltd., 2016. .

Mapping of COs with POs / PSOs														
COs	**POs**												**PSOs**	
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
1									2	3				
2		2		2										
3		2		2										
CO (W.A)		**2**		**2**					**2**	**3**				

22MAN05 - YOGA – II (For Common To All Branches)				
	L	**T**	**P**	**C**
	0	**0**	**I**	**0**

PREREQUISITE : NIL

Course Objective:	• To strengthen the body through physical exercises. • To understand the importance of value system and ethics. • To know the life philosophy of yogis and maharishis. • To understand the nature laws, cause and effect theory. • To inculcate knowledge about different types of Asanas and their benefits.

Course Outcomes The Student will be able to		**Cognitive Level**	**Weightage of COs in End Semester Examination**
CO1	Perform physical exercises like spine exercises, massage and acupressure.	Ap	Internal Assessment
CO2	Learn the human values, ethics, time management and the importance of introspection.	U	
CO3	Analyze various life philosophies of yogi's and rishi's.	An	
CO4	Understand life lessons and nature laws.	U	
CO5	Demonstrate different types of yoga Asanas and improve their personal fitness.	Ap	

UNIT I - PHYSICAL EXCERCISES (PART-II)	**(3)**
Breathing Exercises - Kapalapathi - Maharasanam (Spine Exerices) - Massage and Acupressure.	
UNIT II - HUMAN VALUE	**(3)**
Divine power - Life force (Bio magnetism) - Importance of Introspection - Time management - Punctuality - self confidence - mind control.	
UNIT III - PHILOSOPHY OF LIFE	**(3)**
Basic needs for life - Hunger and thirst - climatic/weather changes - Body wastes - pressure of excretory organs - safety measures - protection from natural disaster - protection from enmity - protection from accidents - ethics - morality - duty - charity - Wisdom of perfection stages - faith - understanding - realization.	
UNIT IV - NATURE'S LAW OF CAUSE AND EFFECT	**(3)**
Food transformation into seven minerals - Natural actions - pattern - precision - regularity - Required skills - planned work - awareness - introspection.	
UNIT V - ASANAS (PART-II)	**(3)**
Ustrasana - Vakrasana - Komugasana - Padmasana - Vajrasana - Sukhasana - Yogamudra - Mahamudra.	
TOTAL (P:45) : I5 PERIODS	

TEXT BOOK/REFERENCES:

1. Light on Yoga by B.K.S. Iyengar.

Mapping of COs with POs / PSOs														
COs	**POs**												**PSOs**	
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
1								3	2			3		
2								3	2			3		
3								3	2			3		
4								3	2			3		
5								3	2			3		
CO (W.A)								**3**	**2**			**3**		

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22GYA01 HERITAGE OF TAMILS *(For Common To All Branches)*				
	L	**T**	**P**	**C**
	I	**0**	**0**	**I**
PRE REQUISITE : NIL				

UNIT I - LANGUAGE AND LITERATURE	**(3)**
Language Families in India - Dravidian Languages – Tamil as aClassical Language - Classical Literature in Tamil – Secular Nature of Sangam Literature – Distributive Justice in Sangam Literature - Management Principles in Thirukural - Tamil Epics and Impact of Buddhism & Jainism in Tamil Land - Bakthi Literature Azhwars and Nayanmars - Forms of minor Poetry - Development of Modern literature in Tamil - Contribution of Bharathiyar and Bharathidhasan.	
UNIT II - HERITAGE - ROCK ART PAINTINGS TO MODERN ART – SCULPTURE	**(3)**
Hero stone to modern sculpture - Bronze icons - Tribes and their handicrafts - Art of temple car making - Massive Terracotta sculptures, Village deities, Thiruvalluvar Statue at Kanyakumari, Making of musical instruments - Mridhangam, Parai, Veenai, Yazh and Nadhaswaram - Role of Temples in Social and Economic Life of Tamils.	
UNIT III - FOLK AND MARTIAL ARTS	**(3)**
Therukoothu, Karagattam, Villu Pattu, Kaniyan Koothu, Oyillattam, Leatherpuppetry, Silambattam, Valari, Tiger dance - Sports and Games of Tamils.	
UNIT IV - THINAI CONCEPT OF TAMILS	**(3)**
Flora and Fauna of Tamils & Aham and Puram Concept from Tholkappiyam and Sangam Literature - Aram Concept of Tamils - Education and Literacy during Sangam Age - Ancient Cities and Ports of Sangam Age - Export and Import during Sangam Age - Overseas Conquest of Cholas.	
UNIT V - CONTRIBUTION OF TAMILS TO INDIAN NATIONAL MOVEMENT AND INDIAN CULTURE	**(3)**
Contribution of Tamils to Indian Freedom Struggle - The Cultural Influence of Tamils over the other parts of India – Self-Respect Movement - Role of Siddha Medicine in Indigenous Systems of Medicine – Inscriptions & Manuscripts – Print History of Tamil Books.	
TOTAL (L:15) : 15 PERIODS	

TEXT-CUM-REFERENCE BOOKS

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

5. Social Life of Tamils (Dr.K.K.Pillay) A joint publication of TNTB & ESC and RMRL – (in print)
6. Social Life of the Tamils - The Classical Period (Dr.S.Singaravelu) (Published by: International Institute of Tamil Studies.
7. Historical Heritage of the Tamils (Dr.S.V.Subatamanian, Dr.K.D. Thirunavukkarasu) (Published by: International Institute of Tamil Studies).
8. The Contributions of the Tamils to Indian Culture (Dr.M.Valarmathi) (Published by: International Institute of Tamil Studies.)
9. Keeladi - 'Sangam City Civilization on the banks of river Vaigai' (Jointly Published by: Department of Archaeology & Tamil Nadu Text Book and Educational Services Corporation, Tamil Nadu)
10. Studies in the History of India with Special Reference to Tamil Nadu (Dr.K.K.Pillay) (Published by: The Author)
11. Porunai Civilization (Jointly Published by: Department of Archaeology & Tamil Nadu Text Book and Educational Services Corporation, Tamil Nadu)
12. Journey of Civilization Indus to Vaigai (R.Balakrishnan) (Published by: RMRL) – Reference Book.

22GYA01 தமிழர் மரபு (அனைத்து பாடப்பிரிவினருக்கும்)				
	L	T	P	C
	1	0	0	1
முன் தேவை: இல்லை				

அலகு 1 மொழி மற்றும் இலக்கியம்	(3)
இந்திய மொழிக் குடும்பங்கள் – திராவிட மொழிகள் – தமிழ் ஒரு செம்மொழி – தமிழ் செவ்விலக்கியங்கள் – சங்க இலக்கியத்தின் சமயச் சார்பற்ற தன்மை– சங்க இலக்கியத்தில் பகிர்தல் அறம் – திருக்குறளில் மேலாண்மைக் கருத்துக்கள் – தமிழ்க காப்பியங்கள், தமிழகத்தில் சமண பௌத்த சமயங்களின் தாக்கம் – பக்தி இலக்கியம், ஆழ்வார்கள் மற்றும் நாயன்மார்கள் – சிற்றிலக்கியங்கள் – தமிழில் நவீன இலக்கியத்தின் வளர்ச்சி – தமிழ் இலக்கிய வளர்ச்சியில் பாரதியார் மற்றும் பாரதிதாசன் ஆகியோரின் பங்களிப்பு.	
அலகு 2 மரபு – பாறை ஓவியங்கள் முதல் நவீன ஓவியங்கள் வரை – சிற்பக்கலை:	**(3)**
நடுகல் முதல் நவீன சிற்பங்கள் வரை – ஐம்பொன் சிலைகள் – பழங்குடியினர் மற்றும் அவர்கள் தயாரிக்கும் கைவினைப் பொருட்கள், பொம்மைகள்– தேர் செய்யும் கலை– சுடுமண் சிற்பங்கள் – நாட்டுப்புறத் தெய்வங்கள் – குமரிமுனையில் திருவள்ளுவர் சிலை – இசைக் கருவிகள் – மிருதங்கம், பறை, வீணை, யாழ், நாதஸ்வரம் – தமிழர்களின் சமூக பொருளாதார வாழ்வில் கோவில்களின் பங்கு.	
அலகு 3 நாட்டுப்பறக் கலைகள் மற்றும் வீர விளையாட்டுகள்:	**(3)**
தெருக்கூத்து, கரகாட்டம், வில்லுப்பாட்டு, கணியான் கூத்து, ஒயிலாட்டாம், தோல்பாவைக்கூத்து, சிலம்பாட்டம், வளரி, புலியாட்டம், தமிழர்களின் விளையாட்டுகள்.	
அலகு 4 தமிழர்களின் திணைக் கோட்பாடுகள்:	**(3)**
தமிழகத்தின் தாவரங்களும், விலங்குகளும் – தொல்காப்பியம் மற்றும் சங்க இலக்கியத்தில் அகம் மற்றும் புறக் கோட்பாடுகள் – தமிழர்கள் போற்றிய அறக்கோட்பாடு – சங்ககாலத்தில் தமிழகத்தில் எழுத்தறிவும், கல்வியும் – சங்ககால நகரங்களும் துறை முகங்களும் – சங்ககாலத்தில் ஏற்றுமதி மற்றும் இறக்குமதி – கடல்கடந்த நாடுகளின் சோழர்களின் வெற்றி.	
அலகு 5 இந்திய தேசிய இயக்கம் மற்றும் இந்திய பண்பாட்டிற்குத் தமிழர்களின் பங்களிப்பு:	**(3)**
இந்திய விடுதலைப்போரில் தமிழர்களின் பங்கு – இந்தியாவின் பிறப்பகுதிகளில் தமிழ்ப் பண்பாட்டின் தாக்கம் – சுயமரியாதை இயக்கம் –இந்திய மருத்துவத்தில் சித்த மருத்துவத்தின் பங்கு, கல்வெட்டுகள், கையெழுத்துப்படிகள் – தமிழ் புத்தக்களின் அச்சு வரலாறு.	
TOTAL (L:15) : 15 PERIODS	

TEXT-CUM-REFERENCE BOOKS

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

5. Social Life of Tamils (Dr.K.K.Pillay) A joint publication of TNTB & ESC and RMRL – (in print)
6. Social Life of the Tamils - The Classical Period (Dr.S.Singaravelu) (Published by: International Institute of Tamil Studies.
7. Historical Heritage of the Tamils (Dr.S.V.Subatamanian, Dr.K.D. Thirunavukkarasu) (Published by: International Institute of Tamil Studies).
8. The Contributions of the Tamils to Indian Culture (Dr.M.Valarmathi) (Published by: International Institute of Tamil Studies.)
9. Keeladi - 'Sangam City Civilization on the banks of river Vaigai' (Jointly Published by: Department of Archaeology & Tamil Nadu Text Book and Educational Services Corporation, Tamil Nadu)
10. Studies in the History of India with Special Reference to Tamil Nadu (Dr.K.K.Pillay) (Published by: The Author)
11. Porunai Civilization (Jointly Published by: Department of Archaeology & Tamil Nadu Text Book and Educational Services Corporation, Tamil Nadu)
12. Journey of Civilization Indus to Vaigai (R.Balakrishnan) (Published by: RMRL) – Reference Book.

22GYA02 TAMILS AND TECHNOLOGY *(For Common To All Branches)*				
	L	**T**	**P**	**C**
	I	**0**	**0**	**I**
PRE REQUISITE : NIL				

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 n household materials during Sangam Age - Building materials and Hero stones of Sangam age – Details of Stage Constructions in Silappathikaram - Sculptures and Temples of Mamallapuram - Great Temples of Cholas and other worship places - Temples of Nayaka Period - Type study (Madurai Meenakshi Temple)- Thirumalai Nayakar Mahal - Chetti Nadu Houses, Indo - Saracenic architecture at Madras during British Period.	
UNIT III - MANUFACTURING TECHNOLOGY	**(3)**
Art of Ship Building - Metallurgical studies - Iron industry - Iron smelting,steel -Copper and gold- Coins as source of history - Minting of Coins – Beads making-industries Stone beads -Glass beads - Terracotta beads -Shell beads/ bone beats - Archeological evidences - Gem stone types described in Silappathikaram.	
UNIT IV - AGRICULTURE AND IRRIGATION TECHNOLOGY	**(3)**
Dam, Tank, ponds, Sluice, Significance of Kumizhi Thoompu of Chola Period, Animal Husbandry - Wells designed for cattle use - Agriculture and Agro Processing - Knowledge of Sea - Fisheries – Pearl - Conche diving - Ancient Knowledge of Ocean - Knowledge Specific Society.	
UNIT V - SCIENTIFIC TAMIL & TAMIL COMPUTING	**(3)**
Development of Scientific Tamil - Tamil computing – Digitalization of Tamil Books – Development of Tamil Software – Tamil Virtual Academy – Tamil Digital Library – Online Tamil Dictionaries – Sorkuvai Project.	
TOTAL (L:15) : 15 PERIODS	

TEXT-CUM-REFERENCE BOOKS

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

5. Social Life of Tamils (Dr.K.K.Pillay) A joint publication of TNTB & ESC and RMRL – (in print)
6. Social Life of the Tamils - The Classical Period (Dr.S.Singaravelu) (Published by: International Institute of Tamil Studies.
7. Historical Heritage of the Tamils (Dr.S.V.Subatamanian, Dr.K.D. Thirunavukkarasu) (Published by: International Institute of Tamil Studies).
8. The Contributions of the Tamils to Indian Culture (Dr.M.Valarmathi) (Published by: International Institute of Tamil Studies.)
9. Keeladi - 'Sangam City Civilization on the banks of river Vaigai' (Jointly Published by: Department of Archaeology & Tamil Nadu Text Book and Educational Services Corporation, Tamil Nadu)
10. Studies in the History of India with Special Reference to Tamil Nadu (Dr.K.K.Pillay) (Published by: The Author)
11. Porunai Civilization (Jointly Published by: Department of Archaeology & Tamil Nadu Text Book and Educational Services Corporation, Tamil Nadu)
12. Journey of Civilization Indus to Vaigai (R.Balakrishnan) (Published by: RMRL) – Reference Book.

22GYA02 தமிழரும் தொழில்நுட்பமும் (அனைத்து பாடப்பிரிவினருக்கும்)				
	L	T	P	C
	I	0	0	I
முன் தேவை: இல்லை				

அலகு 1 நெசவு மற்றும் பானைத் தொழில்நுட்பம்:	(3)
சங்ககாலத்தில் நெசவுத்தொழில் – பானைத் தொழிலநுட்பம் – கருப்பு சிவப்பு பாண்டங்கள் – பாண்டங்களில் கீறல் குறியீடுகள்.	
அலகு 2 வடிவமைப்பு மற்றும் கட்டிடத் தொழில்நுட்பம்:	**(3)**
சங்ககாலத்தில் வடிவமைப்பு மற்றும் கட்டுமானங்கள் மற்றும் சங்ககாலத்தில் வீட்டுப் பொருட்களில் வடிவமைப்பு – சங்ககாலத்தில் கட்டுமான பொருட்களும் நடுக்கல்லும் – சிலப்பதிகாரத்தில் மேடை அமைப்பு பற்றிய விவரங்கள் – மாமல்லபுரச் சிற்பங்களும், கோவில்களும் – சோழர் காலத்துப் பெருங்கோயில்கள் மற்றும் பிற வழிபாட்டுத் தலங்கள் – நாயக்கர் காலக் கோயில்கள் – மாதிரி கட்டமைப்புகள் பற்றி அறிதல், மதுரை மீனாட்சி அம்மன் ஆலயம் மற்றும் திருமலை நாயக்கர் மஹால் – செட்டிநாட்டு வீடுகள் – பிரிட்டிஷ் காலத்தில் சென்னையில் இந்தோ–சாரோசெனிக் கட்டிடக் கலை.	
அலகு 3 உற்பத்தி தொழில் நுட்பம்:	**(3)**
கப்பல் கட்டும் கலை – உலோகவியல் – இரும்புத் தொழிற்சாலை – இரும்பை உருக்குதல், எக்கு – வரலாற்றுச் சான்றுகளாக செம்பு மற்றும் தங்க நாணயங்கள் – நாணயங்கள் அச்சடித்தல் – மணி உருவாக்கும் தொழிற்சாலைகள் – கல்மணிகள், கண்ணாடி மணிகள் – சுடுமண் மணிகள் – சங்கு மணிகள் – எலும்புத் துண்டுகள் – தொல்லியல் சான்றுகள் – சிலப்பதிகாரத்தில் மணிகளின் வகைகள்.	
அலகு 4 வேளாண்மை மற்றும் நீர்பாசனத் தொழில் நுட்பம்:	**(3)**
அணை, ஏரி, குளங்கள், மதகு – சோழர்காலக் குமுழித் தூம்பின் முக்கியத்துவம் – கால்நடை பராமரிப்பு – கால்நடைகளுக்காக வடிவமைக்கப்பட்ட கிணறுகள் – வேளாண்மை மற்றும் வேளாண்மைச் சார்ந்த செயல்பாடுகள் – கடல்சார் அறிவு – மீன்வளம் – முத்து மற்றும் முத்துக்குளித்தல் – பெருங்கடல் குறித்த பண்டைய அறிவு – அறிவுசார் சமூகம்.	
அலகு 5 அறிவியல் தமிழ் மற்றும் கணித்தமிழ்:	**(3)**
அறிவியல் தமிழின் வளர்ச்சி – கணித்தமிழ் வளர்ச்சி – தமிழ் நூல்களை மின் பதிப்பு செய்தல் – தமிழ் மென்பொருட்கள் உருவாக்கம் – தமிழ் இணையக் கல்விக்கழகம் – தமிழ் மின் நூலகம் – இணையத்தில் தமிழ் அகராதிகள் – சொற்குவைத் திட்டம்.	
TOTAL (L:15) : 15 PERIODS	

TEXT-CUM-REFERENCE BOOKS

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

5. Social Life of Tamils (Dr.K.K.Pillay) A joint publication of TNTB & ESC and RMRL – (in print)
6. Social Life of the Tamils - The Classical Period (Dr.S.Singaravelu) (Published by: International Institute of Tamil Studies.
7. Historical Heritage of the Tamils (Dr.S.V.Subatamanian, Dr.K.D. Thirunavukkarasu) (Published by: International Institute of Tamil Studies).
8. The Contributions of the Tamils to Indian Culture (Dr.M.Valarmathi) (Published by: International Institute of Tamil Studies.)
9. Keeladi - 'Sangam City Civilization on the banks of river Vaigai' (Jointly Published by: Department of Archaeology & Tamil Nadu Text Book and Educational Services Corporation, Tamil Nadu)
10. Studies in the History of India with Special Reference to Tamil Nadu (Dr.K.K.Pillay) (Published by: The Author)
11. Porunai Civilization (Jointly Published by: Department of Archaeology & Tamil Nadu Text Book and Educational Services Corporation, Tamil Nadu)
12. Journey of Civilization Indus to Vaigai (R.Balakrishnan) (Published by: RMRL) – Reference Book.

22MYB03 - STATISTICS AND NUMERICAL METHODS

(Common to AGRI, AI&DS,CSE,IT,IOT,CS(Cyber security)CIVIL,CHEMICAL,EEE,MECH Branches)

L	T	P	C
3	1	0	4

PREREQUISITE : NIL

Course Objective:	• To understand the concept of testing of hypothesis for small and large samples and design of experiments. • To provide adequate knowledge in numerical techniques to solving ordinary differential equations and numerical integration which plays an important role in engineering and technology disciplines.

Course Outcomes The Student will be able to		**Cognitive Level**	**Weightage of COs in End Semester Examination**
CO1	Interpret the principles and techniques in experimental design to solve the variance	Ap	20%
CO2	Apply the fundamental numerical techniques used to solve various types of mathematical problems on solution of equations, interpolation and numerical integration.	Ap	40%
CO3	Determine the statistics based on the data and related to the testing of hypothesis.	An	20%
CO4	Solve the real-world problems using numerical methods for IVPs, demonstrating their applicability and limitations.	Ap	20%
CO5	Demonstrate the importance of interpolation and approximation techniques to solve real-world problems in various disciplines of Engineering using modern tools.	Ap	Internal Assessment

UNIT I - TESTING OF HYPOTHESIS	**(9+3)**
Sampling Distributions-Tests for single mean, difference of means (Large and Small samples) Using z, t - distribution, F - distribution- Chi-square - Test for independence of attributes and Goodness of fit.	
UNIT II - DESIGN OF EXPERIMENTS	**(9+3)**
Analysis of variance - Completely randomized design - Randomized block design - Latin square design.	
UNIT III - SOLUTION OF EQUATIONS AND EIGEN VALUE PROBLEMS	**(9+3)**
Solution of algebraic and transcendental equations - Fixed point iteration method - Newton Raphson method- Solution of linear system of equations Gauss elimination method - Iterative methods of Gauss Jacobi and Gauss Seidel Methods- Eigen values of a matrix by Power method.	
UNIT IV - INTERPOLATION AND APPROXIMATION	**(9+3)**
Lagrange's and Newton's divided difference interpolations - Newton's forward and backward difference interpolation - Numerical single and double integrations using Trapezoidal and Simpson's 1/3 rules - Romberg's Methods.	
UNIT V - NUMERICAL DIFFERENTIATION AND INTEGRATION	**(9+3)**

Single step methods: Taylor's series method - Euler's method - Modified Euler's method - Fourth order Runge - Kutta method for solving first order differential equations - Multi step methods: Milne's and Adams - Bash forth predictor corrector methods for solving first order differential equations.

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

TEXT BOOKS:

1. Grewal, B.S., and Grewal, J.S., "Numerical Methods in Engineering and Science", Khanna Publishers, 10th Edition, New Delhi, 2015.
2. Johnson, R.A., Miller, I and Freund J., "Miller and Freund's Probability and Statistics for Engineers", Pearson Education, Asia, 8th Edition, 2015.
3. Gupta S.C. and Kapoor V. K., "Fundamentals of Mathematical Statistics", Sultan Chand & Sons, New Delhi, 12th Edition, 2020.

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, 7th Edition, 2007.

Mapping of COs with POs / PSOs

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	3													
2	3													
3		2												
4	3													2
5	3				2				3			2		2
CO (W.A)	**3**	**2**			**2**				**3**			**2**		**2**

22CEC02 - MECHANICS OF MATERIALS					
		L	T	P	C
		3	0	0	3
PREREQUISITE : 22CEC01					
Course Objective:	To impart knowledge about stresses, strains, shear force, bending moment, slope and deflection in beams and concept of torsion in circular shaft.				

Course Outcomes The students will be able to		Cognitive Level	Weightage of COs in End Semester Examination
CO1	Calculate simple stresses and strains in various structural members.	Ap	20%
CO2	Apply force equilibrium conditions and concept of free body diagrams to determine stresses and responses under different loading conditions	Ap	40%
CO3	Apply beam theory principles to predict structural behavior under various loading conditions.	An	20%
CO4	Examine the behavior of beams due to and cylinders subjected to bending stress.	An	20%
CO5	Engage in independent learning and prepare a report by analyze structural failure cases due to material stress or deflection issues.	An	Internal Assessment

UNIT I - SIMPLE AND COMPOUND STRESSES	**(9)**
Stresses in simple and compound bars - Elastic constants - Thin cylindrical and spherical shells - Biaxial state of stress - Principal stresses and principal planes - Torsion on circular shafts.	
UNIT II - BENDING OF BEAMS	**(9)**
Types of beams and transverse loadings - Shear force and bending moment for simply supported, cantilever and over-hanging beams - Theory of simple bending - Bending stress distribution - Shear stress distribution.	
UNIT III - DEFLECTION OF BEAMS	**(9)**
Double Integration method - Macaulay's method - Area moment method - Conjugate beam method - Strain energy method for determinate beams	
UNIT IV - INDETERMINATE BEAMS	**(9)**
Propped Cantilever and Fixed Beams - Fixed end moments reactions, slope and deflection for standard cases of loading - Continuous beams - support reactions and moments - Theorem of three moments - Shear Force and Bending Moment Diagrams.	
UNIT V - ADVANCED TOPICS	**(9)**
Bending stress in beams subjected to Unsymmetrical bending - Curved beams - Winkler Bach Theory - Rectangular, Circular, Trapezoidal sections - Thick cylinders - Compound cylinders.	
TOTAL (L:45) = 45 PERIODS	

TEXTBOOKS:

1. Rajput R.K. "Strength of Materials (Mechanics of Solids)", S.Chand & company Ltd., New Delhi, 2018.
2. Punmia B.C., Ashok Kumar Jain and Arun Kumar Jain, "Theory of Structures (SMTS) Vol - II", Laxmi Publishing Pvt Ltd, New Delhi 2017.
3. Vazirani.V.N, Ratwani. M.M, Duggal S.K, "Analysis of Structures: Analysis, Design and Detailing of Structures-Vol.I", Khanna Publishers, New Delhi 2014.

REFERENCES:

1. Kazimi S.M.A, "Solid Mechanics", Tata McGraw-Hill Publishing Co., New Delhi, 2017
2. William A .Nash, "Theory and Problems of Strength of Materials", Schaum's Outline Series, Tata McGraw Hill Publishing company, 2017.
3. Singh. D.K., " Strength of Materials", Ane Books Pvt. Ltd., New Delhi, 2021
4. Egor P Popov, "Engineering Mechanics of Solids", 2nd edition, PHI Learning Pvt. Ltd., New Delhi, 2015
5. Beer. F.P. and Johnston E.R. "Mechanics of Materials", Tata McGraw Hill, Sixth Edition, New Delhi 2010.

Mapping of COs with POs / PSOs

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	3													
2	3												2	2
3	2	3		2									2	2
4	2	2												
5		2							2	2		2		2
CO (W.A)	2.5	2.3		2									2	2

22CEC03 - HIGHWAY AND RAILWAY ENGINEERING

	L	T	P	C
	3	0	0	3

PREREQUISITE : NIL

Course Objective:	• To identify key principles and terminology in highway and railway engineering, including design standards and materials used in infrastructure.

Course Outcomes The students will be able to		Cognitive Level	Weightage of COs in End Semester Examination
CO1	Apply fundamental principles of highway and railway engineering to develop new infrastructure projects including design standards.	Ap	40%
CO2	Implement construction practices for pavements ensuring compliance with IS standards.	Ap	20%
CO3	Apply design criteria to create geometric layouts for highway elements.	Ap	20%
CO4	Apply the construction techniques and maintenance of track laying and railway stations.	Ap	20%
CO5	Analyze and present a real-world highway / railway project to evaluate its design approaches, construction methods, and project outcomes.	An	Internal Assessment

UNIT I - HIGHWAY ENGINEERING	**(9)**
Classification of highways - Institutions for Highway planning, design and construction at different levels - factors influencing highway alignment - Typical cross sections of Urban and Rural roads - Engineering surveys for alignment - Conventional and Modern method	
UNIT II - DESIGN OF HIGHWAY ELEMENTS	**(9)**
Cross sectional elements - Horizontal curves, super elevation, transition curves, widening of curves - Sight distances - 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)**
Bitumen, material testing and properties - Construction practice of flexible and concrete pavement - Highway drainage - Evaluation and Maintenance of pavements.	
UNIT IV - RAILWAY PLANNING AND CONSTRUCTION	**(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, super elevation, widening of gauge on curves (Problems) - Railway drainage.	
UNIT V - RAILWAY TRACK CONSTRUCTION MAINTENANCE AND OPERATION	**(9)**
Points and Crossings - Design of Turnouts, Working Principle -Track Circuiting - Construction and Maintenance - Conventional, Modern methods and Materials, Lay outs of Railway Stations and Yards, Rolling Stock, Tractive Power, Track Resistance - Role of Indian Railways in National Development - Railways for Urban Transportation - LRT & MRTS Feasibility study, Planning and construction.	
TOTAL (L:45) = 45 PERIODS	

TEXTBOOKS:

1. Khanna.S. K., Justo.C.E.G and Veeraragavan A. "Highway Engineering", Nemchand Publishers, 2014.
2. Subramanian K.P., "Highways, Railways, Airport and Harbour Engineering", SciTech Publications (India), Chennai, 2010
3. Kadiyali.L.R. "Principles and Practice of Highway Engineering", Khanna Technical Publications, 6th Edition Delhi, 2015.
4. C. Venkatramaiah., "Transportation Engineering - Vol.2 Railways, Airports, Docks and Harbours, Bridges and Tunnels", Universities Press (India) Private Limited, Hyderabad, 2015.

REFERENCES:

1. Yang H. Huang, "Pavement Analysis and Design", Pearson Education Inc, Nineth Impression, South Asia,2012
2. Ian D. Walsh, "ICE manual of highway design and management", ICE Publishers, Ist Edition, USA,2011
3. Garber and Hoel, "Principles of Traffic and Highway Engineering", CENGAGE Learning, New Delhi,2010
4. IRC 37 - 2012,"The Indian roads Congress, Guidelines for the Design of Flexible Pavements", New Delhi
5. IRC 58 -2012, "The Indian Road Congress, Guidelines for the Design of Rigid Pavements for Highways", New Delhi
6. Saxena Subhash, C. and Satyapal Arora, "A Course in Railway Engineering", Dhanapat Rai and Sons, Delhi, 1998.

Mapping of COs with POs / PSOs

Cos	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	2													2
2	3													
3	3		2										2	3
4	3													2
5								2	3			3		
CO (W.A)	2.8		2					2	3			3	2	2.3

22CEC04 - SURVEYING					
		L	T	P	C
		3	0	0	3
PREREQUISITE : NIL					
Course Objective:	• To learn the use of various surveying instruments and apply surveying techniques to real-world problems.				

Course Outcomes The students will be able to		**Cognitive Level**	**Weightage of COs in End Semester Examination**
CO1	Calculate various parameters of linear, direction, angular measurement of objects.	Ap	40%
CO2	Analyse and evaluate the measurements in leveling to obtain reduced levels and locate the contours.	An	20%
CO3	Apply hydrographic surveying techniques and analyse the data for mapping and charting water bodies.	Ap	20%
CO4	Apply the fundamental principles and advanced technologies in surveying.	Ap	20%
CO5	Create and Present their own maps based on surveyed data.	C	Internal Assessment

UNIT I - CHAIN AND COMPASS SURVEYING	**(9)**
Definition- Classifications - Plane and Geodetic Surveying - Basic principles - Equipment and accessories for ranging and chaining - Methods of ranging - well conditioned triangles - Compass - Types - Bearing - System and conversions - Sources of errors and Local attraction - Magnetic declination - Dip - Compass traversing and plotting - Closing error adjustment.	
UNIT II - LEVELING AND CONTOURING	**(9)**
Level line - Horizontal line - Datum - Bench marks - temporary and permanent adjustments - Methods of levelling - Fly levelling - Check levelling - Contouring - Methods - Characteristics and uses of contours. - Problems by using height of collimation and rise and fall method.	
UNIT III - THEODOLITE AND TACHEOMETRIC SURVEYING	**(9)**
Theodolite - Types - Horizontal and vertical angle measurements - Temporary and permanent adjustments -Tacheometric systems - Tangential and stadia methods - Stadia systems - Determination of stadia constants	
UNIT IV - HYDROGRAPHIC SURVEYING	**(9)**
Introduction to Hydrographic surveying - Tides - Mean Sea Level - Vertical depth measurements - Soundings - Methods of locating soundings	
UNIT V - DIGITAL SURVEYING	**(9)**
Introduction, aerial photogrammetry, types of EDM instruments. Total station - Principles of remote sensing and its applications.	
TOTAL (L:45) = 45 PERIODS	

TEXTBOOKS:

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. Duggal R.K, "Surveying Vol. I & II", Tata McGraw Hill Publishing Company Ltd., New Delhi, 2004.

REFERENCES:

1. R. Subramanian, "Surveying and Levelling", Oxford University Press, Second Edition, 2012.
2. Bannister and S. Raymond, "Surveying", Seventh Edition, Longman 2004.
3. S. K. Roy, "Fundamentals of Surveying", Second Edition, Prentice Hall of India 2010.
4. K. R. Arora, "Surveying Vol I & II", Standard Book house, Twelfth Edition 2013.
5 C. Venkatramaiah, "Textbook of Surveying", Universities Press, Second Edition, 2011.

Mapping of COs with POs / PSOs

Cos	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	3		2										2	3
2	3	2	2										3	3
3	3	2											3	3
4	2				3								3	3
5	3				2	2			3	3	2	3	3	3
CO (W.A)	**2.8**	**2**	**2**		**2.5**	**2**			**3**	**3**	**2**	**3**	**2.8**	**3**

22CEC05 - CONSTRUCTION MATERIALS AND PRACTICES

	L	T	P	C
	3	0	2	4

PREREQUISITE : NIL

Course Objective:	• To impart knowledge on the materials used for construction and the construction techniques implemented in construction industry. • To evaluate sustainable practices, safety measures, and economic considerations in selecting and using materials.

Course Outcomes The students will be able to		**Cognitive Level**	**Weightage of COs in End Semester Examination**
CO1	Identify suitable building materials for a construction project.	Ap	40%
CO2	Select and apply appropriate binding agents and composite materials for a specific construction project.	Ap	20%
CO3	Interpret the various construction practices and techniques adopted in building construction.	An	20%
CO4	Select equipment that meets the requirements of a construction project.	Ap	20%
CO5	Design and develop a construction project that demonstrates the application of construction materials and practices, and document the process in a comprehensive report.	E	Internal Assessment

UNIT I - BUILDING MATERIALS	**(9)**
Introduction and types of building materials - Properties - Physical and mechanical properties. Stones and Rocks: Classification of Rocks - Qualities of good stones - Uses. Bricks: Constituents - Qualities of good brick - Classification - Uses. Cement: Ingredients - Qualities of good cement - Types and Uses of cement.	
UNIT II - MORTAR, CONCRETE AND STEEL	**(9)**
Mortar: Types of Mortars - Properties - Uses - Selection of mortar. Concrete: Ingredients - Types of Concrete - Properties - Uses - Reinforced concrete. Steel: Steel sections - steel as a reinforcing material - Types of reinforcing steels.	
UNIT III - OTHER MATERIALS	**(9)**
Timber: Characteristics of timber - Seasoning of timber - Properties and uses - Common forms of timber - Plywood - Veneer - False ceiling materials - Aluminum - Uses - Market forms - Glass - Ceramics - Refractories - Composite Materials - Types and applications - FRP - Fibre textiles - Geomembranes and Geotextiles for earth reinforcement.	
UNIT IV - CONSTRUCTION PRACTICES AND SERVICE REQUIREMENTS	**(9)**
Types of Foundations - Shallow and Deep Foundations - Stone Masonry - Brick Masonry - Plastering and Pointing - Cavity Walls - Diaphragm Walls - Formwork - Centering and Shuttering - Shoring - Scaffolding - Underpinning - Roofing - Flooring - Joints in concrete - Contraction/Construction/Expansion joints - Fire Protection - Thermal Insulation - Ventilation and Air conditioning - Acoustics and Sound Insulation - Damp Proofing.	

UNIT V - CONSTRUCTION EQUIPMENTS	(9)
Selection of equipment for earthwork excavation, concreting, material handling and erection of structures - Dewatering and pumping equipment.	

LIST OF EXPERIMENTS:

1. Determination of Tension on mild steel rod.
2. Determination of Compression strength on Bricks and Blocks.
3. Determination of Water Absorption Test on Bricks and Blocks.
4. Determination of Izod and Charpy impact test on metal specimens.
5. Finding out the Rockwell Hardness Number on metal Specimens.
6. Finding out the Brinell hardness test on metal Specimens.
7. Determination of Torsional strength of steel specimen.

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

TEXTBOOK:

1. Palanichamy M.S., "Basic Civil Engineering", 4th Edition, McGraw-Hill Education, New Delhi, 2020.

REFERENCES:

1. Navaneethakrishnan P., "Basic of Civil and Mechanical Engineering", 1st Edition, McGraw-Hill Education, New Delhi, 2016
2. Duggal S.K., "Building Materials", 5th Edition, New Age Publishers, 2021.

Mapping of COs with POs / PSOs

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	3												3	3
2	3													3
3		3		2									2	2
4	2													2
5	3		2	2					3	2		3	3	3
CO (W.A)	2.8	3	2	2					3	2		3	2.7	2.6

22CEC06 - FLUID MECHANICS AND HYDRAULICS ENGINEERING

	L	T	P	C
	3	0	2	4

PREREQUISITE : NIL

Course Objective:	• To apply fluid mechanics principles to analyze and solve engineering problems related to fluid flow, hydraulic systems, and fluid machinery. • To demonstrate proficiency in designing and evaluating hydraulic structures and systems for practical applications.

Course Outcomes The students will be able to		**Cognitive Level**	**Weightage of COs in End Semester Examination**
CO1	Calculate the properties and characteristics of fluids.	Ap	20%
CO2	Apply concept of fluid measurement and pipe flows in engineering problems.	Ap	40%
CO3	Classify different types of flow and apply the concepts to design efficient channel systems.	Ap	20%
CO4	Evaluate the dimensional and model parameters to solve complex fluid problems.	Ap	20%
CO5	Apply theoretical concepts to practical problems, analyze and evaluate the performance of various hydraulic systems and interpret the data.	An	Internal Assessment

UNIT I - FLUID PROPERTIES, STATICS AND KINEMATICS	**(9)**
Properties of fluids - Types of fluids- Hydrostatic law - Pascal's law- Types and measurement of pressure - Hydrostatic pressure -Total pressure - Centre of pressure - Buoyancy - Metacentre - Equilibrium conditions.	
UNIT II - FLUID DYNAMICS	**(9)**
Classification and types of flow - flow lines and Path lines - Continuity equation - Velocity potential function and Stream function - Flow net - Euler's equation of motion - Bernoulli's equation and its applications	
UNIT III - OPEN CHANNEL FLOW	**(9)**
Types of flow- Specific energy - Critical flow - Velocity measurements by Manning's and Chezy' formula - Most economical sections - Characteristics and types of flow profiles - Back water and draw down curves - Surface profile calculations	
UNIT IV - FLOW THROUGH PIPES AND BOUNDARY LAYER	**(9)**
Flow through Pipes in series and parallel - Darcy Weisbach's formula - Moody diagram - Hydraulic Jumps - Surges. Boundary layer concept, thickness and classification.	
UNIT V - DIMENSIONAL AND MODEL ANALYSIS	**(9)**
Dimensional analysis - Dimensional parameters - Rayleigh's method and Buckingham's Pi theorem - Model analysis - Hydraulic structures - Similitude - Scale effect - Distorted and undistorted models.	

LIST OF EXPERIMENTS:

1. Determination of Co-efficient of discharge of Orifice meter,
2. Determination of Co-efficient of discharge of Venturi meter.
3. Determination of friction loss in pipes
4. Determination of various types of minor losses in pipes
5. Evaluation of the performance characteristics of Pelton turbine
6. Evaluation of the performance characteristics of Francis / Kaplan turbine
7. Determination of Metacentric height of floating bodies
8. Evaluation of the performance characteristics of submersible pump

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

TEXTBOOK:

1. Bansal R.K., "A Textbook of Fluid Mechanics and Hydraulic Machines", 10th Edition, Laxmi Publications, New Delhi, 2018.

REFERENCES:

1. Modi P.M., and Seth S.M., "Hydraulics and Fluid Mechanics including Hydraulic Machines", 21st Edition, Standard Book House, New Delhi, 2017.
2. Victor L. Streeter, Benjamin E. Wylie and Bedford K.W., "Fluid Mechanics", 9th Edition, McGraw-Hill, India, 2010.

Mapping of COs with POs / PSOs

Cos	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	3												2	
2	3												2	
3		2		2										2
4	2	2												2
5		2		2					2			2		2
CO (W.A)	2.7	2		2					2			2	2	2

22CEP01- SURVEYING LABORATORY				
	L	T	P	C
	0	0	4	2
PREREQUISITE : NIL				

Course Objective:	• To impart knowledge in linear/angular measurement using various surveying instruments. • To provide an exposure on the use of minor and modern instruments in surveying

Course Outcomes The Student will be able to		**Cognitive Level**
CO1	Apply the usage of basic surveying instruments in the field.	Ap
CO2	Compute area of field using linear and angular measurements.	An
CO3	Determine the elevations of different points using various methods	Ap
CO4	Construct the control points and carry-out the appropriate error corrections for the survey data points.	C
CO5	Represent the concept and principle of modern surveying.	Ap

LIST OF EXPERIMENTS:

1. Measurement of bearings of sides of a traverse with prismatic compass
2. Fixing bench mark with respect to temporary bench mark with dumpy level by fly leveling.
3. Contour plan of given area.
4. Determination of elevation of various points using dumpy level by rise and fall method.
5. Determination of elevation of various points using dumpy level by Height of Collimation Method.
6. Measurements of Horizontal Angles by method of repetition.
7. Study on Setting up of Total Station.
8. Remote elevation Measurement using Total Station
9. Missing Line Measurement Using Total Station
10. Area measurement using Total Station
11. Study on layout preparation using total station

TOTAL (P:60) = 60 PERIODS

REFERENCES:

1. Dr. B. C. Punmia, Ashok K. Jainand Arun K Jain, "Surveying Vol. I & II", Lakshmi Publications Pvt Ltd, New Delhi, 17th Edition, 2016.
2. David Clark, "Plane and Geodetic Surveying for Engineers, Volume I", Constable and Company Ltd, London, CBS, 6th Edition, 2004.
3. S. K. Roy, "Fundamentals of Surveying", Second Edition, Prentice Hall of India 2004
4. K. R. Arora, "Surveying Vol. I & II", Standard Book house, Eleventh Edition, 2013.

Mapping of COs with POs / PSOs

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	3												2	
2		2	3										3	
3	3	2		2										2
4		3		2										
5	3				3							3		2
CO (W.A)	**3**	**2.3**	**3**	**2**	**3**							**3**	**2.5**	**2**

22CEP02 - COMPUTER AIDED BUILDING DRAWING - I				
	L	T	P	C
	0	0	4	2

PREREQUISITE : NIL

Course Objective:	• To imparts knowledge about the preparation of plan, section and elevation of different types of buildings as per specifications.

