1.1.3

List of Employability/ Entrepreneurship/ Skill Development Courses with Course Contents

Colour Codes		
Name of the Subjects	Yellow	
Employability Contents	Green	
Entrepreneurship Contents	Light Blue	
Skill Development Contents	Pink	

List of Courses Focus on Employability/ Entrepreneurship/ Skill Development

Department : *Civil Engineering*

Programme Name : *B.Tech, M. Tech & Ph.D*

Academic Year: 2024-25

List of Courses Focus on Employability/ Entrepreneurship/Skill Development

Sr. No.	Course Code	Name of the Course
01.	IPUALL2	Engineering Workshop Practices
02.	CSUATE5	Computer Programming
03.	CSUALE5	Computer Programming Laboratory
04.	CEUBTE1	Engineering Mechanics
05.	CEUBLE1	Engineering Mechanics Laboratory
06.	MEUBLL1	Engineering Graphics
07.	CEUCTT1	Strength of Materials
08.	CEUCTT2	Fluid Mechanics-I
09.	CEUCTT3	Surveying & Geomatics
10.	CEUCTP1	Building Materials & Construction
11.	CEUCTP2	Engineering Geology
12.	CEUCLT1	Survey Lab
13.	CEUCLT2	Fluid Mechanics Lab
14.	CEUDTT1	Structural Analysis-I
15.	CEUDTT2	Fluid Mechanics-II
16.	CEUDTT3	Concrete Technology
17.	CEUDTP1	Estimation and Costing
18.	CEUDTO1	Remote Sensing & GIS
19.	CEUDLT1	Civil Engineering Drawing with Computer Applications
20.	CEUDLT2	Material Testing Lab
21.	CEUDPT1	Mini Project
22.	CEUETT1	Design of Concrete Structures
23.	CEUETT2	Structural Analysis - II
24.	CEUETT3	Highway Engineering
25.	CEUETT4	Geotechnical Engineering-I
26.	CEUETT5	Environmental Engineering - I

27.	CEUETP1	Advanced Solid Mechanics
28.	CEUETP2	Construction Project Planning and Systems
29.	CEUETP3	Infrastructure Planning & Management
30.	CEUETP4	Disaster Preparedness and Planning Management
31.	CEUETP5	Basics of Computational Hydraulics
32.	CEUELT1	Highway Engineering Lab
33.	CEUELT2	Geotechnical Engineering Lab
34.	CEUEPF1	Mini Project-II
35.	CEUFTT1	Design of Steel Structures
36.	CEUFTT2	Environmental Engineering - II
37.	CEUFTT3	Water Resources Engineering -I
38.	CEUFTT4	Geotechnical Engineering-II
39.	CEUFTP1	Advanced Concrete Design
40.	CEUFTP2	Ground Improvement Techniques
41.	CEUFTP3	Sustainable Urban Transportation Planning
42.	CEUFTP4	Open Channel Flow
43.	CEUFTP5	Solid and Hazardous Waste Management
44.	CEUFMO1	MOOCs-1 *
45.	CEUFLT1	Environmental Engineering Lab
46.	CEUFLT2	Computer Applications in Civil Engineering. Lab
47.	CEUFPF1	Mini Project-III
48.	CE208TPC21	Earthquake Resistant Design of Structures
49.	CE208TPE05A	Offshore Engineering
50.	CE208TPE05B	Surface Hydrology
51.	CE208TPE05C	Bridge Engineering
52.	CE208TPE05D	Traffic Engineering
53.	CE208TPE05E	Construction Equipment & Automation
54.	CE208TPE06A	Low Cost Housing Techniques
55.	CE208TPE06B	Water and Air Quality Modelling
56.	CE208TPE06C	Repair and Rehabilitation of Structures
57.	CE208TPE06D	Finite Element Analysis
58.	CE208TPE06E	Urban Hydrology and Hydraulics
59.	CE208TOE03	Infrastructure Planning and Management
60.	CE208PPC11	Major Project
61.	CE208PPC12	Structural Detailing Lab

M. Tech (2023-24)		
1.	CEPATT1	Advanced Structural Analysis
2.	CEPATT2	Advanced Solid Mechanics
3.	CEPATP1	Theory of Thin Plates and Shells
4.	CEPATP2	Theory and Applications of Cement Composites
5.	CEPATP3	Theory of Structural Stability
6.	CEPATP6	Structural Optimization
7.	CEPATP7	Advance Concrete Technology
8.	CEPATP8	Advanced Steel Design
9.	CEPATP9	Design of Formwork
10.	CEPATP10	Design of High-Rise Structures
11.	CEPALT1	Advanced Concrete Lab
12.	CEPBTT1	FEM in Structural Engineering
13.	CEPBTT2	Structural Dynamics
14.	CEPBTP1	Design of Advanced Concrete Structures
15.	CEPBTP2	Advanced Design of Foundations
16.	CEPBTP3	Soil Structure Interaction
17.	CEPBTP4	Design of Industrial Structure
18.	CEPBTP5	Advanced Prestressed Concrete
19.	CEPBTP6	Laminated Composite Plates
20.	CEPBTP7	Fracture Mechanics of Concrete Structures
21.	CEPBTP8	Design of Plates and Shells
22.	CEPBLT1	Computer Applications Lab
23.	CEPBPT1	Mini Project
24.	CEPCPT1	Dissertation Stage–I
25.	CEPDPT1	Dissertation Stage–II
Ph. D (2023-24)		
1.	ETPHDT00	Research Methodology In Engineering
2.	CEPHDT01	Optimization Techniques
3.	CEPHDT02	Finite Element Methods
4.	CEPHDT03	Structural Dynamics
5.	CEPHDT04	Advanced Concrete Technology
6.	CEPHDT05	Concrete Fracture Mechanics
7.	CEPHDT06	Special Concretes
8.	CEPHDT07	Multimodal Transportation System
9.	CEPHDT08	Design And Construction Of Rural Roads

10.	CEPHDT09	Advanced Pavement Materials
11.	CEPHDT10	Transportation Geotechnics
12.	CEPHDT11	Geo-Environmental Engineering
13.	CEPHDT12	River Hydraulics
14.	CEPHDT13	Irrigation Technology and Water Management
15.	CEPHDT14	Open Channel Hydraulics
16.	CEPHDT15	Earthquake Engineering
17.	CEPHDT16	Advanced Solid Mechanics
18.	CEPHDT17	Geo-Informatics
19.	CEPHDT16	Transportation System Design and Management
20.	CEPHDT17	Advance Soil Mechanics
21.	CEPHDT18	Environmental Geotechnics
22.	CEPHDT19	Principles of Ground Modification
23.	CEPHDT20	Soil Remediation

Scheme and Syllabus

SCHOOL OF STUDIES OF ENGINEERING AND TECHNOLOGY

Scheme of Teaching and Evaluation 2022-2023 (As per NEP-2020)

Choice Based Credit System (CBCS) and Outcome Based Education (OBE)

(Effective from the Academic Year 2022–2023)

I-SEMESTER BTech Mechanical/IP/Chemical/Civil Engineering

S.N.	Course Code	Course Title	Teaching Hours/week			Examination				Credits
			Theory lectures	Tutorial	Practical/ Drawing	Examination in Hours	CIA Marks	SEA Marks	Total Marks	
			L	T	P					
1	AMUATB1	Engineering Mathematics - A	3	1	-	03	40	60	100	4
2	CYUATB3	Engineering Chemistry	3	-	-	03	40	60	100	3
3	ECUATE4	Basic Electrical and Electronics Engineering	3	-	-	03	40	60	100	3
4	FOUATC2	Environmental Science and Ecology	2	-	-	03	40	60	100	2
5	CSUATE5	Computer Programming	3	-	-	03	40	60	100	3
6	LAUATC1	Indian Constitution	1	-	-	01	50	-	50	1
7	CYUALB3	Engineering Chemistry Laboratory	-	-	2	03	25	25	50	1
8	CSUALE5	Computer Programming Laboratory	-	-	2	03	25	25	50	1
9	IPUALL2	Engineering Workshop Practices	-	-	2	03	25	25	50	1
10	PEUALS2	Sports and Yoga	-	-	2		25	25	50	1
		Total	**15**	**1**	**08**	**25**	**350**	**400**	**750**	**20**

Note: AM:Mathematics, PP:Physics, ME: Mechanical Engineering, IP: Industrial & Production Engineering, CE: Civil Engineering, CS: Computer Sc. & Engg., IT: Information Technology, PE: Physical Education, FO: Forestry, LA: Law, NS: NSS, U: Undergraduate, T: Theory, L: Laboratory,

BASIC SCIENCE (B)	ENGINEERING SCIENCE (E)	SKILL ENHANCEMENT COURSE (L)	HUMANITIES SCIENCE (H)	MANDATORY COURSE (C)	EXTRA-CURRICULAR ACTIVITIES (S)
1. Mathematics – A 2. Physics 3. Chemistry 4. Mathematics - B	1. Engineering Mechanics 2. Introduction to Information Technology 3. Basic Electrical Engineering 4. Basic Electrical and Electronics Engineering 5. Computer Programming 6. Basic Communication Engineering	1. Engineering Graphics 2. Engineering Workshop Practices	1. English for communication 2. Human Values and Ethics	1. Indian Constitution 2. Environmental Science & Ecology	1. NSS 2.Sports and Yoga

SCHOOL OF STUDIES OF ENGINEERING AND TECHNOLOGY

Scheme of Teaching and Evaluation 2022-2023 (As per NEP-2020)
Choice Based Credit System (CBCS) and Outcome Based Education (OBE)
(Effective from the Academic Year 2022–2023)

II-SEMESTER BTech Mechanical/IP/Chemical/Civil Engineering

S.N.	Course Code	Course Title	Teaching Hours/week			Examination				Credits
			Theory lectures	Tutorial	Practical/ Drawing	Examination in Hours	CIA Marks	SEA Marks	Total Marks	
			L	T	P					
1	AMUBTB4	Engineering Mathematics-B	3	1	-	03	40	60	100	4
2	PPUBTB2	Engineering Physics	3	1	-	03	40	60	100	4
3	ITUBTE2	Introduction to Information Technology	3	-	-	03	40	60	100	3
4	ELUBTH1	English for Communication	3	-	-	03	40	60	100	3
5	CEUBTE1	Engineering Mechanics	3	-	-	03	40	60	100	3
6	ME UBTH2/CH UBTH2/ IP UBTH2/CEUBTH2	Human Values and Ethics	1	-	-	02	50	-	50	1
7	PPUBLB2	Engineering Physics Laboratory	-	-	2	03	25	25	50	1
8	CEUBLE1	Engineering Mechanics Laboratory	-	-	2	03	25	25	50	1
9	MEUBLL1	Engineering Graphics	1	-	3	03	25	25	50	3
10	NSUBLS1	NSS	-	-	2	01	25	25	50	1
Total			**17**	**2**	**09**	**27**	**350**	**400**	**750**	**24**

Note: AM:Mathematics, PP:Physics, ME: Mechanical Engineering, IP: Industrial & Production Engineering, CE: Civil Engineering, CS: Computer Sc. & Engg., IT: Information Technology, PE: Physical Education, NS: NSS, U: Undergraduate, T: Theory, L: Laboratory,

BASIC SCIENCE (B)	ENGINEERING SCIENCE (E)	SKILL ENHANCEMENT COURSE (L)	HUMANITIES SCIENCE (H)	MANDATORY COURSE (C)	EXTRA-CURRICULAR ACTIVITIES (S)
1. Mathematics – A 2. Physics 3. Chemistry 4. Mathematics - B	1. Engineering Mechanics 2. Introduction to Information Technology 3. Basic Electrical Engineering 4. Basic Electrical and Electronics Engineering 5. Computer Programming 6. Basic Communication Engineering	1. Engineering Graphics 2. Engineering Workshop Practices	1. English for communication 2. Human Values and Ethics	1. Indian Constitution 2. Environmental Science & Ecology	1. NSS 2.Sports and Yoga

Scheme of B.Tech. III Semester Civil Engineering (As per NEP 2020, CBCS & OBE)
W.E.F 2023-24 (Even Semester)

S. No	Course Code	Subjects	Periods			Evaluation Scheme				Credits
		Theory	L	T	P	TA	IA	ESE	Total	
1	AMUCTB1	Engineering Mathematics-III	3	0	0	10	30	60	100	3
2	CEUCTT1	Strength of Materials	3	1	0	10	30	60	100	4
3	CEUCTT2	Fluid Mechanics-I	3	0	0	10	30	60	100	3
4	CEUCTT3	Surveying & Geomatics	3	0	0	10	30	60	100	3
5	CEUCTP1	Building Materials & Construction	3	0	0	10	30	60	100	3
	CEUCTP2	Engineering Geology								
	CEUCTP3	Ancient Philosophy of Civil Engineering								
6	CEUCTO1	Green Buildings	3	0	0	10	30	60	100	3
	CHUCTO1	Engineering Materials								
	CSUCTO1	Data Structure with C++								
	ITUCTO1	Computer Organization and Architecture								
	IPUCTO1	I.C. Engine								
	MEUCTO1	Introduction to Thermodynamics								
	ECUCTO1	Data Communication								
Total (A)			18	1	0				600	19
Practical's/Labs										
7	CEUCLT1	Survey Lab	0	0	2		25	25	50	1
8	CEUCLT2	Fluid Mechanics Lab	0	0	2		25	25	50	1
Total(B)			0	0	4				100	2
Total Credits (A+B)									700	21

L-Lecture, T-Tutorial, P-Practical, TA-Teacher Assessment, IA- Internal Assessment {Based on two class tests (CT)of marks-15 each}, ESE-End Sem Examination, NEP-National Education Policy, CBCS-Choice Based Credit System, OBE-Outcome Based Education

Scheme of B.Tech. IV Semester Civil Engineering (As per NEP 2020, CBCS & OBE)
W.E.F 2023-24 (Even Semester)

S.No	Course Code	Subjects	Periods				Evaluation Scheme			Credits
		Theory	L	T	P	TA	IA	ESE	Total	
1	CEUDTT1	Structural Analysis-I	3	1	0	10	30	60	100	4
2	CEUDTT2	Fluid Mechanics-II	3	0	0	10	30	60	100	3
3	CEUDTT3	Concrete Technology	3	0	0	10	30	60	100	3
4	CEUDTP1	Estimation and Costing	3	0	0	10	30	60	100	3
	CEUDTP2	Sustainable Construction								
	CEUDTP3	Ocean Engineering								
5	CEUDTO1	Remote Sensing & GIS	3	0	0	10	30	60	100	3
	CHUDTO1	Fluidization Engineering								
	CSUDTO1	Introduction to Information Science								
	ITUDTO1	Computer Network								
	ITUDTO1	Fundamentals of python programming								
	IPUDTO1	Automobile Engineering								
	MEUDTO1	Introduction to Fluid Mechanics								
	ECUDTO1	Introduction to Electronic Devices & Circuits								
6	CEUDTM1	Management and Organizational Behaviour	2	0	0					0
Total (A)			17	1	0				500	16
Practical's/Labs										
7	CEUDLT1	Civil Engineering Drawing with Computer Applications	0	0	2		25	25	50	1
8	CEUDLT2	Material Testing Lab	0	0	2		25	25	50	1
9	CEUDPT1	Mini Project	0	0	4		50	50	100	2
Total(B)			0	0	8				200	4
Total Credits(A+B)									700	20

L-Lecture, T-Tutorial-Practical, TA-Teacher Assessment, IA- Internal Assessment (Based on two class tests (CT)of marks-15 each), ESE-End Sem Examination, NEP-National Education Policy, CBCS-Choice Based Credit System, OBE-Outcome Based Education

SYLLABUS	(SEMESTER-I)	Periods/ Week			Internal Assessment (IA)				ESE	Grand Total	Credits
Subject Code:	CSUATE5	L	T	P	CT-1	CT-II	Attendance & Assignments	TOTAL	60	100	03
Subject:	COMPUTER PROGRAMMING	3	-	-	15	15	10	40			

Course Objectives:

- To learn the basic ideas of the Algorithms and Flowcharts.
- To learn Basic C concepts Data types and Control statements.
- To learn the Functions and Structure of Array.
- To learn the concepts of Sorting and Searching Algorithms.
- To learn basic concepts of Linked List Notations.

Course Content:

UNIT-1: Introduction to Programming
Introduction to components of a computer system (disks, memory, processor, where a program is stored and executed, operating system, compilers etc.) -
Idea of Algorithm: steps to solve logical and numerical problems. Representation of Algorithm: Flowchart/Pseudo code with examples. From algorithms to programs; source code, variables (with data types) variables and memory locations, Syntax and Logical Errors in compilation, object and executable code.

UNIT-2: Arithmetic expressions and precedence
Conditional Branching and Loops, Writing and evaluation of conditionals and consequent branching Iteration and loops, **Arrays** (1-D, 2-D), Character arrays and strings

UNIT-3: Basic Algorithms
Searching, concept of binary search etc., Basic Sorting Algorithms Bubble sort etc., Finding roots of equations, introduction of Algorithm complexity

UNIT-4: Function
Functions (including using built in libraries), Parameter passing in functions, call by value, passing arrays to functions: idea of call by reference binary search etc.
Recursion functions Recursion, as a different way of solving problems. Example programs, such as, Finding Factorial, Fibonacci series, etc.

UNIT -5: Structure
Structures, Defining structures and Array of Structures
Pointers Idea of pointers, defining pointers, Use of Pointers in self-referential structures, notion of linked list (no implementation)

Course Outcomes- At the end of the course students will be able to
1. Understand the designing of basic level Algorithm and Flowcharts.
2. Understand the C programming fundamentals on the different Control Statements, Functions and Arrays.
3. Understand the Searching, Sorting Algorithms and concepts of linked list operations.

Textbooks/References:
1. Byron Gottfried, Schaum's Outline of Programming with C, McGraw-Hill
2. E. Balaguruswamy, Programming in ANSI C, Tata McGraw-Hill
3. Brian W. Kernighan and Dennis M. Ritchie, the C Programming Language, Prentice Hall of India

Course Outcomes and their mapping with Programme Outcomes: COMPUTER PROGRAMMING (CSUATE5)

CO	PO												PSO		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	2	3	2				1	2	2	1	3	2	2	3
CO2	3	2	3	2	3			1	2	2	1	3	2	2	3
CO3	3	2	3	2	3				2	2	1	3	2	2	2

Weightage: **1-Sightly; 2-Moderately; 3-Strongly**

SYLLABUS	(SEMESTER-I)	Periods/ Week			INTERNAL ASSESSMENT (IA)			ESE	Grand total	Credits
Subject Code:	CSUALE5	L	T	P	IA	MSE	TOTAL			
Subject:	COMPUTER PROGRAMMING LABORATORY	-	-	2	25	--	25	25	50	01

Course Learning Objectives:

- To learn the Branching and logical expressions and Loops
- To learn the Arrays and Function
- To understand the Numerical methods and Recursion

Course Content:

The laboratory should be preceded or followed by a tutorial to explain the approach or Algorithm to be implemented for the problem given.

Tutorial 1: Problem solving using computers:
Lab1: Familiarization with programming environment

Tutorial 2: Variable types and type conversions:
Lab 2: Simple computational problems using arithmetic expressions

Tutorial 3: Branching and logical expressions:
Lab 3: Problems involving if-then-else structures

Tutorial 4: Loops, while and for loops:
Lab 4: Iterative problems e.g., sum of series

Tutorial 5: 1D Arrays: searching, sorting:
Lab 5: 1D Array manipulation

Tutorial 6: 2D arrays and Strings
Lab 6: Matrix problems, String operations

Tutorial 7: Functions, call by value:
Lab 7: Simple functions

Tutorial 8 &9: Numerical methods (Root finding, numerical differentiation, numerical Integration):
Lab 8 and 9: Programming for solving Numerical methods problems

Tutorial 10: Recursion, structure of recursive calls
Lab 10: Recursive functions

Tutorial 11: Pointers, structures and dynamic memory allocation
Lab 11: Pointers and structures

Course Outcomes- At the end of the course students will be able to

1. Design basic level Algorithms and Flowcharts.
2. Understand C programming fundamentals on the different Control Statements, Functions and Arrays.
3. Understand the programing concepts of Recursion, Searching, Sorting Algorithms.
4. Write C programs for basic engineering solutions.

Course Outcomes and their mapping with Programme Outcomes: COMPUTER PROGRAMMING LABORATORY (CSUALE5)

CO	PO												PSO		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	1	2	3				2	1	2	3	3	3	2
CO2	3	3	3	2	2				2	2	2	3	3	3	2
CO3	3	3	3	2	3				2	2	2	3	3	3	2
CO4	3	3	3	2	3				2	3	3	3	3	3	2

Weightage: 1-Sightly; 2-Moderately; 3-Strongly

SYLLABUS	(SEMESTER-I)	Periods/ Week			INTERNAL ASSESSMENT (IA)			ESE	Grand total	Credits
Subject Code:	IPUALL2	L	T	P	IA	MSE	TOTAL	25	50	01
Subject:	ENGINEERING WORKSHOP PRACTICES	-	-	2	25	--	25			

Course objectives:

- To impart student knowledge on various hand tools for usage in engineering applications.
- Be able to use analytical skills for the production of components, electrical switch board wiring and logic gate.

Course Content:

1. Study of M/C tools in lathe machine
   Demonstration of different operations of lathe machine
   Practice of facing plain turning, taper turning etc
2. Study of Carpentry tools, equipments and different jobs
   Practice of Lap joints, Butt joints, T-Lab joints
3. Practice of Lap joint, Butt Joint, T-joint
4. Preparation of ₹ shape, square shape, work pieces as per the given specification
5. Replacement of fuse, condenser of fan/motor and fan regulator;
   Installation of switch board with wiring;
   Concepts of measuring instruments.
6. Identification of various electronics components and their terminals;
   Study of logic gates AND, OR, XOR and NOT, NAND, NOR;
   Study of Basic ICs.

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

1. Understand the appropriate tools, materials, instruments required for specific operations in workshop.
2. Understand the figures of the hand tools used in fitting, carpentry, welding shop and machine tools such as lathe machine.
3. Understand report of procedures followed for a given task in fitting, carpentry, welding and machine shops.
4. Basic understanding of electrical equipment fitting and understanding of electronic logic gates AND, OR, NOT and ICs.
5. Basic understanding of electrical equipment fitting and understanding of electronic logic gates AND, OR, NOT and ICs. Apply techniques to perform basic operations with hand tools and power tools such as center lathe machine, fitting shop, carpentry, welding using given job drawing.

Textbooks/References:

1. Hajra Choudhury S.K., Hajra Choudhury A.K. and Nirjhar Roy S.K., "Elements of WorkshopTechnology", Vol. I 2008 and Vol. II 2010, Media promoters and publishersprivate limited,Mumbai.
2. Kalpakjian S. And Steven S. Schmid, "Manufacturing Engineering and Technology", 4th edition, Pearson Education India Edition,2002.
3. Gowri P. Hariharan and A. Suresh Babu, "Manufacturing Technology – I" Pearson Education, 2008. (iv)Roy A. Lindberg, "Processes and Materials of Manufacture", 4thedition, PrenticeHallIndia, 1998.
4. Rao P.N., "Manufacturing Technology", Vol. I and Vol. II, Tata Mc-Graw Hill House,2017.

Course Outcomes and their mapping with Programme Outcomes: ENGINEERING WORKSHOP PRACTICES (IPUALL2)

CO	PO												PSO		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2								2						
CO2	2								3						
CO3	2								1						
CO4	2								2					1	
CO5	1								3					1	

Weightage: **1-Sightly; 2-Moderately; 3-Strongly**

SYLLABUS	(SEMESTER-II)	Periods/ Week			Internal Assessment (IA)				ESE	Grand Total	Credits
Subject Code:	CEUBTE1	L	T	P	CT-I	CT-II	Attendance & Assignments	TOTAL	60	100	03
Subject:	ENGINEERING MECHANICS	3	0	-	15	15	10	40			

Course Learning Objectives:

- To learn the basics of engineering mechanics and force systems.
- To learn the different type of support reactions and the basics of friction.
- To learn the concepts of centroid, centre of gravity and moment of inertia.
- To learn the basics of linear, curvilinear motions, centripetal and centrifugal forces under dynamics.

UNIT – I
INTRODUCTION: Basic idealization of mechanics, particle, rigid body, mass, time, continuum, force, force system, system of units, principle of transmissibility of forces, principle of superposition.
COPLANAR CONCURRENT FORCE SYSTEM: Resultant of forces. Resolution of forces, Composition of coplanar concurrent, parallel and non-concurrent forces, Moment of a force, Varignon's theorem, free body diagram, equilibrant, equilibrium of particles and rigid bodies.
Self-Study Component: Application of triangle and polygon Law, vector method of resolution and Composition of forces.
UNIT – II
SUPPORT REACTIONS: Types of loads and types of supports, statically determinant beams, Numerical problems on support reactions for beams with point loads (normal and inclined), uniformly distributed load, uniformly varying load and moment.
FRICTION: Introduction, types of friction, laws of friction, angle of friction, angle of repose , cone of friction, characteristics of dry friction, application –body on horizontal plane and inclined plane and ladder friction.
Self-Study Component: Numerical problems on support reaction of beams loaded with trapezoidal loads, Support reactions for Compound beams and wedge friction - numerical problems.
UNIT – III
CENTROID AND CENTRE OF GRAVITY: Introduction to centroid and centre of gravity, Centroid of rectangular, triangular, circle, semicircle, quarter circle lamina and sector from first principles. Numerical problems on Centroid of composite lamina.
Self-Study Component: Determining Centroid for Composite Lamina with openings.
UNIT – IV
MOMENT OF INERTIA: Introduction, radius of gyration, parallel axis theorem, perpendicular axis theorem, polar moment of inertia, moment of inertia of standard geometrical figures by first principles. Numerical problems on moment of inertia of composite sections.
Self-Study Component: Determining moment of Inertia of Composite sections with reference to given axis.
UNIT – V
DYNAMICS: Introduction to dynamics, Classification, linear and curvilinear motion- projectiles, centripetal and centrifugal forces, banking/super elevation.
Introduction to work, power and energy, impulse – numerical problems.
Self-Study Component: Concept of motion with varying acceleration. Collision of elastic bodies.

Text Book(s):
1. S.S Bhavikatti, A text on elements of Civil Engineering and mechanics, New age International publishers, 2015.
2. R.S. Khurmi, A text book of engineering mechanics, S. CHAND & COMPANY LTD.

Reference Book(s):
1. Ramamrutham S: A text book of applied mechanics, Dhanpatrai and sons
2. S. Rajashekaran, G Shankar Subramanian: Engineering Mechanics- Statics and Dynamics, Vikas Publishing House 1999.
3. Ferdinand Beer and Johnson F.R. (Jr) Mechanics for Engineers, Tata Mc Graw-hill Publishing comp. Ltd New Delhi.

Course Outcome:
At the end of this course, students will demonstrate the ability to:
1. Determine the resultant force and moment for a given system of forces
2. Determine the support reactions under different loading conditions in structural members and problems related to friction.
3. Determine the centroid and centre of gravity
4. Determine the moment of inertia
5. Calculate the motion characteristics of a body under dynamic conditions

Course Outcomes and their mapping with Programme Outcomes: ENGINEERING MECHANICS (CEUBTE1)

CO	PO												PSO		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	2			1								3	
CO2	3	3	2			1								3	
CO3	3	3	2			1								3	
CO4	3	3	2			1								3	
CO5	3	3	2			1								3	

Weightage: 1-Sightly, 2-Moderately, 3-Strongly

SYLLABUS	(SEMESTER-II)	Periods/ Week			INTERNAL ASSESSMENT (IA)			ESE	Grand total	Credits
Subject Code:	CEUBLE1	L	T	P	IA	MSE	TOTAL			
Subject:	ENGINEERING MECHANICS LABORATORY	-	-	2	25	--	25	25	50	01

Course Objectives:

- To perform the practical giving basic understanding to fundamental principles of mechanics like parallelogram of forces, triangle of forces and polygon of forces by universal force table
- To perform the practical giving basic understanding to fundamental application of mechanics like screw jack, winchcrab and simple wheel and axle

Course Content: List of Experiments

1. Verification of law of parallelogram of forces.
2. Verification of law of triangle of forces.
3. Verification of law of polygon of forces by universal force table.
4. Verification of law of moment by parallel forces apparatus.
5. Practical verification of forces in the member of jib crane.
6. Practical verification of forces in the member of the truss.
7. Determination of coefficient of friction between two given surfaces by inclined plane method.
8. Determination of efficiency of simple screw jack.
9. Determination of efficiency of single purchase winch crab.
10. Determination of efficiency of double purchase winch crab.
11. Determination of efficiency of simple wheel and axle.

Course Outcome: At the end of the course students will be able to:

1. Verify the fundamental principles of mechanics like parallelogram of forces, triangle of forces and polygon of forces by universal force table
2. Analyze the friction coefficient between two surfaces
3. Calculate the efficiency of screw jack, winch crab and wheel and axle

Course Outcomes and their mapping with Programme Outcomes: ENGINEERING MECHANICS LABORATORY (CEUBLE1)

CO	PO												PSO		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	1						1	1		1	1	2	
CO2	3	2					1		1	1		1	1	2	
CO3	3	2	1				1		1	1		1	1	2	

SYLLABUS	(SEMESTER-II)	Periods/ Week			INTERNAL ASSESSMENT (IA)			ESE	Grand total	Credits
Subject Code:	MEUBLL1	L	T	P	IA	MSE	TOTAL	25	50	01
Subject:	ENGINEERING GRAPHICS	1	-	3	25	--	25			

Course Learning Objectives:

1. To learn the basic of Engineering Drawing and Orthographic Projections
2. To learn the Sections and Sectional Views of Right Angular Solids
3. To learn the Isometric Projections covering and overview of Computer Graphics

UNIT 1:Introduction Engineering Graphics and Engineering Curves: Principles of engineering graphics and their significance – drawing instruments and their use – conventions in drawing – lettering – BIS conventions. Dimensioning rules, geometrical construction. Engineering Curves - Conic Sections, Special Curves-Cycloids, Epicycloids, Hypocycloids, Involutes and trochoid.

