


Government College of Engineering, Aurangabad
(An Autonomous Institute)

Teaching and Evaluation Scheme from year 2023-24

Third Year B. Tech. Program in Civil Engineering
Semester V

Course				Teaching Scheme			Continuous Evaluation in terms of Marks					
Sr No	Category	Course Code	Course Name	TH	T	PR	Credits	ISE I	ISEII	ISEIII	ESE	Total (100)
1	PC	CEPC3001	Geotechnical Engineering	3	-	-	3	15	15	10	60	100
2	PC	CEPC3002	Design of Steel Structures	3	-	-	3	15	15	10	60	100
3	PC	CEPC3003	Water Resources Engineering	3	-	-	3	15	15	10	60	100
4	PC	CEPC3004	Transportation Engineering	3	-	-	3	15	15	10	60	100
5	HSMC	CEHS0020	HSMC-II	3	-	-	3	15	15	10	60	100
6	OE	CEOE0020	Open Elective-II	3	-	-	3	15	15	10	60	100
7	PC	CEPC3005	Lab-Geotechnical Engineering	-	-	2	1	25			25	50
8	PC	CEPC3006	Lab- Design of Steel Structures	-	-	4	2	50			50	100
9	PC	CEPC3007	Lab-Water Resources Engineering	-	-	2	1	25			25	50
10	PC	CEPC3008	Lab-Transportation Engineering			2	1	25			25	50
Total				18	-	10	23	365			485	850


 Approved in XXVth Academic Council
 Dated: 18th April 2023

Government College of Engineering, Aurangabad
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Teaching and Evaluation Scheme from year 2023-24

Third Year B. Tech. Program in Civil Engineering
Semester VI

Course				Teaching Scheme			Continuous Evaluation in terms of Marks					
Sr No	Category	Course Code	Course Name	TH	T	PR	Credits	ISE I	ISEII	ISEIII	ESE	Total (100)
1	OE	CEOE1030	Open Elective-III	3	-	-	3	15	15	10	60	100
2	PC	CEPC3009	Estimation, Costing & Valuation	3	-	-	3	15	15	10	60	100
3	PC	CEPC3010	Design of RCC Structures	3	-	-	3	15	15	10	60	100
4	HSMC	CEHS1030	HSMC-III	3	-	-	3	15	15	10	60	100
5	PE-II	CEPE3001 to 3004	PE II	3	-	-	3	15	15	10	60	100
6	PE-III	CEPE3005 to CEPE3010	PE III	3	-	-	3	15	15	10	60	100
7	PC	CEPC3011	Lab-Estimation, Costing & Valuation	-	-	4	2	50			50	100
8	PC	CEPC3012	Lab-Design of RCC Structures	-	-	4	2	50			50	100
Total				18	-	8	22	340			460	800

Professional Elective II		
Sr. No.	Course Name	Course Code
1	Advanced Structural Analysis	CEPE3001
2	Open Channel Hydraulics	CEPE3002
3	Ground Improvement Techniques	CEPE3003
4	Dam & Water Power Engineering	CEPE3004

Professional Elective III		
Sr. No.	Course Name	Course Code
1	Advanced Water & Wastewater Treatment	CEPE3005
2	Advanced Transportation Engineering	CEPE3006
3	Advanced Concrete Technology	CEPE3007
4	Building Maintenance & Repairs	CEPE3008
5	Finite Element Method	CEPE3009
6	Design of Bridges	CEPE3010

CEPC 3001: Geotechnical and Foundation Engineering			
Teaching Scheme		Evaluation Scheme	
Theory	03 hrs/week	ISE I	15 Marks
Tutorial		ISE II	15 Marks
Total Credits	03	ISE III	10 Marks
		End Semester Examination	60 Marks
		Total	100 Marks

Prerequisite: Knowledge of Applied Mechanics, Fluid Mechanics and Engineering Geology.

Course Description: Course Description: This course introduces the different terminologies in geotechnical engineering, soil classification methods, significance of permeability, seepage and shear strength parameters of soil, laboratory and field compaction methods, stability of slopes, general types of foundations.

Course Outcomes: After Successful completion of the course, Student will be able to:

Course Outcomes	
CO1	Understand and apply basic soil mechanics principles to identify various properties of soil.
CO2	Characterize and classify soils and calculate permeability of soil in various types of soil and field conditions.
CO3	Determine shear strength parameters and stresses in soils.
CO4	Suggest suitable compaction methods, determine M.D.D., O.M.C values and Earth pressures
CO5	Choose Type of foundation as per site conditions. Select suitable exploration and boring methods. Calculate bearing capacity values.

Detailed Syllabus:

Unit - 1	Introduction, Soil problems in civil engineering, Major soil deposits of India, Soil phase system, Particle size and shape, Soil structures, Weight volume relationships,	7 Hrs
Unit - 2	I.S. classification of soil, Permeability and seepage, Darcy's law, Laboratory and field methods for determination of coefficient of permeability, Determination of average permeability of stratified soil deposits, Critical hydraulic gradient, Quick sand condition.	7 Hrs
Unit - 3	Shear Strength Parameters of soil, Mohr's envelopes for different types of soils, Pore pressure, Total and effective stress, Sensitivity and thixotropy, Stresses in soils, Boussinesq's theory.	7 Hrs
Unit -	Soil compaction, Dry density and moisture content relationship,	7 Hrs

4	Zero air voids line, Standard proctor test and modified proctor test, Field compaction methods, Earth pressure, Stability of slopes, Classification and failure of slopes,.	
Unit - 5	Methods of exploration, Introductory concepts of foundation, Location and depth of foundation, Choice of foundation type and preliminary selection, Bearing capacity, Settlement of shallow foundations, Types of settlements, Causes and control of settlement.	7 Hrs

References:

1. V.N.S.Murthy, "Soil Mechanics and Foundation Engineering", Vol. I, Saikrupa Technical Consultants, Bangalore.
2. Shashi K. Gulhati and Manoj Datta, "Geotechnical Engineering". Tata McGraw Hill Publication.
3. C. Venkatramaiah, "Geotechnical Engineering", New Age International Publication.
4. Dr. K. R. Arora. "Soil mechanics and foundation Engineering", Standard publishers distributors, Delhi.
5. Relevant Indian Standard Specifications and Codes.

Table 1: Mapping of Course Outcome with Program Outcomes:

Course Outcome	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3		2										
CO2	2	3		2		2								3
CO3		3		2										
CO4		3		3										2
CO5		2		2		2								3

3-High 2 - Medium 1 - Low

Assessment: ISE I: Shall be on the basis of Class Tests/ Assignments/ Quizzes/ Field visits/ Presentations/ Course Projects on First and Second unit

ISE II: Shall be based on class test on third and fourth units

ISE III: Shall be on the basis of Class Tests/ Assignments/ Quizzes/ Field visits/ Presentations/Course Projects on Fifth unit

Table 2: Recommended Assessment Pattern

Assessment Pattern Level No.	Knowledge Level	ISE I	ISE II	ISE III	End Semester Examination
K1	Remember	05	05		15
K2	Understand	05	05		15
K3	Apply	05	05	05	15
K4	Analyze			05	15
K5	Evaluate				
K6	Create				
Total Marks 100		15	15	10	60

CEPC 3002 : Design of steel Structures		
Teaching Scheme	Examination Scheme	
Lectures: 03hrs/ week	ISE I	15 Marks
Tutorials:	ISE II	15 Marks
Credits:03	ISE III	10 Marks
	End Semester Examination	60 Marks
Total Marks		100

Pre-requisites: The students should have learnt about properties, behavior of various materials and basic principles of strength of materials.

Course Description: To introduce the concept of structural design using steel sections, basic principles of design philosophies used in steel design and make the students aware of the code provisions for design. To make the students to understand the design procedures and detailing of various structural steel members.

Course Outcomes:

After completing the course, students will able:

Course Outcomes	
CO1	Interpret the provisions of IS 800-2007 for the design of steel structural elements.
CO2	Design of steel structural members and joints using relevant codes and standards.
CO3	Complete detailing after the design of steel structural elements.
CO4	Associate the design concept with overall design of steel structures.

Detailed Syllabus:

Unit 1	Introduction: Types of structural steel used in general construction work, permissible stresses. Various Indian standard sections and their properties. Relevant IS specifications such as IS:800-2007, IS:808-1989, IS:875 part I to III, SP: 6(1), SP: 6(6),IS:4000-1992, codes for welded connections. Philosophy of limit state design for strength and serviceability, partial safety factor for load and resistance, various design load combinations, classification of cross section such as plastic, compact, semi-compact and slender. Design of bolted and welded joint, structural connection, framed connection, and design of joints,	7 Hrs
Unit 2	Tension member in roof truss: Assessment of dead load, live load and wind load, design of purlin, design of Tension member of a truss, detailing of typical joints and supports. Tension member: Types of tension member. Factors affecting strength of member, Limit strength due to yielding, rupture and block shear. Design of tension member using single and double angle sections, connections	7 Hrs

	of member with gusset plate by bolts and welds. Design of lug angle.	
Unit 3	Compression member: Buckling classification as per geometry of cross section, buckling curves, design of struts in trusses using single and double angle section, connections of members with gusset plate by bolts and welds. Design of axially loaded column using rolled steel section. Design of built-up column, lacing and battening, connection of lacing/battening with main components by bolts and welds. Column base under axial load: design of slab base, gusseted base. Column base for axial load	7 Hrs
Unit 4	Design of flexural member- Laterally supported and unsupported beams using single rolled steel section with and without flange plate, strength in flexure, low and high shear, check for deflection. Secondary and main beam arrangement for floor of a building, design of beam to beam and beam to column connections using bolt / weld.	7 Hrs
Unit 5	Design of plate girder: Introduction to plate girder and design concept design of cross section, curtailment of flange plates, stiffeners and connections. Introduction of gantry girder	7 Hrs

TEXT BOOKS:

1. Design of Steel Structure by N Subramanian, Oxford University Press, New Delhi.
2. Limit state Design of steel structures by Limit State Method as per IS: 800- 2007 by S.K.Duggal Tata McGraw Hill Education Private limited New Delhi
3. Design of steel structure by Limit State Method as per IS: 800- 2007 by Bhavikatti S S,I K International Publishing House, New Delhi.
4. Design of Steel Structure By K.S. Sai Ram, Pearson Education India Pvt Ltd, New Delhi 2010
5. Limit state design of Steel Structure by V L Shah & Gore, Structures Publication, Pune.
6. Teaching Resource Material by INSDAG.
7. IS 456-2000: Code of practice for plain and R. C. BIS, New Delhi.
8. I.S.800:2007,"Code for general construction in steel structures," Bureau of Indian Standards,Manak Bhavan,9,Bhadur Shah ZafarMarg, New Delhi

REFERENCE BOOKS:

1. I.S.875 (part I to part V)," Code Of Practice For. Design Loads," Bureau of Indian Standards,Manak Bhavan,9,Bhadur Shah ZafarMarg, New Delhi.
2. I.S.226," Steel for general structural purposes," Bureau of Indian Standards,Manak Bhavan,9,Bhadur Shah ZafarMarg, New Delhi.
3. I.S.808:1989,"Code for Classification of Hot Rolled Steel ," Bureau of Indian Standards,Manak Bhavan,9,Bhadur Shah ZafarMarg, New Delhi.
4. I.S.226," Steel for general structural purposes," Bureau of Indian Standards,Manak Bhavan,9,Bhadur Shah ZafarMarg, New Delhi.
5. I.S.808:1989,"Code for Classification of Hot Rolled Steel ," Bureau of Indian Standards,Manak Bhavan,9,Bhadur Shah ZafarMarg, New Delhi.
6. I.S.816:1969," Code of practice for use of metal arc welding for general construction in mild steel," Bureau of Indian Standards,Manak Bhavan,9,Bhadur Shah ZafarMarg, New Delhi.