Course Outcomes The Student will be able to		**Cognitive Level**
CO1	Apply the various basic commands for drafting and know the types of coordinate systems.	Ap
CO2	Draw and label the various building elements.	Ap
CO3	Plan buildings based on NBC specifications and building bye-laws.	Ap
CO4	Draw the detailed working drawing for residential building.	C
CO5	Prepare detailed drawings to include the plan, elevation, and sectional views of the load-bearing structure.	C

LIST OF EXPERIMENTS:

1. Introduction to AutoCAD and basic drafting tools /commands
2. Building Planning - NBC provisions and Bye-laws -Terminologies, Orientation, Ventilation & Lighting
3. Preparation of key plan and site plan
4. Draw the Building Elements - Foundations, Super structure
5. Draw the Building Elements - Types of Roofs and Staircase
6. Draw the Building Elements - Types of Doors and Windows
7. Preparation of approval plan for a Residential Building
8. Draw the Plan, Elevation and Section of a residential Building with Load Bearing Wall (Flat roof)
9. Draw a Plan, Elevation and Section of sloped roof residential building with load bearing wall
10. Draw a Single floor residential building - Plan, Section and Elevation

TOTAL (P:60) = 60 PERIODS

REFERENCES/ MANUAL /SOFTWARE:

1. Reference manual for AutoCAD
2. Sikka V.B., "A course in Civil Engineering Drawing", 4th Edition, S.K.Kataria and Sons, 2015.
3. Bhavikatti, S.S and Chitawadagi, M.V., "Building Planning and Drawing", I.K. International Publishing House Pvt. Ltd. New Delhi,2019

Mapping of COs with POs / PSOs

Cos	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	3													
2	3													
3	3									2		3		3
4	3				2					3	3	3	3	3
5	3				2					3	3	3	3	3
CO (W.A)	3				2					2.7	3	3	3	3

22MAN04R - SOFT/ANALYTICAL SKILLS - II (Common to All Branches)				
	L	**T**	**P**	**C**
	1	**0**	**2**	**0**

PREREQUISITE : NIL

Course Objective:	• To develop comprehensive English language skills • To enhance logical reasoning skills and enhance problem-solving abilities

Course Outcomes The Student will be able to		**Cognitive Level**	**Weightage of COs in Continuous Assessment Test**
CO1	Comprehend grammar, analyze texts, understand spoken language, articulate ideas in speech, and produce well-structured written compositions.	U	40%
CO2	Analyze quantitative aptitude problems and find solutions.	Ap	30%
CO3	Demonstrate the ability to solve problems through logical reasoning.	An	30%

UNIT I - VERBAL ABILITY	**(5+10)**
Grammar - One Word Substitutions - Phrasal Verbs - **Listening** - IELTS Listening (Intermediate) - **Speaking** - Group Discussion - **Reading** - Reading Newspaper / Articles -**Writing** - Proverb Expansion.	
UNIT II - APTITUDE	**(5+10)**
Ratio and Proportion - Allegation and Mixture - Partnership - Average - Problems on Ages - Percentage Profit and Loss - Height and Distance.	
UNIT III - REASONING	**(5+10)**
Blood Relationship - Direction Sense - Paper Cutting and Folding - Logical Arrangements and Ranking - Venn Diagram.	
TOTAL(L:45) = 45 PERIODS	

REFERENCES:

1. Rizvi, M.Ashraf. "Effective Technical Communication". Tata McGraw-Hill Education, 2017.
2. Aggarwal R S. "Quantitative Aptitude for Competitive Examinations", S.Chand Publishing Company Ltd(s)., 2022.
3. Sharma, Arun. "How to Prepare for Quantitative Aptitude for the CAT". Tata McGraw – Hill Publishing, 2022.
4. Praveen R V. "Quantitative Aptitude and Reasoning", PHI Learning Pvt. Ltd., 2016.

Mapping of COs with POs / PSOs														
COs	**POs**												**PSOs**	
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
1									2	3				
2		2		2										
3		2		2										
CO (W.A)		**2**		**2**					**2**	**3**				

22CEC07 - STRUCTURAL ANALYSIS					
		L	T	P	C
		3	1	0	4
PREREQUISITE : 22CEC02					
Course Objective:	• To provide knowledge on various methods for the analysis of determinate and indeterminate structures. • To impart knowledge on moving loads and influence line diagrams. • To understand the approximate methods for analyzing multi-storey frames				

Course Outcomes The students will be able to		**Cognitive Level**	**Weightage of COs in End Semester Examination**
CO1	Determine member forces including bending moments and shears in beams.	An	20%
CO2	Analyze the multistory frames using approximate methods.	An	20%
CO3	Analyze the beams, frames and truss system using matrix method.	An	40%
CO4	Analyze the response in structural elements for the moving loads using method of influence line diagram.	An	20%
CO5	Carry out the analysis of framed structures and document the results in a detailed report.	An	Internal Assessment

UNIT I - SLOPE DEFLECTION METHOD	**(9+3)**
Introduction to displacement method of analysis - Sign conventions - Development of slope deflection equations - Analysis of continuous beams - Analysis of continuous beams with support settlement - Analysis of non-sway frames - Analysis of sway frames.	
UNIT II - MOMENT DISTRIBUTION METHOD	**(9+3)**
Introduction to moment distribution method - Stiffness factor - Carryover factor and distribution Factor - Analysis of continuous beams - Sinking of supports - Analysis of non-sway frames - Analysis of sway frames.	
UNIT III - FLEXIBILITY MATRIX METHOD	**(9+3)**
Introduction - Static and kinematic indeterminacy - Equilibrium and compatibility conditions - Primary structure - Element and global flexibility matrix - Applications - Analysis of indeterminate beams, frames and trusses (Redundancy restricted to two).	
UNIT IV - STIFFNESS MATRIX METHOD	**(9+3)**
Introduction to matrix methods of analysis - Displacement and force transformation matrices - Element and global stiffness matrix - Applications - Analysis of indeterminate beams - Analysis of portal frames - Analysis of trusses (Redundancy restricted to two).	
UNIT V - MOVING LOADS AND INFLUENCE LINES	**(9+3)**
Influence lines for reactions in statically determinate structures - Influence lines for member forces in pin-jointed frames - Influence lines for shear force and bending moment in beam sections - Muller Breslau's principle - Influence lines for continuous beams (2 - degree redundant structures)	
TOTAL (L:45+T:15) = 60 PERIODS	

TEXTBOOKS:

1. Devdas Menon, "Structural Analysis", 2nd Edition, Narosa Publishing House, New Delhi, 2018.
2. Vaidyanathan, R and Perumal, P., "Comprehensive Structural Analysis Volume I and II", Laxmi Publications Pvt. Ltd., Chennai, 4th Edition, 2016.
3. S.S.Bhavikatti, "Structural Analysis - Vol. I & II", Vikas Publishing Pvt Ltd., New Delhi, 4th ed., 2013.

REFERENCES:

1. Hibbeler, R.C, "Structural Analysis", 10th Edition, Pearson India, Bengaluru, 2018.
2. Punmia.B.C, Ashok K.Jain, ArunK.Jain, "Theory of Structures", 13th Edition, Laxmi Publications, New Delhi, 2017

Mapping of COs with POs / PSOs

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	2	3												
2	3	3											2	
3	3	3												2
4	3	3												2
5	3	3	2						2	2		3	2	2
CO (W.A)	**3**	**3**		**2**					**2**	**2**		**2**	**2**	**2**

22CEC08 - WATER RESOURCES AND IRRIGATION ENGINEERING				
	L	T	P	C
	3	0	0	3
PREREQUISITE : NIL				
Course Objective:	• To provide knowledge of water resources, irrigation engineering concepts, and national water policy. • To impart the required knowledge on reservoir management and Irrigation management practices.			

Course Outcomes The students will be able to		**Cognitive Level**	**Weightage of COs in End Semester Examination**
CO1	Identify the components of water storage structures along with its functions.	Ap	20%
CO2	Identify the suitable method of irrigation and estimate the water requirements of irrigation scheduling.	An	40%
CO3	Apply the principles of canal alignment in the design of irrigation canals.	Ap	20%
CO4	Assess water quality parameters and proposing strategies to maintain or improve water quality.	An	20%
CO5	Design and develop an irrigation project and document the process in a comprehensive report.	Ap	Internal Assessment

UNIT I - WATER RESOURCES	**(9)**
Need for water resources - Water resources of Tamil Nadu and India - Planning of water resources - Assessment of water requirement for drinking and irrigation purposes - Reservoirs - Single and multipurpose reservoir - Multi objective - Storage capacity of reservoirs - Reservoir operation strategies - Design flood level - levees and flood walls.	
UNIT II - WATER RESOURCE MANAGEMENT	**(9)**
Financial aspects of water resources planning - National Water Policy - Consumptive and non - consumptive water use - Water quality - Scope and aims of master plan - Idea of basin as a unit for development - Water budget - Conjunctive use of surface and ground water.	
UNIT III - IRRIGATION ENGINEERING	**(9)**
Need - Advantages and Disadvantages - Connection between Duty, Delta and Base period - Causes affecting duty - Problems - Irrigation efficiencies - problems - Seasonal crops of India - Crop water Requirement - Evaluation of Consumptive use of water.	
UNIT IV - CANAL IRRIGATION	**(9)**
Types of impounding structures: Gravity dam - Diversion Head works - Canal drop - Cross drainage works - Canal regulations - Canal outlets - Canal classifications - Alignment of canals - River Training works - Kennedy's and Lacey's Regime theory.	

UNIT V - IRRIGATION METHODS AND MANAGEMENT	(9)
Types of Irrigation - Lift irrigation - Tank irrigation - Well irrigation - Irrigation methods: Surface and Sub - Surface and Micro irrigation - Merits and demerits - Irrigation scheduling - Water distribution - Participatory irrigation management with a case study - On farm development works - Participatory irrigation management - Case study.	
TOTAL (L:45) = 45 PERIODS	

TEXTBOOKS:

1. Garg S.K., "Water Resources Engineering Vol. II Irrigation Engineering and Hydraulic Structures", 34th Edition, Khanna Publishers,New Delhi, 2016.
2. Punmia B.C. and Pande B.B .Lal," Irrigation and Water Power Engineering", Laxmi Publishing, New Delhi, 2007
3. Asawa G.L., "Irrigation and Water Resources Engineering", 1st Edition, New Age International Publishers, New Delhi, 2005.

REFERENCES:

1. Suresh Ukarande, "Irrigation Engineering and Hydraulic Structures", 3rd Edition, Ane Books Pvt. Ltd., New Delhi, 2015.
2. Sharma R.K. "Irrigation Engineering", S.Chand and Co. 2007.

Mapping of COs with POs / PSOs

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	2													
2	2			2										
3	3													2
4		2		2										2
5	3								2	3		3		2
CO (W.A)	2.5	2		2					2	3		3		2

22CEC09 - SOIL MECHANICS					
		L	T	P	C
		3	0	2	4
PREREQUISITE : NIL					
Course Objective:	• To understand the role of water in soil behavior and how soil stresses, permeability and quantity of seepage under various loading conditions.				

Course Outcomes The students will be able to		Cognitive Level	Weightage of COs in End Semester Examination
CO1	Apply weight-volume relations and index properties of soils to characterize soil behavior and properties for engineering applications.	Ap	20%
CO2	Estimate soil stresses and for various types of foundation loads.	An	40%
CO3	Apply the principles and techniques to achieve optimal density and stability in engineering constructions.	Ap	20%
CO4	Apply the concepts of shear strength in the analysis of stability of slopes, foundations, and earth structures.	An	20%
CO5	Analyze the role of soil in structural failures and interpret test data to prepare technical reports.	An	Internal Assessment

UNIT I - WEIGHT VOLUME RELATIONS AND INDEX PROPERTIES	**(9)**
Soil formation -Three phase diagram - Weight-volume relations - Index properties of soils - Atterberg's limits - Classification of soils - BIS System.	
UNIT II - SOIL WATER AND PERMEABILITY	**(9)**
Soil water - Effective and neutral stresses - Flow of water through soils - Permeability - Laboratory methods - Darcy's law - Seepage and flow-nets - Quick sand.	
UNIT III - STRESS DISTRIBUTION IN SOILS	**(9)**
Vertical pressure distribution - Boussinesq's equation for point load and uniformly distributed loads - New mark's influence chart - Westergaard's equation -Isobar diagram - Pressure bulb - Contact pressure distribution.	
UNIT IV - CONSOLIDATION AND COMPACTION	**(9)**
Compressibility - e-log p curve - Preconsolidation pressure - Primary consolidation - Terzaghi's consolidation theory - Compaction - factors affecting soil compaction - Laboratory compaction tests - dry density and moisture content relationship - field compaction.	
UNIT V - SHEAR STRENGTH OF SOIL	**(9)**
Shear strength of soils - Stress analysis by Mohr's circle - Mohr's strength theory - Mohr-Coloumb strength envelope - Measurement of shear strength - Direct shear test - Triaxial compression - Unconfined compression test - Vane shear test - Shear strength of saturated cohesive soils - Shear strength of cohesionless soils.	

LIST OF EXPERIMENTS:

1. Determination of specific gravity of soil.
2. Determination of moisture content of soil.
3. Determination of grain size distribution using sieve analysis.
4. Determination of plasticity index of soil.
5. Determination of field density by sand replacement method
6. Determination of field density by core cutter method
7. Determination of moisture - density relationship using Standard Proctor Method
8. Determination of shear strength of soil by direct shear test

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

TEXTBOOKS:

1. Punmia, B.C., "Soil Mechanics and Foundations", Laxmi Publications Pvt. Ltd. New Delhi, 2005.
2. Gopal Ranjan and Rao, A.S.R., "Basic and Applied Soil Mechanics", New Age Ltd. International Publisher New Delhi (India) 2006.
3. Arora K.R"Soil Mechanics and Foundation Engineering ", Standard Publishers and Distributors, New Delhi, 2005.

REFERENCES:

1. McCarthy, D.F., "Essentials of Soil Mechanics and Foundations". Prentice-Hall, 2006.
2. Das, B.M., "Principles of Geotechnical Engineering". Brooks / Coles / Thompson Learning Singapore, 8th Edition, 2013.
3. Murthy, V.N.S., "Soil Mechanics and Foundation Engineering", CBS Publishers Distribution Ltd., New Delhi. 2015.

Mapping of COs with POs / PSOs

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	3			2				3					3	3
2		3												2
3		3		2										2
4	3							3						2
5	3							3				3	3	3
CO (W.A)	3	3		2				3				3	3	2.4

22CEC10 - DESIGN OF REINFORCED CONCRETE ELEMENTS

(IS 456 and SP 16 code books are permitted)

	L	T	P	C
	3	0	0	3

PREREQUISITE : NIL

Course Objective:	• To understand and apply the fundamental principles of reinforced concrete design, including the behavior of concrete and steel under load, to ensure safety and durability in structures.

Course Outcomes The students will be able to		**Cognitive Level**	**Weightage of COs in End Semester Examination**
CO1	Apply limit state principles to the design and analysis of structural components.	Ap	20%
CO2	Apply relevant design codes and specifications in the design of structural elements, ensuring compliance with IS standards.	Ap	40%
CO3	Design slab and staircase using appropriate codes and standards, ensuring structural safety and serviceability.	An	20%
CO4	Analyze and design foundations to safely transmit loads to the soil.	An	20%
CO5	Design RC structural elements (beams, slabs, columns, footings) based on IS codes and prepare detailed reinforcement drawings.	An	Internal Assessment

UNIT I - DESIGN PHILOSOPHY	**(6)**
Concept of Elastic method, ultimate load method and limit state method - Advantages of Limit State Method over other methods - Design codes and specification - Limit State philosophy as detailed in IS code.	
UNIT II - DESIGN OF BEAM	**(12)**
Analysis and design of singly and doubly reinforced rectangular beam and Flanged beams (T- Beams only) - Use of design aids for Flexure - Behaviour of RC members in Shear, Bond and Anchorage - Design requirements as per current code - Behaviour of rectangular RC beams in shear and torsion.	
UNIT III - DESIGN OF SLAB AND STAIRCASE	**(9)**
Analysis and design of cantilever, one way simply supported and continuous slabs and supporting beams - Two way slab - Design of simply supported and continuous slabs using IS code coefficients - Types of Staircases - Design of dog-legged Staircase.	
UNIT IV - DESIGN OF COLUMN	**(9)**
Types of columns - Braced and unbraced columns - Design of short rectangular and circular columns for axial, uniaxial and biaxial bending.	
UNIT V - DESIGN OF FOOTING	**(9)**
Design of wall footing - Design of axially and eccentrically loaded rectangular pad and sloped footings - Design of combined footing.	
TOTAL (L: 45) = 45 PERIODS	

TEXTBOOKS:

1. Gambhir.M.L., "Fundamentals of Reinforced Concrete Design", Prentice Hall of India Private Limited, New Delhi, 2006.
2. Krishnaraju.N, "Design of Reinforced Concrete Structures ", CBS Publishers & Distributors

REFERENCES:

1. Sinha, S.N., "Reinforced Concrete Design", Tata McGraw Hill Publishing Company Ltd., New Delhi, 2017.
2. Unnikrishna Pillai, S., Devdas Menon, "Reinforced Concrete Design", Tata McGraw Hill Publishing Company Ltd., 2021
3. Punmia.B.C., Ashok Kumar Jain, Arun Kumar Jain, "Limit State Design of Reinforced Concrete", Laxmi Publication Pvt. Ltd., New Delhi, 2016
4. Shah V L Karve S R., "Limit State Theory and Design of Reinforced Concrete", Structures Publilcations, Pune, 2013
5. IS 456 - Indian Standard Plain and Reinforced Concrete - Code of Practice. 2000
6. SP 16 :Design Aids for Reinforced Concrete to IS : 456- 1978

Mapping of COs with POs / PSOs

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	3													
2	3	3	3					3				3	3	3
3		3	3					3				3	3	3
4		3	3					3				3	3	3
5		3	3					3	2	2	2	3	3	3
CO (W.A)	**3**	**3**	**3**					**3**	**2**	**2**	**2**	**3**	**3**	**3**

22CEC11- CONCRETE TECHNOLOGY *(IS 456 and IS 10262-2019 code books are permitted)*					
		L	**T**	**P**	**C**
		3	**0**	**0**	**3**
PREREQUISITE : 22CEC05					
Course Objective:	• To imparts knowledge about the various ingredients and properties of materials used for concrete and mix design for concrete.				

Course Outcomes The students will be able to		**Cognitive Level**	**Weightage of COs in End Semester Examination**
CO1	Apply principles of concrete mix design to select appropriate constituents and proportions to achieve desired properties.	Ap	40%
CO2	Evaluate the concrete's properties and interpret with IS standards.	Ap	20%
CO3	Evaluate concrete's durability performance through standard tests and assessments.	An	20%
CO4	Identify and apply suitable special concretes in construction projects.	An	20%
CO5	Prepare comprehensive reports and presentations including experimental results, design rationale and recommendations.	C	Internal Assessment

UNIT I - CONSTITUENTS OF CONCRETE	**(9)**
Cement - Manufacturing Process - Types of cement - Properties - Heat of Hydration - Field and Laboratory Test on cement; Aggregates - Fine and Coarse aggregates - Properties - Classifications - Testing methods of Fine and Coarse aggregates; Admixtures - Mineral and Chemical admixtures; Water - Quality of water for use in concrete.	
UNIT II - MIX DESIGN OF CONCRETE	**(9)**
Concrete Mix Proportioning - Methods of IS concrete mix proportion - Guidelines for normal concrete - Concrete - Concepts variables in proportioning - Concepts of Self Compacting Concrete (SCC) mix design.	
UNIT III - FRESH AND HARDENED CONCRETE PROPERTIES	**(9)**
Workability - measurement of workability - Statistical and quality control of concrete; Properties of fresh concrete - Test on fresh concrete - Test on hardened concrete - modulus of elasticity of concrete- Elasticity - Creep, Shrinkage and temperature effects - Stress and Strain characteristics - Non Destructive Tests for concrete.	
UNIT IV - DURABILITY PROPERTIES OF CONCRETE	**(9)**
Durability of concrete - Tests for durability - Strength and durability relationship - Factors affecting durability of concrete - Permeability- Rapid Chloride Permeability Test (RCPT) - Sorptivity - Alkali Aggregate Reaction - Chemical attack - Corrosion tests - Cracks in Concrete- Performance based durability design	

UNIT V - SPECIAL CONCRETES	(9)
Introduction to Polymer concrete, High performance concrete, High strength concrete, Fibre reinforced concrete, Light weight concrete, Ready mix concrete and pumping of concrete, Slurry Infiltrated Fiber Concrete (SIFCON), Permeable concrete, Self compacting concrete, Geo-polymer Concrete, Ferrocement.	
TOTAL (L:45) = 45 PERIODS	

TEXTBOOKS:

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. Neville, A.M; "Properties of Concrete", Pitman Publishing Limited, London,1995
2. Gambhir.M.L. "Concrete Technology", Fifth Edition, McGraw Hill Education, 2017.
3. Job Thomas., "Concrete Technology", Cencage learning India Private Ltd, New Delhi, 2015.
4. IS10262-2019," Recommended Guidelines for Concrete Mix Design", Bureau of Indian Standards, New Delhi.
5. IS : 12269-1987,"Specification for 53 grade OPC", BIS, New Delhi
6. IS : 383 - 2016, "Coarse and Fine Aggregate - Specification's, BIS, New Delhi
7. IS: 456-2000, "Plain and Reinforced Concrete - Code of Practice", BIS, New Delhi.

Mapping of COs with POs / PSOs

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	3	3	3	3				3		3	3	3	3	3
2		3						3		3		3	3	3
3								3						3
4		3										3	2	3
5	3			3				3		3	3	3	3	3
CO (W.A)	**3**	**3**	**3**	**3**				**3**		**3**	**3**	**3**	**2.8**	**3**

22CEC12 - ENVIRONMENTAL ENGINEERING					
		L	T	P	C
		3	0	2	4
PREREQUISITE : NIL					
Course Objective:	• To impart knowledge on water and sewage occurrence, distribution, treatment and disposal techniques.				

Course Outcomes The students will be able to		**Cognitive Level**	**Weightage of COs in End Semester Examination**
CO1	Design efficient water supply in water treatment units	Ap	40%
CO2	Design sewage treatment systems to minimize environmental impact	An	20%
CO3	Design advanced treatment units for disposal of sewage	An	20%
CO4	Analyse the disposal methods of sewage in water bodies	An	20%
CO5	Analyze water quality to assess the condition of water samples and present a report their suitability for various applications.	An	Internal Assessment

UNIT I - SOURCES AND CONVEYANCE OF WATER	**(9)**
Objectives of Public Water supply system - Intakes - Channels and pipes for conveying water - Planning, Design period, Population forecasting - water demand -Sources of water - Surface and Ground water - Characteristics of water	
UNIT II - WATER TREATMENT	**(11)**
Water treatment Objectives - Unit operations and processes in surface water treatment - Principles, functions and design of flash mixers, flocculators, sedimentation tanks and sand filters - Aeration - iron and manganese removal, defluoridation.	
UNIT III - PRIMARY SEWAGE TREATMENT	**(9)**
Characteristics of sewage, Primary treatment: Principles, functions and design of screen, grit chambers and primary sedimentation tanks - Layout of Sewage Treatment Plant.	
UNIT IV - SECONDARY SEWAGE TREATMENT	**(9)**
Activated Sludge Process and Trickling filter (no design); Other treatment methods - oxidation ditches, UASB -Waste Stabilization Ponds - Anaerobic Stabilization units - Septic tanks.	
UNIT V - DISPOSAL OF SEWAGE AND SLUDGE	**(7)**
Dilution - Self-purification of surface water bodies - Oxygen sag curve - Sewage farming - characteristics of Sludge -Thickening - Sludge digestion - Sludge disposal - Environmental Pollution Act.	

LIST OF EXPERIMENTS:

1. Determination of Turbidity by using Nephlometer
2. Measurement of pH and conductivity of water sample
3. Determination of Hardness by EDTA method
4. Determination of Alkalinity
5. Determination of Acidity in water
6. Determination of Chlorides
7. Determination of Optimum Coagulant by Jar test
8. Determination of Total, Dissolved and Suspended solids
9. Determination of Available chlorine in bleaching powder
10. Determination of COD for given sample

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

TEXTBOOKS:

1. Garg, S.K., "Environmental Engineering Vol. I and II", Khanna Publishers, New Delhi, 2010.
2. Modi, P.N. "Water Supply Engineering Vol. I", Standard Book House, New Delhi, 2010.
3. Punmia, B.C., Ashok K Jain and Arun K Jain, "Water Supply Engineering", Laxmi Publications Pvt. Ltd., New Delhi, 2013

REFERENCES:

1. Metcalf and Eddy, " Waste Water Engineering: Treatment and Reuse", 4th Edition, McGraw-Hill, New Delhi, 2017.
2. Duggal K.N., "Elements of Environmental Engineering" S. Chand and Co. Ltd., New Delhi, 2014.
3. George Tchobanoglous, Franklin Louis Burton, H. David Stensel, Metcalf and Eddy, "Wastewater Engineering, Treatment and Reuse", Tata McGraw-Hill Edition, 4th Edition, New Delhi, 2009.

Mapping of COs with POs / PSOs

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	2													
2	3		2											
3		3	3					3						
4		2		2				2						
5		3		3					3	2	2	3	3	2
CO (W.A)	2.5	2.7	2.5	2.5				2.5	3	2	2	3	3	2

22CEP03 - COMPUTER AIDED BUILDING DRAWING - II				
	L	T	P	C
	0	0	4	2

PREREQUISITE : NIL

Course Objective:	• To imparts knowledge about the preparation of plan, section and elevation of different types of buildings as per specifications.

Course Outcomes The Student will be able to		**Cognitive Level**
CO1	Plan buildings based on NBC specifications and building bye-laws.	Ap
CO2	Draw the detailed working drawing for residential building.	C
CO3	Prepare detailed drawings to include the plan, elevation, and sectional views of the multi-storied structure.	C
CO4	Prepare detailed plans, sections, and elevations for different types of buildings.	C
CO5	Present residential building designs in three dimensions for spatial relationships, materials, and finishes.	C

LIST OF EXPERIMENTS:

1. Draw the Plan, Elevation and Section of an Industrial Building
2. Draw the Plan, Elevation and Section of a School Building with Framed structure
3. Draw the multi-Storied residential building with Dog legged staircase - Plan, Section and Elevation
4. Draw a Primary Health Center - Plan, Section and Elevation
5. Draw a Hostel Building - Plan, Section and Elevation
6. Draw a plan for Shopping Mall
7. Draw a Plan for Apartment Building
8. Layout Preparation for Individual Villas
9. Preparation of approval plan for a Commercial Building
10. 3D view for Residential Building

TOTAL (P:60) = 60 PERIODS

REFERENCES/ MANUAL /SOFTWARE:

1. Reference manual for AutoCAD
2. Sikka V.B., "A course in Civil Engineering Drawing", 4th Edition, S.K.Kataria and Sons, 2015.
3. Bhavikatti, S.S and Chitawadagi, M.V., "Building Planning and Drawing", I.K. International Publishing House Pvt.Ltd. New Delhi,2019

Mapping of COs with POs / PSOs														
Cos	**POs**												**PSOs**	
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
1	3											3	3	3
2	2				2					3		3	3	3
3			3		3					3		3	3	3
4			3		3					3		3	3	3
5			3		3					3		3	3	3
CO (W.A)	**2.5**		**3**		**3**					**3**		**3**	**3**	**3**

22MAN07R - SOFT/ANALYTICAL SKILLS – III (Common to All Branches)				
	L	**T**	**P**	**C**
	1	**0**	**2**	**0**

PREREQUISITE : Nil

Course Objective:	• To improve language proficiency for personal or professional reasons • To enhance students' mathematical problem-solving and critical thinking skills

Course Outcomes The Student will be able to		**Cognitive Level**	**Weightage of COs in Continuous Assessment Test**
CO1	Demonstrate effective communication skills by listening actively, speaking clearly, reading critically, and writing coherently in contexts.	U	40%
CO2	Develop proficiency in applying mathematical concepts of time, speed, distance, and financial calculations involving simple and compound interest.	Ap	30%
CO3	Analyse logical reasoning skills through various forms of statements.	An	30%

UNIT I – VERBAL ABILITY	**(5+10)**
Grammar - Concord - Relative Clause - **Listening** - IELTS Listening (Advanced) and Gap Filling - **Speaking** - Introducing Others - Formal Conversations - **Reading** - Reading Comprehension - **Writing** - Hints Development.	
UNIT II – APTITUDE	**(5+10)**
Simple and Compound Interest - Time, Speed and Distance - Problems on Trains - Boats and Streams - Chain Rule - Time and Work - Pipe and Cisterns.	
UNIT III - REASONING	**(5+10)**
Seating Arrangements - Syllogism - Statement and Conclusion - Statement and Assumption - Statement and Course of Action.	
TOTAL(L:45) = 45 PERIODS	

REFERENCES:

1. Rizvi, M.Ashraf. *Effective Technical Communication.* Tata McGraw-Hill Education, 2017.
2. Aggarwal R S. *Quantitative* Aptitude for Competitive Examinations. S.Chand Publishing Company Ltd(s)., 2022.
3. Sharma, Arun. *How to Prepare for Quantitative Aptitude for the CAT*. Tata McGraw – Hill Publishing, 2022.
4. Praveen R V. *Quantitative Aptitude and Reasoning.* PHI Learning Pvt. Ltd., 2016.

Mapping of COs with POs / PSOs														
COs	**POs**												**PSOs**	
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
1									2	3				
2		2		2										
3		2		2										
CO (W.A)		**2**		**2**					**2**	**3**				

22MAN09 - INDIAN CONSTITUTION (Common to All Branches)				
	L	**T**	**P**	**C**
	I	**0**	**0**	**0**

PREREQUISITE : NIL

Course Objective:	• To educate students to learn about the Constitutional Law of India. • To motivate students to understand the role of Union Government. • To make students to understand about State Government. • To understand about District Administration, Municipal Corporation and Zila Panchayat. • To encourage students to Understand about the election commission.

Course Outcomes The Student will be able to		**Cognitive Level**	**Weightage of COs in End Semester Examination**
CO1	Gain Knowledge about the Constitutional Law of India.	U	Internal Assessment
CO2	Know the Union Government and role of President and Prime Minister.	R	
CO3	Gain knowledge about State Government and role of Governor, Chief Minister.	U	
CO4	Understand the District Administration, Municipal Corporation and Zila Panchayat.	U	
CO5	Understand the role and function of election commission.	U	

UNIT I - THE CONSTITUTION INTRODUCTION	**(9)**
The History of the Making of the Indian Constitution - Preamble and the Basic Structure, and its interpretation - Fundamental Rights and Duties and their interpretation - State Policy Principles.	
UNIT II - UNION GOVERNMENT	**(9)**
Structure of the Indian Union - President - Role and Power - Prime Minister and Council of Ministers - Lok Sabha and Rajya Sabha	
UNIT III - STATE GOVERNMENT	**(9)**
Governor - Role and Power - Chief Minister and Council of Ministers - State Secretariat	
UNIT IV - LOCAL ADMINISTRATION	**(9)**
District Administration - Municipal Corporation - Zila Panchayat	
UNIT V - ELECTION COMMISSION	**(9)**
Role and Functioning - Chief Election Commissioner - State Election Commission	
TOTAL (L:45) : 45 PERIODS	

TEXT BOOKS:

1. Rajeev Bhargava, "Ethics and Politics of the Indian Constitution", Oxford University Press, New Delhi, 2008.
2. B.L. Fadia, "The Constitution of India", Sahitya Bhawan; New edition (2017).
3. DD Basu, "Introduction to the Constitution of India", Lexis Nexis; Twenty-Third 2018 edition.

REFERENCES:

1. Steve Blank and Bob Dorf, "The Startup Owner's Manual: The Step-by-Step Guide for Building a Great Company", K & S Ranch ISBN – 978-0984999392
2. Eric Ries, "The Lean Startup: How Today's Entrepreneurs Use Continuous Innovation to Create Radically Successful Businesses" , Penguin UK ISBN - 978-0670921607
3. Adrian J. Slywotzky with Karl Weber, "Demand: Creating What People Love Before They Know They Want It", Headline Book Publishing ISBN - 978-0755388974
4. Clayton M. Christensen, "The Innovator's Dilemma: The Revolutionary Book That Will Change the Way You Do Business", Harvard business ISBN: 978-142219602.

REFERENCES: Web link

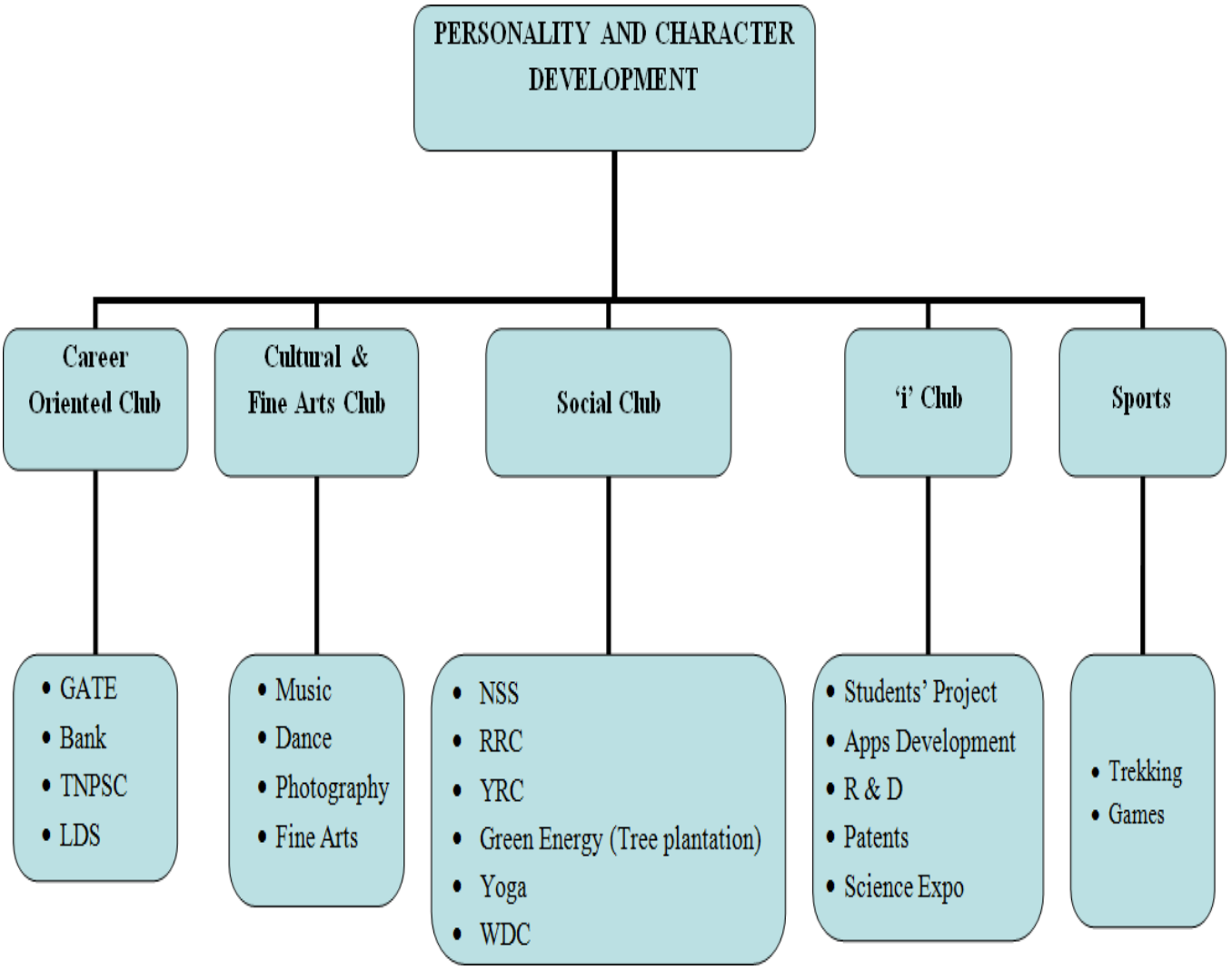
1. https://www.fundable.com/learn/resources/guides/startup
2. https://corporatefinanceinstitute.com/resources/knowledge/finance/corporate- structure/
3. https://www.finder.com/small-business-finance-tips
4. https://www.profitbooks.net/funding-options-to-raise-startup-capital-for-your-business/

Mapping of COs with POs / PSOs

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1						3		3		2		3		
2						3		3		2		3		
3						3		3		2		3		
4						3		3		2		3		
5						3		3		2		3		
CO (W.A)						3		3		2		3		

22GED01 - PERSONALITY AND CHARACTER DEVELOPMENT

L	T	P	C
0	0	I	0



*LDS - Leadership Development Skills

OBJECTIVES :				
Career Oriented Club	**Cultural & Fine Arts Club**	**Social Club**	**'i' club**	**Sports**
• To provide support for identifying specific career field of interests and career path • To provide support for preparing for competitive exams	• To bring out the hidden talent of students in music, dance and other fine arts. • To promote photography skill among the students • To develop and enhance the performance of students by participating in various events • To inculcatemanagerial capabilities such as event management and stage organization	• To create social awareness and develop a sense of social and civic responsibility • To inculcate socially and environmentally sound practices and be aware of the benefits • To encourage the students to work along with the people in rural areas, thereby developing their character, social consciousness, commitment, discipline and being helpful towards the community.	• To inculcate the basic concepts of innovation • To foster the networking between students, build teams, exchange ideas, do projects and discuss entrepreneurial opportunities • To enrich the academic experience, buildcompetencies andrelationships beyond the classroom	• To provide opportunities to excel at sports • To promote an understanding of physical and mental well-being through an appreciation of stress, rest and relaxation. • To develop an ability to observe, analyze and judge the performance of self and peers in sporting activities. • To develop leadership skills and nurture the team building qualities. **Trekking:** • To provide opportunities to explore nature and educating about the purity of nature • To improve physical and mental health.

OUTCOMES : At the end of this course, the students will be able to				
• Find a better career of their interest. • Make use of their knowledge during competitive exams and interviews.	• Take part in various events • Develop team spirit, leadership and managerial qualities	• Develop socially responsive qualities by applying acquired knowledge • Build character, social consciousness, commitment and discipline	• Apply the acquired knowledge in creating better solutions that meet new requirements and market needs • Develop skills on transforming new knowledge or new Technology into viable products and services on commercial markets as a team	• Demonstrate positive leadership skills that contribute to the organizational effectiveness • Take part an active role in their personal wellness (emotional, physical, and spiritual) that supports a healthy lifestyle • Create inclination towards outdoor activity like nature study and Adventure.

TOTAL [2 x (P: 15)]: 30 PERIODS

(Cumulatively for Two Semesters)

22CEC13 - DESIGN OF REINFORCED CONCRETE STRUCTURES [IS 456, SP 16 and IS 3370 Code Books are to be permitted]				
	L	**T**	**P**	**C**
	3	**0**	**0**	**3**
PREREQUISITE : 22CEC10				
Course Objective:	• To understanding the behavior, design and detailing of reinforced concrete flat slab, retaining walls and storage structures according to the Indian standard building code requirements.			

Course Outcomes The students will be able to		**Cognitive Level**	**Weightage of COs in End Semester Examination**
CO1	Design retaining walls to resist lateral earth pressure in various engineering projects.	Ap	20%
CO2	Design water tanks to determine dimensions and reinforcement details for safe storage of water.	An	20%
CO3	Design reinforced concrete slab systems as per IS standards.	Ap	40%
CO4	Design slender columns to resist bending moments as per IS code provisions.	An	20%
CO5	Submit a comprehensive report summarizing fundamental concepts and relevant IS codes, including design calculations, outputs, and detailed drawings.	An	Internal Assessment

UNIT I - RETAINING WALLS	**(9)**
Functions of a Retaining Wall - Design of Cantilever and Counterfort Retaining walls.	
UNIT II - WATER TANKS	**(9)**
Design of rectangular underground water tank and design of rectangular, circular water tanks resting on ground.	
UNIT III - FLAT SLABS	**(9)**
Design of flat slabs (Problems) - Design of Raft foundation, Design principles of Box culvert and Road Bridges.	
UNIT IV - YIELD LINE THEORY	**(9)**
Assumptions - Characteristics of yield line - Determination of collapse load / plastic moment - Application of virtual work method - square, rectangular, circular slabs - Design problems.	
UNIT V - SLENDER COLUMN	**(9)**
Design of Slender columns - Design for Uniaxial and Biaxial bending using Column Curves.	
TOTAL (L:45) = 45 PERIODS	

TEXT BOOKS:

1. Krishnaraju N.," Design of reinforced Concrete Structures", CBS Publishers and Distributors Pvt Ltd, 4th Edition, 2015.
2. Punmia B.C, Ashok Kumar Jain, Arun K. Jain, "R.C.C. Designs Reinforced Concrete Structures", Laxmi Publications Pvt. Ltd., New Delhi, 2006.
3. Varghese P.C., "Advanced Reinforced Concrete Design", Prentice Hall of India Pvt. Ltd., New Delhi, 2012.

REFERENCES:

1. Gambhir M.L., "Design of Reinforced Concrete Structures", Prentice Hall of India Private Limited, 2012
2. Subramanian. N., "Design of Reinforced Concrete Structures", Oxford University, New Delhi, 2013.
3. IS 456:2000, "Code of Practice for Plain and Reinforced Concrete", Bureau of Indian Standards, New Delhi, 2007
4. SP 16:1980, "Design Aids for Reinforced Concrete, Bureau of Indian Standards", New Delhi.
5. IS 3370 (Part I & II):2009, "Concrete Structures for Storage of Liquids - Code of Practice", Bureau of Indian Standards, New Delhi.

Mapping of COs with POs / PSOs

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	3							2				2	3	2
2	3	3	2					2				2	2	2
3	2		2					2				3	3	2
4	2	3						2					3	3
5		3						2	3	2	2	3	3	3
CO (W.A)	2.5	3	2					2	3	2	2	2.5	2.8	2.4

22CEC14 - FOUNDATION ENGINEERING

[IS 6403 code book is to be permitted]

L	T	P
3	0	0

PREREQUISITE : 22CEC09

Course Objective:	• To provide basic understanding of site investigation and selection of appropriate foundation. • To apply design concepts of different types of foundations and earth retaining structures.

	Course Outcomes The students will be able to	**Cognitive Level**	**Weightage of COs in End Semester Examination**
CO1	Apply soil exploration techniques according to various soil conditions.	Ap	20%
CO2	Compute bearing capacity and settlement of shallow foundations.	Ap	20%
CO3	Analyze and proportionate shallow and pile foundations for their capacity.	An	40%
CO4	Analyze the failures of retaining walls and earth pressures using various theories.	An	20%
CO5	Demonstrate familiarity with different types of foundations suited for varying ground conditions.	U	Internal Assessment

UNIT I - SITE INVESTIGATION AND SELECTION OF FOUNDATION	**(9)**
Scope and objectives - Methods of exploration - Auguring and boring - Wash boring and rotary drilling - Depth and spacing of bore holes - Soil samples - Representative and undisturbed - Sampling methods - Split spoon sampler, Thin wall sampler, Stationary piston sampler - Penetration tests (SPT and SCPT) - Selection of foundation based on soil condition - Bore log report.	
UNIT II - BEARING CAPACITY OF SHALLOW FOUNDATION	**(9)**
Introduction - Location and depth of foundation - Bearing capacity of shallow foundation on homogeneous deposits - Terzaghi's formula and BIS formula - Factors affecting bearing capacity - Bearing capacity from in -situ tests (SPT, SCPT and plate load) - Settlement of foundations - Total and differential settlement - Components of settlements - Codal provision.	
UNIT III - FOOTINGS AND RAFTS	**(9)**
Types of Isolated footing, Combined footing, Mat foundation - Contact pressure and settlement distribution - Proportioning of foundations for conventional rigid behaviour - Applications - Floating foundation - Special foundations - Seismic force consideration - Codal provision.	
UNIT IV - PILE FOUNDATION	**(9)**
Types of piles and their functions - Carrying capacity of single pile in granular and cohesive soil - Static formula - Dynamic formulae (Engineering news and Hileys) - Capacity from insitu tests (SPT, SCPT) - Negative skin friction - Group capacity by different methods (Feld's rule, Converse - Labarra formula) - Settlement of pile groups - Under reamed piles.	

UNIT V - RETAINING WALLS	(9)
Slopes - infinite and finite slopes - types of failure - Earth pressure in soils - Active and passive states - Rankine's theory - Earth pressure on retaining walls of simple configurations - Culmann Graphical method - Stabilization of soil using various methods.	
TOTAL (L:45) = 45 PERIODS	

TEXTBOOKS:

1. Punmia, B.C., "Soil Mechanics and Foundations", Laxmi Publications Pvt. Ltd., New Delhi, 2017.
2. Dr. K. R. Arora., "Soil Mechanics and Foundation Engineering", Standard Publisher, New Delhi, 7th ed., 2017.
3. Gopal Ranjan and Rao A.S.R. "Basic and Applied soil mechanics", New Age International (P) Ltd, New Delhi, 2006.

REFERENCES:

1. Murthy, V.N.S., "Soil Mechanics and Foundation Engineering", CBS Publishers and Distributers Ltd., New Delhi, 2015.
2. Varghese, P.C.,"Foundation Engineering", Prentice Hall of India Private Limited, New Delhi, 2012.
3. Das, B.M. "Principles of Foundation Engineering", Eighth edition, Thompson Asia Pvt. Ltd., Singapore, 2017.

Mapping of COs with POs / PSOs

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	3												3	3
2	3												3	3
3		3											3	3
4		2											3	3
5				3					3	2			3	3
CO (W.A)	**3**	**2.5**		**3**					**3**	**2**			**3**	**3**

22CEC15 - DESIGN OF STEEL STRUCTURES *[IS 800-2007 and Steel Table are to be permitted]*				
	L	**T**	**P**	**C**
	3	**0**	**0**	**3**

PREREQUISITE : NIL

Course Objective:	To impart knowledge on limit state design of structural steel members subjected to compressive, tensile and bending loads, including connection design along with the design of structural systems like roof trusses as per provisions of current code (IS 800 - 2007) of practice.

Course Outcomes The students will be able to		**Cognitive Level**	**Weightage of COs in End Semester Examination**
CO1	Apply design ethos of steel structure to compute strength parameter for structural members.	Ap	40%
CO2	Determine the design strength of joints.	Ap	20%
CO3	Choose the appropriate size for flexural members according to the design criteria.	An	20%
CO4	Evaluate the various loads acting and design the steel structural elements.	Ap	20%
CO5	Propose and present effective solutions to address the practical issues, based on codal provisions.	An	Internal Assessment

UNIT I - DESIGN AND CONNECTIONS	**(9)**
Properties of steel - Structural steel sections - Limit state design Concepts - Loads on structures - Connections using welding and bolting - Design of bolted and welded joints - Eccentric connections - Efficiency of joints.	
UNIT II - TENSION MEMBERS	**(9)**
Types of sections - Net area - Net effective sections for angles and Tee in tension - Design of connections in tension members - Use of lug angles - Design of tension splice - Concept of shear lag.	
UNIT III - COMPRESSION MEMBERS	**(9)**
Types of compression members - Theory of columns - Basics of current codal provision for compression member design - Slenderness ratio - Design of simple and built up members - Design of laced and battened type columns - Design of column bases - Gusseted base - Anchor Bolts.	
UNIT IV - BEAM	**(9)**
Design of laterally supported and unsupported beams - Built up beams - Beams subjected to uniaxial and biaxial bending - Design of plate girders - Intermediate and bearing stiffeners - Flange and web splices.	
UNIT V - ROOF TRUSS AND INDUSTRIAL BUILDING	**(9)**
Roof trusses - Roof and side coverings - Introduction of Pre-Engineered Buildings - Design of purlins - Design of truss elements.	
TOTAL (L:45) = 45 PERIODS	

TEXT BOOKS:

1. Subramanian. N, "Design of Steel Structures", Oxford University Press, New Delhi, 2018.
2. Gambhir. M. L., "Fundamentals of Structural Steel Design", McGraw Hill Education India Pvt. Ltd., 2013.
3. Shiyekar. M. R., "Limit State Design in Structural Steel", Prentice Hall of India Pvt. Ltd, Learning Pvt. Ltd., 2nd Edition, 2013.
4. Bhavikatti. S. S, "Design of Steel Structures", IK International Publishing House Pvt. Ltd., New Delhi 2010.

REFERENCES:

1. Dr. L. S. Jayagopal, Dr. D. Tensing, "Design of Steel Structures", Vikas Publishing House Pvt. Ltd., 2015.
2. Narayanan. R "Teaching Resource on Structural Steel Design", INSDAG, Ministry of Steel Publications, 2002.
3. Duggal. S.K, "Limit State Design of Steel Structures", Tata McGraw Hill Publishing Company, 2009.
4. Shah V.L and Veena Gore, "Limit State Design of Steel Structures", IS 800–2007 Structures Publications, 2012.
5. IS 800:2007, General Construction in Steel - Code of Practice, (Third Revision), Bureau of Indian Standards, New Delhi, 2007.

Mapping of COs with POs / PSOs

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	2	2											2	
2	3		2											
3		3		2									2	
4			2	2									2	
5		2											3	2
CO (W.A)	2.5	2.3	2	2									2.3	2

22CEP04 - CONCRETE TECHNOLOGY LABORATORY					
		L	T	P	C
		0	0	4	2
PREREQUISITE : 22CEC11					
Course Objective:	• To provide fundamental knowledge of testing concrete material properties in accordance with the IS codes. • To perform tests on fresh and hardened concrete, as well as explore non-destructive testing methods for assessing concrete quality and durability.				
Course Outcomes The students will be able to		**Cognitive Level**			
CO1	Propionate the concrete mix for various field application using IS codal provision.	Ap			
CO2	Identify and ascertain the characteristics of the ingredients and quality of concrete based on its properties for field application.	An			
CO3	Interpret the results from tests on cubes, cylinders and prisms to evaluate the strength characteristics of hardened concrete.	An			
CO4	Assess the performance of fine and coarse aggregate test results in exposed concrete structures.	An			
CO5	Interpret NDT test results to detect and characterize defects such as cracks, voids, and inclusions in test specimens.	E			

LIST OF EXPERIMENTS:

1. TEST ON CEMENT

a. Fineness Test
b. Consistency Test
c. Initial and Final Setting Time Test
d. Soundness Test
e. Specific gravity

2. TEST ON FINE AGGREGATE

a. Specific Gravity
b. Fineness Modulus

3. TEST ON COARSE AGGREGATE

a. Specific Gravity
b. Water Absorption Test
c. Impact Strength Test
d. Crushing Strength Test
e. Abrasion and Attrition Test

4. TEST ON FRESH CONCRETE

a. Slump Test
b. Vee-Bee Test
c. Compaction Factor Test
d. Flow table

5. TEST ON HARDENED CONCRETE

a. Test on Cubes (Compressive Strength Test)
b. Test on Cylinders (Split Tensile Strength)
c. Test on Prisms (Flexural Strength of Concrete)

6. NON - DESTRUCTIVE TESTS

a. Rebound Hammer Test
b. Ultrasonic Pulse Velocity Test

TOTAL (P:60) : 60 PERIODS

REFERENCES:

1. Shetty. M. S, "Concrete Technology", S. Chand & Co., Ltd, New Delhi, 2010.
2. IS: 10262 - 2019, "Indian Standard specification for Methods of Mix design".
3. IS: 383 - 1987, "Indian Standard specification for Test for Fine and Coarse aggregates from natural source for concrete".
4. IS: 403 1 (Part 4, 5, 7 and 11) - 1988 (Reaffirmed 2000), "Methods of physical tests for hydraulic cement".

Mapping of COs with POs / PSOs														
COs	**POs**												**PSOs**	
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
1		3						3				2	2	
2	3		3									3	3	
3		3		3				3	3	3		3		3
4		3						3		3		3	3	
5		3		2	3			3	3	2		3	3	3
CO (W.A)	**3**	**3**	**3**	**2.5**	**3**			**3**	**3**	**2.7**		**3**	**2.8**	**3**

22CEP05 - DESIGN AND DRAWING LABORATORY

	L	T	P	C
	0	0	4	2

PREREQUISITE : NIL

Course Objective:	• To acquire hands on experience in design and preparation of structural drawings for concrete / steel structures normally encountered in Civil Engineering practice.

	Course Outcomes The students will be able to	**Cognitive Level**
CO1	Apply design principles and standards to detailed drawings of multi-storey framed structures, slab and retaining walls.	Ap
CO2	Assess the compliance of design drawings with relevant codes and standards.	An
CO3	Design and draw reinforcement details for RCC structures.	Ap
CO4	Assess the structural integrity and stability of designed components under different loading conditions.	Ap
CO5	Design the structural members with ethical responsibility.	C

LIST OF EXPERIMENTS:

1. Design and drawing of multi storey framed structure (Beam, Column and Slab)
2. Design and drawing of RCC cantilever retaining walls
3. Design and drawing of one way and two way slab
4. Design of solid slab bridges for IRC loading and reinforcement details
5. Design and drawing of rectangular and circular RCC water tank
6. Design and drawing of elevated RCC water tank (Rectangular and Circular)
7. Design and detailing of Roof Truss
8. Design and detailing of Culvert
9. Design and detailing of Irrigation canal bridge
10. Design and detailing of Septic tank

TOTAL (P:60) = 60 PERIODS

REFERENCES:

1. Krishnaraju. N "Structural Design and Drawing, Universities Press, 2009.
2. Punmia, B.C., Ashok Kumar Jain, Arun Kumar Jain, "Comprehensive Design of Steel Structures, Laxmi Publications Pvt. Ltd., 2015.

Note: Manual Design and CAD Drawing

Mapping of COs with POs / PSOs														
COs	**POs**												**PSOs**	
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
1	3	2								3		3	3	3
2	2	2												2
3	3		3		3							3	3	3
4	3	2										3	2	
5		3	3		3			3		3			3	3
CO (W.A)	**2.8**	**2.2**	**3**		**3**			**3**		**3**		**3**	**2.8**	**2.8**

22MAN08R - SOFT/ANALYTICAL SKILLS - IV (Common to All Branches)				
	L	**T**	**P**	**C**
	1	**0**	**2**	**0**

PREREQUISITE : NIL

Course Objective:	• To enhance the ability to communicate coherently and effectively across contexts • To develop quantitative aptitude and analytical reasoning skills

Course Outcomes The Student will be able to		**Cognitive Level**	**Weightage of COs in Continuous Assessment Test**
CO1	Develop proficiency to communicate accurately, fluently, and appropriately in various academic, professional and social contexts.	U	40%
CO2	Solve quantitative aptitude problems with more confidence.	Ap	30%
CO3	Draw valid conclusions, identify patterns, and solve problems.	An	30%

UNIT I - VERBAL ABILITY	**(15)**
Grammar - Sentence Completion – Sentence Improvement - Error Spotting - **Listening** - TOEFL Listening Practice Tests - **Speaking** – Interview Skills - **Reading** - GRE Reading Passages - **Writing** - Paragraph Writing.	
UNIT II - APTITUDE	**(15)**
Probability - Permutations and Combinations - Data Interpretation on Multiple Charts - Mensuration - Area, Shapes, Perimeter - Races and Games.	
UNIT III - REASONING	**(15)**
Data Sufficiency - Mathematical Operations - Pattern Completion - Cubes - Embedded Images.	
TOTAL(L:45) = 45 PERIODS	

REFERENCES:

1. Rizvi, M.Ashraf. *Effective Technical Communication.* Tata McGraw-Hill Education, 2017.
2. Aggarwal R S. *Quantitative* Aptitude for Competitive Examinations. S.Chand Publishing Company Ltd(s)., 2022.
3. Sharma, Arun. *How to Prepare for Quantitative Aptitude for the CAT*. Tata McGraw – Hill Publishing, 2022.
4. Praveen R V. *Quantitative Aptitude and Reasoning.* PHI Learning Pvt. Ltd., 2016.

Mapping of COs with POs / PSOs

COs	**POs**												**PSOs**	
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
1									2	3				
2		2		2										
3		2		2										
CO		**1**		**1**					**1**	**1**				

22CEC16 - ESTIMATION AND COSTING				
	L	T	P	C
	3	0	2	4

PREREQUISITE : NIL

Course Objective :	• To estimate costs using various methods and techniques, and effectively manage and control project budgets. • To develop the skills to present and justify cost estimates professionally while understanding industry standards and ethical considerations.

Course Outcomes The students will be able to		**Cognitive Level**	**Weightage of COs in End Semester Examination**
CO1	Apply different estimation methods to real-world scenarios	Ap	40%
CO2	Analyze cost data to develop comprehensive budgets.	An	20%
CO3	Evaluate the effectiveness of tendering and contracting strategies in construction projects.	An	20%
CO4	Develop valuation reports, adhere to industry standards.	An	20%
CO5	Apply ethical principles and collaborate with engineers in preparing reports for residential buildings, roads, water supply, and sanitary installations.	An	Internal Assessment

UNIT I - ESTIMATE OF BUILDING	**(10)**
Introduction - General items of work in building - standard units - Principles of working out quantities for detailed and abstract estimates - Methods of Estimate of buildings - Long wall and short wall method - center line method - Preparation of detailed estimate of R.C.C framed and Load bearing structure.	
UNIT II - ESTIMATION OF OTHER STRUCTURES	**(9)**
Estimate of Septic tank, soak pit - Estimate of road materials for flexible and rigid pavements - Estimate retaining walls - Estimate of RCC slab culvert, pipe culvert.	
UNIT III - RATE ANALYSIS	**(9)**
Analysis of Rates - Schedule of rates - factors affecting rates - Rate materials and labors - Analysis of rates for cement concrete, RCC, Brick masonry, stone masonry, concreting, flooring, plastering, painting and tile laying - PWD schedule of rates.	
UNIT IV - TENDER AND CONTRACT	**(9)**
Tender: Tender notices - Types - Prequalification of contractors - pre-bid meeting - Drafting - Model tenders - Procedure for Submission and opening tender - Acceptance and rejection of tender -Tender validity period - E-Tendering. Contracts: contract -Types of contract - Contract Laws - contract conditions - Arbitration and legal requirements.	
UNIT V - VALUATION AND REPORT PREPARATION	**(8)**
Valuation: Necessity - Purpose -Types and Valuation methods - Market value - Scrap value - Salvage value - Annuity - Capitalized value - Sinking fund - Depreciation - Value of building - Rent fixation - Mortgage - Lease - Principles of report preparation - Report on Residential building - Roads - Water supply and sanitary installations.	

LIST OF EXPERIMENTS:

1. Rate analysis for earth work, PCC, RCC, Brick work, plastering and steel fabrication
2. Calculation of quantities and prepare the estimate for load bearing structure (Residential)
3. Calculation of quantities and prepare the estimate for framed structure (Residential)
4. Prepare the bar-bending schedule for footing, column, plinth / roof beam and slab

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

TEXTBOOKS:

1. Dutta, B.N., "Estimating and Costing in Civil Engineering (Theory and Practice)", UBS Publishers & Distributors Pvt. Ltd., New Delhi, 2016.
2. Rangwala .S.C.," Estimating, Costing and Valuation", Charotar Publishing House, Anand, 2017.

REFERENCES:

1. Kohli, D.D and Kohli, R.C., "A Text Book of Estimating and Costing (Civil)", S. Chand & Company Ltd., 2014.
2. Chakraborti M," Estimating Costing, Specification and Valuation in Civil Engineering", Chakraborti Publishers, 2010.

Mapping of COs with POs / PSOs

Cos	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	3	2						2	3					
2	3	3						2	2	3				3
3		2												
4	2							2					3	2
5	2					2		2	2	3			3	3
CO (W.A)	**2.5**	**2.3**				**2**		**2**	**2.3**	**3**			**3**	**2.7**

22CEC17 - PRE ENGINEERING BUILDINGS				
	L	T	P	C
	3	0	0	3
PREREQUISITE : NIL				

Course Objective :	• To analyze design requirements and to create effective pre-engineered building solutions. To evaluate structural and functional performance to ensure that designs meet industry standards and project specifications.

Course Outcomes The students will be able to		Cognitive Level	Weightage of COs in End Semester Examination
CO1	Use industry guidelines and standards to select appropriate structural systems.	Ap	20%
CO2	Analyze the various framing systems in pre-engineered Building (PEB) structures.	An	40%
CO3	Apply pre-engineering knowledge to design, analyze, and solve problems in building construction and materials.	Ap	20%
CO4	Apply techniques for estimating structural reactions and analyze methods for managing lateral forces in building systems.	Ap	20%
CO5	Observe real-life applications and construction techniques and prepare a detailed report on the construction process and system implementation.	An	Internal Assessment

UNIT I - BASICS OF METAL BUILDING SYSTEMS	**(9)**
Introduction to metal building systems - Origin - Advantages and disadvantages - Industry groups - MBMA - MBCEA - NAIMA - MCA - NRCA - Structural loads - Loads and load combinations - Structural behavior - Structural system selection criteria.	
UNIT II - PRIMARY FRAMING	**(9)**
Available systems - Tapered beams - Single span rigid frame - Multi span rigid frame - Single span and continuous trusses - Framing systems - Lean to framing - Role of frame bracing.	
UNIT III - SECONDARY FRAMING	**(9)**
Girts and Purlins - Types of purlins for metal building systems - Design of cold-formed framing - Cold - formed steel purlins - Purlin bracings - Cold-formed steel grits - Hot rolled steel girts.	
UNIT IV - METAL ROOFING AND WALL MATERIALS	**(9)**
Types of metal roofs - Seam configurations - Through fastened Roofing - Structural standing-seam roof - Insulated structural panels - Architectural metal roofing - Panel finishes - Site - formed metal panels - Wind uplift ratings of metal roofs. Wall Materials - Metal panels - Hard walls - Single - Wythe Masonry - Brick veneer walls - Combination walls - Concrete Materials.	

UNIT V - FOUNDATION FOR METAL BUILDING SYSTEMS	(9)
Soil investigation program - Difference between conventional foundation and foundation for metal building system - Estimation of column reaction - Methods of resisting lateral reactions - Anchor bolt and base plates - Design of slabs on grade.	
TOTAL (L :45) = 45 PERIODS	

TEXT BOOK:

1. Alexander Newman, "Metal Building Systems", 3rd Edition, McGraw Hill, 2014.

REFERENCES:

1. Subramanian N, "Design of Steel Structures Limit States Method", 2nd Edition, Oxford University Press, New Delhi, 2016.
2. Bhavikatti S.S., "Design of Steel Structures", 5th Edition, I.K. International Publishing House Pvt. Ltd., New Delhi, 2017.
3. Duggal S., "Design of Steel Structures", 3rd Edition, McGraw Hill Education, 2017.

Mapping of COs with POs / PSOs

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	2													2
2		2												
3	3		2	2									3	2
4	3		2					3						3
5		3						2	3	3		3	3	3
CO (W.A)	**2.7**	**2.5**	**2**	**2**				**2.5**	**3**	3		**3**	**3**	**2.5**

22CEP06 - COMPUTER AIDED STRUCTURAL DESIGN LABORATORY				
	L	T	P	C
	0	0	4	2

PREREQUISITE : NIL

Course Objective:	• To equip with fundamental principles and practical skills in structural analysis and design. • To design safe and efficient structural elements, ensuring compliance with relevant codes and standards.

	Course Outcomes The students will be able to	**Cognitive Level**
CO1	Apply structural analysis principles and their application to different types of loads and structures.	Ap
CO2	Perform detailed structural analysis using appropriate software and analytical methods for designing structures.	An
CO3	Apply structural design principles to develop safe, economical, and efficient designs for various structural elements and systems.	Ap
CO4	Interpret and apply relevant design codes and standards	Ap
CO5	Analyze the structures to seismic forces and apply seismic design principles to mitigate earthquake risks in RCC structures.	An

LIST OF EXPERIMENTS:

1. Analysis and design of continuous beam with various loading
2. Analysis of single storey RCC building
3. Earthquake analysis of RCC structures
4. Analysis and design of shear wall
5. Analysis and design of footing
6. Analysis and design of RCC rectangular elevated water tank
7. Analysis and design of an industrial building (Steel Structure)
8. Analysis and design of transmission line tower

TOTAL(P:60)=60PERIODS

Mapping of COs with POs / PSOs														
COs	**POs**												**PSOs**	
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
1		2												2
2		2			2					3		3	3	3
3	3	3	2		3					2			3	3
4	3											2	2	2
5		2										2		2
CO (W.A)	**3**	**2.3**	**2**		**2.5**					**2.5**		**2.3**	**2.7**	**2.4**

22CEP07 - SURVEY CAMP					
		L	T	P	C
		0	0	2	1
PREREQUISITE : 22CEC04					
Course Objective:	• To apply various surveying methods and equipment in field settings to collect and analyze accurate survey data. • To design and execute a complete surveying project, integrating theory and practice to address real-world surveying challenges effectively.				
Course Outcomes The students will be able to		**Cognitive Level**			
CO1	Design and execute surveying projects, applying theoretical knowledge to practical scenarios effectively.	Ap			
CO2	Demonstrate a thorough understanding of surveying principles and techniques using field equipment and methods.	Ap			
CO3	Analyze and interpret survey data to produce precise and comprehensive reports.	An			
CO4	Compare and contrast different surveying methods and techniques.	An			
CO5	Prepare contour map for the given area.	C			

LIST OF EXPERIMENTS:

Ten days survey camp using theodolite, leveling and total station. At the end of the camp, each student shall have plot the contour map and calculate the area. The camp record shall include all original field observations, calculations and plots.

1.Traverse - using Theodolite / Total station

2. Contouring

3. L.S & C.S - Road

4. Offset of Buildings and Plotting the Location

5. Using GPS to find latitude and longitude for given location

6. Determination of height of the object (Total station)

7. Foundation marking

(Ten Days Survey Camp will be conducted during 5th Semester winter vacation)

TOTAL (P:30) = 30 PERIODS

Mapping of COs with POs / PSOs														
COs	**POs**												**PSOs**	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	3		2						3			2		3
2	2								3			3	3	3
3		2						3	3	2	3	3	3	3
4		2			2				3		3	3	2	3
5	3		2						3	3		3	3	3
CO (W.A)	**2.7**	**2**	**2**		**2**			**3**	**3**	**2.5**	**3**	**2.8**	**2.8**	**3**

22GEA01 UNIVERSAL HUMAN VALUES (For Common to All Branches)				
	L	T	P	C
	2	0	0	2

PREREQUISITE : NIL

Course Objective:	• To help the students appreciate the essential complementarily between 'VALUES' and 'SKILLS' to ensure sustained happiness and prosperity. • To facilitate the development of a holistic perspective among students towards life and profession. • To highlight plausible implications of holistic understanding in terms of ethical human conduct. • To understand the nature and existence. • To understand human contact and holistic way of living

Course Outcomes The Student will be able to		**Cognitive Level**	**Weightage of COs in End Semester Examination**
CO1	Evaluate the significance of value inputs in formal education and start applying them in their life and profession.	E	Internal Assessment
CO2	Distinguish between values and skills, happiness and accumulation of physical facilities, the Self and the Body, Intention and Competence of an individual.	Ap	
CO3	Analyze the value of harmonious relationship based on trust and respect in their life and profession.	An	
CO4	Examine the role of a human being in ensuring harmony in society and nature.	Ap	
CO5	Apply the understanding of ethical conduct to formulate the strategy for ethicallife and profession.	Ap	

UNIT I - INTRODUCTION - BASIC HUMAN ASPIRATION, ITS FULFILLMENT THROUGH ALL - ENCOMPASSING RESOLUTION	**(6)**
The basic human aspirations and their fulfillment through Right understanding and Resolution, Right understanding and Resolution as the activities of the Self, Self being central to Human Existence; All-encompassing Resolution for a Human Being, its details and solution of problems in the light of Resolution	
UNIT II - RIGHT UNDERSTANDING (KNOWING)- KNOWER, KNOWN & THE PROCESS	**(6)**
The domain of right understanding starting from understanding the human being (the knower, the experiencer and the doer) and extending up to understanding nature/existence – its interconnectedness and co-existence; and finally understanding the role of human being in existence (human conduct).	
UNIT III - UNDERSTANDING HUMAN BEING	**(6)**
Understanding the human being comprehensively as the first step and the core theme of this course; human being as co-existence of the self and the body; the activities and potentialities of the self; Basis for harmony/contradiction in the self	
UNIT IV - UNDERSTANDING NATURE AND EXISTENCE	**(6)**
A comprehensive understanding (knowledge) about the existence, Nature being included; the need and process of inner evolution (through self-exploration, self- awareness and self-evaluation), particularly	

awakening to activities of the Self: Realization, Understanding and Contemplation in the Self (Realization of Co-Existence, Understanding of Harmony in Nature and Contemplation of Participation of Human in this harmony/ order leading to comprehensive knowledge about the existence).	
UNIT V - UNDERSTANDING HUMAN CONDUCT, ALL-ENCOMPASSING RESOLUTION AND HOLISTIC WAY OF LIVING	**(6)**
Understanding Human Conduct, different aspects of All-encompassing Resolution (understanding, wisdom, science etc.), Holistic way of living for Human Being with All- encompassing Resolution covering all four dimensions of human endeavor viz., realization, thought, behavior and work (participation in the larger order) leading to harmony at all levels from Self to Nature and entire Existence	
TOTAL (L:30) = 30 PERIODS	

TEXT BOOKS:

1. R R Gaur, R Asthana, G P Bagaria, 2019 (2nd Revised Edition), "A Foundation Course in Human Values and Professional Ethics". ISBN 978-93-87034-47-1, Excel Books, New Delhi

REFERENCES:

1. Ivan Illich, 1974, "Energy & Equity", The Trinity Press, Worcester, and Harper Collins, USA
2. E.F. Schumacher, 1973, "Small is Beautiful: a study of economics as if people mattered", Blond & Briggs, Britain.
3. Sussan George, 1976, "How the Other Half Dies", Penguin Press. Reprinted 1986, 1991
4. Donella H. Meadows, Dennis L. Meadows, Jorgen Randers, William W. Behrens III, 1972, "Limits to Growth - Club of Rome's report", Universe Books.
5. A Nagraj, 1998, Jeevan Vidya EkParichay, Divya Path Sansthan, Amarkantak.
6. P L Dhar, RR Gaur, 1990, "Science and Humanism", Commonwealth Publishers.
7. A N Tripathy, 2003, "Human Values", New Age International Publishers
8. E G Seebauer& Robert L. Berry, 2000, "Fundamentals of Ethics for Scientists & Engineers", Oxford University Press
9. M Govindrajran, S Natrajan& V.S. Senthil Kumar, "Engineering Ethics (including Human Values)", Eastern Economy Edition, Prentice Hall of India Ltd.
10. Subhas Palekar, 2000, "How to practice Natural Farming", Pracheen (Vaidik) Krishi Tantra Shodh, Amravati
11. B P Banerjee, 2005, "Foundations of Ethics and Management", Excel Books
12. B L Bajpai, 2004, "Indian Ethos and Modern Management", New Royal Book Co., Lucknow. Reprinted 2008.

Mapping of COs with POs / PSOs

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1						2	2	3	2	2		3		
2						2	2	3	2	2		3		
3						2	2	3	2	2		3		
4						2	2	3	2	2		3		
5						2	2	3	2	2		3		
CO (W.A)						**2**	**2**	**3**	**2**	**2**		**3**		

22CED01 - DESIGN PROJECT				
	L	T	P	C
	0	0	4	2
PREREQUISITE : NIL				

Course Objective:	• To improve the skill of designing various problems related to Civil Engineering projects

Course Outcomes The students will be able to		**Cognitive Level**
CO1	Prepare plan, section and elevation of a civil engineering structure as per NBC.	C
CO2	Design the structure in accordance with relevant IS codes	Ap
CO3	Analysing the structure in accordance with relevant IS codes	An
CO4	Calculate quantity and rate for the civil engineering structure as per PWD schedule of rates	Ap
CO5	Prepare and present the project report	Ap

This course conceives purely a design problem in any one of the disciplines of Civil Engineering; e.g., Design of an RC structure, Design of a waste water treatment plant, Design of a foundation system, Design of traffic intersection etc. The design problem can be allotted to either an individual student or a group of students comprising of not more than four. At the end of the course the group should submit a complete report on the design problem consisting of the data given, the design calculations, specifications if any and complete set of drawings which follow the design.

TOTAL (P:60) = 60 PERIODS

Mapping of COs with POs / PSOs

COs	**POs**												**PSOs**	
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
1		3	3	3	3				3	3	3	3	3	3
2			3				3	3	3	3	3	3	3	3
3		3			3				3	3	3	3	3	3
4	3						3	3		3	3	3	3	3
5	3								3	3	3	3	3	3
CO (W.A)	**3**	**3**		**2**	**3**		**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**

22GED02 - INTERNSHIP / INDUSTRIAL TRAINING					
		L	T	P	C
		0	0	0	2
PREREQUISITE : NIL					
Course Objective:	• To apply the theoretical knowledge gained in academic courses to real-world industrial or professional settings. • To obtain a broad understanding of the emerging technologies in Industry.				
Course Outcomes The students will be able to		**Cognitive Level**			
CO1	Engage in Industrial activity which is a community service.	U			
CO2	Prepare the project report, three minute video and the poster of the work.	Ap			
CO3	Develop new ideas into feasible projects, enhancing their problem-solving and project development skills.	C			
CO4	Develop problem-solving skills and innovative thinking.	Ap			
CO5	Assess the effectiveness of industry practices.	E			

During semester breaks, students are encouraged to engage in industrial training or undergo internship in an industry related to the field of study. The duration of the activity shall be of 4 weeks (28 days). The work carried out in the semester break is assessed through an oral seminar accompanied by a written report. It is expected that this association will motivate the student to develop simple civil (or other) products to make their life comfortable and convert new ideas into projects.

Every student is required to complete 4 weeks of internship (with about 28days), during the Summer/Winter semester breaks. The Internships are evaluated through Internship Reports. The internships can be taken up in an industry, a government organization, a research organization or an academic institution, either in the country or outside the country, that include activities like:

- Successful completion of Internships/ Value Added Programs / Training
- Programs/ workshops organized by academic Institutions and Industries
- Soft skill training by the Placement Cell of the college
- Active association with incubation/ innovation /entrepreneurship cell of the institute;
- Participation in Inter-Institute innovation related competitions like Hackathons
- Working for consultancy/ research project within the institutes
- Participation in activities of Institute's Innovation Council, IPR cell, Leadership
- Talks, Idea/ Design/ Innovation contests
- Internship with industry/ NGO's/ Government organizations/ Micro/ Small/
- Medium enterprises
- Development of a new product/ business plan/ registration of a start-up

Mapping of COs with POs / PSOs														
COs	**POs**												**PSOs**	
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
1									2		2		3	3
2	3								2	3	3	3	3	3
3	3									2		2	3	3
4			2			3					2	3	3	3
5	2												3	3
CO (W.A)	**2.7**		**2**			**3**			**2.5**	**2.5**	**2.3**	**2.7**	**3**	**3**

22CED02 - PROJECT WORK				
	L	**T**	**P**	**C**
	0	**0**	**20**	**10**
PREREQUISITE : NIL				
Course Objective:	• To solve a specific problem by identifying it through literature review and proceeding to successful solution by formulating proper methodology. • To provide opportunity to exercise their creative and innovative qualities by working together in a team to solve problem statements involving both theoretical and experimental studies related to civil engineering.			

Course Outcomes The students will be able to		**Cognitive Level**
CO1	Identify the practical problem by conducting literature survey/patent search.	Ap
CO2	Formulate proper methodology as per standards available.	Ap
CO3	Solving the problem using suitable experimental/analytical studies	An
CO4	Analyze the problem based on the methodology and tabulate the results.	An
CO5	Conclude the results and submit the project report.	C

DESCRIPTION

Project work may be allotted to a single student or to a group of students not exceeding 3 per group. The title of project work is approved by head of the department under the guidance of a faculty member and student(s) shall prepare a comprehensive project report after completing the work to the satisfaction of the guide.

The Head of the department shall constitute a review committee for project work. There shall be three reviews during the semester by the committee to review the progress. Student(s) shall make presentation on the progress made by him / her / them before the committee and evaluation is done as per Rules and Regulations.

TOTAL (P:300) = 300 PERIODS

Mapping of COs with POs / PSOs														
COs	**POs**												**PSOs**	
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
1	3			3					3			3		2
2		3		3					3			3		3
3		2					3	3	3					
4	3	3	3	3		3	2		3					
5									3	3	3	3	3	3
CO (W.A)	**3**	**2.7**	**3**	**3**		**3**	**2.5**	**3**	**3**	**3**	**3**	**3**	**3**	**2.7**

22CEX01 - ADVANCED STEEL DESIGN				
	L	T	P	C
	3	0	0	3
PREREQUISITE : 22CEC15				
Course Objective:	• To apply relevant building codes and standards to ensure that their steel designs meet regulatory requirements. • To determine safe as well as economical steel section for various industrial and framed structures like chimneys, silos, plate girders and gantry girders.			

Course Outcomes The students will be able to		**Cognitive Level**	**Weightage of COs in End Semester Examination**
CO1	Apply design principles to design steel industrial structures in accordance with relevant IS codes and functional requirements.	Ap	40%
CO2	Apply relevant codes and standards for the design and analysis of cold-formed steel structures.	An	20%
CO3	Analyze and design welded plate girders.	An	20%
CO4	Estimate the design forces over a gantry girder and design the member.	An	20%
CO5	Study a steel structure through a field visit or case study, observe its functional and structural details, and prepare a report linking the site observations with relevant design concepts and IS code provisions.	An	Internal Assessment

UNIT I - INDUSTRIAL BUILDINGS	**(9)**
Roof trusses - Roof and side coverings - Wind load calculation - Design of purlins - Design of truss under gravity load and wind load - Introduction to design of steel structures for fire loads	
UNIT II - DESIGN OF CHIMNEYS AND SILOS	**(9)**
Introduction - Forces acting on chimneys - Types - Load calculation - Design of Self supporting chimneys - Pressure on side walls of silos - Design of single cell circular silos.	
UNIT III - LIGHT GAUGE STEEL STRUCTURES	**(9)**
Introduction to cold formed steel - Advantages of cold formed steel sections - Types of cross sections - Local buckling - Design of compression members - Design of beams.	
UNIT IV - PLATE GIRDER	**(9)**
Introduction - Difference between beam and plate girder - Types of plate girders - Post buckling behavior of web plate - Proportioning of the web plate and flanges - Design of welded plate girder.	
UNIT V - GANTRY GIRDER	**(9)**
Introduction - Load consideration - Max load effects - Determination of maximum bending moment and shear force due to crane wheel load - Longitudinal effect of wheel load - Design of gantry girder.	
TOTAL (L:45) = 45 PERIODS	

TEXTBOOK:
1. Duggal S.K., "Design of Steel Structures", 3rd Edition, McGraw Hill Education, 2019.
REFERENCES:
1. Subramanian N., "Design of Steel Structures Limit States Method",2nd Edition, Oxford University Press, New Delhi,2015. 2. Bhavikatti S.S., "Design of Steel Structures", 5th Edition, I.K. International Publishing House Pvt. Ltd., New Delhi, 2017.

Mapping of COs with POs / PSOs														
COs	**POs**												**PSOs**	
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
1	3		2					2				2		3
2		3	2									2		2
3	3	2	2					2						2
4		2	2					2				2		
5		2	2						2	2			2	2
CO (W.A)	**3**	**2.3**	**2**					**2**	**2**	**2**		**2**	**2**	**2.3**

22CEX02 - PREFABRICATED STRUCTURES				
	L	T	P	C
	3	0	0	3

PREREQUISITE : NIL

Course Objective:	• To impart knowledge on prefabricated elements and the technologies used for fabrication and erection. • To acquire the knowledge about the modern trends in building construction, role of prefabricated structures and the basic functional requirements of industrial structures.

Course Outcomes The students will be able to		Cognitive Level	Weightage of COs in End Semester Examination
CO1	Apply principles of fabrication in the construction industry that necessitate the adoption of prefabrication techniques.	Ap	20%
CO2	Analyse the various components of prefabrications.	An	20%
CO3	Apply knowledge of fabrication techniques in the design and production of prefabricated elements.	Ap	20%
CO4	Design the structural elements in accordance with codal provisions.	E	40%
CO5	Conduct independent study as part of a team and deliver an effective oral presentation on real-time examples.	An	Internal Assessment

UNIT I - DESIGN PRINCIPLES	**(9)**
Introduction to prefabrication - Need for prefabrication - General principles - Comparison with monolithic construction -Types of prefabrication - Site and plant prefabrication - Economy of prefabrication - Modular coordination - Standardization - Materials - Systems - Production - Transportation - Erection.	
UNIT II - PREFABRICATED COMPONENTS AND JOINTS	**(9)**
Planning for components of prefabricated structures, Behaviour of structural components - Large panel constructions - Construction of roof and floor slabs - Wall panels - Columns - Shear walls, Disuniting of structures - Joints - Joints for different structural connections, Effective sealing of joints for water proofing, Provisions for non-structural fastenings, Expansion joints in precast construction.	
UNIT III - PRODUCTION AND FABRICATION	**(9)**
Production technology - Choice of production setup, manufacturing methods, stationary and mobile production, planning of production setup, storage of precast elements, dimensional tolerances, acceleration of concrete hardening. Hoisting technology - equipment for hoisting and erection, techniques for erection of different types of members like beams, slabs, wall panels and columns, vacuum lifting pads.	
UNIT IV - DESIGN OF PREFABRICATED BEAMS	**(9)**
Prefabricated load carrying members - Types of beams - Design of simple rectangular beams and I-beams, handling and erection stresses, elimination of erection stresses - beams, columns, symmetric frames.	

UNIT V - DESIGN OF PREFABRICATED ELEMENTS	(9)
Types of Slabs - Construction of roof and floor slabs - Design of hollow core slab - Columns - Construction and design principles of column.	
TOTAL (L:45) = 45 PERIODS	

TEXT BOOKS:

1. Lewitt,M. " Precast Concrete- Materials, Manufacture, Properties And Usage ,CRC Press, 2019,
2. Ramachandra Murthy D.S., "Design and Construction of Precast Concrete Structures", 1st Edition, Dipti Press OPC Private Limited, Chennai; 2017.

REFERENCES:

1. Kim S. Elliott, "Precast Concrete Structures", 2nd Edition, CRC Press, United States, 2017.
2. PCI Design Hand Book", 6th Edition, Precast / Prestressed Concrete Institute, ACI, Chicago, 2004.

Mapping of COs with POs / PSOs

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	3													3
2		2				2								
3	3					2						2		2
4			3				2					3	3	3
5	3	3							3	3	3	3	3	3
CO (W.A)	3	2.5	3			2	2		3	3	3	2.7	3	2.8

22CEX03 - PRESTRESSED CONCRETE STRUCTURES
[IS 1343 code book is to be permitted]

L	T	P	C
3	0	0	3

PREREQUISITE : NIL

Course Objective:	• To impart knowledge on the prestressing principles and the methods of prestressing for real time applications.

	Course Outcomes The students will be able to	Cognitive Level	Weightage of COs in End Semester Examination
CO1	Apply the design concepts of prestressing in members.	Ap	20%
CO2	Design the prestressed concrete structural elements and assess serviceability factors.	An	40%
CO3	Implement the methods for achieving continuity in beams.	Ap	20%
CO4	Evaluate the design of circular prestressing and the uses of non-prestressed reinforcement.	E	20%
CO5	Engage in independent study as a member of a team and make an effective oral presentation on the research article.	U	Internal Assessment

UNIT I - DESIGN CONCEPTS OF PRESTRESSING (9)

Basic concepts - Advantages - Materials required - Systems and methods of prestressing - Freyssinet, Magnel, Lee - McCall and Gifford Udall anchorage systems - Analysis of sections - Stress concept - Strength concept - Load balancing concept - Losses of prestress - in post -tensioned and pre-tensioned members.

UNIT II - DESIGN FOR FLEXURE AND SHEAR (9)

Basic assumptions of flexural design - Permissible stresses in steel and concrete as per I.S.1343 Code - Different Types of sections - Design of sections of Type I and Type II post-tensioned and pre-tensioned beams - Check for flexural capacity based on I.S. 1343 Code - Influence of 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 states. Determination of anchorage zone stresses in post -tensioned beams by Magnel's method, Guyon's method and I.S. 1343 code - design of anchorage zone reinforcement.

UNIT IV - COMPOSITE BEAMS AND CONTINUOUS BEAMS (9)

Composite structures - Advantages - Types of composite structures - Analysis and design of composite beams - Shrinkage strain and its importance - Differential shrinkage - Methods of achieving continuity in continuous beams - Analysis for secondary moments - Concordant cable and linear transformation - Calculation of stresses - Principles of design.

UNIT V - MISCELANEOUS STRUCTURES	(9)
Role of prestressing in members subjected to tensile forces and compressive forces - Design of tension members and compression members - Design of tanks, pipes and sleepers - Partial prestressing - methods of achieving partial prestressing, merits and demerits of partial prestressing.	
TOTAL (L:45) = 45 PERIODS	

TEXTBOOKS:

1. Krishna Raju, "Prestressed Concrete", 6th Edition, Tata McGraw Hill Publishing Co, India, 2018.
2. Rajagopalan N, "Prestressed Concrete", 2nd Edition, Narosa Book Distributors, 2010.

REFERENCES:

1. Dayaratnam.P., "Prestressed Concrete Structures", Oxford and IBH, 2017.
2. Lin T.Y. and Ned.H.Burns, "Design of prestressed Concrete Structures", 3rd Edition, Wiley India Pvt. Ltd., New Delhi, 2013.
3. IS 1343 - 2012: Code of practice for Prestressed concrete.
4. IS 784 - 2001: Code of practice for Prestressed concrete pipes.
5. IS 3370 - 1999: Code of practice for concrete structures for the storage of liquids.

Mapping of COs with POs / PSOs

Cos	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	3													
2		3	3			3		3				3	3	3
3	2					2						3		3
4	3		3	3				3						3
5		3		3					3	3		3	3	3
CO (W.A)		3	3	3		2.5		3	3	3		3	3	3

22CEX04 - DISTRESS MONITORING AND REHABILITATION OF STRUCTURES				
	L	T	P	C
	3	0	0	3
PREREQUISITE : NIL				
Course Objective:	• To explain the causes and effects of structural distress and describe various rehabilitation methods and their applications. • To apply monitoring techniques and assessment tools to identify and evaluate distress in structures.			

Course Outcomes The students will be able to		**Cognitive Level**	**Weightage of COs in End Semester Examination**
CO1	Apply the knowledge of construction materials and techniques to analyze building durability problems.	Ap	40%
CO2	Apply various repair techniques for cracked and corroded elements.	Ap	20%
CO3	Evaluate the common defects and distress in construction through diagnostic procedures.	An	20%
CO4	Apply various methods of strengthening the structural components.	Ap	20%
CO5	Analyze and develop report for simple maintenance and repair problems.	An	Internal Assessment

UNIT I - INTRODUCTION	**(9)**
Maintenance, rehabilitation, repair, retrofit and strengthening - need for rehabilitation of structures - Cracks in R.C. buildings - causes and effects - importance of maintenance, routine and preventive maintenance.	
UNIT II - REPAIR MATERIALS	**(9)**
Criteria for material selection -Special mortars and concrete - Polymer Concrete and Mortar - Quick setting compounds - Grouting materials - Gas forming grouts - Bonding agents -Latex emulsions - Epoxy bonding agents - Protective coatings - FRP sheets.	
UNIT III - CRACK REPAIR TECHNIQUES	**(9)**
Methods of crack repair - Grouting - Routing - sealing - Stitching - Dry packing - Repair of active cracks - dormant cracks - Corrosion of embedded steel in concrete - Mechanism - Stages of corrosion - Repair techniques of corroded structural elements.	
UNIT IV - DAMAGE DIAGNOSIS AND ASSESSMENT	**(9)**
Visual inspection - Non-Destructive Testing - Rebound hammer, Ultra sonic pulse velocity - Semi destructive testing - Probe test - Pull out test - Chloride penetration test - Carbonation - Corrosion activity measurements.	
UNIT V - RETROFITTING OF STRUCTURES	**(9)**
Jacketing - Column jacketing - Beam jacketing - Beam Column joint - Reinforced concrete jacketing - Steel jacketing - FRP jacketing - Strengthening - Shear strengthening - Flexural strengthening.	
	TOTAL (L:45) = 45 PERIODS

TEXT BOOKS:

1. Vidivelli. B., "Rehabilitation of Concrete Structures", Standard Publishers, 2009.
2. PeterH.Emmons, "Concrete Repair and Maintenance Illustrated Problem Analysis, Repair Strategy, Techniques", Galgotia Publication, 2018.

REFERENCES:

1. Shetty M.S., "Concrete Technology - Theory and Practice", S.Chand and Company, 2019.
2. Ravishankar.K, Krishnamoorthy T.S, "Repair and Rehabilitation of Concrete Structures", Allied Publishers, 2004.
3. Santhakumar A. R., "Concrete Technology", Oxford University Press, 2006.

Mapping of COs with POs / PSOs

COs	**POs**												**PSOs**	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	3													3
2	3			3				2		2		3	2	3
3		3			2							3		2
4	3			2										
5		3		2	2				3	2		3	3	3
CO (W.A)	**3**	**3**		**2.3**	**2**			**2**	**3**	**2**		**3**	**2.5**	**2.8**

22CEX05 - DYNAMICS AND EARTHQUAKE RESISTANT STRUCTURES [IS 1893, IS 4326 and IS 13920 code books are to be permitted]				
	L	**T**	**P**	**C**
	3	**0**	**0**	**3**
PREREQUISITE : NIL				

Course Objective:	• To impart knowledge on the theory of vibration and basics of structural dynamics. • To impart the design philosophy of earthquake resistant design of structures. • To create awareness on the use of codal provisions for aseismic design of structures.

Course Outcomes The students will be able to		**Cognitive Level**	**Weightage of COs in End Semester Examination**
CO1	Apply the basics of structural dynamics in analysis of structures subjected to earthquake	Ap	20%
CO2	Apply knowledge of seismic characteristics to adopt suitable techniques in structural design.	An	40%
CO3	Design the earthquake resistant RCC structures as per codal provisions.	E	20%
CO4	Compute earthquake forces for buildings and able to understand design concepts.	E	20%
CO5	Analyze historical case studies of significant earthquakes and their effects on structures, and write detailed reports.	An	Internal Assessment

UNIT I BASICS AND CAUSES OF EARTHQUAKE	**(9)**
Cross section of earth interior - Seismology - Plate tectonics - Faults - Seismic waves - Consequences of earthquake - Earthquake parameters - Magnitude & intensity scales - Seismic zones of India - Characteristics of ground motion and attenuation - Earthquake recording instruments - Seismograph - Seismogram - Causes of earthquakes and its effect on built structures - Damages caused during past earthquakes.	
UNIT II EARTHQUAKE VIBRATIONS OF BUILDINGS	**(9)**
Static load v/s Dynamic load - Force control and displacement control - Simplified single degree of freedom system - Modelling of buildings - Natural frequency and resonance - Responses of buildings to different types of vibrations like free and forced - Damped and Undamped vibration - Response of building to earthquake ground motion - Introduction to multi degree of freedom systems - Mode shapes only.	
UNIT III EARTHQUAKE LOAD ANALYSIS	**(9)**
Planning considerations and Architectural concepts - Evaluation of Earthquake forces - Material properties - Guidelines for Earthquake resistant design - lateral load analysis - Capacity based design and Detailing - Rigid frames - Shear walls.	
UNIT IV EARTHQUAKE RESISTANT DESIGN OF STRUCTURES	**(9)**
Earthquake resistant design of RCC buildings - Pinching Effect - Bouchinger Effects - Response Spectra -	

Design spectra - Seismic coefficient method and Dynamic analysis - Ductile detailing of reinforced concrete beams, Columns and shear wall - Design procedure on ductile detailing (IS 13920:1993) - Design concepts of non-structural members.

UNIT V VIBRATION CONTROL TECHNIQUES **(9)**

Vibration control - Tuned mass dampers - Principles and application, Basic concepts of seismic base isolation - Various systems. Case studies of important structures.

TOTAL (L:45) = 45 PERIODS

TEXT BOOKS:

1. Mario Paz, "Structural Dynamics – Theory and Computations", Fourth Edition, CBS publishers, 1997.
2. Agarwal.P and Shrikhande.M. Earthquake Resistant Design of Structures, Prentice Hall of India Pvt. Ltd. 2007.

REFERENCES:

1. Anil K Chopra, "Dynamics of structures – Theory and applications to Earthquake Engineering", Prentice Hall Inc., 2007.
2. Moorthy C.V.R., "Earthquake Tips", NICEE, IIT Kanpur,2002.
3. IS13920-1993, Ductile detailing of reinforced concrete structures subjected to seismic forces - Code of practice.
4. IS 1893 part 1 2002, Indian standard criteria for earthquake resistant design of structures.
5. IS 4326-1993, Earthquake Resistant Design and Construction of Buildings Code of Practice (Second Revision)

Mapping of COs with POs / PSOs

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	3											3	2	3
2	2			3										2
3		3	3					3				3	2	3
4		3	3					3				3	3	3
5		3		3		3			3	3	3	3	3	3
CO (W.A)	2.5	3	3	3		3		3	3	3	3	3	2.5	2.8

22CEX06 - INTRODUCTION TO FINITE ELEMENT METHOD				
	L	T	P	C
	3	0	0	3

PREREQUISITE : NIL

Course Objective:	• To impact basic knowledge on the various steps involved in finite element analysis. • To introduce various types of one - two - three - dimensional elements.

Course Outcomes The students will be able to		**Cognitive Level**	**Weightage of COs in End Semester Examination**
CO1	Apply the concepts of finite element method to solve engineering problems.	Ap	20%
CO2	Employ the direct stiffness matrix method for analysis of structural elements.	An	20%
CO3	Apply numerical methods for various isoparametric elements.	Ap	40%
CO4	Analyze the structural elements of framed structures.	An	20%
CO5	Prepare and present a report on the historical development of the Finite Element Method along with its real-world engineering applications.	An	Internal Assessment

UNIT I - INTRODUCTION	**(9)**
Historical Background - Mathematical Modeling of field problems in Engineering - Governing Equations - Discrete and continuous models - Boundary, Initial and Eigen Value problems - Weighted Residual Methods - Variational Formulation of Boundary Value Problems - Ritz Technique - Basic concepts of the Finite Element Method.	
UNIT II - STIFFNESS MATRIX FORMULATION	**(9)**
Introduction to discrete and continua elements - Discrete Elements - Direct stiffness method - Special characteristics of stiffness matrix - Assemblage of elements - Boundary condition & reaction - 2D - truss element - 2D - beam element - Analysis of framed Structures - Basic steps in finite element analysis - Differential equilibrium equations - strain displacement relation - linear constitutive relation - Numerical methods in finite element analysis- Gauss elimination method.	
UNIT III - ONE DIMENSIONAL PROBLEMS	**(9)**
One Dimensional Second Order Equations - Discretization - Element types- Linear and Higher order Elements - Continua Elements - Displacement models - convergence requirements. Natural coordinate systems - Shape function. Interpolation function. Linear and quadratic elements - Lagrange and Serendipity elements. Strain displacement matrix - element stiffness matrix and nodal load vector. Natural frequencies of longitudinal vibration and mode shapes.	
UNIT IV - TWO DIMENSIONAL PROBLEMS	**(9)**
Two dimensional isoparametric elements - Four node quadrilateral elements - triangular elements. Computation of stiffness matrix for isoparametric elements - numerical integration (Gauss quadrature) Convergence criteria for isoparametric elements.	

UNIT V - ANALYSIS OF FRAMED STRUCTURES	(9)
Stiffness of Truss Members-Analysis of Truss-Stiffness of Beam Members-Finite Element Analysis of Continuous Beam-Plane Frame Analysis-Analysis of Grid and Space Frame.	
TOTAL (L:45) : 45 PERIODS	

TEXTBOOKS:

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

REFERENCES:

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

Mapping of COs with POs / PSOs

Cos	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	3													
2	2	2											2	
3		2												2
4		2												
5	2	2		2									2	
CO (W.A)	2.3	2		2									2	2

22CEX07 - ADVANCED STRUCTURAL ANALYSIS				
	L	T	P	C
	3	0	0	3
PREREQUISITE : 22CEC07				
Course Objective:	• To impart knowledge on plastic and elastic methods of analysis for structures. • To impart knowledge on the analysis of space truss, cable supported structures and arch structures.			

Course Outcomes The students will be able to		**Cognitive Level**	**Weightage of COs in End Semester Examination**
CO1	Apply the concept of plastic analysis to optimize the structural performance.	Ap	20%
CO2	Apply energy methods to analyse the structures.	Ap	20%
CO3	Determine the forces acting in cable structures and analyse the behaviour of various types of arches.	An	40%
CO4	Analyze the structural behavior of shell structures under various loading conditions.	An	20%
CO5	Solve the problems to analysis the various structures.	An	Internal Assessment

UNIT I - PLASTIC ANALYSIS OF STRUCTURES	**(9)**
Plastic moment of resistance - Plastic modulus - Shape factor - Load factor - Plastic hinge and mechanism - Plastic analysis of indeterminate beams and portal frames.	
UNIT II - ENERGY METHOD OF ANALYSIS	**(9)**
Introduction - Applications - Statically indeterminate beams - Kani's Method - Analysis of Indeterminate Structures - Continuous Beams and Portal Frames (with and without sway).	
UNIT III - ARCHES	**(9)**
Arches as structural forms - Arch structures - Arch action - Types of arches - Parabolic and circular arches - Analysis of three hinged and two hinged arches.	
UNIT IV - SUSPENSION CABLES	**(9)**
Suspension Cables - Components - Analysis of suspension cables - Analysis of stiffening girders - Beams curved in plan.	
UNIT V - SHELLS	**(9)**
Introduction - Classification of shells - Structural action - Analysis of spherical domes - Analysis of cylindrical shells - Introduction to folded plates.	
TOTAL (L:45) : 45 PERIODS	

TEXT BOOKS:

1. Devdas Menon, Structural Analysis, 3rd Edition, Narosa Publishing House, New Delhi, 2023
2. Vaidyanathan, R and Perumal, P., "Comprehensive Structural Analysis ‖ Volume I and II", Laxmi Publications Pvt. Ltd., Chennai, 4th Edition, 2016.

REFERENCES:

1. Hibbeler, R.C, "Structural Analysis", 10th Edition, Pearson India, Bengaluru, 2023
2. Punmia.B.C, Ashok K.Jain, Arun K Jain, "Theory of Structures", 12th Edition, Laxmi Publications, New Delhi, 2023.

Mapping of COs with POs / PSOs

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	3													
2	3													2
3		3		3								2	2	3
4		2												2
5		3		3					3			3	2	3
CO (W.A)	3	2.7		3					3			2.5	2	2.5

22CEX08 - STEEL CONCRETE COMPOSITE STRUCTURES

L	T	P	C
3	0	0	3

PREREQUISITE : NIL

Course Objective:	• To impart knowledge on the behaviour and design procedure of steel - concrete composite elements and structures. • To understand the effect of composite action and assess governing limit states for composite elements.

Course Outcomes The students will be able to		**Cognitive Level**	**Weightage of COs in End Semester Examination**
CO1	Identify the different types of steel-concrete composite structure and its connections.	Ap	20%
CO2	Design the composite beam and column.	E	40%
CO3	Design the slab under various loading conditions.	E	20%
CO4	Analysis the historical Steel concrete composite construction and seismic behaviour of the structures.	An	20%
CO5	Engage in independent learning through real time case studies of composite structure with respect to seismic circumstances.	An	Internal Assessment

UNIT I - INTRODUCTION	**(9)**
Introduction to steel - concrete composite construction - codes - composite design - shear connectors - types of shear connectors - degrees of shear connections - partial and full shear connections.	
UNIT II - DESIGN OF COMPOSITE BEAM	**(9)**
Introduce composite beams, including shear studs - Determine the location of a beam's neutral axis/axes depending on the level of composite action. Calculate shear stud strength and understand strength modifiers - deflection of composite beams.	
UNIT III - DESIGN OF COMPOSITE COLUMN	**(9)**
Introduction of composite beams-shear studs - Location of beams neutral axis depending on the level of composite action-shear stud strength and strength modifiers-deflection of composite beams. Types of Composite columns - design of encased columns - design of in-filled columns - axial, uni-axial and bi-axially loaded columns.	
UNIT IV - DESIGN OF COMPOSITE SLAB	**(9)**
Introduction - Composite slabs - profiled sheeting - sheeting parallel to span - sheeting perpendicular to span.	
UNIT V - CASE STUDY	**(9)**
Case studies on steel concrete composite construction in buildings - seismic behaviour of composite structures.	
TOTAL (L:45) = 45 PERIODS	

TEXTBOOKS:
1. Johnson R.P., "Composite structures steel and concrete Beams, Slabs, Columns and Frames for Buildings", Vol. 1, Fourth Edition, Blackwell Scientific Publications, 2018. 2. Oehlers D. J, and Bradford M. A., "Composite Steel and Concrete Structural Members, Fundamental Behaviour", Revised Edition, Pergamon press, Oxford, 2000.
REFERENCES:
1. Owens G.W and Knowles.P, "Steel Designers Manual", Seventh Edition, Steel Concrete Institute (UK), Oxford Blackwell Scientific Publications, 2011. 2. Teaching resource for "Structural Steel Design", Vol.2 of 3, Institute for steel Development and

Mapping of COs with POs / PSOs

Cos	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	3													3
2		3	3									3	3	3
3		3	3									3	3	3
4		3		3										3
5		3		3					3	3	3	3	3	3
CO (W.A)	**3**	**3**	**3**	**3**					**3**	**3**	**3**	**3**	**3**	**3**

22CEX11 - CONSTRUCTION EQUIPMENT AND MANAGEMENT					
		L	T	P	C
		3	0	0	3
PREREQUISITE : NIL					
Course Objective:	• To impart knowledge in selection strategies of various equipment based on the requirement of the project at optimum cost and time.				

Course Outcomes The students will be able to		Cognitive Level	Weightage of COs in End Semester Examination
CO1	Select suitable equipment required for building construction.	U	20%
CO2	Choose appropriate equipment for specific tasks in different scenarios.	Ap	40%
CO3	Recommend the most effective equipment for various concreting tasks based on project-specific requirements.	Ap	20%
CO4	Categorize the modern equipment's needed for surveying.	An	20%
CO5	Explain type of equipment and its applications through independent learning in a team and give oral presentation.	An	Internal Assessment

UNIT I - EQUIPMENT MANAGEMENT	**(9)**
Identification - Factors in selection of equipment - Planning Equipment Utilization - Renting strategies - Capital cost - Investment alternatives - Elements of operating and owning - Bidding costs - Replacement decisions - Rent and Lease considerations - Safety management.	
UNIT II - EARTHWORK EQUIPMENT	**(9)**
Tractors - Motor Graders - Scrapers - Front end Loaders - Earth movers -Equipment for Dredging and Trenching- Tunnelling methods and equipments - Compaction Equipment - Diaphragm wall equipment - Pile Driving Equipment - Drilling and Blasting.	
UNIT III - EQUIPMENTS FOR SCREENING AND TRANSPORTING	**(9)**
Forklifts and related equipment - Portable Material Bins - Material handling cranes - Conveyors - Aggregate Crushers - Feeders - Screening Equipment - Gantry girder.	
UNIT IV - CONCRETING EQUIPMENT	**(9)**
Batching and Mixing Equipment - Hauling equipment - RMC- Modern Formwork Techniques - Shuttering - Types of pumps used for Construction - Boom placer- Equipment for Grouting and Dewatering - 3D Concrete Printing.	
UNIT V - SURVEYING EQUIPMENT	**(9)**
Modern electronic surveying equipments - Digital levels - Digital theodolite - Advanced Total station - Lasers and sensors in Surveying - Remote sensing - Geographical Information System.	
TOTAL (L:45) = 45 PERIODS	

TEXTBOOK:

1. Sharma.S. C., "Construction Equipment and Management", 1st Edition, Khanna Book Publishing Co. (P) Ltd., India, 2019.

REFERENCES:

1. Peurifoy R.L., "Construction Planning, Equipment and Methods", 7th Edition, McGraw Hill, Singapore, 2013.
2. Leonid Nadolinets, "Surveying Instruments and Technology", 1st Edition, CRC Press, 2017.

Mapping of COs with POs / PSOs

Cos	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	2													2
2	2			2									2	3
3	3			2										2
4		2											2	
5		3		3					3	3	3	3	3	3
CO (W.A)	**2.3**	**2.5**		**2.3**					**3**	**3**	**3**	**3**	**2.3**	**2.5**

22CEX12 - SUSTAINABLE AND LEAN CONSTRUCTION				
	L	T	P	C
	3	0	0	3
PREREQUISITE : NIL				

Course Objective:	• To develop student's ability to implement sustainable building practices, energy conservation strategies, and lean construction techniques, with a focus on achieving green energy buildings. • To equip students with the knowledge and skills to implement sustainable construction practices, accurately assess building energy use, and apply advanced green building concepts.

Course Outcomes The students will be able to		**Cognitive Level**	**Weightage of COs in End Semester Examination**
CO1	Apply methods to calculate the embodied energy of various construction materials and assess their impact on the overall energy efficiency of buildings.	Ap	40
CO2	Apply quality control and durability practices to enhance the life cycle and sustainability of construction materials and structures.	Ap	20
CO3	Apply building information modeling tools to support and enhance lean construction practices on project site.	Ap	20
CO4	Apply productivity measurement systems (PMS) to evaluate and enhance efficiency in construction projects, leading to continuous improvement and effective project management.	Ap	20
CO5	Demonstrate practical aspects of sustainable and lean construction to real-world scenarios.	E	Internal Assessment

UNIT I - INTRODUCTION	**(9)**
Introduction and definition of Sustainability - Carbon cycle - role of construction material: concrete and steel, etc. - CO2 contribution from cement and other construction materials - Recycled and manufactured aggregate - Role of QC and durability - Life cycle and sustainability.	
UNIT II - ENERGY CALCULATIONS	**(9)**
Components of embodied energy - calculation of embodied energy for construction materials - Energy concept and primary energy - Embodied energy via-a-vis operational energy in conditioned building - Life Cycle energy use.	
UNIT III - GREEN BUILDINGS	**(9)**
Control of energy use in building - National Building Code (NBC), ECBC code, codes in neighboring tropical countries - OTTV concepts and calculations - Features of LEED and TERI - Griha ratings - Role of insulation and thermal properties of construction materials - influence of moisture content and modeling - Performance ratings of green buildings - Zero energy building.	
UNIT IV - CORE CONCEPTS IN LEAN	**(9)**
Introduction to the Course; Lean Overview; Need for Productivity Measurement and improvement; Productivity Measurement System (PMS).	

UNIT V - LEAN CONSTRUCTION TOOLS AND TECHNIQUES	(9)
Sampling-Work Sampling; Survey - Foreman delay survey, Value Stream- Process Mapping - 5S , Collaborative Planning System (CPS) - Last Planner System (LPS) - Big Room Approach, IT-BIM and Lean, How to Start Practicing Lean Tools in Project Site.	
TOTAL (L:45) = 45 PERIODS	

TEXTBOOKS:

1. Charles J Kibert, Sustainable Construction: Green Building Design & Delivery, 4th Edition, Wiley Publishers 2016.
2. Steve Goodhew, Sustainable Construction Process, Wiley Blackwell,UK, 2016.

REFERENCES:

1. Craig A. Langston & Grace K.C. Ding, Sustainable Practices in the Built Environment, Butterworth Heinemann Publishers, 2011.
2. Ballard. G, Tommelein I, Koskela L. and Howell G., Lean construction tools and techniques, 2002.
3. Salem. O, Solomon J, Genaidy A and Luegring M., Site implementation and Assessment of Lean Construction Techniques, Lean Construction Journal, 2005.

Mapping of COs with POs / PSOs

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	2													2
2	2						2							
3	3				2	2	2							2
4				2							2			
5		3					2		2	2			2	2
CO (W.A)	2.3	3		2	2	2	2		2	2	2		2	2

22CEX13 - SAFETY IN CONSTRUCTION PRACTICES				
	L	T	P	C
	3	0	0	3

PREREQUISITE : NIL

Course Objective:	• To understand the latest safety and health regulations and the Indian Standards applicable to the construction industry.

Course Outcomes The students will be able to		**Cognitive Level**	**Weightage of COs in End Semester Examination**
CO1	Illustrate the causes of construction accidents and their effects on workers and project timelines.	Ap	20%
CO2	Apply workplace standards, safety regulations and ethical codes of conduct.	Ap	20%
CO3	Identify the suitable safety measures in handling construction equipment.	An	20%
CO4	Evaluate workplace hazards and incidents using various analysis and investigation techniques, then implement health management systems.	An	40%
CO5	Engage in independent study as a member of a team and make an effective oral presentation / draft a report on the applications of safety norms and procedures in construction site.	C	Internal Assessment

UNIT I - INTRODUCTION TO CONSTRUCTION SAFETY	**(9)**
History of safety in construction - Evolution of safety thinking - Basic terminology in safety - types of injuries - Safety pyramid - Accident patterns - Theories of accident - Causation - Role of top management and workers in construction safety.	
UNIT II - PLANNING FOR SAFETY	**(9)**
Introduction to OSHA regulations - Causes and effects of accidents at site - Safety personnel - Safety budget - Safety culture - Planning for PPE - Role of stakeholders in safety - Workers' compensation.	
UNIT III - SITE SAFETY PROGRAMS	**(9)**
SOP (Safe Operating Procedures) - Construction equipment - Materials handling - Disposal - Hand tools - Safety during alteration ,Demolition works - Earth work, steel construction, temporary structures, masonry & concrete construction, cutting and welding.	
UNIT IV - HAZARDS IN CONSTRUCTION PROJECTS	**(9)**
Job Safety Analysis (JSA) - Job hazard analysis (JHA) - Health hazards - Types - Precautionary measures - Hazard management - Accident investigation - Accident indices - Violation - Penalty	
UNIT V - SAFETY IN CONSTRUCTION	**(9)**
Safety concern in construction - Role of owners in safety and health management - Responsibility of owners in safety - Fostering total safety culture - Job site safety - Responsibility of workers at site.	
TOTAL (L:45) = 45 PERIODS	

TEXTBOOKS:

1. S.K.Bhattacharjee, "Safety Management in Construction",1st Edition, Khanna Publishers, New Delhi,2011.
2. Allan St John Holt, "Principles of Construction Safety", Wiley-Blackwell Publications, 2008.

REFERENCES:

1. Rita Yi Man Li& Sun WahPoon, "Construction Safety" ,1st Edition, Springer, New York,2013
2. Richard J. Coble, Jimmie Hinze and Theo C. Haupt, "Construction Safety and Health Management", Prentice Hall Inc., 2011
3. Jimmy W. Hinze, "Construction Safety", Prentice Hall Inc., 2015.
4. Tamilnadu Factory Act, Department of Inspectorate of factories, Tamilnadu.
5. Patrick X.W. Zou, Riza Yosia Sunindijo, "Strategic Safety Management in Construction and Engineering", John Wiley & Sons, Ltd 2015.

Mapping of COs with POs / PSOs

Cos	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	2					2								2
2	3	2				2		3					2	
3		2			2									
4		3		2							2			2
5		2		2					3	2		3	3	2
CO (W.A)	**2.5**	**2.3**		**2**	**2**	**2**		**3**	**3**	**2**	**2**	**3**	**2.5**	**2**

22CEX14 - ADVANCED CONSTRUCTION TECHNIQUES				
	L	T	P	C
	3	0	0	3
PREREQUISITE : NIL				

Course Objective:	• To understand and apply the latest construction techniques to engineering construction for sub structure, super structure, special structures, rehabilitation and strengthening techniques and demolition techniques.

Course Outcomes The students will be able to		**Cognitive Level**	**Weightage of COs in End Semester Examination**
CO1	Apply the modern construction techniques used in the sub structure and super structure construction.	Ap	40%
CO2	Analyse the sequences and methods used in construction of special structures.	An	20%
CO3	Identify the repair techniques for different structures undergoing damage for various reasons.	An	20%
CO4	Assess the safety measures and precautions used in demolition and dismantling activities.	An	20%
CO5	Examine the implementation of advanced techniques in construction projects based on case studies or site visits, and develop a presentation or report outlining a new innovation or improvement in advanced construction techniques.	E	Internal Assessment

UNIT I - SUB STRUCTURE CONSTRUCTION	**(9)**
Construction Methodology - Box jacking - Pipe jacking - Under water construction of diaphragm walls and basement - Tunneling techniques - Piling techniques - Driving well and caisson - sinking cofferdam - cable anchoring and grouting.	
UNIT II - SUPER STRUCTURE CONSTRUCTION	**(9)**
Vacuum dewatering of concrete flooring - Concrete paving technology - Techniques of construction for continuous concreting operation in tall buildings of various shapes and varying sections - Erection techniques of tall structures, Large span structures - launching techniques for heavy decks - in-situ prestressing in high rise structures.	
UNIT III - CONSTRUCTION OF SPECIAL STRUCTURES	**(9)**
Erection of lattice towers - Rigging of transmission line structures - Construction sequence in cooling towers, Silos, chimney, sky scrapers - Bow string bridges, Cable stayed bridges - Launching and pushing of box decks - Construction of jetties and break water structures - Construction sequence and methods in domes - Support structure for heavy equipment and machinery in heavy industries.	

UNIT IV - REHABILITATION AND STRENGTHENING TECHNIQUES	(9)
Seismic retrofitting - Strengthening of beams - Strengthening of columns - Strengthening of slab - Strengthening of masonry wall, Protection methods of structures, Mud jacking and grouting for foundation - Micro piling and underpinning for strengthening floor and shallow profile - Sub grade water proofing, Soil Stabilization techniques.	
UNIT V - DEMOLITION	**(9)**
Demolition Techniques, Demolition by Machines, Demolition by Explosives, Advanced techniques using Robotic Machines, Demolition Sequence, Dismantling Techniques, Safety precaution in Demolition and Dismantling.	
TOTAL (L:45) = 45 PERIODS	

TEXT BOOKS:

1. Arora S.P. and Bindra S.P., "Building Construction, Planning Techniques and Method of Construction", Dhanpat Rai and Sons, 2010.
2. Varghese, P.C. "Building construction", Prentice Hall of India Pvt. Ltd, New Delhi, 2016.
3. Sharma S.C. "Construction Equipment and Management", Khanna Publishers New Delhi, 2013

REFERENCES:

1. Peter H.Emmons, "Concrete repair and maintenance illustrated", Galgotia Publications Pvt. Ltd., 2008.
2. Sankar, S.K. and Saraswati, S., "Construction Technology", Oxford University, New Delhi, 2008.

Mapping of COs with POs / PSOs

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	3											3	2	3
2		2		2										
3		3												
4		2												2
5	3	2	2		3		2		3	2		3	2	3
CO (W.A)	3	2.3	2	2	3	2	2		3	2		3	2	2.7

22CEX15 - ENERGY EFFICIENT BUILDINGS				
	L	T	P	C
	3	0	0	3

PREREQUISITE : NIL

Course Objective:	• To acquire and apply knowledge of energy consumption, passive solar heating and cooling, day lighting, electrical lighting, and building ventilation. • To design energy-efficient buildings that ensure indoor comfort and optimize energy use..

Course Outcomes The students will be able to		Cognitive Level	Weightage of COs in End Semester Examination
CO1	Apply principles of climate adaptation to design buildings that optimize thermal comfort and energy efficiency.	Ap	40%
CO2	Evaluate, optimize, and integrate day lighting and electric lighting systems in building design.	Ap	20%
CO3	Design energy-efficient buildings by applying advanced architectural and engineering principles.	Ap	20%
CO4	Apply energy efficiency design concepts and architectural interventions.	Ap	20%
CO5	Synthesize and present their knowledge of climate adaptation, passive solar heating, day lighting, heat control, and energy-efficient building design.	E	Internal Assessment

UNIT I - INTRODUCTION	**(9)**
Climate adapted and climate rejecting buildings - Heat Transfer - Thermal Storage - Measurement of Radiation - The Greenhouse Effect -Thermal Comfort - Site Planning and Development - Temperature - Humidity - Wind - Sun Path Diagrams - Sun Protection - Types of Shading Devices.	
UNIT II - PASSIVE SOLAR HEATING AND COOLING	**(9)**
General Principles of passive Solar Heating - Water Walls - Concepts - Ventilation - Principles - Case studies - Courtyards - Roof Ponds - Cool Pools - Predicting ventilation in buildings - Window Ventilation Calculations - Evaporation and dehumidification - Zoning - Air Filtration.	
UNIT III - DAYLIGHTING AND ELECTRICAL LIGHTING	**(9)**
Materials, components and details - Insulation - Glazing materials - Day lighting - concepts - Building Design Strategies - Daylight apertures - Light Shelves - Codal requirements - Day lighting design - Electric Lighting - Switching controls - Electric Task Lighting - Electric Light Zones - Power Adjustment Factors.	
UNIT IV - HEAT CONTROL AND VENTILATION	**(9)**
Heat insulation - Terminology - Thermal performance of Building sections - Orientation of buildings - Building characteristics for various climates - Thermal Design of buildings - Ventilation - Minimum standards for ventilation - Ventilation Design - Natural Ventilation.	

UNIT V - DESIGN FOR CLIMATIC ZONES	(9)
Energy efficiency - Design Concepts and Architectural Interventions - Evaporative Cooling - Design of Energy Efficient Buildings for Various Zones - Cold and sunny - Commonly used software packages in energy efficient building analysis and design	
TOTAL (L:45) = 45 PERIODS	

TEXT BOOKS:

1. Brown, G.Z. and DeKay, M., "Sun, Wind and Light - Architectural Design Strategies", John Wiley and Sons Inc, 3rd Edition, 2014.
2. Majumdar, M (Ed), "Energy - Efficient Buildings in India", Tata Energy Research Institute, Ministry of Non-Conventional Energy Sources, 2009.

REFERENCES:

1. Energy Conservation Building Code, CAU of Energy Efficiency, New Delhi, 2018.
2. Handbook on Functional Requirements of Buildings Part 1 to 4 SP : 41 (S and T) 1995
3. John Krigger, Chris Dorsi, "Residential Energy: Cost Savings and Comfort for Existing Buildings", Published by Saturn Resource Management, 2013.

Mapping of COs with POs / PSOs

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	2													
2		2												2
3			2	2										2
4	2													
5		3				3	2		3	2	3	3	2	3
CO (W.A)	**2**	**2.5**	**2**	**2**		**3**	**2**		**3**	2	**3**	**3**	**2**	**2.3**

22CEX16 - CONSTRUCTION PLANNING AND SCHEDULING					
		L	T	P	C
		3	0	0	3
PREREQUISITE : NIL					
Course Objective:	• To equip students with the knowledge and skills required to effectively plan, schedule, and manage construction projects. • To prepare students to manage construction projects efficiently, ensuring adherence to timelines, budgets, quality standards, and safety regulations.				

Course Outcomes The students will be able to		**Cognitive Level**	**Weightage of COs in End Semester Examination**
CO1	Apply financial concepts within cost accounting systems to achieve overall project success.	Ap	40%
CO2	Estimate activity durations, resource requirements and utilize coding systems to implement effective construction plans.	Ap	20%
CO3	Apply various scheduling techniques to manage construction schedules.	Ap	20%
CO4	Apply principles of resource management to estimate various requirements of resources.	Ap	20%
CO5	Analyze real construction projects and addressing in aspects of technology choice, scheduling with critical path and resource leveling, cost forecasting, quality control measures, and effective resource utilization.	E	Internal Assessment

UNIT I - CONSTRUCTION PLANNING	**(9)**
Basic concepts in the development of construction plans-choice of Technology and Construction method-Defining Work Tasks - Definition- Precedence relationships among activities - Estimating Activity Durations-Estimating Resource Requirements for work activities - coding systems.	
UNIT II - SCHEDULING PROCEDURES AND TECHNIQUES	**(9)**
Relevance of construction schedules - Bar charts - The critical path method-Calculations for critical path scheduling - Activity float and schedules - Presenting project schedules - Critical path scheduling for Activity - on-node and with leads, Lags and Windows - Calculations for scheduling with leads, lags and windows - Crashing and time/cost tradeoffs - Introduction to application software.	
UNIT III - COST CONTROL MONITORING AND ACCOUNTING	**(9)**
The cost control problem - The project Budget - Forecasting for Activity cost control - financial accounting systems and cost accounts - Control of project cash flows - Schedule control - Schedule and Budget updates -Relating cost and schedule information.	
UNIT IV - QUALITY CONTROL AND SAFETY DURING CONSTRUCTION	**(9)**
Quality and safety Concerns in Construction - Organizing for Quality and Safety - Work and Material Specifications - Total Quality control - Quality control by statistical methods - Statistical Quality control with Sampling by Attributes - Statistical Quality control by Sampling and Variables - Safety.	

UNIT V - RESOURCE MANAGEMENT	(9)
Types of resources - Estimating resource requirements - Material management - Effective utilization of resources - Depreciation of construction equipment - Manpower planning - Performance Appraisal - Resource levelling - Resource smoothing.	
TOTAL (L:45) = 45 PERIODS	

TEXT BOOKS :

1. Seetharaman. S, "Construction Engineering and Management", 5th Edition, Umesh Publishing, 2019.

REFERENCES:

1. S.C. Sharma, S.V. Deodhar, "Construction Engineering and Management", 1st Edition, Khanna Publishing House, 2017.
2. Garold D. Oberlender, "Project Management for Engineering and Construction", 3rd Edition, McGraw- Hill Education, 2014.

Mapping of COs with POs / PSOs														
COs	**POs**												**PSOs**	
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
1	2													2
2	3												2	
3		3											2	3
4	3													3
5		3		3				3	2	2		3		2
CO (W.A)	**2.7**	**3**		**3**	**3**			**3**	**2**	**2**		**3**	**2**	**2.5**

22CEX17 - ARCHITECTURE AND TOWN PLANNING					
		L	T	P	C
		3	0	0	3
PREREQUISITE : NIL					
Course Objective:	• To apply architectural design principles to develop basic building layouts and town plans that meet specified functional, aesthetic, and sustainability criteria.				

Course Outcomes The students will be able to		Cognitive Level	Weightage of COs in End Semester Examination
CO1	Apply the architectural concepts into design practice.	Ap	20%
CO2	Practice the interior design using locally available materials.	Ap	20%
CO3	Classify the zoning and Identify the standards required for town planning.	Ap	40%
CO4	Prepare building plans as per standards and zoning regulations.	Ap	20%
CO5	Engage in independent study as a member of a team and make an effective oral presentation / draft a report on the on a specific issue findings by observing real-world applications of architectural and town planning concepts.	E	Internal Assessment

UNIT I - ARCHITECTURAL SPACE STANDARDS	**(9)**
Introduction to architecture - Aesthetics - Fundamental concepts of architecture - Form, shape, size - Background - Focus - Balance - Rhythm - Harmony - Texture - Contrast - Monotony - Scale - Proportion - Colour - Circulation and inter - circulation - Solids and voids - Principles of planning.	
UNIT II - INTERIORS	**(9)**
Interior Planning and treatment - Use of natural and synthetic building materials - Thermal and Acoustical materials - Lighting and illumination.	
UNIT III - PLANNING AND CONCEPTS OF TOWN PLANNING	**(9)**
Planning Surveys - Importance of Climate topography, drainage and water supply in the selection of site for the development - Residential - Commercial - Industrial - Public - Transportation, Basic amenities and services.	
UNIT IV - ZONING	**(9)**
Principles of zoning - Housing - Slum - Parks and Playgrounds - Industries - Public buildings - Urban roads and Traffic Management.	
UNIT V - BUILDING BYE-LAWS	**(9)**
Town planning legislation and municipal acts - Planning control development schemes - Building rules and regulations - Set back - Light plane - Floor space Index - Off-street parking - Fire protection - Examples of planned cities and housing in India - Applications of Remote Sensing and GIS in town planning.	
TOTAL (L:45) = 45 PERIODS	

TEXTBOOKS:

1. Rangwala. S., "Town Planning", 32nd Edition, Charotar Publishers, 2023.
2. Pramar. V.S. "Design fundamental in Architecture", Somiya Publications Pvt. Ltd., New Delhi, 1997.

REFERENCES:

1. Hiraskar. G. K., "Fundamentals of Town Planning", 17th Edition, Dhanpat Rai Publications, 2017.
2. Francis D. K. Ching., "Architecture: Form, Space & Order", 4th Edition, John Wiley & Sons, 2014.
3. Biswas Hiranmay, "Principles of Town Planning and Architecture" ,VAYU Education of India, New Delhi., 1st ed., 2012
4. National Building Code of India, SP7 (Group 1) Bureau of Indian Standards, New Delhi, 2017.