UNIT 2:Projection of Points, Straight lines and Planes: Principles of orthographic projections – conventions – first and third angle projections. Projections of points and lines inclined to both the planes. Projections of regular planes, inclined to both planes

UNIT 3:Projections Solids:Introduction, Type of solid, Projections of solids in simple position, Projection of solids with axes inclined to one of the reference planes and parallel to the other, Projections of solids with axes inclined to both H.P. and the V.P.

UNIT 4: Section of Solids and Development of Surfaces: Sectioning of regular solids - Section planes perpendicular to one plane and parallel or inclined to other plane - Development of surfaces of right, regular solids – development of prisms, cylinders, pyramids, cones and their parts.

UNIT 5: Isometric Projections and Orthographic Views: Principles of Isometric Projections-Isometric Scale- Isometric Views Conventions-Plane Figures, Simple and Compound Solids. Conversion of isometric views to orthographic views. Conversion of orthographic views to isometric projections, vice-versa. Introduction to perspective projection.

Computer Aided Drafting: Introduction to computer aided drafting package to make 2-D drawings. Demonstration purpose only - not to be included in examinations.

Textbooks/References:

1. Bhatt N.D., Panchal V.M. & Ingle P.R., (2014), Engineering Drawing, Charotar Publishing House
2. Shah, M.B. & Rana B.C. (2008), Engineering Drawing and Computer Graphics, PearsonEducation
3. Agrawal B. & Agrawal C. M. (2012), Engineering Graphics, TMH Publication
4. Narayana, K.L. & P Kannaiah (2008), Text book on Engineering Drawing, Scitech Publishers
5. CAD Software Theory and User Manuals

Course Outcomes:

At the end of the course, the student shall be able to

1. Describe the fundamentals of engineering drawing and construct basic engineering curves.
2. Enhance visualization skill using projections of points, lines and planes.
3. Enhance visualization skill using projections of solids.
4. Enhance visualization skill using construction of sections of solids and development of surfaces.
5. Comprehend the theory of Orthographic and Isometric projections and views

Course Outcomes and their mapping with PO and PSO: ENGINEERING GRAPHICS (MEUBLL1)

CO	PO												PSO		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2									2					
CO2	1									1					
CO3	3									3					
CO4	3									3				1	
CO5	1									1				1	

Weightage: 1-Slightly; 2-Moderately; 3-Strongly

Course Code	Subjects	Periods			Evaluation Scheme				Credits
		L	T	P	TA	IA	ESE	Total	
CEUCTT1	Strength of Materials	3	1	0	10	30	60	100	4

Course Objective:
The objective of this Course is to:

- To understand the nature of stresses induced in material under different loads
- To plot construct the shear force and bending moments diagrams in determinate beams under gravity loads.
- To study the stress variation in beams subjected to bending and shear.
- To understand the elastic behavior of beams using conceptual theories.
- To study the theory of torsion in solid and hollow circular shafts and stresses developed in cylindrical shells.

Course Content:

Unit 1 : Simple Stress - Strain and Compound Stresses: Types of stress and strains, Mechanicals properties, Hooke's law, stress– strain curve for mild & cast iron, and HYSD. Relation between the elastic moduli & Poisson's ratio, Bars subjected to varying loads, Temperature stresses in composite bars, Elongation of bars of prismatic and non prismatic sections.
Plane Stresses: Stress at a point. Components of stress in rectangular coordinates, Stresses on an inclined plane, Principal stresses & Principle plane, Mohr's circle of stresses.

Unit 2 : Shear Force - Bending Moment: Shear Force & Bending Moment diagrams in statically determinate beams loaded with different load combination, Relationship between Load intensity-Shear Force -Bending Moment, Thrust diagram, Point of contra flexure, loading diagram & Bending moment diagram from shear force diagram, beam with internal hinge.

Unit 3 : Bending Stress : Theory of simple bending, Assumptions, Bending equation, Neutral axis, Determination of bending stresses – section modulus of sections, Combine Bending and Direct Stress.
Shear Stress: Derivation of Shear Stress formula, assumptions, Shear stresses in symmetrical elastic beam with different sections. Shear Centre.

Unit 4 : Slope and Deflections of simple Beams: Derivation of differential equation for deflection, Slope & Deflection of Beams by Double integration method, Macaulay's method & Moment area method for Simply supported, Cantilever beam subjected to point load, UDL, UVL.

Unit 5 : Torsion: Equation of Pure Torsion, Assumptions, and Power transmitted, Stiffness of Shafts, Comparison of Solid & Hollow shaft, Strain energy in Torsion.
Cylindrical Shells: Type of Loads in pressure vessels, Stress Distribution in thin cylinder, Spherical vessels.

Text Books:

1) Strength of Materials – R.K. Rajput (S. Chand & Co.)
2) Strength of Materials – R.K. Bansal (Laxmi Publication)

3) Strength of Materials– S.S Ratnam (Tata McGrawHill)

Reference Books:

1) Strength of Materials – Timoshenko, S. & Gere (CBSPublishers)
2) Introductions to Solid Mechanics –Shames &Pitarresi (Prentice Hall of India)
3) Strength of Materials–S.Ramamurtham (DhanpatRai Publications)

Course Outcomes-
At the end of the course the students will be able to:

CO1 : Determine compound stresses and strains in material under different loads.
CO2 : Draw the shear force and bending moment diagrams for the beam subjected to different loading conditions.
CO3 : Evaluate stresses induced in different cross-sectional members subjected to bending and shear.
CO4 : Evaluate the deflections in beams subjected to different loading conditions.
CO5 : Estimate torsional stress in solid and hollow circular shaft and stresses variation in cylindrical shells.

CO_s	PO_s												PSO_s		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	1			1	1						3		2
CO2	3	2	2	1		1							3	1	2
CO3	3	2	2	1									3	1	2
CO4	3	2	2	1									3		
CO5	3	2	2	1									3	1	2

Course Code	Subject	Periods			Evaluation Scheme				Credits
		L	T	P	TA	IA	ESE	Total	
CEUCTT2	Fluid Mechanics-I	3	0	0	10	30	60	100	3

Course Objectives:

- To introduce and give explanation of fundamentals of Fluid Mechanics and give fundamental knowledge of fluid with its properties, behaviour, forces on various surfaces and stability of submerged and floating body.
- To develop understanding about Kinematics of fluid flow.
- To imbibe basic law of energy and equation used for analysis of dynamic fluids.
- To introduce the importance of fluid Flow in Pipes and determine the losses in a flow system.
- To develop understanding about flow through mouthpieces and orifice

Course Content:

UNIT-1: **Introduction:** Fluid, physical properties of fluids ideal and real fluid, Newtonian and Non-Newtonian Fluid Statics: Pressure density height relationship, pressure measurement by Manometers, Pressure on plane and curved surfaces, centre of pressure, buoyancy, stability of immersed and floating bodies, metacentric height.

UNIT-2: **Kinematics of fluid flow:** Steady and unsteady flow, uniform and non-uniform flow, laminar and turbulent flow, one, two and three dimensional flow, streamlines and path lines, rotational and irrotational flow, continuity equation, three dimensional continuity equation. Velocity potential and stream function.

UNIT-3:**Dynamics of fluid flow:** Euler's equation of motion along a streamline and its integration, Bernoulli's equation and its applications – Pitot tube, Venturimeter, orificemeter, and problems related to application of momentum equations.

UNIT-4: **Flow in Pipes:** Major and minor losses in pipe lines, loss due to sudden contraction & expansion, Pipes in series and parallel Flow in open Channel: Comparison between open channel and pipe flow, definition of uniform and non-uniform flow, Chezy's and Manning's Formula, Hydraulically efficient channel section of rectangular, trapezoidal.

UNIT -5: **Flow through mouthpieces and orifices:** Hydraulic coefficients of orifice, flow through large rectangular orifice, mouthpieces, Borda's mouthpieces. Notches and Weirs: Rectangular, triangular and trapezoidal notches and weir, cippoletti and broad crested weir.

Text Books:

1) Fluid Mechanics and Machines – Dr. A.K. Jain (Khanna Publications)
2) Fluid Mechanics and Machines – Dr. R.K. Bansal (Laxmi Publications)
3) Fluid Mechanics & Hydraulic Machines – Dr. P. N. Modi & S. M. Seth, (Narosa Publishing House)

Reference Books:

1) Mechanics of Fluid – Irving H. Shames (McGraw Hill)

2) Introduction to Fluid Mechanics – James A. Fay (Prentice Hall India)
3) Fluid Mechanics – R.J. Garde (New Age International Publication)
4) Fluid Mechanics – Streeter V.L. & Wylie E.B. (Tata McGraw Hills)
5) Fluid Mechanics – John F Douglas (Pearson Publication)
6) Introduction to Fluid Mechanics Fox, R.W. and McDonald, A.T., John Wiley & Sons.
7) Fluid Mechanics", Streeter, V.L. and Benjamin, W.E., "McGraw-Hill.
8) Fluid Mechanics and Fluid Mechanics Som, S.K. and Biswas, G., Tata McGraw Hill.
9) Introduction to Fluid Mechanics, Fox, R. W. and A. T. McDonald, 6th ed., John Wiley, New York, (2004)

Course Outcomes: At the end of the course students will be able to

CO1 Define fluid properties and state the Newton's law of viscosity with explain the mechanics of fluid at rest .
CO2 Describe the Kinematics of fluid flow.
CO3 Employ Bernoulli's equation for ideal and real fluid flow and deduce expressions for Venturimeter, orifice meter and pitot tube.
CO4 Explain the concept of Flow in Pipes and types of losses in pipe flow.
CO5 Describe Flow through mouthpieces & orifices and distinguish it.

Course Outcomes and their mapping with Programme Outcomes Fluid Mechanics- I (CE203TPC02)

CO_s	PO_s												PSO_s		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	1	2									3	2	2
CO2	3	2	1	2	2								3	2	2
CO3	3	2	1	3									3	2	3
CO4	3	2	2	2	3								3	2	2
CO5	3	2	1	3	2								3	2	3

Weightage: 1-Sightly; 2-Moderately; 3-Strongly

Course Code	Subjects	Periods			Evaluation Scheme				Credits
		L	T	P	TA	IA	ESE	Total	
CEUCTT3	Surveying & Geomatics	3	0	0	10	30	60	100	3

Course Objectives:

- To understand the Concepts of surveying & levelling &its application on the field.
- To learn about the concepts of theodolites, tacheometry & triangulation.
- To understand subsidiary surveying like photographic & hydrographic surveying.
- To learn to apply advanced application of surveying like Remote sensing, EDM.

Course Content:

Unit 1: Introduction to Surveying- Basic Principles, Objectives & Classification of surveying, Survey lines- ranging.
Compass Surveying: Bearing of survey lines (QB & WCB), Local attraction, Dip & Declination.
Levelling: Principles of levelling- Dumpy level, booking and reducing levels, Methods- simple, differential, reciprocal leveling, profile levelling and cross sectioning. Digital and Auto Level, Errors in leveling.

Unit 2: Theodolite and Tacheometry: Vernier theodolites, Temporary and permanent adjustments, Requirements of nonadjustable parts, Measurement of horizontal angle by repetition and reiteration method, Measurement of vertical angles.
Tacheometery: Definitions, Principles of stadia systems, Instrument constants, Substance and Tangential Systems, Construction and use of Reduction Tacheometers.

Unit 3: Triangulation: Triangulation figures, Triangulation stations, Inter visibility of stations, Satellite Stations and reduction to centre.
Theory of Errors – Types, theory of least squares, Weighting of observations, Most probable value, Computation of indirectly observed quantities - method of normal equations.

Unit 4: Photogrammetry: Phototheodolite, principle of the method of terrestrial photogrammetry; Aerial Surveying: scale and distortion of the vertical and tilted photograph.

Unit 5: Principle of Electronic Distance Measurement: Principle, Type, Use, Measurement: Modulation, Types of EDM instruments, Distomat, Total Station – Parts of a Total Station – Accessories –Advantages and Applications.
Remote Sensing: Introduction– Electromagnetic Spectrum, interaction of electromagnetic radiation with the atmosphere and earth surface, remote sensing data acquisition: platforms and sensors, Introduction to GPS.

Text/Reference Books:

1. B.C. Punamia, A. K Jain, SurveyingVol.1&2, Laxmi Publications.
2. Madhu, N, Sathikumar, Rand Satheesh Gobi, Advanced Surveying: TotalStation, GIS and Remote Sensing, Pearson India, 2006.
3. Bhavikatti ,S. S. ,Surveying and Levelling, Vol. I and II,I.K.International,2010
4. Manoj,K.AroraandBadjatia,GeomaticsEngineering,NemChand&Bros,2011

Course Outcomes-

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

CO1: Remember& Understand the principle & classifications of surveying & Apply concepts &techniques of compass surveying & levelling.
CO2: Understand the working of theodolite & apply the concepts of tacheometery.
CO3: Apply the concepts of triangulation & Photogrammetry & Analyze the computations of surveying using theory of errors.
CO4: Employ surveying techniques using advanced surveying equipments & Techniques like EDM's & Remote sensing.

Course Outcomes and their mapping with Programme Outcomes: Surveying & Geomatics (CE23DC303)

COs	POs												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	1		2								3	3	3
CO2	2	1	2	1					1				2	2	3
CO3	3		3	2	3							2	2	3	1
CO4	3	3	3	2								2	2	3	2
CO5															

Weightage:1-Sightly;2-Moderately;3-Strongly

Course Code	Subjects	Periods			Evaluation Scheme				Credits
		L	T	P	TA	IA	ESE	Total	
CEUCTP1	Building Materials & Construction	3	0	0	10	30	60	100	3

Course Objectives:

- To introduce the basic engineering properties of building materials like brick, stones, timber, ceramics,plastics, etc.
- To understand the elementary characteristics of construction materials like cement aggregates, concrete,steel, etc.
- To understand the types of foundations, functions, types of masonry, lintels, etc.
- To learn the structure supporting method like Shoring, Underpinning, and other advanced constructionmaterials & Techniques.

Course Content:

UNIT-1: Bricks, Tiles, Timber; Properties, Classification & application in Construction.

UNIT-2: Miscellaneous Engineering Materials; Ceramics & Glass; Polymers in construction; Plastics & Rubber; Paints & Paint admixtures, Varnishes andDistempers; Composite materials; Adhesives; Thermal Electrical & Sound Insulators.
Other materials for construction; Cost effective materials, industrial byproducts, agricultural byproducts Construction & demolition waste, Introduction to new materials (Survey and study), and locally available materials.

UNIT 3: Cement, Mortar, Aggregate, Admixtures, Concrete and Steel; classification, properties & uses.

UNIT-4: Foundations, Masonry, Arches & Lintels, Door & Window, Sill, Stairs case; Classification Requirements, Uses & Construction, Joints; Construction, Contraction and Expansion Joints in buildings.

UNIT-5: Shoring, Underpinning, Formwork, Scaffolding, Slip form; Types and Construction Practice Advanced Construction Materials & Techniques, Low Cost housing techniques, Damp Proofing, Sound Proofing, and Fire Proofing Construction Practice.
The relevant IS Codes for all the materials and NBC.

Name of Text Books:

1) Building Materials – S.K. Duggal (New Age Publication)
2) Building Materials – S. C. Rangwala (Charotar Publication)
3) Building Construction by S.G. Rangwala, Charter Publishing House, Anand, India.
4) Building Construction by Sushil Kumar, Standard Publ. and Distributors, New Delhi
5) Building Construction by Punmia B.C., Lakshmi Publications, New Delhi.
6) Advanced Building Materials and Construction by Mohan Rai and Jai Sing, CBRI Publication Roorkee
7) Concrete Technology – A.M. Neville & J.J. Brooks (Pearson Education)

1

8) Concrete Technology – M.S. Shetty (S. Chand & Co.)
9) Engineering Materials – Surendra Singh (Laxmi Publication)
10) Construction Engineering and Management – S. Seetharaman (Umesh Publication)
11) Building Materials – Gurucharan Singh (Standard Publishers, Delhi

Course Outcomes:

At the end of the course the students shall be able

CO1 To compare the properties of most common and advanced building materials.
CO2 To understand the typical and potential applications of these materials
CO3 To select the appropriate building material for building construction
CO4 To identify the different components of a building and differentiate various types of foundations, masonry, arches and lintels
CO5 To select the appropriate supporting structure for strengthening of the building

Course Outcomes and their mapping with Programme Outcomes: Building Materials & Construction (CE23DE301)

COs	POs												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2			1		1			1		1	2		
CO2	3	2			1	1	1					1	1	1	
CO3	3	1					1			1			2		
CO4	3	2				1	1						2		
CO5	2	1			1	1	1			1			1		

Weight age: 1-Sightly; 2-Moderately; 3-Strongly

Course Code	Subjects	Periods			Evaluation Scheme				Credits
		L	T	P	TA	IA	ESE	Total	
CEUCTP2	Engineering Geology	3	0	0	10	30	60	100	3

COURSE OBJECTIVES

To describe weathering process and mass movements

- To gain knowledge about various properties of minerals and their engineering significance.
- To acquire knowledge of various classification of rocks.
- To interpret the importance of different geological features and their effects.
- To apply the principles of geological investigations in civil engineering structures.

Course Content:

UNIT I: PHYSICAL GEOLOGY Geology in civil engineering – branches of geology; structure of earth and its composition; weathering of rocks – scale of weathering; soils landforms and processes associated with river, wind, groundwater and sea; relevance to civil engineering; Plate tectonics.

UNIT II: MINEROLOGY Physical properties of minerals – Quartz group, Feldspar group; Pyroxene - hypersthene and augite, Amphibole, hornblende; Mica – muscovite and biotite, Calcite, Gypsum and Clay minerals.

UNIT III: PETROLOGY Classification of rocks - distinction between Igneous, Sedimentary and Metamorphic rocks; Engineering properties of rocks-Description, occurrence, engineering properties, distribution and uses of Granite, Dolerite, Basalt, Sandstone, Limestone, Laterite, Shale, Quartzite, Marble, Slate, Gneiss and Schist.

UNIT IV: STRUCTURAL GEOLOGY AND GEOPHYSICAL METHOD - Geological maps – attitude of beds, study of structures; folds, faults and joints – relevance to civil engineering; Geophysical methods – Seismic and electrical methods for subsurface investigations.

UNIT V: GEOLOGICAL INVESTIGATION - Remote sensing for civil engineering applications; Geological conditions necessary for design and construction of Dams, Reservoirs, Tunnels, and Road cuttings; Coastal protection structures; Investigation of Landslides and earthquakes - causes and mitigation; seismic zonation – seismic zones of India.

TEXT BOOKS :-

1) Parbin Singh, "Engineering and General Geology", S.K. Kataria & Sons, 2008.
2) Venkatareddy. D. Engineering Geology, Vikas Publishing House Pvt. Ltd. 2010.

REFERENCES :-

1) Muthiayya, V.D. (1969), "A Text of Geology", Oxford IBH Publications, Calcutta.

2) Blyth F.G.H. and de Freitas M.H., Geology for Engineers, Edward Arnold, London, 2010.
3) F.G. Bell. Fundamentals of Engineering Geology, B.S. Publications. Hyderabad 2011.
4) Dobrin, M.B An introduction to geophysical prospecting, McGraw-Hill, New Delhi, 1988
5) Varghese, P.C., Engineering Geology for Civil Engineering PHI Learning Private Limited, New Delhi, 2012.
6) MarlandP.Billings, "Structural Geology", PHI Learing Pvt. Ltd. New Delhi, 2012

WEB LINKS :

i. http://studentsuvidha.com/forum/Forum-Engineering-Geology-btech-Notes-study-material
ii. https://www.examrace.com/IES/IES-Free-Study-Material/Civil-Engineering/Engineering-Geology

COURSE OUTCOMES:-

The end of this course, students will be able to :

CO1- Classify the various geological agents and processes involved.
CO2- Identify the available minerals by their properties and behavior.
CO3- Classify and identify the available rock in the construction site.
CO4- Interpret the different geological features and their engineering importance.
CO5- Apply the geological concepts in civil engineering projects.

COs	POs												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2					2	2						2		
CO2	2			2	2				2				2		
CO3	2	2	1	2					2				2		
CO4	2	2		2	2	2	2	2			2	2	2		
CO5			2	2		2	2	2	2		2	2	2		

Weight age: 1-Sightly; 2-Moderately; 3-Strongly

Course Code	Subjects	Periods			Evaluation Scheme				Credits
		L	T	P	TA	IA	ESE	Total	
CEUCLT1	Survey Lab	0	0	2		25	25	50	1

Course Objectives:
The Lab sessions would help in learning:

- Applications of chains & compass in surveying.
- Various Applications of levelling process.
- Use of Plane table surveying in preparing of maps of a location
- Tacheometry & its applications.
- Relative adjustment of non- accessible stations
- Principle & operation of Total Station.

Course Content:
List of experiments:

1. Linear measurement, offsetting using metric chain.
2. Determination of the area of the given field by cross staff survey &metric chain.
3. Compass Open Traversing using prismatic compass and elimination of local attraction.
4. Compass Close Traversing using prismatic compass and elimination of local attraction
5. To find the difference in elevation between the two non-invisible stations by the method of differential levelling.
6. To draw longitudinal profile of the road by the method of profile levelling.
7. To draw Cross-Sectional profile of the road by the method of profile levelling
8. Measurement of horizontal angle by repetition & reiteration method using theodolite.
9. Measurement of vertical angle by using theodolite
10. Determination of Tachometric constants (K & C).
11. Determination of elevation and height by tangential method when both angles are angles of elevation & angles of Depression.
12. Determination of elevation and distance by Stadia Hair method when line of sight inclined Upward & Downward
13. To perform the experiment for reduction to center from different positions of a satellite station when: (i) Satellite station in north position, (ii) Satellite station in left position
14. To perform the experiment for reduction to Centre from different positions of a satellite station when: (i) Satellite station in south position, (ii) Satellite station in right position
15. Traversing of the given area by radiation & intersection method using plane table survey.
16. Find the plane table instrument station using Resection method (Two-point problem & three-point problem)
17. Study of total station

Text Book:

1) Surveying and Levelling. N.N.Basak, 1st Edition, Tata McGraw Hill
2) Surveying (Vol. I & II) – Punmia, B.C. (Laxmi Publications, New Delhi, 1996)
3) Surveying (Vol. I & II) – Kanetkar (Pune VidyarthiGrihaPrakashan, Pune)

Reference Books:

1) Surveying (Vol. II & III) – Agor, R (Khanna publications, Delhi, 1995)
2) Surveying (Vol. II & III) – Arora, K.R. (Standard Book House, Delhi, 1993)
3) Surveying (Vol. I & II) – S.K. Duggal (Tata McGraw Hill)

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

CO1 Remember about conventional surveying tools such as chain/tape, compass, plane table, levels, Theodolite & Tachometer in the field of civil engineering applications such as structural plotting and highway profiling.

CO2 Understand & apply the concepts of Traversing, Plane Table Surveying & Levelling in the surveying field.

CO3 Understand & apply the concepts of Tacheometery & Triangulation in the surveying field.

Course Outcomes and their mapping with Programme Outcomes: Survey Lab (CE23LB301

COs	POs												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	1	1	3								3	3	1
CO2	2	1	2	3	2								2	3	2
CO3	3	2	3	3	2							2	2	1	1

Weightage: 1-Sightly; 2-Moderately; 3-Strongly

Course Code	Subjects	Periods			Evaluation Scheme				Credits
		L	T	P	TA	IA	ESE	Total	
CEUCLT2	Fluid Mechanics Lab	0	0	2		25	25	50	1

Course Objectives:

- To understand the verification of Bernoulli's equation.
- Determination of Meta centric height of ship model
- Calibration of flow measuring devices as Venturimeter
- Calibration of flow measuring devices as Orificemeter.
- Demonstrate and find out co-efficient of velocity for orifice and Mouthpiece.
- Demonstrate and find out co-efficient of discharge for various types notches.
- Determination of friction factor for pipes
- Determination of critical velocity in pipe
- Determination of the co-efficient of pitot tube.
- Determination of coefficient of impact for vanes
- To plot velocity profile across the cross section of pipe
- Determine the Reynold's Number in pipe.
- To learn the Calibration of rectangular sharp cornered weir and to study the pressure distribution on the upstream face of the weir.
- To learn the Calibration of rectangular streamlined weir and to study the pressure distribution on the upstream face of the weir.

Course Content:

List of experiments:

1) To calculate the total energy at different points and plot the graph between total energy vs. distance. (Verification of Bernoulli's equation)
2) To determine the Meta centric height with angle of ship model.
3) To determine the co-efficient of Discharge Cd for Venturimeter
4) To determine the co-efficient of Discharge Cd for Orificemeter.
5) To determine the co-efficient of discharge and the co-efficient of velocity for Orifice.
6) To determine the co-efficient of discharge and the co-efficient of velocity for Mouthpiece.
7) To determine the coefficient of discharge Cd of Rectangular Notch.
8) To determine the coefficient of discharge Cd V Notch - 45 0
9) To determine the coefficient of discharge Cd V Notch - 60 0
10) To determine the friction factor for Darcy-Weisbach equation
11) Experimental determination of critical velocity in pipe.
12) To determine the coefficient of impact for vanes
13) To find the co-efficient of pitot tube
14) To plot velocity profile across the cross section of pipe
15) To determine the Reynold's Number in pipe
16) Calibration of rectangular sharp cornered weir and to study the pressure distribution on the upstream face of the weir.
17) Calibration of rectangular streamlined weir and to study the pressure distribution on the upstream face of the weir.

Course Outcomes-At the end of the course students will be able to

CO1 Verify the basic energy principles (Bernoulli's equation).
CO2 Utilize the basic measurement techniques of fluid flow in Venturimeter.
CO3 Utilize the basic measurement techniques of fluid flow in Orificemeter.
CO4 Gain knowledge to calculate co-efficient of velocity for orifice and Mouthpiece
CO5 Gain knowledge to calculate co-efficient of discharge for various types notches
CO6 Determine the critical velocity in pipe.
CO7 Understand the pipe flow systems and its losses.
CO8 Determine the coefficient of impact for vanes.
CO9 Determine co-efficient of discharge for pitot tube
CO10 Plot velocity profile across the cross section of pipe
CO11 Determine the Reynold's Number in pipe
CO12 Calibrate the rectangular sharp cornered weir and to study the pressure distribution on the upstream face of the weir.
CO13 Calibrate the rectangular streamlined weir and to study the pressure distribution on the upstream face of the weir.

Course Outcomes and their mapping with Programme Outcomes: Fluid Mechanics Lab (CE203PPC02)

COs	POs												PSOs		
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO1	3	3	3	2	1								3	2	2
CO2	3	3	3	2	1								3	2	2
CO3	3	3	2	2	1								3	2	2
CO4	3	3	2	2	1								3	2	2
CO5	3	3	2	2	1								3	2	2
CO6	3	3	3	2	1								3	2	2
CO7	3	3	3	2	1								3	2	2
CO8	3	3	2	2	1								3	2	2
CO9	3	3	3	2	1								3	2	2
CO10	3	3	2	2	1								3	2	2
CO11	3	3	3	2	1								3	2	2
CO12	3	3	2	2	1								3	2	2
CO13	2	2	3	2	1								3	2	2

Weightage: 1-Sightly; 2-Moderately; 3-Strongly

Course Code	Subjects	Periods			Evaluation Scheme				Credits
		L	T	P	TA	IA	ESE	Total	
CEUDTT1	Structural Analysis-I	3	1	0	10	30	60	100	4

Course Objectives:

To study the strain energy principles and their application tobeams and pin joint plane frames
To learn about analysis of arches &cables.
To know how to construct the influence line diagrams for determinate beams and its application to estimate the maximum shear force, bending moment at a section and absolute maximum bending moment in the beams.
To study the construction of influence lines for determinate trusses and three hinged arches and its applications.
To learn about the static indeterminacy of structures and methods of analysis, application of three momenttheorem to beams

Course Content:

UNIT 1: Principle of superposition, virtual work principle, Maxwell reciprocal theorem, deflection of beams using conjugate beam method. Deflection of beams and truss using energy method (Castiglianotheorem), Analysis of plane truss using tension coefficient method (determinate).

UNIT 2: Three-hinged Arches: Bending Moment, Shear force, axial force for three-hinged arches, Analysis ofSuspension Bridge without stiffening girders.

UNIT 3: Influence Lines: Basic concept of moving load and influence line; influence lines for reactions, Shearforce and bending moment for determinate beams; absolute maximum shearing force and bending moment.

UNIT4: Influence lines for three-hinged arches and stresses in simply supported plane determinate trusses.

UNIT 5: Static and kinematic indeterminacy of structure, Method of structural analysis, Analysis of fixed beam, continuous beam using Theorem of three moments, Effect of yielding of supports.

Reference Book:

1. Structural Analysis by Devdas Meenon
2. Fundamental of Structural Analysis by Lee.
3. Elementary structural Analysis by A.K. Jain
4. Advanced Structural Analysis by A. K. Jain
5. Structural Analysis (SI units) by R C hibbeler
6. Structural Analysis by L S nagi & R S Jangid

Course Outcomes:

At the end of the course the students will be able

CO1 To apply the concept of conjugate beam and strain energy methods to estimate the deflections ofdeterminate beams and trusses
CO2 To able to analysis three hinged arches and cables.
CO3 To construct and use the influence lines for estimation of different force functions in

determinatebeams
CO4 To able to draw the ILDs for reactions and internal forces in three hinged arches and determinatetrusses and find their values
CO5 To differentiate the determinate and indeterminate structures and apply the three-moment area theoremfor the analysis of continuous beams and fixed beams

Course Outcomes and their mapping with Programme Outcomes: Structural Analysis-I (CE23TDC401)

Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO 1	3	2	2	2	2							3	1	1	
CO 2	3	3	3	1	2							3	2	1	
CO 3	3	3	2	2	3							3	2	1	
CO 4	3	3	2	2	3							3	2	1	
CO 5	3	3	2	1	2							3	2	1	

Weightage: 1-Sightly; 2-Moderately; 3-Strongly

Course Code	Subjects	Periods			Evaluation Scheme				Credits
		L	T	P	TA	IA	ESE	Total	
CEUDTT2	Fluid Mechanics-II	3	0	0	10	30	60	100	3

Course Objectives:

To introduce and give explanation of fundamentals of turbulent flow in pipe.
To develop understanding about Boundary layer Analysis.
To develop understanding about non-uniform flow in open channel.
To introduce the importance of Compressibility effect in pipe flow.
To develop understanding about Hydraulic Machines.

Course Content:

UNIT 1: Non-uniform flow in open channel: Specific energy, critical flow, analysis of flow over hump and transition, equation of gradually varied flow, hydraulic jump and evaluation of its elements in rectangular channel.

UNIT 2: Boundary layer Analysis: Boundary layer thickness, boundary layer over a flat plate, laminar boundary layer, turbulent boundary layer, and laminar sub layer, Application of momentum equation, local and average friction coefficient. Fluid flow past submerged bodies. Drag and lift, drag on sphere and cylinder Magnus effect.

UNIT 3: Turbulent flow in pipe: Nature of turbulence, free and wall turbulence, turbulent flow in pipes, equation for velocity distribution over smooth and rough surfaces, Colebrook-White equation, Moody's diagram, Explicit equation for friction factors.

UNIT 4: Compressibility effect in pipe flow: Transmission of pressure waves in rigid and elastic pipes, water hammer Dimensional analysis and Hydraulic similitude. Dimensional analysis, Buckingham's theorem, important dimensionless numbers and their significances, geometric, kinematics and dynamicssimilarity, model study.

UNIT 5: Hydraulic Machines: Turbines: Classification of turbines, draft tube, specific speed, unit quantities, and characteristics curves of turbines, and governing of turbine. Pump: Introduction, Centrifugal pumps, efficiencies, specific speed, cavitations, slip, percentage slip.

Name of Text Books:

1. Fluid Mechanics and Machines – Dr. A.K. Jain (Khanna Publications)
2. Fluid Mechanics and Machines – Dr. R.K. Bansal (Laxmi Publications)
3. Fluid Mechanics – Dr. P.N. Modi (Standard Book House)
4. Mechanics of Fluid – Irving H. Shames (McGraw Hill)
5. Introduction to Fluid Mechanics – James A. Fay (Prentice Hall India) Name of

Reference Books:

1. Fluid Machines – Dr. Jagdish Lal (Metropolitan Book Company Private Ltd.)2. Fluid Machines – John P. Douglas (Pearson Publication)

Course Outcomes: At the end of the course students will be able to

CO1 Define Turbulent flow in pipe and velocity equations for smooth and rough boundary of pipe.
CO2 Describe the Boundary layer theory and drag and lift.
CO3 Explain the concept of non-uniform flow in open channel
CO4 Explain the concept of Compressibility effect in pipe flow
CO5 Describe the concept of Hydraulic Machines.

COs	POs												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	3	3	3	2							3	3	2
CO2	3	3	2	2	2	3							3	2	2
CO3	3	3	3	2	3	2							3	2	2
CO4	3	3	2	3	2								3	2	2
CO5	3	2	2	3	3								3	2	3

Course Code	Subjects	Periods			Evaluation Scheme				Credits
		L	T	P	TA	IA	ESE	Total	
CEUDTT3	Concrete Technology	3	0	0	10	30	60	100	3

Course Objectives:

To learn about various ingredients materials of concrete, like cement aggregates, water, etc
To understand the role of various Admixtures added to concrete mixes
To design various grades of concrete as per IS method.
To understand the various testing methods for fresh & hardened properties of concrete.
To learn about various special application concretes.

Course Content:

Unit1: Constituent Material: Cement-Types-Chemical composition and Properties-Tests on cement - IS Specifications- Aggregates-Classification-Mechanical properties and tests as per BIS grading requirements-Water- Quality of water for use in concrete.

Unit 2: Chemical and Mineral Admixtures: Accelerators-Retarders- Plasticizers- Super plasticizers-Water proofers – Mineral Admixtures like Fly Ash, Silica Fume, Ground Granulated Blast Furnace Slag and Metakaolin-Their effects on concrete properties

Unit 3: Proportioning of Concrete Mix: Principles of Mix Proportioning-Properties of concrete related to Mix Design Physical properties of materials required for Mix Design – Design Mix and Nominal Mix-BIS Method of Mix Design – Mix Design Examples

Unit4: Fresh and Hardened Properties of Concrete: Workability-TestsforworkabilityofconcreteSlumpTestandCompactingfactorTest-Segregation and Bleeding-Determination of Compressive and Flexural strength as per BIS – Properties of Hardened Concrete-Determination of Compressive and Flexural Strength-Stress-strain curve for concrete Determination of Young's Modulus.

Unit 5: Special Concretes: Light weight concretes – High strength concrete – Fibre reinforced concrete –Ferrocement–Ready mix concrete–Slurry in filtrated fibrous concrete (IFCON)-Shotcrete–Polymer concrete – High performance concrete- Geopolymer Concrete.

Text Books:

1. Gupta. B.L., Amit Gupta, "ConcreteTechnology",JainBookAgency,2010.
2. Shetty,M.S,"ConcreteTechnology",S.ChandandCompanyLtd,NewDelhi,2003
3. Santha kumar, A.R; "Concrete Technology", Oxford University Press, New Delhi,2007

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4. Neville, A.M; "Properties ofConcrete", Pitman Publishing Limited, London,1995
5. Gambir, M.L; "ConcreteTechnology",3rd Edition, Tata McGraw Hill Publishing Co Ltd, NewDelhi,2007
6. IS10262-1982Recommended Guidelines for Concrete Mix Design, Bureau of Indian Standards, New Delhi, 1998.

Course Outcomes:

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

CO1 Remember & understand properties and role of ingredients like cement, aggregate, admixtures etc. to produce better quality concrete.

CO2 Understand various classification & role of admixtures on properties of concrete.

CO3 Apply design concepts (as per IS method) to design various grades of concrete as per requirement.CO4 Demonstrate destructive, semi-destructive and non-destructive tests for concrete.

CO5 Understand about various special application concretes.

COs	POs												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2			3	2		3	2		3	2		3		2
CO2	1			3	3		3	3		3	3		3		1
CO3	2	2		3			1			3			3		2
CO4				3	2			2	2		3		2	3	2
CO5	2			1	3	3	3	1					3	2	1

Weightage:1-Sigtly;2-Moderately;3-Strongly

Course Code	Subjects	Periods			Evaluation Scheme				Credits
		L	T	P	TA	IA	ESE	Total	
CEUDTP1	Estimation and Costing	3	0	0	10	30	60	100	3

Course Objectives:

The objective of this Course is

1. To able prepare detailed and abstract estimation for the building and other structure.
2. To prepare bill of quantity and schedule of rate for various item of work.
3. To able to value the existing building and property.

UNIT-I
ESTIMATION OF BUILDING

Types of estimates – Units of measurements – Methods of estimates – Advantages. Quantity estimate for load bearing and framed structures - brick work and RCC works only, Steel requirement and Bar bending schedule - Calculation of quantities of earth work excavation, brickwork, PCC, RCC, Plastering, white washing, colour washing and painting/varnishing for shops and residential building with flat roof.

UNIT-II
ESTIMATE OF OTHER STRUCTURES

Estimating of septic tank, soak pit – sanitary and water supply installations – water supply pipe line – sewer line– estimate of bituminous and cement concrete roads

UNIT-III
ANALYSIS OF RATES AND SPECIFICATIONS

Data – Schedule of rates – Analysis of rates – Specifications – sources – General and Detailed Specifications-Material Calculations for each work. - Material cost

UNIT-IV
CONTRACTS AND TENDER

UNIT-V
REPORT WRITING OF PROJECT

Principles for report preparation – report on estimate of residential and industrial building –Roads – Water supply and sanitary installations. Introduction to Value Engineering: Cash flow and cost control. Systems of cost control based on accounting details of spends and periodicity of cost comparison

TEXTBOOKS

1. Dutta. B.N" Estimation and Costing in civil Engineering,27th Edition -2011.
2. Chackraborti .M 'Estimation and Costing Specification and valuation in civil Engineering,24th edition 2010.
3. Rangalwala S C Estimation costing and valuation, Charotar Publishing House"2008
4. Kohli D.D and Kohli. R. C" a TEXT BOOK OF Estimating and Costing,2013.
5. Estimating and Costing: Including Quantity Surveying, Tendering and Evaluation Kataria & Sons, 2010.

Course Outcomes:

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

- **CO1** Prepare detailed estimation and find out the quantity of various works involved in the building.
- **CO2** Estimate the quantity of works involved in road works, water supply and sanitary works and septic tank
- **CO3** Carry out analysis of rates and bill preparation using spreadsheets.
- **CO4** Able to value the building and calculate rent from building.
- **CO5** Estimate the value of buildings.

COs	POs												PSOs		
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	PO 12	PSO 1	PSO 2	PSO 3
CO1						3				3	3		3		2
CO2						3				3	3		3		1
CO3						3				3	3		3		1
CO4						3				3	3		3		1
CO5						3				3	3		3	2	

Course Code	Subjects	Periods			Evaluation Scheme				Credits
		L	T	P	TA	IA	ESE	Total	
CEUDTD1	Remote Sensing & GIS	3	0	0	10	30	60	100	3

Course Objectives:

- Apply the concepts of Photogrametry and its applications such as determination of heights of objects on terrain.
- Understand the basic concept of Remote Sensing and know about different types of satellite and sensors.
- Illustrate Energy interactions with atmosphere and with earth surface features, Interpretation of satellite and top sheet maps.
- Understand different components of GIS and Learning about map projection and coordinate system.
- Develop knowledge on conversion of data from analogue to digital and working with GIS software.

SYLLABUS:

UNIT – I: INTRODUCTION TO PHOTOGRAMMETRY Principles and types of aerial photographs, geometry of vertical and aerial photograph, Scale and Height measurement on single and vertical aerial photograph, Height measurement based on relief displacement, Fundamentals of Stereoscopy, fiducial points, parallax measurement using fiducial line.

UNIT – II: REMOTE SENSING Basic concepts and foundation of Remote Sensing elements, Data information, Remote sensing data collection, Remote sensing advantages and Limitations, Remote sensing process. Electromagnetic spectrum, Energy interaction with atmosphere and with earth surface features (soil, water, and vegetation) Indian Satellites and Sensors characteristics, Map and Image false color composite, introduction to digital data, elements of visual interpretations techniques.

UNIT – III: GEOGRAPHIC INFORMATION SYSTEMS Introduction to GIS, Components of GIS, Geospatial data: Spatial Data – Attribute Data- Joining Spatial and Attribute Data, GIS Operations: Spatial Data input- Attribute Data Management-Data Display-Data Exploration-Data Analysis. **COORDINATE SYSTEMS:** Geographic Coordinate system; Approximation of Earth, Datum: Map Projections; Types of Map Projections-Map Projection Parameters-Commonly used Map Projections – Projected Coordinate Systems.

UNIT – IV: VECTOR DATA MODEL Representation of simple features- Topology and its importance: coverage and its data structure, shape file: data models for composite features Object Based Vector Data Model; Classes and their Relationships: The geo-based data model: Geometric representation of Spatial feature and data structure: Topology rules.

UNIT – V: RASTER DATA MODEL Elements of Raster data model: Types of Raster data: Raster data structure: Data conversion, Integration of Raster and Vector data. Data Input: Metadata: Conversion of Existing data, Creating new data, Remote sensing data, Field data, Digitizing, Scanning, on screen digitizing, importance of source map, Data Editing.

TEXT BOOKS:

1. Bhatta B (2008), Remote sensing and GIS", Oxford University Press
2. Lillesand, T.M, R.W. Kiefer and J.W. Chipman (2013) Remote Sensing and Image Interpretation", Wiley India Pvt. Ltd., New Delhi
3. Schowenger, R. A (2006) Remote Sensing, Elsevier publishers.

4. Parkinson, B. W., Spilker, J. J. (Jr.) (1996). Global Positioning System: Theory & Applications (Volume-I). AIAA, USA
5. Remote Sensing of the environment- An earth resource perspective- 2nd edition- by John R. Jensen, Pearson Education.
6. Introduction to geographic information system- kang – Tsung Chang, Tata McGraw- Hill Education Private Limited.
7. Concepts & Techniques of GIS by C.P. Lo Albert, K.W. Young, Prentice Hall (India) Publications. Remote Sensing and Geographical Information systems by M.Anji Reddy JNTU Hyderabad 2001, B.S. Publications.
8. Principals of Geo physical Information System- Peter A Burragh and Rachael A. Mc Donnell, Oxford Publishers 2004
9. Basics of Remote Sensing and GIS by S. Kumar, laxmi Publications.

REFERENCE BOOKS:

1. Fundamentals of Remote Sensing by George Joseph, Universities Press, 2013.
2. Fundamentals of Geographic Information Systems" by Demers, M.N, Wiley India Pvt. Ltd, 2013. 3. Jensen John R. Introduction to Digital Image Processing: A Remote Sensing Perspective Prentice hall, New Jersey
4. Paul Wolf, Elements of Photogrammetry, McGraw Hill.
5. Leick Alfred, 1995: GPS Satellite Surveying, Wiley Interscience
6. Burrough, P. P. &McDonnel, R. A. (1998). Principles of GIS. Oxford University Press

Course Outcomes:

After completing this course, the student will have acquired the ability on the following. 1. Understand the concepts of Photogrammetry and compute the heights of objects.

CO1 Understand the principles of aerial and satellite remote sensing, Able to comprehend the energy interactions with earth surface features, spectral properties of water bodies.
CO2 Understand the basic concept of GIS and its applications, know different types of data representation in GIS.
CO3 Understand and Develop models for GIS spatial Analysis and will be able to know what the questions that GIS can answer are.
CO4 Apply knowledge of GIS software and able to work with GIS software in various application fields.
CO5 Illustrate spatial and non-spatial data features in GIS and understand the map projections and coordinates systems.
CO6 Apply knowledge of GIS and understand the integration of Remote Sensing and GIS.

COs	POs												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	3											3		2
CO2	3	2											3	2	
CO3				3			2						3	2	
CO4											2		2	3	
CO5			3	2						2			2	3	2

Course Code	Subjects	Periods			Evaluation Scheme				Credits
		L	T	P	TA	IA	ESE	Total	
CEUDLT1	Civil Engineering Drawing with Computer Applications	0	0	2		25	25	50	1

Course Objectives:

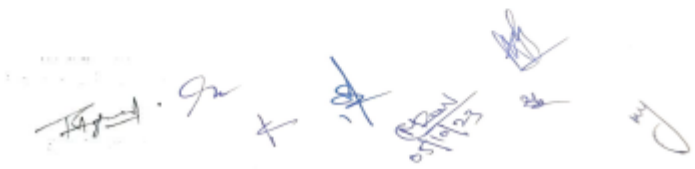
1. To introduce the fundamentals of Civil Engineering drawing.
2. To practice the understanding of the principles of planning.
3. To develop capability to understand and learn drafting of building drawings.
4. To impart knowledge on drafting software such as Auto CAD Course Content:

List of Experiments:

1. To draw various symbols used in building drawings & Learn Bye-Laws of the building drawing.
2. To draw the cross section of a wall (Load bearing & Framed Structures) and its foundation.
3. To draw the line plan of a single storey residential building.
4. To draw the ground floor plan of a residential building.
5. To draw the section for the above plan showing maximum details.
6. To draw the corresponding front elevation of the above residential building.
7. To draw the plan, Elevation and section of a primary school building.
8. To draw the plan, Elevation and section of a hostel building.
9. To draw the plan, Elevation and section of a Primary Health Center building
10. To draw elevation & section of flush shutter, paneled shutter doors and windows.
11. To draw section and elevation of fully glazed, half glazed, half glazed and half paneled doors and windows.
12. To draw Bar Bending Schedule of footing, Beams , Columns & Slab.
13. To draw different stair cases (RC/Steel).
14. To draw the elevations of various types of trusses.

Refrences:

1. National Building Code of India.
2. Building drawing with a ninety grated approach to built environment by M.Shah, C.Kale, S.Patki, Tata McGraw Hill Education; 4th edition.
3. Building Planning and Drawing by M.V. Chitawadagi S.S. Bhavikatti, Dreamtech Press.
4. Civil Engineering Drawing & House Planning: A TextBook by B.P. Verma, Khanna publishers.
5. Civil Engineering Drawing by Rangwala, Charotar Publishing House Pvt.Ltd.
6. Building Planning and Drawing by Dr. N. Kumara Swamy, A. Kameswara Rao, Charotar Publishing House Pvt. Ltd.
7. NKrishna Raju, Structural Design and Drawing, Second Edition, Universities Press (India),



Private Limited, Hyderabad.

Course Outcomes:

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

CO1 Remember & Understand Building Bye-Law & various symbols used for drawings of structures.

CO2 Apply drawing concepts to draw Plans Sections & Elevations for Various types of buildings.

CO3 Apply drawing concepts to draw Sections & Elevations for Various types of Doors, Windows, Staircases and Trusses.

Course Outcomes and their mapping with Programme Outcomes: Computer Aided Civil Engineering Drawing (CE23PLB401)

COs	POs												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	1		1	3	1							2	1	1
CO2	2	1								1			3	2	1
CO3	2	1				1				1			2	1	1

Weightage: 1-Sightly; 2-Moderately; 3-Strongly

Course Code	Subjects	Periods			Evaluation Scheme				Credits
		L	T	P	TA	IA	ESE	Total	
CEUDLT2	Material Test Lab	0	0	2		25	25	50	1

Course Objectives:

- To Remember & understand various Properties of Cement & to learn testing methodology of eachproperties of cement.
- To learn to perform various experiments related to properties of Aggregates.
- To be able to examine the various properties of prefabricated bricks.
- To learn to perform various Destructive & non –destructive tests on concrete.

Course Content:

1.Normal Consistency, Fineness of Cement, Setting times of Cement
2.Specific Gravity of Cement
3.Soundness of Cement
4.Compressive strength of cement
Testing of aggregate:
5.Fineness modulus of Fine and Coarse aggregate
6.Bulk density of aggregate
7.Specific Gravity and Water Absorption of Aggregate
8.Bulking of Sand
Testing of bricks
9.Compressive strength, Water Absorption &Efflorescence of BricksTesting of concrete:
10. Workability of Concrete
11. Compressive strength
12. Modulus of Elasticity
13. Tensile Strength of Concrete
14. NDT Test of Concrete

Text Books / References:

1.Building Materials – S.K. Duggal (New Age Publication) 2. Building Materials – S. C. Rangwala (Charotar Publication)
3.Building Construction by S.G. Rangwala, Charter Publishing House, Anand, India

Course Outcomes: At the end of the course students will be able to:

CO1 Understand & demonstrate various tests on cement, Aggregates & Bricks.
CO2 Design Concrete for desired grade & test its various mechanical properties.
CO3 Demonstrate modern Non – Destructive method of concrete in-situ testing.

COs	POs												PSOs		
PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	
CO1	1	3	1	2	2	1							2		3
CO2	2	2	3	3	2	1							2		2
CO3	1	3	1	3	2	2		2					2	3	2

Course Code	Subjects	Periods			Evaluation Scheme				Credits
		L	T	P	TA	IA	ESE	Total	
CEUDPT1	Mini Project	0	0	4	-	50	50	100	2

Course Outcomes:
After successful completion of this course, the students will be able to
CO1: prepare plan for various types of structures.
CO2: prepare the working and approval drawings for Civil engineering structures
CO3: prepare the project reports in the prescribed formats.
CO4: present project proposals efficiently. Pre-requisites: Nil Course Assessment methods:

Civil Engineering Department, SoS of Engineering and Technology
Guru Ghasidas Vishwavidyalaya, Bilaspur (C.G.)

Scheme & Syllabus of B.Tech. (Civil Engineering) as Per NEP 2020

Syllabus	Semester -V	Teaching Hours/ Week			Continuous Internal Assessment	Semester Examination Assessment	Total Marks	Credits	Pre-requisite Course(s)
Course Code	CEUETT1	L	T	P	CIA	SEA	100	3	CEUBTE1 CEUCTT1, CEUDTT1
Course Name	Design of Concrete Structures	3	0	0	40	60			

Course Objectives:

- To understand the various philosophies of design of concrete structures using IS Codes.
- To understand the design beam for flexure, shear, bond, and torsion
- To know the design of slabs and staircases and their detailing.
- To learn the design of axially and eccentrically loaded columns.
- To know about different types of footings and their reinforcement detailing.

Unit	Content	Teaching/ Lecture Hours
I	Introduction to design of concrete structures-limit state analysis and design of beams for flexure and bond.	10
II	Shear and Torsion	8
III	One-way slabs, Staircases, Two-way slabs	10
IV	Axially and eccentrically loaded columns (Uniaxial only).	8
V	Footings – different types of footings, Design of isolated footing, synthesis of limit state, and working Stress methods.	8
	Total Lecture Hours	44

Course Outcomes: At the end of the course completion, a student is able

CO1 To adopt limit state design philosophy for deign of reinforced concrete.
CO2 To carry out the design of RC structural elements for flexure, bond, shear, and torsion.
CO3 To implement the design of slabs and staircases as per LSD.
CO4 To design RC structural columns subjected to axial and eccentric loads.
CO5 To propose and design the type of footing for an RC structure.

Text Books: -

1 Krishna, R. N. (2007). Reinforced Concrete Design: Principles And Practice. New Age International.
2 Varghese, P. C. (2008). Limit State Design of Reinforced Concrete. PHI Learning Pvt. Ltd.
3 Unnikrishna Pillai,S & Devdas Menon. (2021/4th Ed.), Reinforced Concrete Design. TMH Edu. Pvt. Ltd.

Reference Books: -

1 Subramanian, N. (2013). Reinforced Concrete Structures. Oxford University Press.
2 Syal, I. C., & Goel, A. K. (2008). Reinforced Concrete Structure. S. Chand Publishing.
3 Punmia, B. C., Jain, A. K., Jain, A. K., Jain, A. K., & Jain, A. K. (2007). Limit State Design of Reinforced Concrete. Firewall Media.

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Scheme & Syllabus of B.Tech. (Civil Engineering) as Per NEP 2020

COs, POs, and PSOs Mapping (Design of Concrete Structures- CEUETT1)

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

Scheme & Syllabus of B.Tech. (Civil Engineering) as Per NEP 2020

Syllabus	Semester -V	Teaching Hours/ Week			Continuous Internal Assessment	Semester Examination Assessment	Total Marks	Credits	Pre - requisite Course(s)
Course Code	CEUETT2	L	T	P	CIA	SEA	100	3	CEUDTT1
Course Name	Structural Analysis - II	3	0	0	40	60			

Course Objectives:

- To understand the principles of energy methods and their applications to indeterminate beams and plane frames.
- To know the principles and applications of slope deflection method to the indeterminate beams and rigid frames.
- To study the principles of the moment distribution method and its applications to indeterminate beams and rigid joint plane frames.
- To study the principles of matrix methods and their applications to beams.
- To apply the Muller Breslau Principle for constructing influence lines to indeterminate beams and two-hinged arches.

Unit	Content	Teaching /Lecture Hours
I	Analysis of indeterminate beams by consistent deformation methods and analysis of indeterminate rigid plane frames and trusses using the energy method.	8
II	Slope Deflection Method: Continuous beams and rigid joint plane frames by moment distribution due to loads and yielding of supports.	8
III	Moment-distribution method. Continuous beams and rigid joint plane frames by moment distribution method due to loads and yielding of supports.	10
IV	Introduction to Flexibility Matrix and Stiffness Matrix methods: Applications of the methods to simple indeterminate beams.	10
V	Analysis of symmetrical two hinge arches (parabolic and circular). Influence lines for propped cantilevers and continuous beams using Muller-Breslau's principle.	9
	Total Lecture Hours	45

Course Outcomes: At the end of the course completion, a student is able

CO1 To identify the suitable method of analysis for the analysis of indeterminate beams and trusses and analyses the same using consistent deformation method and energy method.
CO2 To analyze the indeterminate beams and rigid joint plane frames using slope deflection and moment distribution methods.
CO3 To analyze the mechanisms of slope stability and implement methods like Bishop's method for slope stability analysis.
CO4 To apply and analyze the indeterminate beams using matrix methods.
CO5 To construct the influence lines for stress resultants in indeterminate beams and two-hinged arches and analyze the same for moving loads.

Text Books: -

1 Menon, D. (2017). Structural Analysis (2nd ed.). Alpha Science International, Limited.
2 Wang, C. K. (2017). Intermediate Structural Analysis (1st ed.). McGraw Hill Education.
3 Leet, K. M. (2007). Fundamentals of Structural Analysis (3rd ed.). McGraw-Hill Higher Education.

Scheme & Syllabus of B.Tech. (Civil Engineering) as Per NEP 2020

Reference Books: -

1 Hibbler, R. C. (2019). Structural Analysis (SI units) (10th ed.). Pearson.
2 Jain, A. K. (2015). Advanced Structural Analysis (3rd ed.). Nem Chand & Bros.
3 Negi, L. S., & Jangid, R. S. (1997). Structural Analysis (1st ed.). Tata McGraw Hill.

COs, POs, and PSOs Mapping (Structural Analysis – II- CEUETT2)

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

Scheme & Syllabus of B.Tech. (Civil Engineering) as Per NEP 2020

Syllabus	Semester -V	Teaching Hours/ Week			Continuous Internal Assessment	Semester Examination Assessment	Total Marks	Credits	Pre-requisite Course(s)
Course Code	CEUETT3	L	T	P	CIA	SEA	100	3	Nil
Course Name	Highway Engineering	3	0	0	40	60			

Course Objectives:

- To understand the importance of transportation and characteristics of highway transport.
- To study the geometric design of highways
- To understand the traffic characteristics.
- To recognize the pavement materials.
- To understand the design concept of flexible and rigid pavement.

Unit	Content	Teaching/ Lecture Hours
I	Introduction: Role of transportation, Modes of transportation, characteristics of highway transport, Road development and planning in India, Road's classification, patterns, Engineering surveys for highway locations.	6
II	Geometric Design of Highway: Factors controlling the geometric design, Basic consideration for the design of highway, Cross-sectional element, Sight distance, Curve, Design of horizontal alignment, Transition curves, Set back distance, and Design of vertical alignment.	10
III	Traffic Engineering: Functions of traffic engineering, Traffic characteristics, Traffic studies on flow and speed, Peak hour factor, Accident study, Statistical analysis of traffic data, Microscopic and macroscopic parameters of traffic flow, Fundamental relationships, Traffic signs, Signal design by Webster's method, Types of intersection, Highway capacity, Level of service.	10
IV	Highway Materials: Subgrade soil, Plate bearing test, California bearing ratio test, Desirable properties of road aggregates, Test for road aggregates, Bitumen, Tar, Mix design, Marshall mix design.	8
V	Pavement Design: Types of pavement structure, Functions of pavement components, Design factors, Design of flexible pavement, Design of rigid pavement, Design of joint.	10
	Total Lecture Hours	44

Course Outcomes: At the end of the course completion, a student is able

CO1 To propose modes of transportation, transportation planning and survey.
CO2 To design cross-section elements, sight distance, horizontal and vertical alignment
CO3 To analyze traffic studies, traffic regulations and carryout control and intersection designs.
CO4 To interpret the properties of pavement materials
CO5 To design flexible and rigid pavements as per IRC specifications.

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Text Books: -

1 Kadiyali, L. R., & Lab, N. B. (2012). Principle and Practices of Highway Engineering. Khanna Publishers.
2 Khanna, S. K., & Justo, C. E. G. (2011). Highway Engineering. Khanna Publishers.
3 Rangawala, S. C. (2015). Highway Engineering. Charotar Publishing House Pvt. Ltd.
4 Khisty, C. J., & Lall, B. K. (2002). Transportation Engineering: An Introduction (3rd ed.). Prentice Hall.

Reference Books: -

1 Ministry of Road Transport and Highways (MoRTH). (2013). Specifications for Road and Bridge Works. Indian Roads Congress.
2 Indian Roads Congress. (2017). Indian Highway Capacity Manual. Indian Roads Congress.

COs, POs, and PSOs Mapping (Transportation Engineering- CEUETT3)

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

Scheme & Syllabus of B.Tech. (Civil Engineering) as Per NEP 2020

Syllabus	Semester -V	Teaching Hours/ Week			Continuous Internal Assessment	Semester Examination Assessment	Total Marks	Credits	Pre-requisite Course(s)
Course Code	CEUETT4	L	T	P	CIA	SEA	100	3	Nil
Course Name	Geotechnical Engineering - I	3	0	0	40	60			

Course Objectives:

- To understand the fundamental principles of soil formation, classification, and properties to assess soil types.
- To develop the ability to analyze soil permeability, apply Darcy's Law, and construct flow nets for various seepage problems
- To understand and apply the principles of effective stress, compaction, and consolidation to predict and mitigate soil deformation and settlement in engineering projects.
- To understand and evaluate the stresses and shear strength characteristics in soil masses to determine the stability and safety of geotechnical structures

Unit	Content	Teaching/ Lecture Hours
I	Soil Formation, Soil Types, Composition, Three-Phase System and Phase Relationships, Index Properties; Unified and Indian Standard Soil Classification System; Clay Minerals, Clay Water Relations, Field Identification Tests	8
II	Darcy's Law, Permeability - One-Dimensional Flow, Determination of Permeability, Equivalent Permeability in Stratified Soils, In-Situ Permeability Test Seepage Through Soils – Two - Dimensional Flow, Flow Nets, Uplift Pressure, Piping, Capillarity, Seepage Force, Confined and Unconfined Flows, Filter Criteria	9
III	Stresses in Soil Mass: Normal and Shear Stress on Plane, Geostatic Stresses, Stress Caused by point load, line load, and strip load, Vertical Stress due to embankment loading, vertical stresses below uniformly loaded circular area, vertical stress caused by rectangular loaded area, Boussinesq's Theory, Newmark's Influence Chart, Contact pressure	10
IV	Principle Of Effective Stress and Quicksand Condition; General Principles of Compaction, Compaction Tests, Factors Affecting Compaction, Field Compaction, Compaction Techniques; Fundamentals, 1-D Consolidation, Normally and Over-Consolidated Clays, Void Ratio – Pressure Relationships, Compressibility Characteristics, Time Rate of Consolidation, Coefficient of Consolidation, Settlement, Secondary Consolidation.	8
V	Shear Strength, Mohr's Circle, Effective and Total Shear Strength Parameters, Stress-Strain Characteristics of Clays and Sand; Mohr-Coulomb Failure Criterion, Direct Shear Test, Unconfined Compression Test, Triaxial Shear Test: Consolidated Drained, Consolidated Undrained, Unconsolidated Undrained, Vane Shear Test, Shear Strength of Clays and Sands, Critical Void Ratio, Stress Path, Pore-Pressure Coefficient.	8
	Total Lecture Hours	43

Scheme & Syllabus of B.Tech. (Civil Engineering) as Per NEP 2020

Course Outcomes: At the end of the course completion, a student is able

CO1 To identify and classify different types of soils using the Unified and Indian Standard Soil Classification Systems and conduct field identification tests

CO2 To measure and interpret permeability and seepage through soils, utilizing Darcy's Law, flow nets, and in-situ tests to determine soil filtration and drainage properties.

CO3 To calculate stresses in soil masses using various theoretical approaches such as Boussinesq's Theory and Newmark's Influence Chart

CO4 To demonstrate knowledge of compaction principles and consolidation processes to predict the behavior of normally and over-consolidated clays and calculate the settlement of the structure

CO5 To perform and evaluate shear strength tests, including Direct Shear, Unconfined Compression, and Triaxial Shear Tests, to determine the stress-strain characteristics and failure criteria of clays and sands.

Text Books: -

1 Das, B. M. (2018). Principles of Geotechnical Engineering (9th ed.). Cengage Learning.
2 Craig, R. F. (2004). Soil Mechanics (7th ed.). CRC Press.
3 Coduto, D. P., Kitch, W. A., & Yeung, M. R. (2010). Geotechnical Engineering: Principles and Practices (2nd ed.). Pearson.

Reference Books: -

1 Holtz, R. D., Kovacs, W. D., & Sheahan, T. C. (2011). An Introduction to Geotechnical Engineering (2nd ed.). Pearson.
2 Terzaghi, K., Peck, R. B., & Mesri, G. (1996). Soil Mechanics in Engineering Practice (3rd ed.). Wiley.
3 Lambe, T. W., & Whitman, R. V. (1969). Soil Mechanics. Wiley.

COs, POs, and PSOs Mapping (Geotechnical Engineering – I- CEUETT4)

PO / CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 11	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO1	3	3	3	3									3	2	2
CO2	3	3	3	3									3	2	2
CO3	3	3	3	3									3	2	2
CO4	3	3	3	3									3	2	2
CO5	3	3	3	3									3	2	2

Scheme & Syllabus of B.Tech. (Civil Engineering) as Per NEP 2020

Syllabus	Semester -V	Teaching Hours/ Week			Continuous Internal Assessment	Semester Examination Assessment	Total Marks	Credits	Pre-requisite Course(s)
Course Code	CEUETT5	L	T	P	CIA	SEA	100	3	Nil
Course Name	Environmental Engineering - I	3	0	0	40	60			

Course Objectives:

- To learn the water sources, demand, and water quantity estimation techniques.
- To know the water characterization and various physical and chemical treatment techniques.
- To learn the basics of water supply, purification, and treatment
- To learn filtration, coagulation, and softening techniques & mechanisms for water treatment.
- To study distribution systems

Unit	Content	Teaching/ Lecture Hours
I	Introduction: Necessity and importance of water supply schemes. Water demand: Classification of water demands, Estimation of the quantity of water required by a town, per capita demand, factors affecting per capita demand, design period and population forecasting, and variation in water demand.	10
II	Sources of water supply: Surface sources and underground sources, Intake works, site selection, type of intake works	8
III	**Quality of water:** Common impurities, physical, chemical, and biological characteristics of water, and water quality standards for municipal and domestic supplies.	8
IV	Treatment of water: Object of water processing, flow diagrams of typical ground water system and surface water systems. Sedimentation Theory of sedimentation, sedimentation tanks and its types, design parameters related with sedimentation tanks, sedimentation with coagulations, coagulants and coagulant aids, Jar test for determining coagulant dosage. Filtration: Theory of filtration, slow sand and rapid sand filters, Construction and operation. Disinfection: Methods of disinfection, Chlorination, Types of chlorination, Break Point chlorination. Softening: Methods of Softening, Iron Removal, Fluoridization.	10
V	Distribution System: Methods of distribution, layout of distribution system, methods of analysis, pressure in the distribution system, distribution reservoirs, functions, and its types,	8
	Total Lecture Hours	44

Course Outcomes: At the end of the course completion, a student is able

CO1 To forecast the population and design water supply schemes.
CO2 To identify the various constituents present in a water sample
CO3 To demonstrate water quality concepts and their effect on the treatment process selection.
CO4 To identify different treatment units in a water treatment plant and formulate their design procedures.
CO5 To design various water distribution network systems.

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Text Books: -

1 Garg, S. K. (2010). Water Supply Engineering (8th ed.). Khanna Publishers.
2 Punmia, B. C., Jain, A. K., & Jain, A. K. (2010). Water Supply Engineering. Laxmi Publications.
3 Peavy, H. S., Rowe, D. R., & Tchobanoglous, G. (1985). Environmental Engineering. McGraw-Hill Education.
4 Birdi, G. S. (2005). Water Supply and Sanitary Engineering. Dhanpat Rai Publications
5 Anjaneyulu, Y. (2004). Introduction to Environmental Science. B.S. Publications.
6 Henry, J. G., & Heinke, G. W. (2004). Environmental Science and Engineering (2nd ed.). Pearson Education.

Reference Books: -

1 Garg, S. K. (2010). Water Supply Engineering (8th ed.). Khanna Publishers.
2 Birdi, G. S. (2005). Water Supply and Sanitary Engineering. Dhanpat Rai Publications
3 Anjaneyulu, Y. (2004). Introduction to Environmental Science. B.S. Publications.
4 Henry, J. G., & Heinke, G. W. (2004). Environmental Science and Engineering (2nd ed.). Pearson Education.

COs, POs, and PSOs Mapping (Environmental Engineering – I- CEUETT5)

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

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Syllabus	Semester -V	Teaching Hours/ Week			Continuous Internal Assessment	Semester Examination Assessment	Total Marks	Credits	Pre-requisite Course(s)
Course Code	CEUETP1	L	T	P	CIA	SEA	100	3	CEUCTT1
Course Name	Advanced Solid Mechanics	3	0	0	40	60			

Course Objectives:

- Understand and apply elasticity principles to analyze three-dimensional stress and strain.
- Analyze beam behavior under unsymmetrical bending and determine shear center and stress distributions.
- Solve problems related to thick-walled cylinders under internal and external pressures.
- Evaluate torsion effects in various non-prismatic and thin-walled sections.
- Apply plastic analysis to determine collapse loads and plastic hinge behavior in beams.

Unit	Content	Teaching/ Lecture Hours
I	**Concept of Elasticity:** Stresses in three dimensional bodies, equations of equilibrium, strain displacement relations, stress strain relations, compatibility equations, boundary conditions, plane stress, governing differential equation, Airy stress function(Cartesian co-ordinates).	8
II	**Unsymmetrical bending:** Properties of beam cross-sections slope of neutral axis, stresses and deflections in unsymmetrical bending. Shear Flow and Shear centre of thin wall beam cross section.	9
	Curved beams: Bending of beams of large initial curvature, stress distribution in beams with rectangular, circular and trapezoidal cross sections	
III	**Thick walled cylinders:** Thick-walled cylinder subjected to internal and external pressures-Lames-problems, Compound cylinders, Sphere with purely radial displacements, rotating disc of uniform thickness, rotating shafts and cylinders.	9
IV	**Torsion:** Torsion of Non Prismatic Members- Circular, Elliptical, Triangular bars, Torsion of thin-walled tubes and multiple closed sections, center of twist and flexure center.	9
	Column- Column with eccentric loading, Uniaxial and Bi-axial Bending, Unsymmetrical section as Strut	
V	**Plastic Analysis of Beams**: Plastic Modulus, Shape factor, plastic hinge, application to beams, and determination of collapse loads.	8
	Total Lecture Hours	43

Course Outcomes: At the end of the course completion, a student is able

CO1 Model and solve three-dimensional elasticity problems accurately.

CO2 Calculate stress, deflection and shear center for unsymmetrical bending scenarios.

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CO3 Analyze stress distribution in thick-walled cylinders and other cylindrical structures.

CO4 Solve torsion problems for various cross-sections and determine twist and flexure center.

CO5 Perform plastic analysis to find collapse loads and plastic hinge locations in beams

Text Books: -

1 L. S. Srinath, Advanced Mechanics of Solids, Tata-McGraw Hill Publishing Co. Ltd., New Delhi.

2 S. P. Timoshenko, Strength of Materials, Part I and II, D. Van Nostrand Company Inc.

Reference Books: -

1. P. Boresi, R. J. Schmidth and O. M. Sidebottom, Advanced Mechanics of Materials, John Wiley and Sons.
2. F. B. Seely and J. O. Smith, Advanced Mechanics of Materials, John Wiley and Sons.
3. S. P. Timoshenko and J. N. Goodier, Theories of Elasticity, McGraw Hill Publisher

COs, POs, and PSOs Mapping (Advanced Solid Mechanics: CEUETP1)

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

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Scheme & Syllabus of B.Tech. (Civil Engineering) as Per NEP 2020

Syllabus	Semester -V	Teaching Hours/ Week			Continuous Internal Assessment	Semester Examination Assessment	Total Marks	Credits	Pre-requisite Course(s)
Course Code	CEUETP2	L	T	P	CIA	SEA	100	3	Nil
Course Name	Construction Project Planning and Systems	3	0	0	40	60			

Course Objectives:

- To understand the project management and different scheduling techniques.
- To expertise in PERT network analysis.
- To learn CPM network analysis and compare it with PERT.
- To understand time-cost analysis and resource scheduling.
- To understand the factors for equipment selection, cost of owning and operating, and basic knowledge of different equipment used in the construction industry.

Unit	Content	Teaching/ Lecture Hours
I	**Introduction**: Objectives and functions of project management, project feasibility reports, Planning for construction projects: Steps, factors, advantages, and disadvantages for the different stakeholders. Construction Finance and control. **Scheduling**: Scheduling job layout and line of balance, project management through networking, bar chart, linked bar chart, work breakdown structures, and activity-on-arrow diagrams.	8
II	**PERT**: Network analysis, critical path, probability of project.	8
III	**CPM:** Network analysis, Critical Path, Difference between CPM and PERT.	8
IV	**Time-cost relationship**: Direct and Indirect cost. **Resource allocation**: Resource smoothing and Resource leveling **Construction safety management**: Importance, causes of accidents, safety measures, responsibility for safety, and safety benefits to various parties.	9
V	Classification of construction equipment, Standard and special equipment, factors affecting selection of construction equipment, cost of owning and operating the Construction Equipment, Basics of Excavators, Lifting, Hauling, Converting, and concreting equipment. Time and Motion studies	9
	Total Lecture Hours	42

Course Outcomes: At the end of the course completion, a student is able

CO1 To apply the knowledge in managing and handling of different civil engineering project and also able to schedule the project.

CO2 To do PERT analysis and able to find the project completion time and its probability.

CO3 To do CPM analysis and able to find the project completion time and compare with PERT analysis.

CO4 To do cost and time analysis and also resource allocation, scheduling and crashing for different activities of the network.

CO5 To apply the knowledge in equipment selection and able to find cost of owing and operating, which help in comparisons of different equipment's.

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Text Books: -

1 Seetharaman, S. (1997). Construction Engineering and Management. Umesh Publications.
2 Punmia, B. C., & Khandelwal, K. K. (1997). PERT & CPM. Laxmi Publications.
3 Sen Gupta, & Guha. (1995). Construction Management and Planning. Tata McGraw Hill

Reference Books: -

1 Chitkara, K. K. (1998). Construction Project Management Planning, Scheduling and Control. Tata McGraw-Hill Publishing Co.
2 Srinath, L. S. (2001). PERT and CPM Principles and Applications. Affiliated East-West Press.
3 Hendrickson, C., & Au, T. (2000). Project Management for Construction – Fundamentals Concepts for Owners, Engineers, Architects and Builders. Prentice Hall.
4 Moder, J., Phillips, C., & Davis, E. (1983). Project Management with CPM, PERT and Precedence Diagramming (3rd ed.). Van Nostrand Reinhold Co
5 Halpin, D. W. (1985). *Financial and Cost Concepts for Construction Management*. John Wiley and Sons.

COs, POs, and PSOs Mapping (Construction Project Planning and System: CEUETP2)

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

Scheme & Syllabus of B.Tech. (Civil Engineering) as Per NEP 2020

Syllabus	Semester -V	Teaching Hours/ Week			Continuous Internal Assessment	Semester Examination Assessment	Total Marks	Credits	Pre-requisite Course(s)
Course Code	CEUETP3	L	T	P	CIA	SEA	100	3	Nil
Course Name	Infrastructure Planning & Management	3	0	0	40	60			

Course Objectives:

- To remember & understand various concepts of infrastructure.
- To understand the involvement of the private sector in infrastructure.
- To learn about challenges in successful infrastructure planning and implementation
- To apply strategies for successful infrastructure project implementation.
- To Understand sustainable development of infrastructure.

Unit	Content	Teaching/ Lecture Hours
I	An Overview of Basic Concepts Related to Infrastructure: Introduction to Infrastructure, an overview with regards to Indian sectors(i) Power Sector, (ii) Water Supply and Sanitation Sector in India., (iii) Road, Rail, Air and Port Transportation Sectors, (iv) Telecommunications, (v) Urban Infrastructure (vi) Rural Infrastructure.	8
II	Private Involvement in Infrastructure: A Historical Overview of Infrastructure Privatization. The Benefits of Infrastructure Privatization, Problems with Infrastructure Privatization, Challenges in Privatization of Water Supply, Privatization of Infrastructure in India.	8
III	Challenges to Successful Infrastructure Planning and Implementation: Mapping and Facing the Landscape of Risks in Infrastructure Projects, Economic and Demand Risks, Socio-Environmental Risks, Cultural Risks in International Infrastructure Projects, Legal and Contractual Issues in Infrastructure, Challenges in Construction and Maintenance of Infrastructure.	9
IV	Strategies for Successful Infrastructure Project Implementation: Risk Management Framework for Infrastructure Projects, Shaping the Planning Phase of Infrastructure Projects to mitigate risks, Designing Sustainable Contracts, Introduction to Fair Process and Negotiation, Negotiating with multiple Stakeholders on Infrastructure Projects.	9
V	Sustainable Development of Infrastructure: Information Technology and Systems for Successful Infrastructure Management, - Innovative Design and Maintenance of Infrastructure Facilities, Infrastructure Modeling and Life Cycle Analysis Techniques, Capacity Building and Improving the Governments Role in Infrastructure Implementation, An Integrated Framework for Successful Infrastructure Planning and Management - Infrastructure Management Systems and Future Directions.	10
	Total Lecture Hours	44

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Course Outcomes: At the end of the course completion, a student is able

CO1 To remember & understand the basic concepts related to Infrastructure Projects.
CO2 To understand the role of the private sector in infrastructure growth.
CO3 To apply the strategies for successful Infrastructure Project implementation.
CO4 To apply Infrastructure modelling and Life Cycle Analysis Techniques.
CO5 To Create Sustainable development plans for various Infrastructure projects.

Text Books: -

1 Goodman, A. S., & Hastak, M. (2006). Infrastructure Planning Handbook: Planning, Engineering, and Economics. McGraw Hill/ASCE Press.
2 Grigg, N. (1988). Infrastructure Engineering and Management. Wiley.

Reference Books: -

1 Hudson, W., & Ralph. (1997). Infrastructure Management: Integrating Design, Construction, Maintenance, Rehabilitation, and Renovation. Tata McGraw Hill.
2 Haas, R., Hudson, W. R., & Zaniewski, J. (1994). Modern Pavement Management. Krieger Publishing Company.
3 Hudson, W. R., Haas, R., & Uddin, W. (1997). Infrastructure Management: Integrating Design, Construction, Maintenance, Rehabilitation, and Renovation. McGraw Hill.

COs, POs, and PSOs Mapping (Infrastructure Planning & Management: CEUETP3)

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

Scheme & Syllabus of B.Tech. (Civil Engineering) as Per NEP 2020

Syllabus	Semester -V	Teaching Hours/ Week			Continuous Internal Assessment	Semester Examination Assessment	Total Marks	Credits	Pre-requisite Course(s)
Course Code	CEUETP4	L	T	P	CIA	SEA	100	3	Nil
Course Name	Disaster Preparedness and Planning Management	3	0	0	40	60			

Course Objectives:

- To understand basic ideas in disaster management
- To know the definitions and terms used in disaster management
- To understand the types and classes of disasters.
- To know the challenges posed by disasters
- To understand the influences of disasters on skills

Unit	Content	Teaching/ Lecture Hours
I	**Introduction** - Concepts and definitions: disaster, hazard, vulnerability, resilience, risks severity, frequency and details, capacity, impact, prevention, mitigation.	6
II	**Disasters** - Disasters classification: natural disasters, floods, drought, cyclones, volcanoes, earthquakes, tsunamis, landslides, soil erosion, forest fires; manmade disasters; industrial pollution, nuclear disasters, chemical spills, biological disasters, structural failures-buildings, and bridges. Transportation accidents-air, rail & road, war & terrorism.	10
III	**Disaster Impacts** - Disaster impacts on environmental, physical, social, ecological, economic, political, health, and demographic aspects; hazard locations; global and national disaster trends and urban disasters. addressing the problem of climate change	8
IV	**Disaster Risk**- Its concept and phases; prevention, mitigation, preparedness, relief, and recovery; structural and non-structural, risk analysis, vulnerability and capacity assessment; disaster risk reduction and planning management, early warning systems, post-disaster environmental response, roles and responsibilities of government and community	10
V	**Disasters, Environment and Development** - Factors affecting vulnerability such as impact of developmental projects and environmental modifications (including of dams, land use changes, urbanization etc.), sustainable and environment friendly recovery; reconstruction and development methods.	8
	Total Lecture Hours	42

Course Outcomes: At the end of the course completion, a student is able

CO1 To apply disaster concepts to management
CO2 To analyze the relationship between development and disasters
CO3 To understand Categories of Disasters
CO4 To the realization of the responsibilities to society
CO5 To understand the impacts of disasters skills and application of disaster concepts to management.

Scheme & Syllabus of B.Tech. (Civil Engineering) as Per NEP 2020

Text Books: -

1 Rai, N., & Singh, A. K. (2021). Disaster Management in India: Perspectives, Issues and Strategies. New Royal Book Company.
2 Bhattacharya, T. (2017). Disaster Science and Management. McGraw Hill Education (India) Private Limited.
3 Sahni, P. (2004). Disaster Risk Reduction in South Asia. Prentice Hall.

Reference Books: -

1 Singhal, J. P. (2019). Disaster Management. Laxmi Publications.
2 Singh, J. (2013). Disaster Management: Future Challenges and Opportunities. K W Publishers Private Limited.
3 Pandey, M. (2014). Disaster Management. Wiley India Private Limited.

COs, POs, and PSOs Mapping (Disaster Preparedness and Planning Management: CEUETP4)

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

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Syllabus	Semester -V	Teaching Hours/ Week			Continuous Internal Assessment	Semester Examination Assessment	Total Marks	Credits	Pre-requisite Course(s)
Course Code	CEUETP5	L	T	P	CIA	SEA	100	3	CEUCTT2, CEUDTT2
Course Name	Basics of Computational Hydraulics	3	0	0	40	60			

Course Objectives:

- To provide knowledge on the application of computational fluid mechanics to different Civil engineering problems.
- To Provide knowledge on conservation law and the numerical approach to solve by converting different forms of partial differential equations.
- To Provide some experience in the software engineering skills associated with the implementation of MATLAB computer programming and use of Computational Fluid Dynamics (CFD)software.
- To study the analysis of Open Channel Flow
- To learn about water surface profiles.

Unit	Content	Teaching/ Lecture Hours
I	Introduction, significance of computational hydraulics, discrete forms of mass, momentum, and energy conservation laws, examples of free surface flows.	8
II	Continuous forms of the conservation laws, lateral inflow's 1-D expansions, and contractions, homogeneous and stratified fluid flows.	9
III	Introduction to computer programming and computation with MATLAB and using of Computational Fluid Dynamics (CFD)software.	8
IV	Pipe flow analysis, Open channel flow: Types of Open Channel Flow, Estimation of normal and critical depth, uniform flow computations	9
V	Computation of water surface profile (WSP) gradually varied flow estimation using direct step methods.	8
	Total Lecture Hours	42

Course Outcomes: At the end of the course completion, a student is able

CO1	To evaluate the governing equations based on conservation principles in fluid flow problems
CO2	To apply the finite difference method to the fluid flow problems
CO3	To analyze model fluid dynamics using MATLAB and CFD software.
CO4	To apply the computational methods in open channel flow
CO5	To apply direct step methods on the water surface profile

Text Books: -

1 Jayanti, S. (2018). Computational Fluid Dynamics for Engineers and Scientists. Springer.
2 Hoffman, J. D. (2011). Numerical Methods for Engineers and Scientists. CRC Press, Special Indian Edition.
3 Choudhary, M. H. (1997). Applied Hydraulic Transients. Van Nostrand Reinhold.

Scheme & Syllabus of B.Tech. (Civil Engineering) as Per NEP 2020

Reference Books: -

1 Abbot, M. B., & Minns, A. W. (1994). Computational Hydraulics. Ashgate Publication.
2 Anderson, J. D. (1995). Computational Fluid Dynamics. McGraw Hill.

COs, POs, and PSOs Mapping (Basics of Computational Hydraulics: CEUETP5)

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

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Syllabus	Semester -V	Teaching Hours/ Week			Continuous Internal Assessment	Semester Examination Assessment	Total Marks	Credits	Pre-requisite Course(s)
Course Code	CEUELT1	L	T	P	CIA	SEA	50	1	CEUETT3
Course Name	Highway Engineering Lab	0	0	2	25	25			

Course Objectives:

- To study the physical properties of road aggregate & their laboratory test.
- To determine the properties of bitumen and bituminous mix.
- To determine the CBR value for subgrade soil

List of Experiments (*Minimum 10 experiments to be performed*)

1. To determine the crushing value of the given aggregate sample.
2. To determine the abrasion value of the given aggregate sample by loss angles apparatus.
3. To determine the impact value of the given aggregate sample.
4. To determine the elongation index of the given aggregate sample.
5. To determine the flakiness index of the given aggregate sample.
6. To determine the water absorption of the given coarse aggregate.
7. To determine the specific gravity of the given coarse aggregate.
8. To determine the penetration value of the given bitumen material.
9. To determine the softening point of the given bitumen material.
10. To determine the ductility of the given bitumen material.
11. To determine the viscosity of the given bitumen material
12. To determine the optimum binder content of bituminous mix.
13. To determine the California Bearing Ratio (CBR) value of subgrade soil.

Course Outcomes: At the end of the course completion, a student is able

CO1 To recognize the knowledge about different physical properties of aggregates by performing different tests on road aggregates

CO2 To determine the various properties of bitumen by perfoeming various tests on it.

CO3 To compute the strength of subgrade soil by CBR test.

Text Books: -

1 Khanna, S.K. & Justo, C.E.G. (2015). Highway Material Testing. Nem Chand and Bros
2 Khanna, S.K., Justo, A. & Veeraragavan, A. (2013). Highway Materials and Pavement Testing. Nem Chand and Bros.

Reference Books: -

1 Indian Roads Congress, IRC. (2014). Handbook of Quality Control for Construction of Roads and Runways.
2 Kandhal, P.S. (2017). Bituminous Road Construction in India. PHI Learning Pvt. Limited.

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Syllabus	Semester -V	Teaching Hours/ Week			Continuous Internal Assessment	Semester Examination Assessment	Total Marks	Credits	Pre-requisite Course(s)
Course Code	CEUELT2	L	T	P	CIA	SEA	50	1	CEUETT4
Course Name	Geotechnical Engineering Lab	0	0	2	25	25			

Course Objectives:

- To Develop practical skills in conducting soil testing.
- To analyze various soil test results for design and analysis
- To demonstrate proficiency in using laboratory equipment and following standardized testing procedures.

List of Experiments (*Minimum 10 experiments to be performed*)

1. Visual identification and water content determination
2. To determine the specific gravity of soil solids by using a density bottle and pycnometer method.
3. To determine the particle size of the soil by the dry and wet methods.
4. To determine the particle size of the soil by the hydrometer analysis
5. To determine the Atterberg limit of the test.
6. To determine the compaction characteristics of soil.
7. To determine the maximum and minimum density of sand
8. To determine in-situ density by sand replacement and core cutter method
9. To determine the permeability of the soil by constant head and falling head test.
10. To determine the shear strength of the parameter of coarse-grained soil by direct shear test.
11. To determine the unconfined compressive strength test
12. To demonstrate triaxial UU test.
13. To demonstrate consolidation test.

Course Outcomes: At the end of the course completion, a student is able

CO1 To identify and measure the basic soil properties such as visual identification and water content.
CO2 To determine specific gravity, particle size distribution, and Atterberg limits of soil samples.
CO3 To evaluate compaction characteristics and in-situ density using standard methods
CO4 To assess permeability and shear strength parameters of soil through various tests.
CO5 To perform advanced soil tests, including unconfined compressive strength, triaxial tests, and consolidation tests

Text Books: -

1 Das, B. M. (2013). Soil Mechanics Laboratory Manual (8th ed.). Oxford University Press.
2 Lambe, T. W. (1967). Soil Testing for Engineers. MIT Press.
3 Head, K. H. (2006). Manual of Soil Laboratory Testing. Whittles Publishing.

Reference Books: -

1 Bowles, J. E. (1992). Engineering Properties of Soils and Their Measurement (4th ed.). McGraw-Hill.
2 Germaine, J. T., & Germaine, A. V. (2009). Geotechnical laboratory measurements for engineers. John Wiley & Sons.

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Syllabus	Semester -V	Teaching Hours/ Week			Continuous Internal Assessment	Semester Examination Assessment	Total Marks	Credits	Pre-requisite Course(s)
Course Code	CEUEPF1	L	T	P	CIA	SEA	100	2	Nil
Course Name	Mini Project-II			4	50	50			

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Syllabus	Semester -VI	Teaching Hours/ Week			Continuous Internal Assessment	Semester Examination Assessment	Total Marks	Credits	Pre-requisite Course(s)
Course Code	CEUFTT1	L	T	P	CIA	SEA	100	3	CEUBTE1 CEUCTT1
Course Name	Design of Steel Structures	3	0	0	40	60			

Course Objectives: The objective of this course is

- To study mechanical properties of structural steel and outline general aspect of design philosophies.
- To classify and design connections in steel structure.
- To determine tensile and compressive strength of structural steel member.
- To understand design examples of Beam, Beam Column, Column Splices and Column Base
- To introduce components of plate girders and its behavior.

Unit	Content	Teaching/ Lecture Hours
I	Introduction: General, types of Steel, mechanical behaviour of steel, measures of Yielding, measures of Ductility, types of Structural system, Structural Steel Sections. Methods of Structural design: Introduction- Design Philosophies-Working Stress Method-Ultimate Strength Method-Load and Resistant factor- Limit State Method-Partial safety factor Load Combinations-Classification of Cross sections-General aspects in the design.	4
II	Design of Steel fasteners: Types of fasteners – Riveted connections- Bolted connections- Assumptions- Failure of bolted joints – Strength of bolted joints – Design examples – Design of Welded connections – Butt weld- fillet weld – Design examples. Design of Eccentric Connections: Design of Brackets- Type-1 and Type 2 – Moment Resistant connections – Design Examples.	16
III	Design of Tension Members: General – Modes of Failure of Tension member-Analysis of Tension members- Example - Design steps – Design examples – Lug angles – Design.Design of Compression Members: General – Strength of Compression members- Design Compressive strength- Example on analysis of Compression members – Design of Angle struts – Design Examples- Built up Columns- Design of Lacing – Design of Battens- Design Examples- Design of Roof members.	9
IV	Design of Beams: General- Lateral Stability of Beams- Bending Strength of Beams – Plastic Section Modulus - Design Examples.Design of Beam Columns: Behaviour of members under combined loading – Modes of Failures – Design Examples.Design of Column Splices and Column Base: Design of Column Splice-Design Examples- Design of Column Base- Slab Base- Gusseted Base- Design	9

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	Examples.	
V	Design of Plate Girder: General- Components of Plate Girder- Optimum depth – Bending Strength – Shear Strength – Shear Buckling- Simple Post critical method-Tension Field method- Stiffeners-Bearing- Transverse stiffeners - Design Examples.	6
	Total Lecture Hours	44

Course Outcomes: At the end of the course completion, a student is able

CO1	Define mechanical properties of structural steel and implement the limit state design philosophy.
CO2	Design bolted, welded and eccentric connections in steel structure.
CO3	Design tension and compression members
CO4	Design Evaluate beam and column element.
CO5	Evaluate the behaviour of plate girder

Text Books:-

1 Duggal, S. K. (2020). *Limit state design of steel structures*. Oxford University Press.
2 Bhavikatti, S. S. (2019). *Design of steel structures: By limit state method*. I.K. International Publishing House.
3 Sai Ram, K. S. (2018). *Design of steel structures*. CBS Publishers & Distributors.
4 Punmia, B. C., Jain, A. K., & Jain, A. K. (2017). *Comprehensive design of steel structures*. Laxmi Publications.
5 Ramamrutham, S. (2016). *Design of steel structures*. Dhanpat Rai Publishing Company.
6 Gambhir, M. L. (2021). *Fundamentals of structural steel design*. Tata McGraw-Hill Education.
7 Bureau of Indian Standards. (2007). *IS-800:2007 - Indian standard - General construction in steel - Code of practice & steel tables*. Bureau of Indian Standards.

Reference Books: -

1 Subramanian, N. (2014). *Design of steel structures: Limit states method*. Oxford University Press.
2 Ramchandra. (2013). *Design of steel structure volume I*. Standard Publishers.
3 Ramchandra. (2015). *Design of steel structure volume II*. Standard Publishers.
4 Boracchini, A. (2018). *Design and analysis of connections in steel structures: Fundamentals and examples*.

COs, POs and PSOs Mapping (Design of Steel Structures : CEUFTT1)

PO / CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO1 1	PO1 2	PSO 1	PSO 2	PSO 3
CO1	1	1	2	2	2								2	1	2
CO2	3	3	3	2	2	1							3	2	2
CO3	3	3	3	2	2	1							3	2	2
CO4	3	3	3	2	2	1							3	2	2
CO5	3	3	3	2	2	1							3	2	2

Scheme & Syllabus of B.Tech (Civil Engineering) as Per NEP 2020

Syllabus	Semester -VI	Teaching Hours/ Week			Continuous Internal Assessment	Semester Examination Assessment	Total Marks	Credits	Pre-requisite Course(s)
Course Code	CEUFTT2	L	T	P	CIA	SEA	100	3	CEUETT5
Course Name	Environmental Engineering - II	3	0	0	40	60			

Course Objectives:

- To help students develop the ability to apply basic understanding of physical, chemical, and biological characteristics of the sewage.
- To learn about the anaerobic treatment units.
- To Study the various process performed with Municipal Solid Wastes.

Unit	Content	Teaching/Lecture Hours
I	**Introduction:** Objective, design period, Physical, Waste water sampling, self-purification of natural streams, Oxygen Sag Curve, sources of sewage. **Design of sewers:** minimum size of sewer, velocities and gradient of sewers. **Sewer appurtenances:** manholes, street inlets, flushing devices, Vent pipes etc.	10
II	**Treatment of wastewater:** characteristics of wastewater. Effluent discharge standards. **Primary treatment of wastewater:** Types of screens, design of screen chamber, sources of grit, design of grit chamber, disposal of grit, oil and grease removing skimming tanks.	8
III	**Secondary treatment of wastewater:** Aerobic Treatment UNITs: Biological principle of ASP, SVI, sludge bulking and control; biological principle of Trickling filter, re-circulation, operational troubles; Rotating biological contactor. Low-cost treatment methods: Principle of Oxidation Pond, symbiosis, principle of Aerated Lagoons, aeration method, Principle of Oxidation Ditches, sewage farming, ground water recharge.	10
IV	**Anaerobic Treatment UNITs:** Septic tanks, biological Principle, method of treatment and disposal of tank effluent. Anaerobic digester, principle of anaerobic digestion, Stages of digestion, bio-gas production. Sludge disposal methods, advantages and disadvantages, Design of STP.	10
V	**Municipal Solid Wastes:** Characteristics, generation, collection & transportation of solid wastes, engineered systems for solid waste management (reuse/ recycle, energy recovery, treatment & disposal), environmental & health implications, disposal of solid waste by land filling, composting and incineration methods.	6
	Total Lecture Hours	**44**

Scheme & Syllabus of B.Tech (Civil Engineering) as Per NEP 2020

Course Outcomes: At the end of the course completion, a student is able

CO1 To understand the basic terms related to Sewage and sewerage system.
CO2 To estimate waste water quantity and can design the sewerage system.
CO3 To understand basic methodology for wastewater treatment (screening, grit chambers, sedimentation, biological treatment and chemical treatment) and to understand various processes of Aerobic & Anaerobic treatment units.
CO4 To design unit operations specific to wastewater treatment and to control & monitor wastewater treatment facilities.
CO5 To understand solid wastes management.

Text Books: -

1. Peavy, H. S., & Rowe, D. R. (1985). *Environmental engineering*. Tata McGraw-Hill.
2. Garg, S. K. (2009). *Waste water engineering*. Khanna Publishers.
3. Metcalf, L., & Eddy, H. (2014). *Waste water engineering*. Tata McGraw-Hill.

Reference Books: -

1 Central Public Health and Environmental Engineering Organization (CPHEEO). (2000). *Manual on municipal solid waste management*. Ministry of Urban Development.
2 Venugopala Rao, P. (2015). *Environmental engineering II*. Tata McGraw-Hill.
3 Hammer, M. J. (2018). *Water and wastewater technology*. PHI Learning.
4. Ministry of Urban Development, Government of India. (2014). *Manual on sewerage and sewage treatment*. Ministry of Urban Development.

COs, POs and PSOs Mapping (Environmental Engineering - II : CEUFTT2

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

Scheme & Syllabus of B.Tech (Civil Engineering) as Per NEP 2020

Syllabus	Semester -VI	Teaching Hours/ Week			Continuous Internal Assessment	Semester Examination Assessment	Total Marks	Credits	Pre-requisite Course(s)
Course Code	CEUFTT3	L	T	P	CIA	SEA	100	3	Nil
Course Name	Water Resources Engineering -I	3	0	0	40	60			

Course Objectives:

- To understand the need of Irrigation, types of irrigation systems and Methods of Irrigation.
- To understand the Canal Irrigation systems and design of stable channels in alluvium.
- To understand Water Logging and its Control
- To know the river behavior, control and training.
- To know the Reservoir Planning, Hydrograph and Flood Routing and its principle

Unit	Content	Teaching/ Lecture Hours
I	**Introduction:** Need for Irrigation, advantages and disadvantages of irrigation, types of irrigation systems – Flow irrigation, lift irrigation. Methods of Irrigation: Introduction, requirement of irrigation methods, surface and sub-surface irrigation. Water Requirement of crops: Introduction, water requirement of crop, crop season and crops of India, crop period and base period, delta, duty of water, relationship between delta, duty and base period, factors affecting duty.	10
II	**Canal Irrigation:** Classification of canal, parts of canal irrigation system, canal alignment, typical canal cross section, command areas, losses in irrigation systems. Design of stable channels in alluvium. Introduction, Kennedy's silt theory, Lacey's Theory, Lacey's regime equations, Lacey's shock theory, Design of channels by Kennedy's and Lacey's theories, maintenance of irrigation channels.	8
III	**Water Logging and its Control.** Causes and ill effects of water logging, prevention and control, reclamation of waterlogged lands, surface drainage. Design of Lined Channels. Introduction, benefits of lining, types of lining, economics of lining, procedure and design of lined canals.	8
IV	**River behaviour, control and training.** Objects, river characteristics, classification of river training works, methods of river training embankments, bank protection, cut-offs, meandering causes and parameters. Flood Control; Introduction, channel improvement, flood ways evacuation and flood plain zoning.	8
V	**Reservoir Planning:** Introduction, type of reservoirs, investigation for reservoir planning, site selection criteria for reservoir, basic terms and definitions of reservoir, storage zones of a reservoir, mass curve and demand curve, determination of reservoir capacity, reservoir losses, reservoir sedimentation, factors affecting sedimentation, type of sediment load, life of reservoir, safe field. Applications of GIS in Reservoir Planning.	8
	Total Lecture Hours	**42**

Scheme & Syllabus of B.Tech (Civil Engineering) as Per NEP 2020

Course Outcomes: At the end of the course completion, a student is able

CO1	To describe about the types of Irrigation systems, and methods of irrigation.
CO2	To design irrigation canals and canal network
CO3	To propose solutions regarding water logging and drainage.
CO4	To plan and design river training works and flood control of river.
CO5	To evaluate the capacity of reservoir and use Flood Routing principle for Reservoir Planning.

Text Books: -

1 Peavy, H. S., & Rowe, D. R. (1985). *Environmental engineering*. Tata McGraw-Hill.
2 Garg, S. K. (2009). *Waste water engineering*. Khanna Publishers.
3 Metcalf, L., & Eddy, H. (2014). *Waste water engineering*. Tata McGraw-Hill.

Reference Books: -

1 Bharat Singh (2005), Fundamentals of Irrigation Engineering, *Nem Chand & Bros, Roorkee*
2 G.L Asawa (2008), Irrigation and Water resources Engineering, *New Age International Publishers, New Delhi*
3 R.S. Varshney, S.C. Gupta, R.L. Gupta (2009), Theory and Design of Irrigation Structures (Volume I), *Nem Chand & Bros, Roorkee*

COs, POs, and PSOs Mapping (Water Resources Engineering –I : CEUFTT3)

PO / CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO1	3	2	2	1	0	1	3	0	0	1	0	0	3	0	0
CO2	3	3	3	3	0	1	1	0	0	0	0	0	3	0	0
CO3	3	1	0	1	0	1	1	0	0	0	0	0	3	0	0
CO4	3	1	1	1	3	1	0	0	0	0	0	0	3	0	0
CO5	3	1	1	1	3	1	0	0	0	0	0	0	3	0	0

Scheme & Syllabus of B.Tech (Civil Engineering) as Per NEP 2020

Syllabus	Semester -V	Teaching Hours/ Week			Continuous Internal Assessment	Semester Examination Assessment	Total Marks	Credits	Pre-requisite Course(s)
Course Code	CEUFTT4	L	T	P	CIA	SEA	100	3	CEUETT4
Course Name	Geotechnical Engineering - II	3	0	0	40	60			

Course Objectives:

- To understand the role of civil engineers in selecting, designing, and constructing foundations for civil engineering structures.
- To apply methods of soil exploration to determine soil design parameters and their correlations.
- To understand and compare earth pressure theories and their applications in designing stable retaining walls.
- To assess and design shallow and deep foundations using various bearing capacity theories and analyze settlement in different soil types

Unit	Content	Teaching/ Lecture Hours
I	Role of civil engineer in the selection, design, and construction of the foundation of civil engineering structures. Soil Exploration: Methods of soil exploration include boring, sampling, penetration tests, and correlations between penetration resistance and soil design parameters.	8
II	Earth pressure at rest, active and passive earth pressure, Rankine and Coulomb's earth pressure theories, earth pressure due to surcharge, retaining walls, and stability analysis of retaining walls.	7
III	Mode of failure – mechanism, Stability of slopes – Finite and infinite slopes, methods of slices, Bishop's method.	6
IV	Shallow foundations – Terzaghi's and Meyerhoff's bearing capacity theories, the effect of the water table, Combined footing and raft foundation, Contact pressure; Settlement analysis in sands and clays	10
V	Deep foundations – dynamic and static formulae, Axial load capacity of piles in sands and clays, pile load test, pile under lateral loading, pile group efficiency, negative skin friction. Well, foundations: Methods of construction, tilt and shift, remedial measures, lateral stability of the well foundation.	12
	Total Lecture Hours	43

Scheme & Syllabus of B.Tech (Civil Engineering) as Per NEP 2020

Course Outcomes: At the end of the course completion, a student is able

CO1 To identify and describe the methods of soil exploration and their importance in foundation engineering

CO2 To evaluate earth pressure theories and apply them in designing retaining walls and stability analysis.

CO3 To analyze the mechanisms of slope stability and implement methods like Bishop's method for slope stability analysis.

CO4 To calculate the bearing capacity of shallow foundations and assess the impact of water tables

CO5 To determine the axial load capacity of piles and evaluate the efficiency and stability of deep foundation systems, including well foundations.

Text Books: -

1 Das, B. M. (2018). Principles of Foundation Engineering (9th ed.). Cengage Learning.
2 Bell, F. G. (1991). Foundation Engineering in Difficult Ground (2nd ed.). Butterworth-Heinemann.
3 Poulos, H. G., & Davis, E. H. (1980). Pile Foundation Analysis and Design. John Wiley & Sons.

Reference Books: -

1 Fang, H.-Y. (Ed.). (1990). Foundation Engineering Handbook (2nd ed.). Springer
2 Bowles, J. E. (1996). Foundation Analysis and Design (5th ed.). McGraw-Hill.
3 Coduto, D. P., Kitch, W. A., & Yeung, M. R. (2016). Foundation Design: Principles and Practices (3rd ed.). Pearson.

COs, POs, and PSOs Mapping (Geotechnical Engineering – II: CEUFTT4)

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

Scheme & Syllabus of B.Tech (Civil Engineering) as Per NEP 2020

Syllabus	Semester -VI	Teaching Hours/ Week			Continuous Internal Assessment	Semester Examination Assessment	Total Marks	Credits	Pre-requisite Course(s)
Course Code	CEUFTP1	L	T	P	CIA	SEA	100	3	CEUBTE1 CEUCTT1 CEUDTT1
Course Name	Advanced Concrete Design	3	0	0	40	60			

Course Objectives:

- To understand the design procedures for combined footings.
- To study the design of retaining walls
- To know the design of different types of water tanks
- To learn the design of flat slabs
- To know the design of RCC chimneys

Unit	Content	Teaching/Lecture Hours
I	Combined Footings: Simple Rectangular, trapezoidal footings (with and without central beam); Strap footing; raft foundation.	10
II	Types of retaining walls; Cantilever Retaining wall design; Counterfort retaining wall (demonstration only)	8
III	Water tanks resting on ground; Intze type water tank design.	8
IV	Large span concrete roofs, Introduction– classification- behaviour of flat slabs - direct design and equivalent frame method- Codal provisions - waffle slabs.	10
V	Chimneys, analysis of stresses in concrete chimneys- uncracked and cracked sections- Codal provisions- design of chimney.	8
	Total Lecture Hours	44

Course Outcomes: At the end of the course completion, a student is able

CO1 To adopt limit state design philosophy for deign of reinforced concrete.
CO2 To carry out the design of RC structural elements for flexure, bond, shear and torsion.
CO3 To implement the design slabs and staircases as per LSD.
CO4 To do the design of RC structural columns subjected to axial and eccentric loads.
CO5 To propose and design the type of footing for a RC structure.

Scheme & Syllabus of B.Tech (Civil Engineering) as Per NEP 2020

Text Books: -

1 Advanced Reinforced Concrete Design by N Krishna Raju
2 Reinforced Concrete Design by Devdas Menon and S U Pillai,
3 Ashok K Jain, Reinforced Concrete –Nem Chand Bros. Roorkee , 1998
4 Purushothaman, P., Reinforced Concrete Structural Elements-, Tata McGraw Hill, 1986

Reference Books: -

1 Mallick and Gupta, Reinforced Concrete, - Oxford and IBH, 1982
2 Jain and Jaikrishna, Plain and Reinforced Concrete – Vol I and II Nem Chand Bros., Roorkee, 2000.
3 Taylor C Pere, Reinforced Concrete Chimneys, Concrete publications, 1960
4 Design of deep girders, Concrete Association of India, 1960
5 BIS codes (IS 456 , IS 2210, IS 4998, IS 3370, SP 16, SP 24, SP 34).
6 IRC Codes (IRC 5, IRC 6, IRC 21)

COs, POs, and PSOs Mapping (Advanced Concrete Design : CEUFTP1)

PO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	1	1									3		
CO2	3	3	3	3	3	2			1		2	2	3	1	2
CO3	3	3	3	3	3	2			1		2	2	3	1	2
CO4	3	3	3	3	3	2			1		2	2	3	1	2
CO5	3	3	3	3	3	2			1		2	2	3	1	2

Scheme & Syllabus of B.Tech (Civil Engineering) as Per NEP 2020

Syllabus	Semester -VI	Teaching Hours/ Week			Continuous Internal Assessment	Semester Examination Assessment	Total Marks	Credits	Pre-requisite Course(s)
Course Code	CEUFTP2	L	T	P	CIA	SEA	100	3	CEUETT4
Course Name	Ground Improvement Techniques	3	0	0	40	60			

Course Objectives: At the end of the course completion, a student is able

- To impart knowledge of various types of soils and need of ground improvement
- To make familiar with the various techniques to improve the characteristics of soil.
- To impart knowledge of dynamics methods as well as chemical additives requirement foe the ground improvement.
- To introduce about reinforced earth mechanism in ground improvement techniques.
- To understand the use of Geo-Synthetics in present construction era.

Unit	Content	Teaching/ Lecture Hours
I	**Introduction**: Necessity of Ground Improvement, Selection of Ground Improvement Techniques, Stabilization of Expansive Soil, Current Status and Scope in the Profession.	6
II	**Methods of Ground Improvement:** Dewatering, Well Points-Vacuum / Electro Osmotic Methods, Analysis of Seepage, Two-Dimensional Flow, Heat Treatment, Ground Freezing., Analysis and Design of Dewatering Systems. Grouting Types, Properties, Method of Grouting, Ground Selection and Control	9
III	**Dynamic Methods of Ground Improvement**: Compaction, Methods of Compaction, Engineering Properties of Compacted Soil, Field Compaction and its Control, Dynamic Compaction- Vibro-Flotation, Compaction Piles, Consolidation, Sand Drains, Preloading, Stone Columns, Construction Methods, Merits and Demerits Of Various Techniques. Soil stabilization by Use of chemical additives	9
IV	**Reinforced Earth:** Basic Mechanism, Choice of Soil and Reinforcement, Strength Characteristics of Reinforced Earth, Principles of Design of Reinforced Earth Wall.	9
V	**Geosynthetics:** Raw Materials, Durability and Aging, Manufacturing Methods, Geotextiles-Testing and Evaluation, Geotextile as Separators and as Reinforcement, Geotextile in Filtration, Drainage and Erosion Control, Bearing Capacity Improvement by Geotextiles.	9
	Total Lecture Hours	42

Course Outcomes: At the end of the course completion, a student is able

CO1 To understand of ground improvement techniques and future prospects.
CO2 To execute various methods/techniques of ground improvement.
CO3 To apply the dynamics methods as well as chemical additives as per field conditions.

Scheme & Syllabus of B.Tech (Civil Engineering) as Per NEP 2020

CO4 To implements reinforced earth method in the field.
CO5 To apply the various types of geo synthetics in roads/ highways or other various construction works.

Text Books: -

1 Gopal Ranjan and A. S. R. Rao, Basic and Applied Soil Mechanics; *New Age International Publishers New Delhi*
2 Nihar Ranjan Patra (First Edition (1 January 2012); Ground Improvement Techniques, Vikas *Publishing House New Delhi -110044*

Reference Books: -

1. V.N. S. Murthy (2010), **Geotechnical Engineering: Principles and Practices of Soil Mechanics And Foundation Engineering**, Crc Press
2. Robert M. Koerner (Vol-I & II/6th Edition), **Designing with Geosynthetics;** Xlibris US

COs, POs, and PSOs Mapping (Ground Improvement Techniques : CEUFTP2)

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

Syllabus	Semester -VI	Teaching Hours/ Week			Continuous Internal Assessment	Semester Examination Assessment	Total Marks	Credits	Pre-requisite Course(s)
Course Code	CEUFTP3	L	T	P	CIA	SEA	100	3	Nil
Course Name	Sustainable Urban Transportation Planning	3	0	0	40	60			

Course Objectives:

- To introduce concepts of different types of mode of transportation and associated facilities.
- To understand the concept of urban transport scenario, traffic characteristics and transport development.
- To study the Intelligence Transport System
- To understand ITS user services and its components.
- To understand the approach and utility of Environmental Impact Assessment for the urban infrastructural measures.

Unit	Content	Teaching/Lecture Hours
I	**Modes of Transportation:** Transportation parameters- Traffic and Transport Problems of a city, Mass transport system, Modes of transportation & characteristics, Public transport system, public private transport system, Advantages and disadvantages of Public transport system. Role of transportation in mass transportation, advanced modes. **Transportation Infrastructure-** Green bays, control stations, mitigation buildings, separator lanes and safety islands.	9
II	**Urban Public Transport System Rapid transit systems:** BRTS, Bus Lane system, Advantages and limitations in Indian Scenario, Rail System. Types of rail system, advantages and disadvantages of rail system, sky walk and under bridge and its advantages. Advances in infrastructure. **Urban Pedestrian Safety-** Skyways, Intersection subways, halt stations, crossing measures, flexibility in accessibility.	9
III	**ITS Background and Telemetric systems:** Definitions, features and objectives of ITS, History of ITS and its development over the world, telemetric concept, transport telemetric, telemetric structure, ITS taxonomy, ITS application areas, uses, and application overview, ITS implication through AI, ITS based regression models.	8
IV	**ITS components, tools and strategies:** Components of user services; advanced traffic management system, advanced traveller information systems, advanced vehicle control system, commercial vehicle operational management, advanced public transportation system, electronic payment system, advanced rural transportation, security and safety systems, urban traffic control, benefits and limitations, traffic calming systems, freight management by ITS.	8
V	**Environmental Impact Assessment:** Description of proposed activity, structural audits, analysis of site selection procedure, baseline conditions / major concerns, green building and its advantages, description of potential positive and negative environmental, social, economic and cultural impacts including cumulative, regional, temporal and spatial considerations, significance of mitigation plans and monitoring plans (impacts and mitigation efforts)	8
	Total Lecture Hours	42

Course Outcomes: At the end of the course completion, a student is able

CO1 To implement the concept of urban transport scenario, traffic characteristics and transport development.
CO2 To adopt the concepts of different mode of transportation and associated facilities with advanced system.
CO3 To Identify and differentiate ITS user services and its components.
CO4 To plan and design appropriate ITS technology to solve real-life traffic problems.
CO5 To propose the mitigation plan for the EIA for the urban infrastructure.

Text Books: -

1 Chowdhury, M. A., & Sadek, A. (2003). *Fundamentals of intelligent transportation systems planning*. Artech House.
2 Bekiaris, E., & Nakanishi, Y. J. (2004). *Economic impacts of intelligent transportation systems: Innovations and case studies*. Elsevier/JAI.

Reference Books: -

1 Chowdhury, M. A., & Sadek, A. (2010). *Fundamentals of intelligent transport systems planning*. Artech House.
2 Stough, R. (2001). *Intelligent transport systems: Cases and policies*. Edward Elgar.
3 National Research Council. (2010). *Artificial intelligence and intelligent transportation systems*. National Academy Press.
4 Jain, A. K. (2007). *Fundamentals of digital image processing*. Prentice Hall.

COs, POs and PSOs Mapping (Sustainable Urban Transportation System : CEUFTP3)

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

Syllabus	Semester -VI	Teaching Hours/ Week			Continuous Internal Assessment	Semester Examination Assessment	Total Marks	Credits	Pre-requisite Course(s)
Course Code	CEUFTP4	L	T	P	CIA	SEA	100	3	CEUCTT2 CEUDTT2
Course Name	Open Channel Flow	3	0	0	40	60			

Course Objectives:

- To introduce the concepts of channel hydraulics, used in design of inland waterways for irrigation and hydraulic structures.
- To understand the Canal Irrigation systems and design of stable channels in alluvium.
- To develop a basic knowledge of open channel flow relationships by the conservation equations for mass, momentum, and energy.
- To develop a basic knowledge in open channel flow Measurement
- To develop a basic knowledge of Unsteady Flow in open channel flow

Unit	Content	Teaching/ Lecture Hours
I	**Introduction to Free Surface Flows:** Comparison between pipe and channel flows, classification of channels and basic equations of flow. **Concepts of Specific Energy:** Specific energy, critical, subcritical and super critical flows, critical depth computations, transitions and introduction to hydraulic jump	10
II	**Uniform Flow:** Shear stress and velocity distribution, resistance relationships, normal depth, and its computation design of channels, most efficient cross-section in rigid boundary channels.	8
III	**Gradually Varied Flow:** Governing equations, characteristics and classification of water surface profiles, control sections, computations of GVF profiles in prismatic and non-prismatic channels.	8
IV	**Hydraulic Jump:** Types of jumps, hydraulic jump in horizontal rectangular channels, forced jump, stilling basins. **Flow Measurement in Open Channels:** Broad and sharp-crested weirs, free overall, flow over spillways, sluice gates.	8
V	**Fluvial Hydraulics:** Incipient motion, shields diagram, regimes of flow and resistance to flow in mobile bed channels regime channels and design aggradation and degradation of alluvial streams, bridge and abutment scour **Unsteady Flow:** Wave celerity, surges, positive and negative surges	8
	Total Lecture Hours	42

Course Outcomes: At the end of the course completion, a student is able

CO1	Ability to explain the terms of the open channel flow equations and explain the interactions among the terms.
CO2	Understanding of the concepts of free flow and its applications.
CO3	Ability to explain and apply mathematical relationships for gradually Varied Flow.
CO4	Ability to explain the physical mechanisms of hydraulic jumps, surges, and Flow measurement.
CO5	Ability to solve open channel flow problems through the selection and use of appropriate equations.

Text Books: -

1 Chow, V.T. (1959) "Open Channel Hydraulics", McGraw Hill.
2 Subramanya, K. (1997) "Flow in Open Channels", Tata McGraw-Hill.
3 Ranga Raju, K.G. (2003) "Flow through Open Channels", Tata McGraw-Hill.

Reference Books: -

1 Chanson, H. (2004) "The Hydraulics of Open Channel Flow: An Introduction", Elsevier Scientific.
2 Chaudhry, M.H. (1993) "Open Channel Flow", Prentice-Hall, New Jersey, USA

COs, POs and PSOs Mapping (Open Channel Flow : CEUFTP4)

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

Scheme & Syllabus of B.Tech (Civil Engineering) as Per NEP 2020

Syllabus	Semester -VI	Teaching Hours/ Week			Continuous Internal Assessment	Semester Examination Assessment	Total Marks	Credits	Pre-requisite Course(s)
Course Code	CEUFTP5	L	T	P	CIA	SEA	100	3	Nil
Course Name	Solid and Hazardous Waste Management	3	0	0	40	60			

Course Objectives:

- To define and characterize municipal solid wastes from technical and regulatory points of view.
- To provide comprehensive ways of collection, transportation and management of different types of solid wastes.
- To classify the waste and remove hazardous wastes; apply different methods of management.
- To introduce the most common techniques for hazardous waste disposal.
- To use laboratorial tests in sampling & characterization of solid wastes.

Unit	Content	Teaching/ Lecture Hours
I	**Municipal Solid Waste Management:** Legal and Organizational foundation: Definition of Solid Waste, Waste Generation Technological Society, Major Legislation, Monitoring Responsibilities, Sources and Types of Solid Waste, Sampling and Characterization – Determination of Composition of MSW, Storage and Handling of Solid Waste, Future Changes in Waste Composition.	8
II	**Incinerators Transfer and Transport:** Need for Transfer Operation, Transport Means and Methods, Transfer Station Types and Design Requirements, Landfills, Site Selection, Design and Operation, drainage and Leachate Collection Systems, Requirements and Technical solution, Designated Waste Landfill Remediation, Integrated Waste Management Facilities.	8
III	**Hazardous Waste Treatment:** Technologies, Design and Operation, Facilities for Physical, Chemical and Thermal Treatment of Hazardous Waste –, Solidification, Chemical Fixation and Encapsulation, Incineration, Hazardous Waste landfills: Site Selection, Design and Operation, Remediation of Hazardous Waste Disposal Sites.	10
IV	**Hazardous Waste:** Definition and episodes, Sources and types, Classification and testing-EP Toxicity Test, TCLP, Future endeavors. Physical and chemical properties: Solubility, Vapor pressure, diffusion, portioning: Octanol-water, soil-water, bio-concentration factor.	10
V	**Laboratory Practice:** Sampling and Characterization of Solid Wastes; TCLP Tests and Leachate Studies.	6
	Total Lecture Hours	42

Scheme & Syllabus of B.Tech (Civil Engineering) as Per NEP 2020

Course Outcomes: At the end of the course completion, a student is able

CO1 To plan waste minimization and design storage, collection, transport, processing and disposal of municipal solid waste
CO2 To design all units of solid waste management.
CO3 To compute the quantities of waste generated.
CO4 To find the type of waste generated and its end use.
CO5 To utilize the waste by material recovery sheets.

Text Books: -

1 Environmental Engineering - H.S. Peavy, D.R. Rowe and G. Tchobanoglous (McGraw-Hill)
2 Evans and Environmental Resources Management, Hazardous Waste Management- M.D. LaGrega, P.L. Buckinghum, J.C (McGraw-Hill)
3 Environmental Pollution and Control in Chemical Process Industries- S.C. Bhatia (Khanna Publishers)
4. Integrated Solid Waste Management by George Techobanoglous et al, McGraw-Hill Publication, 1993
5. Hazardous Waste Management by Charles A. Wentz, McGraw Hill Publication, 1995.

Reference Books: -

1 Environmental Engineering - H.S.Peavy, D.R.Rowe and G. Tchobanoglous (McGraw-Hill)
2 Evans and Environmental Resources Management, Hazardous Waste Management- M.D. LaGrega, P.L.Buckinghum, J.C (McGraw-Hill)
3 Environmental Pollution and Control in Chemical Process Industries- S.C. Bhatia (Khanna Publishers)

COs, POs, and PSOs Mapping (Solid and Hazardous Waste Management : CEUFTP5)

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

Scheme & Syllabus of B.Tech (Civil Engineering) as Per NEP 2020

Syllabus	Semester -VI	Teaching Hours/ Week			Continuous Internal Assessment	Semester Examination Assessment	Total Marks	Credits	Pre-requisite Course(s)
Course Code	CEUFMO1	L	T	P	CIA	SEA	100	3	Nil
Course Name	MOOCs-I	3	0	0	40	60			

NOTE:

****The students should be opted the MOOC(s) offered by NPTEL/SWAYAM of 03 credits only and that needs to be approved by the BoS.***

*****Student shall take MOOCs based on availability of courses at SWAYAM portal during that academic year.***

SEMESTER VII

SYLLABUS	(SEMESTER VII)	Periods/ Week			Internal Assessment (IA)			ESE	Grand Total	Credits
Subject Code:	CE207TPC19	L	T	P	CT-I	CT-II	TOTAL	70	100	3
Subject:	Pre-stressed Concrete	3	0	0	15	15	30			

Course Learning Objectives:

- To introduce fundamental of pre stressing and develop understanding of pre stressing system.
- To determine loss of pre stress in pre tensioned and post tensioned members as per IS Code provision.
- To analyze simple and composite section in flexure.
- To evaluate deflection in beam and design simply supported beams as per IS Code provision.
- To design the members for shear reinforcement, Ultimate Shear Strength and end block design.

Course Content:

UNIT 1: Introduction: Fundamentals of Prestressing - Classification and types of Prestressing- Concrete Strength and strain characteristics - Steel mechanical properties - Auxiliary Materials like duct formers.

UNIT 2: Prestressing Systems: Principles of pretensioning and post tensioning - study of common systems of prestressing for wires strands and bars. Losses of Prestress: Losses of prestress in pre tensioned and post tensioned members - I.S. code provisions.

UNIT 3: Analysis of Sections: In flexure, simple sections in flexure, kern distance - cable profile - limiting zones - composite sections cracking moment of rectangular sections.

UNIT 4: Deflection of Beams: Long term and Short term deflectionsand Design of Simply Supported Beams, Allowable stress as per I.S. 1343 - elastic design of rectangular and I-sections.

UNIT 5: Shear and Bond: Shear and bond in prestressed concrete beams - conventional design of shear reinforcement - Ultimate shear strength of a section - Prestress transfer in pretensioned beams-Principles of end block design.

Text Books:

1. Krishna Raju. N "Prestressed Concrete", Tata Mc Graw Hill.
2. Lin.T.Y, "Prestressed concrete", Mc Graw Hill Pub. Co.
3. Rajagopalan, "Prestressed concrete", Narosa Publishing House.

Course Outcomes:-

On completion of this course the student will be able

CO1: Describe mechanical properties of pre stressed concrete, types of pre stressing and its system.

CO2: Calculate losses in pre-tensioned and post tensioned members.

CO3: Analyze pre-stressed concrete members for flexure, shear and cracking moment.

CO4: Design pre stressed concrete beams of rectangular and I section and compute deflection.

CO5: Explain principle of end block design, pre stress transfer, shear and bond.

SYLLABUS	(SEMESTER VII)	Periods/ Week			Internal Assessment (IA)			ESE	Grand Total	Credits
Subject Code:	CE207TPC20	L	T	P	CT-I	CT-II	TOTAL	70	100	3
Subject:	Water Resources Engineering-II	3	0	0	15	15	30			

Course Learning Objectives:

- Introduce the types of dams and its failure criteria for structural stability
- Introduce the concepts of spillways and energy dissipaters
- Discuss the concept of diversion Head-works and understand design theory of seepage flow
- Introduce the concepts of regulation works, falls and hydraulic gates of spillways
- Know the concepts and design principles of Cross Drainage Works

Course Content:

UNIT 1: Dams: Types of Dams, Forces, failure of dams and criteria for structural stability, principle and their stress, stability analysis, Elementary profile of a gravity dam, Profile from practical considerations, Openings in dams.

UNIT 2: Spillways and Energy Dissipaters: Introduction, essential requirements of a spillway, spillway capacity, components, Types of spillways, Ogee Spillway, Energy Dissipation below spillways, Types of Energy dissipater, USBR and Indian stilling basins.

UNIT 3: Diversion Head-works: Introduction, Types of diversion works, location and components, Weir and Barrage, Effect of construction of weir on the river regime, Bligh's creep theory, Theory of seepage flow, Khosla's theory, Vertical drop Weir.

UNIT 4: Regulation Works: Introduction, Definition of falls, necessity and location of falls, comparative study of the main types of falls. Hydraulic Gates: Spillway gates, types, tainter gates, Roller gates.

UNIT 5: Cross Drainage Works: Introduction, suitability, various types of C-D Works, Design principles of C-D Works

Text Books:

1. Irrigation Engineering and Hydraulic Structures – S.K. Garg (Khanna Publications)
2. Irrigation Engineering – B.C. Punmia (Laxmi Publications)
3. Irrigation, Water Resources and Water Power Engineering – Dr. P.N. Modi (Standard Book House)

Course Outcome

On completion of this course the student will be able:

CO1: Explain the various forces acting on gravity dam and its stability analysis

CO2: Design of ogee spillway and getting concept of energy dissipation

CO3: Explain the diversion head-works and the theory of seepage flow

CO4: Demonstrate the concept of regulation works, falls and spillways gates

CO5: Apply the basic design principles of Cross Drainage Works

SYLLABUS	(SEMESTER VII)	Periods/ Week			Internal Assessment (IA)			ESE	Grand Total	Credits
Subject Code:	CE207TPE02A	L	T	P	CT-I	CT-II	TOTAL	70	100	3
Subject:	Environmental Geo-technology	3	0	0	15	15	30			

Course Learning Objectives:

- Learning various soil engineering for land reclamation purposes, conversion of degraded waste land in new land use.
- Understanding land degradation and soil pollution and their restoration.
- Integration of engineering techniques with ecological process for restoration of productivity.

Course Content:

UNIT-1 Soil and ground water pollutants - their sources, nature, composition and polluting effects. The physico-chemical aspects of soils contaminated by various pollutants. Effects of environment and wastes on the properties of soils.
UNIT–2 Solid and liquid wastes disposal method and management. land treatment systems.
UNIT-3 Man made changes in geotechnical environment - mining, embankments, pumping, reservoir, land fills and reclamation effects and control.
UNIT- 4 Control of contamination with use of clay barriers, geosynthetics, cut-off walls, leachate collection systems.
UNIT- 5 Stabilization - different materials and techniques in control of ground pollution and treatment.

Text Books:

1. D.E.Daniel, Geotechnical Practice for Waste Disposal, Chaman & Hall, London, 1993
2. Hsai_Yang Fang and Daniels, J.L. Introductory Geotechnical Engineering an Environmental Perspective, Taylor & Francis, Oxon., 2006.
3. Lakshmi N. Reddy, Hilary. I. Inyang – Geo-Environmental Engineering – Principles and Applications – Makcel Dekker Ink, 2000
4. Mitchell, J.K. and Soga, K., Fundamentals of Soil Behaviour, John Wiley & Sons, Inc., New Jersey., 2005.
5. Mohamed, A.M.O. and Antia, H.E., Geo-environmental Engineering, Elsevier, Netherlands, 1998.
6. Reddy, L.N. and Inyang, H. I., Geo-environmental Engineering –Principles and Applications, Marcel Dekker, Inc., New York., 2000.
7. Yong, R. N., Geo-environmental Engineering: Contaminated Soils, Pollutant Fate and Mitigation", CRC press LLC, Florida., 2001.

Course Outcomes:-

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

CO1: Understanding causes of soil pollution.

CO2: Understand the fundamentals of soil behavior under varied environmental conditions.

CO3: Identify contaminant transport mechanisms in soils.

CO4: Specify site investigation techniques in the characterization of the contaminated site

CO5: Understand remediation techniques to reclaim degraded land for conversion in to various land uses.

SYLLABUS	(SEMESTER VII)	Periods/ Week			Internal Assessment (IA)			ESE	Grand Total	Credits
Subject Code:	CE207TPE02B	L	T	P	CT-I	CT-II	TOTAL	70	100	3
Subject:	Air and Noise Pollution and Control	3	0	0	15	15	30			

Course Learning Objectives:

- To comprehend the essential concepts of Air and Noise pollution Learning
- To understand, measure and evaluate the character &behaviour of air and noise pollutants
- To understand the measurement techniques and strategies to control their presence in the ambient atmosphere.

Course Content:

Unit I: Air pollution: composition and structure of atmosphere, global implications of air pollution. classification of air pollutants: particulates, hydrocarbon, carbon monoxide, oxides of sulphur, oxides of nitrogen and photochemical oxidants. Indoor air pollution. Effects of air pollutants on humans, animals, property and plants.

Unit II: Air pollution chemistry, meteorological aspects of air pollution dispersion; temperature lapse rate and stability, wind velocity and turbulence, plume behaviour, dispersion of air pollutants, the Gaussian Plume Model, stack height and dispersion.

Unit III: Ambient air quality and standards, air sampling and measurements; Ambient air sampling, collection of gaseous air pollutants, collection of particulate air pollutants, stack sampling. Control devices for particulate contaminants: gravitational settling chambers, cyclone separators, wet collectors, fabric filters (Bag-house filter), electrostatic precipitators (ESP).

Unit IV: Control of gaseous contaminants: Absorption, Adsorption, Condensation and Combustion, Control of sulphur oxides, nitrogen oxides, carbon monoxide, and hydrocarbons. Automotive emission control, catalytic convertor, Euro-I, Euro-II and Euro-III specifications, Indian specifications.

Unit V NOISE POLLUTION: Basics of acoustics and specification of sound; sound power, sound intensity and sound pressure levels; plane, point and line sources, multiple sources; outdoor and indoor noise propagation; psycho-acoustics and noise criteria, effects of noise on health, annoyance rating schemes; special noise environments: Infra-sound, ultrasound, impulsive sound and sonic boom; noise standards and limit values; noise instrumentation and monitoring procedure. Noise indices.

Text Books:

1. Peavy, Rowe and Tchobanoglous: Environmental Engineering.
2. Martin Crawford: Air Pollution Control Theory.
3. Wark and Warner: Air Pollution: Its Origin and Control.
4. M.N.Rao& HVN Rao, Air Pollution, Tata McGraw-Hill Publishing Company Limited, New Delhi.
5. Environmental Pollution Control Engineering- CS Rao, Wiley Eastern Ltd., New Delhi, 1996.
6. Environmental Noise Pollution – PE Cunniff, McGraw Hill, New York, 1987
7. Mycock, McKenna and Theodore: Handbook of Air Pollution Control Engineering and Technology.
8. Suess and Craxford: W.H.O. Manual on Urban Air Quality Management

Course Outcomes:-

After studying the course, the students will be able to

CO1: Identify the major sources, effects and monitoring of air and noise pollutants.
CO2: Understand the key transformations and meteorological influence on air and noise.
CO3: Understand the behaviour of air pollutants in atmosphere.
CO4: Relate and analyse the pollution regulation on its scientific basis.
CO5: Application of various control equipment's for the abatement of air and noise.
CO6: Evaluate the engineering solutions for industrial and vehicular air & noise pollution problems.

Syllabus	(SEMESTER VII)	Periods/ Week			Internal Assessment (IA)			ESE	Grand Total	Credits
Subject Code:	CE207TPE02C	L	T	P	CT-I	CT-II	TOTAL	70	100	3
Subject:	Solid and Hazardous Waste Management	3	0	0	15	15	30			

Course Learning Objectives:

- To define and characterize municipal solid wastes from technical and regulatory points of view.
- To provide comprehensive ways of collection, transportation and management of different types of solid wastes.
- To classify the waste and remove hazardous wastes; apply different methods of management.
- .To introduce the most common techniques for hazardous waste disposal.
- To use laboratorial tests in sampling & characterization of solid wastes.

Course Content:

UNIT-1:Municipal Solid Waste Management
Legal and Organizational foundation: Definition of Solid Waste, Waste Generation Technological Society, Major Legislation, Monitoring Responsibilities, Sources and Types of Solid Waste, Sampling and Characterization – Determination of Composition of MSW, Storage and Handling of Solid Waste ,Future Changes in Waste Composition.

UNIT-2:Collection and Transport of Solid Waste
Collection of Solid Waste: Type of Waste Collection Systems, Analysis of Collection System, Alternative Techniques for Collection System, Separation, Processing and Transformation of Solid Waste: UNIT Operations User for Separation and Processing, Materials Recovery Facilities, Waste Transformation through Combustion and Aerobic Composting, Anaerobic Methods for Materials Recovery and Treatment, Energy Recovery.
Incinerator: Transfer and Transport
Need for Transfer Operation, Transport Means and Methods, Transfer Station Types and Design Requirements, Landfills, Site Selection, Design and Operation, drainage and Leachate Collection Systems , Requirements and Technical solution, Designated Waste Landfill Remediation, Integrated Waste Management Facilities.
UNIT-3:Hazardous Waste Management
Definition and Identification of Hazardous Wastes-Sources and Characteristics, Hazardous Wastes in Municipal Waste ,Hazardous Wastes Regulations ,Minimization of Hazardous Waste-Compatibility, Handling and Storage of Hazardous Waste-Collection and Transport, e-waste Sources, Collection, Treatment and Reuse Management.

UNIT-4:Hazardous waste treatment and Design
Hazardous Waste Treatment Technologies, Design and Operation , Facilities for Physical, Chemical and Thermal Treatment of Hazardous Waste –,Solidification, Chemical Fixation and Encapsulation, Incineration, Hazardous Waste landfills: Site Selection, Design and Operation, Remediation of Hazardous Waste Disposal Sites.

UNIT-5:Laboratory Practice: Sampling and Characterization of Solid Wastes; TCLP Tests and Leachate Studies.

Text Books:
1) Integrated Solid Waste Management by George Techobanoglous et al, McGraw-Hill Publication, 1993.
2) Hazardous Waste Management by Charles A. Wentz, McGraw Hill Publication, 1995.

Reference Books:
1) Solid and Hazardous Waste Management by S.C. Bhatia,Atlantic Publishers; Edition (1 December , 2007).
2) Solid and Hazardous Waste Management by M.N Rao & Razia Sultana,BS Publications, Second Edition (2020)

Course Outcomes:- At the end of the course completion, the students shall be able to:

CO1: Ability to characterize municipal solid wastes from technical view.
CO2: Learn ways of collection, transportation and management of different types of solid wastes.
CO3: Apply different methods of management for hazardous wastes.
CO4: Develop most suitable techniques for disposal of hazardous wastes.
CO5: Learn different laboratorial tests for solid wastes.

SYLLABUS	(SEMESTER VII)	Periods/ Week			Internal Assessment (IA)			ESE	Grand Total	Credits
Subject Code:	CE207TPE02D	L	T	P	CT-I	CT-II	TOTAL	70	100	3
Subject:	Urban Hydrology and Hydraulics	3	0	0	15	15	30			

Course Learning Objectives:

- To describe physical properties of urban area.
- To understand the elements of drainage systems.
- To study about urban water supply
- To know about the measures to control storm water pollution
- To learn urban watershed software.

Course Content:

UNIT 1: Urbanisation: Process of urbanisation, Trends of urbanisation and industrialisation, influence on hydrologic cycle, effects and consequences for drainage, Rainfall analysis in urban environment, design storm. Urban Runoff computations: Empirical, Time-area and unit hydrograph approaches. Urban storm water runoff: overland flow.

UNIT 2: Design of drainage system elements: Hydraulic fundamentals, infiltration and on-site detention of storm water, design of sewerage and drainage channels, design of appurtenances, road drainage, design of pumping stations

UNIT 3: Urban water supply: Estimate of demand, sources in surface and groundwater, Reservoir, capacity estimation.

UNIT 4: Control of storm water pollution: Pollution build-up and wash off process with reference to urban drainage systems. Source control in commercial and industrial complexes, storage options - dry and wet ponds, biological treatment of wastewater, chemical treatment of storm water

UNIT 5: Introduction to urban watershed software - Hydrologic Cistern, water conservation and ecological aspects, Water harvesting.

TEXT BOOKS:

1. Chow V T, Handbook of Applied Hydrology: A Compendium of Water resources technology, McGraw Hill, New York, 1964.
2. Gupta R S, Hydrology and Hydraulic Systems, Prentice Hall Publishers, New Jersey, 1989.
3. Geiger W F, Marsalek J Z, and Rawls G J, Manual on Drainage in Urban Areas, 2 Volumes, UNESCO, Paris, 1987
4. Hall M J, Urban Hydrology, Elsevier Applied Science Publishers, New York, 1984.
5. Stahre P, and Urbonas B, Stormwater Detention for Drainage, water quality and CSO Management, Prentice Hall Publishers, New Jersey, 1983.
6. Wanielista M P, and Yousef Y A, Stormwater Management, JohnWiley and Sons, New York, 1993.

Course Outcome: At the end of the course students shall be able to:

CO1: Understand and explain the effects of urbanization on rainfall and runoff.

CO2: Design various urban drainage system elements.

CO3: Estimate the demand of urban areas

CO4: Identify and apply the control required for storm water pollution

CO5: Use urban watershed software for simulation purpose.

SYLLABUS	(SEMESTER VII)	Periods/ Week			Internal Assessment (IA)			ESE	Grand Total	Credits
Subject Code:	CE207TPE02E	L	T	P	CT-I	CT-II	TOTAL	70	100	3
Subject:	Environmental Impact Assessment and Life Cycle Analysis	3	0	0	15	15	30			

Course Learning Objectives:

- Identify environmental attributes for the EIA study.
- Identify methodology and prepare EIA reports.
- Specify methods for prediction of the impacts.
- Formulate environmental management plans.
- Understand the concept of life cycle analysis (LCA) and the basic principles.

Course Content:

UNIT-1:Introduction: Historical development of Environmental Impact Assessment (EIA). EIA in Project Cycle. Legal and Regulatory aspects in India. – Types and limitations of EIA – Cross sectoral issues and terms of reference in EIA – Public Participation in EIA. EIA process- screening – scoping - setting – analysis – mitigation

UNIT–2: Components and Methods for EIA: Matrices – Networks – Checklists – Connections and combinations of processes – Cost benefit analysis – Analysis of alternatives – Software packages for EIA – Expert systems in EIA. Prediction tools for EIA – Mathematical modelling for impact prediction – Assessment of impacts – air – water – soil – noise – biological — Cumulative Impact Assessment – Documentation of EIA findings – planning – organization of information and visual display materials – Report preparation. EIA methods in other countries.

UNIT-3:Environmental Management Plan: Environmental Management Plan - preparation, implementation and review – Mitigation and Rehabilitation Plans – Policy and guidelines for planning and monitoring programmes – Post project audit – Ethical and Quality aspects of Environmental Impact Assessment.

UNIT- 4:An Introduction to Sustainability Concepts and Life Cycle Analysis (Introduction, Material flow and waste management, What it all means for an engineer? Water energy and food nexus). Risk and Life Cycle Framework for Sustainability (Introduction, Risk, Environmental Risk Assessment, Example Chemicals and Health Effects, Character of Environmental Problems)

UNIT- 5:Environmental Data Collection and LCA Methodology (Environmental Data Collection Issues, Statistical Analysis of Environmental Data, Common Analytical Instruments, Overview of LCA Methodology - Goal Definition, Life Cycle Inventory, Life Cycle Impact Assessment, Life Cycle Interpretation, LCA Software tools). Life Cycle Assessment – Detailed Methodology and ISO Framework (Detailed Example on LCA Comparisons, LCA Benefits and Drawbacks, Historical Development and LCA Steps from ISO Framework)

Text Books:

1) Anjaneyulu.Y., and Manickam. V., Environmental Impact Assessment Methodologies, B.S. Publications, Hyderabad, 2007
2) Canter, L.W., Environmental Impact Assessment, McGraw Hill Pub. Co., New York. 1997
3) David P. Lawrence, Environmental Impact Assessment: Practical Solutions to Recurrent Problems, John Wiley & Sons, 2003
4) Environmental Assessment, 2001. Ravi Jain, LV Urban, GS Stacey, H Balbach, McGraw-Hill.
5) Handbook on Life Cycle Assessment : Operational guide to the ISO standards, Kluwer Academic Publishers, 2004
6) Hosetti, B. B., Kumar A, Eds, Environmental Impact Assessment & Management, Daya Publishing House, 1998
7) Lawrence, D.P., Environmental Impact Assessment – Practical solutions to recurrent problems, Wiley-Inter science, New Jersey, 2003.
8) Petts, J., Handbook of Environmental Impact Assessment, Vol., I and II, Blackwell Science, London, 1999.

Course Outcomes: At the end of the course the student will be able to:

CO1: Identify environmental attributes for the EIA study.
CO2: Identify methodology and prepare EIA reports.
CO3: Specify methods for prediction of the impacts.
CO4: Understand EIA tools & methodologies, auditing and documentation of EIA
CO5: Formulate environmental management plans
CO6: Perform life cycle inventory analysis of products.
CO7: Develop strategies to bring energy efficiency in all stages of the product development cycle.
CO8: Formulate plans for comprehensive environmental protection, in order to comply with environmental laws

SYLLABUS	(SEMESTER VII)	Periods/ Week			Internal Assessment (IA)			ESE	Grand Total	Credits
Subject Code:	CE207TPE03A	L	T	P	CT-I	CT-II	TOTAL	70	100	3
Subject:	Engineering Hydrology	3	0	0	15	15	30			

Course Learning Objectives:

- To develop the fundamentals of hydrology and Precipitation.
- To study various abstractions of precipitation.
- To understand the concepts of Rainfall-Runoff correlations
- To learn about the importance of Hydrographs and the basics of the flood.
- To understand the fundamentals of groundwater hydrology

Course Content:

UNIT-1 Introduction Description of Hydrologic Cycle, Overview of the applications of hydrology in engineering, Forms of precipitation, measurement, depth-area-duration, and intensity-duration frequency relations.

UNIT–2Abstraction from Precipitation, Evaporation : process, measurement, and estimation, Evapotranspiration measurement and estimation Infiltration process, measurement, and estimation.

UNIT-3 Runoff Surface Runoff and Stream Flow Measurements, Rainfall-Runoff relations.

UNIT- 4 Hydrograph Factors affecting flow hydrograph, Unit hydrograph, its analysis, and S-curve hydrograph, Synthetic and instantaneous unit hydrographs. Basics of Flood and Flood Routing.

UNIT- 5 Groundwater Occurrence of groundwater, types of aquifers, aquifer properties, Darcy's law, Conductivity and Transmissivity, the yield from a well under steady-state conditions, Laboratory and field measurement of permeability.

Text Books:

1. Engineering Hydrology K.Subramanya, Tata McGraw-HillEducation
2. Hydrology Principles, Analysis and Design H.M.Raghunath, New AgeInternational
3. Hand BookofAppliedhydrologyV.T.Chow, McGraw-Hill,Inc
4. ViessmanWandLewisGL(2008)"IntroductiontoHydrology" PrenticeHallofIndia
5. Ojha,C.S.P. , Bhunya, P. and Berndtsson, R. - Engineering Hydrology, Oxford University PressCanada.
6. K. C. Patra, Hydrology and Water Resources Engg., Narosa Publishing house, New Delhi.
7. D. K. Todd, Groundwater Hydrology, John Wiley and Sons

Course Outcomes-Upon completion of this course students shall be able to

CO1: Describe the basic concepts of hydrology and precipitation to integrate them with the physical hydrological processes.

CO2: Understand and Explain the various process, measurements, and estimations of hydrological components

CO3: Formulate the rainfall-runoff relationship and apply it to engineering practices.

CO4: Explain and use the hydrographs for practical purposes and investigations.

CO5: Understand and explain the basics of groundwater hydrology.

SYLLABUS	(SEMESTER VII)	Periods/ Week			Internal Assessment (IA)			ESE	Grand Total	Credits
Subject Code:	CE207TPE03B	L	T	P	CT-I	CT-II	TOTAL	70	100	3
Subject:	Structural Dynamics	3	0	0	15	15	30			

Course Learning Objectives:

- To Introduce fundamentals of vibrations of SDOF system
- To Impart damped and undamped system
- To Present free and forced vibration
- To Acquaint with free and forced vibration of MDOF system
- To Present free and forced vibration of continuous system

Course Content:

UNIT- 1: INTRODUCTION: Comparison between static and dynamic analysis; Degrees of freedom; Undamped system; Newton's law of motion; 'D' Alembert's principle; Solution of the differential equation of motion.

UNIT-2: FREE VIBATION OF SINGLE DEGREE - OF - FREEDOM SYSTEM: Equation of motion for single degree - of - freedom system; free undamped vibration of the SDOF system; Damped single degree - of - freedom system -Viscous damping; Equation of motion, critically damped system, Over- damped system, Under-damped system and Logarithmic decrement.

UNIT-3: RESPONSE OF SDOF SYSTEM TO HARMONIC LOADING: Undamped harmonic excitation; Damped harmonic excitation; Evaluation of damping at resonance; Response to support motion; Force transmitted to the foundation. Response of SDOF system to general dynamic loading: Impulsive loading and Duhamel's integral; Numerical evaluation of Duhamel's integral — Undamped system;Numerical evaluation of Duhamel's integral -Damped system.

UNIT-4: GENERALIZED COORDINATES AND RAYLEIGH'S METHOD: Principle of virtual work; Generalized SDOF system - Rigid body; Generalized SDOF system - Distributed elasticity; Rayleigh's method; Improved Rayleigh's method.

UNIT-5: STRUCTURES MODELED AS SHEAR BUILDINGS: Stiffness equations for the shear building; Flexibility equations for the shear building; Free vibration of a shear building (Single bay two Storeyed) - Natural frequencies and normal modes. Forced motion of shear buildings (Two Storeyed): Modal superposition method; Response of a shear building to base motion; Harmonic forced excitation.

Text Books/Reference Books:

1. Dynamics of Structures by A.K.Chopra, Second edition (2001), Prentice Hall India Private Ltd
2. Dynamics of Structures by Clough, R.W. &Penzin, J., McGraw Hill, 1993.
3. Earthquake Resistant Design of Structures by Pankaj Agarwal, Manish Shrikhande , 1st edition (2006), Prentice Hall of India Private Ltd., New Delhi .
4. Dynamics of Structures by Humar, J.L., Prentice Hall, 1990.
5. Structural Dynamics by Mario, Paz, CBS Publ. New-Delhi, 1995.
6. Advanced Dynamics by Timoshanko, S., McGraw Hill Book Co, NY, 1948.
7. Elements of Vibration Analysis by Meirovitch, L., 2nd Edi. McGraw Hill Intr. Edi.,Singapore, 1986.
8. Introduction of Structural Dynamics, Biggs, J.M., McGraw Hill, NY, 1964
9. Principles and techniques of vibrations by L Meirovich, 1997, Prentice Hall, NJ.
10. Analytical methods in vibrations by L Meirovich, 1967, Macmillan, NY.
11. Theory of vibrations by W T Thompson, 1983, Prentice hall, New Delhi
12. Vibration: fundamentals and practice by C W de Silva, 1999, CRC Press, Boca Raton.
13. Mechanical Vibrations by S S Rao, 2004, 4th Edition, Pearson Education, New Delhi.

Course Outcomes:

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

CO1: Convert a physical structure into SDOF system/model
CO2: Find response of free and force vibration (harmonic, periodic and transient) of SDOF system
CO3: Calculate natural frequency and mode shapes of MDOF system
CO4: Carry out modal analysis of MDOF system
CO5: Get the Response of structures by performing experiments and/or by computer simulation.

SYLLABUS	(SEMESTER VII)	Periods/ Week			Internal Assessment (IA)			ESE	Grand Total	Credits
Subject Code:	CE207TPE03C	L	T	P	CT-I	CT-II	TOTAL	70	100	3
Subject:	Foundation Engineering	3	0	0	15	15	30			

Course Learning Objectives:

- To introduction of different methods of soil exploration.
- To provide comprehensive studies of shallow foundation and calculate settlements.
- To analyze various types of footings & rafts.
- To introduction of various types of piles foundations and to calculate bearing capacity.
- To introduce Comprehensive studies of Retaining walls and determine stability.

Course Content:

UNIT-1 Site Investigation And Selection Of Foundation: Scope and Objectives, Methods of Exploration , Augering and Boring ,Wash Boring and Rotary Drilling ,Depth and Spacing of Bore Holes ,Soil Samples ,Representative and Undisturbed, Sampling Methods Split Spoon Sampler, Thin Wall Sampler, Stationary Piston Sampler ,Penetration Tests (SPT and SCPT) ,Data Interpretation ,Strength Parameters ,Bore Log Report and Selection of Foundation.

UNIT–2 Shallow Foundation: Location and Depth of foundation, Codal Provisions, Bearing Capacity of Shallow Foundation onHomogeneous Deposits ,Terzaghi's Formula and BIS formula ,Factors Affecting Bearing Capacity Bearing Capacity from In-Situ Tests (SPT, SCPT and Plate Load) ,Allowable Bearing Pressure , Seismic Considerations in Bearing Capacity Evaluation, Determination of Settlement of Foundations on Granular and Clay Deposits ,Total and Differential Settlement , Allowable Settlements , Codal Provision , Methods of Minimizing Total and Differential Settlements.

UNIT-3 Footings And Rafts: Types of Isolated Footing, Combined Footing, Mat Foundation, Contact Pressure and Settlement Distribution, Proportioning of Foundations for Conventional Rigid Behavior, Minimum Thickness for Rigid Behavior, Applications, Compensated Foundation, Codal Provisions.

UNIT- 4 Pile Foundation: Types of Piles and Functions ,Factors Influencing the Selection of Pile , Carrying Capacity of Single Pile in Granular and Cohesive Soil , Static Formula ,Dynamic Formulae (Engineering News and Hilevy) ,Capacity from In-Situ Tests (SPT and SCPT) , Negative Skin Friction , Uplift Capacity, Group Capacity by Different Methods (Feld's rule, Converse — Labarre formula and Block Failure Criterion) ,Settlement of Pile Groups , Interpretation of Pile Load Test (Routine Test Only), Under Reamed Piles, Capacity under Compression and Uplift , Cohesive -Expansive ,Non Expansive — Cohesionless Soils , Codal Provisions.

UNIT- 5 Retaining Walls: Plastic Equilibrium in Soils ,Active and Passive States , Rankine's Theory for Cohesionless and Cohesive Soil ,Coulomb's Wedge Theory , Condition for Critical Failure Plane ,Earth Pressure on Retaining Walls of Simple Configurations , Culmann's Graphical method ,Pressure on the Wall due to Line Load ,Stability Analysis of Retaining Walls ,Codal Provisions.

Text Books:

1) Foundation Analysis and Design by J. E. Bowels, McGraw Hill. Companies, Inc. 6th Ed. 2001.
2) Principles of Foundation Engineering by B. M. Das, CENGAGE Learning. Seventh Edition.
3) Foundation Engineering Handbook by R. W. Day, McGraw Hill. ConstructionASCE Press. Ed. 2006.
4) Basic and Applied Soil Mechanics by Gopal Ranjan & A.S. R. Rao, New Age International (P) Limited Publishers, New Delhi-110002.
5) Textbook of Soil Mechanics and Foundation Engineering –Geotechnical Engineering Series (PB 2018) by V.N. S. Murthy, CBS Publications, New Delhi
6) Soil Mechanics by Robert V. Whitman & T. William Lambe, Wiley India Pvt Ltd., New Delhi.
7) Soil Mechanics and Foundation Engineering (Geotechnical Engineering) by Dr. P.N. Modi, Standard Book House(Rajsons Publications Pvt Ltd), New Delhi-110002

Course Outcomes:-At the end of the course completion, the students shall be able to:

CO1: Understand different methods of soil exploration.
CO2: Analyze various shallow foundations and calculate different types of settlements.
CO3: Understand various types of footings & rafts.
CO4: Analyze bearing capacity of piles with different methods
CO5: Design stability of Retaining walls.

SYLLABUS	(SEMESTER VII)	Periods/ Week			Internal Assessment (IA)			ESE	Grand Total	Credits
Subject Code:	CE207TPE03D	L	T	P	CT-I	CT-II	TOTAL	70	100	3
Subject:	Rock Mechanics	3	0	0	15	15	30			

Course Learning Objectives:

- To understand the basics of rock mechanics and able to analysis stress.
- To calculate strain and determine physical properties of rocks.
- To determine mechanical properties of rocks by different methods.
- To analyse different models of stress–strain in rocks.
- To determine the static & dynamic elastic constants of rocks.

Course Content:

UNIT – 1: INTRODUCTION TO ROCK MECHANICS

Definition, Scope, Importance & Development, Application in Mining, Discontinuities; Description of Discontinuities, Introduction to Mapping and Hemispherical Projection of Discontinuities, Barton's Shear Strength of Joints.
Analysis of Stress: Introduction, Definition and Basic Concepts, Stress in a Plane(2-D), Mohr's Circle of Stress, Secondary Principal Stress, Equations of Equilibrium, Plane Stress Equations.

UNIT – 2: ANALYSIS OF STRAIN

Introduction, Definition and Basic Concepts, Strain in a Pane (2-D), Mohr's Circle of Strain, Equations of Compatibility, Stress-Strain Relationship, Basic Equations in Elastic Theory, Pain Strain Equations, Elasto Plastic Behaviour of Rocks, Stress – Strain Curves of Various Rocks.
Physical Properties: Definition and Determination of Density, Hardness, Porosity, Permeability, Moisture Content, Degree of Saturation, Electrical and Thermal Properties of Rocks.

UNIT – 3: MECHANICAL PROPERTIES

Definition and Determination of Compressive Strength, Tensile Strength, Shear Strength, Triaxial Testing. Time Dependent Properties, Scaling of Laboratory Data to In-Situ Values.
Rock Indices: Protodyakanov Strength Index, Point Load Strength Index, RQD, In-Situ Strength Properties of Rocks, Necessity and Requirement, Methods of In-Situ Stress Measurements, Plate Load Test, Cable Jack Test, Bore Hole Test, Dilatometer Test, Flat Jack Test, Hydraulic Fracture and Velocity Propagation.

UNIT – 4: RHEOLOGICAL MODELS

Relationship and Rate of Change of Stress-Strain for Idealizing Materials – Models Representing Elastic, Plastic, Viscous, Elasto-Plastic, Non-Elastic and Brittle Rock Properties.

UNIT – 5: STATIC AND DYNAMIC ELASTIC CONSTANTS OF ROCKS

Static Elastic Constants of Rocks: Introduction, Definition, Instrument, Measurement of Deformation, Mechanical, Optical, Electrical Gauges, LVDT, Calculation of Elastic Constants of Rocks.
Dynamic Elastic Constants of Rocks: Introduction, Elastic Wave, Calculation of Modulus of Elasticity.

TEXT BOOKS:

1) Rock Mechanics for Engineers - B. P. Verma, 2nd edition, Khanna Publishers, 1989.
2) Strata Mechanics in Coal Mining - Jeremic, K. L. Jeremic, Rotterdam, Balkema, 1985.
3) Fundamentals of Rock Mechanics - Jager & Cook, Methuen andco. London, 1969.
4) Handbook on Mechanical Properties of rocks - R.D. Lama, V. S. Vutukuri, Vol. I to IV, Transtech Publications,1978.
5) Rock Mechanics for Underground Mining - 2nd edition, Brady and Brown, Khwar AcademicPublishers, 1993.

Course Outcomes: At the end of the course completion, the students shall be able to:

CO1: Learn basics of rock mechanics and calculate stresses.
CO2: Determine physical properties of rocks and strain.
CO3: Evaluate mechanical properties of rocks.
CO4: Compare stress strain in rocks by different methods.
CO5: Determine the static & dynamic elastic constants of rocks.

SYLLABUS	(SEMESTER VII)	Periods/ Week			Internal Assessment (IA)			ESE	Grand Total	Credits
Subject Code:	CE207TPE03E	L	T	P	CT-I	CT-II	TOTAL	70	100	3
Subject:	Water Resources Planning & Management	3	0	0	15	15	30			

Course Learning Objectives:

- To learn how to assess water resources
- To study how to develop suitable plans for water resources development and management
- To understand various types of water resources systems.
- To learn managing the water resources quality and quantity
- To understand water quantity and quality modelling.

Course Content:

UNIT 1: Introduction: Role of water in national development, assessment of water resources of country, scope of water resources development vis-a-vis environment, Irrigation development in India, utilisation of Irrigation potential.

UNIT 2: Planning: Water resources planning process; planning for single purpose and multipurpose projects, estimation of different water needs and project formulations, comparison of alternatives, cost-benefit analysis.

UNIT 3: Water Resources Systems: Definition, types of system, optimization techniques, system approach, system analysis, linear programming, and formulation of a linear programming problem, formulation with different types of constraints, graphical analysis, graphical solution, simplex method, optimization techniques and systems approach.

UNIT 4: Management: Evaluation and monitoring of water quantity and quality; managing water distribution networks for irrigation, flood control and power generation, inter-basin transfer of water, conjunctive use of surface and ground water.

UNIT 5: Modelling: Water quantity and quality modelling, evaluation of impacts of water resources projects on river regimes and environment, reservoir sedimentation and watershed management.

Text Books:

1. Principles of Water Resources Planning – Good Man, A.S., (Prentice Hall, Inc., Englewood Cliffs, N.J. 1984.)
2. Water Resources Systems -S Vedula and P P Majumdar, Tata McGraw-Hill Education, 2005
3. James, L. Douglas, and Robert R. Lee, Economics of Water resources Planning, McGraw-Hill Book Company, 1971.
4. Quentin Grafton, R. and Karen Hussey, Water Resources Planning and Management, Cambridge University Press, 2011.
5. Water Resources System, Planning and Management – M.C. Chaturvedy (Tata McGraw Hill)
6. Water Resources System, Planning and Management – Helweg O.J. (John and Wiley & Sons)

Course Outcomes- after completion of the course the students shall be able to

CO1: Describe the potential of assessing water resources
CO2: Prepare master and strategic water resources planning
CO3: Apply the optimization techniques for water resources systems.
CO4: Exercise the management of water resources in different real life situations
CO5: Solve various water resources problems using modelling.

SYLLABUS	(SEMESTER VII)	Periods/ Week			Internal Assessment (IA)			ESE	Grand Total	Credits
Subject Code:	CE207TPE04A	L	T	P	CT-I	CT-II	TOTAL	70	100	3
Subject:	Industrial Structures	3	0	0	15	15	30			

Course Learning Objectives:
The purpose of this course is to:

- Develop an in-depth knowledge in the area of design of industrial structure with the latest code of practice as per the Indian Standard.
- To introduce the students about planning & functional requirement of industries
- To analyse& design the industrial buildings, bunkers & Silos
- To understand the design concept of chimneys
- To understand the principles of cylindrical shells

Course Content:

UNIT: I Planning and functional requirements- classification of industries and industrial structures- planning for layout- requirements regarding lighting ventilation and fire safety- protection against noise and vibrations

UNIT-II Thin Walled / Cold Formed Steel Members: Definitions – Local Buckling of Thin-Elements-Post Buckling of Thin-Elements – Light Gauge Steel Columns and Compression Members – Form-Factor for Columns and Compression Members – Behaviour of Stiffened Elements Under Uniform Compression – Multiple Stiffened Compression Elements –Effective Length of Light Gauge Steel Compression Members – Light Gauge Steel Tension Members.

UNIT-III RC Bunkers & Silos: Introduction – Janssen's Theory – Airy's Theory – Design of Square, Rectangular and Circular Bunkers; Design of Silos.

UNIT-IV RC Chimneys: Introduction – Wind Pressure – Stresses in Chimney Shaft Due to Self-Weight and Wind – Stresses in Horizontal Reinforcement Due to Wind Shear – Stresses Due to Temperature Difference – Combined Effect of Self Load, Wind and Temperature – Temperature Stresses in Horizontal Reinforcement Problems.

UNIT-V Design Principles of Cylindrical Shells & Design Problems.

TEXT BOOKS

1) Advanced Reinforced Concrete Design, By N. Krishna Raju (CBS Publishers & Distributors) 2005
2) Design of Steel Structures, By Ram Chandra and Virendra Gehlot vol-II, 2007.
3) Design of Steel Structures, By Duggal - Tata McGraw-Hill publishers – 2010
4) Handbook on Machine Foundations by P. Srinivasulu and C. V. Vaidyanathan, Structural Engineering Research Center
5) Tall Chimneys- Design and Construction by S. N. Manohar Tata Mc Grawhill Publishing Company

REFERENCES:

1) Transmission Line Structures by S. S. Murthy and A. R. Santakumar McGraw Hill
2) SP 32: 1986, Handbook on functional requirements of Industrial buildings
3) Design of steel structures by N. Subramanian

Course Outcomes:-
Course Outcomes: At the end of the course, the student will be able to -

CO1: Plan the functional requirements of structural systems for various industries.
CO2: Get an idea about the materials used and design of industrial structural elements.
CO3: Realize the basic concepts and design of power plant structures.
CO4: Design power transmission structures.
CO5: Possess the ability to understand the design concepts of Chimneys, bunkers and silos

SYLLABUS	(SEMESTER VII)	Periods/ Week			Internal Assessment (IA)			ESE	Grand Total	Credits
Subject Code:	CE207TPE04B	L	T	P	CT-I	CT-II	TOTAL	70	100	3
Subject:	Airport Planning and Design	3	0	0	15	15	30			

Course Learning Objectives:

- To familiarize students with of airport planning.
- To develop the knowledge for design and analysis of airport runway, taxiway and airport pavement crust.
- To understand air traffic control system.

Course Content:

UNIT-1 Airport Planning: Significance of transport, Different modes of transportation, Airport master plan-FAA recommendation, Regional planning, airport site selection, survey for site selection, Estimation of future air traffic, Characteristics of aircraft, Environmental consideration.

UNIT–2Runway Design: Orientation of runway , Basic runway length, Corrections for basic runway length, Runway geometric design.

UNIT-3 Taxiway Design: Controlling factors of taxiway, Geometric design for taxiway, Design for exit taxiways.

UNIT- 4 Airport Pavement Design: Design factors, Design of flexible pavement, Design of rigid pavement, design of overlay pavements.

UNIT- 5Air Traffic Control and Visual Aids: Air traffic control objectives, control system. Visual aids-airport markings and lighting.

Text Books:

1. Dr. S. K. Khanna, M.G. Arora and S.S. Jain, Airport Planning & Design, Nem Chand &Bros.,Roorkee
2. G.V. Rao Airport Engineering, Tata McGraw Hill Pub. Co., New Delhi
3. S.C. Rangwala and K.S, Rangwala, Airport Engineering, Charotar Publishing House Pvt. Ltd, Anand

Course Outcomes:-

After learning the course the students should be able to:

CO1: Understand the fundamentals of airport planning.

CO2: Familiarize with design of runway.

CO3: Recognize design of taxiway

CO4: Understand airport pavement design

CO5: Analyse air traffic control system.

SYLLABUS	(SEMESTER VII)	Periods/ Week			Internal Assessment (IA)			ESE	Grand Total	Credits
Subject Code:	CE207TPE04C	L	T	P	CT-I	CT-II	TOTAL	70	100	3
Subject:	Railway Engineering	3	0	0	15	15	30			

Course Learning Objectives:
The objective of this Course is

- Comprehend the history of indian railway and basic study required with respect to construction of railway track.
- To make aware of the different components of railway track and the recent updation in indian railway with respect to the components.
- Comprehensive understanding of the factors involved in designing of the various alignment elements.
- Explain essential features, requirements and components of different types of point, crossings, turnouts, switches, crossovers etc.
- Detailed study and understanding of the signalling and station yard system of railway.

Course Content:

UNIT 1: Introduction to Railways in India: Role of Indian Railways in National Development. Railways for Urban Transportation –LRT & MRTS. Alignment of Railway Lines: Engineering Surveys for Track Alignment. Permanent Way: Components and their Functions.

UNIT 2: Rails - Types of Rails, Length of rail, Weight of Rail, Rail Joints, Creep of rail, Buckling of rail, Kinks of Rail Fastenings, Coning of Wheels & tilting of rails.
Sleepers – Types, Functions, sleeper density.
Ballasts- Types, function, advantage & disadvantage of each type.

UNIT 3: Geometric Design of Railway Tracks: Gradients and Grade Compensation, Super-Elevation, Widening of Gauges in Curves, Transition Curves, Horizontal Curves.

UNIT 4: Points and Crossings, Turnouts: Working Principles, Cross overs.

UNIT 5: Signalling: Types and their function. Station and Yards: Types, Requirements, factors for site selection.

Text Books:

1. Chandra S. and M.M. Agarwal, Railway Engineering, Oxford University Press, New Delhi, India, 2007.
2. Saxena, S.C. and S.P. Arora, Railway Engineering, Dhanpat Rai and Sons, New Delhi, India, 1997.
3. Agarwal, M.M., Indian Railway Track, Prabha and Co., New Delhi, India, 1988.
4. Rangwala, S.C., Principles of Railway Engineering, Charotar Publishing House, Anand, India, 1988.
5. J. S. Mundrey, "Railway Track Engineering", McGraw Hill Publishing Co., 2009

Course Outcomes:

At the end of the course the students shall be able to:

CO1: The students are expected to prepare the detailed project report for the construction, design and operation of mass transit systems that use a fixed guide way.
CO2: The students understands the basic requirents of the components of the railway tracks and also got global updation about the railway track components.
CO3: The students are expected to handle the tasks that include determining horizontal alignment and vertical alignment design.
CO4: The students are able to design various components of point, crossing, turnouts etc.
CO5: The students understand the requirenmets and also differntiate the signalling system for particular track. Also understand the basic factors and requirtenmet of station yards.

SYLLABUS	(SEMESTER VII)	Periods/ Week			Internal Assessment (IA)			ESE	Grand Total	Credits
Subject Code:	CE207TPE04D	L	T	P	CT-I	CT-II	TOTAL	70	100	3
Subject:	Contracts Management	3	0	0	15	15	30			

Course Learning Objectives:

- To introduce about various Authorities, indulge in construction contract management.
- To impart knowledge on municipal bye-laws related to construction.
- To elaborate about construction contracts, arbitration, and litigation procedures

Course Content:

UNIT-1 Introduction and concepts of Construction law-public law-government departments and local authorities.

UNIT–2Private law-contracts-torts-property law and building law-concepts-salient features sections

UNIT-3 Construction contracts-contracts specifications-types of contract documents used for construction.

UNIT- 4 Contract procurement- selection of contractor-contract procedure-salient features.

UNIT- 5Arbitration and litigation procedure-preparation, settlement, evidence, price adjustment-need for the formulae-civil engineering and building formulae- practical implications.

Text Books:

1. Gajaria G. T., laws relating to building and engineering contracts in India, M. M Tripathi Private Ltd., Bombay, 1982.
2. Jimmie Hinze, construction contracts, 2nd edition. McGraw hill, 2001.
3. Joseph T. Bockrath, contracts and the legal environment for engineers and architects, 6th edition, McGraw Hill, 2000.

Course Outcomes-

CO1: To remember about various Authorities, indulge in construction contract management.

CO2: To understand about municipal bye-laws related to construction.

CO3: To remember & understand about various classifications of construction contacts.

CO4: To review about various steps of contract procurement in construction industry.

CO5: To evaluate the role of Arbitration and litigation procedure in settlement of contract related disputes.

SYLLABUS	(SEMESTER VII)	Periods/ Week			Internal Assessment (IA)			ESE	Grand Total	Credits
Subject Code:	CE207TPE04E	L	T	P	CT-I	CT-II	TOTAL	70	100	3
Subject:	Construction Projects Planning & Systems	3	0	0	15	15	30			

Course Learning Objectives:

- To understand the project management and different scheduling techniques.
- To expertise in PERT network analysis.
- To learn CPM network analysis and compared with PERT.
- To understand time-cost analysis and resource scheduling.
- To understand the factor for equipment selection and cost of owing and operating and expertise in evaluation and analysis of different equipment life.

Course Content:

UNIT 1: Introduction: Objectives and functions of project management, project feasibility reports, Planning for construction projects: Steps, factors, advantages and disadvantages for different stake holder.

Scheduling: Scheduling Job layout and Line of balance, project management through networking, Bar Chart, Linked bar chart, Work-break down structures, Activity-on-arrow diagrams.

UNIT 2: PERT: Network analysis, critical path, probability of project.

UNIT3: CPM: Network analysis, Critical Path, Difference between CPM and PERT.

UNIT 4: Time-Cost Trade-off, Resource Scheduling

UNIT 5: Time and motion studies, Standard and special equipment, factors affecting selection of construction equipment, cost of owning and operating the construction Equipment, Equipment Life and Replacement Analysis

Text Books:

1. Chitkara, K.K. "Construction Project Management Planning", Scheduling and Control, Tata McGraw-Hill Publishing Co., New Delhi, 1998.
2. Srinath,L. S., "PERT and CPM Principles and Applications ", Affiliated East West Press, 2001
3. Chris Hendrickson and Tung Au, "ProjectManagement for Construction – Fundamentals Concepts for Owners", Engineers, Architects and Builders, Prentice Hall, Pittsburgh, 2000.
4. Moder J., C.Phillips and Davis, "Project Management with CPM", PERT and Precedence Diagramming, Van Nostrand Reinhold Co., Third Edition, 1983.
5. Construction Planning and Equipment - R.L.Peurifoy - Tata McGraw Hill, New Delhi Willis., E.M., "Scheduling Construction projects", John Wiley and Sons 1986.
6. Halpin,D.W., "Financial and cost concepts for construction Management", John Wiley and Sons, New York, 1985.

Course Outcomes- At the end of the course students will be able to:

- **CO1**: To apply the knowledge in managing and handling of different civil engineering project and also able to schedule the project.
- **CO2**: To do PERT analysis and able to find the project completion time and its probability.
- **CO3**: To do CPM analysis and able to find the project completion time and compare with PERT analysis.
- **CO4**: To do cost and time analysis and also resource allocation, scheduling and crashing for different activities of the network.
- **CO5**: To apply the knowledge in equipment selection and able to find cost of owing and operating and able to find the equipment life, which help in comparisons of different equipments.

SYLLABUS	(SEMESTER VII)	Periods/ Week			Internal Assessment (IA)			ESE	Grand Total	Credits
Subject Code:	CE07TOE02A	L	T	P	CT-I	CT-II	TOTAL	70	100	3
Subject:	Green Building and Sustainable Materials	3	0	0	15	15	30			

Course Learning Objectives:

- To understand the basics of Green Buildings.
- To learn the concept of site selection and planning.
- To study the use of efficient energies.
- To understand the types of sustainable building materials.
- To learn about maintenance of Indoor environmental quality.

Course Content:

UNIT-I
Green Buildings: Introduction, Definition, sustainable development, typicalfeatures of green buildings, benefits,key Requisites for Constructing a Green Building,Greenbuildingrating systems – GRIHA, IGBC and LEED.

UNIT- II
Site selection and building planning: Criteria for site selection, preservation of landscape, soil erosion control,minimizing urban heat island effect, maximize comfort by proper orientation of building facades, daylighting, ventilation, etc.
Water conservation and efficiency: Rainwater harvesting methods for roof & non-roof,water demand, water efficient plumbing systems, water metering, waste water disposal, recycle and reuse systems.

UNIT-III
Energy Efficiency: Environmental impact of building constructions, Concepts of embodied energy,operationalenergy and life cycle energy; Methods to reduce operational energy: Energy efficientbuildingenvelopes, efficient lighting technologies, energy efficient appliances for heating and airconditioningsystems in buildings, zero ozone depleting potential (ODP) materials; wind and solarenergyharvesting,energy metering and monitoring, concept of net zero buildings; Optimum EnergyEfficiency, Typical Energy Saving Approach in Buildings Use of Renewable Energy Sources

UNIT-IV
Sustainable Building materials: local building materials, natural and renewable materials like bamboo, timber,

rammed earth, stabilized mud blocks, materials with recycled content such as blended cements, pozzolana cements, fly ash bricks, vitrified tiles, materials from agro and industrial waste. Reuse of waste and salvaged materials

UNIT-V
Indoor Environmental Quality for Occupant Comfort and Wellbeing: Daylighting, air ventilation,exhaust systems, low VOC paints, materials & adhesives, building acoustics. Codes related to greenbuildings: NBC, ECBC, ASHRAE, UPC etc.Rapidly renewable building materials and furniture; Environment Quality And Occupational Health: Air conditioning, air quality, Sick building syndrome, Tobacco smoke control, Minimum fresh air requirements avoid use of asbestos in the building, improved fresh air ventilation, Measure of IAQ, Reasons for poor IAQ, Measures to achieve Acceptable IAQ levels.

Text Books:
1. IGBC Green Homes Rating System, Version 2.0., Abridged reference guide, 2013, Indian Green Building Council Publishers.
2. GRIHA version 2015, GRIHA rating system, Green Rating for Integrated Habitat Assessment.
3. Alternative building materials and technologies by K.S. Jagadish, B.V. Venkatarama Reddy and K.S. Nanjunda Rao.
4. Non-Conventional Energy Resources by G. D. Rai, Khanna Publishers.
5. Sustainable Building Design Manual, Vol.1 and 2, TERI, New Delhi 2004.
6. Mike Montoya, Green Building Fundamentals, Pearson, USA, 2010.
7. Charles J. Kibert, Sustainable Construction – Green Building Design and Delivery, John Wiley & Sons, New York, 2008.
8. Regina Leffers, Sustainable Construction and Design, Pearson / Prentice Hall, USA, 2009.

Course Outcomes:- At the end of the course students will be able to:

CO1: To apply the knowledge of Green Building in handling any physical projects.

CO2: To conduct a site selection process with respect to green buildings.

CO3: To make use of technologies with efficient energies.

CO4: To select and work with various sustainable materials.

CO5: To apply the knowledge in maintaining the indoor environmental quality.

SEMESTER VIII

SYLLABUS	(SEMESTER-VIII)	Periods/ Week			Internal Assessment (IA)			ESE	Grand Total	Credits
Subject Code:	CE208TPC21	L	T	P	CT-I	CT-II	TOTAL	70	100	03
Subject:	Earthquake Resistant Design of Structures	3	0	0	15	15	30			

Course Learning Objectives:

- To introduce Engineering seismology and functional planning and the effects of configurations of buildings for earthquakes.
- To introduce the requirements for conceptual design for earthquake safety and the analysis methods.
- To acquaint with IS code-based design lateral forces for earthquake resistant design of structures.
- To identify the behavior of structural and nonstructural elements for seismic resistance and impart design of shear walls.
- Introduce Capacity Design as per IS 13920: 2016, Capacity Design for Beams, Columns, beam column joints and structure as a whole.

Course Content:

UNIT 1: Engineering Seismology: Earthquake phenomenon cause of earthquakes-Faults- Plate tectonics- Seismic waves- Terms associated with earthquakes-Magnitude Intensity of an earthquake-scales-Energy released-Earthquake measuring instruments-Seismoscope, Seismograph, accelerograph-Characteristics of strong ground motions- Seismic zones of India. Introduction-Functional Planning-Continuous load path-Overall form-simplicity and symmetry-elongated shapes-stiffness and strength - Seismic design requirements-regular and irregular configurations-basic assumptions.

UNIT 2: Conceptual Design - Horizontal and Vertical Load Resisting Systems - System and Members for Lateral Loads and High Rise / Tall Structures. Twisting of Buildings – Flexible Building and Rigid Building Systems. Strength and Stiffness – Ductility – Definition – Ductility Relationships – Choice of construction Materials – Unconfined Concrete & Confined Concrete – Masonry, Steel Structures. Design Earthquake Loads – Basic Load Combinations – Permissible Stresses. Seismic Methods of Analysis – Static Method – Equivalent Lateral Force Method. Dynamic Analysis – Response Spectrum Method – Modal Analysis Torsion.

UNIT 3: Introduction to Earthquake Resistant Design – Seismic Design Requirements and Methods. RC Buildings – IS Code based Method. - Vertical Irregularities – Mass Irregularity Torsional Irregularity - Plan Configuration Problem - Design Lateral Force, Base Shear Evaluation – Lateral Distribution of Base Shear –.

UNIT 4: Structural Walls Strategies and the Location of Structural Walls – Sectional Shapes – Behaviour of Unreinforced and Reinforced Masonry Walls – Behaviour of Walls Box Action and Bands – Behaviour of infill Walls - Non Structural Elements – Failure Mechanism of Nonstructural Elements – Effects of Nonstructural Elements on Structural System – Analysis – Prevention of Damage to Nonstructural Elements – Isolation of Non-Structures, Design of Shear walls: Classification according to Behavior, Loads in Shear walls, Design of Rectangular and Flanged Shear walls.

UNIT 5: Ductility Considerations in Earthquake Resistant Design of RC Buildings: Introduction Impact of Ductility-Requirements for Ductility- Assessment of Ductility- Factors affecting Ductility- Ductile detailing considerations as per IS 13920. Behavior of beams, columns and joints in RC buildings during earthquakes-Vulnerability of open ground storey and short columns during earthquake- Seismic Evaluation and Retrofitting. Capacity Based Design: Introduction to Capacity Design, Capacity Design for Beams and Columns-Case studies.

Text Books/References:

1. Seismic Design of Reinforced Concrete and Masonry Building – T. Paulay and M.J.N. Priestly, John Wiley & Sons
2. Earthquake Resistant Design of structures – Pankaj Agarwal and Manish Shrikhande, Prentice Hall of India Pvt. Ltd
3. Earthquake Resistant Design for Engineers & Architects by Dowrick, D. J., John Willey & Sons, 2nd Edition; 1987.
4. Earthquake Resistant Design of structures by S. K. Duggal, Oxford University Press.
5. Concrete Structures in Earthquake Regions by Booth, E., Longman Higher Education, 1994.

6. Reinforced Concrete Structures by Park, R. &Paulay, T., John Willey & Sons, 2nd Edition; 1975.
7. Masonry and Timber structures including earthquake Resistant Design –Anand S.Arya, Nemchand& Bros.
8. Earthquake –Resistant Design of Masonry Building –Miha Tomazevic, Imperial College Press.
9. Design of Reinforced Concrete Structures by N. Subramanian, Oxford University Press.
10. Dynamics of Structures by A.K.Chopra, Second edition (2001), Prentice Hall India Private Ltd
11. Handbook on Seismic Analysis and Design of Structures by Farzad Naeim, Kluwer Academic Publisher, 2001.

Reference Codes:

1. IS 1893 (Part-1): 2016, "Criteria for Earthquake Resistant – Design of structures." B.I.S., New Delhi.
2. IS 4326: 2013, "Earthquake Resistant Design and Construction of Building", Code of Practice, B.I.S., New Delhi.
3. IS 13920: 2016, "Ductile design and detailing of reinforced concrete structures subjected to seismic forces" – Code of practice, B.I.S., New Delhi.

Course Outcomes:

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

CO1: Identify the causes of earthquakes, its propagation, and measurement and can quantify the hazard at the location of the structure and quantify the forces based on the source.

CO2: Adopt a suitable structural system to resist earthquake forces considering safe behavior of structural and nonstructural elements with different material properties and load combinations.

CO3: Design seismically safe structures in accordance with the provisions of Indian code IS 1893.

CO4: Implement design of shear wall elements for earthquake safety of structures.

CO5: Design or retrofitting of structures by detailing the elements, beams, columns, beam-column joints as per capacity-based design adopting ductility provisions as per IS 1893, IS 13920, to mitigate the vulnerability of earthquake damages of elements and structures.

SYLLABUS	(SEMESTER-VIII)	Periods/ Week			Internal Assessment (IA)			ESE	Grand Total	Credits
Subject Code:	CE208TPE05A	L	T	P	CT-I	CT-II	TOTAL	70	100	03
Subject:	Offshore Engineering	3	0	0	15	15	30			

Course Objective:

- To introduce basics of offshore structures and its historical development.
- To characterize static and dynamic loads coming on offshore structure.
- To study about general layout consideration of deck and oil & gas processing system.
- To understand method involving platform installation.
- To learn about material used in design and construction of offshore structure.

Course Content:

UNIT I HISTORICAL DEVELOPMENT OF OFFSHORE STRUCTURES: Introduction – Definition of Offshore Structures – Historical Developments – Deep water challenges, Functions of Offshore Structures, selection of Offshore Structure and its Configurations, Bottom Supported Fixed Structures, Compliant Structures, Floating Structures – Novel offshore design – Field development concepts.

UNIT 2 LOAD AND RESPONSES: Introduction, Gravity Load, Hydrostatic Loads, Resistance Loads, Current loads on Structures, Current Drag and Lift Force, Steady and Dynamic Wind Loads on Structures, Wave Loads on Structures, Varying Wind Load, Impulse loads and Introduction to design.

UNIT 3TOPSIDE FACILITIES AND LAYOUT: Introduction - General layout Considerations - Areas and Equipment - Deck Impact Loads - Deck Placement and Configuration - Float over Deck Installation - Helipad - Platform Crane - Living quarters - Oil and gas treatment - Oil and gas storage, offloading and export - Utility and process support systems - Drilling facilities

UNIT 4 OFFSHORE INSTALLATION: Introduction – Installation of Fixed Platform Substructures - Floating Structures – Foundations - Subsea Templates – load outs - transportation - Platform Installation Methods and installation criteria – Installation of Pipelines and Risers.

UNIT 5: MATERIALS FOR OFFSHORE APPLICATIONS: Material for Construction-Structural Steel, Topside Materials, Advanced Composite materials, Corrosion Control, Material Reliability and Monitoring and Fracture Control.

Textbooks:

1. Dawson, T.H., "Offshore Structural Engineering", Prentice Hall, 1983
2. B.C Gerwick, Jr. "Construction of Marine and Offshore Structures", CRC Press, Florida, 2000.
3. Subrata K Chakrabarti, "Handbook of Offshore Engineering", Vol 1, Vol 2, Elsevier Publishers, 1 st edition, 2005.

Reference Books:

1. API RP 2A., "Planning Designing and Constructing Fixed Offshore Platforms", API
2. McClelland, B &Reifel, M.D., "Planning & Design of fixed Offshore Platforms", VanNostrand, 1986
3. Graff, W.J., "Introduction to Offshore Structures", Gulf Publ. Co. 1981.
4. Reddy, D.V &Arockiasamy, M., "Offshore Structure" Vol.1 & 2,

Course Outcomes:

CO1: To classify types of offshore structure and know its basic fundamental knowledge.
CO2: To analyze various loads and their response on the structure.
CO3: To describe process involving deck layout and oil & gas treatment.
CO4: To outline key feature of platform, foundation and pipelines installation.
CO5: To identify and select appropriate material for construction.

SYLLABUS	(SEMESTER-VIII)	Periods/ Week			Internal Assessment (IA)			ESE	Grand Total	Credit
Subject Code:	CE208TPE05B	L	T	P	CT-I	CT-II	TOTAL	70	100	03
Subject:	Surface Hydrology	3	0	0	15	15	30			

Course Learning Objectives:

- To understand the fundamentals of hydrology and concepts of watershed
- To study the analysis of rainfall and its components.
- To understand the estimation techniques of evapo-transpiration and infiltration
- To learn various types of Hydrographs and its uses.
- To know the Flood estimation and Flood routing methods

Course Content:

UNIT 1: Introduction: Scope and importance of hydrology, Hydrologic cycle, Global and India's Water resources, Applications of hydrology, Formation of precipitation, Climate and Weather seasons in India. Watershed concept and modeling: Catchment-topographic and ground water divide, Description of the catchment, catchment processes, demarking a catchment, stream patterns.

UNIT 2: Location of rain-gauges and optimum number of rain-gauges, Analysis of rainfall data, Rainfall mass curve and hyetograph, Intensity-Duration analysis, Intensity-Frequency-Duration analysis, Depth-Area-Duration analysis, Double mass curve. Abstractions from precipitation: Evaporation-Process, measurement, empirical equations and Estimation by water budget method and Energy budget method.

UNIT 3: Evapo-transpiration-AET & PET, Estimation by Penman's equation, Reference Crop Evapo-transpiration by Blaney Criddle formula, Infiltration-Process, Factor affecting infiltration, Measurement, Horton's equation and Philip's equation. Infiltration indices, Probability and Statistics-Introduction, Probability and Random variables, PDF and CDF, Distribution functions, Selection of distribution function and its parameter estimation.

UNIT 4: Hydrograph and its features, Unit hydrograph and its derivation, Unit hydrographs from complex storms and for various durations, S-curve hydrograph and its uses, Synthetic unit hydrograph.

UNIT 5: Flood: Design flood and its estimation- Rational method, Frequency analysis Gumbel's and Log-Pearson's type III distribution, Selection of design return period. Flood routing- Reservoir routing: Channel routing- Prism and Wedge storage, Muskingum method. Flood control: Structural and Non-structural measures.

Text Books:

1. Engineering Hydrology K.Subramanya, Tata McGraw-HillEducation
2. Hydrology Principles, Analysis and Design H.M.Raghunath, New AgeInternational
3. Hand BookofAppliedhydrologyV.T.Chow, McGraw-Hill,Inc
4. ViessmanWandLewisGL(2008)"IntroductiontoHydrology" PrenticeHallofIndia
5. Ojha,C.S.P. Bhunya, P. and Berndtsson, R.- Engineering Hydrology, Oxford University PressCanada.
6. K. C. Patra, Hydrology and Water Resources Engg., Narosa Publishing house, New Delhi.

Course Outcomes-Upon completion of this course, students shall be able to:

CO1: Describe the basic concepts of hydrology and watershed to incorporate into physical hydrological processes.

CO2: Relate and analyze the various components involved in rainfall analysis.

CO3: Explain the various process, measurement, and estimation of hydrological components

CO4: Formulate the hydrograph's estimation and apply into engineering practices.

SYLLABUS	(SEMESTER-VIII)	Periods/ Week			Internal Assessment (IA)			ESE	Grand Total	Credits
Subject Code:	CE208TPE05C	L	T	P	CT-I	CT-II	TOTAL	70	100	03
Subject:	Bridge Engineering	3	0	0	15	15	30			

Course Learning Objectives:

- To understand the IRC Loadings and Standards for bridge design and to know the important hydrological parameters necessary for bridge design
- To learn the design of slab bridges under various IRC loading cases
- To understand the behaviour of T-beam slab bridge and the design of T-beam bridges
- To evaluate the stresses due to various loads and design of RCC box-culverts
- To study the various forces acting on bridge piers and abutments and the design of abutment and bridge piers

Course Content:

UNIT-1: Brief historical review, Different types of Bridges and span range, Bridge codes, Importance of hydrologic factors in bridge design, Hydraulic geometry, linear water ways, economic span, afflux and scour.

UNIT-2: Design of Reinforced concrete deck slab bridges.

UNIT-3: Design of Reinforced Concrete Tee beam bridges.

UNIT-4: Design of Box culverts.

UNIT-5: Design of Piers and Abutments.

Text Books:

1. Xanthakos, P. P. (1993) Reinforced Concrete Bridges, in Theory and Design of Bridges, John Wiley & Sons, Inc., Hoboken, NJ, USA. doi: 10.1002/9780470172889.ch3
2. Design of Bridge Structures by M A Jayaram, Prentice-Hall Of India Pvt. Limited, 01-Aug-2004 - Bridges - 292 pages
3. Design of Bridges by N. Krishna raju , Oxford and IBH Publishing, ISBN 8120417410, 9788120417410
4. Essentials Of Bridge Engineering, 6/E, Victor , Oxford and IBH Publishing, 2007, ISBN 8120417178, 9788120417175

Course Outcome: At the end of the course the students will be able:

CO1: To explain and apply various IRC loadings as per the IRC standards in the design of bridges and also explain the importance of hydrological parameters in bridge design

CO2: To design the slab bridges under various IRC loadings

CO3: To analyse and design the T-beam girder bridges

CO4: To explain the behaviour and design the box-culverts

CO5: To describe the various forces to be considered on pier and abutment and design the bridge abutments and piers

SYLLABUS	(SEMESTER-VIII)	Periods/ Week			Internal Assessment (IA)			ESE	Grand Total	Credits
Subject Code:	CE208TPE05D	L	T	P	CT-I	CT-II	TOTAL	70	100	03
Subject:	Traffic Engineering	3	0	0	15	15	30			

Course Objectives:

- To develop the basic knowledge of Traffic Engineering.
- To define Traffic flow characteristic.
- To develop knowledge about traffic control system.
- To understand the parking and highway lighting
- To develop the knowledge of different pollution occurring and its remedial measures.

Course Content:

UNIT 1: Introduction To Traffic Engineering-Definition and Scope of Traffic Engineering. Functions, Organization and Importance of Traffic Engineering. Elements of Traffic Engineering: Vehicular, Driver and Road Characteristics.

UNIT 2: Traffic Flow Parameters -Traffic flow parameters: volume, density, speed and related terms, Relationship between various parameters, Study and analysis of vehicle arrivals, headways, and gap acceptance in traffic flow. Highway Capacity and Level of Service.

UNIT 3: Traffic Control-Definition, functions and importance of traffic control. Methods of traffic control: Traffic signs, Road Markings, and other traffic controls aids. Traffic Regulation. Intersection control and design of traffic signals.

UNIT 4: Parking- Parking survey, types of parking, design of parking places. Lighting-Lumen arrangement, Types of lamp

UNIT 5: Traffic and Environment- Pollution problems of cities, Detrimental effects of traffic on environment, Noise pollution, Air pollution, Vibration, Environmental Impact Assessment.

Text Books:

1. Kadialy L.R., "Traffic Engg. and Transport Planning", 8th edition, Khanna Publishers.
2. Parthachakrobarty&Animesh Das, "Principles of Transportation Engineering", PHI.
3. C. JotinKhisty, B. Kent Lal, "Transportation Engineering – An Introduction", PHI.

Course Outcomes:

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

CO1: Estimate the basic characteristics of traffic stream

CO2: Conduct traffic flow studies and analyze traffic data

CO3: Design traffic signal systems

CO4: Analyse the parking and highway lighting

CO5: Manage controlling the different pollution occurring in road.

SYLLABUS	(SEMESTER-VIII)	Periods/ Week			Internal Assessment (IA)			ESE	Grand Total	Credits
Subject Code:	CE208TPE05E	L	T	P	CT-I	CT-II	TOTAL	70	100	03
Subject:	Construction Equipment & Automation	3	0	0	15	15	30			

Course Learning Objectives:

- To understand the factor for equipment selection and cost of owning and operating.
- To expertise in evaluation and analysis of different equipment life.
- To learn the engineering fundamentals of excavating equipments.
- To learn fundamentals of the pile driving and lifting equipments.
- To understand the concreting equipments and techniques and the advanced instruments like GIS etc. In construction.

Course Content:

UNIT 1: Introduction to course & Planning Process of Equipment Factors affecting equipment selection.Cost of Owning and Operating Construction Equipment Elements of ownership cost, Depreciation accounting methods, Cost Estimation using Average Annual Investment method. Use of compounding factors in Equipment cost estimation based on time value method, Operating cost components, Caterpillar method and Peurifoymethod.

UNIT 2: Equipment life and replacement analysis determination of economic life of equipment. Minimum cost method, Maximum profit method, Time value concept

UNIT3: Engineering Fundamentals of Moving Earth Machine Performance-Required power, Available power, Usable power, Performance chart.
Earthmoving and Excavating equipment Bull Dozers, Scrapers, Front end loaders, Excavators, Trucks, Productivity estimation and balancing of interdependant machines

UNIT 4 Piles and Pile driving equipment Pile types, pile hammers, principle of pile hammer, factors affecting pile hammer selection, Types of pile hammer: Drop hammer, Single acting and double acting steam hammers, Diesel hammers, Vibratory pile drivers.
Lifting equipment Cranes, Principles of lifting mechanism of crane, types of cranes-lattice boom crawler crane, lattice boom truck mounted cranes, telescopic boom crane, Tower cranes, Factors affecting lifting capacity of crane, Range diagram.

UNIT 5 Concreting equipment Steps in concrete making process, types of concrete mixer machines, Methods of handling and transporting concrete, Consolidation of concrete, Methods of finishing and curing of concrete.
Aerial and Satellite Surveying: GIS and GPS in Construction; use of Drones for spread out sites; Use of robots for repetitive activities.

Reference Books:

1. Construction Planning and Equipment - R.L.Peurifoy - Tata McGraw Hill, New Delhi
2. Construction Equipment & Planning and Application. - Mahesh VermaArtec Publication.
3. GPS satellite surveying- Alfred Leick, Wiley

Course Outcomes- At the end of the course students will be able to:

CO1: To apply the knowledge in equipment selection and able to find cost of owning and operating.
CO2: To find the equipment life, which help in comparisons of different equipments.
CO3: To select the earth excavating equipment on the basis of output and different selection factors.
CO4: To decide the pile driving equipment and lifting equipment based on safe working load determination
CO5: To decide the concreting equipment based on the construction project and relate the knowledge on Surveying to the new frontiers of science like GIS, GPS and Remote Sensing.

SYLLABUS	(SEMESTER-VIII)	Periods/ Week			Internal Assessment (IA)			ESE	Grand Total	Credits
Subject Code:	CE208TPE06A	L	T	P	CT-I	CT-II	TOTAL	70	100	03
Subject:	Low Cost Housing Techniques	3	0	0	15	15	30			

Course Learning Objectives:

- To introduce various housing technique adopted in different zones in country.
- To study various uses of cost effective Technologies.
- To learn needs and innovations of building techniques for low cost construction.
- To learn space norms for low cost construction.
- To learn about building materials and costing of low cost construction.

Course Content:

UNIT-1 An introduction to the subject to understand the various building techniques adopted in different climatic zones of the country, which resulting in varied vernacular expressions.

UNIT–2 Use of cost effective technologies through the use of local materials, up gradation of traditional technologies, prefabrication etc.

UNIT-3 Need for low cost construction, both in the rural and the urban sectors. Innovations of building techniques for low cost construction.

UNIT- 4 Analysis of space norms for low cost buildings. Study of usages pattern of low cost buildings by the habitants.

UNIT- 5 Comparative analysis of building materials and costing.Works of Laurie Baker, Hassan Fathy and other prominent architects.

Text Books:

1. "Building Systems for Low Income Housing", Ashok Kumar Jain; Management Publishing House, 1992
2. "Low Cost Housing in Developing Countries", Guru Charan Mathur; For Centre for Science & Technology of the Non-Aligned and Other Developing Countries, Oxford & IBH Publishing Company, 1993

Course outcomes:

Upon completion of this course students will be able to

CO1: To classify various housing techniques adopted in different zones in country.

CO2: To identify various uses of cost effective Technologies.

CO3: To understand needs and develop innovations of building techniques for low cost construction.

CO4: To explain space norms for low cost construction.

CO5: To analysis about building materials and costing of low cost construction.

SYLLABUS	(SEMESTER-VIII)	Periods/ Week			Internal Assessment (IA)			ESE	Grand Total	Credits
Subject Code:	CE20STPE06B	L	T	P	CT-I	CT-II	TOTAL	70	100	03
Subject:	Water and Air Quality Modelling	3	0	0	15	15	30			

Course Objectives:

- Understand the idea, methodology and basic tools of water and air quality modelling
- Understand the different modelling approaches, their scope and limitations.
- Understand the fate and transport of pollutants in different water bodies and ambient air.
- Become mindful of a wide range of applications of modelling for the water quality and air pollution.
- Understand Water quality indexing parameters and its application.

COURSE CONTENT:

UNIT I MODELING CONCEPTS: Causal and statistical models-Characteristics- Steps in model development - Importance of model building. - conservation of mass and mass balance – calibration and verification of models; Transport phenomena – Advection, diffusion, dispersion, simple transport models; chemical reaction kinetics – Law of mass action, Rate constants, reaction order, types of reactions, equilibrium principles.

UNIT II WATER QUALITY MODELING: Water quality models – Historical development – Mass balance equation – Streeter - Phelps Equation – Modification to Streeter – Phelps Equation – Waste load allocations – Dissolved oxygen in Rivers and estuaries; Lake Water Quality Models; Models for Nitrogen, Bacteria, Phosphate and toxicants - Ground Water Quality Modeling - Contaminant solute transport equation, Numerical methods.

UNIT III AIR POLLUTION MODELING: Chemistry of air Pollutants - Atmospheric reactions, sinks for air pollution – Transport of air Pollutants - Meteorological settling for disperal of air pollutants – Vertical structure of temperature and stability, atmospheric motions, Wind and shear, self-cleaning of atmosphere; transport and diffusion of stack emissions – atmospheric characteristics significant to transport and diffusion of stack emission – stack plume characteristics.

UNIT IV AIR QUALITY MODELS: Types of modeling technique, modeling for non-reactive pollutants, single source, short term impact, multiple sources and area sources, Fixed box models- diffusion models – Gaussian plume derivation-modifications of Gaussian plume equation- long term average-multiple cell model- receptor oriented and source-oriented air pollution model performance, accuracy and utilization.

UNIT V Water Quality Index: Categories of water quality index. Determination of water quality index (WQI): Industrial and municipal effluent index, ambient water quality index, combined water quality index and Delphi method. Air Quality Index: Categories of air quality index. Determination of air quality index (AQI): National AQI, Extreme value indices, regional indices.

Reference Books:

1. Arthur C. Stern, Air Pollution, Air Pollutants, their transformation and Transport, (Ed.), (Third Ed.) Volume I , Academic Press, 2006.
2. Chapra, S.C. Surface Water-Quality Modelling, McGraw-Hill, International Edition, 2008
3. Deaton and Wine Brake, Dynamic Modeling of Environmental Systems, Wiley & Sons, 2002
4. E.V. Thomson, Principles of Surface Water Quality Modeling and Control, Happer and Row Publishers New York, 1987.
5. Hadlock, C.R., Mathematical Modelling in the Environment. The Mathematical Association of America.
6. Rastogi A.K. (2008) Numerical Groundwater Hydrology, Penram International Publishing Pvt. Ltd., Bombay.
7. Steven C. Chapra, Surface Water Quality Modeling, Tata McGraw-Hill Companies, Inc., New Delhi, 1997.
8. Wainwright, J and Mulligan, M., Environmental Modelling Finding simplicity in complexity, John Wiley and Sons Inc., New York, 2013.

Course outcomes:

CO1: To provide basic knowledge on mathematical and statistical concepts required for mode development.
CO2: To Develop models based on the mass-balance approach
CO3: To Perform data exploration and visualization
CO4: To Predict the impact of the of external waste loading on different water bodies
CO5: To Design and model of air & water quality and its applicability in the Control of pollution
CO6: To Determine and evaluate the water quality index

SYLLABUS	(SEMESTER-VIII)	Periods/ Week			Internal Assessment (IA)			ESE	Grand Total	Credits
Subject Code:	CE208TPE06C	L	T	P	CT-I	CT-II	TOTAL	70	100	03
Subject:	Repair and Rehabilitation of Structures	3	0	0	15	15	30			

Course learning objectives:

- To learn about various distress and damages in concrete and steel structures.
- To learn about assess the damage to structures using various methods.
- To study the various methods of rehabilitation.
- To study the various methods of repairs of structures.
- To learn importance of repair and maintenance of structures.

Course Content:

UNIT 1: Aging of structures – performance of structures – need for rehabilitation. Distress in concrete / steel structures – damage – source – cause – effects – case studies.

UNIT 2: Damage assessment and Evaluation models – Damage testing methods – NDT – Core samples.

UNIT 3: Rehabilitation methods – grouting – detailing – imbalance of structural stability – case studies.

UNIT 4: Methods of repairs – shotcreting – guniting – epoxy – cement mortar injection – crack ceiling.

UNIT 5: Repair and maintenance of buildings – IS standards – Bridge repairs – Seismic strengthening.

Reading/Textbooks:

1. Diagnosis and treatment of Structures in Distress – R.N Raikar.
2. Bridge Rehabilitation – V K Raina.
3. Building Failures – Diagnosis and Avoidance – W H Ranson.
4. Forensic Engineering – Kennethe and Carper.

Course outcomes:

Upon completion of this course students will be able to:

CO1: Analyze distress and damages in concrete and steel structures.

CO2: Understand about assess the damage to structures using various methods.

CO3: Classify the various methods of rehabilitation.

CO4: Classify the various methods of repairs of structures.

CO5: Understand the importance of repair and maintenance of structures.

SYLLABUS	(SEMESTER-VIII)	Periods/ Week			Internal Assessment (IA)			ESE	Grand Total	Credits
Subject Code:	CE208TPE06D	L	T	P	CT-I	CT-II	TOTAL	70	100	03
Subject:	Finite Element Analysis	3	0	0	15	15	30			

Course Objectives:

- To introduce the fundamentals of FEM,
- Understand how it works,
- Implement (code) the method,
- Understand the capabilities of FEM

Course Content:

UNIT 1: Matrix Methods of Structural Analysis – Review of concepts – Actions and displacements – compatibility – indeterminacy – Member and joint loads – Flexibility Matrix formulation - Stiffness Matrix formulation.

UNIT 2: Analysis of Beams- Finite Element formulation and Analysis of beams by Finite Element method.

UNIT 3: Analysis of Rigid Jointed Plane Frame- Finite Element formulation and Analysis of rigid jointed plane frame by Finite Element method.

UNIT 4: Analysis of Pin Jointed Plane Frame- Finite Element formulation and Analysis of pin jointed plane frame by Finite Element method.

UNIT 5: Introduction to Plate and Shell Elements:- Analysis of plane stress / strain and ax symmetric solids- triangular, quadrilateral and isoperimetric elements, Analysis of plate bending, basic equations of thin plate theory, Reissinner-Mindlin theory, plate elements and applications. Analysis of shells, degenerated shell elements.

Text Books:

1. Chandrupatla T.R., Belegundu A.D., Introduction to Finite Elements in Engineering, Prentice Hall of India Private Limited, New Delhi.
2. Desai C.S., Abel J.F., Introduction to the Finite Element Method, CBS Publishers & Distributors, Delhi.

Reference Books:

1. Krishnamurthy, C.S., Finite Element Analysis – Theory and Programming, Tata McGraw Hill Publishing Company Limited, New Delhi.
2. Finite Element Analysis – Theory and Programming by Cook R.D. et.al., Concepts and Applications of Finite Element Analysis, John Wile

Course outcomes:

Upon successful completion of this course, you should be able to:

CO1: Understand the concepts behind formulation methods in FEM.

CO2: Identify the application and characteristics of FEA elements such as bars, beams, plane.

CO3: Analyze the rigid and pin jointed plane frame using finite element method.

SYLLABUS	(SEMESTER-VIII)	Periods/ Week			Internal Assessment (IA)			ESE	Grand Total	Credits
Subject Code:	CE208TPE06E	L	T	P	CT-I	CT-II	TOTAL	70	100	03
Subject:	Design of Hydraulic Structures	3	0	0	15	15	30			

Course Learning Objectives:

- Recognise the different types of dams, identify its purpose and function and to select the most appropriate dam.
- To introduce and give explanation the Principles of Design of Hydraulic Structures.
- To develop understanding for Analysis of gravity dam.
- To develop understanding about Earth dam and stability analysis.
- To introduce the importance of Spillways and energy dissipation systems.

Course Content:

UNIT 1: Introduction - Classification of dams, Gravity dams, Earth dams, Arch dam, Buttress dam, Steel dams, Timber dams, selection of site for dam, selection of type of dam, investigations of dam sites, Engineering surveys, Geological investigations, Types of hydropower plants, site selection for power plant, General arrangement of a hydropower project.

UNIT 2: Principles of Design of Hydraulic Structures - Hydraulic structures on permeable foundations, Theories of subsurface floor, Khosla's method of independent variables, Exit gradient, Location of Hydraulic jump, water surface profiles, scour due to subsurface flow, Design Principles, Energy dissipation principles.

UNIT 3: Gravity Dams - Types of storage head works, Forces acting on gravity dams, Analysis of gravity dams, Profile of a gravity dam, Finite Element Method, Design of gravity dam, joints in gravity dam, Galleries in gravity dam, Adits and shafts, Construction of gravity dam, Foundation Grouting, Instrumentation of gravity dams.

UNIT 4: Earth dams - Types of earth dams, Causes of failure of earth dams, Seepage analysis, phreatic line, flow net construction, criteria for safe design of gravity dams, typical cross sections of earth dams, Stability analysis, Seepage control, and design of filters.

UNIT 5: Spillways and energy dissipation systems - Essential requirements of spillways, Required spillway capacity, component parts of spillway, Types of spillways, Design of Ogee spillway, Design of shaft spillway, Design of siphon spillway, Design of stilling basins. Hydropower structures - Storage power plant, Runoff River plant, Pumped storage plant, Water conveyance systems, Tunnels and Penstocks, Gates, Surge tanks, Power house layout.

Text Books:

1. Golze, A. R., Handbook of Dam Engineering, Von Rostrand Reinhold Co., 1977
2. Sharma, H.D., Concrete Dams, CBIP Publication, 1998.
3. Siddiqui, I H, Dams and Reservoirs: Planning, Engineering, Oxford University Press, USA, 2009.
4. Novak, P., Moffat, A. I. B., Nalluri, C and Narayan, R., Hydraulic Structures, Taylor & Francis, 2006.
5. Modi P.M., Irrigation Water Resources and Hydropower Engineering, Standard Publishing Company, New Delhi, 2000.
6. Arora K.L. Irrigation Water Resources Engineering, Standard Book Publishing Co., Delhi, 1996.

Course Outcomes-

CO1: Define different types of dams.
CO2: Describe the Principles of Design of Hydraulic Structures.
CO3: Explain the concept of Gravity Dams.
CO4: Explain the concept of Earth dams and its stability analysis.
CO5: Describe the concept of spillways and energy dissipation systems.

SYLLABUS	(SEMESTER-VIII)	Periods/ Week			Internal Assessment (IA)			ESE	Grand Total	Credits
Subject Code:	CE208TOE03	L	T	P	CT-I	CT-II	TOTAL	70	100	03
Subject:	Infrastructure Planning and Management	3	0	0	15	15	30			

Course Learning Objectives:

The students will be able to:

- Understand and explain concepts of infrastructure
- Understand private involvement in infrastructure
- Learn about challenges to successful infrastructure planning and implementation
- Study strategies for successful infrastructure project implementation
- Understand sustainable development of infrastructure

Course Content:

UNIT I AN OVERVIEW OF BASIC CONCEPTS RELATED TO INFRASTRUCTURE: Introduction to Infrastructure, an overview with regards to Indian sectors(i) Power Sector , (ii) Water Supply and Sanitation Sector in India., (iii) Road, Rail, Air and Port Transportation Sectors, (iv) Telecommunications , (v) Urban Infrastructure ,(vi) Rural Infrastructure.

An Introduction to Special Economic Zones, Organizations and layers in the field of Infrastructure, The Stages of an Infrastructure Project Lifecycle.

UNIT II PRIVATE INVOLVEMENT IN INFRASTRUCTURE: A Historical Overview of Infrastructure Privatization. The Benefits of Infrastructure Privatization, Problems with Infrastructure Privatization, Challenges in Privatization of Water Supply, Privatization of Infrastructure in India.

UNIT III CHALLENGES TO SUCCESSFUL INFRASTRUCTURE PLANNING AND IMPLEMENTATION: Mapping and Facing the Landscape of Risks in Infrastructure Projects, Economic and Demand Risks, Socio-Environmental Risks, Cultural Risks in International Infrastructure Projects, Legal and Contractual Issues in Infrastructure, Challenges in Construction and Maintenance of Infrastructure.

UNIT IV STRATEGIES FOR SUCCESSFUL INFRASTRUCTURE PROJECT IMPLEMENTATION: Risk Management Framework for Infrastructure Projects, Shaping the Planning Phase of Infrastructure Projects to mitigate risks, Designing Sustainable Contracts, Introduction to Fair Process and Negotiation, Negotiating with multiple Stakeholders on Infrastructure Projects.

UNIT V SUSTAINABLE DEVELOPMENT OF INFRASTRUCTURE: Information Technology and Systems for Successful Infrastructure Management, - Innovative Design and Maintenance of Infrastructure Facilities, Infrastructure Modeling and Life Cycle Analysis Techniques, Capacity Building and Improving the

Government's Role in Infrastructure Implementation, An Integrated Framework for Successful Infrastructure Planning and Management - Infrastructure Management Systems and Future Directions.

TEXT BOOKS

1. Grigg, Neil, Infrastructure engineering and management, Wiley, (1988).

2. Haas, Hudson, Zaniewski, Modern Pavement Management, Krieger, Malabar, (1994).

3. Hudson, Haas, Uddin, Infrastructure management: integrating design, construction, maintenance, rehabilitation, and renovation, McGraw Hill, (1997).

Course Outcomes:-

After course completion the students shall be able to:

CO1: Explain the basic concepts related to Infrastructure Projects
CO2: Explain the role of private sector in infrastructure growth.
CO3: Describe the strategies for successful Infrastructure Project implementation.
CO4: Develop Infrastructure modeling and Life Cycle Analysis Techniques.
CO5: Explain Sustainable development of Infrastructure

SYLLABUS	(SEMESTER-VIII)	Periods/ Week			Internal Assessment (IA)			ESE	Grand Total	Credits
Subject Code:	CE208PPC12	L	T	P	CT-I	CT-II	TOTAL	20	50	1
Subject:	Structural Detailing Lab	0	0	2	-	-	30			

Course Learning Objective:

- To learn detailing of structural steel members (tension & compression member, steel connection)
- To study in detail and draw components of industrial building.
- To understand reinforcement detailing of RCC beams and column footings.
- To know about distribution of reinforcement in slab, stair case, water tank and retaining wall.

Course Content:

Part A: (Steel Structures)

1. Detailing of Tension Members.
2. Detailing of Built-up Compression Members.
3. Detailing of Column Bases.
4. Detailing of connections.
5. Detailing of an Industrial shed.
6. Detailing of a Plate girder/Gantry girder.

Part B: (Reinforced Concrete Structures)

1. Details of reinforcement in RCC Continuous Beams.
2. Details of reinforcement for RCC column with isolated footings.
3. Details of reinforcement in a one way/two-way slabs.
4. Details of reinforcement in staircases.
5. Detailing of Combined footings.
6. Detailing of Retaining walls/Water Tanks.

Course Outcome:

CO1: To sketch detailed drawing of structural steel beams, columns and connections.

CO2: To understand design components of industrial shed and gantry girder.

CO3: To sketch reinforcement detailing of RCC member as per IS code provision.

CO4: To draw accurate arrangement of reinforcement in slab, staircase, water tank and retaining wall.