

Fifth Semester					
Group	Paper Code	Paper	L	P	Credits
Theory Papers					
HS/MS	HS-301	Economics for Engineers	2		2
PC	CEC-303	Structural Analysis - II	4		4
PC	CEC-305	Structural Design - II	3		3
PC	CEC-307	Geotechnical Engineering	4		4
PC	CEC-309	Environmental Engineering - II	4		4
PC	CEC-311	Traffic Engineering and Pavement Design	4		4
Practical / Viva Voce					
PC	CEC-351	Structural Design Lab		2	1
PC	CEC-353	Building Material and Concrete Testing Lab		2	1
PC	CEC-355	Geotechnical Engineering Lab		2	1
PC	CEC-357	Environmental Engineering Lab		2	1
PC / Internship	ES-361	Summer Training Report - 1 *			1
Total		-	21	8	26

***NUES:**Comprehensive evaluation of the Summer Training Report – 1 (after 4th Semester) shall be done by the committee of teachers, constituted by the Academic Programme Committee, out of 100. The training shall be of 4 to 6 weeks duration. The training can be under the mentorship of a teacher of the institute.

Sixth Semester					
Group	Paper Code	Paper	L	P	Credits
Theory Papers					
HS/MS	MS-302	Principles of Management for Engineers	3		3
HS/MS	HS-304	Universal Human Values*	1		1
PCE		Programme Core Elective Paper (PCE –1)			4
PCE		Programme Core Elective Paper (PCE – 2)			4
PCE		Programme Core Elective Paper (PCE – 3)			4
EAE / OAE		Emerging Area/Open Area Elective Paper (EAE – 1 /OAE – 1)			4
EAE / OAE		Emerging Area/Open Area Elective Paper (EAE – 2 /OAE – 2)			4
Practical / Viva Voce					
HS/MS	HS-352	NSS / NCC / Cultural Clubs / Technical Society / Technical Club**			2
Total					26

***NUES:**All examinations to be conducted by the concerned teacher as specified in the detailed syllabus of the paper.

****NUES:** Comprehensive evaluation of the students by the concerned coordinator of NCC / NSS / Cultural Clubs / Technical Society / Technical Clubs, out of 100 as per the evaluation schemes worked out by these activity societies, organizations; the faculty co-ordinators shall be responsible for the evaluation of the same. These activities shall start from the 1st semester and the evaluation shall be conducted at the end of the 6th semester for students admitted in the first semester. Students admitted in the 2nd year (3rd semester) as lateral entry shall be evaluated on the basis their performance, by the faculty co-ordinator for the period of 3rd semester to 6th semester only.

Programme Core Electives

Semester	Paper Code	PCE – 1 (Choose Any One)	L	P	Credits
6	CEE-306	Advance Structural Analysis	4		4
6	CEE-308	Irrigation Engineering and Design of Hydraulic Structures	4		4
6	CEE-310	Environmental Impact Assessment	4		4
Semester	Paper Code	PCE – 2 (Choose Any One)	L	P	Credits
6	CEE-312T	Advanced Structural Design	3		3
	CEE-312P	Advanced Structural Design Lab		2	1
6	CEE-314	Water Resource Planning	4		4
6	CEE-316	Pollution Control and Monitoring	4		4
Semester	Paper Code	PCE – 3 (Choose Any One)	L	P	Credits
6	CEE-318T	Non Destructive Evaluation of Structures	3		3
	CEE-318P	Non Destructive Evaluation of Structures Lab		2	1
6	CEE-320	Open Chanel Flow and Sediment Transportation	4		4
6	CEE-322	Disaster Management	4		4
Semester	Paper Code	PCE – 4 (Choose Any One)	L	P	Credits
7	CEE-403	Recent Construction Technologies	4		4
7	CEE-405T	Arc GIS and Remote Sensing	3		3
	CEE-405P	Arc GIS and Remote Sensing Lab		2	1
7	CEE-407T	Transport Planning and Intelligent Transportation System	3		3
	CEE-407P	Transport Planning and Intelligent Transportation System Lab		2	1
Semester	Paper Code	PCE – 5 (Choose Any One)	L	P	Credits
7	CEE-409	Structural Dynamics	4		4
7	CEE-411	Lean Construction Technology and Management	4		4
7	CEE-413T	Advanced Surveying	3		3
	CEE-413P	Advanced Surveying Lab		2	1

Note:

1. An elective shall be offered to the student for each PCE group (That is for PCE-1, PCE-2, etc.) based on the availability of resources and faculty at the institution and at least one third of the batch or at least 20 students must be willing to take the elective. At least two elective per PCE group must be offered to the students of the major discipline.
2. Each PCE slot is of 4 credits, if in a particular slot, the paper has no practical component, then it is of 4 credits (a pure theory paper), otherwise for purpose of examination and conduct of classes, the course is split in two papers, namely a theory paper of 3 credits and a practical paper of 1 credit. The student has to study for 4 credits per slot of PCE group. This is reflected by suffixing the paper code by T (for Theory component) and P (for Practical component), if required.

Emerging Area Specialization: Construction Technology and Management (for CE)

Semester	Paper Group	Paper Code	Paper Name	L	P	Credits
6	CTM-EAE-1	CEC-308	Contract Management	4		4
6	CTM-EAE-2	CEC-310	Advanced Construction Materials and Practices	4		4
7	CTM-EAE-3	CEC-413	Quality and Safety Management	4		4
7	CTM-EAE-4	CEC-415	Lean Construction Technology and Management	4		4
7	CTM-EAE-5	CEC-417	Recent Construction Technologies	4		4

Emerging Area Specialization: Infrastructure Engineering (for CE)

Semester	Paper Group	Paper Code	Paper Name	L	P	Credits
6	IE-EAE-1	IE-322	Water Resource Planning	4		4
6	IE-EAE-2	IE-324	Advanced Environmental Engineering and Design	4		4
7	IE-EAE-3	IE-435	Metro Systems Engineering	4		4
7	IE-EAE-4	IE-437T	Transport Planning and Intelligent Transportation System	3		3
		IE-437P	Transport Planning and Intelligent Transportation System Lab		2	1
7	IE-EAE-5	IE-439	Analysis and Design of High-rise Buildings and Bridges	4		4

Emerging Area Specialization: Green Technology and Sustainability Engineering (for CE)

Semester	Paper Group	Paper Code	Paper Name	L	P	Credits
6	GTSE-EAE-1	GTSE-318	Planning and Design of Green Buildings	4		4
6	GTSE-EAE-2	GTSE-320	Sustainable Materials and Practices	4		4
7	GTSE-EAE-3	GTSE-429	Green Energy Concepts in Smart Cities	4		4
7	GTSE-EAE-4	GTSE-431	Intelligent Transportation System	4		4
7	GTSE-EAE-5	GTSE-433	Sustainable Engineering Technologies	4		4

Advance Structural Analysis	L	P	C
	4		4

Discipline(s) / EAE / OAE	Semester	Group	Sub-group	Paper Code
CE	6	PCE	PCE-1	CEE-306

Marking Scheme:												
1. Teachers Continuous Evaluation: 25 marks												
2. Term end Theory Examinations: 75 marks												
Instructions for paper setter:												
1. There should be 9 questions in the term end examinations question paper.												
2. The first (1st) question should be compulsory and cover the entire syllabus. This question should be objective, single line answers or short answer type question of total 15 marks.												
3. Apart from question 1 which is compulsory, rest of the paper shall consist of 4 units as per the syllabus. Every unit shall have two questions covering the corresponding unit of the syllabus. However, the student shall be asked to attempt only one of the two questions in the unit. Individual questions may contain upto 5 sub-parts / sub-questions. Each Unit shall have a marks weightage of 15.												
4. The questions are to be framed keeping in view the learning outcomes of the course / paper. The standard / level of the questions to be asked should be at the level of the prescribed textbook.												
5. The requirement of (scientific) calculators / log-tables / data – tables may be specified if required.												
Course Objectives :												
1.	To discuss concept of arches and its ILDs, curved beams.											
2.	To find behaviour of cables, structure by plastic theory.											
3.	To explain basics of matrix methods and its use in flexibility matrix method.											
4.	To use stiffness matrix method, direct stiffness methods for analysis of structures.											
Course Outcomes (CO)												
CO 1	Explain reactions and forces in arches, curved beam.											
CO 2	Evaluate structural response of cables, plastic theory.											
CO 3	Determine relation between stiffness and flexibility matrix, unknowns in indeterminate structures by flexibility matrix method.											
CO 4	Analyse indeterminate structures by stiffness methods											
Course Outcomes (CO) to Programme Outcomes (PO) mapping (scale 1: low, 2: Medium, 3: High)												
	PO01	PO02	PO03	PO04	PO05	PO06	PO07	PO08	PO09	PO10	PO11	PO12
CO 1	2	1	3	-	-	-	-	-	-	-	-	-
CO 2	2	3	1	-	-	-	-	-	-	-	-	-
CO 3	1	3	-	-	2	-	-	-	-	-	-	-
CO 4	1	3	-	-	2	-	-	-	-	-	-	-
UNIT-I												
Arches: Theory of arches, Eddy's theorem, Circular, parabolic and geometric arches, Linear arch, concept of radial shear force and axial thrust, analysis of three hinged and two hinged arches with various loads, Effect of yielding of supports, rib shortening and temperature changes, tied arches, ILD for two hinged arches, ILD for three-hinged arches.												
Curved beam: Introduction, forces on curved beams, analysis of circular arch cantilever beam.												
UNIT-II												
Cables: Introduction, components and functions, Equilibrium of cable, Cables subjected to concentrated load and uniformly distributed load, length of cable, effect of change in temperature in suspension cables.												
Plastic Analysis of structures: Introduction, Plastic bending of beams, shape factors, Plastic hinges, Types of Mechanisms, Load Factors, Numerical- beams and frames												

UNIT-III

Matrix Analysis of structure: Introduction, Force and displacement methods of analysis, flexibility influence coefficients and stiffness influence coefficients, Relation between flexibility matrix and stiffness matrix.

Flexibility matrix method: Development of flexibility matrices by physical approach, Flexibility matrices for truss and frame elements, load transformation matrix, development of total flexibility matrix of the structure, analysis of simple structures, plane truss and plane frame, nodal loads and element loads, lack of fit and temperature effects.

UNIT – IV

Stiffness matrix method: Development of stiffness matrices by physical approach, stiffness matrices for truss and frame elements, displacement transformation matrix, development of total stiffness matrix, analysis of simple structures, plane truss and plane frame, nodal loads and element loads, lack of fit and temperature effects.

Direct stiffness method: Introduction, element stiffness matrix, rotation transformation matrix, transformation of displacement and load vectors and stiffness matrix, Introduction to finite element method.

Textbook(s):

1. S S Bhavikatti, "Structural Analysis (Vol.I and II)", Vikas Publication, Fourth Edition (2011)
2. S. Ramamrutham, R. Narayan, "Theory of Structures", Dhanpat Rai Publishing Company, (2017)

References:

1. C.S. Reddy, "Basic Structural Analysis", Tata McGraw Hill (2017)
2. Devdas Menon, "Advanced Structural Analysis", Narosa Publishing House (2015)
3. R.C. Hibbler, "Structural Analysis", Pearson Education
4. C.K. Wang, "Matrix methods of structural analysis", International Textbook Company

Advanced Structural Design	L	P	C
	3		3

Discipline(s) / EAE / OAE	Semester	Group	Sub-group	Paper Code
CE	6	PCE	PCE-2	CEE-312T

Marking Scheme:												
1. Teachers Continuous Evaluation: 25 marks												
2. Term end Theory Examinations: 75 marks												
Instructions for paper setter:												
1. There should be 9 questions in the term end examinations question paper.												
2. The first (1st) question should be compulsory and cover the entire syllabus. This question should be objective, single line answers or short answer type question of total 15 marks.												
3. Apart from question 1 which is compulsory, rest of the paper shall consist of 4 units as per the syllabus. Every unit shall have two questions covering the corresponding unit of the syllabus. However, the student shall be asked to attempt only one of the two questions in the unit. Individual questions may contain upto 5 sub-parts / sub-questions. Each Unit shall have a marks weightage of 15.												
4. The questions are to be framed keeping in view the learning outcomes of the course / paper. The standard / level of the questions to be asked should be at the level of the prescribed textbook.												
5. The requirement of (scientific) calculators / log-tables / data – tables may be specified if required.												
Course Objectives :												
1.	To know the concept of designing RCC structure using Indian codes.											
2.	To know the concept design and analysis of earthquake-resistant structure.											
3.	To calculate and design plate girder and gantry girder.											
4.	To familiarize students about flat slab and its design.											
Course Outcomes (CO)												
CO 1	Analyse earthquake-resistant structure using IS: 1893:2016. Design of G+3 Building using IS: 456:2000											
CO 2	Design of water tank using IS: 3370.											
CO 3	Calculate and design girder using IS: 800:2007											
CO 4	Analysis and Design of Industrial Building.											
Course Outcomes (CO) to Programme Outcomes (PO) mapping (scale 1: low, 2: Medium, 3: High)												
	PO01	PO02	PO03	PO04	PO05	PO06	PO07	PO08	PO09	PO10	PO11	PO12
CO 1	2	1	-	-	-	-	-	-	-	-	-	3
CO 2	1	-	-	-	2	-	-	-	-	-	-	3
CO 3	3	1	-	-	-	-	2	-	-	-	-	-
CO 4	1	-	-	-	3	-	-	-	-	-	-	2
Unit I												
Introduction to Seismic design: General principles of seismic design, Introduction to IS 1893 : 2002, Building equivalent static analysis, Vertical distribution of seismic forces and horizontal shears, dynamic analysis, design spectrum, Seismic weights, Modal combination, Load combinations and permissible stresses, Guidelines for earthquake resistant design, Ductile detailing for seismic design, Analysis for lateral Loads: Introduction to IS 875 Part-III. Design of G+3 Building. Design of slab, beam, column and footing as per IS 456:2000.												
Unit II												
Concrete structure design: Design of elevated and underground water tanks as per IS: 3370 and IS: 1893 Part-V. Forces acting on the water tank. Types of water tanks. Design of retaining walls, Types of retaining wall, Various conditions of backfill, Components of Retaining wall, Forces acting on retaining wall, stability checks, Design of Box culvert.												

Unit III

Beam supported and unsupported, Plate girder, Types of Plate Girder, Components of Plate Girder, Gantry girder including lateral and flexural torsional building, design of structural elements, Components of plate girder. Components of Gantry Girder, Loads acting on gantry girder, Types of gantry girder, and design of gantry girder as per IS: 800:2007

Unit IV

Design of Industrial Building. Introduction, Roof and side coverings, Design loads, purlins, end bearings, general framing of industrial buildings, bracings. Components of Industrial Building. Wind load analysis using IS:875:2016 (All Parts), Orientation of Purlins. Types of Roof Coverings, Permissible loads to be considered for each component of industrial building.

Textbook(s):

1. N. Krishna Raju, R.N.Pranesh, "Reinforced concrete Design", CBS Publishers
2. S.K Duggal, Design of Steel Structure, P.C.Varghese, "Advance Reinforced Concrete Design" PHI Delhi

References:

1. N. Krishna Raju, "Prestressed concrete", Tata McGraw Hill.
2. Arther H. Nilson, "Design of concrete structures", Tata McGraw Hill
3. Arya and Ajamani, "Design of steel structures", Nem Chand and Bros. Publishers
4. C. Syal and A.K. Goel, "Reinforced concrete structures", S. Chand.
5. Prestressed concrete, Pandit and Gupta, CBS
6. T.Y. Lin, Design of Prestressed Concrete Structures, Asia Publishing House, 1955.
7. Edward Nawy, Prestressed Concrete: A fundamental approach, prentice hall, New Jersey
8. BIS 1893 – 2002 and BIS 875 Part III
9. Krishna Raju, "Advance Reinforced concrete Design" CBS Publishers

Advanced Structural Design Lab	L	P	C
		2	1

Discipline(s) / EAE / OAE	Semester	Group	Sub-group	Paper Code
CE	6	PCE	PCE-2	CEE-312P

Marking Scheme:

1. Teachers Continuous Evaluation: 40 marks
2. Term end Theory Examinations: 60 marks

Instructions:

1. The course objectives and course outcomes are identical to that of (Advanced Structural Design) as this is the practical component of the corresponding theory paper.
2. The practical list shall be notified by the teacher in the first week of the class commencement under intimation to the office of the Head of Department / Institution in which the paper is being offered from the list of practicals below. Atleast 10 experiments must be performed by the students, they may be asked to do more. Atleast 5 experiments must be from the given list.

1. To design G+3 Building using STAAD PRO.
2. To determine and design a water tank in STAAD PRO using IS:3370 (Part IV)
3. Earthquake Analysis of Buildings as per IS:1893:2016.
4. Wind Analysis of Buildings as per IS 875:2007(Part 3).
5. Design of Retaining Wall.
6. Design of Industrial Building.
7. Design of gantry girder using IS:800:2007
8. Design of Prestressed Concrete Structure as per IS:1343
9. Design and prepare a prototype model of all structural components showing detailing of reinforcement.

Building Material and Concrete Testing Lab	L	P	C
		2	1

Discipline(s) / EAE / OAE	Semester	Group	Sub-group	Paper Code
CE	5	PC	PC	CEC-353

Marking Scheme:												
1. Teachers Continuous Evaluation: 40 marks												
2. Term end Theory Examinations: 60 marks												
Instructions:												
1. The practical list shall be notified by the teacher in the first week of the class commencement under intimation to the office of the Head of Department / Institution in which the paper is being offered from the list of practicals below. Atleast 10 experiments must be performed by the students, they may be asked to do more. Atleast 5 experiments must be from the given list.												
Course Objectives:												
1.	To understand the building material, characterization and its application											
2.	To recognize the importance of material characteristics and their contributions to strength development in Concrete											
3.	To identify the suitable material for construction and various building components											
4.	To ascertain and measure engineering properties of concrete in fresh and hardened state which meet the requirement of real time structures											
Course Outcomes (CO)												
CO 1	Assess the different properties of Cement.											
CO 2	Determine the different properties of aggregates.											
CO 3	Understand the standard testing procedure of bricks, sand, concrete, aggregate, etc											
CO 4	Design & describe the preparation of concrete and testing of concrete											
Course Outcomes (CO) to Programme Outcomes (PO) mapping (scale 1: low, 2: Medium, 3: High)												
	PO01	PO02	PO03	PO04	PO05	PO06	PO07	PO08	PO09	PO10	PO11	PO12
CO 1	3	3	-	3	3	2	-	-	3	2	-	2
CO 2	3	3	-	3	3	2	-	-	3	2	-	2
CO 3	3	3	-	3	3	2	-	-	3	2	-	3
CO 4	3	3	-	3	3	2	-	-	3	2	-	3

1. Shape & size, water absorption and compressive strength of brick
2. Normal consistency, initial and final setting time of cement.
3. Fineness and soundness of cement.
4. Heat of hydrations of cement, specific gravity of cement, fine and coarse aggregates.
5. Sieve analysis and fineness modulus of fine and coarse aggregates.
6. Water absorption fine and coarse aggregates and impurities tests on aggregates.
7. Compressive strength, workability of lime and cement mortars.
8. Proportioning of aggregates and mix design.
9. Work ability by slump test, compaction factors and Vee-bee consistometer test along with compressive and tensile strength of concrete.
10. Non-destructive tests on concrete (Rebound hammer and UPVT)

Disaster Management	L	P	C
	4		4

Discipline(s) / EAE / OAE	Semester	Group	Sub-group	Paper Code
CE	6	PCE	PCE-3	CEE-322

Marking Scheme:												
1. Teachers Continuous Evaluation: 25 marks												
2. Term end Theory Examinations: 75 marks												
Instructions for paper setter:												
1. There should be 9 questions in the term end examinations question paper.												
2. The first (1st) question should be compulsory and cover the entire syllabus. This question should be objective, single line answers or short answer type question of total 15 marks.												
3. Apart from question 1 which is compulsory, rest of the paper shall consist of 4 units as per the syllabus. Every unit shall have two questions covering the corresponding unit of the syllabus. However, the student shall be asked to attempt only one of the two questions in the unit. Individual questions may contain upto 5 sub-parts / sub-questions. Each Unit shall have a marks weightage of 15.												
4. The questions are to be framed keeping in view the learning outcomes of the course / paper. The standard / level of the questions to be asked should be at the level of the prescribed textbook.												
5. The requirement of (scientific) calculators / log-tables / data – tables may be specified if required.												
Course Objectives :												
1.	To provide a general concept in the dimensions of disasters caused by nature beyond the human control											
2.	To familiarize the student about the disasters and environmental hazards induced by human activities											
3.	To aware about disaster preparedness, response and recovery.											
4.	To know about the latest technology in mitigation of disasters											
Course Outcomes (CO)												
CO 1	Understand the knowledge of the significance of disaster management,											
CO 2	Analyse the occurrences, reasons and mechanism of various types of disaster											
CO 3	Understand the preventive measures as Civil Engineer with latest codal provisions											
CO 4	Apply the latest technology in mitigation of disasters											
Course Outcomes (CO) to Programme Outcomes (PO) mapping (scale 1: low, 2: Medium, 3: High)												
	PO01	PO02	PO03	PO04	PO05	PO06	PO07	PO08	PO09	PO10	PO11	PO12
CO 1	3	1	1	2	2	3	-	-	-	-	-	-
CO 2	3	3	1	2	1	3	-	-	-	-	-	-
CO 3	2	2	3	2	2	2	-	-	-	-	-	-
CO 4	2	2	3	1	1	2	-	-	-	-	-	-
UNIT-I												
Introduction: Disaster, Emergency, Hazard, Mitigation, Disaster Prevention,												
Geological based disasters: Earthquake, Tsunamis, Landslides and avalanches: Definition, causes and structure; past lesson learnt and measures taken; their Characteristic features, Impact and prevention, Atlas (BMTRPC); structural and non-structural measures.												
Man-made Disaster: Fire, Industrial Pollution, Nuclear Disaster, Biological Disasters, Accidents (Air, Sea, Rail & Road), Structural failures (Building and Bridge), War & Terrorism etc. Causes, effects and practical examples for all disasters.												
UNIT-II												
Hydro-meteorological based disasters: Disaster Management Act 2005, Role of NDMA, NDRF, NIDM, Tropical Cyclones, Floods, droughts, mechanism, causes, role of Indian Meteorological Department, Central Water												

Commission, structure and their impacts, classifications, vulnerability. Desertification Zones, causes and impacts of desertification, Characteristics, Vulnerability to India and Step to combat desertification, Forest Fires; Causes of Forest Fires; Impact of Forest Fires, Prevention.

UNIT-III

Disaster Preparedness and Response Preparedness: Disaster Preparedness: Concept and Nature, Disaster Preparedness Plan, Prediction, Early Warnings and Safety Measures of Disaster, Role of Information, Education, Communication, and Training, Role of Government, International and NGO Bodies, Role of IT in Disaster Preparedness, Role of Engineers on Disaster Management

Response: Introduction to Disaster Response, Response Plan, Communication, Participation, and Activation of Emergency Preparedness Plan, Search, Rescue, Evacuation and Logistic Management, Role of Government, International and NGO Bodies.

UNIT – IV

Rehabilitation, Reconstruction and Recovery: Reconstruction and Rehabilitation as a Means of Development, Damage Assessment, Post Disaster effects and Remedial Measures, Creation of Long-term Job Opportunities and Livelihood Options, Disaster Resistant House Construction, Sanitation and Hygiene, Education and Awareness, Dealing with Victims' Psychology, Long-term Counter Disaster Planning, Role of Educational Institute

Textbook(s):

1. J. P. Singhal Disaster Management Laxmi Publications
2. Dr. Mrinalini Pandey Disaster Management Wiley India Pvt. Ltd.

References:

1. Savindra Singh and Jeetendra Singh, Disaster Management, Pravalika Publications, Allahabad
2. Nidhi GaubaDhawan and Ambrina Sardar Khan, Disaster Management and Preparedness, CBS Publishers & Distribution
3. Selected Resources Published by the National Disaster Management Institute of Home Affairs, Govt. of India, New Delhi.

Economics for Engineers	L	P	C
	2		2

Discipline(s) / EAE / OAE	Semester	Group	Sub-group	Paper Code
All	5	HS/MS	HS	HS-301

Marking Scheme:												
1. Teachers Continuous Evaluation: 25 marks												
2. Term end Theory Examinations: 75 marks												
Instructions for paper setter:												
1. There should be 9 questions in the term end examinations question paper.												
2. The first (1st) question should be compulsory and cover the entire syllabus. This question should be objective, single line answers or short answer type question of total 15 marks.												
3. Apart from question 1 which is compulsory, rest of the paper shall consist of 4 units as per the syllabus. Every unit shall have two questions covering the corresponding unit of the syllabus. However, the student shall be asked to attempt only one of the two questions in the unit. Individual questions may contain upto 5 sub-parts / sub-questions. Each Unit shall have a marks weightage of 15.												
4. The questions are to be framed keeping in view the learning outcomes of the course / paper. The standard / level of the questions to be asked should be at the level of the prescribed textbook.												
5. The requirement of (scientific) calculators / log-tables / data – tables may be specified if required.												
Course Objectives :												
1.	To explain the basic micro and macro economics concepts.											
2.	To analyze the theories of production, cost, profit and break even analysis.											
3.	To evaluate the different market structures and their implications for the behavior of the firm.											
4.	To apply the basics of national income accounting and business cycles to Indian economy.											
Course Outcomes (CO)												
CO 1	Analyze the theories of demand, supply, elasticity and consumer choice in the market.											
CO 2	Analyze the theories of production, cost, profit and break even analysis.											
CO 3	Evaluate the different market structures and their implications for the behavior of the firm.											
CO 4	Apply the basics of national income accounting and business cycles to Indian economy.											
Course Outcomes (CO) to Programme Outcomes (PO) mapping (scale 1: low, 2: Medium, 3: High)												
	PO01	PO02	PO03	PO04	PO05	PO06	PO07	PO08	PO09	PO10	PO11	PO12
CO 1	1	2	1	2	1	-	1	-	1	1	3	1
CO 2	1	2	1	2	1	-	1	-	1	1	3	1
CO 3	1	2	1	2	1	-	1	-	1	1	3	1
CO 4	1	2	1	2	1	-	1	-	1	1	3	1
UNIT-I												
Introduction: Economics Definition, Basic economic problems, Resource constraints and welfare maximization. Micro and Macro economics. Production Possibility Curve. Circular flow of economic activities.												
Basics of Demand, Supply and Equilibrium: Demand side and supply side of the market. Factors affecting demand & supply. Elasticity of demand & supply – price, income and cross-price elasticity. Market equilibrium price.												
UNIT-II												
Theory of Consumer Choice: Theory of Utility and consumer's equilibrium. Indifference Curve analysis, Budget Constraints, Consumer Equilibrium.												
Demand forecasting: Regression Technique, Time-series, Smoothing Techniques: Exponential, Moving Averages Method												

UNIT-III

Cost Theory and Analysis: Nature and types of cost, Cost functions- short run and long run, Economies and diseconomies of scale

Market Structure: Market structure and degree of competition Perfect competition, Monopoly, Monopolistic competition, Oligopoly

UNIT - IV

National Income Accounting: Overview of Macroeconomics, Basic concepts of National Income Accounting

Macro Economics Issues: Introduction to Business Cycle, Inflation-causes, consequences and remedies: Monetary and Fiscal policy.

Textbook(s):

1. H.C. Petersen, W.C. Lewis, Managerial Economics, 4th ed., Pearson Education 2001.

References:

1. S.K. Misra & V. K. Puri, Indian Economy, 38th ed., Himalaya Publishing House, 2020.

2. D.N. Dwivedi, Managerial Economics, 8th Edition, Vikas Publishing house

3. D. Salvatore, Managerial Economics in a Global Economy, 8th ed., Oxford University Press, 2015.

4. S. Damodaran, Managerial Economics, 2nd ed., Oxford University Press, 2010.

5. M. Hirschey, Managerial Economics, 12th ed., Cengage India, 2013.

6. P.A. Samuelson, W.D. Nordhaus, S. Nordhaus, Economics, 18th ed., Tata Mc-Graw Hill, 2006.

Environmental Engineering - II	L	P	C
	4		4

Discipline(s) / EAE / OAE	Semester	Group	Sub-group	Paper Code
CE	5	PC	PC	CEC-309

Marking Scheme:												
1. Teachers Continuous Evaluation: 25 marks												
2. Term end Theory Examinations: 75 marks												
Instructions for paper setter:												
1. There should be 9 questions in the term end examinations question paper.												
2. The first (1st) question should be compulsory and cover the entire syllabus. This question should be objective, single line answers or short answer type question of total 15 marks.												
3. Apart from question 1 which is compulsory, rest of the paper shall consist of 4 units as per the syllabus. Every unit shall have two questions covering the corresponding unit of the syllabus. However, the student shall be asked to attempt only one of the two questions in the unit. Individual questions may contain upto 5 sub-parts / sub-questions. Each Unit shall have a marks weightage of 15.												
4. The questions are to be framed keeping in view the learning outcomes of the course / paper. The standard / level of the questions to be asked should be at the level of the prescribed textbook.												
5. The requirement of (scientific) calculators / log-tables / data – tables may be specified if required.												
Course Objectives :												
1.	To analyse the Physical, Chemical and Biological characteristics of wastewater.											
2.	To understand various processes of disposal of sewage.											
3.	Able to differentiate various unit operations and processes with design applications.											
4.	To explain municipal solid waste sources, its characteristics and treatment options.											
Course Outcomes (CO)												
CO 1	Analyse the Physical, Chemical and Biological characteristics of wastewater.											
CO 2	Understand various processes of disposal of sewage.											
CO 3	Differentiate various unit operations and processes with design applications.											
CO 4	Explain municipal solid waste sources, its characteristics and treatment options.											
Course Outcomes (CO) to Programme Outcomes (PO) mapping (scale 1: low, 2: Medium, 3: High)												
	PO01	PO02	PO03	PO04	PO05	PO06	PO07	PO08	PO09	PO10	PO11	PO12
CO 1	1	3	2	3	0	0	2	0	0	0	1	0
CO 2	2	1	3	3	2	1	1	0	1	1	1	2
CO 3	1	2	3	3	2	1	0	0	0	1	1	1
CO 4	2	1	1	2	2	1	2	0	1	1	1	1
UNIT-I												
Sewerage systems and their components: Introduction to sewerage system, Estimation of sewerage and drainage discharge, Dry weather flow, capacity of sewers, self-cleansing and non-scouring velocities, calculations of sizes and grades, forms and cross sections of sewers, hydraulic characteristics of circular sewer sections, egg shaped sewers, systems of drainage, separate, combined and partially combined systems.												
Quality and characteristics of sewage: physical, chemical and biological characteristics of sewage, Aerobic and anaerobic decomposition of sewage, nitrogen, sulphur and carbon cycles, population equivalent, relative stability.												
UNIT-II												
Disposal of Sewage Effluents: Disposal of treated / untreated / partially treated effluents in natural water bodies, Self-purification of stream, Standard for effluent disposal on land, Disposal by land treatment / sewage farming methods, sewage sickness and its preventive measures, Treatment standards for sewage effluents.												

Primary Treatment of Wastewater: Types of treatment units in primary treatment, their functions and efficiencies, analysis and design of screening, grit chambers, detritus tank, skimming tanks and primary sedimentation tank.

UNIT III

Secondary Treatment of Wastewater: Concepts of Biological treatment and removal mechanism, Aerobic and Anaerobic systems, analysis and design of attached and suspended growth systems like–trickling filter, Rotatory biological contractor, activated sludge process, septic tank, upflow anaerobic sludge blanket reactor (UASB), Imhoff tank, and oxidation pond; secondary sedimentation tank.

Sludge Thickening and Sludge Digestion: Sludge characteristics, sludge volume and solids relationships, Aerobic and anaerobic digestion, Factors affecting sludge digestion and their control, disposal of digested sludge.

UNIT IV

Municipal Solid Wastes and its Disposal: Sources and collection of municipal solid wastes, characteristics of solid wastes, treatment and disposal–sanitary landfilling method, composting, incineration, thermal pyrolysis, dumping in-to the sea, pulverisation and shredding, autoclaving.

Textbook(s):

1. S.K. Garg, Sewage Disposal and Air Pollution Engineering (Environmental Engineering Vol.-II).
2. Dr. B.C. Punmia, Ashok Kr. Jain, Arun Kr. Jain, Wastewater Engineering, Laxmi Publications.

References:

1. Metcalf and Eddy, Wastewater Engineering: Treatment and Reuse, Tata McGraw-Hill, New Delhi.
2. G L Karia and R A Christian, Wastewater Treatment Concepts and Design Approach, Prentice Learning Private Ltd., New Delhi.
3. Manuel of Sewerage and Sewage Treatment, CPH and EE organization, Ministry of Works and Housing, Govt. of India, New Delhi, 2006.
4. S R Qasim, and G Zhu, Wastewater Treatment and Reuse, CRC Press, Taylor and Francis Group, New York.
5. M L Davis, Water and Wastewater Engineering, McGraw-Hill, New Delhi.

Environmental Engineering Lab	L	P	C
		2	1

Discipline(s) / EAE / OAE	Semester	Group	Sub-group	Paper Code
CE	5	PC	PC	CEC-357

Marking Scheme:

1. Teachers Continuous Evaluation: 40 marks
2. Term end Theory Examinations: 60 marks

Instructions:

1. The course objectives and course outcomes are identical to that of (Environmental Engineering) as this is the practical component of the corresponding theory paper.
2. The practical list shall be notified by the teacher in the first week of the class commencement under intimation to the office of the Head of Department / Institution in which the paper is being offered from the list of practicals below. Atleast 10 experiments must be performed by the students, they may be asked to do more. Atleast 5 experiments must be from the given list.

1. To determine pH, turbidity, electrical conductivity of the given sample.
2. To determine the total hardness, calcium and magnesium in the given sample.
3. To find the amount of Fluoride, Sulfate, iron and manganese in the given sample.
4. To determine the optimum coagulant dose quantity for a given sample of raw water.
5. To determine chlorine demand and residual chlorine.
6. To determine the most probable number [MPN] of coli-forms of the given sample.
7. To determine the solids [total, suspended and dissolved] of the given sample
8. To find out total settle-able solids [by Imhoff Cone] in the given wastewater sample.
9. To estimate the amount of dissolved oxygen present in the given wastewater sample.
10. To estimate the value of biochemical oxygen demand [BOD] in the given water sample/sewage sample.
11. To find out chemical oxygen demand [COD] of the given wastewater sample.
12. Field visit of water/sewage treatment plant.

Environmental Impact Assessment	L	P	C
	4		4

Discipline(s) / EAE / OAE	Semester	Group	Sub-group	Paper Code
CE	6	PCE	PCE-1	CEE-310

Marking Scheme:												
1. Teachers Continuous Evaluation: 25 marks												
2. Term end Theory Examinations: 75 marks												
Instructions for paper setter:												
1. There should be 9 questions in the term end examinations question paper.												
2. The first (1st) question should be compulsory and cover the entire syllabus. This question should be objective, single line answers or short answer type question of total 15 marks.												
3. Apart from question 1 which is compulsory, rest of the paper shall consist of 4 units as per the syllabus. Every unit shall have two questions covering the corresponding unit of the syllabus. However, the student shall be asked to attempt only one of the two questions in the unit. Individual questions may contain upto 5 sub-parts / sub-questions. Each Unit shall have a marks weightage of 15.												
4. The questions are to be framed keeping in view the learning outcomes of the course / paper. The standard / level of the questions to be asked should be at the level of the prescribed textbook.												
5. The requirement of (scientific) calculators / log-tables / data – tables may be specified if required.												
Course Objectives :												
1.	To Define and Classify Environmental Impacts and the terminology											
2.	To Understand the environmental Impact assessment procedure											
3.	To Explain the EIA methodology											
4.	To List and describe environmental audits											
Course Outcomes (CO)												
CO 1	Identify the environmental attributes to be considered for the EIA study											
CO 2	Formulate objectives of the EIA studies											
CO 3	Identify the methodology to prepare rapid EIA											
CO 4	Prepare EIA reports and environmental management plans											
Course Outcomes (CO) to Programme Outcomes (PO) mapping (scale 1: low, 2: Medium, 3: High)												
	PO01	PO02	PO03	PO04	PO05	PO06	PO07	PO08	PO09	PO10	PO11	PO12
CO 1	1	-	-	2	-	3	-		-	-	2	-
CO 2	-	1	-	2	-	-	-	3		1	-	1
CO 3	-	3	1	-	1	-	2	-	1	1	-	-
CO 4	-	2	-	-	1	-	1	-	2	-	1	3
UNIT-I												
Introduction: The Need for EIA, Indian Policies Requiring EIA, The EIA Cycle and Procedures, Screening, Scoping, Baseline Data, Impact Prediction, Assessment of Alternatives, Delineation of Mitigation Measure and EIA Report, Public Hearing, Decision Making, Monitoring the Clearance Conditions, Components of EIA, Roles in the EIA Process. Government of India Ministry of Environment and Forest Notification (2000), List of projects requiring Environmental clearance, Composition of Expert Committee, Ecological sensitive places, International agreements.												
UNIT-II												

EIA Methodologies: Environmental attributes-Criteria for the selection of EIA methodology, impact identification, impact measurement, impact interpretation & Evaluation, impact communication, Methods-Ad Hoc methods, Checklists methods, Matrices methods, Networks methods, Overlays methods. EIA review-Baseline Conditions -Construction Stage Impacts, post project impacts.

UNIT-III

Environmental Management Plan: Environment Management Plan Preparation, Monitoring of Environmental Management Plan, Identification of Significant or Unacceptable Impacts Requiring Mitigation, Mitigation Plans and Relief & Rehabilitation, Stipulating the Conditions, Monitoring Methods, Pre- Appraisal and Appraisal. Preparation of EIA for developmental projects- Factors to be considered in making assessment decisions.

UNIT – IV

Environmental Legislation and Life cycle Assessment: Environmental laws and protection acts, Constitutional provisions-powers and functions of Central and State government, The Environment (Protection) Act 1986, The Water Act 1974, The Air act 1981, Wild Life act 1972, Guidelines for control of noise, loss of biodiversity, solid and Hazardous waste management rules.

Life cycle assessment: Life cycle analysis, Methodology, Management, Flow of materials-cost criteria- case studies.

Textbook(s):

1. Barthwal, R. R., Environmental Impact Assessment, New Age International Publishers, 2002
2. Anjaneyulu. Y and Manickam. V., Environmental Impact Assessment Methodologies, B.S. Publications, 2007

References:

1. Jain, R.K., Urban, L.V., Stracy, G.S., Environmental Impact Analysis, Van Nostrand Reinhold Co., 1991.
2. Rau, J.G. and Wooten, D.C., Environmental Impact Assessment, McGraw Hill Pub. Co., 1996.

Geotechnical Engineering	L	P	C
	4		4

Discipline(s) / EAE / OAE	Semester	Group	Sub-group	Paper Code
CE	5	PC	PC	CEC-307

Marking Scheme:												
1. Teachers Continuous Evaluation: 25 marks												
2. Term end Theory Examinations: 75 marks												
Instructions for paper setter:												
1. There should be 9 questions in the term end examinations question paper.												
2. The first (1st) question should be compulsory and cover the entire syllabus. This question should be objective, single line answers or short answer type question of total 15 marks.												
3. Apart from question 1 which is compulsory, rest of the paper shall consist of 4 units as per the syllabus. Every unit shall have two questions covering the corresponding unit of the syllabus. However, the student shall be asked to attempt only one of the two questions in the unit. Individual questions may contain upto 5 sub-parts / sub-questions. Each Unit shall have a marks weightage of 15.												
4. The questions are to be framed keeping in view the learning outcomes of the course / paper. The standard / level of the questions to be asked should be at the level of the prescribed textbook.												
5. The requirement of (scientific) calculators / log-tables / data – tables may be specified if required.												
Course Objectives :												
1.	To analyse bearing capacity and settlement of soil for shallow foundation.											
2.	To understand the basics of pile foundation and evaluate the pile load carrying capacity.											
3.	To interpret the earth pressure and understand various sheet pile walls.											
4.	To analyse the stability of slopes and classify various soil stabilization methods.											
Course Outcomes (CO)												
CO 1	Understand various methods of soil exploration and analyse bearing capacity as well as settlement of soil for shallow foundation.											
CO 2	Evaluate the load carrying capacity of pile foundation.											
CO 3	Interpret the earth pressure and understand various types of sheet pile walls.											
CO 4	Analyse the stability of slopes and classify various stabilization methods.											
Course Outcomes (CO) to Programme Outcomes (PO) mapping (scale 1: low, 2: Medium, 3: High)												
	PO01	PO02	PO03	PO04	PO05	PO06	PO07	PO08	PO09	PO10	PO11	PO12
CO 1	2	1	2	3	0	0	2	0	0	0	1	0
CO 2	3	2	2	3	2	1	1	0	1	1	1	2
CO 3	3	3	2	3	2	1	0	0	0	1	1	1
CO 4	2	2	3	2	2	1	2	0	1	1	1	1
UNIT-I												
Sub-soil Exploration: Methods of site exploration, Soil samples and samplers, Penetration tests, Geophysical methods-seismic refraction method, Electrical resistivity method.												
Shallow Foundations: Types of foundations, guidelines for selection of foundation, Factors influencing selection of depth of foundation, Terminologies used for analysis of bearing capacity, Modes of shear failures, Factors affecting bearing capacity, Terzaghi's, Skempton's and Meyerhof's bearing capacity theories, Effect of water table, IS code method, Plate load test, Standard penetration test, Static cone penetration test.												
Settlement of Shallow Foundations: Components of settlement, Immediate settlement, Differential settlement, Angular settlement, Contact pressure and settlement under rigid and flexible footings.												
UNIT-II												
Deep Foundation: Classification of piles, Selection of type of pile, Static methods for determining pile load capacity, Dynamic methods for determining pile load capacity, Pile load test, Penetration tests, Group action												

of piles, Group efficiency, Group settlement ratio, Settlement of pile group in clay, Negative skin friction, Underreamed pile foundations.

Well Foundation: Introduction, Types & components of a Well Foundation, Shapes of well.

UNIT-III

Earth Pressure: Introduction, Earth pressure at rest, Active and passive state, Rankine's earth pressure theory, his approach for determining active and passive earth pressure in frictional and $c-\phi$ soil, Coulomb's theory of earth pressure, Graphical method.

Sheet Pile walls: Classification of sheet pile walls, Cantilever sheet pile wall, Anchored sheet pile wall and Braced sheeting.

UNIT – IV

Stability analysis of slopes: Introduction, Factor of safety analysis of finite and infinite slopes, Types of slope failure, Swedish slip circle method, Taylors stability number, Friction circle method.

Stabilisation of soils: Methods of stabilisation, Mechanical stabilisation, Cement stabilisation, Lime stabilisation, Bitumen stabilisation, Chemical stabilisation, Stabilisation by heating and Electrical stabilisation.

Geotextiles: Reinforced Earth, Geotextiles-definitions, Types and functions.

Textbook(s):

1. Gopal Ranjan & ASR Rao, "Basic and Applied Soil Mechanics", New Age International Publishers, 4th Ed 2022.
2. Dr B.C. Punmia, Er. AK Jain, & Dr. AK Jain, "Soil Mechanics and Foundations", Laxmi Publications, 17th Ed 2021.

Reference Books:

1. Dr KR Arora, "Soil Mechanics and Foundation Engineering", Standard Publishers Distributors (2020).
2. JE Bowles, Foundation Analysis and Design, McGraw-Hill, New Delhi (1996).
3. Venkataramaiah, "Geotechnical Engineering", New Age International Publishers.
4. VNS Murthy, "Geotechnical Engineering: Principles and Practices of Soil Mechanics and Foundation Engineering" (2016).
5. P. Purushothama Raj, "Soil Mechanics and Foundation Engineering", Pearson Education India (2013).
6. DP Coduto, MR Yeung, WA Kitch, "Geotechnical Engineering: Principles and Practices", Pearson, 2nd Ed (2017).
7. K Terzaghi, R B Peck, G Mesri, "Soil Mechanics in Engineering Practice", John Wiley and Sons, (1996).

Geotechnical Engineering Lab	L	P	C
		2	1

Discipline(s) / EAE / OAE	Semester	Group	Sub-group	Paper Code
CE	5	PC	PC	CEC-355

Marking Scheme:

1. Teachers Continuous Evaluation: 40 marks
2. Term end Theory Examinations: 60 marks

Instructions:

1. The course objectives and course outcomes are identical to that of (Geotechnical Engineering) as this is the practical component of the corresponding theory paper.
2. The practical list shall be notified by the teacher in the first week of the class commencement under intimation to the office of the Head of Department / Institution in which the paper is being offered from the list of practicals below. Atleast 10 experiments must be performed by the students, they may be asked to do more. Atleast 5 experiments must be from the given list.

1. Determination of California Bearing Ratio by unsoaked method.
2. Determination of California Bearing Ratio by soaked method.
3. Determination of Optimum moisture content (OMC) and Maximum dry density (MDD) by proctor test using light compaction.
4. Determination of Optimum moisture content (OMC) and Maximum dry density (MDD) by proctor test using heavy compaction.
5. Determination of Consolidation properties.
6. Determination of Shear parameters by direct shear test.
7. Determination of Unconfined compressive strength of soil.
8. Determination of Shear parameters by triaxial test.
9. Determination of Undrained shears strength of cohesive soil by vane shear test.
10. Determination of Permeability by constant head test.
11. Determination of Permeability by falling head test
12. Determination of swelling pressure of an expansive soil (black cotton soil) by consolidometer method.
13. Determination of Free swell index of soil.
14. To conduct the Standard penetration test for soil.

Irrigation Engineering and Design of Hydraulic Structures	L	P	C
	4		4

Discipline(s) / EAE / OAE	Semester	Group	Sub-group	Paper Code
CE	6	PCE	PCE-1	CEE-308

Marking Scheme:												
1. Teachers Continuous Evaluation: 25 marks												
2. Term end Theory Examinations: 75 marks												
Instructions for paper setter:												
1. There should be 9 questions in the term end examinations question paper.												
2. The first (1st) question should be compulsory and cover the entire syllabus. This question should be objective, single line answers or short answer type question of total 15 marks.												
3. Apart from question 1 which is compulsory, rest of the paper shall consist of 4 units as per the syllabus. Every unit shall have two questions covering the corresponding unit of the syllabus. However, the student shall be asked to attempt only one of the two questions in the unit. Individual questions may contain upto 5 sub-parts / sub-questions. Each Unit shall have a marks weightage of 15.												
4. The questions are to be framed keeping in view the learning outcomes of the course / paper. The standard / level of the questions to be asked should be at the level of the prescribed textbook.												
5. The requirement of (scientific) calculators / log-tables / data – tables may be specified if required.												
Course Objectives :												
1.	To understand the principles and requirements of irrigation scheme involving canals											
2.	To design the irrigation channel and develop a knowledge of irrigation water requirement and its distribution.											
3.	To analyze water head works and design canal regulation structures.											
4.	To design hydraulic structures and analyze them under various loading conditions.											
Course Outcomes (CO)												
CO 1	Define irrigation techniques and hydraulic structures.											
CO 2	Explain water requirement, canal regulation structures, components of dam and river training structures											
CO 3	Develop expression for irrigation water requirement, forces exerted on gravity dam, and it's stability analysis.											
CO 4	Design a hydraulic structures with due consideration to all safety factors.											
Course Outcomes (CO) to Programme Outcomes (PO) mapping (scale 1: low, 2: Medium, 3: High)												
	PO01	PO02	PO03	PO04	PO05	PO06	PO07	PO08	PO09	PO10	PO11	PO12
CO 1	2	1	1	1	-	1	1	1	-	-	-	-
CO 2	2	2	1	1	-	-	-	1	-	1	-	-
CO 3	2	2	2	1	-	-	-	-	-	-	-	-
CO 4	3	3	3	2	1	-	-	1	-	-	-	-
UNIT-I												
Major and medium irrigation schemes of India, Command area development, Types of Soils and their suitability for irrigation, Root Zone soil water, Irrigation requirements, Irrigation water quality, Irrigation canal system, Duty of water, Canal losses, Estimation of design discharge of a canal, canal outlets, Canal regulation, Water logging, causes, effects and remedial measures.												
Alluvial channels carrying clear water and Sediment-Laden water, Evaporation and seepage losses in channels, Cross section of irrigation channels, Berms, Freeboard and service road, Silting of channels.												
UNIT-II												

Sheet pile cut-off walls, Khosla's theory and its applications, Correction for Floor Thickness, Correction for Mutual Interference of sheet piles, Correction for the slope of the floor, Method for determination of exit gradient, Uplift force on the floor of canal structure.

Canal regulation structures, Canal Fall, Types of canal fall, Cistern element, Vertical/ Horizontal/Inclined-impact Cisterns, No-Impact Cisterns, Roughening measures for energy dissipation such as Friction Block, Ribbed pitching and Provisions such as baffle wall/ deflector/dentated cill etc at the Downstream end of cistern system

Distributary Head Regulator and Cross Regulator and their Design criteria, Control of Sediment Entry into an offtaking channel.

UNIT-III

Cross Drainage Structure, their need and types, Design of Transitions for canal waterway using Hind's Method, Upiri Method and Vittal and Chiranjeevi's method,

Canal Headworks, Selection of the site, Weir or Barrage, Undersluices, Divide Wall, Fish Ladder, Canal Head Regulator, Sediment Excluders and Sediment Ejector.

UNIT - IV

Types of dams, Factors and General Design Criteria for Embankment Dams, Freeboard, Suitability of Foundation, Slope protection, Factors and General Design Criteria for Gravity Dams, Forces on gravity Dam, Causes of failure of a gravity Dam, Stability Analysis of Gravity Dams, Galleries and outlets.

Introduction to Spillway, Types of spillways, energy dissipaters, Cavitation erosion on spillway surface
Classification/ behaviour of rivers, Cutoffs, Aggradation and Degradation, River Training and its objectives, River training Methods such as Levees, Spurs, Guide Banks.

Textbook(s):

1. S.K.Garg- Irrigation Engineering and Hydraulic Structures, Khanna Publishers, Delhi
2. B.C. Punmia and Pande B.B. Lal- Irrigation and Water Power Engineering, Laxmi Publications (P) Ltd., Delhi.

References:

1. Ralph A.Wurbs, Wisley P.James- Water Resources Engineering, PHI, New Delhi.
2. R.K.Sharma and T.K.Sharma- Irrigation Engineering. S.Chand and Company Ltd., New Delhi.
3. Satya Narayana Murty Challa-Water Resources Engineering: Principles and Practice, NewAge Intl.
4. Applied Hydrology - Ven T Chow, David R Maidment, Larry W Mays, McGraw-Hill, New Delhi.
5. Bharat Singh, Fundamentals of Irrigation Engineering, Nem Chand and Brothers, Roorkee.

Non Destructive Evaluation of Structures	L	P	C
	3		3

Discipline(s) / EAE / OAE	Semester	Group	Sub-group	Paper Code
CE	6	PCE	PCE-3	CEE-318T

Marking Scheme:												
1. Teachers Continuous Evaluation: 25 marks												
2. Term end Theory Examinations: 75 marks												
Instructions for paper setter:												
1. There should be 9 questions in the term end examinations question paper.												
2. The first (1st) question should be compulsory and cover the entire syllabus. This question should be objective, single line answers or short answer type question of total 15 marks.												
3. Apart from question 1 which is compulsory, rest of the paper shall consist of 4 units as per the syllabus. Every unit shall have two questions covering the corresponding unit of the syllabus. However, the student shall be asked to attempt only one of the two questions in the unit. Individual questions may contain upto 5 sub-parts / sub-questions. Each Unit shall have a marks weightage of 15.												
4. The questions are to be framed keeping in view the learning outcomes of the course / paper. The standard / level of the questions to be asked should be at the level of the prescribed textbook.												
5. The requirement of (scientific) calculators / log-tables / data – tables may be specified if required.												
Course Objectives :												
1.	To introduce the basic principles, techniques, equipment, applications and limitations of NDT methods such as Visual, Penetrant Testing, Magnetic Particle Testing, Ultrasonic Testing, Radiography, Eddy Current.											
2.	To enable selection of appropriate NDT methods.											
3.	To identify advantages and limitations of non-destructive testing methods											
4.	To make aware the developments and future trends in NDT.											
Course Outcomes (CO)												
CO 1	Apply the various NDT techniques to identify the defects											
CO 2	Select the suitable NDT techniques for various defects											
CO 3	Understand the various factors affecting the concrete and Advanced Non-Destructive Testing Methods.											
CO 4	Illustrate knowledge on Non-destructive testing (NDT) equipment's – Rebound hammer, Ultrasonic pulse velocity meter											
Course Outcomes (CO) to Programme Outcomes (PO) mapping (scale 1: low, 2: Medium, 3: High)												
	PO01	PO02	PO03	PO04	PO05	PO06	PO07	PO08	PO09	PO10	PO11	PO12
CO 1	2	-	-	-	-	-	-	-	-	-	-	1
CO 2	2	1	-	-	-	-	-	-	-	-	-	1
CO 3	1	2	2	-	-	-	-	-	-	-	-	2
CO 4	3	2	2	2	3	2	2	2	1	-	2	1
UNIT-I												
Introduction to DT, NDT and NDE, necessity of NDE and SHM; Fundamental differences between NDE and SHM philosophies; Causes of degradation in concrete and steel structures; General methods of NDT of civil engineering structures according to Indian Standards, future progress in NDT, economics aspects of NDT. Visual Inspection - tools, applications and limitations -Fundamentals of visual testing: vision, lighting, material attributes, environmental factors. Visual perception, direct and indirect methods mirrors, magnifiers, boroscopes, fibrosopes, closed circuit television, light sources.												
UNIT-II												

Permeability test: Fundamental principle, General procedure for permeability test, Equipment for permeability test, Initial surface absorption test, Modified Figg permeability test, In situ rapid chloride ion permeability test, Applications of permeability test, Range and limitations of permeability test, Half-cell electrical potential method.

UNIT-III

Penetration resistance or Windsor probe test, resistivity measurement Sensor based SHM of civil structures – optical, piezoelectric and non-contact approaches; Imaging as a tool for NDT – A scan, Bscan, C-scan, time of flight based reconstruction, synthetic aperture focusing technique.

UNIT – IV

Electromagnetic imaging – fundamentals, ground penetrating radar; Thermography – fundamentals, Infrared thermography; Elastic wave based methods – impact echo; Ultrasonics – fundamentals, instrumentation, imaging methodologies; Future directions.

Textbook(s):

1. Grandt Jr A F, Fundamentals of Structural Integrity: Damage Tolerant Design and Nondestructive Evaluation, Wiley Publications (2014).
2. Maierhofer C and Dobmann G, Non-Destructive Evaluation of Reinforced Concrete Structures: Non-Destructive Testing Methods, Woodhead Publishing (2010)

References:

1. Hellier C, Handbook of Nondestructive Evaluation, Mc-Graw Hill Education (2012).

Non Destructive Evaluation of Structures Lab	L	P	C
		2	1

Discipline(s) / EAE / OAE	Semester	Group	Sub-group	Paper Code
CE	6	PCE	PCE-3	CEE-318P

Marking Scheme:

1. Teachers Continuous Evaluation: 40 marks
2. Term end Theory Examinations: 60 marks

Instructions:

1. The course objectives and course outcomes are identical to that of (Non Destructive Evaluation of Structures) as this is the practical component of the corresponding theory paper.
2. The practical list shall be notified by the teacher in the first week of the class commencement under intimation to the office of the Head of Department / Institution in which the paper is being offered from the list of practicals below. Atleast 10 experiments must be performed by the students, they may be asked to do more. Atleast 5 experiments must be from the given list.

1. To study about need and scope of Non-destructive testing (NDT).
2. To perform visual test for given sample using visual aid.
3. To study and perform Rebound Hammer Test.
4. To study and perform Electrochemical Half-Cell Potentiometer Test.
5. To study and perform Tests for Carbonation of Concrete.
6. To study and perform Ultrasonic Pulse velocity Test.
7. To perform Dye/Liquid Penetration Test for given sample with visible and fluorescent dye.
8. To study and perform Magnetic Particle test using different methods of magnetization.
9. To study Radiographic Testing.
10. To study and perform penetration resistant test
11. To study and perform pull out test
12. To study and perform Leak Testing.
13. To study of Eddy Current Test.
14. To study acoustic emission testing and thermography

Open Chanel Flow and Sediment Transportation	L	P	C
	4		4

Discipline(s) / EAE / OAE	Semester	Group	Sub-group	Paper Code
CE	6	PCE	PCE-3	CEE-320

Marking Scheme:												
1. Teachers Continuous Evaluation: 25 marks												
2. Term end Theory Examinations: 75 marks												
Instructions for paper setter:												
1. There should be 9 questions in the term end examinations question paper.												
2. The first (1st) question should be compulsory and cover the entire syllabus. This question should be objective, single line answers or short answer type question of total 15 marks.												
3. Apart from question 1 which is compulsory, rest of the paper shall consist of 4 units as per the syllabus. Every unit shall have two questions covering the corresponding unit of the syllabus. However, the student shall be asked to attempt only one of the two questions in the unit. Individual questions may contain upto 5 sub-parts / sub-questions. Each Unit shall have a marks weightage of 15.												
4. The questions are to be framed keeping in view the learning outcomes of the course / paper. The standard / level of the questions to be asked should be at the level of the prescribed textbook.												
5. The requirement of (scientific) calculators / log-tables / data – tables may be specified if required.												
Course Objectives :												
1.	To introduce the concepts of channel hydraulics.											
2.	To study different types of flow and flow characteristics.											
3.	To analyze flow problems and determine effect of channel geometric parameter of flow characteristics.											
4.	To design of inland waterways needed for irrigation, navigation and to study sediment transport.											
Course Outcomes (CO)												
CO 1	Define fundamental concepts of various types open channel flow and concepts of specific energy.											
CO 2	Analyze the flow through transition, varied flow, forces on sediment load											
CO 3	Determine flow profiles, and characteristics of varied flow											
CO 4	Design a stable and regime channel.											
Course Outcomes (CO) to Programme Outcomes (PO) mapping (scale 1: low, 2: Medium, 3: High)												
	PO01	PO02	PO03	PO04	PO05	PO06	PO07	PO08	PO09	PO10	PO11	PO12
CO 1	2	2	-	1	-	-	-	-	-	1	-	-
CO 2	3	2	2	2	-	1	-	-	-	-	-	-
CO 3	1	1	1	2	-	-	-	-	-	-	-	-
CO 4	3	3	3	2	1	-	-	1	-	-	-	-
UNIT-I												
Major and medium irrigation schemes of India, Command area development, Types of Soils and their suitability for irrigation, Root Zone soil water, Irrigation requirements, Irrigation water quality, Irrigation canal system, Duty of water, Canal losses, Estimation of design discharge of a canal, canal outlets, Canal regulation, Water logging, causes, effects and remedial measures.												
Alluvial channels carrying clear water and Sediment-Laden water, Evaporation and seepage losses in channels, Cross section of irrigation channels, Berms, Freeboard and service road, Silting of channels.												
UNIT-II												
Sheet pile cut-off walls, Khosla's theory and its applications, Correction for Floor Thickness, Correction for Mutual Interference of sheet piles, Correction for the slope of the floor, Method for determination of exit gradient, Uplift force on the floor of canal structure.												

Canal regulation structures, Canal Fall, Types of canal fall, Cistern element, Vertical/ Horizontal/Inclined-impact Cisterns, No-Impact Cisterns, Roughening measures for energy dissipation such as Friction Block, Ribbed pitching and Provisions such as baffle wall/ deflector/dentated cill etc at the Downstream end of cistern system

Distributary Head Regulator and Cross Regulator and their Design criteria, Control of Sediment Entry into an offtaking channel.

UNIT-III

Cross Drainage Structure, their need and types, Design of Transitions for canal waterway using Hind's Method, Uperi Method and Vittal and Chiranjeevi's method,

Canal Headworks, Selection of the site, Weir or Barrage, Undersluices, Divide Wall, Fish Ladder, Canal Head Regulator, Sediment Excluders and Sediment Ejector.

UNIT - IV

Types of dams, Factors and General Design Criteria for Embankment Dams, Freeboard, Suitability of Foundation, Slope protection, Factors and General Design Criteria for Gravity Dams, Forces on gravity Dam, Causes of failure of a gravity Dam, Stability Analysis of Gravity Dams, Galleries and outlets.

Introduction to Spillway, Types of spillways, energy dissipaters, Cavitation erosion on spillway surface

Classification/ behaviour of rivers, Cutoffs, Aggradation and Degradation, River Training and its objectives, River training Methods such as Levees, Spurs, Guide Banks.

Textbook(s):

1. S.K.Garg- Irrigation Engineering and Hydraulic Structures, Khanna Publishers, Delhi
2. B.C. Punmia and Pande B.B. Lal- Irrigation and Water Power Engineering, Laxmi Publications (P) Ltd., Delhi.

References:

1. Ralph A.Wurbs, Wisley P.James- Water Resources Engineering, PHI, New Delhi.
2. R.K.Sharma and T.K.Sharma- Irrigation Engineering. S.Chand and Company Ltd., New Delhi.
3. Satya Narayana Murty Challa-Water Resources Engineering [Principles and Practice] NewAge Intl.
4. Applied Hydrology - Ven T Chow, David R Maidment, Larry W Mays, McGraw-Hill, New Delhi.
5. Bharat Singh, Fundamentals of Irrigation Engineering, Nem Chand and Brothers, Roorkee.

Pollution Control and Monitoring	L	P	C
	4		4

Discipline(s) / EAE / OAE	Semester	Group	Sub-group	Paper Code
CE	6	PCE	PCE-2	CEE-316

Marking Scheme:												
1. Teachers Continuous Evaluation: 25 marks												
2. Term end Theory Examinations: 75 marks												
Instructions for paper setter:												
1. There should be 9 questions in the term end examinations question paper.												
2. The first (1st) question should be compulsory and cover the entire syllabus. This question should be objective, single line answers or short answer type question of total 15 marks.												
3. Apart from question 1 which is compulsory, rest of the paper shall consist of 4 units as per the syllabus. Every unit shall have two questions covering the corresponding unit of the syllabus. However, the student shall be asked to attempt only one of the two questions in the unit. Individual questions may contain upto 5 sub-parts / sub-questions. Each Unit shall have a marks weightage of 15.												
4. The questions are to be framed keeping in view the learning outcomes of the course / paper. The standard / level of the questions to be asked should be at the level of the prescribed textbook.												
5. The requirement of (scientific) calculators / log-tables / data – tables may be specified if required.												
Course Objectives :												
1.	To learn about the air pollutants, sources and its effects.											
2.	To have a clear understanding on the air quality standards and its techniques											
3.	To find the Properties of air pollution and its control measures.											
4.	To learn about the effects and the sources of noise pollution											
Course Outcomes (CO)												
CO 1	Understand basic concepts and terminologies of air & noise pollution, sources and effects on environment											
CO 2	Understand air & noise pollution indices, various acts and legislations											
CO 3	Discuss air & noise pollution standards and measurement methods											
CO 4	Analyze removal techniques to control air & noise pollution											
Course Outcomes (CO) to Programme Outcomes (PO) mapping (scale 1: low, 2: Medium, 3: High)												
	PO01	PO02	PO03	PO04	PO05	PO06	PO07	PO08	PO09	PO10	PO11	PO12
CO 1	-	3	-	-	-	3	3	-	-	-	-	-
CO 2	-	2	-	-	-	3	3	-	-	-	-	3
CO 3	-	2	-	3	-	3	3	-	-	-	-	-
CO 4	-	3	3	-	-	3	3	-	-	-	-	3
UNIT-I												
Air pollution: composition and structure of atmosphere, global implications of air pollution, classification of air pollutants: particulates, hydrocarbon, carbon monoxide, oxides of sulphur, oxides of nitrogen and photochemical oxidants. Indoor air pollution. Effects of air pollutants on humans, animals, property and plants.												
UNIT-II												
Air pollution chemistry, meteorological aspects of air pollution dispersion; temperature lapse rate and stability, wind velocity and turbulence, plume behaviour, dispersion of air pollutants, the Gaussian Plume Model, stack height and dispersion.												
UNIT-III												

Ambient air quality and standards, air sampling and measurements. Control of particulate air pollutants using gravitational settling chambers, cyclone separators, wet collectors, fabric filters (Bag-house filter), electrostatic precipitators (ESP) Control of gaseous contaminants: Absorption, Adsorption, Condensation and Combustion, Control of sulphur oxides, nitrogen oxides, carbon monoxide, and hydrocarbons. Automotive emission control, catalytic convertor, Euro-I, Euro-II and Euro-III specifications, Indian specifications.

UNIT – IV

Noise pollution: Basics of acoustics and specification of sound; sound power, sound intensity and sound pressure levels; plane, point and line sources, multiple sources; outdoor and indoor noise propagation; psychoacoustics and noise criteria, effects of noise on health, annoyance rating schemes; special noise environments: Infrasound, ultrasound, impulsive sound and sonic boom; noise standards and limit values; noise instrumentation and monitoring procedure. Noise indices. Noise control methods.

Textbook(s):

1. Peavy, Rowe and Tchobanoglous: Environmental Engineering.
2. Martin Crawford: Air Pollution Control Theory.

References:

1. Mycock, McKenna and Theodore: Handbook of Air Pollution Control Engineering and Technology. Sues and Craxford: W.H.O. Manual on Urban Air Quality Management
2. C.S. Rao, Air Pollution and Control
3. Advanced Air and Noise Pollution Control by Lawrence K. Wang, Norman C. Pereira & Yung IseHung.
4. Noise Pollution and Control by S. P. Singhal, Narosa Pub House
5. Textbook of Noise Pollution and Its Control by S. C. Bhatia, Atlantic; Edition

Principles of Management for Engineers	L	P	C
	3		3

Discipline(s) / EAE / OAE	Semester	Group	Sub-group	Paper Code
All	6	HS/MS	MS	MS-302

Marking Scheme:												
1. Teachers Continuous Evaluation: 25 marks												
2. Term end Theory Examinations: 75 marks												
Instructions for paper setter:												
1. There should be 9 questions in the term end examinations question paper.												
2. The first (1st) question should be compulsory and cover the entire syllabus. This question should be objective, single line answers or short answer type question of total 15 marks.												
3. Apart from question 1 which is compulsory, rest of the paper shall consist of 4 units as per the syllabus. Every unit shall have two questions covering the corresponding unit of the syllabus. However, the student shall be asked to attempt only one of the two questions in the unit. Individual questions may contain upto 5 sub-parts / sub-questions. Each Unit shall have a marks weightage of 15.												
4. The questions are to be framed keeping in view the learning outcomes of the course / paper. The standard / level of the questions to be asked should be at the level of the prescribed textbook.												
5. The requirement of (scientific) calculators / log-tables / data – tables may be specified if required.												
Course Objectives :												
1.	To describe the functions, roles and skills of managers and illustrate how the manager's job is evolving.											
2.	To evaluate approaches to goal setting, planning and organizing in a variety of circumstances.											
3.	To evaluate contemporary approaches for staffing and leading in an organization											
4.	To analyze contemporary issues in controlling for measuring organizational performance.											
Course Outcomes (CO)												
CO 1	Examine the relevance of the political, legal, ethical, economic and cultural environments in global business											
CO 2	Evaluate approaches to goal setting, planning and organizing in a variety of circumstances.											
CO 3	Evaluate contemporary approaches for staffing and leading in an organization											
CO 4	Analyze contemporary issues in controlling for measuring organizational performance.											
Course Outcomes (CO) to Programme Outcomes (PO) mapping (scale 1: low, 2: Medium, 3: High)												
	PO01	PO02	PO03	PO04	PO05	PO06	PO07	PO08	PO09	PO10	PO11	PO12
CO 1	2	2	1	2	-	2	-	-	1	2	3	2
CO 2	2	2	1	2	-	2	-	-	1	2	3	2
CO 3	2	2	1	2	-	2	-	-	1	2	3	2
CO 4	2	2	1	2	-	2	-	-	1	2	3	2
UNIT-I												
Introduction to Managers and Management: Management an Overview: Introduction, Definition of Management, Role of Management, Functions of Managers, Levels of Management, Management Skills and Organizational Hierarchy, Social and Ethical Responsibilities of Management: Arguments for and against Social Responsibilities of Business, Social Stakeholders, Measuring Social Responsiveness and Managerial Ethics, Omnipotent and Symbolic View, Characteristics and importance of organizational culture, Relevance of political, legal, economic and Cultural environments to global business, Structures and techniques organizations use as they go international .												
UNIT-II												
Planning: Nature & Purpose, Steps involved in Planning, Objectives, Setting Objectives, Process of Managing by Objectives, Strategies, Policies & Planning Premises, Competitor Intelligence, Benchmarking, Forecasting, Decision-Making.												

Directing: Scope, Human Factors, Creativity and Innovation, Harmonizing Objectives, Leadership, Types of Leadership, Directing, Managers as leaders, Early Leadership Theories... Trait Theories, Behavioral Theories, Managerial Grid, Contingency Theories of Leadership, Directing ... Path Goal Theory, contemporary views of Leadership, Cross Cultural Leadership, Leadership Training, Substitutes of Leadership

UNIT-III

Organizing: Organizing, Benefits and Limitations-De-Centralization and Delegation of Authority, Authority versus Power, Mechanistic Versus Organic Organization, Common Organizational Designs, Contemporary Organizational Designs and Contingency Factors, The Learning Organization Nature and Purpose, Formal and Informal Organization, Organization Chart, Structure and Process, Departmentalization by difference strategies, Line and Staff authority- Benefits and Limitations-De-Centralization and Delegation of Authority Versus, Staffing, Human Resource Inventory, Job Analysis, Job Description, Recruitment and

UNIT - IV

Controlling: Controlling, Introduction to Controlling System and process of Controlling, Requirements for effective control, The planning Control link, The process of control, types of control The Budget as Control Technique, Information Technology in Controlling, Productivity, Problems and Management, Control of Overall Performance, Direct and Preventive Control, Financial Controls, Tools for measuring organizational Performance, Contemporary issues in control Workplace concerns, employee theft, employee violence

Textbook(s):

1. Tripathi P.C. Principles of management. Tata McGraw-Hill Education; 6th Edition 2017.

References:

1. Koontz H, Weihrich H. Essentials of management: an international, innovation, and leadership perspective. McGraw-Hill Education; 10th Edition 2018.
2. Principles of Management Text and Cases, Pravin Durai, Pearson, 2015
3. Robbins, S.P. & Decenzo, David A. Fundamentals of Management, 7th ed., Pearson, 2010
4. Robbins, S.P. & Coulter, Mary Management; 14 ed., Pearson, 2009

Structural Analysis - II	L	P	C
	4		4

Discipline(s) / EAE / OAE	Semester	Group	Sub-group	Paper Code
CE	5	PC	PC	CEC-303

Marking Scheme:												
1. Teachers Continuous Evaluation: 25 marks												
2. Term end Theory Examinations: 75 marks												
Instructions for paper setter:												
1. There should be 9 questions in the term end examinations question paper.												
2. The first (1st) question should be compulsory and cover the entire syllabus. This question should be objective, single line answers or short answer type question of total 15 marks.												
3. Apart from question 1 which is compulsory, rest of the paper shall consist of 4 units as per the syllabus. Every unit shall have two questions covering the corresponding unit of the syllabus. However, the student shall be asked to attempt only one of the two questions in the unit. Individual questions may contain upto 5 sub-parts / sub-questions. Each Unit shall have a marks weightage of 15.												
4. The questions are to be framed keeping in view the learning outcomes of the course / paper. The standard / level of the questions to be asked should be at the level of the prescribed textbook.												
5. The requirement of (scientific) calculators / log-tables / data – tables may be specified if required.												
Course Objectives :												
1.	To know the concept of combined direct and bending stresses, stresses developed in thin cylinders.											
2.	To construct influence lines and be able to use the same.											
3.	To explain method of consistent deformation and slope deflection method.											
4.	To discuss moment distribution method and unit load method.											
Course Outcomes (CO)												
CO 1	Determine stresses in structures and thin cylinders.											
CO 2	Utilise the concept of influence line diagrams for support reaction, shear force and bending moment.											
CO 3	Interpret unknown forces and displacements in indeterminate structures by method of consistent deformation and slope deflection method.											
CO 4	Analyse indeterminate structures by moment distribution, Kani's and unit load method.											
Course Outcomes (CO) to Programme Outcomes (PO) mapping (scale 1: low, 2: Medium, 3: High)												
	PO01	PO02	PO03	PO04	PO05	PO06	PO07	PO08	PO09	PO10	PO11	PO12
CO 1	3	1	-	-	-	-	-	-	-	-	-	-
CO 2	1	2	-	-	-	-	-	-	-	-	-	-
CO 3	1	3	-	-	-	-	-	-	-	-	-	-
CO 4	1	3	-	-	-	-	-	-	-	-	-	-
UNIT-I												
Combined direct and bending stresses: Middle third rule, core of a section, stresses due to water and earth pressure in structures like retaining walls, dams etc.												
Thin cylinders: Thin cylinders subjected to internal fluid pressure, wire wound thin cylinders. Thin cylindrical shells, circumferential and hoop stresses, longitudinal stresses, Maximum shear stress.												
UNIT-II												
Moving loads and Influence lines: Introduction to moving loads, absolute maximum bending moment and shear force, concept of influence lines, influence lines for reaction, shear force, bending of determinate beams, analysis for different types of moving loads, single concentrated load, several concentrated loads, uniformly distributed load shorter and longer than span, Application of Muller Breslau Principle for determinate structures.												

UNIT-III

Method of consistent deformation: Analysis of indeterminate beams and frames upto two degree of indeterminacy, Analysis of pin jointed plane frame with external indeterminacy, effects due to error in length of a member.

Slope Deflection Method: Analysis of continuous beams, Analysis of rigid frames, frames with sloping legs, frames without sway and with sway, settlement effects.

UNIT – IV

Moment distribution method and Kani's Method: Analysis of continuous beams and plane frames.

Deflections of pin jointed plane frame: Unit Load Method, Deflections due to Lack of Fit and Temperature Changes.

Textbook(s):

1. Dr. B. C. Punamia, Er. Ashok Kumar Jain, Dr. Arun Kumar Jain, "Mechanics of Materials", Laxmi Publications (P) Ltd. Revised edition (2017)
2. Dr. R. K Bansal, "A Textbook of Strength of Materials", Laxmi Publications (P) Ltd. (2018)
3. S S Bhavikatti, "Structural Analysis (Vol.I and II)", Vikas Publication, Fourth Edition (2011)

References:

1. C.S. Reddy, "Basic Structural Analysis", Tata McGraw Hill (2017)
2. 2.R. Agor, "Structural Analysis", Khanna Publishing, Third Edition (2021)
3. S. Ramamrutham, R. Narayan, "Theory of Structures", Dhanpat Rai Publishing Company, (2017)
4. Dr. R. Vaidyanathan, Dr. P. Perumal, "Structural Analysis Volume II", Laxmi Publications (P) Ltd. (2016)
5. R.C. Hibbler, "Structural Analysis", Pearson Education

Structural Design - II	L	P	C
	3		3

Discipline(s) / EAE / OAE	Semester	Group	Sub-group	Paper Code
CE	5	PC	PC	CEC-305

Marking Scheme:												
1. Teachers Continuous Evaluation: 25 marks												
2. Term end Theory Examinations: 75 marks												
Instructions for paper setter:												
1. There should be 9 questions in the term end examinations question paper.												
2. The first (1st) question should be compulsory and cover the entire syllabus. This question should be objective, single line answers or short answer type question of total 15 marks.												
3. Apart from question 1 which is compulsory, rest of the paper shall consist of 4 units as per the syllabus. Every unit shall have two questions covering the corresponding unit of the syllabus. However, the student shall be asked to attempt only one of the two questions in the unit. Individual questions may contain upto 5 sub-parts / sub-questions. Each Unit shall have a marks weightage of 15.												
4. The questions are to be framed keeping in view the learning outcomes of the course / paper. The standard / level of the questions to be asked should be at the level of the prescribed textbook.												
5. The requirement of (scientific) calculators / log-tables / data – tables may be specified if required.												
Course Objectives :												
1.	The course aims at designing of basic elements of structures such as beam and slab											
2.	The course aims at designing of basic elements of structures such as column and foundation.											
3.	To provide a basic understanding of use of steels in civil engineering											
4.	To develop technical competence in the design of simple bolted and welded connections, tension and compression members											
Course Outcomes (CO)												
CO 1	Analyze singly and doubly reinforced beams, one way and two way slabs, short and slender columns and footings.											
CO 2	Understand the behavior of concrete structures under flexure, shear, bond and torsion and compression.											
CO 3	Design of different types of joint system for complex engineering problems considering safety and economic factors.											
CO 4	Identify tension, compression and flexural members in a structure which can meet the specified needs with appropriate considerations.											
Course Outcomes (CO) to Programme Outcomes (PO) mapping (scale 1: low, 2: Medium, 3: High)												
	PO01	PO02	PO03	PO04	PO05	PO06	PO07	PO08	PO09	PO10	PO11	PO12
CO 1	3	1	1	2	2	1	-	1	1	3	2	3
CO 2	3	3	1	2	1	1	1	1	2	3	2	3
CO 3	2	2	3	2	2	2	-	1	-	3	2	2
CO 4	2	2	3	1	1	2	2	1	1	3	2	2
UNIT-I												
Analysis and design of singly and doubly reinforced simply supported cantilever and continuous beams and flanged beam section, lintels, Design principles of retaining walls. Design of simply supported, cantilever slabs, one way and two way slabs												
Limit state of Collapse: Flexure, Shear, bond and torsion, Compression, Limit state of Serviceability												
UNIT-II												
Design of short and slender columns under axial load, under uniaxial and biaxial bending and shear force. Design of isolated footing for vertical load and Moment, Design of combined footings.												

UNIT-III

Riveted connections: Analysis and design of various types of riveted connections, permissible stresses in rivets, Design criteria, Code requirements, Tacking rivets, rivet joints subject to moment, Stresses in rivets.

Welded connections: Advantage and disadvantages of welding, Design criteria, Code requirements, Analysis and design of Fillet and Butt weld, Fillet weld subjected to moment.

UNIT – IV

Design of Tension members: Analysis of trusses and design of axially loaded tension member, Lug angle, tension splice.

Design of compression members: Modes of failure in column, Design of compression member, Lacing and battening for built up compression member. Compression member composed of two components back-to-back, column base and foundation, Roof trusses [including Purlins, bracings and connections].

Textbook(s):

1. Sinha S.N., "Handbook of Reinforced Concrete Design", McGraw Hill Publishing Company., New Delhi.
2. Gambhir M.L., "Fundamentals of Reinforced Concrete Design"., PHI Learning (P) Ltd., New Delhi
3. S.K. Duggal, "Limit State Design of steel structures", Tata Mc Graw Hill
4. L.S. Negi, "Design of steel structures", Tata Mc Graw Hill

References

1. Jain A.K., "Limit State Design of Reinforced Concrete Structures"., Nem Chand Publishers, Roorkee.
2. Shetty M.S., "Concrete Technology, Theory and Practice", S.Chand and Co., New Delhi.
3. Raju K., "Reinforced Concrete", New Age International (P) Ltd., New Delhi.
4. N. Subramanian, "Design of steel structures", Oxford University Press.
5. Krishnamurthy, "Elementary Structural Design"-Vol-III, CBS Publishers

Structural Design Lab	L	P	C
		2	1

Discipline(s) / EAE / OAE	Semester	Group	Sub-group	Paper Code
CE	5	PC	PC	CEC-351

Marking Scheme:

1. Teachers Continuous Evaluation: 40 marks
2. Term end Theory Examinations: 60 marks

Instructions:

1. The course objectives and course outcomes are identical to that of (Structural Design) as this is the practical component of the corresponding theory paper.
2. The practical list shall be notified by the teacher in the first week of the class commencement under intimation to the office of the Head of Department / Institution in which the paper is being offered from the list of practicals below. Atleast 10 experiments must be performed by the students, they may be asked to do more. Atleast 5 experiments must be from the given list.

1. Study of SP34/IS13920/IS456:2000 for detailing of structural elements
2. Preparation of bar bending schedule of Simply supported and Cantilever RCC Beam using MS Excel.
3. Preparation of bar bending schedule of RCC Slabs (One way and two way) by using MS Excel.
4. Preparation of bar bending schedule of RCC Columns –(Tied columns and Spirally reinforced columns) by using MS Excel
5. Preparation of bar bending schedule of Isolated and combined footings for RC Columns by using MS Excel.
6. Preparation of working hand sketches and Auto CAD drawings for RCC Beam
7. Preparation of working hand sketches and Auto CAD drawings for Slabs - One way and two way slabs.
8. Preparation of working hand sketches and Auto CAD drawings for RCC Column.
9. Preparation of working hand sketches and Auto CAD drawings for Combined rectangular and trapezoidal footing.

Traffic Engineering and Pavement Design	L	P	C
	4		4

Discipline(s) / EAE / OAE	Semester	Group	Sub-group	Paper Code
CE	5	PC	PC	CEC-311

Marking Scheme:												
1. Teachers Continuous Evaluation: 25 marks												
2. Term end Theory Examinations: 75 marks												
Instructions for paper setter:												
1. There should be 9 questions in the term end examinations question paper.												
2. The first (1st) question should be compulsory and cover the entire syllabus. This question should be objective, single line answers or short answer type question of total 15 marks.												
3. Apart from question 1 which is compulsory, rest of the paper shall consist of 4 units as per the syllabus. Every unit shall have two questions covering the corresponding unit of the syllabus. However, the student shall be asked to attempt only one of the two questions in the unit. Individual questions may contain upto 5 sub-parts / sub-questions. Each Unit shall have a marks weightage of 15.												
4. The questions are to be framed keeping in view the learning outcomes of the course / paper. The standard / level of the questions to be asked should be at the level of the prescribed textbook.												
5. The requirement of (scientific) calculators / log-tables / data – tables may be specified if required.												
Course Objectives :												
1.	To design the various geometric parameters of road.											
2.	To study the traffic characteristics and design of road intersections & signals.											
3.	To design and construct the pavement by selecting appropriate materials and design approach.											
4.	To learn methods to construct various types of roads and propose the maintenance strategies.											
Course Outcomes (CO)												
CO 1	Design the various geometric parameters of road.											
CO 2	Study the traffic characteristics and design of road intersections & signals.											
CO 3	Design and construct the pavement by selecting appropriate materials and design approach.											
CO 4	Learn methods to construct various types of roads and propose the maintenance strategies.											
Course Outcomes (CO) to Programme Outcomes (PO) mapping (scale 1: low, 2: Medium, 3: High)												
	PO01	PO02	PO03	PO04	PO05	PO06	PO07	PO08	PO09	PO10	PO11	PO12
CO 1	2	1	1	1	-	-	2	-	1	1	1	-
CO 2	1	2	3	1	2	2	1	-	2	1	2	2
CO 3	3	2	3	2	3	-	-	-	3	1	3	1
CO 4	2	3	3	2	3	2	2	-	2	-	-	1
UNIT-I												
Geometric Design of Highways (IRC:73- Latest revision): Cross section elements–pavement surface characteristics, camber, kerbs, shoulder, Sight distance, Horizontal curves, Superelevation, Extra widening, Transition curves, Gradient, Vertical curves–Summit and valley curves.												
Traffic Engineering: Traffic characteristics–road user characteristics, vehicular characteristics; Traffic studies and analysis: Traffic volume studies–methods of counting volume, presentation of volume data; Traffic speed studies– Types of speeds, methods of measuring spot speeds, presentation of spot speed data; Speed & delay studies–floating car method; Origin & destination studies–objective, methods of conducting O & D study, presentation of O-D data; Parking studies; Accident studies.												
UNIT-II												
Traffic Flow and Roadway Capacity: Traffic flow characteristics–space headways, time headways; Speed-Flow-Density relations; Passenger car units, recommended PCU values, peak hour factor; Capacity and level of service of rural highways and urban roads as per latest IRC recommendation.												

Traffic Regulation and Control: Traffic signs and their classification; Traffic signal–classification, general principles of two-phase signal design, Design of traffic signal by Webster method and IRC; Intersection at grade, Grade separated intersection, Design of roundabouts as per IRC:65-2017.

UNIT-III

Design of Highway Pavement: Types of Pavements, Difference between flexible and rigid pavement, Design factors–Standard axle load, ESWL, Rigidity factor; Design of flexible pavement– group index method, CBR method, California resistance value method, Design of flexible pavement by IRC:37 (Latest revision); Design of rigid pavement, Westergaard theory, load and temperature stresses, joints, IRC method of rigid pavement design (IRC:58-2015), Design of Dowel bars, Design of Tie bars.

UNIT – IV

Highway Construction and Maintenance: Construction of Subgrade, Water Bound Macadam (WBM), Wet mix macadam (WMM), Granular Sub Base (GSB), Tack Coat, Prime Coat, Seal Coat, Surface Dressing, Bituminous Macadam (BM), Bituminous concrete, Dry lean concrete (DLC), Cement Concrete (CC) road construction; Maintenance of bituminous and concrete roads, Concepts of overlay design.

Note: All designs and procedure are to be done with reference to latest revision of IRC as given below in reference section.

Textbook(s):

1. S.K. Khanna, C.E.G. Justo, A. Veeraragavan, "Highway Engineering", Nem Chand & Bros., 10th Edition (2021).
2. S.K. Khanna, C.E.G. Justo, A. Veeraragavan, "Highway Materials and Pavement Testing", Nem Chand and Bros.

References:

1. L.R. Kadiyali, "Traffic Engineering and Transport Planning", Khanna Publishers.
2. Rangwala, "Highway Engineering", Charotar Publishing House, 12th Edition (2022).
3. IRC: 37- Latest revision, "Tentative Guidelines for the design of Flexible Pavements" Indian Roads Congress, New Delhi.
4. IRC:58-2015 Guidelines for the Design of Plain Jointed Rigid Pavements for Highways (4th Revision).
5. IRC:65-2017 Guidelines for Planning and Design of Roundabouts (1st Revision)
6. IRC:73-1980 Geometric Design Standards for Rural (Non-Urban) Highways
7. IRC:106-1990 Guidelines for Capacity of Urban Roads in Plain Areas
8. IRC:93-1985 Guidelines on Design and Installation of Road Traffic Signals.
9. IRC:92-2017 Guidelines for Design of Interchanges in Urban Areas (1st Revision)
10. IRC:SP:68-2005, "Guidelines for Construction of Roller Compacted Concrete Pavements", Indian Roads Congress, New Delhi.
11. IRC:15-2002, "Standard Specifications and Code of Practice for construction of Concrete Roads" Indian Roads Congress, New Delhi.
12. MORTH, "Specifications for Road and Bridge Works", Ministry of Shipping, Road Transport & Highways, Published by Indian Roads Congress, New Delhi.

Universal Human Values	L	P	C
	1		1

Discipline(s) / EAE / OAE	Semester	Group	Sub-group	Paper Code
All	6	HS/MS	HS	HS-304

Marking Scheme:												
4. Teachers Continuous Evaluation: 25 marks												
5. Term end Theory Examinations: 75 marks												
6. This is an NUES paper, hence all examinations to be conducted by the concerned teacher.												
Instructions for paper setter:												
1. There should be 9 questions in the term end examinations question paper.												
2. The first (1 st) question should be compulsory and cover the entire syllabus. This question should be objective, single line answers or short answer type question of total 15 marks.												
3. Apart from question 1 which is compulsory, rest of the paper shall consist of 4 units as per the syllabus. Every unit shall have two questions covering the corresponding unit of the syllabus. However, the student shall be asked to attempt only one of the two questions in the unit. Individual questions may contain upto 5 sub-parts / sub-questions. Each Unit shall have a marks weightage of 15.												
4. The questions are to be framed keeping in view the learning outcomes of the course / paper.												
Course Objectives :												
1.	To help the students appreciate the essential complementarity between 'VALUES' and 'SKILLS' to ensure sustained happiness and prosperity which are the core aspirations of all human beings.											
2.	To facilitate the development of a Holistic perspective among students towards life and profession as well as towards happiness and prosperity based on a correct understanding of the Human reality and the rest of existence. Such a holistic perspective forms the basis of Universal Human Values and movement towards value-based living in a natural way.											
3.	To highlight plausible implications of such a Holistic understanding in terms of ethical human conduct, trustful and mutually fulfilling human behaviour and mutually enriching interaction with Nature.											
4.	To analyze the value of harmonious relationship based on trust and respect in their life and profession											
Course Outcomes (CO)												
CO 1	Evaluate the significance of value inputs in formal education and start applying them in their life and profession											
CO 2	Distinguish between values and skills, happiness and accumulation of physical facilities, the Self and the Body, Intention and Competence of an individual, etc.											
CO 3	Examine the role of a human being in ensuring harmony in society and nature.											
CO 4	Apply the understanding of ethical conduct to formulate the strategy for ethical life and profession.											
Course Outcomes (CO) to Programme Outcomes (PO) mapping (scale 1: low, 2: Medium, 3: High)												
	PO01	PO02	PO03	PO04	PO05	PO06	PO07	PO08	PO09	PO10	PO11	PO12
CO 1	-	-	-	-	-	3	-	3	1	1	-	1
CO 2	-	-	-	-	-	3	-	3	1	1	-	1
CO 3	-	-	-	-	-	3	-	3	1	1	-	1
CO 4	-	-	-	-	-	3	-	3	1	1	-	1
UNIT-I												
Introduction-Basic Human Aspiration, its fulfillment through All-encompassing Resolution: The basic human aspirations and their fulfillment through Right understanding and Resolution, Right understanding and Resolution as the activities of the Self, Self being central to Human Existence; All-encompassing Resolution for a Human Being, its details and solution of problems in the light of Resolution												
UNIT-II												

Understanding Human Being: Understanding the human being comprehensively as the first step and the core theme of this course; human being as co-existence of the self and the body; the activities and potentialities of the self; Basis for harmony/contradiction in the self

UNIT-III

Understanding Nature and Existence: A comprehensive understanding (knowledge) about the existence, Nature being included; the need and process of inner evolution (through self-exploration, self-awareness and self-evaluation), particularly awakening to activities of the Self: Realization, Understanding and Contemplation in the Self (Realization of Co-Existence, Understanding of Harmony in Nature and Contemplation of Participation of Human in this harmony/ order leading to comprehensive knowledge about the existence).

UNIT - IV

Understanding Human Conduct, All-encompassing Resolution & Holistic Way of Living: Understanding Human Conduct, different aspects of All-encompassing Resolution (understanding, wisdom, science etc.), Holistic way of living for Human Being with All-encompassing Resolution covering all four dimensions of human endeavor viz., realization, thought, behavior and work (participation in the larger order) leading to harmony at all levels from Self to Nature and entire Existence

Textbook(s):

1. R R Gaur, R Asthana, G P Bagaria, 2019 (2nd Revised Edition), A Foundation Course in Human Values and Professional Ethics. ISBN 978-93-87034-47-1, Excel Books, New Delhi.
2. Premvir Kapoor, Professional Ethics and Human Values, Khanna Book Publishing, New Delhi, 2022.

References:

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

Water Resource Planning	L	P	C
	4		4

Discipline(s) / EAE / OAE	Semester	Group	Sub-group	Paper Code
CE	6	PCE	PCE-2	CEE-314
EAE	6	IE-EAE	IE-EAE-1	IE-322

Marking Scheme:												
1. Teachers Continuous Evaluation: 25 marks												
2. Term end Theory Examinations: 75 marks												
Instructions for paper setter:												
1. There should be 9 questions in the term end examinations question paper.												
2. The first (1st) question should be compulsory and cover the entire syllabus. This question should be objective, single line answers or short answer type question of total 15 marks.												
3. Apart from question 1 which is compulsory, rest of the paper shall consist of 4 units as per the syllabus. Every unit shall have two questions covering the corresponding unit of the syllabus. However, the student shall be asked to attempt only one of the two questions in the unit. Individual questions may contain upto 5 sub-parts / sub-questions. Each Unit shall have a marks weightage of 15.												
4. The questions are to be framed keeping in view the learning outcomes of the course / paper. The standard / level of the questions to be asked should be at the level of the prescribed textbook.												
5. The requirement of (scientific) calculators / log-tables / data – tables may be specified if required.												
Course Objectives :												
1.	To impart knowledge about the planning and management of water resources.											
2.	To introduce the concepts of watershed management, integrated water resources management, environmental interaction of water resources and policies/framework related to water resources											
3.	To enable the students to understand the different components of water resources and their management											
4.	To enable the student to estimate well parameters and yield of well, with the help of mathematics, science, and engineering fundamentals.											
Course Outcomes (CO)												
CO 1	Identify different problems related to water resources planning, management and development.											
CO 2	Describe problems like water balance, water distribution networks, water pollution and other water related concerns.											
CO 3	Apply principles and guidelines to solve above mentioned problems											
CO 4	Determine appropriate techniques for Ground Water modeling and prediction of flow.											
Course Outcomes (CO) to Programme Outcomes (PO) mapping (scale 1: low, 2: Medium, 3: High)												
	PO01	PO02	PO03	PO04	PO05	PO06	PO07	PO08	PO09	PO10	PO11	PO12
CO 1	3	1	-	2	2	-	-	-	-	-	-	-
CO 2	2	-	1	-	-	-	2	-	-	-	-	-
CO 3	3	-	1	2	3	-	-	-	-	-	-	-
CO 4	3	2	2	-	-	-	-	-	-	-	-	-
UNIT-I												
Introduction of Water Systems engineering-scope and approach Issues and the systems planning approach, Water system dynamics, Water Resource [W.R.] development alternatives, Water systems planning objectives, Constraints and Criteria, Economic and Econometric principles, Cost and Benefit Curves.												
UNIT-II												
Application of Linear programming [LP] and Dynamic programming [DP] models in Water Resource Engineering, Problem formulation for W.R. systems, Multi-objective Water Resource Planning, Non-inferior Solutions, Plan Formulation, Weighting Method, Constraint Method, Plan Selection. Reservoir Operation,												

Standard Operating Policy, Optimal Operating Policy using LP Rules, Curves for Reservoir Operations Reservoir Systems [Deterministic Inflow], Reservoir Sizing, Sequent Peak Analysis Neglecting Evaporation, Sequent Peak Analysis Considering Evaporation Loss, Reservoir Capacity using LP , Storage Yield Function, Mixed Integer LP Formulation for Maximising Yield.

UNIT-III

Multireservoir Operation, Stationary Policy using DP, Simulation of Reservoir Operation for Hydropower Generation, Reservoir Systems [Random Inflow], Lognormal and Exponential Distributions, Chance Constrained LP, Linear Decision Rule, Deterministic Equivalent of a chance constraint Concept of Reliability, Reliability-based Reservoir Sizing, Maximum Reliability, Stochastic Dynamic programming for reservoir operation, State variable discretisation, Inflow as a stochastic process, Steady state operating policy, Steady State Probabilities, Real-time Operation, Case Study.

UNIT - IV

Water quality management planning and associated models, Regional planning models, Policy issues for improvement in utilisation of water resources, Optimal Irrigation Water allocation for single and multiple crops, Crop Yield optimization. Applications of Linear Programming in [1] Optimal Irrigation water allocation to multiple crops, [2] Multireservoir system for irrigation planning, [3] Reservoir Operation [Short term] for irrigation, [4] Reservoir operation for Hydropower optimization. Application of dynamic programming in - [1] Steady State Reservoir operating policy for irrigation, [2] Real Time Reservoir Operation for Irrigation, An Example application for inflow forecasting, Fuzzy Sets and Fuzzy logic, Introduction, Fuzzy rule based reservoir operation model.

Textbook(s):

1. Water Resources Systems Planning and Management, Sharad K. Jain, V 2003 ,Elsevier ,Singh . .P
2. Water Resources Systems Planning and Management: An Introduction to Methods, Models and Applications, Daniel P. Loucks, Eelco Van Beek, 2005.

References:

1. S.Vedula, P.P.Majumdar-Water Resources Systems, Tata Mcgraw Hill Publishing Company Ltd., ND
2. M.C. Chaturvedi, W.R.Systems-Planning and Management, Tata McGraw Hill Publications, New Delhi
3. Louks D Petal W.R. System Planning and Analysis, Prentice Hall – 1981. [R4] Maass. A. eta:-Design Water Resources Systems-McMillan, 1968.
4. A.S. Goodman, Principals of Water Resources Planning, Prentice Hall, 1984

Contract Management	L	P	C
	4		4

Discipline(s) / EAE / OAE	Semester	Group	Sub-group	Paper Code
EAE	6	CTM-EAE	CTM-EAE-1	CEC-308

Marking Scheme:												
1. Teachers Continuous Evaluation: 25 marks												
2. Term end Theory Examinations: 75 marks												
Instructions for paper setter:												
1. There should be 9 questions in the term end examinations question paper.												
2. The first (1st) question should be compulsory and cover the entire syllabus. This question should be objective, single line answers or short answer type question of total 15 marks.												
3. Apart from question 1 which is compulsory, rest of the paper shall consist of 4 units as per the syllabus. Every unit shall have two questions covering the corresponding unit of the syllabus. However, the student shall be asked to attempt only one of the two questions in the unit. Individual questions may contain upto 5 sub-parts / sub-questions. Each Unit shall have a marks weightage of 15.												
4. The questions are to be framed keeping in view the learning outcomes of the course / paper. The standard / level of the questions to be asked should be at the level of the prescribed textbook.												
5. The requirement of (scientific) calculators / log-tables / data – tables may be specified if required.												
Course Objectives :												
1.	To make students who take this course be able to design sound contracts by training to interpret legal provisions and effectively administer and fulfill the requirements of a contract											
2.	To be able to effectively administer contract and identify tools available for contract preparation and administration											
3.	To identify good practice important stages of contract and wordings in contract											
4.	Understand jurisprudence to effectively administer contracts and a construction organization											
Course Outcomes (CO)												
CO 1	Prepare contract schedules, notice inviting tender and contract documents.											
CO 2	Understand laws of construction contract.											
CO 3	Implement dispute resolution.											
CO 4	Prepare contract management plan as per standards.											
Course Outcomes (CO) to Programme Outcomes (PO) mapping (scale 1: low, 2: Medium, 3: High)												
	PO01	PO02	PO03	PO04	PO05	PO06	PO07	PO08	PO09	PO10	PO11	PO12
CO 1	2	3	2	-	2	-	1	-	-	-	-	-
CO 2	2	3	1	-	2	-	1	-	-	-	-	-
CO 3	2	2	3	-	2	-	1	-	-	-	-	-
CO 4	2	2	1	-	2	-	1	-	-	-	-	-
UNIT-I												
Definition of Contract Legal issues in contract – Standard forms of contracts- General and special conditions of contracts- Contract pricing by the client, project management consultants and the contractor, Contract correspondence and contract closure.												
Construction Laws: Public law, Government Department and Local authorities, Private law, contracts, Tort, property law and building law.												
Construction contracts: Contract specification, types of contract documents used for construction. Contract procurement: Selecting a contractor.												
UNIT-II												
Construction Contracts: Type of construction contracts: Lump sum contracts, fixed price contracts, Percentage rate contracts, cost plus contracts, Target contracts, Design-Build contracts, Turn-key contracts, BOT contracts.												

Parties to a Contract, Contract Formation, Common contract clauses: Notice to proceed, rights and duties of various parties, Contract Duration and Price.

Tendering: Process of tendering: Tender notice, EOI, RFQ & RFP, Bid security, Prequalification process, Bidding Models and bidding strategy, Tender submission and evaluation, Tender rejection, Security deposits / performance guarantee & Defect liability, Contract agreement & contract documents

UNIT-III

Contract Management: Scope of work, Detailed Estimate [approved plan], Administrative approval/Estimate Sanction, Notice inviting tenders and its types, Tender, earnest money deposit, security deposit, types of contracts, Essentials of legally valid contract, Contract between Engineer and Employers, Appointment and authority of Engineer for execution of civil construction works, Category of contractors.

Public Works Administration: C.P.W.D. Organization set up, system of accounts, classes of works in PWD, Estimates, Delhi Scheduled Rules [CPWD], Cost adjustment indices sub head, sub works, administrative approval, technical sanction, possession of funds, expenditure sanction, Various methods of executing works.

UNIT - IV

Arbitration: Comparison of Actions and Laws – Agreements –Appointment of Arbitrators Contract procedure: Disputes, arbitration and litigation procedure-preparation, settlement, evidence. Arbitration Tribunals, Powers and Duties of Arbitrator, Enforcement of Award, Arbitration and Conciliation Act 1996 - Arbitration case study.

Building formulae: Price adjustment-need for formulae, comparison with previous system, civil engineering and building formulae, practical implication.

Textbook(s):

1. Jimmie Hinze, Construction Contracts, 3rd Edition, McGraw Hill, New Delhi, (2013)
2. Sharma M.R., Fundamentals of Construction Planning & Management S.K. Kataria & Sons, (2013)

References:

1. Joseph T. Bockrath and Fredric L. Plotnick, Contracts and the Legal Environment: for Engineers and Architects, 7th Edition, McGraw Hill, New Delhi, (2013)
2. Markanda P.C., Naresh Markanda and Rajesh Markanda, Law Relating to Arbitration and Conciliation, 9th Edition, Lexis Nexis, New York., (2016)
3. Martin Brook, Estimating and Tendering for Construction Work, 5th Edition, Routledge, Taylor & Francis. (2016)
4. Govt of India, Central Public Works Department, CPWD Works Manual(2019)