Mapping of COs with POs / PSOs

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	3												3	3
2	3							2		3	3	3	3	3
3		2						2			3	3	3	3
4	3					2		2		3			3	3
5		3		3	2	2				3	3	3	3	3
CO (W.A)	3	2.5		3	2	2		2		3	3	3	3	3

22CEX18 - CONTRACT MANAGEMENT				
	L	T	P	C
	3	0	0	3

PREREQUISITE : NIL

Course Objective:	• To impart knowledge on tender preparation, tendering process, arbitration procedure and laws, Intellectual property requirements and Labour Regulations.

Course Outcomes The students will be able to		**Cognitive Level**	**Weightage of COs in End Semester Examination**
CO1	Apply the principles of the Indian Contract Act to ensure that construction agreements meet legal requirements and are enforceable.	Ap	20%
CO2	Apply the concept of bidding and evaluate tenders based on procedure.	Ap	20%
CO3	Ensure the follow of arbitration act and practice ethical code of conduct in IPR, copy rights and design patent.	Ap	40%
CO4	Choose the laws applicable to labour legislation in construction industry.	Ap	20%
CO5	Prepare a report on contract management strategies by analyzing case studies and evaluating effective approaches for contract creation, execution, and oversight.	E	Internal Assessment

UNIT I - CONSTRUCTION CONTRACTS	**(9)**
Indian contract Act - Need - Provisions - Scope for modifications / improvement - Contract specifications - Types of contract documents used in construction - Contract procurement - Selecting a contractor - Introduction to BOT and BOOT projects - EPC contracts.	
UNIT II - TENDERS	**(9)**
Tender request for proposals - Bids & Proposals - Bid evaluation - Contract conditions and specifications - Critical / Red flag conditions - Contract award and Notice to proceed - Variations and changes in contracts - Differing site conditions - Cost escalation - Delays, Suspensions & Terminations - Wrong practices in contracting (Bid shopping, Bid fixing, Cartels).	
UNIT III – ARBITRATION	**(9)**
Arbitration and litigation procedure - preparation, settlement, evidence - Comparison of actions and laws - Agreements ,subject matter violations - Appointment of arbitrators - Conditions of arbitrations - Powers and duties of arbitrator - Enforcement of award – costs - Arbitration and conciliation act 1996 - Case studies.	

UNIT IV - LAW RELATING TO INTELLECTUAL PROPERTY	(9)
Introduction - meaning of intellectual property - main forms of IP- Copyright - Trademarks, patents and designs, secrets - Law relating to Copyright in India - Meaning of copyright - Ownership of copyrights and assignment - Criteria of infringement - Piracy in internet - Remedies and procedures in India - Law relating to patents under Patents Act - Process of obtaining patent - Application, examination, opposition and sealing of patents.	
UNIT V - LAWS APPLICABLE TO CONSTRUCTION ACTIVITY	**(9)**
Industrial disputes act - Workmen's compensation act - Employer's liability act - Payment of wages act - Contract labour act - Minimum wages act - Inter-state migrant workmen act - BOCW Act - other acts introduced time to time.	
TOTAL (L:45) = 45 PERIODS	

TEXT BOOKS:

1. Gajaria G.T., "Laws Relating to Building and Engineering Contracts in India", 4th Edition, M.M.Tripathi Pvt. Ltd., Bombay, 2000.

REFERENCES:

1. Joseph T. Bockrath, "Contracts and the Legal Environment for Engineers and Architects", 7th Edition, McGraw-Hill, New York 2010.
2. Jimmie Hinze, "Construction Contracts", 3rd Edition, McGraw-Hill, New York, 2010.

Mapping of COs with POs / PSOs

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	2													2
2	2										2			2
3		2						2			2		2	2
4		2												2
5		3						2	2	2	2		2	2
CO (W.A)	**2**	**2.3**						**2**	**2**	**2**	**2**		**2**	**2**

22CEX21 - AIRPORTS AND HARBOURS					
		L	T	P	C
		3	0	0	3
PREREQUISITE : NIL					
Course Objective:	• To examine the essential components and operational procedures of airports and harbours, while exploring their regulatory frameworks and economic impacts.				

Course Outcomes The students will be able to		Cognitive Level	Weightage of COs in End Semester Examination
CO1	Apply the principles of airfield components to optimize efficiency, minimize conflicts, and ensure safe aircraft movements.	Ap	20%
CO2	Apply principles of airport planning in the context of site selection and circulation area.	Ap	20%
CO3	Analyse the various components and construction techniques to devise a strategy for optimizing port infrastructure development.	An	40%
CO4	Investigate the various length and elevation adopted for runway and taxiway designs and it's orientation.	Ap	20%
CO5	Present a detailed case study of a notable airport or harbor project, highlighting its challenges and impact on the local community.	An	Internal Assessment

UNIT I - AIRPORT PLANNING	**(7)**
Air transport characteristics - airport classification - ICAO - airport planning: Site selection typical Airport Layouts, Case Studies, parking and Circulation Area.	
UNIT II - AIRPORT COMPONENTS	**(9)**
Planning of Airfield Components - Runway, Taxiway, Apron, Hangar - Passenger Terminals - Geometric design of runway and taxiways - Runway pavement Design - Difference between Highway and airport pavements - Introduction to various design methods - Airport drainage.	
UNIT III - AIRPORT DESIGN	**(10)**
Runway Design : Orientation, Wind Rose Diagram, Problems on basic and Actual Length, Geometric Design - Elements of Runway Design - Airport Zones - Passenger Facilities and Services - Runway and Taxiway Markings - Air Traffic Control Tower - Instrumental Landing.	
UNIT IV - SEAPORTS COMPONENTS AND CONSTRUCTION	**(10)**
Definition of Basic Terms: Harbor, Port, Satellite Port, Docks - Dry and Floating Dock, Waves and Tides - Planning and Design of Harbors: Harbour Layout and Terminal Facilities - Coastal Structures: Piers, Break waters, Wharves, Jetties, Quays, Spring Fenders, Dolphins Floating Landing Stage - Navigational Aids-Inland Water Transport.	

UNIT V - SEAPORT REGULATIONS AND EIA	(9)
Wave action on Coastal Structures and Shore Protection and Reclamation - Coastal Regulation Zone, 2011- EIA - methods of impact analysis and its process.	
TOTAL (L:45) = 45 PERIODS	

TEXT BOOKS:

1. Khanna S.K. Arora M.G and Jain S.S, Airport Planning and Design, Nemachand and Bros, Roorkee, 2012.
2. Robert Honjeff and Francis X. Mckelvey, "Planning and Design of Airports", McGraw Hill, New York,2000
3. Richard De Neufille and Amedeo Odoni, "Airport Systems Planning and Design", McGraw Hill, New York, 2014.
4. Subramanian K.P., Highways, Railways, Airport and Harbour Engineering ,Scitech Publications (India), Chennai, 2010.

REFERENCES:

1. Venkatramaiah. C., "Transportation Engineering - Vol.2 Railways, Airports, Docks and Harbours, Bridges and Tunnels", Universities Press (India) Private Limited, Hyderabad, 2015.
2. Mundrey J S, "Railway Track Engineering", McGraw Hill Education (India) Private Ltd, New Delhi, 2013.

Mapping of COs with POs / PSOs														
COs	**POs**												**PSOs**	
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
1		3											3	
2		3											3	
3					3									3
4			3										3	
5										3			3	
CO (W.A)		**3**	**3**		**3**					**3**			**3**	**3**

22CEX22 - TRAFFIC ENGINEERING AND MANAGEMENT					
		L	T	P	C
		3	0	0	3
PREREQUISITE : NIL					
Course Objective:	• To imparts knowledge on traffic engineering, safety and management concepts on rural and urban highways.				

Course Outcomes The students will be able to		**Cognitive Level**	**Weightage of COs in End Semester Examination**
CO1	Apply the fundamentals of traffic flow.	Ap	20%
CO2	Implement the traffic planning and management systems	Ap	20%
CO3	Analyze the various traffic surveys and to overcome the time delay so as to ensure the comfort of the journey.	An	40%
CO4	Design the components of urban transportation system	Ap	20%
CO5	Engage with challenges, emerging trends and Ethical considerations in transportation planning through independent learning and discussions.	An	Internal Assessment

UNIT I - TRAFFIC CHARACTERISTICS	**(9)**
Road Characteristics - Road user characteristics - PIEV theory - Vehicle - Performance characteristics - Fundamentals of Traffic Flow - Urban Traffic problems in India - Integrated planning of town country, regional and all urban infrastructure - Towards Sustainable approach - land use & transport and modal integration.	
UNIT II - TRAFFIC SURVEYS	**(9)**
Traffic Surveys - Speed, journey time and delay surveys - Vehicles Volume Survey including non motorized transport - Methods and interpretation - Origin Destination Survey - Methods and presentation - Level of service - Concept, applications and significance.	
UNIT III - TRAFFIC DESIGN AND VISUAL AIDS	**(9)**
Intersection Design - Channelization - Rotary intersection design - Signal design - Coordination of signals - Grade separation - Traffic signs including VMS and road markings.	
UNIT IV - TRAFFIC SAFETY AND ENVIRONMENT	**(9)**
Road accidents - Causes, effect, prevention, and cost - Traffic and environment hazards - Air and Noise Pollution, causes, abatement measures - Promotion and integration of public transportation Promotion of non-motorized transport.	
UNIT V - TRAFFIC MANAGEMENT	**(9)**
Area Traffic Management System - Traffic System Management (TSM) with IRC standards - Traffic Regulatory Measures - Travel Demand Management (TDM) - Intelligent Transport System for traffic management.	
TOTAL (L:45) = 45 PERIODS	

TEXT BOOKS:

1. Kadiyali L.R. "Traffic Engineering and Transport Planning", Khanna Publishers, Delhi, 2019
2. Indian Roads Congress (IRC) Specifications: Guidelines and Special Publications on Traffic Planning and Management.

REFERENCES:

1. Wolfgang S.Homburger et al., "Fundamentals of Traffic Engineering" 15th Edition, Institute of Transportation Studies, University of California, 2012.
2. James L.Pline (Edr),"Traffic Engineering Hand Book, Institute of Transportation Engineers", Washington DC, USA, 2000.
3. Nicholas T.Garber, Lester A Hoel, "Traffic and Highway Engineering", Revised Second Edition, ITP, California, USA, 2010.

Mapping of COs with POs / PSOs

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	2													
2	3			2									3	3
3		2											2	2
4	2		3									3	2	3
5		3		3			3	3			3			3
CO (W.A)	**2.3**	**2.5**	**3**	**2.5**			**3**	**3**			**3**	**3**	**2.3**	**2.8**

22CEX23 - URBAN PLANNING AND DEVELOPMENT					
		L	T	P	C
		3	0	0	3
PREREQUISITE : NIL					
Course Objective:	• To impart knowledge on planning process and to introduce about the regulations and laws related to urban planning. • To apply the knowledge of implementation of urban concepts in city area.				

Course Outcomes The students will be able to		**Cognitive Level**	**Weightage of COs in End Semester Examination**
CO1	Identify the issues involved in urban areas and the challenges in implementing new initiatives under government sectors.	U	20%
CO2	Apply the different concepts to plan the urban area and city development.	Ap	20%
CO3	Evaluate the planning and development methods of urban projects.	Ap	40%
CO4	Apply the regional planning process by identifying and summarizing the key steps according to established standards and norms.	Ap	20%
CO5	Study and compare various Town and Country Planning Acts by analyzing their objectives and functions. Prepare a report supported by case studies showcasing their implementation in different regions.	An	Internal Assessment

UNIT I - INTRODUCTION	**(9)**
Definition of Human settlement, Urban area, Town, City, Metropolitan City, Megalopolis, Urbanization, Urbanism, Suburbanization, Urban sprawl, Peri - urban areas, Urban Agglomeration, Classification of urban areas - Atal Mission for Rejuvenation and Urban Transformation (AMRUT)	
UNIT II - PLANNING PROCESS	**(9)**
Principles of Planning - Objectives, Draft Plans, Final Plan. Planning Theories - Garden City Concept, Geddesian Triad by Patrick Geddes, Modernism Concept by Le-Corbusier, Theories of Ekistics, Bid-rent Theory by William Alonso.	
UNIT III - DEVELOPMENT PLANS, PLAN FORMULATION AND EVALUATION	**(9)**
Types of plans - Regional Plan, Master Plan, Structure Plan, Detailed Development Plan, New Town/ Satellite town- Development Plan, Smart City Plan - Scope and Methodologies for the preparation of Regional Plan (RP), Master Plan (MP), and Detailed Development Plan (DDP).	
UNIT IV - IMPLEMENTATION OF PLANS	**(9)**
Planning Standards, Project Formulation and evaluation; Project Report preparation and presentation; Legal and Financial constraints - Problems due to multiple laws - Urban planning agencies and their functions in the plan formulation and implementation.	

UNIT V - URBAN AND REGIONAL PLANNING LEGISLATIONS, REGULATIONS AND DESIGNS	(9)
Town and Country Planning, Local Bodies and Land Acquisition Acts, Development and Building Rules, Site analyses, Layouts and Buildings Design.	
TOTAL (L:45)= 45 PERIODS	

TEXT BOOKS:

1. M.Pratap Rao, "Urban Planning: Theory and practice", CBS Publishers and Distributors, 2009.
2. Peter Hall, Mark Tewdwr-Jones., "Urban and Regional Planning", Routledge; 5th Edition, 2010.

REFERENCES:

1. S.K.Kulshrestha, "Urban and Regional Planning in India", SAGE Publications India Pvt Ltd, 2012.
2. Goel, S.L Urban Development and Management, Deep and Deep publications, New Delhi 2002.
3. Arthur B. Gallion, "The Urban Pattern" 5th Edition, CBS Publishers & Distributors, 2003.
4. Thooyavan, K.R., Human Settlements - A Planning Guide to Beginners, M.A Publications, Chennai, 2005.
5. Urban and Regional Development Plans Formulation & Implementation Guidelines", Ministry Urban Affairs & • Employment, Govt. of India, New Delhi, 2014.
6. Town and Country Planning organization in India - http://tcpo.gov.in/.
7. Ministry of Housing and Urban Affairs Government of India http:/.moud. gov .in
8. Tamil Nadu Town and Country Planning Act 1971, and Rules made there under, Government of Tamil Nadu, Chennai.

Mapping of COs with POs / PSOs

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1		2												
2	2													
3	3			2							2	2	2	2
4	3			2								2		2
5		2							2	2			2	
CO (W.A)	2.7	2		2					2	2	2	2	2	2

22CEX24 - SMART CITIES					
		L	T	P	C
		3	0	0	3
PREREQUISITE : NIL					
Course Objective:	• To understand the concepts of smart city and to introduce the students about application of technologies in smart cities.				

Course Outcomes The students will be able to		**Cognitive Level**	**Weightage of COs in End Semester Examination**
CO1	Apply appropriate techniques for urbanization and smart cities infrastructure and its challenges.	Ap	20%
CO2	Apply the concept of smart transport system for smart cities.	Ap	20%
CO3	Analyze the relationship between sustainability and smart planning through project guidelines.	An	20%
CO4	Evaluate techniques or strategies used in smart cities to address city challenges effectively.	Ap	40%
CO5	Prepare a report that presents case studies of smart cities, highlighting their strategies, implementations and outcomes in addressing urban challenges	An	Internal Assessment

UNIT I - INTRODUCTION	**(9)**
Urbanization, need of focused development, role of Authorities, Smart city, Opportunity and Challenges - Smart infrastructures for city - Smart Cities Mission	
UNIT II - SMART PHYSICAL INFRASTRUCTURE	**(9)**
Infrastructure development in Smart Cities - Physical Infrastructure, Land Use - Compact/mixed - use development, Transit oriented development (TOD); Smart City Management - Transportation Unified governance structure (UMTA).	
UNIT III - SUSTAINABILITY AND SMART PLANNING	**(9)**
Relationship Between Sustainability and Smart plan - Place making project guidelines - Surveillance, Smart Street Lighting, Intelligent Emergency Services, Intelligent Disaster Forecasting and Management.	
UNIT IV - APPLICATION OF TECHNOLOGIES IN SMART CITIES	**(9)**
Role of Technologies in Smart Cities - Integrated Command and Control Center (ICCC), Data Analytics, Data driven strategies implementation in smart cities.	
UNIT V - SMART CITIES PROJECT MANAGEMENT	**(9)**
Need for project management, Philosophy and concepts; Project phasing and stages; Project organizational structuring: Planning and Scheduling: Project cost analysis; Procurement and Contracting.	
TOTAL (L:45) = 45 PERIODS	

TEXT BOOKS:

1. Sharma P , "Sustainable Smart cities in India, Challenges and Future Perspectives", Springer Link, 2017.
2. Sameer Sharma, "Smart Cities Unbounded- Ideas and Practice of Smart Cities in India", Bloomsbury India, 2018.
3. Anilkumar P.P, "Introduction to Smart Cities", 1st Edition, Pearson India Education Service Pvt Ltd, Noida,Uttar Pradesh, India, 2019.

REFERENCES:

1. Binti Singh, ManojParmar, "Smart City in India Urban Laboratory, Paradigm or Trajectory", Routledge India,2019.
2. https://smartcities.gov.in/guidelines#block-habikon-content
3. https://smartnet.niua.org/learn/library

Mapping of COs with POs / PSOs

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	2													
2	2													2
3		2		2			2					2		2
4		2		2								2		2
5		2					2		3	2	3	3	2	
CO (W.A)	2	2		2			2		3	2	3	2.3	2	2

22CEX25 - INTELLIGENT TRANSPORTATION SYSTEMS				
	L	T	P	C
	3	0	0	3
PREREQUISITE : NIL				
Course Objective:	• To impart knowledge on ITS implementation in developing countries. • To analyze the objectives of Intelligent Transportation Systems (ITS) to improve traffic management, enhance safety, and optimize transportation efficiency, technologies and real-time monitoring.			

Course Outcomes The students will be able to		**Cognitive Level**	**Weightage of COs in End Semester Examination**
CO1	Apply ITS techniques to optimize traffic flow adaptive control systems.	Ap	20%
CO2	Interpret the concepts of data collection in ITS.	An	20%
CO3	Evaluate the impact of intelligent transportation Systems (ITS) by analyzing traffic and incident management systems,	An	40%
CO4	Assess the effectiveness of ITS applications vehicle operations.	An	20%
CO5	Prepare and present a report with case studies, diagrams, or videos demonstrating the practical implementation of ITS in traffic or logistics systems.	Ap	Internal Assessment

UNIT I - INTRODUCTION TO ITS	**(9)**
Fundamentals of ITS: Definition of ITS, Challenges in ITS Development - Purpose of ITS Deployment- Benefits of ITS - Overview of application of ITS in Transportation Planning.	
UNIT II - DATA COLLECTION THROUGH ITS	**(9)**
Sensors and its application in traffic data collection - Elements of Vehicle Location and Route Navigation and Guidance concepts; ITS Data collection techniques - vehicle Detectors, Automatic Vehicle Location (AVL).	
UNIT III - ITS IN TRAFFIC MANAGEMENT	**(9)**
ITS User Needs and Services and Functional areas - Introduction, Advanced Traffic Management systems (ATMS), Advanced Traveler Information systems (ATIS), Advanced Vehicle Control systems (AVCS).	
UNIT IV - ITS IN TRANSPORTATION PLANNING	**(9)**
ITS and safety, ITS and security - Traffic and incident management systems; ITS and sustainable mobility, travel demand management, electronic toll collection, ITS and road - pricing.	
UNIT V - ITS APPLICATION IN LOGISTICS	**(9)**
Commercial vehicle operations and intermodal freight - Fleet Management - IT application in freight logistics - E commerce.	
TOTAL (L:45) = 45 PERIODS	

TEXT BOOK:

1. R. Srinivasa Kumar,"Intelligent Transportation Systems", Universities Press P Ltd, Telangana, 2022.

REFERENCES:

1. Intelligent Transport Systems, Intelligent Transportation Primer, Washington, US,2001.
2. Henry F.Korth, and Abraham Siberschatz, Data Base System Concepts, McGraw Hill,1992.
3. TurbanE. "Decision Support and Export Systems Management Support Systems", Maxwell Macmillan,1998.

Mapping of COs with POs / PSOs														
COs	**POs**												**PSOs**	
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
1	2													2
2	2	2												
3		2												
4	3											2		
5		2		2						2				2
CO (W.A)	**2.3**	**2**		**2**						**2**		**2**		**2**

22CEX26 - PAVEMENT ENGINEERING					
		L	T	P	C
		3	0	0	3
PREREQUISITE : NIL					
Course Objective:	• To gain knowledge on various IRC guidelines for designing rigid and flexible pavements. • To assess quality and serviceability conditions of roads.				

Course Outcomes The students will be able to		**Cognitive Level**	**Weightage of COs in End Semester Examination**
CO1	Classify the pavements and evaluate the performance of pavements	Ap	40%
CO2	Design the flexible pavements.	An	20%
CO3	Design the rigid pavements as per IRC guidelines.	An	20%
CO4	Evaluate the effectiveness of stabilization techniques for highway pavements.	An	20%
CO5	Analyze case studies and prepare a report on pavement types and stabilization methods, evaluating their performance and effectiveness in various environments.	An	Internal assessment

UNIT I - PAVEMENT AND STRESS DISTRIBUTION ON LAYERED SYSTEM	**(9)**
Introduction - Pavement as layered structure - Pavement types rigid and flexible. Resilient modulus - Stress and deflections in pavements under repeated loading.	
UNIT II - DESIGN OF FLEXIBLE PAVEMENTS	**(9)**
Flexible pavement design Factors influencing design of flexible pavement, Empirical - Mechanistic empirical and theoretical methods - Design procedure as per IRC guidelines.	
UNIT III - DESIGN OF RIGID PAVEMENTS	**(9)**
Cement concrete pavements, Factors influencing CC pavements - Modified Westergaard approach - Design procedure as per IRC guidelines - Concrete roads and their scope in India.	
UNIT IV - PERFORMANCE EVALUATION AND MAINTENANCE	**(9)**
Pavement Evaluation - Causes of distress in rigid and flexible pavements - Evaluation based on Surface Appearance, Cracks, Patches and Pot Holes, Undulations, Raveling, Roughness, Skid Resistance.	
UNIT V - STABILIZATION OF PAVEMENTS	**(9)**
Stabilisation with special reference to highway pavements - Choice of stabilizers - Testing and field control - Stabilisation for rural roads in India - Use of Geosynthetics in roads.	
TOTAL (L:45) = 45 PERIODS	

TEXT BOOKS:

1. Khanna, S.K. and Justo C.E.G.and Veeraragavan, A, "Highway Engineering", Revised 10th edition, New Chand and Brothers, Roorkee 2014.
2. Kadiyali, L.R., "Principles and Practice of Highway Engineering", Khanna tech. Publications, New Delhi, 2005.

REFERENCES:

1. Yoder, R.J. and Witchak M.W. "Principles of Pavement Design", John Wiley 2000.
2. Guidelines for the Design of Flexible Pavements, IRC-37-2001,"The Indian Roads Congress", New Delhi.
3. Guideline for the Design of Rigid Pavements for Highways, IRC 58-1998, The Indian Road Congress, New Delhi.

Mapping of COs with POs / PSOs

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	2													
2	3	3	3					3				3	3	3
3	3	3	3					3				3	3	3
4		2		2								2	2	2
5		3		3		3		3	3	3	3		3	3
CO (W.A)	**2.7**	**2.8**	**3**	**2.5**		**3**		**3**	**3**	**3**	**3**	**2.7**	**2.8**	**2.8**

22CEX27 - TRANSPORTATION PLANNING PROCESS					
		L	T	P	C
		3	0	0	3
PREREQUISITE : NIL					
Course Objective:	• To understand and apply the transportation planning process to develop effective strategies for addressing urban mobility challenges, optimizing transportation networks, and ensuring sustainable development.				

Course Outcomes The students will be able to		**Cognitive Level**	**Weightage of COs in End Semester Examination**
CO1	Apply the principles of the transportation planning process and methods of data collection.	Ap	20%
CO2	Apply the survey, trip attraction, generation and distribution in transportation.	An	40%
CO3	Analyse the modal choice and the transportation network.	Ap	20%
CO4	Evaluate the objectives of transportation network assignments by applying general principles and techniques.	An	20%
CO5	Prepare a report that presents case studies on travel patterns to understand trip generation rates and patterns.	An	Internal assessment

UNIT I - TRANSPORTATION PLANNING PROCESS	**(9)**
Importance of transportation planning, Integration of Land Use and Transport - Systems Approach to Transport Planning - Four Steps in the Transport Planning Process; Travel Demand Modelling Approach; Traffic Analyses Zones - internal and external; Various Transportation Surveys for the collection of data - methodology, analyses of data and presentation of results.	
UNIT II - TRIP GENERATION STAGE	**(9)**
Definition and importance - Trip Production and Attraction, Types of trips; Factors governing trip generation: population related data, land and building use, socio-economic - Trip generation models: Types, Assumptions made, Multiple Linear Regression, category analysis- merits and de-merits of the model, verification, calibration and validation of the model.	
UNIT III - TRIP DISTRIBUTION STAGE	**(9)**
Definition and objective - Data collection, analyses and presentation of trip matrix table, Desire Line Diagram, Development of Gravity, growth factor methods for Trip Distribution, Calibration of gravity model and its validation.	
UNIT IV - MODAL SPLIT STAGE	**(9)**
Factors influencing mode choice - Household characteristics - Zonal Characteristics; Network characteristics - Modal split: pre distribution or post distribution - Mode wise trip matrix and modal split analyses- Overview of Probit and Logit model.	

UNIT V - TRAFFIC ASSIGNMENT STAGE	(9)
Meaning and objective - General principles; Assignment Techniques - all - or - nothing assignments, multiple route assignment, capacity restraint, diversion curves, Trip assignment route selection; Mode-wise trip matrices; element of transportation network, nodes and links, speed flow curves, minimum path trees.	
TOTAL (L:45) = 45 PERIODS	

TEXT BOOKS:

1. Kadiyali. L.R., Traffic Engineering and Transport Planning, Khanna Publishers, Delhi, 2019.
2. C.S. Papacostas and P.D. Prevedouros, Transportation Engineering and Planning, Prentice Hall of India Pvt. Ltd., 2009.

REFERENCES:

1. J D Ortuzar and L G Willumnsen. Modeling Transport. John Wiley and Sons, New York, 2011.
2. C. JotinKhisty, Kent Lall, Transportation Engineering: An Introduction, Prentice Hall, 1998
3. Juan de Dios Ort zar and Luis G. Willumsen, Modelling Transport, John Wiley & Sons 2001
4. Chennai Comprehensive Traffic Study, Chennai Metropolitan Development Authority, 2007.
5. James H.Banks, Introduction to Transportation Engineering, Tata McGraw Hill Education Pvt Ltd, 2010.

Mapping of COs with POs / PSOs

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	2													
2	2												3	3
3		2										2		3
4		2												
5		3				3	3			3	3		3	3
CO (W.A)	2	2.3				3	3			3	3	2	3	3

22CEX28 - TRANSPORTATION ECONOMICS					
		L	T	P	C
		3	0	0	3
PREREQUISITE : NIL					
Course Objective:	• To understand the concept and evaluation of economics in various transportation projects.				

Course Outcomes The students will be able to		**Cognitive Level**	**Weightage of COs in End Semester Examination**
CO1	Identify and apply the different methods for economic evaluation.	Ap	20%
CO2	Evaluate the components, and factors to assess the impact of route switching mechanisms when developing new infrastructure.	An	20%
CO3	Analyse the demand supply concept in metropolitan cities.	Ap	20%
CO4	Analyze various transports pricing strategies and financing models to evaluate their applicability in sustainable transport infrastructure development.	An	40%
CO5	Present a report on strategies in urban transport systems, through case studies, models, and real-world applications.	An	20%

UNIT I - ECONOMIC EVALUATION	**(9)**
Need for economic evaluation of urban transport projects - Principles of economic analysis - Methods of economic evaluation - Comparison of various methods - Application of simulation modelling in evolving suitable evaluation techniques.	
UNIT II - MODELING OF ROAD USER COSTS	**(9)**
Components of vehicle operating cost - Factors affecting vehicle operating cost - Value of travel time saving - Accident cost - Concept of route switching mechanism - Ripple effects in developing new infrastructure.	
UNIT III - TRANSPORT DEMAND SUPPLY CONCEPT	**(9)**
Transport demand and supply concepts - Status of transport demand supply in metropolitan cities - Demand and Supply equilibrium - Subsidy in Transport demand - Supply augmentation and saturation consideration.	
UNIT IV - TRANSPORT PRICING	**(9)**
Transport costs - Elasticity of demand - Average cost and marginal cost pricing - Market pricing and market segmentation - Second best pricing - Pricing policy - Congestion pricing - Public and private transport pricing.	
UNIT V - FINANCING TRANSPORT SYSTEM	**(9)**
Characteristics of transportation infrastructure - Trends in transportation infrastructure - Investment needs, options and budgetary support in transport sector - Existing financing practices - Principles of build, operate and transfer (BOT) - BOT variants and its applicability.	
TOTAL (L:45) = 45 PERIODS	

TEXT BOOK:

1. Khanna, S.K., Justo C.E.G. and Veeraragavan A. "Highway Engineering", New Chand and Brothers, Roorkee, Revised 10th Edition, 2018.

REFERENCES:

1. Kadiyali, L.R. and Lai, N.B. "Highway Engineering (Including Expressways and Airport Engineering)", Khanna Publishers, New Delhi, 5th Edition, 2013.
2. Kadiyali L.R. "Traffic Engineering and Transport Planning", Khanna Publishers, Delhi, 10th Edition, 2016.

Mapping of COs with POs / PSOs

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	2													
2		2				2					2			
3	2										3	2		
4		2												
5		2				2				2	2			2
CO (W.A)	**2**	**2**				**2**				**2**	**2.3**	**2**		**2**

22CEX31 - CLIMATE CHANGE ADAPTATION AND MITIGATION					
		L	T	P	C
		3	0	0	3
PREREQUISITE : NIL					
Course Objective:	• To impart knowledge on the global warming, the impact of climate change on society and the adaptation and mitigation measures.				

Course Outcomes The students will be able to		**Cognitive Level**	**Weightage of COs in End Semester Examination**
CO1	Examine key climate parameters to identify their impact on weather patterns.	Ap	40%
CO2	Analyze the elements related to climate change to understand their causes, impacts, and mitigation strategies.	An	20%
CO3	Mitigate the factors influencing climate change and suggest suitable remedial measures.	Ap	20%
CO4	Evaluate various energy sources and audit practices to promote a sustainable energy environment.	An	20%
CO5	Analyze real-world examples of adaptation and mitigation efforts in different regions and prepare a report.	An	Internal Assessment

UNIT I - INTRODUCTION	**(9)**
Atmosphere - weather and Climate - climate parameters - Temperature, Rainfall, Humidity, Wind - Global ocean circulation - El Nino and its effect - Carbon cycle.	
UNIT II - ELEMENTS RELATED TO CLIMATE CHANGE	**(9)**
Greenhouse gases - Total carbon dioxide emissions by energy sector - industrial, commercial, transportation, residential - Impacts - air quality, hydrology, green space - Causes of global and regional climate change - Changes in patterns of temperature, precipitation and sea level rise - Greenhouse effect.	
UNIT III - IMPACTS OF CLIMATE CHANGE	**(9)**
Effects of Climate Changes on living things - health effects, malnutrition, human migration, socioeconomic impacts - tourism, industry and business, vulnerability assessment- infrastructure, population and sector - Agriculture, forestry, human health, coastal areas.	
UNIT IV - MITIGATING CLIMATE CHANGE	**(9)**
IPCC Technical Guidelines for Assessing Climate Change Impact and Adaptation - Identifying adaption options - designing and implementing adaption measures - surface albedo environment - reflective roofing and reflective paving - enhancement of evapo transpiration - tree planting programme - green roofing strategies - energy conservation in buildings - energy efficiencies - carbon sequestration.	

UNIT V - ALTERNATE FUELS AND RENEWABLE ENERGY	(9)
Energy source - coal, natural gas - wind energy, hydropower, solar energy, nuclear energy, geothermal energy - biofuels - Energy policies for a cool future - Energy Audit.	
TOTAL (L:45) = 45 PERIODS	

TEXT BOOKS:

1. Ruddiman W.F, freeman W.H. and Company, "Earth"s Climate Past and Future", 2001
2. Velma. I. Grover,"Global Warming and Climate Change Vol I an II", Science Publishers, 2005.
3. Dash Sushil Kumar, "Climate Change - An Indian Perspective", Cambridge University Press India Pvt. Ltd, 2007.

REFERENCES:

1. Maximilian Lackner, BaharakSajjadi and Wei-Yin Chen, "Handbook of Climate Change Mitigation and Adaptation", Third Edition, Springer Nature, 2022.
2. IPCC Sixth Assessment Report, 2021.
3. Kendal McGuffie, Ann Henderson, "A Climate Modelling" Primer 4th Edition, John Wiley & Sons, Ltd, Chichester, UK 2014.

Mapping of COs with POs / PSOs

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	2										2			2
2		3										2		3
3		3										2		
4		2											2	
5		3				3	3		3	3		3		3
CO (W.A)	2	2.8				3	3		3	3		2.3	2	2.3

22CEX32 - AIR AND NOISE POLLUTION CONTROL ENGINEERING				
	L	T	P	C
	3	0	0	3
PREREQUISITE : NIL				
Course Objective:	• To acquire fundamental knowledge of the sources, effects, dispersion of air pollutants, its mitigation and quality management, and basics of noise pollution.			

Course Outcomes The students will be able to		**Cognitive Level**	**Weightage of COs in End Semester Examination**
CO1	Explain the air quality standards and its management.	Ap	20%
CO2	Classify the various air and noise pollutants and identify their sources.	Ap	40%
CO3	Apply air sampling techniques and interpret the results using meteorological data.	Ap	20%
CO4	Evaluate the appropriate air pollution control methods.	An	20%
CO5	Analyze real-life air or noise pollution incidents and discuss the causes and consequences.	An	Internal Assessment

UNIT I - GENERAL	**(9)**
Atmosphere as a place of disposal of pollutants - Air Pollution - Definition - Global Climate - Units of measurements of pollutants - Air emission and quality standards - Air pollution indices - Air quality management in India.	
UNIT II - SOURCES, CLASSIFICATION AND EFFECTS	**(9)**
Sources and classification of air pollutants - Man made - Natural sources - Type of air pollutants - Pollution due to automobiles - Analysis of air pollutants - Chemical, Instrumental and biological methods. Air pollution and its effects on human beings, plants and animals.	
UNIT III - SAMPLING, METEOROLOGY AND AIR QUALITY MODELLING	**(9)**
Sampling and measurement of particulate and gaseous pollutants - Ambient air sampling - Meteorology - temperature lapse rate and stability - Adiabatic lapse rate - Wind Rose - Wind velocity and turbulence - Dispersion of air pollutants.	
UNIT IV - AIR POLLUTION CONTROL MEASURES	**(9)**
Control - Control equipment's - Particulate control methods - Bag house filter - Settling chamber - cyclone separators - inertial devices - Electrostatic precipitator - Absorption - Absorption equipment's.	
UNIT V - NOISE POLLUTION AND ITS CONTROL	**(9)**
Sources of noise - Units and Measurements of Noise - Characterization of Noise from Construction, Mining, Transportation and Industrial Activities, Airport Noise - auditory effects, non-auditory effects. Prevention and Control of Noise Pollution.	
TOTAL (L:45) = 45 PERIODS	

TEXT BOOKS:

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

REFERENCES:

1. Lawrence K.Wang, Norman C.Pereira, Yung-Tse Hung, "Advanced Air and Noise Pollution Control", 2nd Edition 2010, Humana Press, United States.
2. W.L. Heumann, "Industrial Air Pollution Control Systems", McGraw-Hill, New York, 2015.
3. Peavy S.W., Rowe D.R. and Tchobanoglous G, "Environmental Engineering", McGraw-Hill, New Delhi, 2015.
4. Mahajan S.P, "Pollution Control in Process Industries", Tata McGraw-Hill Publishing Company, New Delhi, 2015.
5. Garg, S.K, "Environmental Engineering Vol. II", Khanna Publishers, New Delhi, 1979.

Mapping of COs with POs / PSOs

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	2					2								2
2	2												2	
3	2	2												
4		3				2							2	2
5		3			2	3	3		3	3	3			3
CO (W.A)	**2**	**2.7**			**2**	**2.3**	**3**		**3**	3	**3**		**3**	**2.3**

22CEX33 - ENVIRONMENTAL IMPACT ASSESSMENT					
		L	T	P	C
		3	0	0	3
PREREQUISITE : 22CEC12					
Course Objective:	• To imparts knowledge on EIA and to identify the impact of environmental attributes for sustainable development.				

Course Outcomes The students will be able to		**Cognitive Level**	**Weightage of COs in End Semester Examination**
CO1	Apply the process and the effectiveness of EIA in identifying significant environmental impacts.	Ap	20%
CO2	Apply appropriate EIA methodologies and prediction tools to assess environmental impacts, and monitoring measures with public participation.	Ap	40%
CO3	Apply environmental laws and prepare Environmental Management Plans for effective planning, implementation, and monitoring of sustainable projects.	Ap	20%
CO4	Analyze case studies to identify the methods used for impact prediction, assessment, and mitigation.	An	20%
CO5	Prepare and present a seminar report on the EIA process, methodologies, legislation, and mitigation measures, supported by detailed case studies from various industries.	An	Internal Assessment

UNIT I - INTRODUCTION	**(9)**
Definition - Concept of environment - Hierarchy in EIA - Initial environmental examination (IEE) - Environmental impact statement (EIS) - Significant environmental impacts - EIA process screening - Stages of development - Need for EIA studies - Advantages and limitation of EIA.	
UNIT II - EIA METHODOLOGIES AND MEASUREMENT	**(9)**
Methods of EIA - Check lists - Matrices - Networks - Cost benefit Analysis - Analysis of alternatives - Prediction tools - Terms of Reference (ToR) - RIA Matrix	
UNIT III - ASSESSMENT AND MITIGATION MEASURES	**(9)**
Definition - Water quality indicators and standards - Water impact factors - Water quality impact analysis - Mitigation measures - Aesthetic environmental impacts - Framework for visual impact assessment - Mitigation Measures and monitoring - Public participation in EIA.	
UNIT IV - EIA DOCUMENTATION AND LEGISLATIONS	**(9)**
Environmental management plan - preparation, implementation and review - policy and guidelines for planning and monitoring programmes - The environmental protection Act - The water act - The Air (Prevention and Control of pollution Act) - EIA notification 1994 and 2006 - Wild life Act.	
UNIT V - CASE STUDIES	**(9)**
Mining, power plants, cement plants, highways, Water resource projects, storage and handling of hazardous chemicals, common hazardous waste facilities, CETPs, CMSWMF, building and construction projects.	
TOTAL (L:45) = 45 PERIODS	

TEXT BOOKS:

1. Barthwal R.R., "Environmental Impact Assessment", 2nd Edition, New Age International Publishers, New Delhi, 2019.
2. K. V. Raghavan and A A. Khan, "Methodologies in Hazard Identification and Risk Assessment", Manual by CLRI, 1990.
3. Kolluru Rao, Bartell Steven, Pitblado R and Stricoff "Risk Assessment and Management Handbook", McGraw Hill Inc., New York, 1996.

REFERENCES:

1. Lawrence, D.P., "Environmental Impact Assessment – Practical solutions to recurrent problems", Wiley-Interscience, New Jersey. 2003.
2. Y.Anjaneyulu and Valli Manikam, "Environmental Impact Assessment Methodologies", 2nd Edition, B.S Publications, Hyderabad 2020.
3. Charles H. Eccleston., "Environmental Impact Assessment: A Guide to Best professional practices", 1st Edition, CRC Press. United States, 2017.

Mapping of COs with POs / PSOs

COs	**POs**												**PSOs**	
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
1	2													
2	2						2					2		
3	2													
4		2												2
5		3							3	3		3		2
CO (W.A)	**2**	**2.5**					**2**		**3**	3		**2.5**		**2**

22CEX34 - INDUSTRIAL WASTEWATER MANAGEMENT				
	L	T	P	C
	3	0	0	3
PREREQUISITE : NIL				
Course Objective:	• To analyze the physical, chemical, and biological characteristics of wastewater from different industrial sources. . To imparts knowledge on the significance of industrial waste water and solid waste treatment techniques for ensuring environmental sustainability.			

Course Outcomes The students will be able to		**Cognitive Level**	**Weightage of COs in End Semester Examination**
CO1	Apply the hierarchy principles to minimizing waste generation and promoting sustainable waste management practices.	Ap	20%
CO2	Analyze the characteristics of industrial wastewater.	An	20%
CO3	Apply industrial wastewater treatment and reuse techniques to manage effluents and minimize environmental impact effectively.	Ap	40%
CO4	Analyze industrial wastewater management practices in real-world case studies to identify challenges and solutions.	An	20%
CO5	Conduct and present a seminar on industrial wastewater characteristics, pollution prevention, treatment methods, and case studies from key industries.	An	Internal Assessment

UNIT I - INTRODUCTION	**(9)**
Industrial scenario in India - Uses of water by industry - Sources, characteristics and types of industrial waste water - Nature and Origin of Pollutants - Industrial wastewater monitoring and sampling - Industrial Wastewater generation rates - Toxicity of Industrial effluents and Bioassay tests.	
UNIT II - INDUSTRIAL POLLUTION PREVENTION AND WASTE MINIMISATION	**(9)**
Prevention Control of Industrial Pollution - Benefits and Barriers - Waste management Hierarchy - Source reduction techniques - Evaluation of Pollution Prevention Options - Cost benefit analysis - Pay-back period - Recycle, reuse and byproduct recovery.	
UNIT III - INDUSTRIAL WASTEWATER TREATMENT	**(9)**
Flow and Load Equalisation - Solids Separation - Removal of Fats, Oil and Grease - Neutralisation - Removal of Inorganic Constituents - Precipitation, Heavy metal removal, Nitrogen & Phosphorous removal, Ion exchange, Adsorption, Membrane Filtration, Electro dialysis & Evaporation.	
UNIT IV - WASTEWATER REUSE AND RESIDUAL MANAGEMENT	**(9)**
Individual and Common Effluent Treatment Plants - Zero effluent discharge systems - Quality	

requirements for Wastewater reuse , Industrial reuse , Present status and issues - Disposal on water and land - Residuals of industrial wastewater treatment.	
UNIT V - CASE STUDIES	**(9)**
Industrial manufacturing process - source reduction options and waste treatment flow sheet for Textiles - Tanneries - Pulp and paper - metal finishing - Sugar and Distilleries.	
TOTAL (L:45) = 45 PERIODS	

TEXT BOOKS:

1. Rao M.N. and Datta A.K., "Wastewater Treatment", 3rd Edition, Oxford - IBH Publication, New Delhi, 2017.
2. Soli. J. Arceivala, Shyam. R. Asolekar, "Waste water Treatment for pollution control and reuse" Tata McGraw Hill, 2007.

REFERENCES:

1. Stanley N Barton "Industrial Waste: Management, Assessment and Environmental Issues (Waste and Waste Management)", 1st Edition, Nova science publishers Inc, New Delhi, 2016.
2. Nelson Leonard Nemerow, "Industrial waste treatment - contemporary practice and vision for the future", Elsevier, Singapore, 2007.

Mapping of COs with POs / PSOs

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	2													
2		2					2						2	
3	3													2
4		2											2	
5		3		3		2	2			2	2	3		3
CO (W.A)	2.5	2.3		3		2	2			2	2	3	2	2.5

22CEX35 - SOLID AND HAZARDOUS WASTE MANAGEMENT				
	L	T	P	C
	3	0	0	3
PREREQUISITE : NIL				

Course Objective:	• To identify environmental concerns for hazardous waste on water, land and air. • To impart knowledge on the principles involved in the management of hazardous wastes from source identification up to disposal. • To identify containment technologies and land treatment techniques for hazardous waste

Course Outcomes The students will be able to		**Cognitive Level**	**Weightage of COs in End Semester Examination**
CO1	*Apply* effective methods for source reduction, segregation, and onsite storage of industrial wastes.	Ap	20%
CO2	Analyze the composition and characteristics of different types of solid and hazardous waste.	An	20%
CO3	Analyze solid waste collection, treatment, and landfill management techniques, including hazardous waste handling and site remediation.	An	40%
CO4	Evaluate thermal and biological waste processing technologies, including operation, by-products, and environmental controls.	An	20%
CO5	Prepare and present a seminar on hazardous waste management, processing technologies, and disposal methods highlighting current practices and challenges.	An	Internal Assessment

UNIT I - HAZARDOUS SOLID WASTE AND ITS CLASSIFICATION	**(9)**
Sources - Types - Composition - Characteristics - need for solid and hazardous waste management - Generation rates - Elements of Integrated waste management - legislations on management and handling of solid wastes.	
UNIT II - WASTE CHARACTERIZATION SOURCE REDUCTION AND RECYCLING	**(9)**
Waste sampling and characterization plan - hazardous characteristics - ignitability, corrosivity and TCLP tests - source reduction, segregation and onsite storage of wastes - waste exchange - extended producer responsibility - recycling of plastics, C&D wastes and E wastes.	
UNIT III - WASTE COLLECTION, TRANSPORT AND RECOVERY OF MATERIALS	**(9)**
Door to door collection of segregated solid wastes - analysis of hauled container and stationery container collection systems - storage, labeling and handling of hazardous wastes - mechanical processing and material separation technologies - Size reduction - size separation - density separation - magenetic separation - compaction - physico chemical treatment of hazardous wastes - solidification and stabilization.	
UNIT IV - THERMAL PROCESSING OF WASTES	**(9)**
Biological and thermos - chemical conversion technologies - composting - bio methanation - incineration - pyrolysis - plasma arc gasification - By-products - operation of facilities and environmental controls -	

treatment of biomedical wastes - case studies and emerging waste processing technologies.	
UNIT V - WASTE DISPOSAL	**(9)**
Sanitary and secure landfills - site selection - liner and cover systems - geo synthetic clay liners and geo membranes - design of sanitary landfills and secure landfills - leachate collection, treatment and landfill gas management - landfill construction and operational controls - landfill closure and environmental monitoring - landfill bioreactors - rehabilitation of open dumps and bio mining of dumpsites - remediation of contaminated sites - Case studies	
TOTAL (L:45) = 45 PERIODS	

TEXT BOOKS:

1. George Tchobanoglous, Hilary Theisen and Samuel A, Vigil, "Integrated Solid Waste Management", Mc- Graw Hill India, First edition, 2015.
2. Rao M.N, Razia Sultana, Sri Harsha Kota, "Solid and Hazardous Waste Management - Science and Engineering" , Butterworth-Heinemann, 2016
3. Cherry P M, "Solid and Hazardous Waste Management", CBS publishers and distributors Pvt Ltd, 2018.

REFERENCES:

1. William A. Worrell, P. Aarne Vesilind, Christian Ludwig, Solid Waste Engineering - A Global respective, 3rd Edition, Cengage Learning, 2017.
2. CPHEEO, "Manual on Municipal Solid waste management, Vol I, II and III", Central Public Health and Environmental Engineering Organisation , Government of India, New Delhi, 2016.
3. Freeman, H. M., "Standard Handbook of Hazardous Waste Treatment and Disposal", 2nd Edition, McGraw-Hill, Inc., 1997.
4. William C.Blackman.Jr, "Basic Hazardous waste management", Third Edition, Lewis Publishers, 2016.

Mapping of COs with POs / PSOs

COs	**POs**												**PSOs**	
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
1	2													
2		2					2							
3		2												2
4		2					2							2
5		2				2				2		3	2	3
CO (W.A)	**2**	**2**				**2**	**2**			**2**		**3**	**2**	**2.3**

22CEX36 - PLUMBING (WATER & SANITATION)				
	L	T	P	C
	3	0	0	3

PREREQUISITE : NIL

Course Objective:	• To identify different types of pipes used in water supply and sanitary and drainage work.

Course Outcomes The students will be able to		Cognitive Level	Weightage of COs in End Semester Examination
CO1	Apply national and international codes, including the NBC and other relevant codes, to building design and construction.	Ap	20%
CO2	Select proper plumbing materials and systems.	An	20%
CO3	Apply appropriate pipe materials and jointing methods based on system requirements	Ap	20%
CO4	Apply strategies for reducing and reusing water in building systems and projects	Ap	40%
CO5	Prepare a comprehensive report on plumbing systems, water supply, drainage, and treatment technologies highlighting codes, standards, and sustainable practices.	Ap	Internal Assessment

UNIT I - IMPORTANCE OF CODES AND STRUCTURAL COORDINATION	**(9)**
Scope and purpose - codes and standards in the building industry - NBC and other codes, Local Municipal Laws, approvals, general regulations, standards - water supply, sewerage system, drainage system, workmanship, water conservation - protection of pipes and structures - waterproofing.	
UNIT II - PLUMBING TERMINOLOGY	**(9)**
Plumbing Fixtures - accessible, readily accessible, aerated fittings, AHJ, bathroom group, carrier, flood level rim, floor sink, flushometer valve, flush tanks, lavatories, macerating toilet, plumbing appliances, and plumber. Traps - indirect waste, vent, blow off, developed length, dirty arm, FOG, receptors, slip joints, trap, and vent. Drainage: adapter fitting, adjusted roof area, AAV, air break, air gap, area drain, base, bell and spigot joint, building drain, branch, DFU, grease interceptor, joints, roof drain, smoke test, stack.	
UNIT III - SANITARY DRAINAGE AND STORM DRAIN	**(9)**
One pipe and two pipe systems, different pipe materials and jointing methods, special joints, hangers and supports, protection of pipes and structures, alternative materials, workmanship, prohibited fittings and practices, hydraulic jump, change in direction of flow, T and Y fittings, cleanouts, pipe grading, fixtures below invert level, suds relief, testing, building sewers, trenching, testing, sumps and pumps, introduction to Drainage Fixture Units (DFU) and sizing of horizontal and vertical pipes. Rain Water Harvesting (RWH) definition, need, catchment, NBC requirements and advantages of RWH.	
UNIT IV - WATER SUPPLY, GRAY AND RECLAIMED WATER	**(9)**
Sources of water, potable and non-potable water, reclaimed water, calculating daily water requirement and storage, hot and cold water distribution system, backflow prevention, air gap, cross connection	

control, pressure and velocity, pipe materials and jointing methods, alternative materials, hangers and supports, workmanship, prohibited fittings and practices - protection of pipes and structures - Water Supply Fixture Units (WSFU) and sizing. Gray water - approvals, specifications and drawings, safety.	
UNIT V - INTRODUCTION TO WTP AND STP	**(9)**
Introduction to Net Zero concept, need to reduce and reuse, rating of Water Efficient Plumbing fixtures and fittings, 24x7 water supply, metering and sub-metering, typical daily water and wastewater calculations for a project. Sources - utility and treatment of water - parameters of water quality, parts of water treatment plant (WTP), disinfection methods, storage conditions, RO water systems, rainwater harvesting treatment, desalinatio - characteristics of domestic sewage, sewage treatment methods, aerobic and anaerobic treatment, level of treatment, reclaimed water, comparison of various methods.	
TOTAL (L:45) = 45 PERIODS	

TEXT BOOKS:

1. O.P. Gupta, "Elements of Water Pollution Control Engineering", Khanna Book Publishing, New Delhi.
2. Uniform Illustrated Plumbing Code-India (UIPC-I) published by IPA and IAPMO (India).

REFERENCES:

1. Water Efficient Products-India (WEP-I) published by IPA and IAPMO (India).
2. "A Guide to Good Plumbing Practices", published by IPA.
3. IS 17650 Part 1 and Part 2 for "Water Efficient Plumbing Products".

Mapping of COs with POs / PSOs

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	3												2	2
2		2		2										
3	3													2
4	2			2										3
5	3	2		2		2				2		2	3	2
CO (W.A)	2.8	2		2		2				2		2	2.5	2.3

22CEX37 - TRANSPORT AND ENVIRONMENT					
		L	T	P	C
		3	0	0	3
PREREQUISITE : NIL					
Course Objective:	• To create an awareness / overview of the impact of transportation projects on the environment and society.				

Course Outcomes The students will be able to		**Cognitive Level**	**Weightage of COs in End Semester Examination**
CO1	Apply EIA guidelines to assess the environmental impacts of transportation projects.	Ap	20%
CO2	Apply appropriate EIA methodologies to predict and assess environmental and socio-economic impacts of transportation projects in accordance with IRC guidelines.	An	40%
CO3	Evaluate methods for reducing global warming through project design and execution.	An	20%
CO4	Analyze Environmental Impact Assessments (EIA) of highway and railway projects to understand their environmental and social implications.	An	20%
CO5	Prepare a detailed report evaluating the environmental impacts of transportation projects using EIA methodologies and propose mitigation and management strategies.	An	Internal Assessment

UNIT I - INTRODUCTION	**(9)**
Environmental Inventory, Environmental Assessment, Environmental Impact Assessment (EIA), Environmental Impact of Transportation Projects, Need for EIA, EIA Guidelines for Transportation Project, Historical Development.	
UNIT II - METHODOLOGIES	**(9)**
Elements of EIA - Screening and Scoping - Methods of Impact Analysis - Applications - Appropriate methodology.	
UNIT III - ENVIRONMENTAL IMPACT, PREDICTION AND ASSESSMENT	**(9)**
Prediction and Assessment of Impact of Transportation Project at various stages on water, air, noise, land acquisition and resettlement, Socio economic impact, indigenous people, aesthetics, health and safety, energy studies, traffic impact studies, IRC guidelines.	
UNIT IV - ENVIRONMENTAL MITIGATION AND MANAGEMENT PLAN	**(9)**
Mitigation of the impact on Natural and Man-made Environment, Health, Water, Land, Noise, Air, Public participation, Environmental Management Plan, Energy Conservation, Methods to reduce Global Warming.	
UNIT V - CASE STUDIES	**(9)**
EIA Case Studies on Highway, Railway - EIA Case Studies on Transit Oriented Development (TOD),	

Compact Cities, Non-Motorised Transport (NMT).
TOTAL (L:45) = 45 PERIODS

TEXT BOOKS:

1. P. Meenakshi, "Elements of Environmental Science and Engineering", Prentice Hall of India, New Delhi, 2006
2. Thirumurthy A.M., "Introduction to Environmental Science and Management", Shroff Publishers, Bombay, 2005.

REFERENCES:

1. Indian Road Congress (IRC), "Environmental Impact of Highway Projects", IRC, Delhi, 1998.
2. EIA Guidance Manual- Highway- MOEF & Govt of India, 2010
3. Indian Road Congress (IRC), "Environmental Impact of Highway Projects", IRC, Delhi, 1998.

Mapping of COs with POs / PSOs

COs	**POs**												**PSOs**	
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
1	3													2
2	2													
3		2					2						2	
4		2												2
5		3		3		2			2	2		3		3
CO (W.A)	**2.5**	**2.3**		**3**		**2**	**2**		**2**	2		**3**	**2**	**2.3**

22CEX38 - GROUNDWATER ENGINEERING				
	L	T	P	C
	3	0	0	3

PREREQUISITE : NIL

Course Objective:	• To understand the principles of groundwater governing equations, characteristics of different aquifers and techniques of groundwater model development and management.

Course Outcomes The students will be able to		Cognitive Level	Weightage of COs in End Semester Examination
CO1	Apply methods and norms for estimating aquifer properties and groundwater resources.	Ap	20%
CO2	Apply methods to analyze groundwater flow using various analytical techniques.	An	20%
CO3	Assess the inflows and outflows in an aquifer system.	An	20%
CO4	Evaluate water quality standards to ensure compliance and safety, and identify methods to improve groundwater quality and promote sustainability.	An	40%
CO5	Prepare and present a report on key concepts related to the movement, quality, management, and conservation of groundwater systems.	An	Internal Assessment

UNIT I - HYDROGEOLOGICAL PARAMETERS	**(9)**
Introduction - Water bearing Properties of Rock - Type of aquifers - Aquifer properties - permeability, specific yield, transmissivity and storage coefficient - Methods of Estimation - GEC norms - Steady state flow - Darcy's Law - Groundwater Velocity - Dupuit Forchheimer assumption - Steady Radial Flow into a Well.	
UNIT II - WELL HYDRAULICS	**(9)**
Unsteady state flow - Theis method - Jacob method - Chow's method - Law of Times - Theis Recovery - Bailer method - Slug method - tests - Image well theory - Partial penetrations of wells - Well losses - Specific Capacity and Safe yield - Collector well and Infiltration gallery.	
UNIT III - GROUNDWATER MANAGEMENT	**(9)**
Need for Management Model - Database for Groundwater Management - Groundwater balance study - Introduction to Mathematical model - Model Conceptualization - Initial and Boundary Condition - Calibration - Validation - Future Prediction - Sensitivity Analysis - Uncertainty - Development of a model.	
UNIT IV - GROUNDWATER QUALITY	**(9)**
Ground water chemistry - Origin, movement and quality - Water quality standards - Drinking water Industrial water - Irrigation water - Groundwater Pollution and legislation - Environmental Regulatory requirements.	

UNIT V - GROUNDWATER CONSERVATION	(9)
Artificial recharge techniques - Reclaimed wastewater recharge - Soil aquifer treatment (SAT) - Aquifer Storage and Recovery (ASR) Seawater Intrusion and Remediation - Ground water Basin management and Conjunctive use - Protection zone delineation, Contamination source inventory and remediation schemes.	
TOTAL : 45 PERIODS	

TEXT BOOKS:

1. Raghunath, H.M., "Ground Water", New Age International, 2007.
2. Todd D.K., "Ground Water Hydrology", John Wiley and Sons, New York, 2000.
3. Karanth, K. "Groundwater Assessment, Development and Management", Tata McGraw Hill, 2003.

REFERENCES:

1. Fitts R Charles, "Groundwater Science". *Elsevier, Academic Press, 2002.*
2. Ramakrishnan, S, "Ground *Water", K.J. Graph arts, Chennai, 1998.*
3. Chahar BR, *"Groundwater hydrology", McGraw Hill Education (India) Pvt Ltd, New Delhi, 2015.*
4. Raghunath H. M., "Hydrology : Principles, Analysis and Design", New Age International Publishers, 2006.

Mapping of COs with POs / PSOs

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	2													
2		2											2	2
3	3	2												
4		2										2		2
5		3	2						2	2		2	2	2
CO (W.A)	3	2.3	2						2	2		2	2	2

22CEX41 - GROUND IMPROVEMENT TECHNIQUES					
		L	T	P	C
		3	0	0	3
PREREQUISITE : NIL					
Course Objective:	• To Apply various ground improvement techniques, such as compaction, grouting, and soil stabilization, to address specific soil issues.				

Course Outcomes The students will be able to		**Cognitive Level**	**Weightage of COs in End Semester Examination**
CO1	Identify and apply suitable ground improvement techniques for problematic soils based on their geotechnical properties and site conditions.	Ap	40%
CO2	Design and select suitable technique of dewatering.	An	20%
CO3	Recommend different soil reinforcement materials based on their application.	Ap	20%
CO4	Select different types of grouting methods and stabilization techniques.	Ap	20%
CO5	Prepare and present a report using case studies to illustrate the application of ground improvement, dewatering, reinforcement, and grouting techniques for various soil conditions.	An	Internal Assessment

UNIT I - PROBLEMATIC SOIL AND IMPROVEMENT TECHNIQUES	**(9)**
Role of ground improvement in foundation engineering - Methods of ground improvement - Geotechnical problems in alluvial, lateritic and black cotton soils - Selection of suitable ground improvement techniques based on soil conditions.	
UNIT II - DEWATERING	**(9)**
Dewatering Techniques - Well points - Seepage analysis for two-dimensional flow for fully and partially penetrated slots in homogeneous deposits - Design for simple cases.	
UNIT III - IN-SITU TREATMENT OF COHESIONLESS AND COHESIVE	**(9)**
In-situ densification of cohesionless soils - Dynamic compaction - Vibro-flotation, Sand compaction piles and deep compaction - Consolidation of cohesionless soils - Preloading with sand drains and fabric drains - Stabilization of soft clay ground using stone columns - Installation techniques.	
UNIT IV - EARTH REINFORCEMENT	**(9)**
Concept of reinforcement - Types of reinforcement material - Soil nailing - Reinforced earth wall - Mechanism - Applications of reinforced earth - Functions of geo textiles in filtration, drainage, separation, road works and containment applications.	
UNIT V - GROUTING TECHNIQUES	**(9)**
Types of grouts - Grouting equipment and machinery - Injection methods - Grout monitoring - Stabilization with cement, lime and chemicals - Stabilization of expansive soil.	
TOTAL (L:45) = 45 PERIODS	

TEXTBOOKS:
1. Purushothama Raj. P, "Ground Improvement Techniques", 3rd Edition, Laxmi Publications (P) Ltd, 2023.
REFERENCES:
1. Koerner, R.M. "Construction and Geotechnical Methods in Foundation Engineering", 2nd Edition McGraw Hill, 1994. 2. Das, B.M., "Principles of Foundation Engineering" 8th edition, Cengage learning, 2016.

Mapping of COs with POs / PSOs														
COs	**POs**												**PSOs**	
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
1	2													2
2		2												
3	2													2
4	2					2							2	2
5	2	2	2						2	2	2	3		2
CO (W.A)	**3**	**2**	**2**			**2**			**2**	**2**	**2**	**3**	**2**	**2**

22CEX42 - ENGINEERING GEOLOGY					
		L	T	P	C
		3	0	0	3
PREREQUISITE : NIL					
Course Objective:	• To imparts knowledge on geological process, classification, morphology of rocks and the importance of the study of geology for civil engineering practices with regard to the selection of appropriate site for their projects like dams, tunnels, buildings etc.,				

Course Outcomes The students will be able to		**Cognitive Level**	**Weightage of COs in End Semester Examination**
CO1	Identify and classify rocks using basic geologic features and to apply those concepts on rock engineering projects.	Ap	20%
CO2	Analyze the physical and chemical properties of minerals.	An	20%
CO3	Identify the geological structures of rocks and suggest suitable site investigation methods.	An	20%
CO4	Apply geological mapping and geophysical investigation techniques to evaluate geohazards for safe infrastructure design and construction.	Ap	40%
CO5	Analyze and present case studies illustrating the use of geological mapping, remote sensing, and geophysical techniques in solving civil engineering challenges.	An	Internal Assessment

UNIT I - PHYSICAL GEOLOGY AND GEOMORPHOLOGY	**(9)**
Significance of Geology in Civil Engineering; Internal structure of the Earth; Weathering: types, engineering classification of weathered rocks; Plate tectonics and its relevance to earthquakes; Groundwater: types of aquifers, origin.	
UNIT II - MINERALOGY AND PETROLOGY	**(9)**
Physical and Chemical properties of common rock forming minerals: Quartz family, Feldspar family, Mica (Biotite), Pyroxene (Augite), Amphibole (Hornblende), Calcite, Gypsum and Clay minerals. Formation of Igneous, Metamorphic and Sedimentary rocks; Description of important rocks: Granite, Dolerite, Basalt.	
UNIT III - STRUCTURAL GEOLOGY AND ROCK MECHANICS	**(9)**
Attitudes of beds: Strike and Dip measurements in civil engineering; Different types of folds, faults, joints and fractures in rocks; Rock Quality Designation (RQD) and Geological Strength Index (GSI).	
UNIT IV - GEOPROSPECTING	**(9)**
Geological mapping techniques; Remote Sensing: Fundamentals and its role in geological mapping; Geophysical methods for subsurface investigations: Electrical, Seismic and Ground Penetrating Radar (GPR); Subsurface logging.	

UNIT V - GEOLOGICAL CONSIDERATIONS AND GEOHAZARDS	(9)
Geological conditions necessary for designing and construction of important structures: Dams, Reservoirs, Tunnels, Road cuttings and Coastal protection; Landslides - Causes and mitigation; Earthquakes and Tsunamis: Causes and mitigation; Case studies.	
TOTAL (L:45) = 45 PERIODS	

TEXT BOOKS:

1. Parbin Singh, "A Textbook of Engineering and General Geology", S. K. Kataria and Sons, 2021.
2. Chenna Kesavulu, N. "Textbook of Engineering Geology", Macmillan India Ltd., 2018.
3. Varghese, P.C., "Engineering Geology for Civil Engineering", Prentice Hall of India Learning Private Limited, New Delhi, 2012.

REFERENCES:

1. Krynine and Judd, "Principals of Engineering Geology and Geotechnics" Tata McGraw Hill, New Delhi, 2018.
2. Venkat Reddy, D. "Engineering Geology", Vikas Publishing House Pvt. Lt, 2021.
3. Bell, F.G. "Fundamentals of Engineering Geology", B.S. Publications. Hyderabad 2011.

Mapping of COs with POs / PSOs

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	2													2
2		2										2		
3		2												2
4		2											2	
5		2							2	2		3		3
CO (W.A)	2	2							2	2		2.5	2	2.3

22CEX43 - SITE INVESTIGATION AND SOIL EXPLORATION				
	L	T	P	C
	3	0	0	3

PREREQUISITE : NIL

Course Objective:	• *To* understand the principles and importance of site investigation and soil exploration for engineering and construction projects.

Course Outcomes The students will be able to		**Cognitive Level**	**Weightage of COs in End Semester Examination**
CO1	Apply geophysical investigation methods to assess subsurface conditions.	Ap	20%
CO2	Utilize sampling and exploration techniques and interpret results to assess subsurface conditions.	An	40%
CO3	Analyze results from various field tests to determine soil properties and behavior for engineering purposes.	Ap	20%
CO4	Apply the principles and applications of various instrumentation techniques used in soil engineering.	An	20%
CO5	Prepare comprehensive reports detailing the soil sampling and field testing methods.	An	Internal Assessment

UNIT I - PLANNING OF EXPLORATION AND GEOPHYSICAL METHODS	**(9)**
Site investigation - Scope and objectives - activities involved in site investigation - Preliminary desk studies - Subsurface exploration - General considerations - Objectives - Planning an exploration programme - Location - Spacing and depth of borings - Soil Profile - Bore logs - Data Presentation - Soil investigation and exploration reports - Geophysical investigation.	
UNIT II - EXPLORATION TECHNIQUES	**(9)**
Open pits and trenches - Different methods of boring and drilling - Stabilization of bore holes - Cleaning of bore hole - Geophysical exploration and interpretation - non-displacement and displacement methods - Drilling in difficult subsoil conditions.	
UNIT III - SOIL SAMPLING	**(9)**
Sampling Techniques - Quality of samples - Factors influencing sample quality - disturbed and undisturbed soil sampling - advanced sampling techniques, shallow penetration samplers, preservation and handling of samples.	
UNIT IV - FIELD TESTING IN SOIL EXPLORATION	**(9)**
Field tests - Importance of field tests in soil exploration - Penetration testing - Standard Penetration Test - Static Cone Penetration Test - Dynamic cone penetration test - Plate load test - Field Vane shear test - Cyclic plate load test - Block vibration test - Field Permeability test.	
UNIT V - INSTRUMENTATION	**(9)**
Instrumentation in soil engineering, Strain gauges, Resistance and inductance type, Load cells, Earth pressure cells, Pore pressure measurements - Slope indicators, Sensing units - case studies.	
TOTAL (L:45) = 45 PERIODS	

TEXTBOOKS:

1. Punmia, B.C., "Soil Mechanics and Foundations", Laxmi Publications Pvt.Ltd., New Delhi, 2017.
2. Dr. K. R. Arora., "Soil Mechanics and Foundation Engineering", Standard Publisher, New Delhi, 7th ed., 2017.
3. Gopal Ranjan and Rao A.S.R. "Basic and Applied soil mechanics", New Age International (P) Ltd, New Delhi,2006.
4. Clayton C.R, Matthews M.C, Simons N.E, "Site Investigation", 2nd edition, Trans Tech Publications Ltd, 1995.

REFERENCES:

1. Murthy, V.N.S., "Soil Mechanics and Foundation Engineering", CBS Publishers and Distributers Ltd., New Delhi, 2015.
2. Varghese, P.C.,"Foundation Engineering", Prentice Hall of India Private Limited, New Delhi, 2012.
3. Das, B.M. "Principles of Foundation Engineering" (Eigth edition), Thompson Asia Pvt. Ltd., Singapore, 2017.

Mapping of COs with POs / PSOs

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	3			2								3	2	3
2		3				2								3
3		3											2	2
4	3			2							3			3
5		3					2		3	3		3	2	2
CO (W.A)	**3**	**3**		**2**		**2**	**2**		**3**	**3**	**3**	**3**	**2**	**2.6**

22CEX44 - SLOPE STABILTY AND LANDSLIDES					
		L	T	P	C
		3	0	0	3
PREREQUISITE : NIL					
Course Objective:	• To analyze stability of finite and irregular slopes and to impart knowledge on mechanism of landslides and understand the importance of field instrumentation and remedial measures.				

Course Outcomes The students will be able to		**Cognitive Level**	**Weightage of COs in End Semester Examination**
CO1	Apply methods to investigate and compute slope stability of slope failures.	Ap	20%
CO2	Apply slope stability analysis methods to evaluate embankment safety considering soil properties and pore water pressure.	An	20%
CO3	Apply advanced analytical techniques to assess and address stability challenges in irregular slopes and landslide-prone areas.	Ap	40%
CO4	Analyze the effectiveness various soil compaction and stabilization techniques in ensuring embankment stability.	An	20%
CO5	Prepare and present a detailed report analyzing slope stability concepts, failure causes, stabilization methods, and field observation techniques for effective slope management.	An	Internal Assessment

UNIT I - STABILITY OF SLOPES	**(9)**
Introduction - Importance - General characteristics - Types of failures - Causes of failures - Purpose of Stability computation - Investigation of failures - Procedure - Case studies.	
UNIT II - STABILITY ANALYSIS	**(9)**
Stability analysis - Method of slices - Friction circle method - Soils with cohesion Soils with cohesion and angle of internal friction. Critical states for design for embankments - Stability computations - Evaluation of pore water pressure	
UNIT III - IRREGULAR SLOPES	**(9)**
Non - uniform soils - Janbu's analysis - Taylor's analysis - Bishop's analysis - Total stress and effective stress approaches - Composite surfaces of sliding - Block sliding.	
UNIT IV - LANDSLIDES	**(9)**
General Characteristics - Sources - Stability of Hill side slopes - Open cuts - Engineering problems involving the stability of slopes - Cuts in sand - Cuts in loess - Homogeneous and soft clay slopes - Sudden spreading of clay slopes - Clay flows - Clays containing pockets and sand masses - Slides in stiff clay slopes on shale - Slopes on weathered rock; talus slopes, slopes on over consolidated clays - Slides along coastal areas and tropically weathered residual soils - Long term stability of clay slopes.	
UNIT V - FIELD OBSERVATIONS AND SLOPE STABILIZATION	**(9)**
Field instrumentation - Observation studies during construction - Post construction, piezometers - Settlement plates - Inclinometer - Case histories. Compaction of new embankments - Compaction of	

natural masses of soil and existing fills - Compaction of deep deposits of sand - Vibroflotation - Compaction of compressible soils - Drainage as a means of stabilization - Use of Geotextiles - Soil nailing.
TOTAL (L:45) = 45 PERIODS

TEXT BOOKS:
1. Duncan J. M., Wright S. G., and Brandon. T. L, "Soil Strength and Slope Stability" 2nd Edition, Wiley, 2014. 2. Chowdhury R, Flentje P and Bhattacharya G, "Geotechnical Slope Analysis", CRC Press, 2019. .
REFERENCES:
1. McCarthy, D.F., "Essentials of Soil Mechanics and Foundations: Basic Geotechnics", Sixth Edition, Prentice Hall, 2002. 2. Anderson, M.G., and Richards, K.S., "Slope Stability", JohnWiley, 1987. 3. Cheng and Lau, "Slope Stability Analysis and Stabilization" , CRC press.

Mapping of COs with POs / PSOs														
COs	**POs**												**PSOs**	
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
1	2													2
2		2		2										
3		2					2							2
4		2		2									2	2
5	3								2	2		3	2	3
CO (W.A)	**2.5**	**2**		**2**			**2**		**2**	**2**		**3**	**2**	**2.3**

22CEX45 - ROCK MECHANICS				
	L	T	P	C
	3	0	0	3

PREREQUISITE : NIL

Course Objective:	• To impart knowledge on fundamentals of rock mechanics and its application in solving simple problems associated with rock slopes and underground openings. • To understand the mechanics of rock and its applications in underground structures and rock slope stability analysis.

Course Outcomes The students will be able to		Cognitive Level	Weightage of COs in End Semester Examination
CO1	Identify and classify rocks based on geological characteristics and their engineering significance.	Ap	20%
CO2	Apply rock mechanics principles to the design and stability analysis of underground openings.	Ap	20%
CO3	Determine the strength and behavior of rock materials under different loading conditions.	An	20%
CO4	Evaluate rock mechanics principles and apply stabilization techniques for safe design and maintenance of underground and surface structures.	An	40%
CO5	Prepare and present a report using case studies to analyze rock behavior and apply suitable stabilization and support techniques in engineering projects.	An	Internal Assessment

UNIT I - CLASSIFICATION AND INDEX PROPERTIES OF ROCKS	**(9)**
Introduction - Scope of rock mechanics- Geological classification - Index properties of rock systems - Classification of rock masses for engineering purpose - Rock mass rating and Q System - Strength and modulus from classifications, Classification based on strength and modulus and strength and fracture strain, Geo engineering classification.	
UNIT II - ROCK STRENGTH AND FAILURE CRITERIA	**(9)**
Modes of rock failures - Strength of rock - Laboratory measurement of shear, tensile and compressive strength - Stress-strain behaviour of rock under hydrostatic compression and deviator loading - Mohr-Coulomb failure criteria.	
UNIT III - INITIAL STRESSES AND THEIR MEASUREMENTS	**(9)**
Estimation of initial stresses in rocks - Influence of joints and their orientation in distribution of stresses - Measurement of in-situ stresses - Hydraulic fracturing - Flat jack method - Over coring method.	
UNIT IV - APPLICATION OF ROCK MECHANICS IN ENGINEERING	**(9)**
Simple engineering application - Underground openings - Rock slopes - Bolting - Anchoring - Foundations and mining subsidence - Improvement of slope stability and protection.	
UNIT V - ROCK STABILIZATION	**(9)**
Rock support and rock reinforcement - Methods of excavation of tunnels - Control and maintenance- Tunnel ventilation - Grouting in rocks - Rock bolting - Rock anchor.	
	TOTAL (L:45) = 45 PERIODS

TEXTBOOKS:

1. Ramamurthy T. "Engineering in Rocks for Slopes Foundations and Tunnels", 3rd Edition, PHI Learning Pvt. Ltd, 2014.

REFERENCES:

1. Debasis & Verma Abhiram Kumar, "Fundamentals and Applications of Rock Mechanics" 1st Edition, PHI Learning Pvt. Ltd, 2016.
2. Nagaratnam Sivakugan, Sanjay Kumar Shukla and Braja M. Das, "Rock Mechanics - An Introduction", 1st edition CRC press, India, 2012.

Mapping of COs with POs / PSOs

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	2													2
2	3											3		3
3		2											2	
4		2											2	
5		2		2					2	2				2
CO (W.A)	**2.5**	**2**		**2**					**2**	**2**		**3**	**2**	**2.3**

22CEX46 – GEO ENVIRONMENTAL ENGINEERING					
		L	T	P	C
		3	0	0	3
PREREQUISITE : NIL					
Course Objective:	• To impart 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.				

Course Outcomes The students will be able to		**Cognitive Level**	**Weightage of COs in End Semester Examination**
CO1	Identify the soil-pollutant interaction and assess the modification of soil properties.	Ap	20%
CO2	Categorize the process of contaminant transport and characterize the contaminated sites.	Ap	20%
CO3	Apply remediation and reuse techniques for waste and contaminated sites by evaluating their geotechnical and environmental characteristics.	Ap	40%
CO4	Design the cover system by identifying the suitable components of landfill.	An	20%
CO5	Prepare and present a seminar on waste containment, remediation methods, and reuse of waste materials using practical examples or case studies.	An	Internal Assessment

UNIT I - INTRODUCTION	**(9)**
Role of Geo-environmental Engineering - sources, generation and classification of wastes- causes and consequences of soil pollution -factors influencing soil-pollutant interaction-modification of index-physical, chemical and engineering properties.	
UNIT II - CONTAMINANT TRANSPORT AND SITE CHARACTERISATION	**(9)**
Transport of contaminant in subsurface - advection, diffusion, dispersion - chemical process in subsurface - sorption, desorption, precipitation, dissolution, oxidation, complexation, ion exchange, volatization - biological process in subsurface - characterization of contaminated sites.	
UNIT III - WASTE CONTAINMENT AND REMEDIATION OF CONTAMINATED SITES	**(9)**
In situ containment - vertical and horizontal barrier - soil remediation - soil vapour extraction, electro kinetic remediation, soil heating, vitrification, bioremediation, phyto remediation - ground water remediation -pump and treat, In situ flushing, permeable reacting barrier.	
UNIT IV - LAND FILLS AND SURFACE IMPOUNDMENTS	**(9)**
Site selection for landfills - Components of landfills - liner system - soil, geomembrane, geosynthetic clay, geocomposite liner system - leachate collection-construction and operation of landfill-landfill cover - disposal of slurry waste in ponds and impoundments.	
UNIT V - UTILIZATION OF WASTE	**(9)**
Evaluation of waste materials - flyash, municipal sludge, plastics, scrap tire, blast furnace slag - physical, chemical and biological characteristics-geotechnical reuse of waste materials.	
TOTAL (L:45) = 45 PERIODS	

TEXTBOOKS:

1. Hari D. Sharma and Krishna R.Reddy, "Geo-Environmental Engineering", John Wiley and Sons, INC, USA, 2004.
2. Sharma H D and Reddy K R, "Geoenvironmental Engineering: Site remediation, Waste containment and Emerging Waste Management Technologies", John Wiley & Sons, Inc. Hoboken, New Jersey, 2004.

REFERENCES:

1. Westlake, K., "Landfill Waste pollution and Control", Albion Publishing Ltd., England, 2014.
2. Bagchi A, "Design of landfills and integrated solid waste management", John Wiley & Sons, Inc., USA 2004.

Mapping of COs with POs / PSOs

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	2													
2	2													2
3	2													
4		2												2
5		2		3		2	2		2	2		2	2	
CO (W.A)	**2**	**2**		**3**		**2**	**2**		**2**	**2**		**2**	**2**	**2**

22CEX47 - OFFSHORE ENGINEERING					
		L	T	P	C
		3	0	0	3
PREREQUISITE : NIL					
Course Objective:	• To impart knowledge on the offshore environment, types, suitability, and design concepts of offshore structures as per the appropriate requirements.				

Course Outcomes The students will be able to		**Cognitive Level**	**Weightage of COs in End Semester Examination**
CO1	Identify *and* calculate key wave parameters such as height, period, and wavelength.	Ap	20%
CO2	Apply design principles and analyze environmental and operational forces acting on various offshore structures.	An	40%
CO3	Adapt appropriate codes to design the submarine pipelines.	Ap	20%
CO4	Analyse the accidental loads and corrosion on offshore structures.	An	20%
CO5	Deliver report analyzing offshore structural types, environmental forces, and corrosion impacts, applying relevant design standards and case-based insights.	An	Internal Assessment

UNIT I - INTRODUCTION TO OFFSHORE ENVIRONMENT	**(9)**
Ocean winds-characterization of wind regime-wind velocity profile, Ocean waves-wave parameters - Introduction to Airy's wave theory and its applications-brief about time and frequency domain analysis, brief introduction about ocean currents-tides, seaquakes, Ice environment, Ice-sea interactions.	
UNIT II - TYPES OF OFFSHORE STRUCTURES	**(9)**
Offshore Structures-need for offshore structures. Types of Offshore Structures - components - materials used-design parameters-suitable environment conditions - construction practices - drawbacks - EIA for Offshore structures.	
UNIT III - FORCES ON OFFSHORE STRUCTURES	**(9)**
Introduction - Permanent loads-operating loads. Environmental forces - wind force - wave force - current force - seaquake force-Ice force. Force due to tides - Marine growth - Use of API RP 2A guidelines.	
UNIT IV - SUBMARINE PIPELINES AND RISERS	**(9)**
Pipeline elements - types of pipelines - laying method-materials. Pipe wall thickness verification. Pipeline stability. Design using DNV 81 code	
UNIT V - ACCIDENTAL LOADS AND CORROSION	**(9)**
Fire, Blast and Collision - Behaviour of steel at elevated temperature - Fire rating for Hydrocarbon fire, Blast Mitigation-Blast walls - Collision of boats and energy absorption - Corrosion - Corrosion mechanism - Types of corrosion - Offshore structure corrosion zones - Biological corrosion - Preventive measures of corrosion - Online corrosion monitoring- Corrosion fatigue.	
TOTAL (L:45) = 45 PERIODS	

TEXTBOOKS:

1. B.C Gerwick, Jr. "Construction of Marine and Offshore Structures", CRC Press, Florida, 2000.

REFERENCES:

1. McClelland, B and Reifel, M. D., "Planning and Design of fixed Offshore Platforms", Van Nostrand, 1986.
2. DNV-RP-B101-Corrosion Protection of Floating Protection and Storage Units, 2007.
3. API RP 2A. Planning,Designing and Constructing Fixed Offshore Platforms, API. 2000.

Mapping of COs with POs / PSOs

Cos	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	2													
2		2										2		2
3		2		2										
4	2					2								
5		2							2	2			2	
CO (W.A)	2	2		2		2			2	2		2	2	2

22CEX48 - ADVANCED FOUNDATION ENGINEERING				
	L	T	P	C
	3	0	0	3
PREREQUISITE : NIL				
Course Objective:	• To learn different soil exploration techniques and to estimate load carrying capacity of different types of foundations. • To understand the mechanism of load transfer mechanism in deep foundations. • To have basic idea of machine foundations.			

Course Outcomes The students will be able to		**Cognitive Level**	**Weightage of COs in End Semester Examination**
CO1	Apply appropriate subsurface investigation techniques to analyze and interpret soil properties for geotechnical reporting.	Ap	20%
CO2	Design shallow and deep foundations by applying bearing capacity theories for various soil conditions.	An	40%
CO3	Analyse retaining wall, sheet pile and brace cut.	An	20%
CO4	Design and analyse machine foundations.	An	20%
CO5	Prepare and present a report analyzing through case studies for real-world geotechnical applications.	An	Internal Assessment

UNIT I - SUBSURFACE EXPLORATION	**(9)**
Boring, Sampling, SPT, CPT, Geophysical methods, Bore log and soil report.	
UNIT II - DESIGN OF SHALLOW FOUNDATIONS	**(9)**
Bearing capacity theories - Terzaghi, Meyerhoff, Hansen, SBC based on SPT, layered soils, eccentric and inclined loads. Bearing capacity on slopes, Foundation settlements, Design of combined and Raft Foundations, Design of combined footings by conventional and elastic line methods.	
UNIT III - PILE FOUNDATIONS	**(9)**
Load transfer mechanism, Pile capacity in various soil types, negative skin friction, group action, settlements, laterally loaded vertical piles. Drilled Piers and Caissons - Design considerations, bearing capacity equations, Settlements.	
UNIT IV - MACHINE FOUNDATIONS	**(9)**
Free and forced vibration with and without damping, Elastic half space for rigid footings. Vibration analysis of foundations subjected to vertical, sliding and rocking modes, Design criteria for machine foundations.	
UNIT V - DESIGN OF RETAINING WALLS	**(9)**
Lateral earth pressure, Retaining wall stability, Sheet Pile Walls - Cantilever and Anchored sheet pile walls. Braced Cuts: Pressure envelopes and design of various components	
TOTAL (L:45) = 45 PERIODS	

TEXTBOOKS:
1. Varghese P.C., "Foundation Engineering", Prentice-Hall of India Private Ltd, 2009. 2. Swami saran, "Soil dynamics and Machine Foundations", Galgotias, 2012.
REFERENCES:
1. Srinivasalu and Vaidyanathan, "Handbook of Machine Foundations", Tata McGraw Hill, 2004. 2. Swami Saran, "Analysis and Design of Substructures", Oxford & IBH, 2008. 3. Tomlinson M.J., "Foundation Design & Construction", Prentice-Hall, 2003.

Mapping of COs with POs / PSOs														
Cos	**POs**												**PSOs**	
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
1	2											2		2
2		2	3									2		2
3		2	2									2		
4	2	2										2		
5	2	2	2										3	3
CO (W.A)	**2**	**2**	**2.3**									**2**	**3**	**2.3**

22CEX51 - GREEN BUILDINGS				
	L	T	P	C
	3	0	0	3
PREREQUISITE : NIL				
Course Objective:	•To impart knowledge on eco-friendly building concepts and building certification systems as per Indian and International Standards. •To expose the concept of green building techniques for the construction project.			

Course Outcomes The students will be able to		**Cognitive Level**	**Weightage of COs in End Semester Examination**
CO1	Explore green building concepts; apply climate-responsive and renewable energy strategies to enhance building efficiency.	Ap	40%
CO2	Identify the suitable cost effective construction materials.	Ap	20%
CO3	Apply energy-efficient techniques to enhance thermal comfort and lighting in buildings.	Ap	20%
CO4	Compare various green building rating systems, and describe the certification process for sustainable buildings.	An	20%
CO5	Present comprehensive reports on green building concepts, and green certification systems to promote sustainable construction practices.	An	Internal Assessment

UNIT I - GREEN BUILDING CONCEPT	**(9)**
Historical perspective buildings - Global warming - conventional versus green buildings - concept and necessity - Merits and Demerits - Classification - Renewable energy in buildings - Basic concepts and efficiency.	
UNIT II - PRINCIPLES AND ELEMENTS OF GREEN BUILDINGS	**(9)**
Climate responsive process of design - 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 effect.	
UNIT III - SUSTAINABLE MATERIALS	**(9)**
Sustainability - Material conservation: concept of embodied energy, low energy materials, sustainable materials, alternative materials - handling non - process waste reduction during construction - Materials with recycled waste - Concept of carbon emission and its reduction.	
UNIT IV - UTILITY OF ENERGY IN BUILDINGS	**(9)**
Concept - Solar passive cooling techniques - Solar passive heating techniques - Low energy cooling techniques - Case studies - Thermal comfort - Day lighting - Ventilation.	
UNIT V - GREEN BUILDING CERTIFICATION	**(9)**
Bureau of energy efficiency - Functions, policies, guidelines - Green building rating systems - IGBC - LEED - GRIHA - BREEAM - Process for obtaining green certification.	
TOTAL (L:45) = 45 PERIODS	

TEXTBOOKS:

1. Jagadish K, Venkatarama Reddy B.V and Nanjundarao K.S, "Alternative Building Materials and Technology", New age international (P) limited, 2007.
2. Aravind Krishnana , Simos Yannas, Nick Baker, Szokolay S.V, "Climate responsive architecture (A design hand book for energy efficient buildings)", Mcgraw hill education, 7th reprint, 2013.

REFERENCES:

1. Bureau of energy efficiency, "Energy Conservation Building Code 2007", Ministry of Power, Government of India 2007.
2. Abe Kruger," Green building Principles and practices in residential construction", Cengage learning India Pvt Ltd, 1st Edition, 2012.
3. Charles J Kibert, "Sustainable Construction Green Building Design and Delivery", John Wiley and Sons, New Jersey, 2008.
4. Jerry Yudelson, "Marketing Green Buildings: Guide for Engineering, Construction and Architecture", the Fairmont press Inc, 2006.

Mapping of COs with POs / PSOs

Cos	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	2													2
2		2										2		2
3	2													
4		3		2			2					3		3
5		2					2		2	2		3		2
CO (W.A)	2	2.3		2			2		2	2		2.7		2.3

22CEX52 - BUILDING INFORMATION MODELING				
	L	T	P	C
	3	0	0	3
PREREQUISITE : NIL				
Course Objective:	• To highlight the use of BIM models based on real-world construction projects. • To explain the modelling and analysis using BIM software. • To give an overview of clash detection and avoidance using BIM. • To give an exposure on BIM 4D and 5 D models.			

Course Outcomes The students will be able to		Cognitive Level	Weightage of COs in End Semester Examination
CO1	Apply BIM tools to create and manage models for different types of buildings.	Ap	20%
CO2	Identify clash and avoid its occurrence.	An	20%
CO3	Apply specific modeling techniques in BIM to create detailed and integrated models.	Ap	20%
CO4	Apply BIM techniques and 4D/5D modeling for effective project scheduling, construction planning, cost estimation, and asset management.	Ap	40%
CO5	Develop a detailed report or case study on BIM documentation standards and methodologies for clash avoidance and resolution.	An	Internal Assessment

UNIT I - INTRODUCTION TO BIM	**(9)**
Building information Modeling - Introduction and Process- Evolution of BIM - BIM model of various buildings like commercial and residential, WTP, Transportation, Airports - Isometric view - Introduction - Examples and Problems - 3D Modeling.	
UNIT II - DESIGN AUTHORING AND VISUALIZATION	**(9)**
Design authoring - Work flow, Discipline based modeling, Architectural, Plumbing, Energy Analysis, Design review- Views in model, Visualization models, Walkthrough and fly through the model, Layers and Properties, AR,VR and MR.	
UNIT III - INTERFERENCE / CLASH CHECK	**(9)**
Clash check - types of clashes - Federated model - Clash avoidance process –Clash detection process – Introduction. Clash detection - Priority Marix, Clash detection - Rules, Clash detection - Report, Clash detection - Grouping. Clash detection - Roles and Responsibilities, Clash detection Process - Demo.	
UNIT IV - DOCUMENTATION, CDE AND LOE	**(9)**
2D drawings operation, cloud computing, COE - Level of detail and level of information, LOD-Structural elements - Chart and matrix.	
UNIT V - 4D AND 5D IN BUILDING INFORMATION MODELLING	**(9)**

Project schedule - 4D MIM modeling - Construction analysis - 3D control and planning - BIM for safety - Disaster and risk analysis - digital fabrication- phase planning - As built / Record models - 5D in BIM - 5D BIM and quantity take off with UOM, Exercise and Demo, quantity take off, 5D - Estimation and analysis - Asset attributes and asset requirement - Infrastructure system - Information Exchange with faculty management.

TOTAL (L:45) = 45 PERIODS

TEXTBOOKS:

1. Karen kensek, Doughlas Noble, "Building Information Modeling: BIM in Current and future practice", 2014.
2. Autodesk Revit 2023 - BIM Management template and family creation by ASCENT, ISBN 978-1-63057-528-1, 2023

REFERENCES:

1. Eastman C, Teichotz P, Sacks Rand Liston C, "BIM handbook: A guide to building information modeling for owners, managers, designers, engineers and contractors" John Wiley and Sons, 2011.
2. Hardin B and McCool D,"BIM and construction management proven tools, methods, and workflows", John Wiley and Sons, 2015.
3. Issa R R and Olbina S, "Building Information modeling Application and Practices", American Society of Civil Engineers, 2015.
4. Pittard S & Sell P, "BIM and Quantity Surveying" Routledge, 2016.

Mapping of COs with POs / PSOs

Cos	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	2													3
2		2												
3	3											2		
4	2													2
5		2		2		2			2	2		3		3
CO (W.A)	2.3	2		2		2			2	2		2.5		2.7

22CEX53 - ADVANCED SURVEYING				
	L	T	P	C
	3	0	0	3
PREREQUISITE : NIL				
Course Objective:	• To impart knowledge on advanced surveying methodologies, including geodetic and satellite-based surveying systems..			

Course Outcomes The students will be able to		**Cognitive Level**	**Weightage of COs in End Semester Examination**
CO1	Apply the principles and advanced surveying techniques to conduct precise distance measurements and surveying operations.	Ap	40%
CO2	Apply the fundamental concepts of GPS, satellite motion, and related geodetic principles to solve positioning and navigation problems.	Ap	20%
CO3	Analyze GPS observables and differential techniques to estimate parameters.	An	20%
CO4	Perform surveying measurements and create maps using various methods like total station, traversing, and trilateration.	An	20%
CO5	Conduct a presentation or report on practical surveying methods using total stations, including traversing, trilateration, and mapping techniques for planimetric, contour, and topographic maps.	Ap	Internal Assessment

UNIT I - FUNDAMENTALS OF TOTAL STATION AND ELECTROMAGNETIC WAVES	**(9)**
Methods of Measuring Distance, Basic Principles of Total Station, Historical Development, Classifications, applications and comparison with conventional surveying - Applications of Electromagnetic waves.	
UNIT II - ELECTRO-OPTICAL AND MICROWAVE	**(9)**
Electro - optical system: Measuring principle, Working principle, Sources of Error, Infrared and Laser Total Station instruments. Microwave system: Measuring principle, working principle, Sources of Error, Microwave Total Station instruments.	
UNIT III - SATELLITE SYSTEM	**(9)**
Basic concepts of GPS - Historical perspective and development - applications -Geoid and Ellipsoid - satellite orbital motion - Keplerian motion - Kepler's Law - Perturbing forces -Geodetic satellite - Doppler effect.	
UNIT IV - GPS DATA PROCESSING	**(9)**
GPS observables - code and carrier phase observation - linear combination and derived observables - concept of parameter estimation - downloading the data - RINEX Format - Differential data processing - software modules - solutions of cycle slips.	
UNIT V - SURVEYING METHODS AND APPLICATIONS	**(9)**

Total Station -Traversing and Trilateration measurement and adjustment - Planimetric map and Contour map and Topography Mapping.
TOTAL (L:45) = 45 PERIODS

TEXT BOOKS:
1. Rueger, J.M. Electronic Distance Measurement, Springer-Verlag, Berlin, 4th Edition, 1996. 2. SatheeshGopi, rasathishkumar, N.madhu, "Advanced Surveying, Total Station GPS and Remote Sensing", Pearson education, 2nd Edition,2017. 3. Gunter Seeber , Satellite Geodesy, Walter De Gruyter, Berlin, 2nd Edition, 2003
REFERENCES:
1. R.Subramanian, "Surveying and Levelling", Oxford University Press, Second Edition, 2012. 2. Laurila, S.H. "Electronic Surveying in Practice", John Wiley and Sons Inc, 1983 3. Guocheng Xu, "GPS Theory, Algorithms and Applications", Springer - Verlag, Berlin, 3rd Edition, 2016. 4. Alfred Leick, "GPS satellite surveying", John Wiley & Sons Inc., 4th Edition, 2015.

Mapping of COs with POs / PSOs														
COs	**POs**												**PSOs**	
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
1	2											2	2	2
2	2													2
3	2													2
4		3												
5		2		2	3				3	2			2	2
CO (W.A)	**2**	**2.5**		**2**	**3**				**3**	**2**		**2**	**2**	**2**

22CEX54 - REMOTE SENSING AND GIS					
		L	T	P	C
		3	0	0	3
PREREQUISITE : NIL					
Course Objective:	• To imparts the knowledge on the remote sensing and its working principles. • To deliver describes the image processing techniques using GIS for real time applications.				

Course Outcomes The students will be able to		**Cognitive Level**	**Weightage of COs in End Semester Examination**
CO1	Apply the fundamentals of remote sensing principles and image analysis methods to interpret and process spatial data.	Ap	40%
CO2	Integrate remote sensing and GIS to perform raster and vector data analysis.	An	20%
CO3	Extrapolate the database concepts of GIS for developing and improving the imagery by selecting suitable data models.	An	20%
CO4	Compute the field applications of remote sensing and GIS with the recent advancement techniques.	Ap	20%
CO5	Prepare and present reports or seminars on the principles and applications of remote sensing and GIS, including image interpretation, spatial analysis, and data integration techniques.	Ap	Internal Assessment

UNIT I - FUNDAMENTALS OF REMOTE SENSING	**(9)**
Definition - Components of remote sensing - History of Remote sensing - Merits and demerits of data collation between conventional and remote sensing methods - Electromagnetic spectrum - Wavelength regions important to remote sensing - Particle and Wave - theory - Stefan-Boltzman and Wein's Laws - Atmospheric scattering and absorption - Atmospheric windows - Concept of Spectral Response and Spectral Signature - Spectral reflectance of EMR with earth surface - water, vegetation and soil - Platforms and Sensors.	
UNIT II - IMAGE INTERPRETATION AND ANALYSIS	**(9)**
Concept and types of image interpretation - Basic elements of image interpretation - Visual interpretation keys - Types of Data Products - Digital Image Processing - Pre-processing – Image compression and enhancement techniques - Multispectral Image classification - Supervised and unsupervised.	
UNIT III - GEOGRAPHICAL INFORMATION SYSTEM	**(9)**
GIS definition - Basic components of GIS - Data types - Spatial and non-spatial data - Raster and Vector Data - Analysis and structure of Raster and Vector data - Maps - Map projections - Types of map projections - standard GIS software - Concept of GPS and its advantages.	
UNIT IV - DATA INPUT, EDITING AND ANALYSIS	**(9)**
Input methods - Data stream - Data Retrieval - Query Building - Simple Spatial Analysis - Overlay Technique - Topological analysis - Modeling surfaces - TIN - DEM - DTM - Slope Model - Integration of Remote Sensing and GIS.	

UNIT V - MAJOR APPLICATIONS OF REMOTE SENSING AND GIS	(9)
Natural Resources Management - Land Cover and Land Use - Water Resources and Watershed management - Irrigation and Agriculture - Environmental studies - Ground Water exploration - Wasteland Management - Forest Resources - Natural Disaster Management- Land Slides, Flood Routing, Forest Fires, Earth Quakes.	
TOTAL (L:45) = 45 PERIODS	

TEXTBOOKS:

1. Anji Reddy M, "Remote sensing and Geographical Information Systems" , Third Edition, BS Publications, India, 2006.
2. Burrough P.A. and Rachel A. McDonell, "Principles of Geographical Information Systems", Oxford Publication, 3rd Edition 2016.

REFERENCES:

1. Basudeb Bhatta, "Remote Sensing and GIS", Second Edition, Oxford University Press, New Delhi, 2017.
2. Thomas M.Lillesand, Ralph W. Kiefer and Jonathan W. Chipman, "Remote Sensing and Image Interpretation", John Wiley and Sons, Inc, New York, 2015.
3. Basudeb Bhatta, "Remote sensing and GIS" Oxford Publication, 2nd Edition, 2011.

Mapping of COs with POs / PSOs

Cos	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	2													
2		2												
3		2											2	
4	2													2
5		2		2					2	2		2	2	3
CO (W.A)	2	2		2					2	2		2	2	2.5

22CEX55 - AI IN CIVIL ENGINEERING					
		L	T	P	C
		3	0	0	3
PREREQUISITE : NIL					
Course Objective:	• To impart knowledge on application of AI tools and techniques to optimize design, construction, and maintenance processes in civil engineering projects.				

Course Outcomes The students will be able to		**Cognitive Level**	**Weightage of COs in End Semester Examination**
CO1	Apply core AI concepts and computational techniques in geotechnical engineering scenarios.	Ap	40%
CO2	Examine the structural elements by using AI.	An	20%
CO3	Analyze the AI based construction activities and scheduling.	An	20%
CO4	Apply the AI in traffic management system.	Ap	20%
CO5	Demonstrate the ability to apply Artificial Intelligence techniques and expert systems in various domains of civil engineering through analysis, problem-solving, and effective technical presentation.	Ap	Internal Assessment

UNIT I - INTRODUCTION TO ARTIFICIAL INTELLIGENCE	**(9)**
Introduction to AI - Applications of AI in Engineering - Implementation of AI in Civil Engineering - Fundamentals of AIN Networks in AI - Genetic algorithm - Machine Learning - Regression model - Dimension Analysis - Simulation Theory - Game theory and its applications.	
UNIT II - APPLICATION OF AI IN GEOTECHNICAL ENGINEERING	**(9)**
Expert system for landslide hazard and risk management - Advisor on the selection of Earth retaining structures - Development of a prolonged based expert system for ground water control - Real time expert system for excavation - Knowledge based assistant for earthquake resistant design in AI - Case studies.	
UNIT III - APPLICATION OF AI IN STRUCTURAL ENGINEERING	**(9)**
Prolog standards for structural design - Expert system for conceptual design of bridges - structural design using intelligent objects - Expert system for design of offshore structures - knowledge based system for design of reinforced concrete walls - damage assessment based on fuzzy reasoning using AI - ANN - Expert system for base plates - Expert system for structural inspection and maintenance - case studies.	
UNIT IV - APPLICATION OF AI IN CONSTRUCTION MANAGEMENT	**(9)**
Knowledge based regulation processing for site development - Key approach to site layout problems - Duration of each activity forecasting techniques - Expert system for construction industry - A fuzzy expert system for priority ranking in network resource allocation - Expert system in network resource allocation - generation and scheduling of construction activities - case studies.	
UNIT V - APPLICATION OF AI IN TRANSPORTATION ENGINEERING	**(9)**

Traffic control system of non - autonomous vehicles at signalized road intersection - traffic lights - traffic patterns - improved safety services - application in traffic management system - application in health monitoring - case studies.
TOTAL (L:45) = 45 PERIODS

TEXTBOOKS:

1. Prateek J," Artificial Intelligence with Python", Packt Publishing, Birmingham, 1st Edition, 2017.
2. Daugherty Paul R, and James Wilson H, "Human Machine Reimaging Working the Age of AI" Harvand Business Press, 2nd Edition, 2018.

REFERENCES:

1. Husai, Amir, "The sentient machine: The coming age of artificial Intelligence", Scribner publishing, 1st Edition, 2017.
2. Kaplan Jerry, "Artificial Intelligence: what everyone needs to Know", Oxford University Press, 1st Edition, 2018.
3. B.H Topping, "Artificial Intelligence Techniques and Application for Civil and Structural Engineers", Civil Compress press, Edinburgh, 1st Edition, 1989.
4. https://nptel.ac.in/courses/106102220.

Mapping of COs with POs / PSOs

Cos	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	2													
2	2			2										2
3				2										2
4		2												2
5	2				2				2	2	2	3		2
CO (W.A)	**2**	**2**		**2**	**2**				**2**	**2**	**2**	**3**		**2**

22CEX56 - RAINWATER HARVESTING					
		L	T	P	C
		3	0	0	3
PREREQUISITE : NIL					
Course Objective:	• To impart knowledge and skills relevant to water conservation and management towards achieving the sustainability in water resources.				

Course Outcomes The students will be able to		**Cognitive Level**	**Weightage of COs in End Semester Examination**
CO1	Apply water conservation principles and relevant policies to support and promote rainwater harvesting practices.	Ap	20%
CO2	Apply the concepts of hydrology and groundwater in the estimation of runoff and recharge potentials.	Ap	20%
CO3	Apply appropriate rainwater harvesting methods and design effective components and structures for water conservation and recharge.	An	40%
CO4	Explain the difficulties of RWH, evaluation methods and maintenance through various case studies.	Ap	20%
CO5	Present and communicate the principles, methods, design, and management practices of rainwater harvesting systems, supported by case studies and real-world applications.	An	Internal Assessment

UNIT I - BASICS OF RWH	**(9)**
Water and its sources - Need for water conservation - Types of water demand - Conservation Methods - Global and Indian perspectives - National mission and goals towards rainwater harvesting - National water policy - Legislation on rainwater harvesting in India and Tamil Nadu.	
UNIT II - HYDROLOGY AND GROUND WATER	**(9)**
Hydrological cycle - Precipitation - Rainfall measurement - Rain-gauges - Hyetograph - Infiltration - Runoff estimation - Rooftop runoff estimation. Ground water - Aquifer Properties - Darcy law and well hydraulics - Steady flow.	
UNIT III - METHODS OF RAINWATER HARVESTING	**(9)**
Rainwater harvesting potential of an area - Traditional harvesting practices - Rooftop harvesting - Methods of RWH structures - Site selection for rainwater harvesting - Surface runoff Harvesting - Ground water recharge - Artificial recharge.	
UNIT IV - DESIGN OF RAINWATER HARVESTING STRUCTURES	**(9)**
Design Considerations - Components of Rainwater harvesting system - Simple roof water collection system - Design of Storage structure - Design of Recharge structures - Recharge pit - Recharge trench - Recharge well - Gully plug - Contour bund - Percolation tank - Check dam - Recharge shaft - Efficiency of RWH system	
UNIT V - MANAGEMENT OF RWH AND CASE STUDIES	**(9)**
Difficulties in RWH - At catchment level - At household level - Evaluation of RWH systems - Maintenance of RWH structures - Modernisation of RWH system - Case studies on best practice of RWH in urban - Success stories of Contemporary practices of RWH in India.	
TOTAL (L:45) = 45 PERIODS	

TEXTBOOKS:

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

REFERENCES:

1. Rain water Harvesting Techniques to Augment Ground Water: Ministry of Water Resources Central Ground Water Board Faridabad, 2003.
2. Rainwater Harvesting: Indian Railway Institute of Civil Engineering Pune, October 2015.
3. A Manual on "Rainwater Harvesting and Conservation": Government of India, Consultancy Service Organization Central Public Works Department, New Delhi.
4. "A Water Harvesting Manual for Urban Areas" issued by Centre for Science and Environment.
5. "Traditional Water Harvesting Systems of India" C.P.R. Environmental Education Centre, Chennai, India (2004).
6. "Handbook on rainwater harvesting storage options", Ministry of Water and Environment, Uganda.

Mapping of COs with POs / PSOs

Cos	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	2													
2	2			2		2								2
3		3		2		2							3	3
4		2												2
5	2			2		2	3		3	3	2	3	2	
CO (W.A)	**2**	**2.5**		**2**		**2**	**3**		**3**	**3**	**2**	**3**	**2.5**	**2.3**

22CEX57 - DISASTER PREPAREDNESS AND PLANNING				
	L	T	P	C
	3	0	0	3
PREREQUISITE : NIL				
Course Objective:	• To imparts knowledge about various natural hazards like earthquakes, slope stability, floods, droughts, and Tsunami and the mitigation measures			

Course Outcomes The students will be able to		Cognitive Level	Weightage of COs in End Semester Examination
CO1	Identify the principles and components of disaster management.	Ap	20%
CO2	Apply disaster management principles to mitigate the risks associated with man-made disasters.	Ap	20%
CO3	Analyze the multifaceted impacts of disasters and apply disaster risk reduction strategies.	An	40%
CO4	Analyse the risk and vulnerability in disaster management.	An	20%
CO5	Present various natural and man-made disasters with a focus on India's vulnerability profile using real-world examples.	An	Internal Assessment

UNIT I - INTRODUCTION	**(9)**
Concepts and definitions: disaster, hazard, vulnerability, risks - severity, frequency and details, capacity, impact, prevention, mitigation.	
UNIT II - DISASTERS	**(9)**
Disasters classification - natural disasters - floods, draught, cyclones, volcanoes, earthquakes, tsunami, landslides, coastal erosion, soil erosion, forest fires - manmade disasters - industrial pollution, artificial flooding in urban areas, nuclear radiation, chemical spills, transportation accidents, terrorist strikes - hazard and vulnerability profile of India, mountain and coastal areas, ecological fragility.	
UNIT III - DISASTER IMPACTS	**(9)**
Disaster impacts - environmental, physical, social, ecological, economic, political - health, psycho-social issues; demographic aspects - gender, age, special needs - hazard locations - global and national disaster trends - climate change and urban disasters.	
UNIT IV - DISASTER RISK REDUCTION (DRR)	**(9)**
Hazards, Risks and Vulnerabilities - Disasters in India, Assessment of Disaster Vulnerability of a location and vulnerable groups - Preparedness and Mitigation measures for various Disasters - Mitigation through capacity building - Preparation of Disaster Management Plans.	

UNIT V - DISASTERS, ENVIRONMENT AND DEVELOPMENT	(9)
Legislative responsibilities of disaster management - Disaster management act 2005 - post disaster recovery and rehabilitation, Relief and Logistics Management - disaster related infrastructure development - Post Disaster, Emergency Support Functions and their coordination mechanism.	
TOTAL (L:45) = 45 PERIODS	

TEXT BOOKS:

1. Ramana Murthy, - Disaster Management, Dominant, New Delhi, 2004.
2. RajdeepDasgupta, Disaster Management and Rehabilitation, Mittal Publishers, New Delhi, 2007.

REFERENCES:

1. Murthy D B N, "Disaster Management: Text and Case Studies", Deep and Deep Publications (P) Ltd., New Delhi, 2007.
2. Sundar I and Sezhiyan T, "Disaster Management", Sarup and Sons, New Delhi, 2007.
3. Khanna B K, "All You Wanted To Know About Disasters", New India Publishing Agency, New Delhi, 2005.
4. "Disaster Management in India - A Status Report", Published by the National Disaster Management Institute, Ministry of Home Affairs, Govt. of India, 2004.

Mapping of COs with POs / PSOs

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	2													
2	2													
3		3										2		
4		2												
5		2		2					2	2		2	2	2
CO (W.A)	2	2.3		2					2			2	2	2

22CEX58 - CONSTRUCTION ECONOMICS AND FINANCE					
		L	T	P	C
		3	0	0	3
PREREQUISITE : NIL					
Course Objective:	• To expose the students to the concepts of construction finance such as comparing alternatives proposals, evaluating alternative investments, cost estimating and management of accounting.				

Course Outcomes The students will be able to		**Cognitive Level**	**Weightage of COs in End Semester Examination**
CO1	Apply time-value of money concept to compare alternatives.	Ap	20%
CO2	Apply these methods to compare different investment alternatives and determine the most financially viable option.	Ap	20%
CO3	Apply cost estimating techniques and financial management principles to prepare construction project budgets and analyze financial performance.	An	40%
CO4	Apply the financial management procedures and estimate the financial ratios.	An	20%
CO5	Demonstrate the ability to analyze economic and financial aspects of engineering projects and effectively communicate findings through seminars and reports.	An	Internal Assessment

UNIT I - ENGINEERING ECONOMICS	**(9)**
Basic principles - Time value of money, Quantifying alternatives for decision making, Cash flow diagrams, Equivalence - Single payment in the future (P/F, F/P), Present payment compared to uniform series payments (P/A, A/P), Future payment compared to uniform series payments (F/A, A/F), Arithmetic gradient, Geometric gradient. Funds - cash flow, sources of funds - Histograms and S - Curves - Earned Value.	
UNIT II - COMPARISON OF ALTERNATIVES	**(9)**
Present, future and annual worth method of comparing alternatives, Rate of return, Incremental rate of return, Break - even comparisons, Capitalized cost analysis, Benefit - cost analysis. Depreciation, Inflation and Taxes.	
UNIT III - EQUIPMENT ECONOMICS	**(9)**
Equipment costs, Ownership and operating costs, Buy/Rent/Lease options, Replacement analysis.	
UNIT IV - COST ESTIMATING	**(9)**
Types of Estimates, Approximate estimates - Unit estimate, Factor estimate, Cost indexes, Parametric estimate, Life cycle cost.	
UNIT V - FINANCIAL MANAGEMENT	**(9)**
Construction accounting, Chart of Accounts, Financial statements - Profit and loss, Balance sheets, Financial ratios, Working capital management.	
TOTAL (L:45) = 45 PERIODS	

TEXT BOOKS:

1. Bose, D. C., "Fundamentals of Financial management", 2nd ed., PHI, New Delhi, 2011.
2. Prasanna Chandra, "Projects: Planning, Analysis, Selection, Financing, Implementation and Review", McGraw- Hill Education, 2019.

REFERENCES:

1. Gould, F. E., "Managing the Construction Process", 4th ed., Pearson Education, 2012.
2. Harris, F. , McCaffer, R. and Edum-Fotwe, F., "Modern Construction Management", 6th ed., Wiley India, New Delhi, 2012.
3. Jha, K. N., "Construction Project Management, Theory and Practice", Pearson, New Delhi, 2015.
4. Peurifoy, R. L. and Oberlender, G. D., "Estimating Construction Costs", 6th ed., McGraw-Hill, 2015.

Mapping of COs with POs / PSOs

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	2													
2	2													
3		3												2
4		3												
5		3							2	2	2		2	2
CO (W.A)	2.3	3							2	2	2		2	2

22GEA02 - PRINCIPLES OF MANAGEMENT				
	L	**T**	**P**	**C**
	3	**0**	**0**	**3**

PRE-REQUISITE: NIL

Course Objective:	• To provide with a foundational understanding of management concepts and practices. • To equip students with the knowledge and skills necessary to manage and lead organizations effectively, understanding both theoretical frameworks and practical applications in management. • To learn about various planning tools and decision-making processes crucial for organizational success. • To gain insights into human resource management functions. • To study effective communication strategies and the impact of information technology on communication and how effective control can lead to improved productivity and organizational performance.

Course Outcomes The Student will be able to		**Cognitive Level**	**Weightage of COs in End Semester Examination**
CO1	Apply key management theories and practices to real-world business scenarios, demonstrating the ability to implement management functions.	Ap	20%
CO2	Analyze human resource management practices, evaluating how recruitment, training, performance appraisal, and employee relations contribute to organizational success.	An	30%
CO3	Evaluate strategic decisions and their impacts on organizational performance,the effectiveness of communication strategies and the use of information technology in facilitating efficient and effective communication within organizations.	E	30%
CO4	Create comprehensive strategic plans and organizational policies and design control systemsto ensure continuous improvement in productivity and organizational performance.	C	20%
CO5	Engage in independent study as a member of a team and develop higher-order thinking skills that are crucial for effective management and leadership in complex organizational settings with assignments or case studies.	Ap	Internal Assessment

UNIT I -INTRODUCTION TO MANAGEMENT AND ORGANIZATIONS	**(9)**
Definition of Management - Science or Art - Manager Vs Entrepreneur - types of managers -managerial roles and skills - Evolution of Management - Scientific, human relations, system and contingency approaches - Types of Business organization-Organization culture and Environment - Current trends and issues in Management.	
UNIT II -PLANNING	**(9)**
Nature and purpose of planning - planning process - types of planning - objectives - setting objectives - policies - Planning premises - Strategic Management - Planning Tools and Techniques - Decision making steps and process.	
UNIT III -ORGANISING	**(9)**
Nature and purpose - Formal and informal organization - organization chart - organization structure - types - Line and staff authority - departmentalization -delegation of authority - centralization and decentralization -Job Design - Human Resource Management - HR Planning, Recruitment, selection, Training and Development, Performance Management, Career planning and management	

UNIT IV - DIRECTING	(9)
Foundations of individual and group behaviour - motivation -motivation theories - motivational techniques - job satisfaction - job enrichment - leadership - types and theories of leadership -communication - process of communication - barrier in communication - effective communication -communication and IT.	
UNIT V - CONTROLLING	**(9)**
System and process of controlling - budgetary and non-budgetary control techniques - use of computers and IT in Management control - Productivity problems and management - control and performance -direct and preventive control -reporting.	
TOTAL (L:45) : 45 PERIODS	

TEXT BOOKS:

1. Harold Koontz, Heinz Weihrichand Mark V. Cannice"Essentials of Management: An International, Innovation, and Leadership Perspective", 11th Edition, Tata McGraw-Hill Education, 2021.
2. J.A.F. Stoner, R.E. Freeman, and Daniel R. Gilbert "Management", 6th Edition, Pearson Education, 2018.

REFERENCES:

1. JAF Stoner, Freeman R.E and Daniel R Gilbert "Management", 6th Edition, Pearson Education, 2004.
2. Robert Kreitner & Mamata Mohapatra, "Management", Biztantra, 2008.
3. Stephen A. Robbins & David A. Decenzo & Mary Coulter, "Fundamentals of Management", 7th Edition, Pearson Education, 2011.
4. Tripathy PC & Reddy PN, "Principles of Management", Tata Mcgraw Hill, 1999.

Mapping of COs with POs / PSOs

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	3										3			
2		3									3			
3										3				
4			3							3				
5											3	3		
CO (W.A)	3	3	3							3	3	3		

22GEA03 - TOTAL QUALITY MANAGEMENT				
	L	T	P	C
	3	0	0	3

PREREQUISITE : NIL

Course Objective:	• To Recognize the importance of quality councils and strategic planning in TQM. • To Explore the elements and historical development of TQM. • To Foster employee involvement through motivation, empowerment, teamwork, and recognition. • To Implement continuous process improvement methods like Juran's Trilogy, PDSA Cycle, 5S, and Kaizen. • To Conduct quality audits and understand the introduction to other ISO standards like ISO 14000, IATF 16949, TL 9000, IEC 17025, ISO 18000, ISO 20000, ISO 22000, and ISO 21001.

Course Outcomes The Student will be able to		Cognitive Level	Weightage of COs in End Semester Examination
CO1	Describe the elements and principles of Total Quality Management (TQM).	Ap	30%
CO2	Apply continuous process improvement methodologies such as Juran's Trilogy, PDSA Cycle, 5S, and Kaizen.	Ap	20%
CO3	Apply various quality tools and techniques in both manufacturing and service industry.	Ap	20%
CO4	Develop strong supplier partnerships and understand supplier selection, rating, and relationship development.	An	20%
CO5	Choose appropriate quality standards and implement them in the respective industry App.	E	10%

UNIT I - QUALITY CONCEPTS AND PRINCIPLES	**(9)**
Definition of Quality - Dimensions of Quality - Quality Planning - Quality Assurance and Control - Quality Costs with Case Studies - Elements / Principles of TQM - Historical Review - Leadership - Qualities / Habits - Quality Council - Quality Statements, Strategic Planning - Importance - Case Studies - Deming Philosophy - Barriers to TQM Implementation - Cases with TQM Success and Failures.	
UNIT II - TQM PRINCIPLES AND STRATEGIES	**(9)**
Customer Satisfaction - Customer Perception of Quality - Customer Complaints - Customer Retention, Employee Involvement - Motivation - Empowerment - Teams - Recognition and Reward - Performance Appraisal, Continuous Process Improvement - Juran's Trilogy - PDSA Cycle - 5S - Kaizen, Supplier Partnership - Partnering - Sourcing - Supplier Selection - Supplier Rating - Relationship Development, Performance Measures - Purpose - Methods - Cases.	
UNIT III - CONTROL CHARTS FOR PROCESS CONTROL	**(9)**
Basic Seven Tools of Quality and its Role in Quality Control, Statistical Fundamentals - Measures of Central Tendency and Dispersion, Population and Sample - Normal Curve - Control Charts for Variables and Attributes - Process Capability - Case Study- Introduction to Six Sigma.	
UNIT IV - TQM-MODERN TOOLS	**(9)**
New Seven Tools of Quality, Benchmarking - Need - Types and Process, Quality Function Deployment - House of Quality (HOQ) Construction - Case Studies, Introduction to Taguchi's Robust Design - Quality Loss Function - Design of Experiments (DOE), Total Productive Maintenance (TPM) - Uptime Enhancement, Failure Mode and Effect Analysis (FMEA) - Risk Priority Number (RPN) – Process - Case	

Studies.	
UNIT V - QUALITY SYSTEMS	**(9)**
Need for ISO 9000 and Other Quality Systems - ISO 9000: 2015 Quality System – Elements - Implementation of Quality System - Documentation - Quality Auditing, Introduction to ISO 14000 - IATF 16949 - TL 9000-IEC 17025 - ISO 18000 - ISO20000 - ISO 22000 - ISO21001. Process of Implementing ISO - Barriers in ISO Implementation.	
TOTAL (L:45) = 45 PERIODS	

TEXT BOOK:

1. Besterfield Dale H., Besterfield Carol, Besterfield Glen H., Besterfield Mary, UrdhwareshеHemant, UrdhwareshеRashmi "Total Quality Management", 5th Edition, Pearson Education, Noida, 2018.

REFERENCES:

1. SubburajRamasamy, "Total Quality Management", McGraw Hill Education, New Delhi, 2017.
2. James R. Evans and William M. Lindsay, "The Management and Control of Quality", 8th Edition, Cengage Learning, 2012.
3. David Goetsch& Stanley Davis, "Quality Management for Organizational Excellence: Introduction to Total Quality", 8thEdition,Pearson, 2017.

Mapping of COs with POs / PSOs

	POs												PSOs	
COs	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
1	3													
2	3													
3	3													
4		3												
5	3				2									
CO (W.A)	**3**	**3**			**2**									

22GEA04 - PROFESSIONAL ETHICS				
	L	T	P	C
	3	0	0	3

PREREQUISITE : NIL

Course Objective:	• To develop students' ability to identify, analyse, and resolve ethical dilemmas in engineering contexts, fostering a commitment to professional responsibility, integrity, and ethical decision-making. • To provide engineering students with a comprehensive understanding of ethical principles and practices in the engineering profession. • To Familiarize students with key ethical theories, principles, and frameworks that guide ethical decision-making in professional practice. • To Foster the ability to communicate ethical concerns and collaborate effectively with diverse stakeholders, including colleagues, clients, and the public. • To Encourage students to uphold integrity, honesty, and accountability in their professional activities, fostering a culture of trust and reliability.

Course Outcomes The Student will be able to		**Cognitive Level**	**Weightage of COs in End Semester Examination**
CO1	Apply ethical reasoning to evaluate and resolve these issues.	Ap	30%
CO2	Apply ethical principles and reasoning to analyze real-world case studies in engineering.	Ap	30%
CO3	Analyze the importance of ethics in professional practice.	An	20%
CO4	Develop the ability to make informed and ethical decisions in engineering practice.	An	10%
CO5	Recognize the importance of continuous learning and professional development in maintaining ethical standards.	E	10%

UNIT I - INTRODUCTION TO PROFESSIONAL ETHICS	**(9)**
Definition and Importance of Ethics, Ethical Theories and Principles, Ethics vs. Morals vs. Values, Role of Ethics in Engineering.	
UNIT II - PROFESSIONAL RESPONSIBILITY AND CODES OF CONDUCT	**(9)**
Professional Responsibility and Accountability, Codes of Conduct in Engineering (e.g., IEEE, NSPE), Conflicts of Interest and Whistle blowing, Case Studies.	
UNIT III - ETHICAL DECISION-MAKING AND PROBLEM-SOLVING	**(9)**
Ethical Decision-Making Models, Tools and Frameworks for Ethical Analysis, Resolving Ethical Dilemmas, Case Studies.	
UNIT IV - LEGAL AND REGULATORY ASPECTS	**(9)**
Legal Frameworks Governing Engineering Practice, Intellectual Property Rights, Health, Safety, and Environmental Regulations, Case Studies.	
UNIT V - SOCIAL AND ENVIRONMENTAL RESPONSIBILITY	**(9)**
Social Responsibility of Engineers, Sustainable Engineering Practices, Impact of Engineering on Society and Environment, Case Studies.	
TOTAL (L:45) = 45 PERIODS	

TEXT BOOKS:

1. Charles E. Harris Jr., Michael S. Pritchard, and Michael J. Rabins, "Engineering Ethics: Concepts and Cases" 6th Edition, 2018.
2. Mike W. Martin and Roland Schinzinger, "Ethics in Engineering", 5th Edition 2010.
3. by M. Govindarajan, S. Natarajan, and V. S. Senthil Kumar,"Professional Ethics and Human Values",Ist Edition 2006.

REFERENCES:

1. Stephen H. Unger, "Engineering Ethics: Real-World Case Studies"
2. Online Ethics Center for Engineering and Science - www.onlineethics.org
3. National Society of Professional Engineers (NSPE) - www.nspe.org

Mapping of COs with POs / PSOs

	POs												PSOs	
COs	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
1	3													
2	3													
3		3												
4		3												
5								3						
CO (W.A)	**3**	**3**						**3**						

22GEZ01- ENTREPRENEURSHIP DEVELOPMENT				
	L	T	P	C
	2	0	2	3
PRE REQUISITE : Nil				

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

Course Outcomes The Student will be able to		**Cognitive Level**	**Weightage of COs in End Semester Examination**
CO1	Analyze different types of entrepreneurs and their impact on emerging economies through case studies of successful and failed engineering entrepreneurs	An	20%
CO2	Apply concepts related to societal problems, generate and validate ideas, and assess business opportunities by studying emerging markets and their potential	Ap	20%
CO3	Develop prototypes using various methods and tools, understand their importance in the entrepreneurial process, and iterate based on feedback to enhance their designs	C	20%
CO4	Apply the Lean Canvas to develop business models and craft effective pitches that engage investors and customers	Ap	20%
CO5	Analyze the entrepreneurial ecosystem, including its components, financing models, and stakeholder networks through interactive activities such as visits and interactions with startup founders	Ap	20%

MODULE–I: ENTREPRENEURIAL MINDSET	**(6+6)**
Introduction to Entrepreneurship: Definition - Types of Entrepreneurs - Emerging Economics- Developing and Understanding an Entrepreneurial Mindset - Importance of Technology Entrepreneurship - Benefits to the Society. Case Analysis: Study cases of successful & failed engineering entrepreneurs - Foster Creative Thinking: Engage in a series of Problem-Identification and Problem-Solving tasks.	

MODULE - II: OPPORTUNITIES	(6+6)
Problems and Opportunities - Ideas and Opportunities - Identifying problems in society - Creation of opportunities - Exploring Market Types - Estimating the Market Size, - Knowing the Customer and Consumer - Customer Segmentation - Identifying niche markets - Customer discovery and validation; Market research techniques, tools for validation of ideas and opportunities. Activity Session: Identify emerging sectors / potential opportunities in existing markets - Customer Interviews: Conduct preliminary interviews with potential customers for Opportunity Validation - Analyse feedback to refine the opportunity.	
MODULE – III: PROTOTYPING &ITERATION	**(6+6)**
Prototyping – Importance in entrepreneurial process - Types of Prototypes - Different methods - Tools & Techniques. Hands-on sessions on prototyping tools (3D printing, electronics, software), Develop a prototype based on identified opportunities; Receive feedback and iterate on the prototypes.	
MODULE - IV: BUSINESS MODELS &PITCHING	**(6+6)**
Business Model and Types - Lean Approach - 9 block Lean Canvas Model - Riskiest assumptions to Business Models – Using Business Model Canvas as a Tool - Pitching Techniques:Importanceofpitching-Typesofpitches-craftingacompellingpitch – pitch presentation skills - using storytelling to gain investor/customer attention. ActivitySession:Developabusinessmodelcanvasfortheprototype;presentandreceive feedback from peers and mentors - Prepare and practice pitching the business ideas- Participate in a Pitching Competition and present to a panel of judges - receive & reflect feedback.	
MODULE -V:ENTREPRENEURIAL ECOSYSTEM	**(6+6)**
Understanding the Entrepreneurial Ecosystem - Components: Angels, Venture Capitalists, Maker Spaces, Incubators, Accelerators and Investors. Financing models – equity, debt, crowd funding, etc, Support from the government and corporate. Navigating Ecosystem Support: Searching & Identifying the Right Ecosystem Partner - Leveraging the Ecosystem - Building the right stakeholder network. Activity Session: Arrangement of Guest Speaker Sessions by successful entrepreneurs and entrepreneurial ecosystem leaders (incubation managers; angels; etc), Visit one or two entrepreneurial ecosystem players (Travel and visit a research park or incubator or maker space or interact with startup founders).	
TOTAL(L:30,P:30) = 60 PERIODS	

TEXT BOOKS:

1. Robert D. Hisrich, Michael P. Peters, Dean A. Shepherd, SabyasachiSinha (2020). Entrepreneurship, McGraw Hill, 11thEdition.
2. Ries.E.(2011).”The Lean Startup: How Today's Entrepreneurs Use Continuous Innovation to Create Radically Successful Businesses”. Crown Business.

REFERENCES:

1. Blank, S.G.,&Dorf,B.(2012).”The Startup Owner's Manual: The Step-by-Step Guide for Building a Great Company”, K&S Ranch.
2. Roy, R.(2017).Indian Entrepreneurship: Theory and Practice New Delhi: Oxford University Press.
3. Osterwalder,A.,& Pigneur, Y.(2010),”Business Model Generation: A Handbook for Visionaries, Game Changers, and Challengers” John Wiley & Sons.

Mapping of COs with POs / PSOs														
	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1		3							3	3		3		
2		3	3				2		3	3		3		
3			3		3				3	3		3		
4									3	3	3	3		
5									3	3	3	3		
CO (W.A)		3	3		3		2		3	3	3	3		

22CEZ01 - DRINKING WATER SUPPLY AND TREATMENT (Common to all branches except CIVIL Branch)				
	L	T	P	C
	3	0	0	3

PREREQUISITE : NIL

Course Objective:	• To provide insights into surface and groundwater sources, their availability, and suitability for public water supply. • To impart knowledge on construction and operation of advanced water treatment.

Course Outcomes The students will be able to		Cognitive Level	Weightage of COs in End Semester Examination
CO1	Identify and classify the characteristics of different water sources based on water quality criteria and standards	Ap	20%
CO2	Analyze the functions and construction of pipes and pump stations to efficient operation and maintenance.	An	20%
CO3	Examine and compare the functions and effectiveness of treatment methods.	An	40%
CO4	Analyze the requirements of a water distribution system	An	20%
CO5	Prepare a report and deliver presentations on water quality standards, advanced treatment methods, and challenges in water distribution systems.	An	Internal Assessment

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 - Source Water quality - Drinking Water quality standards.	
UNIT II - CONVEYANCE FROM THE SOURCE	**(9)**
Water supply - intake structures - Functions; Pipes and conduits for water - Pipe materials - Types and capacity of pumps - Selection of pumps and pipe materials.	
UNIT III - WATER TREATMENT	**(9)**
Objectives - Unit operations and processes - Principles, functionsof aerators and flash mixers, Coagulation and flocculation - sand filters - Disinfection - Construction, Operation and Maintenance aspects.	
UNIT IV - ADVANCED WATER TREATMENT	**(9)**
Water softening - Desalination- R.O. Plant - demineralization - Membrane Systems - Iron and Manganese removal - Defluoridation - Construction and Operation and Maintenance aspects.	
UNIT V - WATER DISTRIBUTION AND SUPPLY	**(9)**
Requirements of water distribution - Components - Selection of pipe material - Service reservoirs - Functions - Leak detection - House service connection - Fixtures and fittings, systems of plumbing and types of plumbing.	
TOTAL(L:45) =45PERIODS	

TEXTBOOKS:

1. S.K Garg, "Water Supply Engineering", Khanna Publishers, Delhi, 2008.
2. B.C Punmia, Arun K. Jain, Ashok K. Jain, "Water Supply Engineering" Lakshmi Publication Private Limited, New Delhi, 2016.

REFERENCES:

1. Rangwala, "Water Supply and Sanitary Engineering", Charotar Publishing House Pvt. Ltd, 30th Edition, 2022.
2. G.S Birdie, "Water Supply and Sanitary Engineering", DhanpatRai and sons, 2018.

Mapping of COs with POs / PSOs

COs	**POs**												**PSOs**	
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
1	2													
2		2												
3		2												
4		2												
5		2							2	2				
CO (W.A)	**2**	**2**							**2**	**2**			**-**	**-**

22CEZ02 - WASTE MANAGEMENT (Common to all branches except CIVIL Branch)					
		L	**T**	**P**	**C**
		3	**0**	**0**	**3**
PREREQUISITE : NIL					
Course Objective:	• To comprehend waste disposal techniques and analyze the nature and characteristics of solid and hazardous wastes for designing and implementing appropriate treatment facilities.				

Course Outcomes The students will be able to		**Cognitive Level**	**Weightage of COs in End Semester Examination**
CO1	Examine the causes and impacts of ineffective hazardous waste management systems on health and the environment.	Ap	20%
CO2	Assess the effectiveness of source reduction strategies and recycling and reuse practices in waste management.	An	40%
CO3	Recommend appropriate disposal method for solid and hazardous wastes.	Ap	20%
CO4	Implement waste management rules and policies to ensure compliance with legal and environmental standards.	Ap	20%
CO5	Draft a report for managing waste generation, processing, and disposal based on community needs.	An	Internal Assessment

UNIT I - INTRODUCTION AND TYPES OF SOURCES	**(9)**
Problems and need of solid and hazardous waste management - Waste management planning - Toxicology and risk assessment - Legislations on management and handling of different types of wastes - Agriculture Waste - Chemical Waste - E-Waste - Bio Medical Waste - Variety of Industrial wastes - Nuclear and Radio Active Wastes.	
UNIT II - WASTE GENERATION RATES	**(9)**
Composition - Hazardous Characteristics - TCLP tests - waste sampling- reduction of wastes at source - Recycling and reuse - 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 -labeling and handling of hazardous wastes.	
UNIT III - WASTE PROCESSING	**(9)**
Processing technologies - biological and chemical conversion technologies - Composting - thermal conversion technologies - energy recovery - incineration - solidification and stabilization of hazardous wastes - treatment of biomedical wastes.	
UNIT IV - DISPOSAL OF WASTE	**(9)**
Site selection - design and operation of sanitary landfills - secure landfills and landfill bioreactors - leachate and landfill gas management - landfill closure and environmental monitoring - landfill remediation - disposal of E-waste.	
UNIT V - ECONOMY AND FINANCIAL ASPECTS	**(9)**
Elements of integrated waste management - Economy and financial aspects of waste management - Municipal Budget - Waste Management Rules and Policies.	
TOTAL (L: 45) = 45 PERIODS	

TEXT BOOKS:
1. G. Tchobanoglous, Frank Kreith, "Hand Book of Solid Waste Management", 2nd Edition, McGrawHill, Inc., 2002
REFERENCES:
1. Vesilind P.A., Worrell W and Reinhart, Solid waste Engineering, Thomson Learning Inc., Singapore, 2011. 2. Manual on Municipal Solid Waste Management", CPHEEO, Ministry of Urban Development, Government of India, New Delhi, 2016

Mapping of COs with POs / PSOs														
COs	**POs**												**PSOs**	
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
1	2													
2		2												
3	2													
4	2													
5		2					2		2	2		2		
CO (W.A)	**2**	**2**					**2**		**2**	**2**		**2**	**-**	**-**

22CEZ03 - BUILDING SERVICES

(Common to All branches except CIVIL Branch)

	L	T	P	C
	3	0	0	3

PREREQUISITE : NIL

Course Objective:	• To explain the function and operation of different building services systems and their interrelationship in building design. • To apply knowledge of building services to design a basic HVAC or plumbing system for a residential or commercial building.

Course Outcomes The students will be able to		Cognitive Level	Weightage of COs in End Semester Examination
CO1	Apply knowledge of electrical systems used in building services.	Ap	20%
CO2	Assess the impact of lighting sources comparing the benefits of modern lighting technologies.	Ap	20%
CO3	Apply principles of mechanical services in building design and assess the effectiveness of fire safety installations.	An	40%
CO4	Analyze the effectiveness of plumbing fixtures by assessing their performance in different building types and environments.	An	20%
CO5	Prepare a report on various building services, assessing their effectiveness in both residential and commercial buildings.	An	Internal Assessment

UNIT I - ELECTRICAL SYSTEMS IN BUILDINGS	**(9)**
Basics of electricity - Single / Three phase supply - Protective devices in electrical installations - Earthing for safety -Types of earthing - ISI specifications - Types of wires , wiring systems and their choice - Planning electrical wiring for building - Main and distribution boards - Transformers and switch gears - Layout of substations.	
UNIT II - LIGHTING AND VENTILATION	**(9)**
Natural and artificial lighting - requirements of good lighting - general principles of openings to afford good lighting - Illumination - units of measurement - Luminous flux - Candela - Artificial light sources - modern lighting - Lighting for stores, offices, schools, hospitals and house lighting - temperature rise due to artificial lighting remedial measures - ventilation - types - factors to be considered in the design of ventilation.	
UNIT III - MECHANICAL SERVICES AND AIR CONDITIONING	**(9)**
Lifts - location - sizes - component parts - different types of elevators - escalators - locations and functions - Thermodynamics - Refrigerants - Vapour compression cycle - Compressors - Evaporators - Refrigerant control devices - Electric motors - Starters - Air handling units - Cooling towers - Window type and packaged air-conditioners - Fan coil systems - Water piping - Cooling load - Air conditioning systems for different types of buildings - Protection against fire to be caused by A.C. Systems.	

UNIT IV - FIRE SAFETY INSTALLATION	(9)
Causes of fire in buildings - Safety regulations - NBC - Planning considerations in buildings like non-combustible materials, construction, staircases and lift lobbies, fire escapes and A.C. systems. Special features required for physicallyhandicappedand elderly in building types - Heat and smoke detectors - Fire alarm system, snorkel ladder Fire lighting pump and water storage - Dry and wet risers - Automatic sprinklers.	
UNIT V - PLUMBING AND DRAINAGE	**(9)**
Plumbing fixtures and fixture fittings - Water conserving fittings - Over flows - Strainers and connectors - Prohibited fixtures - Special fixtures - Installation of water closet - Urinals - Flushing devices - Floor drains - Shower stall - Bathtub - Bidets - Minimum plumbing facilities - Rain water harvesting systems - Necessity - Construction - Different types.	
TOTAL(L:45) =45PERIODS	

TEXTBOOKS:

1. R. Udayakumar, "A Text Book on Building Services", Eswar Press, 2007.
2. Dr. B. C. Punmia, "Building Construction", Laxmi Publications (P) Ltd, New Delhi, Reprint 2005.

REFERENCES:

1. P. C. Varghese, "Building Construction" PHI Learning Pvt Ltd, New Delhi, 2015.
2. Roger Greeno and Fred Hall, "Building Services Hand Book", eighth edition, Routledge Publishers, 2015.

Mapping of COs with POs / PSOs

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	2													
2	2													
3		2												
4		2												
5		2							2	2		2		
CO (W.A)	2	2							2	2		2	-	-

22CEZ04 - ENERGY CONSERVATION IN BUILDINGS

(Common to all branches except CIVIL Branch)

	L	T	P	C
	3	0	0	3

PREREQUISITE : NIL

Course Objective:	• To identify climatic influences on architecture • To gain knowledge on energy conservation in buildings and monitoring systems

	Course Outcomes The students will be able to	Cognitive Level	Weightage of COs in End Semester Examination
CO1	Relate the impact of various climatic conditions on architectural design and construction practices.	Ap	20%
CO2	Demonstrate the use of standard methods and tools to estimate energy requirements for various systems and processes.	Ap	40%
CO3	Apply the concepts of energy conservation systems and assess their effectiveness in various climates.	An	20%
CO4	Apply intelligent building design principles to enhance building performance.	Ap	20%
CO5	Present a report with findings from a detailed analysis of the design, energy-saving measures, and overall performance of energy-efficient buildings.	An	Internal Assessment

UNIT I CLIMATE	**(6)**
Climate and shelter - Historic buildings - Modern architecture - Examples from different climate zones.	
UNIT II PRINCIPLES OF ENERGY	**(9)**
Principles of Energy conscious building design - Energy conservation in buildings - Day lighting - Water heating and photo voltaic systems - Advances in thermal insulation - Heat gain / loss through building components - Solar architecture.	
UNIT III ENERGY ESTIMATION	**(9)**
Thermal comfort - Solar geometry and shading - Heating and cooling loads - Energy estimates and site planning - Integrative Modeling methods and building simulation.	
UNIT IV ENERGY CONSERVATION	**(9)**
Passive solar heating - Direct gain - Thermal storage wall - Sunspace - Convective air loop - Passive cooling - Ventilation - Radiation - Evaporation and Dehumidification - Mass effect - Design guidelines.	
UNIT V MONITORING AND CONTROL SYSTEMS	**(12)**
Energy conservation in building - Air conditioning - HVAC equipment - computer packages for thermal design of buildings and performance prediction - Monitoring and instrumentation of passive buildings - Control systems for Energy efficient buildings - Illustrative passive buildings - Integration of emerging technologies - Intelligent building design principles.	
TOTAL (L: 45) = 45PERIODS	

TEXT BOOK:

1. Dr. O. P. Jakhar, "Energy Conservation in Buildings", Khanna Publishin (co) Pvt Ltd, First Edition, New Delhi 2018.

REFERENCES:

1. A. A. M. Sayigh, "Energy Conservation in Buildings", 1st Edition, Pergamon Publisher, 2012
2. J. R. Waters, "Energy Conservation in Buildings: A Guide to Part L of the Building Regulations" 1st Edition, Kindle Edition, Wiley Blackwell Publisher, 2008.
3. Hand Book on Energy Conservation in Buildings, 2008

Mapping of COs with POs / PSOs														
COs	**POs**												**PSOs**	
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
1	2													
2	2													
3		2												
4	2													
5		2							2	2				
CO (W.A)	**2**	**2**							**2**	**2**			**-**	**-**

22CEM01 - INTRODUCTION TO SUSTAINABILITY
(Common to all branches except CIVIL Branch)

	L	T	P	C
	3	0	0	3

PREREQUISITE : NIL

Course Objective:	• To build a foundation on the concept of sustainable development and to gain an empirical understanding of the emerging global challenges for sustainable environmental and societal governance systems.

Course Outcomes The students will be able to		Cognitive Level	Weightage of COs in End Semester Examination
CO1	Apply sustainability principles and the SDG to evaluate and improve real-world sustainability practices in energy and resource management.	Ap	20%
CO2	Analyze the impact of human activities on natural resources, climate change, and biodiversity.	An	20%
CO3	Evaluate sustainability performance across various sectors through sustainability indicators.	An	20%
CO4	Apply the laws and strategic approaches, national and global sustainability initiatives to real-world scenarios.	Ap	40%
CO5	Prepare a report on real-world challenges and sustainable solutions across key sectors, including urban development, industry, and transportation.	An	Internal Assessment

UNIT I - INTRODUCTION	**(8)**
Sustainability - Definition - Necessity - Global energy scenario - Indian energy scenario - Three pillars - contribution of each - UNSDGs - 17 goals of sustainability - no poverty - zero hunger - good health and well-being - Quality Education - Gender Equality - Clean Water and Sanitation- Affordable and Clean Energy - Decent Work and Economic Growth - Industry, Innovation, and Infrastructure - Reduced Inequalities - Sustainable Cities and Communities - Responsible Consumption and Production - Climate Action - Life Below Water - Life on Land - Peace, Justice and Strong Institutions- Partnerships – Green technologies - Renewable energy- hurdles in implementations	

UNIT II - CHALLENGES TO SUSTAINABLE DEVELOPMENT	**(9)**
Challenges and Barriers in various sectors in the context of Climate Change, Responses to Sustainable Development-Challenges Vs Response - Case studies.	

UNIT III - SUSTAINABLE DEVELOPMENT INDICATORS	**(10)**
Need for Sustainable Development indicators, Concept of Ecological Foot print and Carbon Foot Print, Carrying Capacity and its limits, Performance indicators of sustainability for various sectors.	

UNIT IV - ENVIRONMENTAL LAWS IN INDIA	**(9)**
History of environmental laws in India - The Wildlife (Protection) Act, 1972 - The Water (Prevention and Control of Pollution) Act, 1974 - The Air (prevention and control of pollution) act, 1981- The Environment (Protection) Act, 1986 - The National Green Tribunal Act, 2010 - Compensatory Afforestation Fund Act, 2016.	

UNIT V - STRATEGIC APPROACH TO SUSTAINABLE ACTIONS	(9)
Strategies for sustainable development, International programmes on Sustainable Development, Sustainable Development in India: NAPCC & its missions, Various strategic approach with case studies on-Green Economy and Circular Economy, Cleaner production and Pollution Prevention-Environmental Management System, Eco labelling, and Sustainable life style.	
TOTAL(L:45) =45PERIODS	

TEXTBOOKS:

1. Kerr, Julie, "Introduction to Energy and Climate: Developing a Sustainable Environment", CRC Press, 2017.
2. V. R. Krishna Iyer, "Environmental Protection and Legal Defence", Sterling Publishers, 2005.
3. United Nations Indicators of Sustainable Development: Guidelines and Methodologies. New York: United Nations 2007.
4. P. Leelakrishnan, "Environmental Law in India Paperback -1" LexisNexis, 2010

REFERENCES:

1. Elliott, Jennifer, "An Introduction to Sustainable Development", 4th Edition, Routledge, London, 2012.

Mapping of COs with POs / PSOs

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	2						2							
2		2				1								
3	2	2												
4	2					1	2							
5	2	2					2			2				
CO (W.A)	2	2				1	2			2				

22CEM02 - ENVIRONMENT AND ECOLOGY (Common to all branches except CIVIL Branch)				
	L	**T**	**P**	**C**
	3	**0**	**0**	**3**

PREREQUISITE : NIL

Course Objective:	• To impart knowledge on the various theoretical perspectives in urban ecology and urban ecosystems.

	Course Outcomes The students will be able to	**Cognitive Level**	**Weightage of COs in End Semester Examination**
CO1	Apply guidelines to assess compliance of air and water samples with standard limits.	Ap	20%
CO2	Differentiate the various ecosystems with sources of energy and effects of human activities on environment.	An	40%
CO3	Interpret the environment issue based on environmental pollution.	An	20%
CO4	Evaluate the environmental impacts of infrastructure projects using EIA methodologies.	An	20%
CO5	Conduct Investigation on real-world environmental issues through data collection / case studies, and report writing.	An	Internal Assessment

UNIT I - FUNDAMENTALS OF ENVIRONMENT AND ECOLOGY	**(8)**
Environment - Ecology and Ecosystem - Food chain - Food web - Trophic level - Energy flow - Introduction, types, characteristic features, structure and function - Forest - Grassland - Desert and Aquatic ecosystems - Effects of human activities on environment, Agriculture, Housing, Industry, Mining and Transportation.	
UNIT II - NATURAL RESOURCES	**(9)**
Water Resources - Mineral Resources - Soil, Material cycles - Carbon, Nitrogen and Sulphur Cycles - Energy - Different types of energy - Conventional and Non-Conventional sources - Hydro Electric - Fossil Fuel based, Nuclear, Solar, Biomass and Geothermal energy and Bio-gas.	
UNIT III - ENVIRONMENTAL POLLUTION AND CURRENT ISSUES OF IMPORTANCE	**(10)**
Concepts of Air Pollution, Water pollution, Land pollution, Noise pollution - Causes, effects and control measures - Climate Change and Global warming effects - Acid Rain, Ozone Layer depletion, Photochemical Smog - Solid waste management and Waste water treatment.	
UNIT IV - ENVIRONMENT QUALITY STANDARDS	**(9)**
Ambient air quality standards - Water quality parameters and standards - Turbidity, pH, Suspended solids, hardness, residual chlorine, sulphates, phosphates, iron and manganese, DO, BOD and COD - WHO and BIS norms.	
UNIT V - ENVIRONMENT IMPACT ASSESSMENT	**(9)**
Introduction to EIA - Screening, Scoping, Public Participation - EIA for infrastructure projects - Highways - Dams - Multi-storey Buildings - Water Supply and Drainage - Case studies.	
TOTAL(L:45) =45PERIODS	

TEXTBOOKS:

1. Pandey SN and Misra SP, "Environment and Ecology", Ane Books Pvt. Ltd, New Delhi, 2018.
2. P.D.Sharma, "Ecology and Environment", Rastogi Publication, 2015.

REFERENCES:

1. Shukla, S.K. and Srivastava, P.R., "Concepts in Environmental Impact Analysis", Common Wealth Publishers, New Delhi, 1992.
2. Canter, L.W., "Environmental Impact Assessment", McGraw-Hill Inc., 1997.
3. S.S. Dara, "A Text Book of Environmental Chemistry and Pollution Control", S. Chand and Co., 2004.
4. Samir K. Banerjee, "Environmental Chemistry", Prentice Hall of India Pvt. Ltd. New Delhi, 2009.

Mapping of COs with POs / PSOs

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	2						2							
2	2	2					2							
3														
4		2												
5		2					2			2				
CO (W.A)	**2**	**2**					**2**			**2**				

22CEM03 - ENVIRONMENTAL HEALTH AND SAFETY
(Common to all branches except CIVIL Branch)

	L	T	P	C
	3	0	0	3

PREREQUISITE : NIL

Course Objective:	• To enhance the knowledge in regulation and statutory requirements relevant to Environmental, Health and Safety.

Course Outcomes The students will be able to		Cognitive Level	Weightage of COs in End Semester Examination
CO1	Apply the concept of EHS and their framework.	Ap	20%
CO2	Identify the monitoring principles in workplace systems.	Ap	20%
CO3	Choose the need of training and methods of EHS and Identify the key steps involved in HSE legislations.	An	40%
CO4	Organize the safety auditing management systems and their prevention techniques.	Ap	20%
CO5	Work collaboratively as a team to conduct an independent study and present findings through an oral presentation or a detailed report on the industrial case studies related to the Factories Act, Contract Labour Act, and environmental regulations.	Ap	Internal Assessment

UNIT I - OCCUPATION, SAFETY AND MANAGEMENT	**(8)**
Occupational Safety - Health and Environmental Safety Management - Principles & practices - Role of Management in Industrial Safety - Organization Behaviour - Human factors contributing to accident.	
UNIT II - MONITORING FOR SAFETY, HEALTH & ENVIRONMENT	**(9)**
Bureau of Indian Standards on Safety and Health: 14489 - 1998 and 15001 - 2000 - ILO and EPA Standards - Principles of Accident Prevention - Definitions - Incident - accident - injury - dangerous - occurrences - unsafe acts - unsafe conditions - hazards - error - oversight - mistakes.	
UNIT III - EDUCATION, TRAINING AND EMPLOYEE PARTICIPATION IN	**(10)**
Element of training cycle - Techniques of training, design and development of training programs - Training methods and strategies types of training - Competence Building Techniques (CBT) - Employee Participation: Purpose - methods - Role of trade union in SHE.	
UNIT IV - MANAGEMENT INFORMATION SYSTEM	**(9)**
Sources of information on Safety, Health and Environment - Compilation and collation of information - Analysis & use of modern methods of programming - storing and retrieval of MIS for Safety, Health and Environment - QCC HS Computer Software Application	
UNIT V - LEGISLATION ON SAFETY, HEALTH AND ENVIRONMENT	**(9)**
Overview of SHE - The factories act, 1948 (Amended) and Rules - Contract Labour Act - Social Accountability - SA 8000 - Water (Prevention & Control of Pollution) Act 1974 and Rules - Air (Prevention and Control of Pollution) Act 1981 and Rules - Environment Protection Act.	
TOTAL(L:45) =45PERIODS	

TEXTBOOKS:
1. Narayanan K.T., "Safety, Health and Environment Handbook", 1st Edition, McGraw Hill, New Delhi, 2017.
REFERENCES:
1. David Yates W., "Safety Professional's Reference and Study Guide", 2nd Edition, CRC Press Publishers, New Delhi, 2015. 2. Nicholas P. Cheremisinoff & Madelyn L. Graffia, "Environmental and Health and Safety Management - A Guide to Compliance", 1st Edition, William Andrew Publisher, Norwich, 1995.

Mapping of COs with POs / PSOs														
COs	**POs**												**PSOs**	
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
1	2													
2	2													
3		2					2							
4		2					2							
5		2					2			2				
CO (W.A)	**2**	**2**					**2**			**2**				

22CEM04 - GREEN TECHNOLOGY (Common to all branches except CIVIL Branch)					
		L	T	P	C
		3	0	0	3
PREREQUISITE : NIL					
Course Objective:	• To acquire knowledge on green systems and the environment, energy technology and efficiency, and sustainability. • To provide green engineering solutions to energy demand, reduced energy footprint.				

Course Outcomes The students will be able to		Cognitive Level	Weightage of COs in End Semester Examination
CO1	Apply the principles of green engineering and technology.	Ap	20%
CO2	Analyze the type of pollution by evaluating different waste sources, assessing their environmental impact, and comparing waste minimization and recycling strategies.	An	20%
CO3	Illustrate the processes and products to make them green and safe.	Ap	40%
CO4	Apply the design processes and products using green technology.	An	20%
CO5	Prepare a presentation or report on green technology, focusing on its principles, applications, benefits, and real-world case studies in sustainability.	An	Internal Assessment

UNIT I - PRINCIPLES OF GREEN CHEMISTRY	**(8)**
Historical Perspectives and Basic Concepts. The twelve Principles of Green Chemistry and green engineering. Green chemistry metrics- atom economy, E factor, reaction mass efficiency, and other green chemistry metrics, application of green metrics analysis to synthetic plans.	
UNIT II - POLLUTION TYPES	**(9)**
Pollution - types, causes, effects, and abatement. Waste - sources of waste, different types of waste, chemical, physical and biochemical methods of waste minimization and recycling.	
UNIT III - GREEN REAGENTS AND GREEN SYNTHESIS	**(10)**
Environmentally benign processes- alternate solvents- supercritical solvents, ionic liquids, water as a reaction medium, energy - efficient design of processes- photo, electro and sono chemical methods, microwave-assisted reactions	
UNIT IV - DESIGNING GREEN PROCESSES	**(9)**
Safe design, process intensification, in process monitoring. Safe product and process design - Design for degradation, Real-time Analysis for pollution prevention, inherently safer chemistry for accident prevention.	
UNIT V - GREEN NANOTECHNOLOGY	**(9)**
Nanomaterials for water treatment, nanotechnology for renewable energy, nanotechnology for environmental remediation and waste management, nanotechnology products as potential substitutes for harmful chemicals, environmental concerns with nanotechnology.	
TOTAL(L:45) =45PERIODS	

TEXTBOOKS:
1. M. Lancaster, "Green Chemistry - An introductory text ", The Royal Society of Chemistry , 2016. 2. Alexi Lapkin and david Constable (Eds), "Green chemistry metrics", Wiley publications,2008
REFERENCES:
1. Stanley E Manahan, Taylor and Francis, "Environmental chemistry" , 2017. 2. Samir B. Billatos, Nadia A. Basaly, Taylor & Francis, "Green technology and design for the environment" , Washington, DC, 1997.

Mapping of COs with POs / PSOs														
COs	**POs**												**PSOs**	
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
1	2					2	2							
2		2					2							
3	2													
4		2				2								
5		2					2			2				
CO (W.A)	**2**	**2**				**2**	**2**			**2**				

22CEM05 - FUNCTIONAL EFFICIENCY IN BUILDINGS
(Common to all branches except CIVIL Branch)

L	T	P	C
3	0	0	3

PREREQUISITE : NIL

Course Objective:	• To acquire and apply knowledge of energy consumption, passive solar heating and cooling, day lighting, electrical lighting, and building ventilation. • To design energy-efficient buildings that ensure indoor comfort and optimize energy use..

Course Outcomes The students will be able to		Cognitive Level	Weightage of COs in End Semester Examination
CO1	Apply principles of climate adaptation to design buildings that optimize thermal comfort and energy efficiency.	Ap	40%
CO2	Evaluate, optimize, and integrate day lighting and electric lighting systems in building design.	Ap	20%
CO3	Design energy-efficient buildings by applying advanced architectural and engineering principles.	Ap	20%
CO4	Apply energy efficiency design concepts and architectural interventions.	Ap	20%
CO5	Synthesize and present their knowledge of climate adaptation, passive solar heating, day lighting, heat control, and energy-efficient building design.	E	Internal Assessment

UNIT I - INTRODUCTION	**(9)**
Climate adapted and climate rejecting buildings - Heat Transfer - Thermal Storage - Measurement of Radiation - The Greenhouse Effect -Thermal Comfort - Site Planning and Development - Temperature - Humidity - Wind - Sun Path Diagrams - Sun Protection - Types of Shading Devices.	
UNIT II - PASSIVE SOLAR HEATING AND COOLING	**(9)**
General Principles of passive Solar Heating - Water Walls - Concepts - Ventilation - Principles - Case studies - Courtyards - Roof Ponds - Cool Pools - Predicting ventilation in buildings - Window Ventilation Calculations - Evaporation and dehumidification - Zoning - Air Filtration.	
UNIT III - DAYLIGHTING AND ELECTRICAL LIGHTING	**(9)**
Materials, components and details - Insulation - Glazing materials - Day lighting - concepts - Building Design Strategies - Daylight apertures - Light Shelves - Codal requirements - Day lighting design - Electric Lighting - Switching controls - Electric Task Lighting - Electric Light Zones - Power Adjustment Factors.	
UNIT IV - HEAT CONTROL AND VENTILATION	**(9)**
Heat insulation - Terminology - Thermal performance of Building sections - Orientation of buildings - Building characteristics for various climates - Thermal Design of buildings - Ventilation - Minimum standards for ventilation - Ventilation Design - Natural Ventilation.	

UNIT V - DESIGN FOR CLIMATIC ZONES	(9)
Energy efficiency - Design Concepts and Architectural Interventions - Evaporative Cooling - Design of Energy Efficient Buildings for Various Zones - Cold and sunny - Commonly used software packages in energy efficient building analysis and design	
TOTAL (L:45) = 45 PERIODS	

TEXT BOOKS:

1. Brown, G.Z. and DeKay, M., "Sun, Wind and Light - Architectural Design Strategies", John Wiley and Sons Inc, 3rd Edition, 2014.
2. Majumdar, M (Ed), "Energy - Efficient Buildings in India", Tata Energy Research Institute, Ministry of Non-Conventional Energy Sources, 2009.

REFERENCES:

1. Energy Conservation Building Code, CAU of Energy Efficiency, New Delhi, 2018.
2. Handbook on Functional Requirements of Buildings Part 1 to 4 SP : 41 (S and T) 1995
3. John Krigger, Chris Dorsi, "Residential Energy: Cost Savings and Comfort for Existing Buildings", Published by Saturn Resource Management, 2013.

Mapping of COs with POs / PSOs

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	2													
2	2													
3			2	2										
4	2													
5		3				3	2		3	2	3	3		
CO (W.A)	2	2.5	2	2		3	2		3	2	3	3		

22CEM06 - WATER CONSERVATION AND SUSTAINABILITY
(Common to all branches except CIVIL Branch)

L	T	P	C
3	0	0	3

PREREQUISITE : NIL

Course Objective:	• To manage and sustain water systems for built environment and ecosystems.

	Course Outcomes The students will be able to	Cognitive Level	Weightage of COs in End Semester Examination
CO1	Identify the major challenges in water resource management,	Ap	20%
CO2	Evaluate sustainable water systems	An	20%
CO3	Employ modelling, demand-supply management and water accounting to evaluate case studies	Ap	40%
CO4	Explore methods for recycling and reusing water.	Ap	20%
CO5	Conduct a comprehensive report of water conservation strategies, evaluate their effectiveness in different sectors (agriculture, industry, domestic), based on research and case studies.	An	Internal Assessment

UNIT I - INTRODUCTION	**(8)**
Principles of Ecology - Ecosystems - Overview of water resources, concepts and principles of sustainability for freshwater systems, issues and challenges in water resources management, humans and water, sustainable development and water.	
UNIT II - WATER USE AND DEMAND MANAGEMENT	**(9)**
Balancing the diverse needs for water - Cities and towns, urban environment - water supply, sanitation, sustainable development goals, water-wise cities, sustainable urban water systems- Resource crisis - Water, Energy, Food and other resources - Case studies.	
UNIT III - WATER SYSTEMS	**(10)**
Designing water systems - Sustainable water infrastructure planning, trade-offs, Integrated water resources management, water governance, partnership for sustainable water management - case studies	
UNIT IV - WATER TREATMENT AND RECYCLING TECHNOLOGIES	**(9)**
Water treatment processes: filtration, chemical treatment, desalination - Techniques for wastewater treatment and reuse in industrial, agricultural, and municipal sectors - The role of decentralized water systems and greywater recycling - Advances in sustainable water treatment technologies and their environmental benefits.	
UNIT V - POLICY AND COMMUNITY ENGAGEMENT IN WATER CONSERVATION	***(9)***
Policies and regulations at local, national, and international levels - Role of governance and water rights in ensuring equitable access to water resources - Community-based water management - Strategies, awareness, and behavioral change.	
TOTAL(L:45) =45PERIODS	

TEXTBOOKS:

1. Daniel P. Loucks, Eelco van Beek, "Water Resources Systems Planning and Management: An introduction to methods, models and applications". Springer Nature jointly published with Deltares and UNESCO-IHE, 2017.
2. Ramesha Chandrappa and Diganta B. Das, "Sustainable Water Engineering: Theory and Practice". Wiley, 2014

REFERENCES:

1. P D Sharma, "Ecology and Environment", Rastogi Publications, 2011.
2. Peter P. Mollinga, Ajaya Dixit, and Kusum Athukorala, "Integrated Water Resources Management: Global
3. Theory, Emerging Practice and Local Needs". Sage India, 2006.
4. Meir Russ, "Handbook of knowledge management for sustainable water systems". Wiley_Blackwell, 2018
5. X.C.Wang and G. Fu, "Water-wise cities and sustainable water systems: concepts, technologies and applications". IWA Publishing, 2021

Mapping of COs with POs / PSOs

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	2					2								
2		2					2							
3		2												
4	2													
5		2								2	2			
CO (W.A)	2	2				2	2			2	2			

22CEM07 - SUSTAINABILITY AND LIFECYCLE ASSESSMENT
(Common to All branches except CIVIL Branch)

	L	T	P	C
	3	0	0	3

PREREQUISITE : NIL

Course Objective:	• To apply sustainability principles and lifecycle thinking and to design solutions that minimizes negative environmental effects and promotes long-term sustainability.

Course Outcomes The students will be able to		Cognitive Level	Weightage of COs in End Semester Examination
CO1	Identify and analyze key challenges to achieving sustainability.	Ap	20%
CO2	Apply effective waste management strategies.	Ap	20%
CO3	Analyze the consumption patterns and lifecycle impacts of common materials, focusing on sustainability.	An	40%
CO4	Select appropriate renewable energy forms based on environmental, economic, and technical factors.	Ap	20%
CO5	Prepare a detailed report by applying lifecycle assessment tools to evaluate its environmental, social, and economic impacts, and propose sustainable alternatives based on their findings.	An	Internal Assessment

UNIT I - INTRODUCTION TO SUSTAINABILITY	**(8)**
Concept of Sustainability, Sustainable engineering and practices, Pillars of sustainability, Challenges to Sustainability, UNESCO sustainable development goals.	
UNIT II - SUSTAINABILITY INDICATORS	**(9)**
Sustainable development indices, Resources and energy consumption, waste management, GHG emissions and eco-indicators.	
UNIT III - MATERIALS AND SUSTAINABILITY	**(10)**
Materials - understanding the properties beyond engineering parameters, Common materials' consumption and lifecycle patterns, Estimation of embodied energy of materials - Numerical and case.	
UNIT IV - LIFE-CYCLE ANALYSIS OF PRODUCTS AND SYSTEMS	**(9)**
Components of lifecycle analysis and estimation, Estimation of lifecycle, End-of-life analysis - Numerical and case studies.	
UNIT V - STRATEGIES FOR SUSTAINABLE ENGINEERING	**(9)**
Impact assessment/ audit process, Selection of suitable alternatives - 3R strategy and other strategies, Choice of renewable forms, Lifestyle practices, Energy-cost relationships, Promotion of sustainability through incentives.	
TOTAL(L:45) =45PERIODS	

TEXTBOOKS:
1. Tom Theis and Jonathan Tomkin, "Sustainability: A Comprehensive Foundation", OpenStax, 2012. 2. Robert A. Coulam, "Introduction to Sustainability", Pearson publication, 2014.
REFERENCE:
1. Joseph Fiksel, "The Role of Life Cycle Assessment in Sustainable Management" CRCPress,2009.

Mapping of COs with POs / PSOs														
COs	**POs**												**PSOs**	
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
1	2						2							
2	2													
3		2				2								
4	2													
5		2				2	2			2				
CO (W.A)	**2**	**2**				**2**	**2**			**2**				

22CEM08 - GLOBAL WARMING AND CLIMATE CHANGE (Common to all branches except CIVIL Branch)				
	L	**T**	**P**	**C**
	3	**0**	**0**	**3**

PREREQUISITE : NIL

Course Objective:	• To know the basics, and importance of global warming, the concept of mitigation measures against global warming, and the concept of mitigation measures against global warming.

	Course Outcomes The students will be able to	Cognitive Level	Weightage of COs in End Semester Examination
CO1	Describe causes and effects of greenhouse gases	Ap	20%
CO2	Illustrate the components of atmosphere	An	20%
CO3	Explain causes and impact of climate change and global measures taken	An	20%
CO4	Suggest mitigation techniques and measures for climate change	An	40%
CO5	Engage in real-world problem solving and strategic thinking regarding climate change mitigation and adaptation.	An	Internal Assessment

UNIT I - EARTH'S CLIMATE SYSTEM	**(8)**
Role of ozone in environment-ozone layer-ozone depleting gases-Green House Effect, Radiative Effects of Greenhouse Gases - The Hydrological Cycle-Green House Gases and Global Warming - Carbon Cycle.	
UNIT II - ATMOSPHERE AND ITS COMPONENTS	**(9)**
Importance of Atmosphere - Physical Chemical Characteristics of Atmosphere- Vertical structure of the atmosphere - Composition of the atmosphere - Atmospheric stability - Temperature profile of the atmosphere - Lapse rates - Temperature.	
UNIT III - IMPACTS OF CLIMATE CHANGE	**(10)**
Causes of Climate change: Change of Temperature in the environment - Melting of ice Pole-sea level rise - Impacts of Climate Change on various sectors - Agriculture, Forestry and Ecosystem - Water Resources - Human Health - Industry, Settlement and Society - Methods and Scenarios - Projected Impacts for Different Regions - Uncertainties in the Projected Impacts of Climate Change - Risk of Irreversible Changes.	
UNIT IV - OBSERVED CHANGES AND ITS CAUSES	**(9)**
Climate change, Carbon foot print and Carbon credits - CDM- Initiatives in India-Kyoto Protocol-Intergovernmental Panel on Climate change Climate Sensitivity and Feedbacks - The Montreal Protocol - UNFCCC - Evidences of Changes in Climate and Environment - on a Global Scale and in India.	

UNIT V - CLIMATE CHANGE AND MITIGATION MEASURES	(9)
Clean Development Mechanism – Carbon Trading- examples of future Clean Technology - Biodiesel - Natural Compost - Eco-Friendly Plastic - Alternate Energy - Hydrogen - Bio-fuels - Solar Energy - Wind - Hydroelectric Power - Mitigation Efforts in India and Adaptation funding. Key Mitigation Technologies and Practices - Energy Supply - Transport - Buildings - Industry - Agriculture - Forestry - Carbon sequestration - Carbon capture and storage (CCS)- Waste (MSW & Bio waste, Biomedical, Industrial waste - International and Regional cooperation.	
TOTAL(L:45) =45PERIODS	

TEXTBOOKS:

1. Dash Sushil Kumar, "Climate Change - An Indian Perspective", Cambridge University Press India Pvt. Ltd, 2007.

REFERENCES:

1. Adaptation and mitigation of climate change-Scientific Technical Analysis, Cambridge University Press, Cambridge, 2006.
2. J.M. Wallace and P.V. Hobbs, "Atmospheric Science", Elsevier / Academic Press 2006.
3. Jan C. van Dam, Impacts of "Climate Change and Climate Variability on Hydrological Regimes", Cambridge University Press, 2003.

Mapping of COs with POs / PSOs

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	2						2							
2		2												
3	2						2							
4		2				2								
5		2					2			2				
CO (W.A)	2	2				2	2			2				