Mapping of Course outcome with Program Outcomes and Program Specific Outcomes

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	3	0	2	2	2	1	0	0	0	3	2	3
CO2	3	3	3	0	2	2	2	1	0	0	0	3	2	3
CO3	3	3	3	0	2	2	2	1	0	0	0	3	2	3
CO4	3	3	3	0	2	2	2	1	0	0	0	3	2	3

3-High 2 – Medium 1 – Low

Assessment: ISE I: Shall be on the basis of Class Tests/ Assignments/ Quizzes/ Field visits/ Presentations/ Course Projects on First and Second unit

ISE II: Shall be based on class test on third and fourth units

ISE III: Shall be on the basis of Class Tests/ Assignments/ Quizzes/ Field visits/ Presentations/ Course Projects on Fifth unit

Assessment Pattern:

Assessment Pattern Level No.	Knowledge Level	ISE I	ISE II	ISE III	End Semester Examination
K1	Remember	01	01	00	05
K2	Understand	02	02	00	05
K3	Apply	06	06	05	20
K4	Analyze	06	06	05	20
K5	Evaluate	00	00	00	10
K6	Create	00	00	00	00
Total Marks: 100		15	15	10	60

Assessment table:

Assessment Tool	K1	K2	K3	K4	K5
	CO1 to CO2	CO1 to CO4	CO1 to CO4	CO1 to CO4	CO1 to CO4
ISE I (15 Marks)	01	02	06	06	00
ISE II (15 Marks)	01	02	06	06	00
ISE III (10 Marks)	00	00	05	05	00
ESE Assessment (60 Marks)	05	05	20	20	10
Total Marks :100	07	09	37	37	10

Table 3: Assessment Table

Assessment Tool	K1	K2	K3	K4
	CO1 to CO5	CO1 to CO5	CO1 to CO5	CO1 to CO5
ISE I (15 Marks)	5	5	5	
ISE II (15 Marks)	5	5	5	
ISE III (10 Marks)			5	5
ESE Assessment (60 Marks)	15	15	15	15
Total Marks :100	25	25	30	20



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CEPC 3003: WATER RESOURCES ENGINEERING		
Teaching Scheme	Examination Scheme	
Lectures: 03 hrs/ week	ISE I	15 Marks
	ISE II	15 Marks
Credits:3	ISE III	10 Marks
	End Semester Examination	60 Marks

Prerequisites: Nil

Course description: This course aims to impart knowledge on the characteristics of water and waste water. The course will give the methods and techniques of treatment of water and waste water.

Course Outcomes: After Successful completion of the course, Student will be able to:

	Course Outcomes
CO1	Describe different terminologies related to hydrology
CO2	Analyze the hydrological and other parameters required for design and Management of water resources.
CO3	Compute the availability of the water resources and decide the mode of application of water, frequency of irrigation and other precautions so as to avoid water logging and soil infertility.
CO4	Select appropriate structures and justify the selection
CO5	Design the various hydraulic structures and check for the stability.

Detailed Syllabus:

Unit 1	<p>Hydrology: Introduction</p> <p>Precipitation: Forms of precipitation, measurement of precipitation, rain gauge network, presentation of rainfall data, estimation of mean precipitation, Depth Area Duration Curves, Frequency of rainfall, Probable Maximum precipitation.</p> <p>Evaporation and Evapo-Transpiration: Evaporation Process , Measurement of Evaporation and Evapo-transpiration, Reduction in Evaporation,</p> <p>Infiltration: Infiltration Process, Infiltration Capacity, measurement of Infiltration, Infiltration Indices</p>	7 Hrs
Unit 2	<p>Runoff and Hydrograph:</p> <p>Runoff: Routes of Runoff, Rainfall Runoff Correlation, Strange Table, Factors affecting runoff, Flow Distribution Curve, Mass curve</p> <p>Hydrograph: Introduction, Factors affecting Hydrograph, Component of Hydrograph, Base flow , Effective Rainfall</p> <p>Unit Hydrograph: Use and Limitations, Derivation of Unit Hydrograph, Synthetic Unit Hydrograph, Instantaneous Unit Hydrograph</p> <p>Flood Study: Design Flood and method of its estimation, Empirical Formula, Frequency Analysis</p>	7 Hrs

Unit 3	<p>Ground Water Hydrology and Crop Water Requirement:</p> <p>Ground Water: Aquifer and their types, Aquifer Parameters, Specific yield of wells, Thiem's and Dupuit's theory for wells in Confined and Unconfined aquifers, Ground Water Recharge and suitable methods.</p> <p>Crop Water Requirements: Factors Affecting crop water requirement, irrigation Water standards, Crop Period and Base Period, Wilting Point, Optimum Utilization of Irrigation Water, Irrigation Efficiencies, Delta, Duty, Determination of Duty, Crops and Seasons in India, Cropping Pattern, Crop Rotation, Design and Frequency of Irrigation, Water Application Methods.</p>	7 Hrs
Unit 4	<p>Dams: Site Selection, classification, storage capacity estimation</p> <p>Gravity Dams: Forces acting on Dams, Stability Analysis of Gravity Dams, Design of Gravity dams, Galleries in Dams.</p> <p>Earth Dam: Types , Elements of Earth Dams and their functions, Construction Aspects, causes of failures, Design of Section, Design of Filter, rock toe and pitching, Seepage and its control through Dam and its foundation.</p> <p>Arch and Buttress Dams: Introduction, Types and Suitability of Dams</p>	7 Hrs
Unit 5	<p>Hydraulic Structures:</p> <p>Spillways: Types of spillways, Spillway Capacity, Energy Dissipation, Spillway Gates</p> <p>Canals: Types of canals, canal alignment, design of canal in non alluvial soils, Kennedy's and Lacey's Silt theories</p> <p>Cross Drainage Works: Types, necessity, Head Regulator, Cross Regulator, Canal Falls, Weirs and Barrages, Design of Weir by Bligh's and Khosla's theory, Dam Outlets.</p>	7 Hrs

Text and Reference Books:

1. Subramanya K, " Engineering Hydrology" , Tata Mc Graw Hill Publications, New Delhi.
2. Sing Vijay P., " Elementary Hydrology", Prentice Hall of India Publication, New Delhi
3. Garg Santosh K., " Irrigation Engineering and Hydraulic Structures", Khanna Publishers, New Delhi
4. Punmia B.C. Pande and Lal B.B., "Irrigation and Water Power Engineering", Laxmi Publications Pvt. Ltd. New Delhi
5. Modi P.N., " Irrigation, Water Resources and Water Power Engineering", Standard Book House New Delhi
6. Wurbs R. A. and James W.P., " Water Resources Engineering", Prentice Hall of India, Pvt. Ltd. New Delhi
7. Asawa G.L., " Irrigation and Water Resources Engineering", New age International (P) Ltd.
8. Varshney R.S. , " Concrete Dams", Oxford and IBM Publishing Company

Mapping of Course outcome with Program Outcomes and Program Specific Outcomes

Course Outcome	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2			1	1				1					
CO2	3						1				2		2	
CO3		2	2											
CO4			1	3	2		1					2	1	
CO5	2								2		3	2		

1 – Low 2 – Medium 3 – High

Assessment: ISE I: Shall be on the basis of Class Tests/ Assignments/ Quizzes/ Field visits/ Presentations/ Course Projects on First and Second unit

ISE II: Shall be based on class test on third and fourth units

ISE III: Shall be on the basis of Class Tests/ Assignments/ Quizzes/ Field visits/ Presentations/ Course Projects on Fifth unit

Assessment Pattern:

Assessment Pattern Level No.	Knowledge Level	ISE I	ISE II	ISE III	End Semester Examination
K1	Remember	5			15
K2	Understand	5	5	5	15
K3	Apply	5	5	5	15
K4	Analyze		5		15
K5	Evaluate				
K6	Create				
Total Marks	100	15	15	10	60

Assessment table:

Assessment Tool	K1,K2,K3,K4	K1,K2,K3,K4	K1,K2,K3,K4	K1,K2,K3,K4	K1,K2,K3,K4
	CO1	CO2	CO3	CO4	CO5
ISE I (15 Marks)	5	5	5		
ISE II (15 Marks)		5	5	5	
ISE III (10 Marks)				5	5
ESE Assessment (60 Marks)	12	12	12	12	12
Total Marks 100	17	22	22	22	17

CEPC 3004: Transportation Engineering		
Teaching Scheme	Examination Scheme	
Lectures: 03 hrs/ week	ISE I	15 Marks
Tutorials:	ISE II	15 Marks
Credits:03	ISE III	10 Marks
	End Semester Examination	60 Marks
Marks	Total	100

Pre-requisites: Not Required

Course Description: This course introduces the elements of roads railways, bridges, Airport, Docks and harbors and tunneling as modes of transportation, properties, and mixes of materials suitable ingredients for mix design of material.

Course Outcomes:

After completing the course, students will able:

Course Outcomes	
CO1	To implement the concepts of Bridge Hydrology ,Bridge construction Techniques , Concepts of River Training
CO2	To interpret the elements of Roads ,Road construction Techniques , Railway Engineering ,Airport Engineering ,Docks and Harbors
CO3	To select suitable ingredients and preparation of Bituminous Mixes
CO4	To compute the stresses and behavior of Rigid pavement
CO5	To design flexible and rigid pavements

Detailed Syllabus:

Unit 1	Bridge Engineering: Classification of Bridges, Minor, major and long span bridges, Site Selection, Subsurface investigations for bridge constructions and its suitability. Collection of Bridge design data ,Bridge hydrology, Catchment Area ,Flood estimation methods in different regions , Waterway ,Time of concentration , Scour depth &Depth of foundations ,Afflux, Freeboard, Economic span of bridges, High & Low level causeways, culverts, Box culverts, Types of Bridge foundations ,Various loads on bridge foundations, Bridge superstructure &Substructure, River training works and its Methods .	7 Hrs
Unit 2	Highway Engineering : Importance &Modes of Transportation, Highway Alignment &Surveys, Drawing and reports ,Highway Project, Highway geometric design, Cross sectional elements ,Sight Distance, Horizontal &Vertical Alignment, Flyovers, Interchanges, Roundabout, Grade separators, Different types of junctions, Highway Drainage, Road safety Issues- Road Markings, Signs,	7 Hrs

	Boards, Road furniture , Rural Roads under PMGSY Program.	
Unit 3	Material Mix Design & Pavement Design : Selection of Suitable Materials, Bituminous Mix Design by Marshall Method, Flexible Pavement Design and IRC Guidelines , Stresses in Rigid Pavement, Rigid Pavement Design including Dowel & Tie bar and IRC Guidelines, White Topping and IRC Guidelines , Benkelman Beam & Overlays Analysis and Design.	7 Hrs
Unit 4	Traffic Engineering : Traffic Characteristics, Traffic Survey ,Traffic Studies ,Operations, Traffic Islands ,Design of Parking and Parking Facilities , Design of Intersections, Highway Lighting, Traffic Planning and Administration,	7 Hrs
Unit 5	Railway ,Airport, Tunneling, Docks & Harbors : Railway Tracks & Its components, Fixtures and fasteners , Points and crossings , Rail Joints , Station and Yards Elements of Airport , Planning of Airport, Runways , Taxiways, Aprons, Wind diagram Types of tunnels , Construction methods, drainage arrangement in tunnel Types of Docks and Harbors, Its Elements ,construction methods	7 Hrs

Books:

1. Bindra & Arora , Bridge Engineering
2. S K Khanna & Justo , Highway Engineering, Nem Chand & Bros , Roorkee (UP)
3. G. Venkatappa Rao , Principals of Transportation & Highway Engineering
4. Partha Chakraborty & Animesh Das , Principals of Transportation engineering
5. Dr R.D Kadiyali , Traffic Engineering , Khanna Publications
6. S.C. Saxena and S.P. Arora, A Text Book Of Railway Engineering, Dhanpat Rai Publications
7. Ketki B Dalal , Airport Engineering, Rangwala Publications
8. S. P Bindra, Docks & Harbors, Dhanpat Rai Publications
9. IRC -37 -2018 , Guidelines and Design for Flexible Pavement
10. IRC -58 -2015 , Guidelines and Design for Rigid Pavement

Mapping of Course outcome with Program Outcomes and Program Specific Outcomes

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

3-High 2 - Medium 1 - Low

Assessment: ISE I: Shall be on the basis of Class Tests/ Assignments/ Surprise Tests Quizzes/ Field visits/ Onsite learning /Presentations
 ISE II: Shall be based on class test on third and fourth units
 ISE III: Shall be on the basis of Class Tests/ Assignments/ Surprise Tests / Field visits/Onsite learning /Presentations for Fifth unit

Assessment Pattern:

Assessment Pattern Level No.	Knowledge Level	ISE I	ISE II	ISE III	End Semester Examination
K1	Remember	3	3		10
K2	Understand	3	3	3	10
K3	Apply	4	4	3	10
K4	Analyze	5	5	4	10
K5	Evaluate				10
K6	Create				10
Total Marks: 100		15	15	10	60

Assessment table:

Assessment Tool	K1	K2	K3	K4	K5	K6
	CO1 to CO5	CO1 to CO5	CO1 to CO5	CO1 to CO5	CO1 to CO5	CO1 to CO5
ISE I (15 Marks)	3	3	4	5		
ISE II (15 Marks)	3	3	4	5		
ISE III (10 Marks)		3	3	4		
ESE Assessment (60 Marks)	10	10	10	10	10	10
Total Marks :100	16	19	21	24	10	10


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 Dated: 18th April 2023

CEPC3005: LAB- GEOTECHNICAL AND FOUNDATION ENGINEERING		
Teaching Scheme	Examination Scheme	
Lectures: 02 hrs/ week	ISE I	25 Marks
	ISE II	
Credits:1	ISE III	
	End Semester Examination	25 Marks
	Total Marks	50 Marks

Prerequisite: Knowledge of Applied Mechanics, Fluid Mechanics and Engineering Geology.

Course Description: This course introduces the determination of various index and engineering properties of soil. Soil classification as per Indian Standards. Choice of type of foundation as per site situations.

Course Outcomes: After Successful completion of the course, Student will be able to:

	Course Outcomes
CO1	Determine various index properties of soil.
CO2	Determine various engineering properties of soil.
CO3	Classify soil as per Indian Standards.
CO4	To choose type of foundation to suit field conditions.
CO5	To calculate Safe bearing capacity values.

Detailed Syllabus: List of the experiments/assignments (Perform any Seven experiments)

Sr. No.	Details
1	Water content determination by Oven drying method.
2	Determination of Specific gravity soil.
3	Sieve analysis and IS classification of soil.
3	Determination of consistency limits and soil classifications.
5	Field Density by core cutter, sand replacement and water displacement method.
6	Determination of coefficient of permeability by constant head and variable head method.
7	Direct shear test.
8	Unconfined compression test.
9	Vane shear test.
10	Standard proctor test.

11	Differential free swell test.
12	Assignments: Methods of exploration, General types of foundations, Choice of foundation type and preliminary selection, Types of settlements.

Reference Books:

1. J.E.Bowles, "Physical and Geotechnical Properties of soils" Mc Graw Hill International Editions.
2. T. W. Lambe, "Soil Testing for Engineers" Wiley.
3. Relevant Indian Standard Specifications and Codes.

Mapping of Course outcome with Program Outcomes and Program Specific Outcomes

Course Outcome	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	2		2										1
CO2	3	3		3		2								3
CO3	2	3		3										2
CO4	2	2		2										2
CO5	3	3		2										3

3-High 2 – Medium 1 – Low

Assessment:

ISE I shall be based on the assessment of term work and interaction with student till 50% coverage of curriculum.

ISE II shall be based on the assessment of submission work and interaction with student till end of the term.

ESE will be based on oral/practical exam conducted by Course co-coordinator and External Examiner.

Assessment Pattern:

Assessment Pattern Level No.	Knowledge Level	ISE I	ISE II	ISE III	ESE	Total
K1	Remember/Perception	5	5		5	15
K2	Understand /Set	5	5		10	20
K3	Apply/Guided Response	2	3		5	10
K4	Analyze/Mechanism				5	5
K5	Evaluate/Complex Overt Response					
K6	Create /Adapation					
Total Marks 25		12	13		25	50

Assessment Table:

Assessment Tool	K1	K2	K3	K4
	CO1 to CO5	CO1 to CO5	CO1 to CO5	CO1 to CO5
ISE I (12 Marks)	5	5	2	
ISE II (13 Marks)	5	5	3	
ISE III -				
ESE Assessment - (25)	5	10	5	5
Total Marks 50	15	20	10	5



Approved in XXVth Academic Council
Dated: 18th April 2023

CEPC-3006: LAB- Design of steel structure		
Teaching Scheme	Examination Scheme	
Lectures: 04hrs/ week	ISE I	50 Marks
	ISE II	
Credits:2	ISE III	
	End Semester Examination	50 Marks
	Total Marks	100 Marks

OBJECTIVE:

1. To expose the students to analysis and design of roof truss.
2. To expose the students to analysis and design of plate girder/gantry girder.
3. To expose the students to design and prepare steel structural detailing using software.

Course Outcome (COs):

After completing the course, students will able:

Course Outcomes	
CO1	To Analyse and design industrial steel structures
CO2	To Prepare detailed drawing of industrial steel structures.
CO3	To use software for design and drawing of steel structural members

Detailed Syllabus :-Minimum two drawing sheets must be prepared by manual drawing or using any drafting software.

Expt. No	Name of Experiment/Test
1	Design and drawing of factory shed consisting of roof truss, column and column bases using recent IS codes
2	Analysis, design and drawing of plate girder/ gantry girder
3	Introduction to various software for analysis and Design of structures

Mapping of Course outcome with Program Outcomes and Program Specific Outcomes

Course Outcome	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	3	0	2	2	2	1	0	0	0	3	2	3
CO2	3	3	3	0	2	2	2	1	0	0	0	3	2	3
CO3	3	3	3	0	2	2	2	1	0	0	0	3	2	3

3-High 2 – Medium 1 – Low


 Approved in XXVth Academic Council
 Dated: 18th April 2023

Assessment:

ISE I shall be based on the assessment of term work and interaction with student till 50% coverage of curriculum.

ISE II shall be based on the assessment of submission work and interaction with student till end of the term.


ESE will be based on oral/practical exam conducted by Course co-coordinator and External Examiner.

Assessment Pattern:

Assessment Pattern Level No.	Knowledge Level	ISE I	ISE II	ISE III	Total
S1	Remember/Perception	00	00	00	00
S2	Understand /Set	05	05	00	10
S3	Apply/Guided Response	10	08	00	20
S4	Analyze/Mechanism	10	07	00	20
S5	Evaluate/Complex Overt Response	00	05	00	00
S6	Create /Adapation	00	00	00	00
Total Marks 50		25	25	00	50

Assessment Table:

Assessment Tool	S2,S3,S4	S5
	CO1,CO2	CO1,CO2,CO3
ISE I (25Marks)	25	00
ISE II (25 Marks)	20	05
ISE III -	00	00
ESE Assessment - (50)	40	10
Total Marks 100	85	15


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Dated: 18th April 2023

CEPC 3007: LAB-WATER RESOURCES ENGINEERING		
Teaching Scheme	Examination Scheme	
Lectures: 02 hrs/ week	ISE I	10 Marks
	ISE II	10 Marks
Credits:1	ISE III	5 Marks
	End Semester Examination	25 Marks

Prerequisites: Nil

Course description: Water is an important natural renewable water resource. This laboratory course deals with different hydrological aspects of water, its availability, and aerial distribution. It also deals with the stability and design aspects of hydraulic structures. In order to get acquainted with field conditions and status of water availability, to understand the legal provisions as per various acts and report writing are also included.

Course Outcomes:

After completing the course, students will able to:

	Course Outcomes
CO1	Understand the field conditions and status of water availability and its equitable distribution and legal provisions for Ground water and surface water distribution
CO2	Derive an Unit hydrograph for various durations
CO3	Design various types dams and also check for the stability of these structures
CO4	Analyze and Design various components of Hydraulic structures and
CO5	Write a report giving technical details

Detailed Syllabus: The term work shall consist of at least 10 exercises of following nature. Individual subject teacher shall have freedom of including additional exercises.

1	Report Writing- on the provisions of laws and Acts related to Water availability in different basins and its distribution, Maharashtra Ground Water Act and other relevant Acts.
2	Derivation Unit Hydrograph, Plotting Flood Hydrograph
3	Design of Gravity Dam by Single Step Method/ Multiple Step Method
4	Stability Analysis of Gravity Dams
5	Design and Stability Analysis of Earthen Dams
6	Design of Spillway (Ogee shape profile)
7	Design of Canal
8	Design of Cross Drainage Work
9	Design and Analysis of Weir on permeable foundation
10	A Detailed report of Field Visit preferably to a major Irrigation project



Mapping of Course outcome with Program Outcomes and Program Specific Outcomes

Course Outcome	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO1	PO12	PSO1	PSO2
CO1			1	1	1		2					2		
CO2						1			1			2	2	
CO3	1	2	2					2			2			
CO4					2	1	1		2		3		1	
CO5	2			3										

1 - Low 2 - Medium 3 - High

Assessment:

ISE I shall be based on the assessment of submission work and interaction with student till midterm.

ISE II shall be based on the assessment of submission work and interaction with student till end of the term.

ISE III shall be based on the assessment of submission work and interaction with student till end of the term.

Assessment Pattern:

Assessment Pattern Level No.	Knowledge Level	ISE I	ISE II	ISE III	ESE
K1	Remember/Perception	5			10
K2	Understand /Set	5	5		10
K3	Apply/Guided Response		05	5	5
K4	Analyze/Mechanism				
K5	Evaluate/Complex Overt Response				
K6	Create /Adapation				
Total Marks 50		10	10	5	25

Assessment table:

Assessment Tool	K1, K2,K3	K1, K2,K3	K1, K2,K3	K1, K2,K3	K1, K2,K3
	CO1	CO2	CO3	CO4	CO5
ISE I (10 Marks)	5	5			
ISE II (10 Marks)			5	5	
ISE III (5 Marks)					5
ESE Assessment (25 Marks)	5	5	5	5	5
Total Marks 50	10	10	10	10	10



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CEPC 3008: LAB- Transportation Engineering		
Teaching Scheme	Examination Scheme	
Lectures: 02 hrs/ week	ISE I	25 Marks
	ISE II	
Credits:1	ISE III	-
	End Semester Examination	25 Marks
	Total Marks	50 Marks

OBJECTIVE:

Course Outcome (COs):

After completing the course, students will able:

Course Outcomes	
CO1	To conduct experiments on materials for road construction
CO2	To design material mix for different types of pavements

Detailed Syllabus: The term work shall consist of, by conducting the experiments from the following list

Expt. No	Name of Experiment/Test	To Perform
1	Tests on Aggregates : Gradation , Impact Value , Crushing Value , Abrasion Value, Water Absorption , Specific Gravity , Soundness, Flakiness & Elongation	All Tests
2	Tests on Bitumen : Ductility , Penetration , Softening Point , Viscosity , Fire & Flash Point , Specific Gravity , Stripping Value	All Tests
3	Marshall Stability Method	One Test
4	Material Mix Design for Flexible Pavement	Any One
5	Material Mix Design for Rigid Pavement	
6	Benkelman beam Method for deformations of Pavement	One Test
7	Laboratory CBR Test & Field CBR Test	Both Tests
8	Design of Flexible Pavement	Any One
9	Design of Rigid Pavement	
10	Preparation of a report based on site visit – Road , Bridge, Flyover, Junctions , Interchange , Airport, Railway Station , Tunnel, Docks & Harbor	Report on any one site visit

Mapping of Course outcome with Program Outcomes and Program Specific Outcomes

Course Outcome	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	2	2	1	-	2	-	2	2	-	2		
CO2	3	3	3	2	1	-	-	-	2	2	-	2		

3-High 2 - Medium 1 - Low

Assessment:

ISE I shall be based on the assessment of term work and interaction/discussion on

Experiments with student till 50% coverage of curriculum.

ISE II shall be based on the assessment of submission work and interaction/discussion on experiments with the Student till end of the term.

ESE will be based on Viva /practical exam conducted by Course co-coordinator and External Examiner.

Assessment Pattern:

Assessment Pattern Level No.	Knowledge Level	ISE I	ISE II	ISE III	Total
S1	Remember/Perception	6			6
S2	Understand /Set	3	1		4
S3	Apply/Guided Response	4	2		6
S4	Analyze/Mechanism		2		2
S5	Evaluate/Complex Overt Response		3		3
S6	Create /Adaptation		4		4
Total Marks 25		13	12		25

Assessment Table:

Assessment Tool	S2,S3,S4	S2,S3,S4
	CO1,CO2	CO1, CO2
ISE I (12Marks)	12	
ISE II (13 Marks)		13
ISE III -	-	-
ESE Assessment - (25)	12	13
Total Marks	24	26
50		


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CEPC3009-Estimation, Costing & Valuation		
Teaching Scheme	Examination Scheme	
Lectures: 3 hrs/ week	ISE I	15 Marks
Tutorials:	ISE II	15 Marks
Credits: 3	ISE III	10 Marks
	End Semester Examination	60 Marks
	Total	100
Marks		

Pre-requisites: NIL

Course Description: The course deals with estimating quantities and probable expenditure on different buildings. The exposure on valuation of properties will also be taught in this course. Exposure to contracts, types of contracts as well as method of tendering will also be given.

Course Outcomes:

After completing the course, students will be able to:

	Course Outcomes
CO1	Estimate the quantities for various civil engineering projects.
CO2	Compute rates for various items of construction.
CO3	Prepare estimates for various civil engineering works.
CO4	Write specifications and tender notice.
CO5	Compose valuation report for buildings.

Detailed Syllabus:

Unit 1	<p>Estimate: Definition, importance of quantity surveying for civil engineer. Purpose, type of estimates, data required for estimates. Items of work, description of an item of work, unit of measurement & principles deciding the units, mode of measurement of building works. Abstracting, bill of quantities. Provisional & prime cost items, contingencies, establishment charges, centage charges, District Schedule of Rates (DSR) Introduction of IS: 1200 for modes of measurement.</p> <p>Approximate Estimate: Definition, purpose, methods of approximate estimation of building & other civil engineering projects like roads, irrigation & water supply & sanitary engineering, electrical works.</p>	7 Hrs
Unit 2	<p>Taking out Quantities Principles, methods of taking out quantities for different assignments mentioned in term work, Abstracting bill of quantities, provisional and prime cost items, contingencies, establishment charges.</p> <p>Analysis of Rates : Factors affecting cost an item of work materials, labour, tools, and plant, overheads and profit. Task work-definition and factors affecting task work Transportation of material and cost Schedule of materials and labour, District Schedule of Rates (D.S.R).</p>	7 Hrs

	Analysis of rates of different items mentioned in T.W. Specifications : Definition and purpose, types, drafting specifications, legal aspect, specifications of stone masonry, wood work, earth work, reinforcing brick work of R.C.C. work.	
Unit 3	<p>Methods of Executing Works :PWD procedure of execution of work, Administrative approval, budget provision, Technical Sanction, Different methods of execution of minor works in PWD, like piecework, rate list, day work, daily labour.</p> <p>Introduction to registration as a contractor in the P.W.D.</p> <p>Tenders: Definition. Methods of inviting tenders, Types of tenders, tender notice, Pre- qualifications of contractor, tender documents, preparation of tenders. Submission in 3 bid/ 2 bid or single bid system. Qualitative and quantitative evaluation of tenders, comparative statement, pre- bid conference, acceptance of tenders, various forms of BOT tenders, global tendering. Administrative approval, technical sanction</p>	7 Hrs
Unit 4	<p>Valuation of Property: Purpose, nature of value, price, factors affecting value of a property. Free hold and leasehold property. Depreciation and methods of working out depreciation, sinking fund, years purchase, out goings. Methods of valuation Land and building basis, Rental basis, Reproduction and replacement cost basis, Profit basis, fixation of rent.</p>	7 Hrs
Unit 5	<p>Contracts: General idea, types of contracts viz: lump sum, item rate, cost plus, Engineering Procurement Construction (EPC). Conditions of contracts. FIDIC document, standard contract conditions published by MOS and PI, Law of contract. Definition, objective & essentials of valid contract.</p> <p>Conditions of contract: General and Specific conditions. Condition regarding EM, SD, time as an essence of contract. Important conditions regarding addition, alteration, extra items, testing of materials, defective work, subletting, powers delegated to Engineer in-charge regarding the above aspect, defect liability period, retention money, interim payment or running account bills, advance payment, secured advance, final bill. Settlement of disputes viz. dispute resolving board, arbitration,</p> <p>Concept of partnering. Liquidated damages, termination of contract. Liquidated damages defect liability period, retention money, termination of contract, payment, secure advance.</p>	7 Hrs

Text Books:

1. Estimating and Costing in Civil Engineering: Theory and Practice, By: B.N Dutta Published By: S. Dutta & Company, Lucknow.
2. Estimating, Costing Specifications & valuation in Civil Engineering, By: M.Chakraborty Published By: Author.
3. Estimating and Costing By: G.S.Birdie
4. Estimating and Costing By: Rangwala Published By: Charotar Publishing House, Anand

Reference Books:

1. Civil Engineering Contracts & Estimates By: B.S.Patil Published By: Orient Longman Ltd. Mumbai.
2. I.S.1200 (Part 01 to 25): Methods of Measurement of Building and Civil Engineering Works.
3. D.S.R: District Schedule of Rates
4. PWD Hand Book and Red Book
5. Standard Contract Clauses for Domestic Bidding Contracts: Ministry of Statistics and Programme Implementation, Government of India.
6. FIDIC Document: Federation International Des Ingenieurs Conseils i.e. International Federation of Consulting Civil Engineers, Geneva, Switzerland.

Mapping of Course outcome with Program Outcomes and Program Specific Outcomes

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

3-High 2 – Medium 1 – Low

Assessment: ISE I: Shall be on the basis of Class Tests/ Assignments/ Quizzes/ Field visits/ Presentations/ Course Projects on First and Second unit
 ISE II: Shall be based on class test on third and fourth units
 ISE III: Shall be on the basis of Class Tests/ Assignments/ Quizzes/ Field visits/ Presentations/ Course Projects on Fifth unit

Assessment Pattern:

Assessment Pattern Level No.	Knowledge Level	ISE I	ISE II	ISE III	End Semester Examination
K1	Remember	5		3	8
K2	Understand	5	5	3	18
K3	Apply	5	5	2	18
K4	Analyze		5	2	18
K5	Evaluate				
K6	Create				
Total Marks: 100		15	15	10	60


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 Dated: 18th April 2023

Assessment table:

Assessment Tool	K1	K2	K3	K4
	CO1 to CO5	CO1 to CO5	CO1 to CO5	CO1 to CO5
ISE I (15 Marks)	5	5	5	
ISE II (15 Marks)		5	5	5
ISE III (10 Marks)	3	3	2	2
ESE Assessment (60 Marks)	6	18	18	18
Total Marks :100	13	30	30	25



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Dated: 18th April 2023

CEPC 3010 : Design of RCC Structures		
Teaching Scheme	Examination Scheme	
Lectures: 03hrs/ week	ISE I	15 Marks
Tutorials:00	ISE II	15 Marks
Credits:03	ISE III	10 Marks
	End Semester Examination	60 Marks
Marks	Total	100

Pre-requisites:The undergraduate courses Concrete Technology, Solid Mechanics, and Theory of Structures should have been studied earlier.

CourseDescription:To introduce the concept of structural design using RCC sections, basic principles of design philosophies used in RCC design and make the students aware of the code provisions for design.To make the students to understand the design procedures and detailing of various structural rcc members.

Course Outcomes:

After completing the course, students will able:

Course Outcomes	
CO1	Interpret the provisions of IS 456-2000 for the design of RCC structural elements.
CO2	Design RCC structural members using relevant codes and standards.
CO3	Complete detailing after the design of RCC structural elements.
CO4	Associate the design concept with overall design of RCC structures.

Detailed Syllabus:

Unit 1	<p>A) Design Philosophies :Introduction to various design philosophies R.C structures: Historical development, working stress method, ultimate load method and limit state method. Limit state method: Limit state of collapse, limit state of serviceability and limit state of durability. Characteristic strength, characteristic load, concept of safety - Partial safety factors for material strengths and loads. Study of structural properties of concrete.</p> <p>B) Limit state of Collapse (flexure) Assumptions of Limit state method, strain variation diagram, stress variation diagram, design parameters for singly reinforced rectangular R.C. section, Moment of resistance of Under reinforced and balanced section, M.R. of doubly reinforced rectangular section and flanged section. Design of flexural members: Simply supported, continuous, cantilever beams Redistribution of moments</p>	7 Hrs
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Unit 2	A) Limit state of collapse (Shear and bond): Shear behavior up to failures. Types of failure, Factor affecting shear failure, strength of R.C. beams in shear, design of shear reinforcement as per I.S. recommendations. Bond: types of bond. Factor affecting bond resistance, check for development length B) Limit state Serviceability: Significance of deflection, types of deflection, types of deflections and I.S. requirements. Limit state of cracking: Cracking, causes mechanism & effects, classification and types of cracks, bar detailing rules	7 Hrs
Unit 3	Design of slab: One way, simply supported, cantilever and continuous slabs. Two wayslab: simply supported, cantilever continuous and restrained. Design of staircase: Dog legged	7 Hrs
Unit 4	Design of Column: Introduction, strain and stress variation diagrams, axially loaded short column with minimum eccentricity requirements. Design of short column for axial load, uni-axial, Biaxial bending using interaction curves, Analysis and design of sections. I.S .456 SP-16 Column design charts of section	7 Hrs
Unit 5	Design of Footing : Design of isolated column footing for axial load ,Uniaxial and Biaxial bending.	7 Hrs

TEXT BOOKS:

1. S U Pillai and Devdas Menon, Reinforced Concrete Design, Tata-McGraw-Hill Publishing Company Limited, New Delhi.
2. B C Punmia, A K Jain and A K Jain, Comprehensive Design of RCC Structures, Laxmi Publications (P) Ltd, New Delhi
3. S Ramamrutham, Design of Reinforced Concrete Structures, Dhanpat Rai Publishing Company, New Delhi,
4. V L Shah and S R Karve, Limit State Theory and design of reinforced Concrete, Structures Publications, Pune, 2011
5. A.K. Jain "Reinforced Concrete Limit state Design". Nem Chand & Brothers 2007
6. IS 456: 2000 Plain and Reinforced Concrete- Code of Practice, Bureau of Indian Standards, New Delhi

REFERENCE BOOKS:

7. Park R and Paulay T, Reinforced Concrete Structures, John Wiley & Sons, Inc., New York, 1975
8. Sinha S.N. "Reinforced Concrete Design". Tata -Mc-Graw-Hill New Delhi.
9. Handbook on Concrete Reinforcement and detailing, Special Publication SP 34, Bureau of Indian Standards, New Delhi, 1987



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Mapping of Course outcome with Program Outcomes and Program Specific Outcomes

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	3	0	2	2	2	1	0	0	0	3	2	3
CO2	3	3	3	0	2	2	2	1	0	0	0	3	2	3
CO3	3	3	3	0	2	2	2	1	0	0	0	3	2	3
CO4	3	3	3	0	2	2	2	1	0	0	0	3	2	3

3-High 2 – Medium 1 – Low

Assessment: ISE I: Shall be on the basis of Class Tests/ Assignments/ Quizzes/ Field visits/ Presentations/ Course Projects on First and Second unit
 ISE II: Shall be based on class test on third and fourth units
 ISE III: Shall be on the basis of Class Tests/ Assignments/ Quizzes/ Field visits/ Presentations/ Course Projects on Fifth unit

Assessment Pattern:

Assessment Pattern Level No.	Knowledge Level	ISE I	ISE II	ISE III	End Semester Examination
K1	Remember	01	01	00	05
K2	Understand	02	02	00	05
K3	Apply	06	06	05	20
K4	Analyze	06	06	05	20
K5	Evaluate	00	00	00	10
K6	Create	00	00	00	00
Total Marks: 100		15	15	10	60

Assessment table:

Assessment Tool	K1	K2	K3	K4	K5
	CO1 to CO2	CO1 to CO4	CO1 to CO4	CO1 to CO4	CO1 to CO4
ISE I (15 Marks)	01	02	06	06	00
ISE II (15 Marks)	01	02	06	06	00
ISE III (10 Marks)	00	00	05	05	00
ESE Assessment (60 Marks)	05	05	20	20	10
Total Marks :100	07	09	37	37	10

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 Dated: 18th April 2023

CEPC3011-Lab: Estimation, Costing & Valuation		
Teaching Scheme	Examination Scheme	
Lectures: 4 hrs/ week	ISE I	50 Marks
	ISE II	
Credits: 2	ISE III	
	End Semester Examination	50 Marks
	Total Marks	100 Marks

OBJECTIVE:

Course Outcome (COs):

After completing the course, students will able:

Course Outcomes	
CO1	Perform to take out the quantities for various construction projects.
CO2	Formulate estimates for various civil engineering works.
CO3	Develop draft specifications and tender notice.
CO4	Formulate valuation report for residential building.

Detailed Syllabus: The term work shall consist of following

Exer. No	Name of Experiment/Test
1	Working out Detailed Quantities for a Two storied R.C.C. framed building based on prevailing DSR rates for Aurangabad District
2	Estimation of quantities of steel reinforcement for an R.C.C. framed structure in (i) above
3	Detailed Estimate of Residential Drainage and Water Supply Project
4	Preparation of any 2 Estimate using Computer Software a. One column, column footing, beam and slab panel. b. Pipe culvert and slab culvert. c. Earthwork (for a road, Railway, Canal or a small dam)
5	Writing Detail specifications of any two items Work from exercise 1
6	Analysis of Rates: For the two Items of Works in exercise 1 based on the prevailing market rates of various items and labour involved
7	Preparing valuation reports of a residential buildings
8	Preparation of draft of tender notice for exercise 1


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Dated: 18th April 2023

Mapping of Course outcome with Program Outcomes and Program Specific Outcomes

Course Outcome	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3			2	2		1							
CO2	3	2		2			1						1	
CO3	3				2	1					1			
CO4	2	3		2		3	1						2	

3-High 2 – Medium 1 – Low

Assessment:

ISE I shall be based on the assessment of term work and interaction with student till 50% coverage of curriculum.

ISE II shall be based on the assessment of submission work and interaction with student till end of the term.


ESE will be based on oral/practical exam conducted by Course co-coordinator and External Examiner.

Assessment Pattern:

Assessment Pattern Level No.	Knowledge Level	ISE I	ISE II	ISE III	ESE	Total
K1	Remember/Perception	10			12	22
K2	Understand /Set	10	5		13	28
K3	Apply/Guided Response	5	10		13	28
K4	Analyze/Mechanism		10		12	22
K5	Evaluate/Complex Overt Response					
K6	Create /Adaptation					
Total Marks 50		25	25		50	100

Assessment Table:

Assessment Tool	K1	K2	K3	K4
	CO1, CO2	CO2, CO3	CO2, CO3	CO3, CO4
ISE I (25 Marks)	10	10	5	
ISE II (25 Marks)		5	10	10
ISE III -				
ESE Assessment - (50)	12	13	13	12
Total Marks 100 Marks	22	28	28	22


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CEPC 3012: LAB- Design Of RCC Structures		
Teaching Scheme	Examination Scheme	
Lectures: 04hrs/ week	ISE I	50 Marks
	ISE II	
Credits:2	ISE III	
	End Semester Examination	50 Marks
	Total Marks	100 Marks

OBJECTIVE:

1. To expose the students to analyze and design of three storied RCC structures.
2. To expose the students to prepare RCC structural detailing using Autocad and recent IS codes.
3. To expose the students to various design software.

Course Outcome (COs):

After completing the course, students will able to :

Course Outcomes	
CO1	Analyze and design of RCC building
CO2	Prepare detailed drawing of RCC building
CO3	Use software for design and drawing of RCC structural members

Detailed Syllabus: The term work shall consist of minimum two drawing sheets prepared manually or using any drafting software based on following design

Expt. No	Name of Experiment/Test
1	Design and drawing of residential /commercial/public RCC building using Autocad and recent IS codes.
2	Design of RCC structural elements like beams ,column ,slab using computer programme/Design using softwares

Mapping of Course outcome with Program Outcomes and Program Specific Outcomes

Course Outcome	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	3	0	2	2	2	2	0	0	0	3	2	3
CO2	3	3	3	0	2	2	2	2	0	0	0	3	2	3
CO3	3	3	3	0	2	2	2	2	0	0	0	3	2	3

3-High 2 – Medium 1 – Low



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Dated: 18th April 2023

Assessment:

ISE I shall be based on the assessment of term work and interaction with student till 50% coverage of curriculum.

ISE II shall be based on the assessment of submission work and interaction with student till end of the term.

ESE will be based on oral/practical exam conducted by Course co-coordinator and External Examiner.

Assessment Pattern:

Assessment Pattern Level No.	Knowledge Level	ISE I	ISE II	ISE III	Total
S1	Remember/Perception	00	00	00	00
S2	Understand /Set	05	05	00	10
S3	Apply/Guided Response	10	08	00	20
S4	Analyze/Mechanism	10	07	00	20
S5	Evaluate/Complex Overt Response	00	05	00	00
S6	Create /Adapation	00	00	00	00
Total Marks 50		25	25	00	50

Assessment Table:

Assessment Tool	S2,S3,S4	S5
	CO1,CO2	CO1,CO2,CO3
ISE I (25Marks)	25	00
ISE II (25 Marks)	20	05
ISE III -	00	00
ESE Assessment - (50)	40	10
100	Total Marks 85	15


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CEPE3001: Advanced Structural Analysis			
Teaching Scheme		Evaluation Scheme	
Theory	3 Hrs/Week	Class Test-I	15 Marks
Tutorial		Class Test-II	15 Marks
Total Credits	3	Teacher's Assessment	10 Marks
		End Semester Examination	60 Marks
		Total	100 Marks

Prerequisites:

The students should have undergone course of AM 2008: Structural Analysis

Course Description:

The course deals with matrix methods of analysis of beams, plane frames and trusses. It provides fundamental understanding required for analysis of three dimensional structures such as space frames, trusses etc. Analysis of arches, cables and suspension bridges are also included in the syllabus. Unit of theory of elasticity provides fundamentals of elasticity approach of structural analysis.

Course Outcomes:

After successful completion of this course, the student will be able to

1. Formulate compatibility equations for structural members
2. Apply and analyze the two dimensional structures using matrix methods of analysis
3. Apply and analyze two dimensional structures using direct stiffness method
4. Analyze determinate and indeterminate arches
5. Analyze Cables and Suspension Bridges

Detailed Syllabus:

Unit - 1:	Flexibility Matrix Method of Structural Analysis Concept of Flexibility, Equations of compatibility of displacements, Flexibility matrix of a structure and its characteristics, Analysis of beams, plane frames and trusses.	7 Hrs
Unit - 2:	Stiffness Matrix Method of Structural Analysis Concept of Stiffness, Equations of equilibrium of forces, Stiffness matrix of a structure and its characteristics, Analysis of beams and plane frames.	7 Hrs
Unit - 3:	Direct Stiffness Method Member stiffness matrix, Joint stiffness matrix , Equivalent joint load vector. Compatibility equations, Application of the method for the analysis of continuous beams and plane frames. Algorithm for developing computer program	7 Hrs
Unit - 4:	Analysis of Arches Three hinged arch, Two hinged arch, Horizontal thrust, Bending moment, Radial shear and Normal thrust, Rib shortening, Temperature stresses	7 Hrs
Unit - 5:	Cables and Suspension Bridges Equilibrium of loaded cables, temperature stresses in cables , Analysis of suspension bridge with three hinged stiffening girder, two hinged stiffening girder, influence line diagrams	7 Hrs

Reference Books:

1. Weaver W. and Gere J.M., Matrix Analysis of Framed Structures, CBS, New Delhi
2. Pandit G.S. and Gupta S.P., Structural Analysis, Tata McGraw Hill, New Delhi
3. Timoshenko S.P. and Goodier J.N., Theory of Elasticity, Tata McGraw Hill, New Delhi
4. C.K. Wang, Indeterminate Structural Analysis, Tata McGraw Hill, New Delhi
5. Devdas Menon, Structural Analysis, Narosa Publications, New Delhi
6. C.S. Reddy, Basic Structural Analysis, Tata McGraw Hill, New Delhi
7. S. Ramamrutham and N. Narayan, Theory of Structures, Dhanpat Rai, New Delhi
8. N.C. Sinha and P.K. Gayen, Advanced Theory of Structures, Dhanpat Rai, New Delhi

Table 1: Mapping of Course Outcome with Program Outcomes

Course Outcome	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO1	PSO2
CO1	3	3	2	1	2									
CO2	3	3	2	1	2	1								2
CO3	3	3	2	1	2	1								1
CO4	2	2	2	1	2	1								
CO5	2	2	2	2	2		1							

H- High, M- Medium, L- Low

Assessment: ISE I: Shall be on the basis of Class Tests/ Assignments/ Quizzes/ Field visits/ Presentations/ Course Projects on First and Second unit

ISE II: Shall be based on class test on third and fourth units

ISE III: Shall be on the basis of Class Tests/ Assignments/ Quizzes/ Field visits/ Presentations/ Course Projects on Fifth unit

Table 2: Recommended Assessment Pattern

Assessment Pattern Level No.	Knowledge Level	Class Test I	Class Test II	Teacher's Assessment	End Semester Examination
K1	Remember	02	02	00	08
K2	Understand	03	03	00	08
K3	Apply	04	04	02	20
K4	Analyze	06	06	03	24
K5	Evaluate	00	00	03	00
K6	Create	00	00	02	00
Total Marks 100		15	15	10	60

Table 3: Assessment Table

Assessment Tool	CO1	CO2	CO3	CO4	CO5
	K1 to K6	K1 to K6	K1 to K6	K1 to K6	K1 to K6
Class Test I	8	7			
Class Test II			8	7	
Teachers Assessment	2	2	2	2	2
ESE	12	12	12	12	12



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CEPE 3003: Ground Improvement Techniques			
Teaching Scheme		Evaluation Scheme	
Theory	03 hrs/week	ISE I	15 Marks
Tutorial	00	ISE II	15 Marks
Total Credits	03	ISE III	10 Marks
		End Semester Examination	60 Marks
		Total	100 Marks

Prerequisite: Knowledge of CE 3004: Geotechnical and Foundation Engineering

Course Description: This course introduces different ground improvement techniques, methods, cost and suitability.

Course Outcomes: After Successful completion of the course, Student will be able to:

Course Outcomes	
CO1	Improve ground conditions by excavation and replacement.
CO2	Improve ground conditions by Vibratory compaction in sands and vibrofloatation in clays.
CO3	Select methodologies to be adopted for particular ground improvement technique.
CO4	Implement densification, grouting, reinforcement mechanism.
CO5	Design with geosynthetics.

Detailed Syllabus:

Unit - 1:	Ground Improvement and Modification: New technologies, Relative costs, Processes of modification and their influence on soil, Improving by excavating and replacing, In-Situ ground improvement, Design methodology.	7 Hrs
Unit - 2:	In-Situ Densification of Soils: Response of sands and clays to externally applied stress, Compaction piles in sands, Impact compaction of sands, Vibratory compaction in sands, Explosion in sands, Comparison of in situ densification methods in sands, Vibrofloatation in clays, Accelerated pre-consolidation in clays.	7 Hrs
Unit - 3:	Grouting in soils: Types of grouts, Desirable characteristics of grouts, Grouting methods, Permeation grouting, Grouting pressure, technology, and arrangements, Displacement- compaction grouting, Displacement-soil fracture grouting, Jet or replacement-displacement grouting.	7 Hrs
Unit - 4:	Reinforced Soil: The mechanism, Reinforcement-soil interaction, Applications, Reinforced soil structures with vertical faces, Reinforced soil embankments, Open excavation using soil nails, Reinforcement of soil beneath unpaved roads and foundations.	7 Hrs
Unit - 5:	Geosynthetics: A manmade product, Why geosynthetics? Types of geosynthetics, Functions of geosynthetics, Properties of geosynthetics, Functional requirements, Designing with geosynthetics	7 Hrs

References:

1. M. R. Hausmann, "Engineering Principles of ground Modifications", McGraw-Hill International.
2. P. P. Xanthakos, L. W. Abramson and D. A. Bruce, "Ground Improvement and Control", John Wiley & Sons.
3. R. H. Manfired, "Engineering Principles of Ground Modifications", McGraw-Hill.,
4. Dr. P Purushothama Raj, "Ground Improvement Techniques", Laxmi Publications, New Delhi.
5. S. K Gulati and Manoj Datta, "Geotechnical Engineering", Tata McGraw Hills Publications, New Delhi.

Table 1: Mapping of Course Outcome with Program Outcomes:

Course Outcome	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1		3		2		2								
CO2		3		2		2								3
CO3		3		2		2								3
CO4		3		2		2								2
CO5		2		3		2								3

3-High 2 – Medium 1 – Low

Assessment: ISE I: Shall be on the basis of Class Tests/ Assignments/ Quizzes/ Field visits/ Presentations/ Course Projects on First and Second unit
ISE II: Shall be based on class test on third and fourth units
ISE III: Shall be on the basis of Class Tests/ Assignments/ Quizzes/ Field visits/ Presentations/Course Projects on Fifth unit

Table 2: Recommended Assessment Pattern

Assessment Pattern Level No.	Knowledge Level	ISE I	ISE II	ISE III	End Semester Examination
K1	Remember	05	05		15
K2	Understand	05	05		15
K3	Apply	05	05	05	15
K4	Analyze			05	15
K5	Evaluate				
K6	Create				
Total Marks 100		15	15	10	60

Table 3: Assessment Table

Assessment Tool	K1	K2	K3	K4
	CO1 to CO5	CO1 to CO5	CO1 to CO5	CO1 to CO5
ISE I (15 Marks)	5	5	5	
ISE II (15 Marks)	5	5	5	
ISE III (10 Marks)			5	5
ESE Assessment (60 Marks)	15	15	15	15
Total Marks :100	25	25	30	20



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CEPE 3004: Dam and Water Power Engineering		
Teaching Scheme	Examination Scheme	
Lectures: 03 hrs/ week	ISE I	15 Marks
Tutorials:00	ISE II	15 Marks
Credits:03	ISE III	10 Marks
	End Semester Examination	60 Marks
	Total	100
Marks		

Pre-requisites: CEPC 2003 Fluid Mechanics

Course Description: This course covers planning and development aspects of multipurpose irrigation projects, the various components of a Hydro Electric Power Plant, Selection of various types of turbines, computation of Power generated. Selection of Pumps and its working.

Course Outcomes:

After completing the course, students will able:

	Course Outcomes
CO1	Select type of a dam and suitable site for Power Generation
CO2	Plan location and type of spillway , controlling mechanism for power generation
CO3	Plan and Design a Hydro Electric Power Plant
CO4	Analyze, Select and Design the turbines
CO5	Analyze, Select and Design the Pumps

Detailed Syllabus:

Unit 1	Dams: Type of Dams, Site Selection of Dams, Gravity Dams, Earthen Dams, Arch Dams, Buttress Dams. Multipurpose Irrigation Project, Reservoir Planning	7 Hrs
Unit 2	Spillways: Types of Spillways, Spillway Control Gates, Dam Sluices, Energy dissipation below spillways.	7 Hrs
Unit 3	Introduction to Water Power: Water Power Development Principle components and General Layout of Hydro Electric Power Plant, River Power Development, Small Hydro electric Power Plants, Storage Power Development.	7 Hrs
Unit 4	Turbines: Intake Structures, Penstocks, Surge Tanks, Turbines, Classification, Selection and Characteristics curves of Turbines, , Draft Tube, Valves and Gates, Water Hammer, Surge in Power Tunnel, Cavitation.	7 Hrs
Unit 5	Pumps: Centrifugal Pump, Reciprocating Pump, Classification and Selection of Pumps, Components of Pumps, Working of Pumps, Characteristic curves of Pumps, Priming, slip of pump.	7 Hrs

Text Books:**Reference Books:**

1. Garg S.K. (2010), "Irrigation Engineering and Hydraulic Structures", Khanna Publishers, Delhi
2. Bansal R.K. (2013), "A Text Book of Fluid Mechanics and Hydraulic Machines", Laxmi Publications Private Limited, New Delhi.
3. Punmia B.C. (2016), "Irrigation and Water Power Engineering", Laxmi Publications New Delhi.

Mapping of Course outcome with Program Outcomes and Program Specific Outcomes

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

3-High 2 - Medium 1 - Low

Assessment: ISE I: Shall be on the basis of Class Tests/ Assignments/ Quizzes/ Field visits/ Presentations/ Course Projects on First and Second unit
 ISE II: Shall be based on class test on third and fourth units
 ISE III: Shall be on the basis of Class Tests/ Assignments/ Quizzes/ Field visits/ Presentations

Assessment Pattern:

Assessment Pattern Level No.	Knowledge Level	ISE I	ISE II	ISE III	End Semester Examination
K1	Remember				5
K2	Understand	3	3		10
K3	Apply	4	4		15
K4	Analyze	4	4	5	15
K5	Evaluate	4	4	5	15
K6	Create				
Total Marks: 100		15	15	10	60


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Assessment table:

Assessment Tool	K1	K2	K3	K4	K5
	CO1 to CO5	CO1 to CO5	CO1 to CO5	CO1 to CO5	CO1 to CO5
ISE I (15 Marks)		3	4	4	4
ISE II (15 Marks)		3	4	4	4
ISE III (10 Marks)		-	-	5	5
ESE Assessment (60 Marks)	5	10	15	15	15
Total Marks :100	5	16	23	28	28



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CEPE3005-Advanced Water & Wastewater Treatment		
Teaching Scheme	Examination Scheme	
Lectures: 3 hrs/ week	ISE I	15 Marks
Tutorials:	ISE II	15 Marks
Credits: 3	ISE III	10 Marks
	End Semester Examination	60 Marks
Marks	Total	100

Pre-requisites: NIL

Course Description: The course deals with advanced water and waste water treatments.

Course Outcomes:

After completing the course, students will able to

Course Outcomes	
CO1	Learn how to characterize source water, and the best available technologies (BAT) for physical and chemical treatment of drinking water
CO2	Learn how to characterize wastewater, and the BAT for physical, chemical and microbiological treatment of wastewater
CO3	Select or construct appropriate treatment schemes to remove certain pollutants present in water or wastewater
CO4	Design a water or wastewater treatment component

Detailed Syllabus:

Unit 1	Capabilities and limitations of conventional water and waste water treatment methods, Need for advanced treatment of water and waste water, Advanced water treatment- Iron and manganese removal, colour and odour removal, activated carbon treatment	7 Hrs
Unit 2	Carbonate balance for corrosion control, ion exchange, electro-dialysis, reverse osmosis and modern methods and fluoride management.	7 Hrs
Unit 3	Nitrogen and phosphorus removal methods including biological methods, Methods for the removal of heavy metals, oil and refractory organics, Micro-screening, ultra-filtration, centrifugation and other advanced physical methods- aerobic/anaerobic digestion, anaerobic filtration, novel methods of aeration etc.	7 Hrs
Unit 4	Combined physico-chemical and biological processes, Pure oxygen systems, Filtration for high quality effluents, Multistage treatment systems, Land treatment and other resources recovery systems.	7 Hrs
Unit 5	Decentralized wastewater treatment systems; Reliability and cost effectiveness of wastewater systems. Natural treatment systems- floating aquatic plant treatment systems, constructed wetlands. Industrial Wastewater management and reuse, removal of industry specific pollutants	7 Hrs

Text Books:

1. Metcalf & Eddy., Wastewater Engineering- Treatment and Reuse (Revised by G. Tchobanoglous, F. L. Burton and H. D. Stensel), Tata McGraw Hill.
2. Peavy H. S., Rowe D. R., and Tchobanoglous G., Environmental Engineering, McGraw-Hill International Edition.
3. Nemerow N. L and Dasgupta A., Industrial and Hazardous Waste Treatment, Van Nostrand Reinhold (New York).
4. Arceivala S.J. and Asolekar S.R., Wastewater Treatment for Pollution Control and Reuse, Tata McGraw Hill.

Reference Books:

1. Eckenfelder, W. W., Industrial Water Pollution Control, McGraw-Hill. Nemerow, N. L.,
2. Zero Pollution for Industry: Waste Minimization through Industrial Complexes, John Wiley & Sons. Cites R W., Middlebrooks E J., Reed S C., Natural wastewater Treatment Systems, CRC Taylor and Francis.
3. Patwardhan A.D., Industrial Wastewater Treatment, PHI Learning
4. S.R. Qasim, Edward and Motley and Zhu, H., "Water Works Engineering – Planning, Design and Operation", Prentice Hall, India.
5. S. Vigneswaran and C. Visvanathan, "Water Treatment Processes: Simple Options", CRC Press

Mapping of Course outcome with Program Outcomes and Program Specific Outcomes

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

3-High 2 – Medium 1 – Low

Assessment: ISE I: Shall be on the basis of Class Tests/ Assignments/ Quizzes/ Field visits/ Presentations/ Course Projects on First and Second unit
 ISE II: Shall be based on class test on third and fourth units
 ISE III: Shall be on the basis of Class Tests/ Assignments/ Quizzes/ Field visits/ Presentations/ Course Projects on Fifth unit



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Assessment Pattern:

Assessment Pattern Level No.	Knowledge Level	ISE I	ISE II	ISE III	End Semester Examination
K1	Remember	5		3	8
K2	Understand	5	5	3	18
K3	Apply	5	5	2	18
K4	Analyze		5	2	18
K5	Evaluate				
K6	Create				
Total Marks: 100		15	15	10	60

Assessment table:

Assessment Tool	K1	K2	K3	K4
	CO1 to CO4	CO1 to CO4	CO1 to CO4	CO1 to CO4
ISE I (15 Marks)	5	5	5	
ISE II (15 Marks)		5	5	5
ISE III (10 Marks)	3	3	2	2
ESE Assessment (60 Marks)	6	18	18	18
Total Marks :100	13	30	30	25


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CEPE3006: Advanced Transportation Engineering (PE III)		
Teaching Scheme	Examination Scheme	
Lectures: 03 hrs/ week	ISE I	15 Marks
Tutorials:00	ISE II	15 Marks
Credits:03	ISE III	10 Marks
	End Semester Examination	60 Marks
Marks	Total	100

Pre-requisites: Transportation Engineering

Course Description: This course introduces planning of transportation system, latest transportation technology in urban areas, transport economics and financing, traffic systems and study of different types of pavements and Overlays.

Course Outcomes:

After completing the course, students will able:

Course Outcomes	
CO1	To implement the transport planning system
CO2	To interpret the methods of urban transport technology
CO3	To understand transport economics and financing
CO4	To identify different traffic systems
CO5	To design flexible and rigid pavements

Detailed Syllabus:

Unit 1	Transport Planning: Transport Guidelines and Policy, process, and types of surveys. OD matrix. Travel demand forecasting, trip generation, modal split analysis, trip distribution, route assignment analysis, Transport Networks, network flow analysis.	7 Hrs
Unit 2	Urban Transport: Classification, mass and rapid transit system, Introduction to Intelligent Transportation System (ITS), Introduction to advanced Transport Management System (ATMS), Public Transport policy, intermediate. Introduction to BRT, Mono rail, sky bus, metro projects, and grade separated interchanges such as flyovers, underpasses, overpasses, concept of Integrated Inter Model transit system.	7 Hrs
Unit 3	Economics for Transport: Vehicle operations cost, running cost, pollution cost, value of travel time, road damage cost, congestion cost, accident cost economic evaluation, various economic studies. Transportation plans – Benefit cost method, Net present value method, First year rate of return method, Internal rate of return method & comparison of various methods. Pavement management systems. Highway Financing: Pay as you go method, credit financing, private financing, BOT, BOOT, dedicated road funds, road pricing, tolls&Toll Plaza.	7 Hrs
Unit 4	Traffic Systems: Traffic impacts, traffic studies, level of service, traffic analysis process, basic traffic theory, intersection studies, turning	7 Hrs

	movements, flow, delays, and queuing, signal design, grade separated intersection, parking studies, Traffic generation and parking, parking demand surveys and requirements, parking facilities, Parking design ,instrumentation of traffic monitoring. Street Light Designing.	
Unit 5	<p>Flexible Pavement: Highway pavements and airport pavements, Flexible pavements studies, performance studies, surface, surface characteristics of pavements, profile measurements, pavement unevenness, skid resistance, its measurements, IRC, AASHTO guide to design of pavement, pavements failure, maintenance and drainage. Freezing of soil, B.C. soil, desert soil etc. Strengthening of pavement – Benkelman beam method. Distresses in Pavements.</p> <p>Rigid Pavement: Concept of rigid pavement, comparison of rigid pavement over flexible pavement , Stress distribution in layered media, one and two layered system, joints in rigid pavement, longitudinal construction joints, design as per IRC guidelines, design of joints, dowel bars, design of white topping and overlay design, temperature reinforcement, pavement failure, maintenance strategy strengthening of rigid pavement, types of overlays, flexible over rigid, rigid over rigid, mechanization in pavement construction.</p>	7 Hrs

Books:

1. The Design and Performance of Road Pavements - David Croney, Paul Croney.
2. Understanding Traffic System -Michel A Taylor, William Young, PeterWBonsall.
3. Principles of Urban Transport Systems Planning - B. Hutchinson.
4. Introduction to transport planning - M. J. Burton.
5. Transport Networks - Potts Oliver (Academic Press).
6. Modern Construction Equipment and methods- Frank Harries.
7. Principles of Pavement Design - E.F. Yoder (John Wiley & Sons, Inc USA).
8. Fundamentals of Transportation Engineering - C. S. Papacostas.
9. Pavement analysis and Design – Huang Y H, Prentice Hall, Englewood Cliff, New Jersey.
10. Introduction to Transportation Engg. and Planning – Morlok E K, McGraw-Hill Company.
11. Fundamentals of Traffic flow Theory – Drew, McGraw-Hill book co
12. A course in Traffic Planning and design-Saxena Subhash, Dhanpat Rai & sons, Delhi
13. Traffic analysis (New technologies new solutions)-Taylor M P ,Hargreen Pub.Co. New Delhi
14. S K Khanna & Justo ,Highway Engineering, Nem Chand & Bros ,Roorkee (UP)
15. IRC -37 -2018 ,Guidelines and Design for Flexible Pavement
16. IRC -58 -2015 , Guidelines and Design for Rigid Pavement

Mapping of Course outcome with Program Outcomes and Program Specific Outcomes

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

3-High 2 – Medium 1 – Low

Assessment: ISE I: Shall be on the basis of Class Tests/ Assignments/ Surprise

Tests Quizzes/ Field visits/ Onsite learning /Presentations

ISE II: Shall be based on class test on third and fourth units

ISE III: Shall be on the basis of Class Tests/ Assignments/ Surprise

Tests / Field visits/Onsite learning /Presentations for Fifth unit

Assessment Pattern:

Assessment Pattern Level No.	Knowledge Level	ISE I	ISE II	ISE III	End Semester Examination
K1	Remember	3	3		10
K2	Understand	3	3	3	10
K3	Apply	4	4	3	10
K4	Analyze	5	5	4	10
K5	Evaluate				10
K6	Create				10
Total Marks: 100		15	15	10	60

Assessment table:

Assessment Tool	K1	K2	K3	K4	K5	K6
	CO1 to CO5	CO1 to CO5	CO1 to CO5	CO1 to CO5	CO1 to CO5	CO1 to CO5
ISE I (15 Marks)	3	3	4	5		
ISE II (15 Marks)	3	3	4	5		
ISE III (10 Marks)		3	3	4		
ESE Assessment (60 Marks)	10	10	10	10	10	10
Total Marks :100	16	19	21	24	10	10

CEPE 3007: Advanced Concrete Technology			
Teaching Scheme		Evaluation Scheme	
Theory	3 Hrs/Week	Test	20 Marks
Tutorial		Teacher's Assessment	20 Marks
Total Credits	3	End-Semester Examination	60 Marks

Prerequisites:

Knowledge about interaction of concrete making materials and their influence on the properties of concrete

Course Description:

The Unit 1 and 2 provide the fundamentals of concrete technology and mix proportioning of concrete of desired properties. Unit 3 and 4 on High Performance Concrete and Special Concretes provide the information about selection of ingredients based on the performance requirements. Unit 5 deals with non destructive evaluation and concrete repairs

Course Outcomes:

After successful completion of this course, the student will be able to

1. Select the ingredients judiciously for making concrete
2. Classify various types of concrete
3. Design concrete mixes with desired properties
4. Evaluate the properties of concrete in the structure and investigate the causes of damage of concrete
5. Propose the methods for concrete repair

Detailed Syllabus:

Unit-1:	Fundamentals of Concrete Technology Review of various constituents of concrete Properties of concrete: workability, rheology, permeability, strength , elasticity, shrinkage, creep, durability	7 Hrs
Unit -2:	Fundamentals of Concrete Mix Proportioning: Abram's Law, Lyse's Rule, Glianville's work, Exposure conditions Comparative study of various concrete mix proportioning methods, Quality control.	7 Hrs
Unit -3:	High Performance Concrete High performance concrete (HPC): performance requirements, materials, cement-superplasticiser compatibility, methods of mix proportioning, concept of particle packing, properties in fresh and hardened state, durability of HPC	7 Hrs
Unit -4:	Special Concretes Self compacting concrete, High density concrete, Aerated concrete, Lightweight concrete, Concrete with recycled waste: Constituent materials, mix proportioning, properties and applications, hot weather and cold weather concreting Fibre Reinforced Concrete (FRC):Types and properties of fibers,mix	7 Hrs

	proportioning and behavior in fresh and hardened state. Ferrocement.	
Unit - 5:	<p>Non Destructive Evaluation and Concrete Repairs:</p> <p>Non-Destructive Evaluation of Concrete: Rebound hammer test- Ultrasonic pulse velocity tests, penetration resistance, pull out tests, elastic properties</p> <p>Chemical tests: Carbonation tests and chloride content, Corrosion potential assessment- cover meter survey, half-cell potentiometer test, resistivity measurement</p> <p>Concrete Repairs: Types and causes of damages of concrete, Materials and technology for repairing damaged concrete</p>	7 Hrs

TEXT AND REFERENCE BOOKS

1. A M Neville, Properties of Concrete, 4th edition, 2006, ELBS with Longman, UK
2. M L Gambhir, Concrete Technology, 3rd edition, 2006, Tata McGraw Hill, New Delhi
3. M S Shetty, Concrete Technology, 2008, S. Chand & Co., New Delhi
4. R.N.Raikar, Diagnosis and treatment of structures in distress, Published by R&D Centre of Structural Designers & Consultants Pvt.Ltd., Mumbai, 1994.
5. Raikar, R.N., "Learning from failures - Deficiencies in Design", Construction and Service - R and D Centre (SDCPL), Raikar Bhavan, 1987
6. Handbook on Repair and Rehabilitation of RCC buildings, Published by CPWD, Delhi, 2002.
7. Balaguru P.N. and Shah S.P., Fibre Reinforced Cement Composites, McGraw Hill, New Delhi
8. Hannant D.J., Fibre Cements and Fibre Concretes, John Willey and Sons, New York
9. Naaman, A.E., Ferrocement and Laminated Cementitious Composites, Techno Press, USA

Table 1: Mapping of Course Outcomes with Program Outcomes:

Course Outcome	PO1	PO2	PO3	PO4	PO5	PO 6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	2	1	2	2	2							
CO2	3	2	3	1	2		2							
CO3	3	3	3	2	2	2	2							
CO4	2	3	2	2	2	2								
CO5	2	2	3	1	1	2								

H- High, M- Medium, L- Low


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Assessment: ISE I: Shall be on the basis of Class Tests/ Assignments/ Quizzes/ Field visits/ Presentations/ Course Projects on First and Second unit

ISE II: Shall be based on class test on third and fourth units

ISE III: Shall be on the basis of Class Tests/ Assignments/ Quizzes/ Field visits/ Presentations/ Course Projects on Fifth unit

Table 2: Recommended Assessment Pattern

Assessment Pattern Level No.	Knowledge Level	Class Test	Teacher's Assessment	End Semester Examination
K1	Remember	02	02	07
K2	Understand	03	03	08
K3	Apply	05	05	15
K4	Analyze	06	06	20
K5	Evaluate	04	04	10
K6	Create	00	00	00
Total Marks 100		20	20	60

Table 3: Assessment Table

Assessment Tool	CO1	CO2	CO3	CO4	CO5
	K1 to K6	K1 to K6	K1 to K6	K1 to K6	K1 to K6
Class Test	10	10			
Teacher's Assessment	04	04	04	04	04
ESE	12	12	12	12	12



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CEPE 3008: Building Maintenance & Repairs		
Teaching Scheme	Examination Scheme	
Lectures : 03 hrs/ week	ISE I	15 Marks
Tutorials :00	ISE II	15 Marks
Credits :03	ISE III	10 Marks
	End Semester Examination	60 Marks
	Total Marks	100

Pre-requisites: Nil

Course Description:

Civil Engineering Industry is one of the oldest industries which provide a basic infrastructure to all the human beings. Structures can be any kind it can be Historical, Heritage Structure, Residential building, Commercial building or an Industrial building. Every structure has its own service life, and within this service life it should stand firmly on its position. One of the major concerns of a civil engineers is, therefore, to take care of the structures in order to keep these structures in utmost workable conditions. Over a period of time, as these structures become older, we find in them certain degradation or deterioration with resultant distress manifested in the form of cracking, splitting, delaminating, corrosion etc. The construction material mainly reinforced concrete is being used extensively for various types of construction projects. However, the deterioration of Reinforced Concrete structures is recognized as a major problem worldwide. Apart from requiring regular maintenance, many structures require extensive Repair, Rehabilitation &Retrofitting.

Proper maintenance not only improves functional and aesthetic value but also extends the life of building/structure and ensures safety of the occupants/user. Normally, constructed building remains in a good structural condition only for 40 to 50 years and starts deteriorating if not maintained properly. Inadequate maintenance and lack of repairs works may lead to limited life span of buildings/structures. However, regular inspection and maintenance that enable timely identification of deteriorated elements and appropriate remedial measures, the life of normally constructed buildings/structures may be extended up to 100 years.

Most of the buildings/structures constructed in India are now becoming old as they have reached the age beyond 40 years and therefore needs maintenance. Thus there is great demand and employment potential in this area. This course is therefore, introduced in the curriculum so that students can develop competence in this area. Knowledge and skills gained through this course may also prove helpful in upkeep and preservation of historical monuments as well. Thus this course is an important course for civil engineers. The course deals with the need/basics of maintenance and repairs, causes and detection of damages/deterioration, Materials for maintenance and repairs, maintenance and repairs methods/techniques for masonry buildings,



maintenance and repairs methods/techniques for RCC buildings, structural audit etc.

Course Outcomes:

After completing the course, students will able:

Course Outcomes (CO's)	
CO1	To explain the basics of maintenance and repairs.
CO2	To explain the causes of deterioration and carry out non-destructive tests for maintenance and repairs
CO3	To explain the suitable materials and techniques of maintenance and repairs
CO4	To explain the various causes of cracks and select relevant repair techniques for maintenance and repairs methods/techniques for masonry buildings
CO5	To explain the various causes of cracks and select relevant repair techniques for maintenance and repairs methods/techniques for RCC buildings.

Detailed Syllabus:

Unit 1	Fundamentals of Maintenance and Repairs of Building Necessity, objectives and importance of maintenance and repairs, Factors influencing maintenance and repairs, Maintenance and its classification, Concepts of repair, retrofitting, rehabilitation and restoration, Advantages and limitations of maintenance and repairs	7 Hrs
Unit 2	Causes of Deterioration and Detection of Damages Meaning of deterioration/decay, Factors causing deterioration , Identify the types of deterioration in various structural and non-structural elements, Defects and their root causes in various structural and non-structural elements due to distress, earthquakes, wind , dampness , corrosions, fire dilapidation, termites etc, Systematic approach of damages detection, Various approach of visual observations for detection of damages, Tests on damaged structures such as rebound hammer, ultrasonic pulse velocity, rebar locator, cover gauge crack detection microscope, chloride test, sulphate attack, pH measurement , half cell potentiometer etc.	7 Hrs
Unit 3	Materials and Techniques for Maintenance and Repairs Types and selection of relevant materials for maintenance and repairs, Factors influencing the relevant materials for maintenance and repairs, Types and selection of techniques for repairs, Factors influencing the techniques for repairs	7 Hrs
Unit 4	Maintenance and repairs methods/techniques for masonry and RCC buildings a) Masonry Buildings Causes of cracks in the walls and probable crack locations, Repair techniques and methods, Causes and remedies of foundation	7 Hrs

	settlement, Improvement techniques for bearing capacity of foundation ,Effects of dampness in walls, