



MUTHAYAMMAL ENGINEERING COLLEGE

(An Autonomous Institution)

(Approved by AICTE, New Delhi, Accredited by NAAC, NBA & Affiliated to Anna University)
Rasipuram - 637 408, Namakkal Dist., Tamil Nadu.

B.E-Department of Civil Engineering

Curriculum/Syllabus

Regulation-2019



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Rasipuram - 637 408, Namakkal Dt, Tamil Nadu.

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INSTITUTION VISION & MISSION

INSTITUTION VISION

To be a Centre of Excellence in Engineering, Technology and Management on par with International Standards.

INSTITUTION MISSION

- To prepare the students with high professional skills and ethical values
- To impart knowledge through best practices
- To instill a spirit of innovation through Training, Research and Development
- To undertake continuous assessment and remedial measures
- To achieve academic excellence through intellectual, emotional and social stimulation

INSTITUTION MOTTO

Rural upliftment through Technical Education.



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DEPARTMENT VISION & MISSION

DEPARTMENT VISION

To Excel in Education, Research and Technological Services in Civil Engineering with strong Ethical Values to Cater to the local and Global Needs of the Society.

DEPARTMENT MISSION

- To impart quality education to produce Civil Engineers capable of globally extending technological services
- To provide conducive ambience for collaborate research to develop contemporary and sustainable technologies.
- To develop and Transfer Innovative applications of Engineering, Science and Technology to improve Civil Engineering Practices.



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DEPARTMENT PROGRAM EDUCATIONAL OBJECTIVES, PROGRAM OUTCOMES & PROGRAM SPECIFIC OUTCOMES

PROGRAM EDUCATIONAL OBJECTIVES

The Civil Engineering Graduates should be able to

PEO1: The graduates will have successful careers in industry that meet the needs of Indian and multinational standards.

PEO2: The graduates will have the ability to synthesize data and technical concepts for product design application.

PEO3: The graduates will be a part of team on multidisciplinary Project.

PEO4: The graduates will have a sound foundation in the mathematical, scientific and engineering fundamentals necessary to formulate, solve and analyze engineering problems for post graduate studies.

PEO5: The graduates will have an awareness of the life-long learning with professional codes of ethics.

PROGRAM OUTCOMES

1. **Engineering Knowledge:** An ability to apply knowledge of basic mathematics, physical sciences and Civil Engineering.
2. **Problem Analysis:** An ability to analyze a problem, interprets data, and defines Structural system requirements.
3. **Design/Development solutions:** An ability to design, implements, and evaluate a Civil Engineering system, process, component to meet desired needs
4. **Conduct investigations of complex problems:** An ability to design modern structures which will provide Solutions for the complex problem in the Infrastructure domain.
5. **Modern tool usage:** An ability to use of modern Civil Engineering Software's to provide suitable solution in the domain of Civil Engineering

6. **The engineer and society:** An ability to give a contemporary technical and professional solutions in the practice of Civil Engineering problems to meet the society needs
7. **Environment and sustainability:** An ability to develop and use the Civil Engineering systems within realistic constraints environmental, health and safety, manufacturability, and sustainability considerations.
8. **Individual and Team work:** An Ability to understanding of professional, ethical, legal, security and social issues and responsibilities.
9. **Communication:** An ability to function effectively on teams and individually to accomplish a common goal.
10. **Project management and finance:** An ability to communicate effectively to the higher authorities and staff in the department.
11. **Lifelong learning:** An ability to demonstrate leadership and managerial characteristics
12. **Engineering solutions:** Recognize the need for and an ability to engage in life-long learning in Infrastructure system.

PROGRAM SPECIFIC OUTCOMES

PS01: Professional Skill Development: An ability to design Complex Structures through or by design based software like STAAD PRO & STRUDS

PS02: Analytical Skill and Problem Solving Expertise: Ability to design R.C.C & Steel Structures by use of modern design methods.

PS03: Project development skill: Ability to work with complex Infrastructure projects.



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B.E.-CIVILENGINEERING

GROUPING OF COURSES

TOTAL NO. OF CREDITS TO BE EARNED FOR THE AWARD OF DEGREE = 161

1. Humanities and Social Sciences (HS)

S.No	Course Code	Course Title	Category	Contact Hours	Instruction Hours/Week			C
					L	T	P	
1	19HSS01	Business English	HS	2	2	0	0	2
2	19HSS02	English Communicative Skills Laboratory	HS	2	0	0	2	1
3	19HSS03	Life Skills and Workplace Psychology	HS	2	2	0	0	2
4	19HSS04	Technical English for Engineers	HS	2	2	0	0	2
5	19HSS05	Communicative English for Engineers	HS	2	2	0	0	2
6	19HSS06	Basics of Japanese Language	HS	2	2	0	0	2
7	19HSS07	Basics of French Language	HS	2	2	0	0	2

2. Basic Sciences (BS)

S. No	Course Code	Course Title	Category	Contact Hours	Instruction Hours/Week			C
					L	T	P	
1	19BSS01	Engineering Physics	BS	3	3	0	0	3
2	19BSS02	Physics and Chemistry Laboratory	BS	2	0	0	2	1
3	19BSS03	Bio and Nanomaterials Sciences	BS	3	3	0	0	3
4	19BSS04	Material Sciences	BS	3	3	0	0	3
5	19BSS05	Physics for Mechanical Engineers	BS	3	3	0	0	3
6	19BSS11	Engineering Chemistry	BS	3	3	0	0	3
7	19BSS12	Environmental Science and Engineering	BS	3	3	0	0	3
8	19BSS13	Organic Chemistry	BS	3	3	0	0	3
9	19BSS14	Physical Chemistry	BS	3	3	0	0	3
10	19BSS15	Applied Chemistry	BS	3	3	0	0	3
11	19BSS16	Organic Chemistry Laboratory	BS	3	3	0	3	1

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12	19BSS17	Physical Chemistry Laboratory	BS	3	0	0	3	1
13	19BSS21	Algebra and Calculus	BS	4	3	1	0	4
14	19BSS22	Differential Equations and Vector Analysis	BS	4	3	1	0	4
15	19BSS23	Transform and Partial Differential Equations	BS	4	3	1	0	4
16	19BSS24	Discrete Mathematics	BS	4	3	1	0	4
17	19BSS25	Statistical and Queuing Model	BS	4	3	1	0	4
18	19BSS26	Numerical Methods	BS	4	3	1	0	4
19	19BSS27	Probability and Random Processes	BS	4	3	1	0	4
20	19BSS28	Statistics and Numerical Methods	BS	4	3	1	0	4

3. General Engineering Science Courses (GES)

S.No	Course Code	Course Title	Category	Contact Hours	Instruction Hours/Week			C
					L	T	P	
1	19GES01	Programming for Problem Solving Using C	GES	3	3	0	0	3
2	19GES02	Programming for Problem Solving Technique	GES	3	3	0	0	3
3	19GES03	Programming in C Laboratory	GES	2	0	0	2	1
4	19GES04	Programming in C and Python Laboratory	GES	2	0	0	2	1
5	19GES05	Electrical and Electronic Sciences	GES	3	3	0	0	3
6	19GES06	Mechanical and Building Sciences	GES	3	3	0	0	3
7	19GES07	Computer Aided Drafting Laboratory	GES	2	0	0	2	1
8	19GES08	Python Programming	GES	3	3	0	0	3
9	19GES09	Programming in Python Laboratory	GES	2	0	0	2	1
10	19GES10	Soft Skills Laboratory	GES	2	0	0	2	1
11	19GES11	Electronic Devices	GES	3	3	0	0	3
12	19GES12	Electronic Simulation Laboratory	GES	2	0	0	2	1
13	19GES13	Electric Circuits	GES	3	2	1	0	3
14	19GES14	Electric Circuits Laboratory	GES	2	0	0	2	1
15	19GES15	Manufacturing Processes	GES	3	3	0	0	3
16	19GES16	Manufacturing Processes Laboratory	GES	2	0	0	2	1

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17	19GES17	Mechanical and Building Sciences Laboratory	GES	2	0	0	2	1
18	19GES18	Construction Materials	GES	3	3	0	0	3
19	19GES19	Concepts in Product Design	GES	3	3	0	0	3
20	19GES20	Renewable Energy Resources	GES	3	3	0	0	3
21	19GES21	Electrical Drives and Control	GES	3	3	0	0	3
22	19GES22	Electrical Drives and Control Laboratory	GES	2	0	0	2	1
23	19GES23	Analog and digital communication	GES	3	3	0	0	3
24	19GES24	Digital Principles and System Design	GES	3	3	0	0	3
25	19GES25	Digital Principles and System Design Laboratory	GES	2	0	0	2	1
26	19GES26	Engineering Drawing	GES	5	1	0	4	3
27	19GES27	Engineering Geology	GES	3	3	0	0	3
28	19GES28	Engineering Mechanics	GES	4	3	1	0	4
29	19GES29	Wireless Communication	GES	4	3	1	0	4
30	19GES30	Electronics and Microprocessor	GES	3	3	0	0	3
31	19GES31	Electronics and Microprocessor Laboratory	GES	2	0	0	2	1
32	19GES32	Data Structures using Python	GES	3	3	0	0	3
33	19GES33	Electronic Devices and Circuits	GES	3	3	0	0	3
34	19GES34	Electronic Devices and Circuits Lab	GES	2	0	0	2	1
35	19GES35	Remote Sensing and GIS	GES	3	3	0	0	3

4. Professional Core (PC)

S. No.	Course Code	Course Title	Category	Contact Hours	Instruction Hours/Week			C
					L	T	P	
1	19CEC01	Mechanics of Solids	PC	3	3	0	0	3
2	19CEC02	Strength of Materials	PC	3	3	0	0	3

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3	19CEC03	Structural Analysis	PC	5	3	1	0	4
4	19CEC04	Design of Steel Structures	PC	5	3	1	0	4
5	19CEC05	Estimation and Quantity Surveying	PC	3	3	0	0	3
6	19CEC06	Mechanics of Fluids	PC	3	3	0	0	3
7	19CEC07	Surveying	PC	5	3	1	0	4
8	19CEC08	Geotechnical Engineering	PC	3	3	0	0	3
9	19CEC09	Design of Reinforced Concrete Elements	PC	5	3	1	0	4
10	19CEC10	Water Supply Engineering	PC	3	3	0	0	3
11	19CEC11	Highway Engineering	PC	3	3	0	0	3
12	19CEC12	Computer Aided Building Drawing Laboratory	PC	2	0	0	2	1
13	19CEC13	Surveying Laboratory	PC	2	0	0	2	1
14	19CEC14	Strength of Materials Laboratory	PC	2	0	0	2	1
15	19CEC15	Hydraulic Engineering Laboratory	PC	2	0	0	2	1
16	19CEC16	Geotechnical Engineering Laboratory	PC	2	0	0	2	1
17	19CEC17	Concrete and Highway Engineering Laboratory	PC	2	0	0	2	1
18	19CEC18	Survey Camp	PC	2	0	0	2	1
19	19CEC19	Computer Aided Design and Drafting Laboratory	PC	0	0	0	0	1
20	19CEC20	Environmental Engineering Laboratory	PC	2	0	0	2	1

5. Professional Electives (PE)

S. No.	Course Code	Course Title	Category	Contact Hours	Instruction Hours/Week			
					L	T	P	C
1	19CEE01	Advanced Structural Analysis	PE	3	3	0	0	3
2	19CEE02	Design of Reinforced Concrete Structures	PE	3	3	0	0	3
3	19CEE03	Construction Technology	PE	3	3	0	0	3
4	19CEE04	Industrial Structures	PE	3	3	0	0	3
5	19CEE05	Health Monitoring of Structures	PE	3	3	0	0	3
6	19CEE06	Building Services	PE	3	3	0	0	3
7	19CEE07	Smart Materials and Smart Structures	PE	3	3	0	0	3

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8	19CEE08	Concrete Technology	PE	3	3	0	0	3
9	19CEE09	Seismic Design of Structures	PE	3	3	0	0	3
10	19CEE10	Prefabricated Structures	PE	3	3	0	0	3
11	19CEE11	Prestressed Concrete Structures	PE	3	3	0	0	3
12	19CEE12	Foundation Engineering	PE	3	3	0	0	3
13	19CEE13	Ground Improvement Techniques	PE	3	3	0	0	3
14	19CEE14	Environmental Impact Assessment in Civil Engineering Project	PE	3	3	0	0	3
15	19CEE15	Waste Water Engineering	PE	3	3	0	0	3
16	19CEE16	Municipal Solid Waste Management	PE	3	3	0	0	3
17	19CEE17	Industrial Waste Management	PE	3	3	0	0	3
18	19CEE18	Air Pollution and Management	PE	3	3	0	0	3
19	19CEE19	Public Health and Irrigation Engineering Drawing	PE	3	3	0	0	3
20	19CEE20	Hydrology	PE	3	3	0	0	3
21	19CEE21	Water Resources Engineering	PE	3	3	0	0	3
22	19CEE22	Ground Water Engineering	PE	3	3	0	0	3
23	19CEE23	Irrigation Engineering	PE	3	3	0	0	3
24	19CEE24	Applied Hydraulic Engineering	PE	3	3	0	0	3
25	19CEE25	Pavement Engineering	PE	3	3	0	0	3
26	19CEE26	Traffic Engineering and Safety Transport	PE	3	3	0	0	3
27	19CEE27	Railways ,Airports and Harbour Engineering	PE	3	3	0	0	3
28	19CEE28	Construction Planning and Management	PE	3	3	0	0	3
29	19CEE29	Housing Planning and Management	PE	3	3	0	0	3
30	19CEE30	Engineering Economics And Cost Analysis	PE	3	3	0	0	3

6. Open Electives (OE)

S. No.	Course Code	Course Title	Department	Contact Hours	Instruction Hours/Week			C
					L	T	P	
1	19EEE09	Total Quality Management	EE	3	3	0	0	3
2	19EEE15	Wind and Solar Energy Systems	EE	3	3	0	0	3

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3	19MEE18	Power Plant Engineering	ME	3	3	0	0	3
4	19MEE10	Composite Materials	ME	3	3	0	0	3
5	19MEE02	Principles of Management	ME	3	3	0	0	3
6	19MEF10	Maintenance Engineering	ME	3	3	0	0	3
7	19MEE12	Energy Conservation in Industry	ME	3	3	0	0	3
8	19CHE05	Disaster Management	CH	3	3	0	0	3
9	19ECE25	Internet of Things	EC	3	3	0	0	3
10	19CSE18	Soft Computing Techniques	CS	3	3	0	0	3

ME-Mechanical Engineering, EC-Electronics Engineering, EE-Electrical and Electronics Engineering CS-Computer Science and Engineering, CH-Chemical Engineering

7. Employability Enhancement Courses (EEC)

S. No.	Course Code	Course Title	Category	Contact Hours	Instruction Hours/Week			C
					L	T	P	
1	19CEG01	Design Project	EEC	4	0	0	4	2
2	19CEG02	Project work	EEC	18	0	0	18	9
3	19CEG03	Value Added Course	EEC	2	0	0	2	1
4	19CEG04	Inplant Training (Four Weeks In VI Sem Summer)	EEC	0	0	0	0	1
5	19CEG05	Comprehension	EEC	2	0	0	2	1
6	19CEG06	Technical Seminar	EEC	2	0	0	2	1

8. Mandatory Course (MC)

S. No	Course Code	Course Title	Category	Contact Hours	Instruction Hours/Week			C
					L	T	P	
1	19CEH01	Organizational Behaviour	MC	3	3	0	0	0
2	19CEH02	India Constitution (Common to All Branches)	MC	3	3	0	0	0
3	19CEH03	Essence of Indian Traditional Knowledge	MC	3	3	0	0	0


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9. NPTEL On line course Electives

S.No	Subject	Total No of weeks	Credit
1	Advanced Topics in the Science and Technology of Concrete	4	1
2	Electronic Waste Management Issues and Challenges	4	1
3	Introduction to Remote Sensing	4	1
4	Subsurface Exploration Importance and Techniques involved	8	2
5	Digital Land Surveying and Mapping (DLS&M)	8	2
6	Earth Sciences for Civil Engineering Part I and II	8	2
7	Hydration, Porosity & Strength of Cementitious Materials	8	2
8	Natural Hazard Part I	8	2
9	Plastic Waste Management	8	2
10	Applied Environmental Microbiology	12	3
11	Energy Efficiency, Acoustics and day lighting in Building	12	3
12	Environmental Remediation of Contaminated sites	12	3
13	Geosynthetics and Reinforced Soil Structures	12	3
14	Geotechnical Engineering II Foundation Engineering	12	3
15	Soil Mechanics/ Geotechnical Engineering I	12	3
16	Infrastructure Planning and Management	12	3

10. Value Added Courses

S.No	Course Name	Contact Hours	Offered by Internal / External
1	Foundation Course On Civil Engineering and Vasthu	40	Internal / External
2	Analysis Software (Any one)	30	Internal / External
3	GRE / GATE	30	Internal / External
4	Reinforcement Detailing	30	Internal / External
5	Estimation and Valuation	20	Internal / External
6	Total Station	20	Internal / External
7	Drafting Software (Any one)	15	Internal / External
8	Modeling Software (Any one)	15	Internal / External

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CREDITS

S.No	Subject Area	CREDITS AS PER SEMESTER								Total Credit	UGC Recommended
		I	II	III	IV	V	VI	VII	VIII		
1	HS	3	3					3		9	12
2	BS	10	8	4	4					26	26
3	ES	8	6	3	3	3		3		26	29
4	PC		5	12	14	9	6	3		49	47
5	PE					6	9	6	6	27	23
6	OE					3	6	3		12	11
7	EEC						1	2	9	12	12
8	MC		0			0		0		0	0
TOTAL		21	22	19	21	21	22	20	15	161	160



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19CEC01

MECHANICS OF SOLIDS

L T P C
3 0 0 3

COURSE OBJECTIVES:

- To develop understanding of the state of stresses and strains in structural components as a result of different loading conditions.
- To provide knowledge on shear force and bending moment for all statically determinate beams by recognizing the beam type, loading, shear and bending stress.
- To provide knowledge on deflection of determinate beam.
- To have knowledge on principal stress and strain and analysis of plane truss
- To understand the effect of torsion on shafts and springs.

COURSE OUTCOMES:

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

- 19CEC01.C01 : Realize the state of stresses and strains in structural components under tension, compression and shear.
- 19CEC01.C02 : Plot the Shear force and bending moment diagrams for all the statically determinate beams.
- 19CEC01.C03 : Analyze the deflection of determinate beam by different methods.
- 19CEC01.C04 : Determine principle stress, strain and analysis of plane truss.
- 19CEC01.C05 : Comprehend the behavior of members under pure torsion and spring.

Course Outcomes	Program Outcomes												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
19CEC01.C01	x	x	x	-	-	-	-	-	-	x	-	x	x	-	-
19CEC01.C02	x	x	x	-	-	x	-	-	x	x	-	x	x	-	-
19CEC01.C03	x	x	x	-	-	x	-	-	x	x	-	x	x	-	-
19CEC01.C04	x	x	x	-	-	x	-	-	x	x	-	x	x	-	-
19CEC01.C05	x	x	x	-	-	x	-	-	x	x	-	x	x	-	-

UNIT I STRESS AND STRAIN

9

Stress and strain at a point - Tension, Compression, Shear Stress – Hook’s Law - Relationship among elastic constants - Stress Strain Diagram for Mild Steel - Ultimate Stress - Yield Stress - Factor of Safety - Thermal Stresses - Strain Energy due to Axial Force - Resilience - Stresses due to impact and Suddenly Applied Load - Compound Bars -Thin cylinder & shells.

UNIT II SHEAR AND BENDING IN BEAMS

9

Beams and Bending - Types of loads, supports - Shear Force and Bending Moment Diagrams for statically determinate beam with concentrated load, UDL, uniformly varying load. Theory of Simple Bending - Analysis of Beams for Stresses - Stress Distribution at a cross Section due to bending moment and shear force for Cantilever, simply supported and overhanging beams with different loading conditions

UNIT III DEFLECTION

9

Double integration method - Macaulay’s methods - Area moment method - conjugate beam method for computation of slopes and deflections of determinant beams

UNIT IV PRINCIPAL STRESS AND STRAIN & ANALYSIS OF PLANE TRUSS

9

Plane stress - Principal stresses and maximum shear stress - Mohr’s circle for plane stress - Determination of principal stresses and planes - plane strain - Applications of plane stress - Maximum stresses in beams- Spherical and deviator components of stress tensor – Determination of principal stresses and principal planes-Truss-Methods of joints - method of sections.

UNIT V TORSION OF SHAFTS AND SPRING

9

Torsional deformations of a circular bar - Circular bars of linearly elastic materials – Non uniform torsion - Stresses and strains in pure shear - transmission of power by circular shafts - Stepped shafts - Shafts fixed at both ends - Strain energy in torsion and pure shear - Springs - Types - Helical and leaf springs - Stresses and deflection of springs.


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TOTAL: 45 + 30 Periods

TEXT BOOKS:

Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Rajput.R.K	Strength of Materials	S.Chand and Co, New Delhi	2015
2.	Gambhir.M.L	Fundamentals of Solid Mechanics	PHI Learning Private Limited., New Delhi	2010

REFERENCE BOOKS:

Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Subramanian R	Strength of materials	Oxford University Press, New Delhi	2012
2.	Ramamrutham S	Strength of Materials	Dhanpat Rai & Sons	2014
3.	Bansal R.K	Strength of materials	Laxmi Publications, New Delhi	2014
4.	William A. Nash	Theory and Problems of Strength of Materials	Schaum's Outline Series, Tata McGraw-Hill publishing co., New Delhi	2010
5.	Srinath L.S	Advanced Mechanics of Solids	Tata McGraw-Hill Publishing Co., New Delhi	2017

WEB URLs:

1. www.informationvine.com/Answers
2. www.iitg.ac.in/kd/Lecture%20Notes/ME101-Lecture11-KD.pdf
3. www.stem.org.uk/resources/elibrary/.../mathematics-simple-beam-deflection
4. www.springer.com/cda/content/document/cda.../9783319243290-c1.pdf?SGWID
5. www.engineersedge.com/spring_torsion_calc.htm


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19CEC02

STRENGTH OF MATERIALS

L T P C
3 0 0 3

COURSE OBJECTIVES:

- To understand the concept of energy principles.
- To analyze the indeterminate beams.
- To analyze columns and thick cylinder.
- To understand the concept of theories of failure and state of stress in three dimensions.
- To understand advanced concepts like unsymmetrical bending, stresses in curved bars and locating shear centre.

COURSE OUTCOMES:

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

- 19CEC02.CO1 : Understand energy method for estimating the slope and deflections of beams and trusses.
- 19CEC02.CO2 : Analyze the indeterminate beams such as propped cantilever, fixed beams and continuous beams
- 19CEC02.CO3 : Formulate the safe load and crippling load on the column for different end conditions and also thick cylinder.
- 19CEC02.CO4 : Analyze the stress distribution in three dimensions.
- 19CEC02.CO5 : Analyze the advanced method of symmetrical and unsymmetrical bending of beams.

Course Outcomes	Program Outcomes												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
19CEC02.CO1	x	x	x	-	-	-	-	-	-	x	-	x	x	-	-
19CEC02.CO2	x	x	x	-	-	x	-	-	x	x	-	x	x	-	-
19CEC02.CO3	x	x	x	-	-	x	-	-	x	x	-	x	x	-	-
19CEC02.CO4	x	x	x	-	-	x	-	-	x	x	-	x	x	-	-
19CEC02.CO5	x	x	x	-	-	x	-	-	x	x	-	x	x	-	-

UNIT I ENERGY PRINCIPLES 9

Strain energy and strain energy density - strain energy in traction, shear in flexure and torsion - castigliano's theorems - principle of virtual work - application of energy theorems for computing deflections in beams and trusses - Maxwell's reciprocal theorems

UNIT II INDETERMINATE BEAMS 9

Propped cantilever and fixed beams-fixed end moments and reactions for concentrated load (central, noncentral), uniformly distributed load, triangular load (maximum at centre and maximum at end) - theorem of three moments - analysis of continuous beams - shear force and bending moment diagrams for continuous beams.

UNIT III COLUMNS AND CYLINDER 9

Eccentrically loaded short columns - middle third rule - core section - columns of unsymmetrical sections - (angle channel sections) - Euler's theory of long columns - critical loads for prismatic columns with different end conditions; Rankine's-Gordon formula for eccentrically loaded columns - thick cylinders - compound cylinders.

UNIT IV STATE OF STRESS IN THREE DIMENSIONS 9

Spherical and deviator components of stress tensor - determination of principal stresses and principal Planes - volumetric strain - dilatation and distortion - theories of failure - principal stress dilatation - Principal strain - shear stress - strain energy and distortion energy theories - application in analysis of Stress, load carrying capacity and design of members - residual stresses.

UNIT V ADVANCED TOPICS IN BENDING OF BEAMS 9

Unsymmetrical bending of beams of symmetrical and unsymmetrical sections - formulae for determining the centroidal axes - formula - stress concentration - fatigue and fracture.


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TEXT BOOKS:

Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Rajput R.K	Strength of Materials	S.Chand & Company Ltd., New Delhi	2015
2.	Bansal R.K	Strength of Materials	Laxmi Publications, New Delhi	2019

REFERENCE BOOKS:

Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Kazimi S.M.A	Solid Mechanics	Tata McGraw-Hill Publishing Co., New Delhi	2017
2.	William A Nash	Theory and Problems of Strength of Materials	Schaum's Outline Series, Tata McGraw Hill Publishing Company Ltd	2010
3.	Khurmi R.S	Strength of Materials (Mechanics of Solids)	S.Chand & Company Ltd	2010
4.	Srinath, L.S	Advanced mechanics and solids	Tata-McGraw Hill publishing company ltd	2017
5.	Punmia B.C, Ashok K. Jain and Arun K Jain	Mechanics of Structures (SMTS I)	Laxmi Publications, New Delhi	2011

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1. www.britannica.com/science/conservation-of-energy
2. www.ocw.tudelft.nl/wp-content/uploads/Statically-Indeterminate-Beams-.pdf
3. www.hydraulicspneumatics.com/200/TechZone/Cylinders/.../TechZone-Cylinders
4. www.informationvine.com/Three+Dimensions
5. www.brainkart.com/.../Strength-of-Materials--Advanced-Topics-In-Bending-of-Beam



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19CEC03

STRUCTURAL ANALYSIS

L T P C
3 1 0 4

COURSE OBJECTIVES:

- To gain knowledge on computing deflection of determinate structures using work- energy methods.
- To know about concepts of force method.
- To gain knowledge on influence lines for statically determinate and indeterminate structures.
- To analyze arched and cable profiled structures.
- To gain knowledge on Plastic Analysis for statically indeterminate structures.

COURSE OUTCOMES:

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

- 19CEC03.C01 : Determine the deflection of determinate structures by using work- energy methods.
 19CEC03.C02 : Gain knowledge about force method.
 19CEC03.C03 : Draw influence lines for statically determinate and indeterminate structures.
 19CEC03.C04 : Solve arched and cable profiled structures.
 19CEC03.C05 : Solve problems on Plastic Analysis for statically indeterminate structures.

Course Outcomes	Program Outcomes												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
19CEC03.C01	X	X	X	-	-	-	-	-	-	X	-	X	X	-	-
19CEC03.C02	X	X	X	-	-	X	-	-	X	X	-	X	X	-	-
19CEC03.C03	X	X	X	-	-	X	-	-	X	X	-	X	X	-	-
19CEC03.C04	X	X	X	-	-	X	-	-	X	X	-	X	X	-	-
19CEC03.C05	X	X	X	-	-	X	-	-	X	X	-	X	X	-	-

UNIT I WORK-ENERGY METHODS

12

Work Energy Principles- Principle of Virtual Displacement-Principle of Stationary Potential Energy – Principle of Complimentary Energy – Principle of Virtual Forces – Castigliano’s First and Second Theorem – Engessor’s First and Second Theorems – Betti Maxwell’s Law – Application to Statically Determinate Beams, Trusses and Frames

UNIT II CONCEPTS OF FORCE METHOD

12

Definition and Determination of static and kinematic Indeterminacy – Beams, Trusses and frames – Analysis of statically indeterminate structures by force method – Theorem of three moments for continuous beams (Only two dimension)

UNIT III MOVING LOADS AND INFLUENCE LINES

12

Introduction – moving loads in ILD – Load categories- Single concentrated load - Udl longer than the span- Udl shorter than the span – Two concentered load – Multiple wheel loads - Influence lines for statically determinate structures – Applications of Muller- Breslau’s principle (Indeterminate structures upto two degrees of freedom)

UNIT IV ARCHES AND SUSPENSION BRIDGES

12

Introduction – Analysis of three hinged and two hinged parabolic and circular arches - Analysis of suspension cables and suspension bridges with two and three hinged stiffening girders.

UNIT V PLASTIC ANALYSIS OF STRUCTURES

12

Statically indeterminate axial problems - Beams in pure bending - plastic moment of resistance - plastic modulus - shape factor - Load factor - plastic hinge and mechanism - plastic analysis of Indeterminate beams and frames (Single bay and single storey) - upper and lower bound theorems.

TOTAL: 60 PERIODS

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TEXT BOOKS:

S.No	Author(s)	Title of the Book	Publisher	Year of Publication
1	Bhavikatti.S.S	Structural Analysis, Vol.1 and Vol. 2	Vikas Publishing House Pvt. Ltd	2011
2	Vaidyanadhan.R and Perumal.P	Comprehensive structural Analysis – Vol.1 & Vol.2	Laxmi Publications, New Delhi	2019

REFERENCE BOOKS:

S.No	Author(s)	Title of the Book	Publisher	Year of Publication
1	Wang C K	Indeterminate Structural Analysis	Tata Mc Graw Hill Education Pvt. Ltd., New Delhi	2013
2	Gambhir. M.L	Fundamentals of Structural Mechanics and Analysis	PHI Learning Pvt. Ltd., New Delhi	2011
3	Negi L.S and Jangid R S	Structural Analysis	Tata Mc Graw Hill Publications, New Delhi, 6th Edition	2014
4	Reddy. C.S	Basic Structural Analysis	Tata Mc Graw Hill Education Pvt. Ltd., New Delhi	2013
5	B. C. Punmia Ashok Kumar Jain and Arun Kumar Jain	Theory of Structures	Laxmi Publications (P) Ltd., New Delhi	2012

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- 1 www.iitg.ac.in/kd/Lecture%20Notes/ME101-Lecture06-KD.pdf
- 2 [www.nptel.ac.in/courses/Webcourse contents/IIT%20Kharagpur/.../pdf/m2l9.pdf](http://www.nptel.ac.in/courses/Webcourse%20contents/IIT%20Kharagpur/.../pdf/m2l9.pdf)
- 3 www.engr.mun.ca/~swamid/ENGI6705-StructuralAnalysis-ClassNotes3.ppt
- 4 www.ibo.org/globalassets/digital-toolkit/pd/build-it/assessed-bridge-definitions.pdf
- 5 www.coursehero.com > University of Texas > CIVIL ENG. > CIVIL ENG. 382



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19CEC04

DESIGN OF STEEL STRUCTURES

L T P C
3 1 0 4

COURSE OBJECTIVES:

- To expose limit state design concepts on bolt and welded joints.
- To provide knowledge on design of tension members.
- To get familiar with compression member design.
- To have knowledge on design of beams and plate girder.
- To gain knowledge on design of industrial roof structure.

COURSE OUTCOMES:

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

- 16CEC04.CO1 : Gain knowledge on limit state design concepts on bolt and welded joints.
- 16CEC04.CO2 : Design tension members.
- 16CEC04.CO3 : Design compression members.
- 16CEC04.CO4 : Get trained with design of beams and plate girder.
- 16CEC04.CO5 : Design components of industrial roof structures.

Course Outcomes	Program Outcomes												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
16CEC04.CO1	X	X	X	X	-	X	-	-	X	X	-	X	X	-	-
16CEC04.CO2	X	X	X	X	-	X	-	-	X	X	-	X	X	-	-
16CEC04.CO3	X	X	X	X	-	X	-	-	X	X	-	X	X	-	-
16CEC04.CO4	X	X	X	X	-	X	-	-	X	X	-	X	X	-	-
16CEC04.CO5	X	X	X	-	-	X	-	-	X	X	-	X	X	-	-

UNIT I INTRODUCTION

9

Structural steel sections – Limit state design concepts – Connections bolted and welded joints - Failure of joints - Efficiency of joints – Eccentric connections.

UNIT II TENSION MEMBERS

9

Types of sections – Net area – net effective sections for angles and Tee in tension – Design of connections in tension members – use of lug angles – Design of tension splice – Concept of Shear lag.

UNIT III COMPRESSION MEMBERS

9

Effective length about major and minor principal axis - I.S code provisions permissible stresses - Design rules- Design of one component – two components and built up compression members under axial load- Design of Lacing and Battens - Different types of column bases - Slab base and Gusseted base - connection details.

UNIT IV BEAMS

9

Design of laterally supported and unsupported beams – Built up beams – design of Plate Girders – Intermediate and bearing stiffeners – Web splicing.

UNIT V ROOF TRUSS AND INDUSTRIAL STRUCTURES

9

Design of roof trusses – Elements of roof trusses – Design of purlins – Estimation of wind loads – Design of gantry girders

TOTAL : 45 PERIODS

TEXT BOOKS:

S.No	Author(s)	Title of the Book	Publisher	Year of Publication
1	Subramanian N	Design of Steel Structures	Oxford University Press	2013
2	Duggal S.K	Design of Steel Structures	Tata McGraw-Hill Education	2014


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REFERENCE BOOKS:

S.No	Author(s)	Title of the Book	Publisher	Year of Publication
1	Gaylord, E.H Gaylord, N.C and Stallmeyer, J.E	Design of Steel Structures	3rd edition, McGraw-Hill Publications	2012
2	S.S. Bhavikatti	Design of Steel Structures	I. K. International Pvt Ltd	2014
3	Gambhir. M.L	Fundamentals of Structural Steel Design	McGraw Hill Education India Pvt. Ltd	2013
4	Narayanan.R.et.al	Teaching Resource on Structural Steel Design	INSDAG, Ministry of Steel Publications	2014
5	-	IS 800:2007, General Construction in Steel – Code of Practice, (III rd Revision)	BIS, New Delhi	2014

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1. www.edx.org/course/introduction-steel-tenarisuniversity-steel101x-2
2. [www://en.wikipedia.org/wiki/Tension_member](http://en.wikipedia.org/wiki/Tension_member)
3. www.coursehero.com > ... > CE > CE CE5660
4. www.revitforum.org/architecture-general.../25126-concrete-beams-walls.html
5. www.redbuilt.com/commercial-systems/open-web-trusses



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19CEC05

ESTIMATION AND QUANTITY SURVEYING

L T P C
3 0 0 3

COURSE OBJECTIVES:

- To produce civil engineering students who have strong foundation in estimation of quantities required for roads and buildings
- To estimate the quantities of items of works involved in buildings, water supply and sanitary works, road works and irrigation works.
- To estimate the material quantities, prepare a bill of quantities, make specifications and prepare tender documents.
- Student should also be able to prepare value estimates.
- To familiarize with the knowledge of preparing reports for various engineering works.

COURSE OUTCOMES:

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

- 19CEC05.CO1 : Student will have the confidence to prepare detailed and abstract estimations for building.
- 19CEC05.CO2 : Student will demonstrate the ability to prepare estimate for other structures.
- 19CEC05.CO3 : Student will have the confidence to prepare specifications and tender documents.
- 19CEC05.CO4 : Gain knowledge about valuation.
- 19CEC05.CO5 : Gain knowledge about report preparation of projects.

Course Outcomes	Program Outcomes												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
19CEC05.CO1	x	x	x	-	-	-	-	x	x	x	-	x	x	-	-
19CEC05.CO2	x	x	x	-	-	-	-	x	x	x	-	x	x	-	-
19CEC05.CO3	x	x	x	-	-	-	-	x	x	x	-	x	x	-	-
19CEC05.CO4	x	x	x	-	-	-	-	x	x	x	-	x	x	-	-
19CEC05.CO5	x	x	x	-	-	-	-	x	x	x	-	x	x	-	-

UNIT I ESTIMATE OF BUILDINGS

9

Introduction – types of estimate- unit of measurement - methods of estimate-Load bearing and framed structures – Calculation of quantities of brick work, RCC, PCC, Plastering, white washing, colour washing and painting / varnishing for shops, rooms, residential building with flat and pitched roof – Various types of arches – Calculation of brick work and RCC works in arches.

UNIT II ESTIMATE OF OTHER STRUCTURES

9

Estimating of septic tank, soak pit – sanitary and water supply installations – water supply pipe line –sewer line – tube well – open well – estimate of bituminous and cement concrete roads – estimate of retaining walls – culverts – estimating of irrigation works – aqueduct, siphon, fall.

UNIT III SPECIFICATION AND TENDERS

9

Data – Schedule of rates – Analysis of rates – Specifications – sources – Detailed and general specifications – Tenders – Contracts – Types of contracts – Arbitration and legal requirements.

UNITIV VALUATION

9

Necessity – Basics of value engineering – Capitalized value – Depreciation – Escalation – Value of Building – Calculation of Standard rent – Mortgage – Lease.

UNITV REPORT PREPARATION

9

Principles for report preparation – report on estimate of residential building – Culvert – Roads – Water Supply and sanitary installations – Tube wells – Open wells.

TOTAL : 45 PERIODS

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TEXT BOOKS:

S.No	Author(s)	Title of the Book	Publisher	Year of Publication
1	Dutta, B.N.	Estimating and Costing in Civil Engineering	UBS Publishers & Distributors Pvt. Ltd	2017
2	Kohli, D.D and Kohli R.C.	A Text Book of Estimating and Costing (Civil)	S.Chand & Company Ltd.	2012

REFERENCE BOOKS:

S.No	Author(s)	Title of the Book	Publisher	Year of Publication
1	-	PWD Data Book.	Public Work Department	-
2	-	TamilNadu Transparencies in Tender Act.	-	2016
3	-	Arbitration and Conciliation Act.	-	2015
4	-	Standard Bid Evaluation Form, Procurement of Goods or Works The World Bank, April.	-	2016
5	Rangwala	Estimating Costing and Valuation	Charotarpublishning company pvt ltd	2015

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2. www.sciencedirect.com/science/article/pii/S0378778815304278
3. www.moef.nic.in/.../tenders%20quotations/02-NCSCM%20Volume%202%20-%20Tec
4. www.dce.edu.in/question-bank/ce6704-eqs-civil-viist-au-unit-iv.pdf
5. www.youtube.com/watch?v=D04uxZpgp6M


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19CEC06

MECHANICS OF FLUIDS

L T P C
3 0 0 3

COURSE OBJECTIVES:

- To understand the basic properties of fluids and fluid statics.
- To get a basic knowledge of fluids in kinematic and dynamics.
- To gain knowledge about various losses in pipes.
- To impart knowledge on boundary layers
- To select appropriate model and similitude in problem related to hydraulics.

COURSE OUTCOMES:

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

- 16CEC06.CO1 : Determine the various fluid properties.
- 16CEC06.CO2 : Impart knowledge on fluid in kinematics and dynamics
- 16CEC06.CO3 : Determine the various losses in pipes.
- 16CEC06.CO4 : Compute the energy and momentum thickness.
- 16CEC06.CO5 : Explain the various applications of similitude and model analysis

CourseOutcomes	ProgramOutcomes												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
16CED06.CO1	X	X	X	-	-	-	-	-	-	X	-	X	X	-	-
16CED06.CO2	X	X	X	-	-	X	-	-	X	X	-	X	X	-	-
16CED06.CO3	X	X	X	-	-	X	-	-	X	X	-	X	X	-	-
16CED06.CO4	X	X	X	-	-	X	-	-	X	X	-	X	X	-	-
16CED06.CO5	X	X	X	-	-	X	-	-	X	X	-	X	X	-	-

UNIT I FLUID PROPERTIES AND STATICS

9

Definitions – Fluid and fluid mechanics – Dimensions and units – Fluid properties – density-specific weight, specific volume, specific gravity, temperature, viscosity, compressibility, vapour pressure, capillarity and surface tension-Fluid statics: concept of fluid pressure, absolute and gauge pressures-pressure measurements by manometers and pressure gauges.

UNIT II FLUID KINEMATICS AND DYNAMICS

9

Fluid Kinematics Stream, streak and path lines – Classification of flows – Continuity equation (one, two and three dimensional forms) – Stream and potential functions – Flow nets –Fluid dynamics –equation of motion-Euler’s equation along a streamline-Bernoulli’s equation-applications-flow measurements.

UNIT III FLOW THROUGH PIPES

9

Shear stress, pressure gradient relationship- Laminar flows through pipes and between plates – Hagen Poiseuille equation –Flow through pipes -Turbulent flow – Darcy- Weisbach formula –pipe roughness- Moody’s diagram – Major and minor losses of flow in pipes-pipes in series and in parallel

UNITIV BOUNDARY LAYER

9

Definition of boundary layer –boundary layer on a flat plate - thickness and classification – Displacement, energy and momentum thickness-Boundary layer separation and control-drag in flat plate- drag and lift coefficients.

UNITV SIMILITUDE AND MODEL STUDY

9

Dimensional Analysis – Rayleigh’s method, Buckingham’s Pi-theorem – Similitude and models – Scale effect and distorted models

TOTAL : 45 PERIODS

TEXT BOOKS:

S.No	Author(s)	Title of the Book	Publisher	Year of Publication
1	Bansal R.K	Fluid Mechanics and Hydraulic Machines	Laxmi Publications	2016
2	Modi P.N. and Seth S.M	Hydraulics and Fluid Mechanics	Standard Book House New Delhi	2011


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REFERENCE BOOKS:

S.No	Author(s)	Title of the Book	Publisher	Year of Publication
1	Streeter, Victor L and Wylie, Benjamin E	Fluid Mechanics	McGraw- Hill Ltd	2013
2	John Finnemore, Joseph B and Franzini	Fluid Mechanics with Engineering Applications	McGraw-Hill Ltd	2014
3	Fox, Robert W and Macdonald, Alan T	Introduction to Fluid Mechanics	John Wiley & Sons	2011
4	Jain. A.K	Fluid Mechanics	Khanna Publishers	2013
5	Rajput R.K	A text book of Fluid Mechanics	S.Chand and Co	2010

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2. www.mcgill.ca/study/2014-2015/courses/mech-331
3. www.pipes.digital/docs
4. www.britannica.com/science/boundary-layer
5. www.springer.com/cda/content/document/cda.../9783319134758-c1.pdf?SGWID

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19CEC07

SURVEYING

L T P C
3 1 0 4

COURSE OBJECTIVES:

- To learn the various methods of plane and geodetic surveying to solve the real world Civil Engineering problems.
- To introduce the concepts of Control Surveying.
- To introduce the basics of Astronomical Surveying
- To know about control survey and adjustments
- To learn about modern surveying

COURSE OUTCOMES:

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

COURSEOUTCOMES:

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

- 16CEC07.C01 : The use of various surveying instruments and mapping.
- 16CEC07.C02 : Measuring Horizontal angle and vertical angle using different instruments.
- 16CEC07.C03 : Methods of Leveling and setting Levels with different instruments
- 16CEC07.C04 : Concepts of astronomical surveying and methods to determine time, longitude, latitude and azimuth
- 16CEC07.C05 : Concept and principle of modern surveying.

Course Outcomes	Program Outcomes												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
16CED07.C01	X	X	X	-	-	-	-	-	-	X	-	X	X	-	-
16CED07.C02	X	X	X	-	-	X	-	-	X	X	-	X	X	-	-
16CED07.C03	X	X	X	-	-	X	-	-	X	X	-	X	X	-	-
16CED07.C04	X	X	X	-	-	X	-	-	X	X	-	X	X	-	-
16CED07.C05	X	X	X	-	-	X	-	-	X	X	-	X	X	-	-

UNIT I FUNDAMENTALS OF CONVENTIONAL SURVEYING AND LEVELLING

9

Classifications and basic principles of surveying - Equipment and accessories for ranging and chaining - Methods of ranging - Compass - Types of Compass - Basic Principles- Bearing – Types - True Bearing - Magnetic Bearing - Levelling- Principles and theory of Levelling – Datum- - Bench Marks – Temporary and Permanent Adjustments- Methods of Levelling- Booking – Reduction - Sources of errors in Levelling - Curvature and refraction.

UNIT II THEODOLITE AND TACHEOMETRIC SURVEYING

9

Horizontal and vertical angle measurements - Temporary and permanent adjustments - Heights and distances - Tacheometer - Stadia Constants - Analytic Lens -Tangential and Stadia Tacheometry surveying - Contour – Contouring – Characteristics of contours – Methods of contouring – Tacheometric contouring - Contour gradient – Uses of contour plan and map

UNIT III CONTROL SURVEYING AND ADJUSTMENT

9

Horizontal and vertical control – Methods – specifications – triangulation- baseline – satellite stations – reduction to centre-trigonometrical levelling – single and reciprocal observations – traversing – Gale’s table. - Errors Sources- precautions and corrections – classification of errors – 40 true and most probable values - weighed observations – method of equal shifts – principle of least squares - normal equation – correlates- level nets- adjustment of simple triangulation networks.

UNIT IV ADVANCED TOPICS IN SURVEYING

9

Hydrographic Surveying – Tides – MSL – Sounding methods – Three point problem - Strength of fix - astronomical Surveying – Field observations and determination of Azimuth by altitude and hour angle methods - Astronomical terms and definitions - Motion of sun and stars - Celestial coordinate systems - different time systems - Nautical Almanac - Apparent altitude and corrections - Field observations and determination of time, longitude, latitude and azimuth by altitude and hour angle method


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UNIT V MODERN SURVEYING

9

Total Station : Advantages - Fundamental quantities measured - Parts and accessories - working principle - On board calculations - Field procedure - Errors and Good practices in using Total Station GPS Surveying : Different segments - space, control and user segments - satellite configuration - signal structure - Orbit determination and representation - Anti Spoofing and Selective Availability - Task of control segment - Hand Held and Geodetic receivers - data processing - Traversing and triangulation.

TOTAL: 45 Periods**TEXTBOOKS:**

S.No	Author(s)	Title of the Book	Publisher	Year of Publication
1	Punmia B.C	Surveying Vol I &II	Laxmi Publications (P) Ltd., New Delhi,	2012
2	Duggal S.K	Surveying Vol I&II	McGraw Hill Publishing Company Ltd., NewDelhi	2011

REFERENCE BOOKS:

S.No	Author(s)	Title of the Book	Publisher	Year of Publication
1	Clark D	Plane and Geodetic Surveying Vols. I and II	C.B.S., Publishers and Distributors, New Delhi	2011
2	Bannister A and Raymond S	Surveying	Addison Wesley Longman Ltd, England	2010
3	Arora, K.R	Surveying Vol. I and II	Standard Book House	2015
4	Heribert Kahmen and Wolfgang Faig	Surveying	Walter de Gruyter	2013
5	Kanetkar .T.P and Kulkarni .S.V	Surveying and Levelling, Vol. I & II	Pune Vidyarthi Griha Prakashan	2017

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2. www-lib.tufs.ac.jp/opac/recordID/catalog.bib/BA61454843
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19CEC08

GEO TECHNICAL ENGINEERING

L T P C
3 0 0 3

COURSE OBJECTIVES:

- To provide knowledge on and classification of soil and compaction
- To acquire knowledge on soil water and permeability
- To impart idea about effective stress distribution due to applied loads and settlement
- To familiarize about shear strength
- To be acquainted with slope stability.

COURSE OUTCOMES:

- 19CEC08.C01 : Classify the soil based on index properties
 19CEC08.C02 : Know about soil water and permeability
 19CEC08.C03 : Find out the stress distribution and settlement
 19CEC08.C04 : Estimate the shear strength of various types of soil.
 19CEC08.C05 : Analyze the stability of slopes using different methods.

Course Outcomes	Program Outcomes												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
19CEC08.C01	X	X	X	-	-	-	-	-	-	X	-	X	X	-	-
19CEC08.C02	X	X	X	-	-	X	-	-	X	X	-	X	X	-	-
19CEC08.C03	X	X	X	-	-	X	-	-	X	X	-	X	X	-	-
19CEC08.C04	X	X	X	-	-	X	-	-	X	X	-	X	X	-	-
19CEC08.C05	X	X	X	-	-	X	-	-	X	X	-	X	X	-	-

UNIT I SOIL CLASSIFICATION AND COMPACTION

9

Nature of soil – phase relationships – Soil classification for engineering purposes – Index properties of soils - IS Classification system – Soil compaction – comparison of laboratory and field compaction methods – Factors influencing compaction

UNIT II SOIL WATER AND PERMEABILITY

9

Soil water – types – capillary stress – Permeability measurement in the laboratory and in field – factors influencing permeability of soils – Seepage – introduction to flow nets – Simple problems – effective stress concept in soil

UNIT III EFFECTIVE STRESS DISTRIBUTION DUE TO APPLIED LOADS AND SETTLEMENT

9

Boussinesq theory – ASSUMPTIONS – point load – circular load – rectangular load- 2:1 distribution method – equivalent point load method - use of newmarks influence chart – components of settlement – immediate and consolidation settlement – computation of rate of settlement. $-\sqrt{t}$ and $\log t$ methods - factors influencing consolidation behavior of soils.

UNIT IV SHEAR STRENGTH

9

Shear strength of cohesive and cohesion less soils – Mohr – Coulomb failure - assumptions – Measurement of shear strength, direct shear – Triaxial compression, UCC and Vane shear tests – Pore pressure parameters –Liquefaction

UNIT V SLOPE STABILITY

9

Slope failure mechanisms – Types - infinite slopes – finite slopes – Total stress analysis for saturated clay – $c - \phi$ soil method of slices - Friction circle method – Use of stability number - slope protection measures.

TOTAL: 45 Periods

TEXT BOOKS:

Sl.No	Author(s)	Title of the Book	Publisher
1.	Arora, K.R	Soil Mechanics and Foundation Engineering	Standard Publishers and Distributors
2.	Venkataramaiah C	Geotechnical Engineering	New Age International Publishers, New Delhi

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REFERENCE BOOKS:				
Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Punmia B.C	Soil Mechanics and Foundations	Laxmi Publications Pvt. Ltd, New Delhi	2010
2.	Kaniraj, S.R	Design aids in Soil Mechanics and Foundation Engineering	Tata McGraw Hill publishing company Ltd., New Delhi	2014
3.	Purushothama Raj. P	Soil Mechanics and Foundation Engineering	Pearson Education	2013
4.	Gopal Ranjan and Rao A.S.R	Basic and Applied Soil Mechanics	New Age International Publishers, New Delhi	2010
5.	Murthy V.N.S	Text Book of Soil Mechanics and Foundation Engineering	CBS Publishers	2011

WEB URLs:

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2. www.eng.fsu.edu/~tawfiq/soilmech/lecture.html
3. www.authorstream.com/.../gosaimadhuri-1561526-compaction-compression-consolidation
4. www.jstage.jst.go.jp/article/jscej1969/1980/300/1980_300_131/_article
5. www.nptelvideos.in/2012/11/soil-mechanics.html



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19CEC09

DESIGN OF REINFORCED CONCRETE ELEMENTS

L T P C
3 1 0 4

COURSE OBJECTIVES:

- To study the stress strain behavior of concrete and steel.
- To gain the knowledge of limit state design for beam
- To gain the knowledge of limit state design for slabs
- To understand the behavior of columns subjected to various load
- To study the design of various types of footing

COURSE OUTCOMES:

- 19CEC09.CO1 : Design the reinforced concrete structural elements using various methods.
 19CEC09.CO2 : Design the reinforced concrete beams by LSM
 19CEC09.CO3 : Design the reinforced concrete slabs by LSM
 19CEC09.CO4 : Design the reinforced concrete columns by LSM
 19CEC09.CO5 : Select and design RC footings by using LSM.

Course Outcomes	Program Outcomes												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
19CEC09.CO1	X	X	X	-	-	-	-	-	-	X	-	X	X	-	-
19CEC09.CO2	X	X	X	-	-	X	-	-	X	X	-	X	X	-	-
19CEC09.CO3	X	X	X	-	-	X	-	-	X	X	-	X	X	-	-
19CEC09.CO4	X	X	X	-	-	X	-	-	X	X	-	X	X	-	-
19CEC09.CO5	X	X	X	-	-	X	-	-	X	X	-	X	X	-	-

UNIT I METHODS OF DESIGN OF CONCRETE STRUCTURES

9

Concept of WSM, ultimate load method and limit state method - Advantages of Limit State method over other methods - Limit State philosophy as detailed in current IS Code - Design of rectangular beam section by working stress- Cracked and Uncracked section-Design of one way and two way slab by working stress method.

UNIT II LIMIT STATE DESIGN OF BEAMS

9

Design of singly and doubly reinforced rectangular and flanged beams - Use of design aids for flexure - Behavior of R.C. beams in shear and torsion - Shear and torsion reinforcement - Limit State design of R.C. members for combined bending, shear and torsion - Use of design aids - Design requirement for bond and anchorage as per IS code - Serviceability requirements.

UNIT III LIMIT STATE DESIGN OF SLABS

9

Behavior of one way and two way slabs - Design of one way simply supported, cantilever and continuous slabs - Design of two-way slabs for various edge conditions - Types of staircases - design of dog-legged staircase-Open well staircase.

UNIT IV LIMIT STATE DESIGN OF COLUMNS

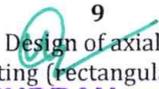
9

Types of columns - Braced and unbraced columns - Assumptions - Design of rectangular and circular columns for axial load - Provisions of IS-456 & SP19 code for the analysis of columns subjected to axial load and uniaxial bending - Design of short and long columns subjected to axial load and biaxial bending moment.

UNIT V LIMIT STATE DESIGN OF FOOTING

9

Classification of Foundations - Design guidelines - Codal provisions -Design of wall footing- Design of axially and eccentrically loaded square, rectangular and circular footing - Design of combined footing (rectangular and trapezoidal) - Detailing of RC footing.


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TOTAL: 45 Periods

TEXT BOOKS:

Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	N. Krishna Raju and R. N. Pranesh	Reinforced Concrete Design – IS 456 – 2000 Principles and Practice	New Age International Publishers, New Delhi	2010
2.	P. C. Varghese	Limit State Design of Reinforced Concrete	Prentice Hall of India Ltd., New Delhi	2010

REFERENCE BOOKS:

Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Punmia, B.C Ashok Kumar Jain and Arun Kumar Jain	Limit state Design of Reinforced concrete	Laxmi Publications Pvt. Ltd., New Delhi	2019
2.	Sinha, S.N	Reinforced Concrete Design	Tata McGraw Hill Publishing Company Ltd., New Delhi	2017
3.	I.C.Syal and A.K.Goel	Reinforced Concrete Structures	S.Chand and Company Ltd, New Delhi	2012
4.	Shah V L Karve S R	Limit State Theory and Design of Reinforced Concrete	Structures Publilcations, Pune	2013
5.	Gambhir.M.L	Fundamentals of Reinforced Concrete Design	Prentice Hall of India Private limited, New Delhi	2013

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2. www.kopykitab.com/ebooks/2019/.../sample_7444.pdf
3. www.scielo.br/scielo.php?script=sci_arttext&pid=S1983
4. www1.rmit.edu.au/courses/c6093cive56791205
5. www.scielo.br/scielo.php?script=sci_arttext&pid=S1983


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19CEC10

WATER SUPPLY ENGINEERING

L T P C
3 0 0 3

COURSE OBJECTIVES:

- To make the students conversant with sources, demand and characteristics of water
- To expose the students to understand the concept of various water supply lines.
- To provide adequate knowledge about the water treatment processes.
- To prefer the suitable advanced treatment techniques.
- To provide knowledge on water distribution and plumbing system

COURSE OUTCOMES:

- 19CEC10.C01 : Identify the quantity and quality of water from various sources.
 19CEC10.C02 : Explain the processes involved in the water conveyance systems
 19CEC10.C03 : Infer the design principles of unit operations and unit processes for water treatment
 19CEC10.C04 : Justify the suitable advanced treatment techniques for water treatment
 19CEC10.C05 : Choose the appropriate water distribution network for a city and plumbing systems for a building

Course Outcomes	Program Outcomes												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
19CEC10.C01	X	X	X	-	-	-	-	-	-	X	-	X	X	-	-
19CEC10.C02	X	X	X	-	-	X	-	-	X	X	-	X	X	-	-
19CEC10.C03	X	X	X	-	-	X	-	-	X	X	-	X	X	-	-
19CEC10.C04	X	X	X	-	-	X	-	-	X	X	-	X	X	-	-
19CEC10.C05	X	X	X	-	-	X	-	-	X	X	-	X	X	-	-

UNIT I PLANNING FOR WATER SUPPLY SYSTEM

9

Public water supply system - Planning - Objectives -Design period - Population forecasting -Water demand - Sources of water and their characteristics - Surface and Groundwater- Impounding Reservoir -Development and selection of source - Water quality - Characterization and standards.

UNIT II CONVEYANCE SYSTEM

9

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

UNIT III WATER TREATMENT

9

Objectives - Unit operations and processes - Principles, functions design and drawing of chemical feeding, Flash mixers, flocculators, sedimentation tanks and sand filters - Disinfection- Residue Management - Construction and Operation & Maintenance aspects of Water Treatment Plants.

UNIT IV ADVANCED WATER TREATMENT

9

Principles and functions of Aeration - Iron and manganese removal, Defluoridation and demineralization - Water softening - Desalination - Membrane Systems - Recent advances.

UNIT V WATER DISTRIBUTION AND SUPPLY TO BUILDINGS

9

Requirements of water distribution -Components -Service reservoirs - Functions and drawings - Network design -Analysis of distribution networks - Appurtenances -operation and maintenance -Leak detection, Methods. Principles of design of water supply in buildings -House service connection -Fixtures and fittings - Systems of plumbing and drawings of types of plumbing.

TOTAL: 45 Periods

TEXT BOOKS:

Sl.No	Author(s)	Title of the Book	Publisher
1.	S.K. Garg	Water Supply Engineering	Khanna Publications Pvt.Ltd. New Delhi
2	Modi, P.N	Environmental Engineering I	Standard Book House, Delhi

Dr. V. RAJENDRAN, M.E., Ph.D.,

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2010

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REFERENCE BOOKS:				
Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1	Cpheeco Manual	Manual on Water supply and Treatment	Government of India, New Delhi	2019
2	Birdie.G	Water Supply and Sanitary Engineering	Dhanpat Rai and sons	2011
3	-	Hand book on Water Supply and Drainage	SP35, B.I.S., New Delhi	2013
4	Syed R Qasim, Motley E M	Water Works Engineering - Planning, Design and Operation	Prentice- hall of India, New Delhi,	2013
5	Babbit. H. E., and Donald. J. J	Water Supply Engineering	McGraw Hill book Co	2012

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3. www.who.int/water_sanitation_health/dwq/S12.pdf
4. www.sswm.info/print/2820?tid=1257
5. www.sswm.info/content/water-distribution-pipes


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19CEC11

HIGHWAY ENGINEERING

L T P C
3 0 0 3

COURSE OBJECTIVES:

- To introduce the fundamentals related to the Planning and alignment of road.
- To provide knowledge on geometric design of highway components.
- To provide knowledge on design of flexible and rigid pavements.
- To provide knowledge on various materials and procedures in pavement construction.
- To provide knowledge on evaluation of pavement and maintenance methods.

COURSE OUTCOMES:

- 19CEC11.C01 : Apply the concepts behind the Highway planning and aligning.
 19CEC11.C02 : Design the cross sectional elements, horizontal and vertical curves.
 19CEC11.C03 : Design flexible and rigid pavements.
 19CEC11.C04 : Choose the characteristics of pavement materials.
 19CEC11.C05 : Perform evaluation and maintenance of pavement.

Course Outcomes	Program Outcomes												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
19CEC11.C01	X	X	X	-	-	-	-	-	-	X	-	X	X	-	-
19CEC11.C02	X	X	X	-	-	X	-	-	X	X	-	X	X	-	-
19CEC11.C03	X	X	X	-	-	X	-	-	X	X	-	X	X	-	-
19CEC11.C04	X	X	X	-	-	X	-	-	X	X	-	X	X	-	-
19CEC11.C05	X	X	X	-	-	X	-	-	X	X	-	X	X	-	-

UNIT I HIGHWAY PLANNING AND ALIGNMENT

9

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

UNIT II GEOMETRIC DESIGN OF HIGHWAYS

9

Typical cross sections of Urban and Rural roads - Cross sectional elements - Sight distances – Horizontal curves, Super elevation, transition curves, widening at curves - Vertical curves - Gradients, Special consideration for hill roads - Hairpin bends – Lateral and vertical clearance at underpasses.

UNIT III DESIGN OF FLEXIBLE AND RIGID PAVEMENTS

9

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

UNIT IV HIGHWAY CONSTRUCTION MATERIALS AND PRACTICE

9

Highway construction materials, properties, testing methods – CBR Test for subgrade - tests on aggregate & bitumen – Construction practice including modern materials and methods, Bituminous and Concrete road construction, Polymer modified bitumen, Recycling, Different materials – Glass, Fiber, Plastic, Geo-Textiles, Geo-Membrane (problem not included) - Quality control measures - Highway drainage - Construction machineries..

UNIT V EVALUATION AND MAINTENANCE OF PAVEMENTS

9

Pavement distress in flexible and rigid pavements – Pavement Management Systems - Pavement evaluation, roughness, present serviceability index, skid resistance, structural evaluation, evaluation by deflection measurements -Strengthening of pavements –Types of maintenance – Highway Project formulation.

TOTAL: 45 Periods

TEXT BOOKS:

Sl.No	Author(s)	Title of the Book	Publisher
1	Khanna, K. and Justo C.E.G.	Highway Engineering	Khanna Publishers
2	Kadiyali L R	Principles and practice of Highway engineering	Khanna Technical Publishers

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REFERENCE BOOKS:				
Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1	Bindra S P	Highway Engineering	Dhanpat Rai & Sons	2012
2	Khiroliya R K	Principle of Highway Engineering	Dhanpat rai and Sons	2019
3	Brockenbrough R L Boedecker K J	Highway engineering handbook	Highway engineering handbook	2015
4	Subramaniam K P	Highways,Railways,Airport And Harbour Engineering Engineering	Scitech Publications,Chennai	2010
5	-	Indian Road Congress(IRC), Guidelines and special Publications of Planning and design	IRC	-

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4. www.trb.org/NotesDocs/25-25%284%29_FR.pdf
5. www.ci.northville.mi.us/.../MunicipalPavementManagements.pdf



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19CEC12

COMPUTER AIDED BUILDING DRAWING

L T P C
0 0 2 1

COURSE OBJECTIVES:

- To make the students understand and learn various elements of Residential / Institutional /Workshop buildings.
- To impart fundamental knowledge on AutoCAD to make the students draw truss structures, the plan, elevation and sectional view of a building.

COURSE OUTCOMES:

- 19CEC12.C01 : To know the various components of the different types of building.
 19CEC12.C02 : To acquire knowledge of minimum size of the various elements of a building.
 19CEC12.C03 : To draw a building plan for a given area.
 19CEC12.C04 : To prepare an elevation and a sectional view of the given plan.

Course Outcomes	Program Outcomes												PSOs		
	P01	P02	P03	P04	P05	P06	P07	P08	P09	P010	P011	P012	PSO1	PSO2	PSO3
19CEC12.C01	x	x	x	-	-	-	-	-	-	x	-	x	x	-	-
19CEC12.C02	x	x	x	-	-	x	-	-	x	x	-	x	x	-	-
19CEC12.C03	x	x	x	-	-	x	-	-	x	x	-	x	x	-	-
19CEC12.C04	x	x	x	-	-	x	-	-	x	x	-	x	x	-	-

LIST OF EXPERIMENTS

1. Develop a model of a Brick wall using basic commands
 - Flemish Bond
 - English Bond
 - Header Bond
 - Stretcher Bond
 - Raking Bond
 - Zigzag Bond
2. Create a model of a hexagonal, triangular shaped paver blocks for a given floor area
3. Joinery details for doors and windows
4. Plan, Elevation and Cross section of a Single and Multi-storied residential buildings for a given plan
5. Steel Truss
6. Develop a 3 Dimensional model of a single storey single bay residential building for a given plan of mini project

TOTAL: 30 PERIODS



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19CEC13

SURVEYING LABORATORY

L T P C
0 0 2 1

COURSE OBJECTIVES:

- At the end of the course the student will possess knowledge about Survey field techniques

COURSE OUTCOMES:

- 19CEC13.CO1 : To know the various instruments used in surveying.
 19CEC13.CO2 : To acquire knowledge about different types of surveying.
 19CEC13.CO3 : To draw the layout of site by plane table.
 19CEC13.CO4 : To calculate the elevation of different structures.

Course Outcomes	Program Outcomes												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
19CEC13.CO1	x	x	x	-	-	-	-	-	-	x	-	x	x	-	-
19CEC13.CO2	x	x	x	-	-	x	-	-	x	x	-	x	x	-	-
19CEC13.CO3	x	x	x	-	-	x	-	-	x	x	-	x	x	-	-
19CEC13.CO4	x	x	x	-	-	x	-	-	x	x	-	x	x	-	-

LIST OF EXPERIMENTS

1. Study of chains and its accessories
2. Aligning, Ranging and Chaining
3. Chain Traversing
4. Compass Traversing
5. Plane table surveying: Radiation
6. Plane table surveying: Intersection
7. Plane table surveying: Traversing
8. Plane table surveying: Resection – Three point problem
9. Plane table surveying: Resection – Two point problem
10. Study of levels and leveling staff
11. Fly leveling using Dumpy level
12. Fly leveling using tilting level
13. Check leveling
14. LS and CS
15. Contouring
16. Measurements of horizontal angles by reiteration and repetition and vertical angles
17. Determination of Tacheometric Constants
18. Heights and distances by stadia Tacheometry & Tangential Tacheometry
20. Study of Total Station, Measuring Horizontal and vertical angles
21. Traverse using Total station and Area of Traverse
22. Determination of distance and difference in elevation between two inaccessible points using Total station

TOTAL: 30 PERIODS


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19CEC14

STRENGTH OF MATERIALS LABORATORY

L T P C
0 0 2 1

COURSE OBJECTIVES:

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

COURSE OUTCOMES:

- 19CEC14.CO1 : To know the various instruments used in surveying.
 19CEC14.CO2 : To acquire knowledge about different types of surveying.
 19CEC14.CO3 : To draw the layout of site by plane table.
 19CEC14.CO4 : To calculate the elevation of different structures.

Course Outcomes	Program Outcomes												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
19CEC14.CO1	x	x	x	-	-	-	-	-	-	x	-	x	x	-	-
19CEC14.CO2	x	x	x	-	-	x	-	-	x	x	-	x	x	-	-
19CEC14.CO3	x	x	x	-	-	x	-	-	x	x	-	x	x	-	-
19CEC14.CO4	x	x	x	-	-	x	-	-	x	x	-	x	x	-	-

LIST OF EXPERIMENTS

- Tension test on mild steel rod
- Compression test on wood
- Double shear test on metal
- Torsion test on mild steel rod
- Impact test on metal specimen (Izod and Charpy)
- Hardness test on metals (Rockwell and Brinell Hardness Tests)
- Deflection test on wooden and metal beam
- Tension and Compression test on helical spring

TOTAL : 30 PERIODS



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19CEC15

HYDRAULIC ENGINEERING LABORATORY

L T P C
0 0 2 1

COURSE OBJECTIVES:

- Students should be able to verify the principles studied in theory by performing the experiments in lab.

COURSE OUTCOMES:

- 19CEC15.CO1 : To learn about co-efficient of discharge.
 19CEC15.CO2 : To acquire knowledge about the various losses in pipes.
 19CEC15.CO3 : To adequate knowledge about the efficiency of different pumps.
 19CEC15.CO4 : To learn about the working efficiency of turbines.

Course Outcomes	Program Outcomes												PSOs		
	P01	P02	P03	P04	P05	P06	P07	P08	P09	P010	P011	P012	PSO1	PSO2	PSO3
19CEC15.CO1	x	x	x	-	-	-	-	-	-	x	-	x	x	-	-
19CEC15.CO2	x	x	x	-	-	x	-	-	x	x	-	x	x	-	-
19CEC15.CO3	x	x	x	-	-	x	-	-	x	x	-	x	x	-	-
19CEC15.CO4	x	x	x	-	-	x	-	-	x	x	-	x	x	-	-

LIST OF EXPERIMENTS

1. Determination of Coefficient of Discharge of Orifice and Mouthpiece.
2. Determination of Coefficient of Discharge of Notches.
3. Determination of Friction factor of a given pipe.
4. Determination of various minor losses in pipes.
5. Calibration of Venturimeter and Orifice meter.
6. Determination of Metacentric height of a ship model.
7. Performance study of single stage, multistage, variable speed centrifugal pumps.
8. Determination of efficiency of submersible and variable speed reciprocating pumps.
9. Performance study on Pelton wheel turbine.
10. Determination of Efficiency of Francis turbine.
11. Determination of Efficiency of Kaplan turbine.
12. Minihydraulic flume
13. Calibration of rotometer.
14. Determination of gear pump.

TOTAL: 30 PERIODS



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19CEC16

GEOTECHNICAL ENGINEERING LABORATORY

L T P C
0 0 2 1

COURSE OBJECTIVES

- At the end of the course student attains adequate knowledge in assessing both Physical and Engineering behaviour of soils through laboratory testing procedures.

COURSE OUTCOMES:

- 19CEC16.CO1 : To learn about engineering properties of soil.
 19CEC16.CO2 : To acquire knowledge about different tests conducted on soil.
 19CEC16.CO3 : To adequate knowledge about the compaction characteristics of soil.
 19CEC16.CO4 : To learn about the index properties of soil.

Course Outcomes	Program Outcomes												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
19CEC16.CO1	x	x	x	-	-	-	-	-	-	x	-	x	x	-	-
19CEC16.CO2	x	x	x	-	-	x	-	-	x	x	-	x	x	-	-
19CEC16.CO3	x	x	x	-	-	x	-	-	x	x	-	x	x	-	-
19CEC16.CO4	x	x	x	-	-	x	-	-	x	x	-	x	x	-	-

LIST OF EXPERIMENTS

1. COLLECTION OF SOIL SAMPLE USING SPLIT SPOON SAMPLER

2. DETERMINATION OF INDEX PROPERTIES

- Special gravity of soil solids
- Grain size distribution – Sieve analysis and Hydrometer analysis
- Liquid limit, Plastic limit and shrinkage limit tests

3. DETERMINATION OF INSITU DENSITY AND COMPACTION CHARACTERISTICS

- Field density Test (Core cutter and Sand replacement method)
- Moisture – density relationship using Standard Proctor Compaction test

4. DETERMINATION OF ENGINEERING PROPERTIES

- Permeability (constant head and falling head methods)
- One dimensional consolidation test on cohesive soil
- Direct shear test in cohesionless soil
- Unconfined compression test in cohesive soil
- California Bearing Ratio Test on Road materials
- Tri-axial compression test in cohesionless soil to estimate shear strength parameters

TOTAL: 30 PERIODS



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19CEC17

CONCRETE AND HIGHWAY ENGINEERING LABORATORY

L T P C
0 0 2 1

COURSE OBJECTIVES

- To learn the principles and procedures of testing Concrete and Highway materials and to get hands on experience by conducting the tests and evolving inferences.

COURSE OUTCOMES:

- 19CEC17.CO1 : To learn about the properties of fresh and hardened concrete.
- 19CEC17.CO2 : To acquire knowledge about different tests conducted on concrete .
- 19CEC17.CO3 : To adequate knowledge about the various tests on aggregate.
- 19CEC17.CO4 : To adequate knowledge about the various tests on bitumen.

Course Outcomes	Program Outcomes												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
19CEC17.CO1	x	x	x	-	-	-	-	-	-	x	-	x	x	-	-
19CEC17.CO2	x	x	x	-	-	x	-	-	x	x	-	x	x	-	-
19CEC17.CO3	x	x	x	-	-	x	-	-	x	x	-	x	x	-	-
19CEC17.CO4	x	x	x	-	-	x	-	-	x	x	-	x	x	-	-

LIST OF EXPERIMENTS

I. TESTS ON FRESH CONCRETE

- Slump cone test
- Flow table
- Compaction factor
- Vee bee test.

II. TESTS ON HARDENED CONCRETE

- Compressive strength - Cube & Cylinder
- Flexure test
- Modulus of Elasticity

III. TESTS ON AGGREGATES

- Specific Gravity
- Gradation of Aggregate
- Crushing Strength
- Abrasion Value
- Impact Value
- Water Absorption
- Flakiness and Elongation Indices

IV. TESTS ON BITUMEN

- Penetration
- Softening Point
- Ductility
- Flash and fire points.
- Viscosity

V. TESTS ON BITUMINOUS MIXES

- Determination of Binder Content
- Marshall Stability and Flow values
- Density



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19CEC18

SURVEY CAMP

L T P C
0 0 0 1

AIM

The aim of the camp is to make the student familiar in mapping and contouring any type of area.

OBJECTIVES

Ten days survey camp using Prismatic compass, Theodolite, Cross staff, Levelling staff, Tapes, Plane table and Total station and GPS. The camp must involve work on a large area of not less than 400 hectares. At the end of the Camp, each student shall have mapped and contoured the area. The camp record should include all original field observations, calculations and plots.

Course Outcomes	Program Outcomes												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
19CEC18.CO1	x	x	x	-	-	x	-	-	-	x	-	x	x	-	-
19CEC18.CO2	x	x	x	-	-	x	-	-	-	x	-	x	x	-	-
19CEC18.CO3	x	x	x	-	-	x	-	-	-	x	-	x	x	-	-
19CEC18.CO4	x	x	x	-	-	x	-	-	-	x	-	x	x	-	-

LIST OF EXPERIMENTS

1. Alignment of Road (LS and CS) by using total station
2. Contouring (Radial and Grid)
3. Setting out of work
 - a. Curve
 - b. Building
4. Triangulation
5. Trilateration
6. Calculating and plotting the given area using GPS
7. Calculating and plotting the given area using Total Station

EVALUATION PROCEDURE

1. **Internal Marks:** 20 marks (decided by the staff in-charge appointed by the Institution)
2. **Evaluation of Survey Camp Report:** 30 marks (Evaluated by the external examiner appointed by the Institution)
3. **Viva voce examination:** 50 marks (evaluated by the internal examiner appointed by the HOD with the approval of HOI and external examiner appointed by the Institution – with equal Weightage)


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19CEC19

COMPUTER AIDED DESIGN AND DRAFTING LABORATORY

L T P C
0 0 2 1

COURSE OBJECTIVES

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

COURSE OUTCOMES:

- 19CEC19.CO1 : To know the various components of the different types of Retaining wall.
 19CEC19.CO2 : To design about various elements of a building.
 19CEC19.CO3 : To know about the designs of water tanks.
 19CEC19.CO4 : To know about the designs of bridges.

Course Outcomes	Program Outcomes												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
19CEC19.CO1	x	x	x	-	-	-	-	-	-	x	-	x	x	-	-
19CEC19.CO2	x	x	x	-	-	x	-	-	x	x	-	x	x	-	-
19CEC19.CO3	x	x	x	-	-	x	-	-	x	x	-	x	x	-	-
19CEC19.CO4	x	x	x	-	-	x	-	-	x	x	-	x	x	-	-

LIST OF EXPERIMENTS

- Design and Detailing of Cantilever retaining wall
- Design and Detailing of Counter fort retaining wall
- Design and Detailing of Elevated circular water tank with staging
- Design and Detailing of deep beams
- Design and Detailing of Floor slab system with T beam
- Design and Detailing of Reinforced concrete T beam bridge deck

TOTAL: 30 PERIODS


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19CEC20

ENVIRONMENTAL ENGINEERING LABORATORY

L T P C
0 0 2 1

COURSE OBJECTIVES

- To understand the sampling and preservation methods and significance of characterization of wastewater.

COURSE OUTCOMES:

- 19CEC20.CO1 : To learn about the physical and chemical properties of water.
 19CEC20.CO2 : To learn about various tests on water.
 19CEC20.CO3 : To know about the calculation of COD & BOD.
 19CEC20.CO4 : To know about the determination of solids present in water.

Course Outcomes	Program Outcomes												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
19CEC20.CO1	x	x	x	-	-	-	-	-	-	x	-	x	x	-	-
19CEC20.CO2	x	x	x	-	-	x	-	-	x	x	-	x	x	-	-
19CEC20.CO3	x	x	x	-	-	x	-	-	x	x	-	x	x	-	-
19CEC20.CO4	x	x	x	-	-	x	-	-	x	x	-	x	x	-	-

LIST OF EXPERIMENTS

- Determination of pH & Turbidity
- Determination of Hardness
- Determination of Dissolved Oxygen & BOD
- Determination of Optimum Coagulant Dosage
- Determination of Suspended, Volatile and Fixed Solids
- Determination of Chlorides
- Determination of Ammonia Nitrogen
- Determination of Sodium and Potassium
- Determination of Nitrate and Phosphate
- Determination of COD

TOTAL: 30 PERIODS



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19CEE01

ADVANCED STRUCTURAL ANALYSIS

L T P C
3 0 0 3

COURSE OBJECTIVES:

- To analyze the indeterminate structure by slope deflection method.
- To analyze indeterminate structures by Moment distribution method.
- To analyze statically indeterminate structures by flexibility matrix method.
- To formulate the element stiffness matrix and assemble the structure stiffness matrix for solving indeterminate structures.
- To understand the basics of finite element method and its applications.

COURSE OUTCOMES:

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

- 19CEE01.CO1 : Determine shear force and bending moment of beams and frames using slope deflection method.
- 19CEE01.CO2 : Determine shear force and bending moment using moment distribution method for beams and frames.
- 19CEE01.CO3 : Analyze the statically indeterminate structures using flexibility matrix method.
- 19CEE01.CO4 : Analyze the statically indeterminate structures using stiffness matrix method.
- 19CEE01.CO5 : Apply the finite element method to structures.

Course Outcomes	Program Outcomes												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
19CEE01.CO1	X	X	X	X	-	X	-	-	X	X	-	X	X	-	-
19CEE01.CO2	X	X	X	X	-	X	-	-	X	X	-	X	X	-	-
19CEE01.CO3	X	X	X	X	-	X	-	-	X	X	-	X	X	-	-
19CEE01.CO4	X	X	X	X	-	X	-	-	X	X	-	X	X	-	-
19CEE01.CO5	X	X	X	-	-	X	-	-	X	X	-	X	X	-	-

UNIT I SLOPE DEFLECTION METHOD 9

Continuous beams and rigid frames (with and without sway) – symmetry and anti -symmetry loading – Deformed shape, Bending moment and shear force diagram - (Unknowns restricted to three only).

UNIT II MOMENT DISTRIBUTION METHOD 9

Basic concepts – stiffness, distribution and carry over factors – Analysis of continuous Beams – plane and rigid frames with and without sway – Deflected shape, bending moment and shear force diagram.

UNIT III FLEXIBILITY MATRIX METHOD 9

Equilibrium and compatibility equation – Determinate Vs Indeterminate structures - Indeterminacy – Primary Structure – compatibility conditions – Analysis of indeterminate structures - continuous beams, Pin-jointed plane frames, rigid jointed plane frames (with redundancy restricted to two).

UNIT IV STIFFNESS MATRIX METHOD 9

Element and global stiffness matrices – Analysis of continuous beams – co-ordinate transformations – Rotation Matrix – Transformations of stiffness matrices, load vectors and displacements vectors – Analysis of pin -jointed plane frames and rigid frames (with redundancy restricted up to three).

UNIT V FINITE ELEMENT METHOD 9

Introduction – Discretisation of a structure – Displacement functions – Truss element – Beam element – Plane stress and plane strain Triangular elements (Concept Only).

TOTAL : 45 +30 PERIODS

TEXT BOOKS:

S.No	Author(s)	Title of the Book	Publisher	Year of Publication
1	Bhavikatti.S.S	Structural Analysis, Vol.1 and Vol. 2	Vikas Publishing House Pvt. Ltd	2015


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2	Vaidyanadhan.R and Perumal.P	Comprehensive structural Analysis – Vol.1 & Vol.2	Laxmi Publications, New Delhi	2016
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REFERENCE BOOKS:

S.No	Author(s)	Title of the Book	Publisher	Year of Publication
1	T.S.Thandavamoorthy	Structural Analysis	Oxford university press, New Delhi	2011
2	Pandit & S.P.Gupta	Structural Analysis – A matrix Approach	Tata MCGraw Hill	2011
3	L.S. Negi& R.S. Jangid	Structural Analysis	Tata McGraw Hill Publications, New Delhi, 6th Edition	2014
4	Manickaselvam M.K.	Elements of Matrix And Stability Analysis of Structures	Khanna Publishers	2013
5	B. C. Punmia, Ashok Kumar Jain and Arun Kumar Jain	Theory of Structures	Laxmi Publications (P) Ltd., New Delhi	2011

WEB URLs

1. www.engr.mun.ca/~swamidas/ENGI6705-ClassNotesHandout6.ppt
2. www.engr.mun.ca/~swamidas/ENGI6705-ClassNotesHandout7.ppt
3. www.iitd.ac.in/~sbhalla/flexibility.pdf
4. www.colorado.edu/engineering/CAS/courses.d/IFEM.d/...d/IFEM.Ch02.pdf
5. www.colorado.edu/engineering/CAS/courses.d/IFEM.d



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19CEE02

DESIGN OF REINFORCED CONCRETE STRUCTURES

L T P C
3 0 0 3

COURSE OBJECTIVES:

- To provide knowledge about cantilever and counterfort retaining walls.
- To provide knowledge on design of various components in the water tank by working stress method.
- To explain the basic concepts about the yield line theory for the analysis and design of slab of various cross sections.
- To provide knowledge on IRC loading ,Principle & design of bridges
- To provide knowledge on design of various reinforced concrete structures such as flat slabs, continuous and deep beams.

COURSE OUTCOMES:

- 19CEE02.CO1 : To design cantilever and counterfort retaining walls
 19CEE02.CO2 : To design underground and overhead water tanks
 19CEE02.CO3 : To design Slab using yield line theory
 19CEE02.CO4 : To design RCC and Prestressed bridges.
 19CEE02.CO5 : To design and detailing of flat slab, grid floor, continuous and deep beams.

Course Outcomes	Program Outcomes												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
19CEE02.CO1	X	X	X	-	-	-	-	X	-	X	-	X	X	-	-
19CEE02.CO2	X	X	X	-	-	X	-	X	-	X	-	X	X	-	-
19CEE02.CO3	X	X	X	-	-	X	-	X	-	X	-	X	X	-	-
19CEE02.CO4	X	X	X	-	-	X	-	X	-	X	-	X	X	-	-
19CEE02.CO5	X	X	X	-	-	X	-	X	-	X	-	X	X	-	-

UNIT I RETAINING WALLS

9

Design of cantilever and counter fort retaining walls

UNIT II WATER TANKS

9

Underground rectangular and Circular tanks – Domes – Overhead circular and rectangular tanks – Design of staging and foundations

UNIT III YIELD LINE THEORY

9

Assumptions – Characteristics of yield line – Determination of collapse load/ plastic moment – Application of virtual work method to square, rectangular, circular and triangular slabs

UNIT IV BRIDGES

9

Introduction-Types of bridges – IRC loading – Design of single and double lane slab culvert for class A loading – Principles of design of box culvert, balanced cantilever bridges and Prestressed concrete bridges

UNIT V SELECTED TOPICS

9

Design of flat slabs – Grid floors using Rankine Method – Grashoff method -Design of continuous beams - Deep beams-Design of continuous deep beam.

TOTAL: 45 Periods

TEXT BOOKS:

Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1	N. Krishna Raju	Advanced Reinforced Concrete Design	CBS Publishers and Distributors	2010
2	M.L.Gambhir	Design of Reinforced Concrete Structures	PHI Learning Pvt. Ltd. New Delhi	2008

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REFERENCE BOOKS:				
Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1	KrishnaRaju.N	Design of Bridges	Oxford and IBH	2010
2	Subramanian.N	Design of Reinforced Concrete Structures	Oxford University Press, New Delhi	2013
3	P. C.Varghese	Advanced Reinforced Concrete Design	Prentice Hall of India Ltd., New Delhi	2010
4	UnnikrishnaPillai. S DevdasMenon	Reinforced Concrete Design	Tata McGraw-Hill Publishing Company Ltd., New Delhi	2015
5	Sinha. S.N	Reinforced Concrete Design	Tata McGraw-Hill Publishing Company Ltd., New Delhi	2014

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1. www.britannica.com/technology/retaining-wall
2. www.oregon.gov/deq/FilterDocs/dwpResourceList.pdf
3. www.scielo.br/pdf/riem/v1n2/en_05.pdf
4. www.vogel.ibk.ethz.ch/en/education/.../bridge-design.html
5. www.gerdau.com/en/products/slabs



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19CEE03

CONSTRUCTION TECHNOLOGY

L T P C
3 0 0 3

COURSE OBJECTIVES:

- To know about the various types of foundation in building construction.
- To guide & know about the masonry & Wall in Buildings.
- To identify the types of roofs, floors and scaffolding for the construction activity.
- To know about the various Construction practices.
- To select the construction equipments as per requirements of construction.

COURSE OUTCOMES:

- 19CEE03.CO1 : Suggest a suitable type of foundation for a given building and soil condition.
- 19CEE03.CO2 : Supervise for the quality construction of brick and stone masonry works & Walls in buildings.
- 19CEE03.CO3 : Select suitable type of floors and roof as per the field condition & scaffolding and formworks for the construction activity.
- 19CEE03.CO4 : Learned about the various Construction practices.
- 19CEE03.CO5 : Select construction equipment for various construction activities.

Course Outcomes	Program Outcomes												PSOs		
	P01	P02	P03	P04	P05	P06	P07	P08	P09	P010	P011	P012	PSO1	PSO2	PSO3
19CEE03.CO1	x	x	-	-	-	x	-	x	x	-	-	x	x	-	-
19CEE03.CO2	x	x	-	-	-	x	-	x	x	-	-	x	x	-	-
19CEE03.CO3	x	x	-	-	-	x	-	x	x	-	-	x	x	-	-
19CEE03.CO4	x	x	-	-	-	x	-	x	x	-	-	x	x	-	-
19CEE03.CO5	x	x	-	-	-	x	-	x	x	-	-	x	x	-	-

UNIT I FOUNDATIONS

9

Concept of foundations - Factors affecting selection of foundations - Types of foundation - Shallow & Deep foundations - Piles and their classification - Foundation on black cotton soils.

UNIT II MASONRY & WALLS

9

Brick Masonry -Terminologies - Types of bonds in brick work and their suitability - Stone Masonry - Terminologies - Types of bonds in Stone masonry and their suitability - Classification of walls - Load bearing & Non-Load bearing - Hollow - Reinforced Brick Walls - Construction with fly ash bricks & Light weight bricks -Lintels and sunshade - Types & Construction

UNIT III FLOORS, ROOFS & SCAFFOLDING

9

Floors - Types of flooring - Repair of floors - Classification of roofs - Types of Pitched & Flat roofs -Roof covering materials - Drainage on pitched & flat roofs - Types of scaffolding - types of shoring - Methods of underpinning -Types of formwork - centering.

UNIT IV CONSTRUCTION PRACTICES

9

Specifications - details and sequence of activities and construction co-ordination-site clearance marking-earthwork - construction joints - movement and expansion joints - pre cast pavements - Causes of dampness; Methods of preventing dampness - Damp proofing materials and their classification - weather and water proof courses-roof finishes - acoustic and fire protection.

UNIT V CONSTRUCTION EQUIPMENT

9

Data acquisition and processing - signal processing and control for smart structures - sensors as geometrical processors - signal processing - control system - linear and non - linear.

TOTAL: 45 Periods

TEXT BOOKS:

Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Brain Culshaw	Smart Structure and Materials	Artech House - Borton, London	2013
2.	A. V. Srinivasan & D.Michael McFarland	Smart Structures: Analysis and Design	Cambridge University Press; 1st Edition	2009

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REFERENCE BOOKS:				
Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	L. S. Srinath	Experimental Stress Analysis	Tata McGraw-Hill	2016
2.	J. W. Dally & W. F. Riley	Experimental Stress Analysis	Tata McGraw-Hill	2014
3.	M.V. Gandhi and B.S. Thompson	Smart Materials and Structures	Chapman & Hall, London; New York	2008
4.	Peter R. Savage	Smart Materials- Wiley	Chapman & Hall, London; New York	2014
5.	A.V. Srinivasan	Smart Structures: Analysis and Design	Cambridge University Press, Cambridge; New York	2009

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2. www.wbdg.org/guides-specifications/building.../wall.../masonry-wall-systems
3. www.blackeaglescaffolding.london/scaffolding-services
4. www.acchelp.in/pdf/best-practices/Good-Construction-practices-1.pdf
5. www.constructionequipment.com/products/top-100/2016



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19CEE04

INDUSTRIAL STRUCTURES

L T P C
3 0 0 3

COURSE OBJECTIVES:

- To impart knowledge on planning, layout and components of Industrial Structures
- To get knowledge on functional requirements of Industrial Structures
- To impart knowledge on design and detailing of industrial RC structures
- To know the concept of power transmission structures
- To design other industrial structures and prefabricated techniques

COURSE OUTCOMES:

- 19CEE04.CO1 : Draw layout for any industrial buildings.
 19CEE04.CO2 : Demonstrate the functional requirements for any industry.
 19CEE04.CO3 : Design of industrial RC structures.
 19CEE04.CO4 : Demonstrate the uses and the steps involved in the design of transmission towers
 19CEE04.CO5 : Design of machine foundations, Nuclear containment structures and Gantry girders

Course Outcomes	Program Outcomes												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
19CEE04.CO1	X	X	X	-	-	X	-	X	X	-	-	X	X	-	-
19CEE04.CO2	X	X	X	-	-	X	-	X	X	-	-	X	X	-	-
19CEE04.CO3	X	X	X	-	-	X	-	X	X	-	-	X	X	-	-
19CEE04.CO4	X	X	X	-	-	X	-	X	X	-	-	X	X	-	-
19CEE04.CO5	X	X	X	-	-	X	-	X	X	-	-	X	X	-	-

UNIT I GENERAL 9

Classification of Industries and Industrial Structures -- General requirements of various industries -- planning and layout of building and components

UNIT II FUNCTIONAL REQUIREMENTS 9

Natural and artificial lighting - Protection from the sun light - Services - Electrical wiring fixtures - Cable and pipe bridge - Electrical installations - substations - Effluent disposal - Fire expanse and chutes - Fire alarm, extinguishers and hydrants - Heating and Ventilation - Air conditioning - Guidelines from factories act

UNIT III INDUSTRIAL RC STRUCTURES 9

Design and detailing of R.C. gable frames, corbels, nibs, bunkers, silos, folded plate and chimneys - Cooling towers

UNIT IV POWER TRANSMISSION STRUCTURES 9

Cables - Transmission line towers - Tower Foundation - Testing of towers - Substation Structures

UNIT V OTHER STRUCTURES 9

Design of Nuclear containment structures - Gantry girders - Machine Foundations - Design procedure - Application of prefabrication techniques.

TOTAL: 45 Periods

TEXT BOOKS:				
Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	N. Krishna Raju	Advanced Reinforced Concrete Design	CBS Publishers and Distributors	2016
2.	A. R. Santhakumar and S. S. Murthy	Transmission Line Structures	Tata McGraw Hill	2012


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REFERENCE BOOKS:				
Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	P. Dayaratnam	Deign of steel structures	A.H. Wheeler & Co., Ltd., Allahabad,	2007
2.	S. N. Manokar	Tall Chimneys – Design and Construction	Tata McGraw Hill	2012
3.	-	IS 4998-1	BIS	1992(R2013)
4.	-	IS: 4995(Part 1 & part 2)	BIS	1974(R2013)
5.	-	IS: 3483	BIS	1965(R2013)

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19CEE05

HEALTH MONITORING OF STRUCTURES

L T P C
3 0 0 3

COURSE OBJECTIVES:

- To Study about maintenance and repair of structure
- To impart the quality and durability of concrete
- To Study about special materials for repair of structures.
- To learn about repair and demolition technique.
- To gain the knowledge about rehabilitation and strengthening of structures.

COURSE OUTCOMES:

- 19CEE05.CO1 : Obtain the knowledge of maintenance and repair of structures.
 19CEE05.CO2 : Obtain the knowledge serviceability and durability of concrete
 19CEE05.CO3 : Select suitable material for repair.
 19CEE05.CO4 : Select appropriate techniques for repair and demolition
 19CEE05.CO5 : Know about repair, rehabilitation and strengthening of structures

Course Outcomes	Program Outcomes												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
19CEE05.CO1	X	X	-	-	-	X	-	X	X	X	-	X	X	-	-
19CEE05.CO2	X	X	-	-	-	X	-	X	X	X	-	X	X	-	-
19CEE05.CO3	X	X	-	-	-	X	-	X	X	X	-	X	X	-	-
19CEE05.CO4	X	X	-	-	-	X	-	X	X	X	-	X	X	-	-
19CEE05.CO5	X	X	-	-	-	X	-	X	X	X	-	X	X	-	-

UNIT I MAINTENANCE AND REPAIR STRATEGIES 9

Maintenance, repair and rehabilitation - Facts of Maintenance - importance of Maintenance various aspects of Inspection - Assessment procedure for evaluating a damaged structure - causes of deterioration - Diagnosis of causes and preventive measures.

UNIT II SERVICEABILITY AND DURABILITY OF CONCRETE 9

Quality assurance for concrete construction concrete properties - strength, permeability, thermal properties and cracking - Effects due to climate, temperature, chemicals, corrosion - design and construction errors - Effects of cover thickness and cracking.

UNIT III SPECIAL MATERIALS FOR REPAIR 9

Special concretes and mortar - concrete chemicals - special elements for accelerated strength gain - Expansive cement - polymer concrete - sulphur infiltrated concrete - ferro cement - Fibre reinforced concrete.

UNIT IV TECHNIQUES FOR REPAIR AND DEMOLITION 9

Rust eliminators and polymers coating for rebars during repair - foamed concrete - mortar and dry pack - vacuum concrete - Guniting and Shotcrete - Epoxy injection - Mortar repair for cracks - shoring and underpinning - Methods of corrosion protection - corrosion inhibitors - coating and cathodic protection - Engineered demolition techniques for Dilapidated structures - case studies.

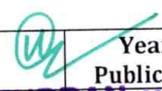
UNIT V REPAIRS, REHABILITATION & STRENGTHENING OF STRUCTURES 9

Repairs to overcome low member strength - Deflection, Cracking, Chemical disruption, weathering corrosion, wear, fire, leakage and marine exposure - Strengthening of Super Structures - plating - Conversion to composite construction - post stressing - Jacketing - Reinforcement addition, strengthening the substructures - Increasing the load capacity of footing.

TOTAL: 45 Periods

TEXT BOOKS:

Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Denison Campbell, Allen and Harold Roper	Concrete Structures, Materials, Maintenance and Repair	Longman Scientific and Technical UK	2006
2.	R.T.Allen and S.C.Edwards	Repair of Concrete structures	Blakie and Sons, UK	2007


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REFERENCE BOOKS:				
Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Dr.B Vidivelli	Rehabilitation of Concrete Structures	Standard Publishers Distributors	2013
2.	M.S.Shetty	Concrete Technology -Theory and Practice	S.Chand and Company, New Delhi	2006
3.	M.L. Gambhir	Concrete Technology	Tata McGraw Hill Company, Noida	2011
4.	Santhakumar, A.R	Training Course notes on Damage Assessment and repairs in Low Cost Housing, "RHDC-NBO"	Anna University	1995
5.	Lakshmiathy, M	Lecture notes of Workshop on "Repairs and Rehabilitation of Structures"	-	1999

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19CEE06

BUILDING SERVICES

L T P C
3 0 0 3

COURSE OBJECTIVES:

- To learn about different types of machineries.
- To know about electrical systems used in Buildings
- To understand principles and design of lighting system.
- To know about principles and applications of refrigeration.
- To learn about fire safety illuminations in buildings.

COURSE OUTCOMES:

- 19CEE06.CO1 : To know about different types of machineries.
 19CEE06.CO2 : To implement wiring systems and prepare the plan for electrical wiring for buildings.
 19CEE06.CO3 : To desing the lighting facilities for building.
 19CEE06.CO4 : To choose suitable air conditioning system for the building.
 19CEE06.CO5 : To choose fire safety systems for various types of buildings

Course Outcomes	Program Outcomes												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
19CEE06.CO1	X	X	X	-	-	X	-	X	X	-	-	X	X	-	-
19CEE06.CO2	X	X	X	-	-	X	-	X	X	-	-	X	X	-	-
19CEE06.CO3	X	X	X	-	-	X	-	X	X	-	-	X	X	-	-
19CEE06.CO4	X	X	X	-	-	X	-	X	X	-	-	X	X	-	-
19CEE06.CO5	X	X	X	-	-	X	-	X	X	-	-	X	X	-	-

UNIT I MACHINERIES

9

Hot Water Boilers -Lifts and Escalators -Special features required for physically handicapped and elderly - Conveyors - Vibrators - Concrete mixers -DC/AC motors - Generators - Laboratory services - Gas, water, air and electricity.

UNIT II ELECTRICAL SYSTEMS IN BUILDINGS

9

Basics of electricity - Single / Three phase supply - Protective devices in electrical installations - Earthing for safety - Types of Earthing - ISI specifications - Types of wires, wiring systems and their choice - Planning electrical wiring for building - Main and distribution boards - Transformers and switch gears - Layout of substations

UNIT III PRINCIPLES OF ILLUMINATION & DESIGN

9

Design of modern lighting - Lighting for stores, offices, schools, hospitals and house lighting. Elementary idea of special features required and minimum level of illumination required for physically handicapped and elderly in building types.

UNIT IV REFRIGERATION PRINCIPLES & APPLICATIONS

9

Refrigerants-Refrigerant control devices - Electric motors -Starters - Air handling units - Cooling towers - Window type and packaged air- conditioners - Chilled water plant - Fan coil systems -Water piping - Cooling load -Air conditioning systems for different types of buildings - Protection against fire to be caused by A.C. Systems

UNIT V FIRE SAFETY INSTALLATION

9

Causes of fire in buildings - Safety regulations - NBC - Planning considerations in buildings like non - combustible materials, construction, staircases and lift lobbies, fire escapes and A.C. systems.

TOTAL: 45 Periods

TEXT BOOKS:				
Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	A.F.C. Sherratt	Air-conditioning and Energy Conservation	The Architectural Press, London	2006
2.	Derek Phillips	Lighting in Architectural Design	McGraw-Hill	2011

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REFERENCE BOOKS:				
Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	E.R.Ambrose	Heat Pumps and Electric Heating	John and Wiley and Sons, Inc., New York	2013
2.	William H.Severns and Julian R.Fellows	Air-conditioning and Refrigeration	John Wiley and Sons, London	2006
3.	Arora and Bindra	Building Construction	Dhanpatrai & Sons	2012
4.	E.R.Ambrose	Heat Pumps and Electric Heating	John and Wiley and Sons, Inc., New York	2013
5.	-	National Building Codes	Bureau of Indian Standards	2015

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19CEE07

SMART MATERIALS AND SMART STRUCTURES

L T P C
3 0 0 3

COURSE OBJECTIVES:

- To introduce the smart material, function and response of the smart structures.
- To understand the various measuring techniques in smart structures.
- To learn about the sensors and their types.
- To understand the various actuator materials and actuating techniques.
- To understand the data acquisition and data processing using sensors.

COURSE OUTCOMES:

- 19CEE07.CO1 : Know about smart structures.
- 19CEE07.CO2 : Apply the measuring techniques to measure the various responses of the smart structures.
- 19CEE07.CO3 : Identify the types of sensors for the measurement techniques.
- 19CEE07.CO4 : Select the actuator material and technique for structural assessment.
- 19CEE07.CO5 : Apply the data acquisition and data processing techniques for a sensor

Course Outcomes	Program Outcomes												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
19CEE07.CO1	X	X	X	-	-	X	-	X	X	-	-	X	X	-	-
19CEE07.CO2	X	X	X	-	-	X	-	X	X	-	-	X	X	-	-
19CEE07.CO3	X	X	X	-	-	X	-	X	X	-	-	X	X	-	-
19CEE07.CO4	X	X	X	-	-	X	-	X	X	-	-	X	X	-	-
19CEE07.CO5	X	X	X	-	-	X	-	X	X	-	-	X	X	-	-

UNIT I INTRODUCTION TO SMART STRUCTURES 9

Introduction - smart materials and structures - functions and response - sensing systems - self-diagnosis - signal processing consideration - actuation systems and effectors.

UNIT II MEASURING TECHNIQUES 9

Strain measuring techniques using electrical strain gauges – types - resistance, capacitance and inductance - Wheatstone bridge - types - pressure transducers - load cells - temperature compensation- strain rosettes - applications.

UNIT III SENSORS 9

Sensing technology -sensors - types - physical measurement using Piezo Electric strain measurement inductively read transducers - LVDT - fiber optic techniques - chemical and bio-chemical sensing in structural assessment - absorptive chemical sensors – spectroscopes - fiber optic chemical sensing systems and distributed measurement.

UNIT IV ACTUATORS 9

Actuator techniques - actuator - materials - Piezoelectric and Electrostrictive material - magneto-structure material - shape memory alloys - electro rheological fluids - electromagnetic actuation - role of actuators and actuator materials in structural assessment.

UNIT V SIGNAL PROCESSING AND CONTROL SYSTEMS 9

Data acquisition and processing - signal processing and control for smart structures - sensors as geometrical processors - signal processing - control system - linear and non - linear.

TOTAL: 45 Periods

TEXT BOOKS:

Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Brain Culshaw	Smart Structure and Materials	Artech House, Borton, London	2013
2.	A. V. Srinivasan & D.Michael McFarland	Smart Structures: Analysis and Design	Cambridge University Press; 1st Edition	2009

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REFERENCE BOOKS:				
Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	L. S. Srinath	Experimental Stress Analysis	Tata McGraw-Hill	2016
2.	J. W. Dally & W. F. Riley	Experimental Stress Analysis	Tata McGraw-Hill	2014
3.	M.V. Gandhi and B.S. Thompson	Smart Materials and Structures	Chapman & Hall, London; New York	2008
4.	Peter R. Savage	Smart Materials- Wiley	Chapman & Hall, London; New York	2014
5.	A.V. Srinivasan	Smart Structures: Analysis and Design	Cambridge University Press, Cambridge; New York	2009

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19CEE08

CONCRETE TECHNOLOGY

L T P C
3 0 0 3

COURSE OBJECTIVES:

- To study the properties of different constituent materials
- To give knowledge on chemical and mineral admixtures concrete.
- To design a mix using ACI and BIS methods and their suitability.
- To practice about various tests on fresh concrete and hardened concrete.
- To understand the concepts of special concretes and concreting methods.

COURSE OUTCOMES:

- 19CEE08.C01 : To have an exposure on quality of concrete.
 19CEE08.C02 : To select a suitable admixture in concrete according to the required properties.
 19CEE08.C03 : To do mix design under various methods.
 19CEE08.C04 : To conduct various tests on fresh and hardened concrete
 19CEE08.C05 : To familiarize about special concretes and their concreting methods.

Course Outcomes	Program Outcomes												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
19CEE08.C01	X	X	X	X	-	X	-	-	X	X	-	X	X	-	-
19CEE08.C02	X	X	X	X	-	X	-	-	X	X	-	X	X	-	-
19CEE08.C03	X	X	X	X	-	X	-	-	X	X	-	X	X	-	-
19CEE08.C04	X	X	X	X	-	X	-	-	X	X	-	X	X	-	-
19CEE08.C05	X	X	X	-	-	X	-	-	X	X	-	X	X	-	-

UNIT I CONSTITUENT MATERIALS

9

Cement-Different 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 - Sea water and their effects

UNIT II ADMIXTURES AND THEIR EFFECTS

9

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

UNIT III PROPORTIONING OF CONCRETE MIX

9

Principles of Mix Proportioning - Properties of concrete related to Mix Design-Physical properties of materials required for Mix Design - Design Mix and Nominal Mix - IS Method of Mix Design - Mix Design Examples

UNIT IV FRESH AND HARDENED PROPERTIES OF CONCRETE

9

Workability - Tests for workability of concrete - Slump Test and Compacting factor Test - 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 V SPECIAL CONCRETES

9

Light weight concretes - High strength concrete - Self compacting concrete - Fibre reinforced concrete - Ferrocement - Ready mix concrete - SIFCON - Shotcrete - Smart concrete - Guniting and shotcreting - Polymer concrete - High performance concrete - Geopolymer Concrete

TOTAL: 45 Periods

TEXT BOOKS:

Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Shetty. M.S	Concrete Technology, Theory & Practice	S.Chand & Co, Pvt.Ltd, New Delhi	2017
2.	Gambhir, M.L	Concrete Technology	Tata McGraw Hill	2017

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REFERENCE BOOKS:				
Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Santhakumar A.R	Concrete Technology	Oxford University Press	2017
2.	IS Board	IS: 456 – 2000 Plain and Reinforced Concrete	Bureau of Indian Standards	2000
3.	IS Board	IS:10262 – 2009 Recommended guide lines for concrete mix design	Bureau of Indian Standards	2009
4.	A.M. Neville,J,J Brooks	Concrete Technology	Pearson Education,	2010
5.	Nevile A.M	Properties of Concrete	Longman Publishers	2012

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19CEE09

SEISMIC DESIGN OF STRUCTURES

L T P C
3 0 0 3

COURSE OBJECTIVES:

- To impart knowledge on the theory of vibration and basics of structural dynamics.
- To impart knowledge on structural dynamics and its response.
- To know about basics of seismic elements.
- To impart the design philosophy of earthquake resistant design of structures
- To create awareness on the use of codal provisions for seismic design of structures.

COURSE OUTCOMES:

- 19CEE09.CO1 : Analyze the amount vibration a structure can withstand it.
 19CEE09.CO2 : Analyze a structure by seismic coefficient method.
 19CEE09.CO3 : Knowledge about earthquake causes and intensity of magnitude.
 19CEE09.CO4 : Knowledge about earthquake resistant structures.
 19CEE09.CO5 : Design the building concept, ductility and design of masonry structures as per IS Codal provisions.

Course Outcomes	Program Outcomes												PSOs		
	P01	P02	P03	P04	P05	P06	P07	P08	P09	P010	P011	P012	PSO1	PSO2	PSO3
19CEE09.CO1	X	X	X	-	-	-	-	X	X	X	-	X	X	-	-
19CEE09.CO2	X	X	X	-	-	-	-	X	X	X	-	X	X	-	-
19CEE09.CO3	X	X	X	-	-	-	-	X	X	X	-	X	X	-	-
19CEE09.CO4	X	X	X	-	-	-	-	X	X	X	-	X	X	-	-
19CEE09.CO5	X	X	X	-	-	-	-	X	-	X	-	X	X	-	-

UNIT I ELEMENTS OF VIBRATIONS

9

Introduction – Basic concept of Vibration – Static and Dynamic loading – Basic definitions – Types of Vibration – Response of the system – consequences of vibration-vibration control measures.

UNIT II STRUCTURAL DYNAMICS AND RESPONSE

9

Undamped free vibration – Derivation of equation of motion – Equivalent stiffness of spring combinations – Natural frequency and Time Period – Introduction to two degree of freedom system and Multi degree of Freedom system

UNIT III ELEMENTS OF SEISMOLOGY

9

Causes of earthquake – Geological faults – Tectonic Plate Theory – Elastic Rebound Theory – Epicenter – Hypocenter – Seismic waves – Seismogram – Magnitude and Intensity of Earthquake – Magnitude and Intensity scales – Information on Some Disaster Earthquakes – Concept of Seismic Microzonation

UNIT IV RESPONSE OF STRUCTURES TO EARTHQUAKE

9

Response and Design Spectra – Design Earthquake – Concept of Peak Acceleration – Site Specific Response Spectrum – Effect of Soil properties and Damping – Types of Base Isolation and its Effects.

UNIT V DESIGN MORPHOLOGY

9

Design concept of Buildings – IS: 1893-2002 – Importance of Ductility – Methods of Introducing Ductility in RC Structures as per IS: 13920- 1993 – Behavior and Design of Masonry Structures as per IS: 13827- 1993

TOTAL: 45 Periods

TEXT BOOKS:

Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1	Pankaj Agarwal and Manish Shrikhande	Earthquake Resistant Design of Structures	PHI Pvt Ltd, New Delhi	2010
2	Damodarasamy S.R.	Basics of Structural Dynamics and Aseismic Design	Laxmi publications, New Delhi	2010

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REFERENCE BOOKS:				
Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1	Paz Mario	Structural Dynamics - Theory and Computation	CBS publishers	2010
2	en L.Kramer	Geotechnical Earthquake Engineering	Pearson Education, Inc, New Delhi	2016
3	Jai Krishna, Chandrasekaran.A.R and Brijesh Chandra	Elements of Earthquake Engineering	South Asia Publishers	2013
4	Humar.J.L	Dynamics of Structures	Prentice Hall Inc.	2015
5	Brijesh Chandra	Elements of Dynamic Structure	CBS publishers	2011

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19CEE10

PREFABRICATED STRUCTURES

L T P C
3 0 0 3

COURSE OBJECTIVES:

- To introduce the fundamentals related to the prefabricated structures.
- To provide knowledge on prefabricated reinforced concrete constructions.
- To provide knowledge on disunity of structures.
- To provide knowledge on types of wall joints and their behavior.
- To provide knowledge on abnormal loads.

COURSE OUTCOMES:

- 19CEE10.C01 : Understand the concepts behind the fundamentals related to the prefabricated structures.
- 19CEE10.C02 : Familiarize the behavior of prefabricated structural components
- 19CEE10.C03 : Apply the knowledge on disunity of structures and joint flexibility
- 19CEE10.C04 : Understand the joints of structural elements and their behavior.
- 19CEE10.C05 : Design the prefabricated structures for abnormal loads using various codal provisions.

Course Outcomes	Program Outcomes												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO 1	PSO2	PSO3
19CEE10.C01	x	x	x	x	-	x	-	-	x	x	-	x	x	-	-
19CEE10.C02	x	x	x	x	-	x	-	-	x	x	-	x	x	-	-
19CEE10.C03	x	x	x	x	-	x	-	-	x	x	-	x	x	-	-
19CEE10.C04	x	x	x	x	-	x	-	-	x	x	-	x	x	-	-
19CEE10.C05	x	x	x	-	-	x	-	-	x	x	-	x	x	-	-

UNIT I INTRODUCTION

9

Need for prefabrication – Principles – Materials – Modular coordination – Standardization – Systems – Production – Transportation – Erection.

UNIT II PREFABRICATED COMPONENTS

9

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

UNIT III DESIGN PRINCIPLES

9

Disuniting of structures- Design of cross section based on efficiency of material used – Problems in design because of joint flexibility – Allowance for joint deformation.

UNIT IV JOINT IN STRUCTURAL MEMBERS

9

Joints for different structural connections – Dimensions and detailing – Design of expansion joints

UNIT V DESIGN FOR ABNORMAL LOADS

9

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

TOTAL: 45 PERIODS

TEXT BOOKS:

S.No	Author(s)	Title of the Book	Publisher	Year of Publication
1	Laszlo Mokka	Prefabricated Concrete for Industrial and Public Structures.	Akademiai Kiado Budapest	2011
2	Koncz.T	Manual of Precast Concrete Construction, Vol.I II and III & IV.	Bauverlag GmbH	2011

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REFERENCE BOOKS:

S.No	Author(s)	Title of the Book	Publisher	Year of Publication
1	Warszawski A	Industrialization and Robotics in Building and A managerial approach.	Harper and Row	2010
2	Gerostiza C.Z Hendrikson C and Rehat D.R	Knowledge based process planning for construction and manufacturing.	Academic Press Inc.,	2011
3	-	CBRI	Building materials and components, India.	2010
4	Lewicki.B	Building with Large Prefabricates.	Elsevier Publishing Company, Amsterdam/ London/New York	2010
5	-	Structural Design Manual, Precast Concrete Connection Details, Society for the Studies in the use of Precast Concrete.	Netherland Betor Verlag	2011

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1. www.readorrefer.in/article/-Principles-of-Prefabrication_4088
2. www.youtube.com/watch?v=jenYP9Acivg
3. www.youtube.com/watch?v=WdXg4M_i0-w
4. www.youtube.com/watch?v=7U4yPDC1u34
5. www.designingbuildings.co.uk/wiki/Shell_roof


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19CEE11

PRESTRESSED CONCRETE STRUCTURES

L T P C
3 0 0 3

COURSE OBJECTIVES:

- To understand the basic concepts, principles and methods of Prestressing.
- To compute flexural strength and ultimate shear resistance capacity as per IS code.
- To determine the deflection of prestressed members and design the anchorage zone stresses.
- To understand the concepts of composite and continuous beams.
- To know about tension and compression members and methods of partial prestressing.

COURSE OUTCOMES:

- 19CEE11.CO1 : Know the basic concepts of prestressing.
 19CEE11.CO2 : Obtain the design for flexure and shear as per IS codal provision.
 19CEE11.CO3 : Understand the deflection and design anchorage zone.
 19CEE11.CO4 : Design the composite and continuous beams.
 19CEE11.CO5 : Design tension and compression members.

Course Outcomes	Program Outcomes												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
19CEE11.CO1	X	X	X	-	-	-	-	X	X	X	-	X	X	-	-
19CEE11.CO2	X	X	X	-	-	-	-	X	X	X	-	X	X	-	-
19CEE11.CO3	X	X	X	-	-	-	-	X	X	X	-	X	X	-	-
19CEE11.CO4	X	X	X	-	-	-	-	X	X	X	-	X	X	-	-
19CEE11.CO5	X	X	X	-	-	-	-	X	-	X	-	X	X	-	-

UNIT I INTRODUCTION – THEORY AND BEHAVIOUR

9

Basic concepts – Advantages – Materials required – Systems and methods of prestressing – Analysis of sections – Stress concept – Strength concept – Load balancing concept – Effect of loading on the tensile stresses in tendons --Losses of prestress

UNIT II DESIGN FOR FLEXURE AND SHEAR

9

Design and Drawing of screen chamber - Grit channel - Primary clarifier - Activated sludge process – Aeration tank & oxidation ditch – Trickling filters – Secondary clarifiers – Sludge digester – Sludge drying beds – Waste stabilization ponds - Septic tanks and disposal arrangements – Manholes.

UNIT III DEFLECTION AND DESIGN OF ANCHORAGE ZONE

9

Deflection – Factors influencing deflections - Effect of tendon profile on deflection - Short term deflections of uncracked members – Prediction of long term deflections due to creep and shrinkage – Check for serviceability limit state of deflection. Determination of anchorage zone stresses in post-tensioned beams by Magnel’s method, Guyon’s method and IS1343 code – design of anchorage zone reinforcement – Check for transfer bond length in pre-tensioned beams.

UNIT IV COMPOSITE BEAMS AND CONTINUOUS BEAMS

9

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

UNIT V MISCELLANEOUS STRUCTURES

9

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

TOTAL: 45 Periods

TEXT BOOKS:

Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1	Krishnaraju.N	Prestressed concrete	Tata McGraw Hill Publishing company Ltd. New Delhi	2015
2	Pandit.G.S. and Gupta.S.P	Prestressed Concrete	CBS Publishers and Distributors Pvt. Ltd.	2012

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REFERENCE BOOKS:				
Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1	Lin .T.Y., and Ned H. Burns	Design of prestressed concrete structures	John Wiley & Sons, International Edition, New York	2015
2	aratnam.P	Prestressed Concrete Structures	Oxford and IBH Publishing Company pvt, Ltd, New Delhi	2017
3	N.Rajagopalan	Prestressed Concrete	Narosana Publications	2013
4	Guyon, Y	Limit State Design of Prestressed Concrete Vols. I & II	Applied Science Publishers, London	2010
5	Sinha. N.C and Roy.S.K	Fundamentals of prestressed concrete	S.Chand and Co Ltd	2011

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3. www.bath.ac.uk/~abstji/end_blocks.htm
4. www.vtt.fi/inf/pdf/workingpapers/2010/W148.pdf
5. www.e-periodica.ch/cntmng?pid=bse-pe-005:1979:3::19


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19CEE12

FOUNDATION ENGINEERING

L T P C
3 0 0 3

COURSE OBJECTIVES:

- To get the basic knowledge of the geotechnical site investigation.
- To understand the types of shallow foundation and design principles.
- To discuss the different types of footing and raft design
- To study the types of pile foundation and its load bearing capacity
- To study the knowledge on retaining wall design and load analysis.

COURSE OUTCOMES:

- 19CEE12.C01 : Conduct subsurface investigation and select type of foundation based on soil condition.
 19CEE12.C02 : Know about shallow foundation.
 19CEE12.C03 : Know about footing tyoes and rafts
 19CEE12.C04 : Calculate the load carrying capacity of piles.
 19CEE12.C05 : Check the stability of retaining wall

Course Outcomes	Program Outcomes												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
19CEE12.C01	X	X	X	-	-	-	-	-	-	X	-	X	X	-	-
19CEE12.C02	X	X	X	-	-	X	-	-	X	X	-	X	X	-	-
19CEE12.C03	X	X	X	-	-	X	-	-	X	X	-	X	X	-	-
19CEE12.C04	X	X	X	-	-	X	-	-	X	X	-	X	X	-	-
19CEE12.C05	X	X	X	-	-	X	-	-	X	X	-	X	X	-	-

UNIT I SITE INVESTIGATION AND SELECTION OF FOUNDATION

9

Methods of exploration – boring technology – Depth of boring – Spacing of bore hole – Sampling – methods – thick, Thin wall samplers, Stationery piston sampler – Penetration tests – Bore log report – Data interpretation.

UNIT II SHALLOW FOUNDATION

9

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

UNIT III FOOTINGS AND RAFTS

9

Types of footings – Contact pressure distribution: Isolated footing – Combined footings – Types and proportioning – Mat foundation – Types – Proportioning of footing – Floating foundation.

UNIT IV PILE FOUNDATION

9

Types of piles and their function – Factors influencing the selection of pile – Carrying capacity of single pile in granular and cohesive soil – static formula – dynamic formulae (Engineering news and Hileys) – Capacity from insitu tests (SPT and SCPT) – Negative skin friction – Group capacity and efficiency (Feld’s rule, Converse – Labarra rule and block failure) – Settlement of pile groups – Interpretation of pile load test (routine test only) – Under reamed piles – Capacity under compression and uplift.

UNIT V RETAINING WALLS

9

Plastic equilibrium in soils – active and passive states – Rankine’s theory – cohesionless and cohesive soil – Coulomb’s wedge theory – Earth pressure on retaining walls of simple configurations – Culmann Graphical method – Stability analysis of retaining walls.

TOTAL: 45 Periods

TEXT BOOKS:

Sl.No	Author(s)	Title of the Book	Publisher
1.	Arora. K.R	Soil Mechanics and Foundation Engineering	Standard Publishers and Distributors
2	Venkataramaiah C	Geotechnical Engineering	New Age International Publishers, New Delhi

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REFERENCE BOOKS:				
Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1	Punmia B.C	Soil Mechanics and Foundations	Laxmi Publications Pvt. Ltd, New Delhi	2016
2	Varghese P.C	Foundation Engineering	Prentice Hall of India Pvt. Ltd., New Delhi	2010
3	Purushothama Raj. P	Soil Mechanics and Foundation Engineering	Pearson Education	2013
4	Gopal Ranjan and Rao A.S.R	Basic and Applied Soil Mechanics	New Age International Publishers, New Delhi	2017
5	Murthy, V.N.S	Text Book of Soil Mechanics and Foundation Engineering	CBS Publishers	2016

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1. www.cdeep.iitb.ac.in/nptel/Civil%20Engineering/Foundation_Engineering/TOC-M1.html
2. www.geoengineer.org/sptprogram.html
3. www.kopykitab.com/ebooks/2016/.../sample_7428.pdf
4. www.iitg.ernet.in/amurali/IGJ/IGJ.../IGJ_41_3_108-120.pdf
5. www.britannica.com/technology/retaining-wall


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19CEE13

GROUND IMPROVEMENT TECHNIQUES

L T P C
3 0 0 3

COURSE OBJECTIVES:

- To get exposed to various methods of dewatering techniques
- To be familiar with compaction methods and influencing factors
- To Understand about consolidation and vertical drains
- To distribute Knowledge about various soil tabilization techniques and its applications
- To learn about various strengthening materials and techniques of soil

COURSE OUTCOMES:

- 19CEE13.CO1 : Choose the suitable method of dewatering.
 19CEE13.CO2 : Identify the soil and select suitable compaction method
 19CEE13.CO3 : Monitor consolidation of soil
 19CEE13.CO4 : Apply suitable techniques for improving the soil properties in the field
 19CEE13.CO5 : Use various types of to strengthening techniques.

Course Outcomes	Program Outcomes												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
19CEE13.CO1	X	X	X	-	-	X	-	X	X	-	-	X	X	-	-
19CEE13.CO2	X	X	X	-	-	X	-	X	X	-	-	X	X	-	-
19CEE13.CO3	X	X	X	-	-	X	-	X	X	-	-	X	X	-	-
19CEE13.CO4	X	X	X	-	-	X	-	X	X	-	-	X	X	-	-
19CEE13.CO5	X	X	X	-	-	X	-	X	X	-	-	X	X	-	-

UNIT I DEWATERING

Introduction - Ground improvement - scope - necessity - New Technologies - Basic concepts - drainage methods - ground water lowering by well points - Deep well - Vacuum and electro - osmosis methods. 9

UNIT II COMPACTION

Introduction - compaction mechanics - field procedure - Surface compaction -selection - compaction quality control -Vibration methods - vibro-compaction, blasting, vibratory probe, vibratory compactors - vibro-displacement compaction - displacement piles - vibro flotation - Sand compaction piles - stone columns - heavy tamping. 9

UNIT III CONSOLIDATION AND VERTICAL DRAINS

Introduction -compressibility of soil and consolidation - preloading and surcharge fills - monitoring of compression - vertical drains - principle, design, types, construction, efficiency and applications. 9

UNIT IV SOIL STABILIZATION

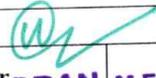
Introduction -Stabilization methods - mechanical stabilization, chemical stabilization - cement, lime, bitumen -electrical stabilization - stabilization of expansive clays - Pre wetting. 9

UNIT V MISCELLANEOUS METHODS

Grouting and injection - aspects, procedure and applications - geosynthetics - types, properties and applications - soil reinforcement - thermal methods. 9

TOTAL: 45 Periods

TEXT BOOKS:			
Sl.No	Author(s)	Title of the Book	Publisher Year of Publication
1.	Klaus Kirsch and Alan Bell	Ground improvement	Taylor and Francis Group 2013
2.	C.A.Raison	Ground and Soil Improvement	Thomas Telford Publishing London


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REFERENCE BOOKS:				
Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	M.P.Moseley and K.Kirsch	Ground Improvement	Spon press, New York	2004
2.	ashothama Raj, P	Ground Improvement Techniques	Laxmi Publications (P) Ltd., New Delhi	2016
3.	Reuben H. Karol	Chemical grouting and soil stabilization	Taylor and Francis	2010
4.	Mittal.S	An Introduction to Ground Improvement Engineering	Medtech Publisher	2015
5.	Nihar Ranjan Patra	Ground Improvement Techniques	Vikas Publishing house	2012

WEB URLS:

1. www.groundwatereng.com/dewatering-techniques
2. www.ebookily.net/pdf/ground-improvement-techniques-notes
3. www.cdeep.iitb.ac.in/nptel/Civil%20Engineering/Foundation_Engineering/Course_home36
4. www.midstatecompanies.com/index.php/services/soil-stabilization
5. www.freevideolectures.com/Course/3435/Ground-Improvement-Techniqu


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19CEE14 ENVIRONMENTAL IMPACT ASSESMENT IN CIVIL ENGINEERING

L T P C
3 0 0 3

COURSE OBJECTIVES:

- To Carry out scoping and screening of developmental projects for environmental and social assessments
- To explain different methodologies for environmental impact assessment
- To plan environmental prediction and assessments
- To evaluate environmental impact assessment reports and management plans
- To develop knowledge on case studies about EIA for infrastructure projects

COURSE OUTCOMES:

- 19CEE14.CO1 : Know Environmental Impact Assessment and Legal provisions
 19CEE14.CO2 : Explain different methodologies for environmental impact assessment
 19CEE14.CO3 : Plan environmental prediction and assessment
 19CEE14.CO4 : Evaluate environmental impact assessment reports
 19CEE14.CO5 : Case studies about environmental impact assessment.

Course Outcomes	Program Outcomes												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
19CEE14.CO1	x	x	x	-	-	x	-	-	x	x	-	x	x	-	-
19CEE14.CO2	x	x	x	-	-	x	x	-	x	x	x	x	x	-	-
19CEE14.CO3	x	x	x	-	-	x	x	-	x	x	x	x	x	-	-
19CEE14.CO4	x	x	x	-	-	x	x	-	x	x	-	x	x	-	-
19CEE14.CO5	x	x	x	-	-	x	x	-	x	x	-	x	x	-	-

UNIT I INTRODUCTION 9

Impact of development projects - Sustainable development - Need for Environmental Impact Assessment (EIA) - Environmental Impact Statement (EIS) - EIA capability and limitations - Legal provisions on EIA - Stages of EIA, Types of EIA.

UNIT II METHODOLOGIES 9

Methods of EIA - Check lists - Matrices - Networks - Cost-benefit analysis - Analysis of alternatives.

UNIT III PREDICTION AND ASSESSMENT 9

Formulation of Housing Projects - Site Analysis, Layout Design, Design of Housing Units (Simple design problems) - Procedure for site analysis and layout planning.

UNIT IV ENVIRONMENTAL MANAGEMENT PLAN 9

Plan for mitigation of adverse impact on environment - Options for mitigation of impact on water, air, land and on flora & fauna - Addressing the issues related to the Project Affected People - ISO 14000.

UNIT V CASE STUDIES 9

EIA for infrastructure projects - Dams - Highways - Multi-storey Buildings - Water Supply and Drainage Projects - Waste water treatment plants, STP.

TOTAL: 45 Periods

TEXT BOOKS:

Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Canter, R.L	Environmental Impact Assessment	McGraw Hill Inc., New Delhi	2016
2.	Shukla, S.K. and Srivastava, P.R	Concepts in Environmental Impact Analysis	Commonwealth Publishers, New Delhi	2010

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REFERENCE BOOKS:				
Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	John G. Rau and David C Hooten	Environmental Impact Analysis Handbook	McGraw Hill Book Company	2012
2.	Judith Petts	Handbook of Environmental Impact Assessment Vol.I &II	Blackwell Science	2014
3.	-	Environmental Assessment Source book", Vol. I, II & III	World Bank, Washington, D.C	2011
4.	Bala Krishnamoorthy	Environmental Management	Blackwell Science	2010
5.	Judith Petts	Environmental Assessment Source book", Vol. I, II & III	McGraw Hill Book Company	2011

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2. www.tandfonline.com/doi/full/10.1080/03043790512331313831?src=recsys
3. www.impactjournals.us/download.php?...Environmental%20Impact%20Assessment%..
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5. www.iitr.ac.in/.../Academics+Course_Structure+CE-601B_Environment_Impac..


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19CEE15

WASTE WATER ENGINEERING

L T P C
3 0 2 4

COURSE OBJECTIVES:

- To realize the principles of Planning, sources and estimation of waste water
- To impart knowledge on Selection of sewers and Pumps for various sources of wastewater
- To recognize the different primary treatment techniques for wastewater.
- To acquire knowledge in the principles of secondary treatment of wastewater.
- To expert in the sludge management.

COURSE OUTCOMES:

- 19CEE15.C01 : Estimate the sanitary sewage flow and storm runoff.
 19CEE15.C02 : Design the sanitary and storm sewers.
 19CEE15.C03 : Design and prefer the various primary wastewater treatment units.
 19CEE15.C04 : Design and choose the various wastewater secondary treatment units.
 19CEE15.C05 : Analyze the various methods on disposal of sludge.

Course Outcomes	Program Outcomes												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
19CEE15.C01	x	x	x	-	-	-	x	x	-	x	-	x	x	-	-
19CEE15.C02	x	x	x	-	-	-	x	x	-	x	-	x	x	-	-
19CEE15.C03	x	x	x	-	-	-	x	x	-	x	-	x	x	-	-
19CEE15.C04	x	x	x	-	-	-	x	x	-	x	-	x	x	-	-
19CEE15.C05	x	x	x	-	-	-	x	x	-	x	-	x	x	-	-

UNIT I PLANNING FOR SEWERAGE SYSTEMS 9

Sources of wastewater generation – Effects – Estimation of sanitary sewage flow – Estimation of storm runoff – Factors affecting Characteristics and composition of sewage and their significance – Effluent standards – Legislation requirements.

UNIT II SEWER DESIGN 9

Sewerage – Hydraulics of flow in sewers – Objectives – Design period - Design of sanitary and storm sewers – Small bore systems - Computer applications – Laying, joining & testing of sewers- appurtenances – Pumps – selection of pumps and pipe Drainage -. Plumbing System for Buildings – One pipe and two pipe system.

UNIT III PRIMARY TREATMENT OF SEWAGE 9

Objective – Selection of treatment processes – Principles, Functions, Design and Drawing of Units- Onsite sanitation - Septic tank with dispersion - Grey water harvesting – Primary treatment – Principles, functions design and drawing of screen, grit chambers and primary sedimentation tanks- Construction, operation and Maintenance aspects.

UNIT IV SECONDARY TREATMENT OF SEWAGE 9

Objective – Selection of Treatment Methods – Principles, Functions, Design and Drawing of Units - Activated Sludge Process and Trickling filter – Oxidation ditches, UASB – Waste Stabilization Ponds – Reclamation and Reuse of sewage - sewage recycle in residential complex - Recent Advances in Sewage Treatment – Construction and Operation & Maintenance of Sewage Treatment Plants.

UNIT V DISPOSAL OF SEWAGE AND SLUDGE MANAGEMENT 9

Standards for Disposal - Methods – dilution – Self purification of surface water bodies – Oxygen sag curve – Land disposal – Sludge characterization – Thickening – Sludge digestion – Biogas recovery – Sludge Conditioning and Dewatering – disposal – Advances in Sludge Treatment and disposal.

TOTAL: 45 Periods

TEXT BOOKS:

Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1	Garg, S.K	Environmental Engineering", Vol.2	Khanna Publishers, New Delhi	2010
2	Hussain, S. K	Text Book of Water Supply and Sanitary Engineering	Oxford and IBH Publishing	2010


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REFERENCE BOOKS:				
Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Metcalf and Eddy	Wastewater Engineering - Treatment and Reuse	Tata McGraw Hill, New Delhi	2003
2	Punmia, B.C Ashok K Jain and Arun K Jain	Waste Water Engineering	Laxmi Publications Pvt. Ltd., New Delhi	2013
3	Shah.C. S	Water supply and Sanitation	Galgotia Publishing Company	2013
4	Mark J. Hammer, Mark J and Hammer J R	Water and Waste Water Technology	Prentice Hall of India	2012
5	Duggal. K.N	Elements of public Health Engineering	S.Chand and Company Ltd, New Delhi.	2017

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19CEE16

MUNICIPAL SOLID WASTE MANAGEMENT

L T P C
3 0 0 3

COURSE OBJECTIVES:

- To know about the different sources and types of municipal solid waste.
- To provide the knowledge about onsite processing and storage of municipal solid waste.
- To study about collection and transfer of municipal solid waste.
- To knowledge about off-site processing of solid waste.
- To understand the various disposal techniques.

COURSE OUTCOMES:

- 19CEE16.C01 : Get an idea about different sources and types of municipal solid waste.
 19CEE16.C02 : Know about onsite storage and processing system.
 19CEE16.C03 : Understand the different methods of collection and transfer of solid waste.
 19CEE16.C04 : Select the suitable offsite processing method for various solid waste.
 19CEE16.C05 : Select the appropriate waste disposal method.

Course Outcomes	Program Outcomes												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
19CEE16.C01	X	X	X	-	-	-	-	-	-	X	-	X	X	-	-
19CEE16.C02	X	X	X	-	-	X	-	-	X	X	-	X	X	-	-
19CEE16.C03	X	X	X	-	-	X	-	-	X	X	-	X	X	-	-
19CEE16.C04	X	X	X	-	-	X	-	-	X	X	-	X	X	-	-
19CEE16.C05	X	X	X	-	-	X	-	-	X	X	-	X	X	-	-

UNIT I SOURCES AND TYPES OF MUNICIPAL SOLID WASTE

9

Solid waste - sources - types - quantity - factors affecting generation - characteristics - Methods of sampling - effects of improper disposal of solid wastes - Public health effects and awareness -Elements of solid waste Management-Social and economic aspects-Municipal solid waste (M&H)-Integrated management - Role of NGOs; Legislation-Public awareness.

UNIT II ON-SITE STORAGE AND PROCESSING

9

On-site storage methods - materials used for containers - on-site segregation of solid wastes - Public health and Economic aspects of storage - waste segregation and storage - Reduction, Reuse and Recycling - options under Indian conditions - Critical Evaluation of Options.

UNIT III COLLECTION AND TRANSFER

9

Methods of Collection - types of vehicles - Manpower requirement - collection route- transfer stations - Need for transfer and transport, Selection of location, operation and maintenance - options under Indian conditions - Field problems- solving

UNIT IV OFF-SITE PROCESSING

9

Objectives of waste processing-Physical processing techniques and equipment - resource recovery from solid wastes - composting and biomethanation - Thermal processing options- Incineration - Pyrolysis

UNIT V DISPOSAL

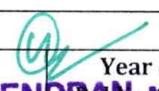
9

E Land disposal of solid waste - sanitary landfills - site selection, design and operation of sanitary landfills - Management of leachate and landfill gas - landfill closure and environmental monitoring - Leachate collection and treatment - Landslide rehabilitation.

TOTAL: 45 Periods

TEXT BOOKS:

Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	George Tchobanoglous	Integrated Solid Waste Management	McGraw- Hill	2004
2.	Sasikumar K & Krishna Sanoop Gopi	Solid Waste Management	PHI, New Delhi	2004


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REFERENCE BOOKS:				
Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Vesilind, Aarne P & Worrell, William A & Reinhart, Debra R	Solid Waste Engineering	Cengage Learning Pvt. Ltd, New Delhi	2011
2.	Landreth.R.E and Rebers.P.A	Municipal Solid Wastes-Problems and Solutions	Lewis Publishers	2015
3.	Bhide.A.D. and Sundaresan.B.B	Solid Waste Management in Developing Countries	Dhanpat Rai and Sons	2012
4.	J. Cointreau	Waste Management	InTechOpen, Published	2011
5.	Jacqueline Vaughn	Waste Management	ABC-CLIO	2009

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2. www.open.edu/openlearncreate/mod/oucontent/view.php?id=209§ion=1.4.
- 3 www.ncbi.nlm.nih.gov/pubmed/7341563
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- 5 www.scribd.com/presentation/84295297/Waste-Management-2


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19CEE17

INDUSTRIAL WASTE MANAGEMENT

L T P C
3 0 0 3

COURSE OBJECTIVES:

- To impart the concepts of sources and effects of industrial wastes.
- To recognize about the cleaner production in waste management.
- To knowledge about various pollution arising from the major industries.
- To understand the concept of various treatment technologies for industrial waste.
- To learn about hazardous waste management.

COURSE OUTCOMES:

- 19CEE17.C01 : Gain knowledge about the sources and effects of industrial solid waste.
 19CEE17.C02 : Prefer the choices of cleaner production in waste management.
 19CEE17.C03 : Identify the pollution from major industries and treatment techniques.
 19CEE17.C04 : Select the suitable treatment technologies for different solid wastes.
 19CEE17.C05 : Understand the principles behind the hazardous waste management.

Course Outcomes	Program Outcomes												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
19CEE17.C01	x	x	x	-	-	x	-	-	x	x	-	x	x	-	-
19CEE17.C02	x	x	x	-	-	x	-	-	x	x	-	x	x	-	-
19CEE17.C03	x	x	x	-	-	x	-	-	x	x	-	x	x	-	-
19CEE17.C04	x	x	x	-	-	x	-	-	x	x	-	x	x	-	-
19CEE17.C05	x	x	x	-	-	x	-	-	x	x	-	x	x	-	-

UNIT I INTRODUCTION

9

Types of industries and industrial pollution - characteristics of industrial wastes - population equivalent - bio-assay studies - effects of industrial effluents on streams, sewer, land, effluent treatment plants and human health - environmental legislations related to prevention and control of industrial effluents and hazardous wastes.

UNIT II CLEANER PRODUCTION

9

Waste management approach - waste audit - ISO 14000 volume and strength reduction - material and process modifications - recycle, reuse and byproduct recovery - applications.

UNIT III POLLUTION FROM MAJOR INDUSTRIES

9

Sources, characteristics, waste treatment flow sheets for selected industries - textiles, tanneries, pharmaceuticals, electroplating industries, dairy, sugar, paper, distilleries, steel plants, refineries, fertilizer and thermal power plants - wastewater reclamation concepts.

UNIT IV TREATMENT TECHNOLOGIES

9

Equalization - neutralization - removal of suspended and dissolved organic solids - chemical oxidation - adsorption - removal of dissolved inorganic - combined treatment of industrial and municipal wastes - residue management - dewatering - disposal

UNIT V HAZARDOUS WASTE MANAGEMENT

9

Hazardous wastes - physic - chemical treatment - solidification - incineration - secured landfills.

TOTAL: 45 Periods

TEXT BOOKS:

Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Rao.M.N and Dutta.AK	Wastewater Treatment	Oxford - IBH Publication	2011
2.	Eckenfelder Jr.W.W	Industrial Water Pollution Control	McGraw-Hill Book Company	2011

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REFERENCE BOOKS:				
Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Dr. Jagbir Singh	Solid Waste Management	I.K. International	2010
2.	Shen T.T	Industrial Pollution Prevention	Springer	2013
3.	Stephenson R.L. and Blackburn, Jr. J.B	Industrial Wastewater Systems Hand book	Lewis Publisher, New York	2016
4.	Freeman .H.M	Industrial Pollution Prevention Hand Book	McGraw-Hill Inc., New Delhi	2008
5.	Bishop, P.L	Pollution Prevention Fundamental and Practice	McGraw-Hill	2010

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19CEE18

AIR POLLUTION AND MANAGEMENT

L T P C
3 0 0 3

COURSE OBJECTIVES:

- To impart knowledge about sources and effect of air pollution.
- To know about dispersion of pollutants.
- To impose the knowledge in the control of air pollution.
- To learn the concepts behind the air quality management.
- To deliver the sources, effect and control of noise pollution.

COURSE OUTCOMES:

- 19CEE18.CO1 : Classify the sources and effects of air pollution.
 19CEE18.CO2 : Realize the dispersion characteristics and modeling of air pollution.
 19CEE18.CO3 : know about air pollution control methods.
 19CEE18.CO4 : Familiarize about air quality management system.
 19CEE18.CO5 : Know the sources, effects and control of noise pollution.

Course Outcomes	Program Outcomes												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
19CEE18.CO1	x	x	x	-	-	x	-	x	x	-	-	x	x	-	-
19CEE18.CO2	x	x	x	-	-	x	-	x	x	-	-	x	x	-	-
19CEE18.CO3	x	x	x	-	-	x	-	x	x	-	-	x	x	-	-
19CEE18.CO4	x	x	x	-	-	x	-	x	x	-	-	x	x	-	-
19CEE18.CO5	x	x	x	-	-	x	-	x	x	-	-	x	x	-	-

UNIT I SOURCES AND EFFECTS OF AIR POLLUTANTS

9

Classification of air pollutants - particulates and gaseous pollutants - sources of air pollution - source inventory - effects of air pollution on human beings, materials, vegetation and animals - global warming - ozone layer depletion, sampling - basic principles - source and ambient sampling - analysis of pollutants.

UNIT II DISPERSION OF POLLUTANTS

9

Elements of atmosphere - meteorological factors - wind roses - lapse rate atmospheric stability and turbulence - plume rise - dispersion of pollutants - dispersion models - applications.

UNIT III AIR POLLUTION CONTROL

9

Concepts of control - principles and design of control measures - particulates control by gravitational, centrifugal, filtration, scrubbing, electrostatic precipitation - selection criteria for equipment - gaseous pollutants control by adsorption, absorption, condensation, combustion - pollution control for specific major industries.

UNIT IV AIR QUALITY MANAGEMENT

9

Air quality standards - Air quality monitoring - preventive measures - air pollution control efforts - Zoning - town planning regulation of new industries - legislation and enforcement - environmental impact assessment on air quality.

UNIT V NOISE POLLUTION

9

Sources of noise pollution - effects - assessment - standards - control methods - prevention measures.

TOTAL: 45 Periods

TEXT BOOKS:				
Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Rao M.N. and Rao H.V.N	Air Pollution	McGraw Hill Education, New Delhi	2013
2.	Rao C.S	Environmental Pollution Control Engineering	Wiley Eastern, New Delhi	2008

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REFERENCE BOOKS:				
Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Anjaneyulu D	Air Pollution and Control Technologies	Allied Publishers, Mumbai	2016
2.	Peavy S.W Rowe D.R. & Tchobanoglous G	Environmental Engineering	McGraw Hill	2010
3.	Garg, S.K.	Environmental Engineering Vol. II	Khanna Publishers, New Delhi.	1999
4.	Mahajan S.P	Pollution Control in Process Industries	Tata McGraw Hill, New Delhi,	2002
5.	Thod Godesh	Air Quality	Lewis Indian Edition	2013

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5. www.environmentalpollutioncenters.org/noise-pollution/



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19CEE19 PUBLIC HEALTH AND IRRIGATION ENGINEERING DRAWING

L T P C
3 0 0 3

COURSE OBJECTIVES:

- To draw the water supply layout
- To draw the waste water treatment plant layout
- To draw the impounding reservoir of the structures
- To draw the canal transmission structures
- To draw the canal regulator structures

COURSE OUTCOMES:

- 19CEE19.CO1 : Design and draw the plan section and elevation of water supply treatment plant
 19CEE19.CO2 : Design and draw the plan section elevation of waste water treatment plant
 19CEE19.CO3 : Design and draw the impounding structures.
 19CEE19.CO4 : Design and draw the canal transmission structures.
 19CEE19.CO5 : Design and draw the canal regulator structures.

Course Outcomes	Program Outcomes												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
19CEE19.CO1	X	X	X	-	X	X	-	X	-	X	-	X	X	-	-
19CEE19.CO2	X	X	X	-	X	X	-	X	-	X	-	X	X	-	-
19CEE19.CO3	X	X	X	-	X	X	-	X	-	X	-	X	X	-	-
19CEE19.CO4	X	X	X	-	X	X	-	X	-	X	-	X	X	-	-
19CEE19.CO5	X	X	X	-	X	X	-	X	-	X	-	X	X	-	-

UNIT I WATER SUPPLY AND TREATMENT

9

Design & Drawing of flash mixer, flocculator, clarifier – Slow sand filter – Rapid sand filter –Infiltration gallery – Intake towers – Service reservoirs – Pumping station – House service connection for water supply and drainage.

UNIT II SEWAGE TREATMENT & DISPOSAL

9

Design and Drawing of screen chamber - Grit channel - Primary clarifier - Activated sludge process - Aeration tank & oxidation ditch - Trickling filters - Secondary clarifiers - Sludge digester - Sludge drying beds - Waste stabilization ponds - Septic tanks and disposal arrangements - Manholes.

UNIT III IMPOUNDING STRUCTURES

9

Gravity dam, Tank Surplus Weir, Tank Sluice with tower road – Drawing showing plan, elevation, half section including foundation details.

UNIT IV CANAL TRANSMISSION STRUCTURES

9

Aqueducts – Syphon Aqueducts – Super passage – Canal siphon – Canal Drops- Drawing showing plan, elevation and foundation details.

UNIT V CANAL REGULATOR STRUCTURES

9

Canal head works- Canal Regulator – Canal escape- Proportional Distributors – Drawing showing detailed plan, elevation and foundation.

TOTAL: 45 Periods

TEXT BOOKS:

Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1	Modi. P.N	Environmental Engineering I &II	Standard Book House, Delhi-6	2015
2	Sathyannarayana Murthy	Irrigation Design and Drawing	Published by Mrs L.Banumathi, Tuni east Godavari District	2010

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REFERENCE BOOKS:				
Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1	Peary. H.S Rowe. D.R and Tchobanoglous.G	Environmental Engineering	McGraw-Hill Book Co., New Delhi	2012
2	Metcalf & Eddy	"Wastewater Engineering (Treatment and Reuse)", 4th edition	Tata McGraw-Hill, New Delhi	2003
3	Garg S.K	Environmental Engineering and design Structures	Khanna Publishers, New Delhi. dDelhi, 17th Reprint	2014
4	-	Manual on Water Supply and Treatment	CPHEEO, Government of India, New Delhi	2015
5	-	Manual on Sewerage and Sewage Treatment	CPHEEO, Government of India, New Delhi	2012

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3. www.sciencedirect.com/science/.../S001379441500714
4. www.dalekovod.com/en/transmission-lines.aspx
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19CEE20

HYDROLOGY

L T P C
3 0 0 3

COURSE OBJECTIVES:

- To know about the hydrological cycle and precipitation.
- To understand the precipitation and infiltration process.
- To acquire in depth knowledge on various types of hydrographs and their applications.
- To realize the importance of flood control and mitigation measures.
- To integrate the fundamental knowledge on ground water hydrology.

COURSE OUTCOMES:

- 19CEE20.CO1 : Understand the various components of hydrological cycle, rainfall and their interactions.
 19CEE20.CO2 : Estimate the mean area precipitation, infiltration and their significance.
 19CEE20.CO3 : Understand the various methods of hydrographs and its applications.
 19CEE20.CO4 : Estimate the flood by various methods and concept of flood routing.
 19CEE20.CO5 : Understand the dynamics of groundwater flow and their estimation.

Course Outcomes	Program Outcomes												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
19CEE20.CO1	X	X	X	-	-	-	-	-	-	X	-	X	X	-	-
19CEE20.CO2	X	X	X	-	-	X	-	-	X	X	-	X	X	-	-
19CEE20.CO3	X	X	X	-	-	X	-	-	X	X	-	X	X	-	-
19CEE20.CO4	X	X	X	-	-	X	-	-	X	X	-	X	X	-	-
16CEE01.CO5	X	X	X	-	-	X	-	-	X	X	-	X	X	-	-

UNIT I PRECIPITATION

9

Hydrologic cycle - Hydro meteorological factors - Cloud formation - Winds and their movement - Types of precipitation - Forms of precipitation - Measurement of Rainfall - Spatial measurement methods - Temporal measurement methods - Frequency analysis of point rainfall - Intensity, duration, frequency relationship - Probable maximum precipitation - Density and Adequacy of rain gauges - Recording and non - recording rain gauges - Optimum number of rain gauges

UNIT II ABSTRACTION FROM PRECIPITATION

9

Losses from precipitation - Evaporation process - Reservoir evaporation - Infiltration process - Infiltration capacity loss - Measurement of infiltration - Infiltration indices -Horton's equation - Effective rainfall Spatial distribution - Consistency analysis -Frequency analysis - Intensity, duration, frequency relationships - abstraction

UNIT III HYDROGRAPHS ANALYSIS

9

Flood Hydrograph - Components of flood hydrograph -Factors affecting shape of Hydrograph - Base flow separation - Unit hydrograph - Advantages - Instantaneous Unit hydrograph - S curve Hydrograph - Synthetic unit hydrograph -Applications - Derivation of unit hydrograph - Unit hydrograph of different deviations

UNIT IV FLOODS AND FLOOD ROUTING

9

Flood frequency studies - Recurrence interval - Flood estimation - Gumbel's method - Log Pearson type III method - Flood routing - Reservoir flood routing - Muskingum's Channel Routing - Flood control.

UNIT V GROUND WATER HYDROLOGY

9

Types of Aquifers - Darcy's Law - Dupuit's assumptions - confined aquifer - unconfined aquifer - recuperation test - transmissibility - specific capacity - pumping test -steady flow analysis only.

TOTAL: 45 Periods

TEXT BOOKS:

Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Subramanya, K	Engineering Hydrology	Tata McGraw-Hill Publishing Co. Ltd, Delhi	2013
2.	Raghunath, H.M	Hydrology	Wiley	2013

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REFERENCE BOOKS:				
Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	JayaRam Reddy	Text Book of Hydrology	Laxmi Publications	2016
2.	Singh V P	Hydrology	McGraw Hill Inc., Ltd	2016
3.	Chow, V.T. and Maidment	Hydrology for Engineers	Mc Graw - Hill Inc., Ltd	2013
4.	Santosh Kumar Garg	Hydrology and Water Resources Engineering	Khanna Publications Pvt.Ltd. NewDelhi	2017
5.	Warren Viessman and Gary L.Lewis	Introduction to Hydrology	Prentice Hall of India Pvt.Ltd NewDelhi	2017

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3. www.kean.edu/~csmart/Hydrology/.../Lecture%2009I%20Intro%20Hydrographs.ppt
4. www.kean.edu/~csmart/Hydrology/.../Lecture%2015u%20Flood%20Routing%201.pp..
5. www.in.gov/dnr/water/files/WFWR_web26-50.pdf


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19CEE22

GROUND WATER ENGINEERING

L T P C
3 0 0 3

COURSE OBJECTIVES:

- To know about hydro geological parameters in ground water.
- To know about well hydraulics.
- To knowledge about ground water management.
- To learn about groundwater quality.
- To familiarize about groundwater conservation.

COURSE OUTCOMES:

- 19CEE22.CO1 : Understand about the hydro geological parameters of ground water.
 19CEE22.CO2 : Knowledge about well hydraulics
 19CEE22.CO3 : Learn about ground water management.
 19CEE22.CO4 : know about groundwater quality.
 19CEE22.CO5 : Learn about groundwater conservation Techniques.

Course Outcomes	Program Outcomes												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
19CEE22.CO1	X	X	X	-	-	X	-	X	X	-	-	X	X	-	-
19CEE22.CO2	X	X	X	-	-	X	-	X	X	-	-	X	X	-	-
19CEE22.CO3	X	X	X	-	-	X	-	X	X	-	-	X	X	-	-
19CEE22.CO4	X	X	X	-	-	X	-	X	X	-	-	X	X	-	-
19CEE22.CO5	X	X	X	-	-	X	-	X	X	-	-	X	X	-	-

UNIT I HYDROGEOLOGICAL PARAMETERS

9

Introduction - water bearing Properties of Rock -Type of aquifers - Aquifer properties - Permeability, specific yield, transmissivity and storage coefficient - methods of Estimation - Ground water table fluctuation and its interpretations - ground water development and Potential in India - GEC norms

UNIT II WELL HYDRAULICS

9

Objectives of Ground water hydraulics - Darcy's Law-- Ground water equation - steady state flow - Dupuit Forchheimer assumption - unsteady state flow - thesis method - Jacob method - Slug tests - Image well theory -Partial penetrations of wells.

UNIT III GROUND WATER MANAGEMENT

9

Need for management model - Database for groundwater management - ground water balance study - Introduction to mathematical model - Conjunctive use - Collector well and infiltration gallery.

UNIT IV GROUNDWATER QUALITY

9

Groundwater chemistry - origin, movement and quality - water quality standards - health and aesthetic aspects of water quality - Saline intrusion - Environmental concern and regulatory requirements

UNIT V GROUNDWATER CONSERVATION

9

Artificial recharge techniques - Remediation of Saline Intrusion - Groundwater management studies - protection zone delineation, Contamination source inventory, remediation schemes - Ground water Pollution and legislation.

TOTAL: 45 Periods

TEXT BOOKS:

Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Raghunath H.M.	Ground Water Hydrology	New Age International Ltd. New Delhi	2010
2.	Todd D.K	Ground Water Hydrology	John Wiley and Sons, New York	

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Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Raghunath H.M.	Ground Water Hydrology	New Age International (P) Ltd. New Delhi	2015
2.	Todd D.K	und Water Hydrology	John Wiley and Sons, New York	2013
3.	Fitts R Charles	Groundwater Science	Elsevier, Academic Press	2014
4.	Ramakrishnan,S	Advanced mechanics and solids	Tata-McGraw Hill publishing company ltd	2016
5.	Punmia B.C, Ashok K. Jain and Arun K. Jain	Ground water, K.J.	Graph arts, Chennai	2017

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19CEE23

IRRIGATION ENGINEERING

L T P C
3 0 0 3

COURSE OBJECTIVES:

- To obtain knowledge about irrigation system and crops season
- To design the various methods of irrigation which are needed for the practical life.
- To understand about canal structures and regulators
- To learn about diversion head work and impounding structure
- To provide knowledge on water management and to minimize irrigation water losses

COURSE OUTCOMES:

- 19CEE23.CO1 : Assess the irrigation systems and crop seasons
 19CEE23.CO2 : Select the suitable methods of irrigation
 19CEE23.CO3 : Design various types of canal structures and regulators.
 19CEE23.CO4 : Select and design suitable type of dam based on the requirement
 19CEE23.CO5 : Examine various river training methods and providing solution to various issues on irrigation water management

Course Outcomes	Program Outcomes												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
19CEE23.CO1	X	X	X	-	-	X	-	X	X	X	-	X	X	-	-
19CEE23.CO2	X	X	X	-	-	X	-	X	X	X	-	X	X	-	-
19CEE23.CO3	X	X	X	-	-	X	-	X	X	X	-	X	X	-	-
19CEE23.CO4	X	X	X	-	-	X	-	-	X	X	-	X	X	-	-
19CEE23.CO5	X	X	X	-	-	-	-	-	-	X	-	X	X	-	-

UNIT I INTRODUCTION

9

Necessity – Merits and demerits of irrigation– Crops and crop seasons–Soil- water- plant relations – saline, alkaline soils and their reclamation – root zone depth – Duty and Delta relationship – Factors affecting duty – Consumptive use of water by a crop – Estimation and assessment of irrigation water – Irrigation efficiencies – optimum utilization of water– Planning and development of irrigation– Problems on Irrigation

UNIT II IRRIGATION METHOD

9

Methods of irrigation– Canal irrigation – lift irrigation – tank irrigation – Surface and sub-surface methods of application of water – Sprinkler and drip irrigation methods.

UNIT III CANAL STRUCTURE AND REGULATORS

9

Alignment of canals – classification of canals – Design of canals based on Kennedy’s and Lacey’s silt theories – canal lining - water logging - canal drops – hydraulic design of drops – Cross drainage works – Hydraulic design of cross drainage works – Canal head works – Functions of Regulators - Design of head and cross regulators– Classification of aqueducts and syphon aqueducts

UNIT IV DIVERSION HEAD WORK AND IMPOUNDING STRUCTURE

9

Functions of diversion head works – Types – Layout of diversion head works – Component parts – functions -Weir –types – Causes of failure of weirs and their remedies –Bligh’s theory -Khosla’s theory – Design of a vertical drop weir – Design principles for under sluices – Types of impounding structures– Gravity dams – Earth dams – Arch dams – Spillways – Factors affecting location and type of dams – Forces on a dam – Hydraulic design of dams

UNIT V IRRIGATION WATER MANAGEMENT

9

Need for optimization of water use – Minimizing irrigation water losses – On farm development works - Participatory irrigation management – Water users associations – Changing paradigms in water management due to climate change – Performance evaluation–River training methods - Investigation and preparation of irrigation project: Classification of projects, concepts of multiple objectives

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TOTAL: 45 Periods

TEXT BOOKS:

Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1	Santosh Kumar Garg	Irrigation Engineering and Hydraulics Structures.	Khanna Publications Pvt.Ltd. New Delhi.	2016
2	Punmia B.C & Pande B.B Lal	Irrigation and water power Engineering.	Lakshmi publications, New Delhi.	2016

REFERENCE BOOKS:

Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1	Sharma R.K and Sharma T.K	Irrigation Engineering and Hydraulics Structures	S. Chand & Company Pvt.Ltd, New Delhi	2010
2	Michel A.M	Irrigation Engineering	Vikas Publishing House Pvt.Ltd, New Delhi	2009
3	Dilip Kumar Majumdar	Irrigation Water Management (Principles & Practices)	Prentice Hall of India (P), Ltd, New Delhi.	2013
4	Varshney and Gupta	Irrigation Engineering & Hydraulic Structure	Nem Chand & Bros., Roorkee	2010
5	Arora K R	Irrigation Water Power & Water Resources Engineering	Standard Publishers Distributors, Delhi	2010

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19CEE24

APPLIED HYDRAULIC ENGINEERING

L T P C
3 0 2 4

COURSE OBJECTIVES:

- To impart knowledge on basic concepts of open channel flows and their types.
- To provide knowledge on designing a most economical section of various shapes in uniform flow.
- To understand the behaviour of various types of non-uniform channel flows and their practical applications.
- To create knowledge on basic concepts of various pumps.
- To study the fundamental concepts of various types of turbines.

COURSE OUTCOMES:

- 19CEE24.CO1 : Analyze the various classifications of open channel flows.
 19CEE24.CO2 : Design of various types of channels and velocity measurement in open channel flows.
 19CEE24.CO3 : Design silting basin for the given non-uniform flow condition.
 19CEE24.CO4 : Select a suitable pump according to the requirement.
 19CEE24.CO5 : Choose a suitable type of hydraulic turbine.

Course Outcomes	Program Outcomes												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
19CEE24.CO1	X	X	X	-	-	X	-	-	X	X	-	X	X	-	-
19CEE24.CO2	X	X	X	-	-	X	X	-	X	X	X	X	X	-	-
19CEE24.CO3	X	X	X	-	-	X	X	-	X	X	X	X	X	-	-
19CEE24.CO4	X	X	X	-	-	X	X	-	X	X	-	X	X	-	-
19CEE24.CO5	X	X	X	-	-	X	X	-	X	X	-	X	X	-	-

UNIT I OPEN CHANNEL AND CRITICAL FLOW

9

Introduction to open channel flow – Types and regimes of flow – Velocity distribution in open channel flow – Wide open channel – Specific energy and specific force – Critical flow and its computation – Channel transition.

UNIT II UNIFORM FLOW

9

Uniform flow – Various methods of velocity measurements – Chezy's and Manning's formula – Determination of roughness coefficients- Determination of normal depth and velocity – Most economical section –Conditions for various types of open channels – Non Erodible channel.

UNIT III NON – UNIFORM FLOW

9

Dynamic equation of Gradually Varied Flow (GVF) – Determination of GVF profiles – Direct and standard step methods – Hydraulic jump – Sequent depths -- Introduction to positive and negative surge.

UNIT IV PUMPS

9

Classification of pumps based on field applications-Minimum speed to start the pump-NPSH - Centrifugal pump - Cavitations in pumps – Single and Multi-stage pumps – Reciprocating pump –Negative slip-Flow separation condition- Air vessels, indicator diagrams and its variations –Cavitations-rotary pumps: Gear pump

UNIT V TURBINES

9

Impact of jet on flat and curved plates, stationary and moving – Classification of turbines – impulse turbine – reaction turbine – radial flow turbine -Francis turbine – Propeller and Kaplan turbine – Draft tube and cavitations - performance of turbine-specific speed.

TOTAL: 45 Periods

TEXT BOOKS:

Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Subramanya K	Flow in Open channels	Tata McGraw-Hill Publishing Company	2011
2.	Bansal R.K	Fluid mechanics & Hydraulic machines	Laxmi Publishing Pvt Ltd,	2011

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REFERENCE BOOKS:				
Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Jain A.K	Fluid Mechanics (including Hydraulic Machines)	Khanna Publishers, 8th Edition	2010
2.	Ranga Raju, K.G	Flow through Open Channels	Tata McGraw-Hill	2010
3.	Rajesh Srivastava	Flow through open channels	Oxford University Press	2016
4.	Rajput R.K	A Text book of Fluid Mechanics	S.Chand Publication Ltd., New Delhi	2015
5.	Modi .P.N and Seth S.M	Hydraulics and Fluid Mechanics	Standard Book House,	2013

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19CEE25

PAVEMENT ENGINEERING

L T P C
3 0 0 3

COURSE OBJECTIVES:

- To understand the types of pavement.
- To gain the knowledge of flexible Pavements design as per IRC guidelines.
- To gain the knowledge of rigid Pavements design as per IRC guidelines.
- To know about the pavement evaluation and Maintenance.
- To study about Stabilization of Pavements.

COURSE OUTCOMES:

- 19CEE25.C01 : To find the stress and deflections in pavements under repeated loading.
 19CEE25.C02 : To design flexible pavement based on IRC guidelines.
 19CEE25.C03 : To design rigid pavement based on IRC guidelines.
 19CEE25.C04 : To evaluate performance of pavements.
 19CEE25.C05 : To adopt suitable soil stabilization techniques for pavements

Course Outcomes	Program Outcomes												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
19CEE25.C01	X	X	X	-	-	-	-	-	-	X	-	X	X	-	-
19CEE25.C02	X	X	X	-	-	X	-	-	X	X	-	X	X	-	-
19CEE25.C03	X	X	X	-	-	X	-	-	X	X	-	X	X	-	-
19CEE25.C04	X	X	X	-	-	X	-	-	X	X	-	X	X	-	-
19CEE25.C05	X	X	X	-	-	X	-	-	X	X	-	X	X	-	-

UNIT I TYPES OF PAVEMENT AND STRESS DISTRIBUTION ON LAYERED SYSTEM 9

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

UNIT II DESIGN OF FLEXIBLE PAVEMENTS 9

Flexible pavement design - factors influencing design of flexible pavement - Empirical, Semi-empirical and theoretical methods - Design procedure as per IRC guidelines - design and specification of rural roads.

UNIT III DESIGN OF RIGID PAVEMENTS 9

Cement concrete pavements factors influencing CC pavements - Modified Westergaard approach - design procedure as per IRC guidelines - Concrete roads and their scope in India.

UNIT IV PERFORMANCE EVALUATION AND MAINTENANCE 9

Pavement Evaluation - causes of distress in rigid and flexible pavements - Evaluation based on Surface Appearance, Cracks, patches and Pot holes, Undulations, Raveling, Roughness, Skid Resistance - Structural evaluation by Deflection Measurements - Pavement Serviceability index pavement maintenance (IRC recommendations only).

UNIT V STABILIZATION OF PAVEMENTS 9

Stabilization with special reference to highway pavements - Choice of stabilizers - Testing and field control stabilization for rural roads in India - Use of Geosynthetics in roads

TOTAL: 45 Periods

TEXT BOOKS:				
Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Wright P.H.	Highway Engineers	John Wiley and Sons, Inc., New York	2009
2.	Khanna S.K., Justo C.E.G and Veeraragavan.A.	Highway Engineering	Nem Chand and Brothers, 10th Edition, Roorkee	2014

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REFERENCE BOOKS:				
Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Yoder R.J. and Witchak M.W.	Principles of Pavement Design	John Wiley	2016
2.	Rajib B. Mallick, Tahar El-Korchi	Pavement Engineering	Principles and Practice 2nd edition, CRC Press	2013
3.	-	Guidelines for the Design of Flexible Pavements - IRC 37	Indian Road Congress	2012
4.	-	Guideline for the Design of Rigid Pavements for Highways, IRC 58	Indian Road Congress	2016
5.	-	Standard Specifications and code of practice for construction of concrete roads, IRC - 015	Indian Road Congress	2011

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4. www.crridom.gov.in/sites/default/files/annual-report/Chapter4-2011-12.pdf
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19CEE26

TRAFFIC ENGINEERING AND SAFETY TRANSPORT

L T P C
3 0 0 3

COURSE OBJECTIVES:

- To familiarize the basics of traffic engineering.
- To give knowledge about traffic control system and geometric design of intersections.
- To familiarize about traffic management system.
- To impart knowledge about road transport systems and preventive measures
- To create awareness among students about road safety.

COURSE OUTCOMES:

- 19CEE26.CO1 : Have knowledge on traffic engineering basics.
 19CEE26.CO2 : Apply geometric design of intersections.
 19CEE26.CO3 : Knowledge about traffic management system
 19CEE26.CO4 : Learn about road transport systems and preventive measures
 19CEE26.CO5 : Understand the various road safety measures.

Course Outcomes	Program Outcomes												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
19CEE26.CO1	X	X	X	X	-	X	-	-	X	X	-	X	X	-	-
19CEE26.CO2	X	X	X	X	-	X	-	-	X	X	-	X	X	-	-
19CEE26.CO3	X	X	X	X	-	X	-	-	X	X	-	X	X	-	-
19CEE26.CO4	X	X	X	X	-	X	-	-	X	X	-	X	X	-	-
19CEE26.CO5	X	X	X	-	-	X	-	-	X	X	-	X	X	-	-

UNIT I INTRODUCTION 9

Significance and scope - Characteristics of Vehicles and Road Users - Skid Resistance and Braking Efficiency (Problems) - Components of Traffic Engineering - Road, Traffic and Land Use Characteristics - Traffic surveys and Analysis - Volume, Capacity, Speed and Delays, Origin and Destination, Parking, Pedestrian Studies, Accident Studies and Safety Level of Services - Basic principles of Traffic flow

UNIT II TRAFFIC CONTROL AND GEOMETRIC DESIGN OF INTERSECTIONS 9

Traffic signs, Road markings, Design of Traffic signals and Signal co-ordination (Problems) - Traffic control aids and Street furniture - Street Lighting - Computer applications in Signal design - Conflicts at Intersections, Classification of 'At Grade Intersections' - Channelized Intersections - Principles of Intersection Design - Elements of Intersection Design - Rotary design - Grade Separation and interchanges - Design principles.

UNIT III TRAFFIC MANAGEMENT 9

Traffic Management - Transportation System Management (TSM) - Travel Demand Management (TDM) - Traffic Forecasting techniques - Restrictions on turning movements - One-way Streets - Traffic Segregation - Traffic Calming - Tidal flow operations - Exclusive Bus Lanes - Introduction to Intelligent Transportation System (ITS).

UNIT IV ROAD TRANSPORT 9

Introduction - factors for improving safety on roads - causes of accidents due to drivers and pedestrians - design, selection, operation and maintenance of motor trucks - preventive maintenance check lists - motor vehicles act - motor vehicle insurance and surveys.

UNIT V ROAD SAFETY 9

Road alignment and gradient-reconnaissance - ruling gradient, maximum rise per km - factors influencing alignment like tractive resistance, tractive force, direct alignment, vertical curves - breaking characteristics of vehicle-skidding-restriction of speeds-significance of speeds- Pavement conditions - Sight distance - Safety at intersections - Traffic control lines and guide posts-guard rails and barriers - street lighting and illumination overloading - concentration of driver.

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TEXT BOOKS:

Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Kadiyali L R	Traffic Engineering and Transport Planning	Khanna Technical Publications	2016
2.	Khanna K and Justo C E G	Highway Engineering	Khanna Publishers	2017

REFERENCE BOOKS:

Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Subhash C.Saxena	A Course in Traffic Planning and Design	Dhanpat Rai Publications	2014
2.	C. Jotin Khisty, B. Kent Lall	Transportation Engineering - An Introduction	Prentice Hall of India Pvt Ltd	2010
3.	Babkov, V.F	Road Conditions and Traffic Safety	MIR Publications	2017
4.	-	Motor Vehicles Act	Government of India	2017
5.	K.W.Ogden	Safer Roads - A guide to Road Safety Engineering	Avebury Technical	2011

WEB URLs:

1. www.virginiadot.org/business/locdes/Traffic-Resource-Links.asp
2. www.gpo.gov/fdsys/pkg/FR-2013-06-17/pdf/2013-14266.pdf
3. www.youtube.com/watch?v=h7p606C-W8g
4. www.youtube.com/watch?v=3XaTwQIugJ4
5. www.youtube.com/watch?v=_YJY2JXk00c


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19CEE27

RAILWAYS, AIRPORTS AND HARBOUR ENGINEERING

L T P C
3 0 0 3

COURSE OBJECTIVES:

- To give exposure to planning of railway tracks.
- To provide proficiency in the railway construction and maintenance.
- To develop skills on planning of airports
- To give exposure on airport design.
- To have basic knowledge on components of docks and harbors.

COURSE OUTCOMES:

- 19CEE27.CO1 : Planning the railway track components.
 19CEE27.CO2 : Perform the railway construction and maintenance.
 19CEE27.CO3 : Possess knowledge on airport planning
 19CEE27.CO4 : Do the design of runways, taxiways and apron.
 19CEE27.CO5 : Familiarize the components of docks and harbors

Course Outcomes	Program Outcomes												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
19CEE27.CO1	X	X	-	-	-	X	-	X	X	-	-	X	X	-	-
19CEE27.CO2	X	X	-	-	-	X	-	X	X	-	-	X	X	-	-
19CEE27.CO3	X	X	-	-	-	X	-	X	X	-	-	X	X	-	-
19CEE27.CO4	X	X	-	-	-	X	-	X	X	-	-	X	X	-	-
19CEE27.CO5	X	X	-	-	-	X	-	X	X	-	-	X	X	-	-

UNIT I RAILWAY PLANNING

9

Significance of Road, Rail, Air and Water transports - Coordination of all modes to achieve sustainability - Elements of permanent way – Rails, Sleepers, Ballast, rail fixtures and fastenings, - Track Stress, coning of wheels, creep in rails, defects in rails – Route alignment surveys, conventional and modern methods (Remote Sensing, GIS & GPS, EDM and other equipments)- Soil suitability analysis - Geometric design of railways, gradient, super elevation, widening of gauge on curves- Points and Crossings.

UNIT II RAILWAY CONSTRUCTION AND MAINTENANCE

9

Earthwork – Stabilization of track on poor soil -- Tunneling Methods, drainage and ventilation – Calculation of Materials required for track laying - Construction and maintenance of tracks –Modern methods of construction & maintenance - Railway stations and yards and passenger amenities- Urban rail – Infrastructure for Metro, Mono and underground railways.

UNIT III AIRPORT PLANNING

9

Floors - Types of flooring - Repair of floors - Classification of roofs - Types of Pitched & Flat roofs -Roof covering materials - Drainage on pitched & flat roofs - Types of scaffolding - types of shoring - Methods of underpinning -Types of formwork - centering.

UNIT IV CONSTRUCTION PRACTICES

9

Runway Design: Orientation, Wind Rose Diagram - Runway length - Problems on basic and Actual Length, Geometric design of runways, Configuration and Pavement Design Principles - Elements of Taxiway Design – Airport Zones , Clear Zone, Approach Zone, Buffer Zone, Turning Zone, wind direction indicators, Clearance over Highways and Railways - Passenger Facilities and Services - Runway and Taxiway Markings and lighting.

UNIT V HARBOUR ENGINEERING

9

Definition of Basic Terms: Harbor, Port, Satellite Port, Docks, Waves and Tides – Planning and Design of Harbors Requirements, Classification, Location and Design Principles – Harbor Layout and Terminal Facilities - Coastal Structures: Piers, Break waters, Wharves, Jetties, Quays, Spring Fenders, Dolphins and Floating Landing Stage - Inland Water Transport - Wave action on Coastal Structures and Port Operations - Works - Environmental concern of Port Operations - Coastal Regulation Zone, 2011.

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TEXT BOOKS:				
Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Rangwala	Railway Engineering	Charotar Publishing House	2013
2.	Bindra S P	A Course in Docks and Harbour Engineering	Dhanpat Rai and Sons	2013

REFERENCE BOOKS:				
Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Rangwala	Airport Engineering	Charotar Publishing House	2013
2.	Dr.K.P.Subramanian	A text book on Railways, Airports, Docks and Harbours	Scitech, Chennai	2012
3.	Oza.H.P and Oza.G.H	A course in Docks & Harbour Engineering	Charotar Publishing Co.	2013
4.	Mundrey J.S	A course in Railway Track Engineering	Tata McGraw Hill	2017
5.	Saxena Subhash C and Satyapal Arora	A Course in Railway Engineering	Dhanpat Rai and Sons	2016

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19CEE28

CONSTRUCTION PLANNING AND MANAGEMENT

L T P C
3 0 2 4

COURSE OBJECTIVES:

- To make the students to learn about basic concepts of planning and methods.
- To study about scheduling procedures and techniques involved in construction projects
- To learn about cost control monitoring and accounting systems.
- To know about the quality control and safety measures during construction practice.
- To learn about organization and use of project information in database management system.

COURSE OUTCOMES:

- 19CEE28.C01 : Understand the requirement of planning techniques exercised in the construction projects.
- 19CEE28.C02 : Choose suitable scheduling technique for the particular project.
- 19CEE28.C03 : Practice modern cost account systems and control techniques adopted.
- 19CEE28.C04 : Adopt the quality control and safety measures during construction.
- 19CEE28.C05 : Understand the use of project information system.

Course Outcomes	Program Outcomes												PSOs		
	P01	P02	P03	P04	P05	P06	P07	P08	P09	P010	P011	P012	PSO1	PSO2	PSO3
19CEE28.C01	X	X	X	X	-	X	-	-	X	X	-	X	X	-	-
19CEE28.C02	X	X	X	X	-	X	-	-	X	X	-	X	X	-	-
19CEE28.C03	X	X	X	X	-	X	-	-	X	X	-	X	X	-	-
19CEE28.C04	X	X	X	X	-	X	-	-	X	X	-	X	X	-	-
19CEE28.C05	X	X	X	-	-	X	-	-	X	X	-	X	X	-	-

UNIT I CONSTRUCTION PLANNING 9

Necessity - Basic concepts - Phases and stages of project planning - Types of construction plans for projects - Planning for materials, labour and equipment - Defining activities and precedence relationships - Estimating activity durations and resource requirements - Program for progress of work and control - Bar and Milestone charts - Uses and drawbacks - Terminology - Coding systems

UNIT II MANAGEMENT TECHNIQUES 9

Evolution of networks - Inter-relationship of events and activities - Fundamental rules for network construction -Critical path method - Program Evaluation and Review Technique - Probability of project completion time -Precedence networks - Scheduling for activity - on-node networks - Resource oriented scheduling - Scheduling with resource constraints - Improving scheduling

UNIT III COST CONTROL MONITORING AND ACCOUNTING 9

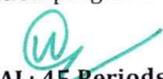
The cost control problem-The project Budget-Forecasting for Activity cost control - financial accounting systems and cost accounts - Control of project cash flows - schedule control - schedule and budget updates - relating cost and schedule information

UNIT IV QUALITY CONTROL AND SAFETY DURING CONSTRUCTION 9

Quality and safety Concerns in Construction - Organizing for Quality and Safety - Work and Material Specifications - Total Quality control - Quality control by statistical methods - Statistical Quality control with Sampling by Attributes - Statistical Quality control by Sampling and Variables-Safety.

UNIT V ORGANIZATION AND USE OF PROJECT INFORMATION 9

Types of project information - Accuracy and Use of Information - Computerized organization and use of Information - Organizing information in databases-relational model of Data bases - Other conceptual Models of Databases - Centralized database Management systems - Databases and application programs - Information transfer and Flow.


TOTAL: 45 Periods
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TEXT BOOKS:

Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Chitkara. K.K	Construction Project Management	Tata McGraw Hill Publishing Co., New Delhi,	2015
2.	Srinath.L.S	PERT and CPM Principles and Applications", Affiliated East West Press, 2001	Wiley, 6th Edition	2013

REFERENCE BOOKS:

Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Chris Hendrickson and Tung Au	Project Management for Construction	Prentice Hall, Pittsburgh,.	2012
2.	Moder.J., Phillips. C and Davis E	Project Management with CPM", PERT and Precedence Diagramming	Van Nostrand Reinhold co	2015
3.	Willis., E.M	"Scheduling Construction projects"	John Wiley and Sons,	2015
4.	Halpin, D.W	Financial and Cost Concepts for Construction Management	John Wiley and Sons, New York	2011
5.	Andrew Baldwin	Construction Planning and Scheduling	I.K International publishing	2014

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2. [www.slideshare.net/drravimr/modern-management-techniques\](http://www.slideshare.net/drravimr/modern-management-techniques)
3. www.careerbuilder.com/jobs-cost-control-monitoring-and-accounting-project
4. www.swg.usace.army.mil/.../26/.../Construction%20Quality%20Management/MOD6.p..
5. www.brighthubpm.co/ProjectPlanning


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19CEE29

HOUSING PLANNING AND MANAGEMENT

L T P C
3 0 0 3

COURSE OBJECTIVES:

- To learn the basics about housing planning and management.
- To give awareness about the existing housing programmes.
- To train the students to do the planning and design of housing projects
- To give exposure about the cost effective construction techniques.
- To knowledge about housing finance and project appraisal.

COURSE OUTCOMES:

- 19CEE29.CO1 : Know the basics of housing planning and management system
 19CEE29.CO2 : Learn the various housing programmes and role of public and private organization.
 19CEE29.CO3 : Plan and design the housing projects.
 19CEE29.CO4 : knowledge about the cost effective construction techniques
 19CEE29.CO5 : Perform the economic analysis based project appraisal of housing projects.

Course Outcomes	Program Outcomes												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
19CEE29.CO1	X	X	X	-	-	X	-	-	X	X	-	X	X	-	-
19CEE29.CO2	X	X	X	-	-	X	X	-	X	X	X	X	X	-	-
19CEE29.CO3	X	X	X	-	-	X	X	-	X	X	X	X	X	-	-
19CEE29.CO4	X	X	X	-	-	X	X	-	X	X	-	X	X	-	-
19CEE29.CO5	X	X	X	-	-	X	X	-	X	X	-	X	X	-	-

UNIT I INTRODUCTION TO HOUSING 9

Definition of Basic Terms - House, Home, Household - Row houses, Apartments, Multi storied Buildings, Special Buildings - Objectives and Strategies of National Housing Policies - Principle of Sustainable Housing, Housing Laws at State level, Bye - laws at Urban and Rural Local Bodies - DC Regulations, Institutions for Housing at National, State and Local levels.

UNIT II HOUSING PROGRAMMES 9

Basic Concepts, Contents and Standards for various Housing Programmes - Sites and Services, Neighbourhoods, Open Development Plots, Apartments, Rental Housing, Co-operative Housing, Slum Housing Programmes, Role of Public, Private and Non-Government Organizations.

UNIT III PLANNING AND DESIGN OF HOUSING PROJECTS 9

Formulation of Housing Projects - Site Analysis, Layout Design, Design of Housing Units (Simple design problems) - Procedure for site analysis and layout planning.

UNIT IV CONSTRUCTION TECHNIQUES AND COST EFFECTIVE TECHNIQUE 9

New construction techniques - Cost effective, Modern Construction Materials, Building centers concept, Functions and Performance Evaluation.

UNIT V HOUSING FINANCE AND PROJECT APPRAISAL 9

Appraisal of Housing Projects - Housing Finance, Cost Recovery - Cash Flow Analysis, Subsidy and Cross Subsidy, Pricing of Housing Units, Rents, Recovery Pattern (Problems)

TOTAL: 45 Periods

TEXT BOOKS:				
Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Meera Mehta and Dinesh Mehta	Metropolitan Housing Markets	Sage Publications Pvt. Ltd., New Delhi.	2015
2.	Francis Cherunilam and Odeyar D Heggade	Housing in India	Himalaya Publishing House, Bombay.	2015

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RASIPURAM - 637 408.

REFERENCE BOOKS:				
Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Wiley- Blackwell	Neufert Architects	4th Edition, Blackwell Publishing Ltd.	2012
2.	Donald Watson and Michael J.Crosbie	Time Saver Standards for Architectural Design	8th Edition, Tata McGraw Hill Edition.	2011
3.	Walter Martin Hosack	Land Development Calculations	McGraw Hill 2nd Edition.	2010
4	Meera Mehta and Dinesh Mehta	Metropolitan Housing Markets	Sage Publications Pvt. Ltd., New Delhi.	2015
5	Francis Cherunilam and Odeyar D Heggade	Housing in India	Himalaya Publishing House, Bombay.	2012

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5. www.unido.org/.../Environment_friendly_Indian_building_material_tec


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19CEE30

ENGINEERING ECONOMICS AND COST ANALYSIS

L T P C
3 0 0 3

COURSE OBJECTIVES:

- To learn about basics of economics.
- To understand the concepts of demand and schedule.
- To learn about different types of organization
- To learn the concepts behind the process of financing.
- To learn about cost and break even analysis.

COURSE OUTCOMES:

- 19CEE30.CO1 : Know the basic concepts of economics.
 19CEE30.CO2 : Know about demand and schedule
 19CEE30.CO3 : Understand about different types of organizations
 19CEE30.CO4 : Understood the financing process.
 19CEE30.CO5 : Apply cost and break even analysis.

Course Outcomes	Program Outcomes												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
19CEE30.CO1	X	X	X	-	-	X	-	X	X	-	-	X	X	-	-
19CEE30.CO2	X	X	X	-	-	X	-	X	X	-	-	X	X	-	-
19CEE30.CO3	X	X	X	-	-	X	-	X	X	-	-	X	X	-	-
19CEE30.CO4	X	X	X	-	-	X	-	X	X	-	-	X	X	-	-
19CEE30.CO5	X	X	X	-	-	X	-	X	X	-	-	X	X	-	-

UNIT I BASIC ECONOMICS

Definition of economics - nature and scope of economic science - nature and scope of managerial economics - basic terms and concepts - goods - utility - value - wealth - factors of production - land - its peculiarities - labour - economies of large and small scale - consumption - wants - its characteristics and classification - law of diminishing marginal utility - relation between economic decision and technical decision.

UNIT II DEMAND AND SCHEDULE

Demand - demand schedule - demand curve - law of demand - elasticity of demand - types of elasticity - factors determining elasticity - measurement - its significance - supply - supply schedule - supply curve - law of supply - elasticity of supply - time element in the determination of value - market price and normal price - perfect competition - monopoly - monopolistic competition.

UNIT III ORGANISATION

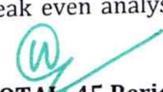
Forms of business - proprietorship - partnership - joint stock company - cooperative organization - state enterprise - mixed economy - money and banking - banking - kinds - commercial banks - central banking functions - control of credit - monetary policy - credit instrument.

UNIT IV FINANCING

Types of financing - Short term borrowing - Long term borrowing - Internal generation of funds - External commercial borrowings - Assistance from government budgeting support and international finance corporations - analysis of financial statement - Balance Sheet - Profit and Loss account - Funds flow statement.

UNIT V COST AND BREAK EVEN ANALYSES

Types of costing - traditional costing approach - activity base costing - Fixed Cost - variable cost - marginal cost - cost output relationship in the short run and in long run - pricing practice - full cost pricing - marginal cost pricing - going rate pricing - bid pricing - pricing for a rate of return - appraising project profitability - internal rate of return - payback period - net present value - cost benefit analysis - feasibility reports - appraisal process - technical feasibility economic feasibility - financial feasibility - Break even analysis - basic assumptions - break even chart - managerial uses of break even analysis.


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TEXT BOOKS:				
Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Dewett K.K and varma J.D	Elementary Economic Theory	S. Chand & Co	2006
2.	Sharma JC	Construction Management and Accounts	Oxford and IBH, New Delhi.	2013

REFERENCE BOOKS:				
Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Adhikary M	Managerial Economics	Khosla Publishers.	2015
2.	n M Y and P K	Financial management	McGraw-Hill publishing	2013
3.	Varshney R L and Maheswary K L	Managerial Economics	S Chand and Co	2017
4.	Ramachandra Aryashri	Engineering Economics and Financial Accounting	McGraw-Hill	2015
5.	Collier, C.A and C. R. Glagola	Engineering Economic and Cost Analysis	Pearson	2012

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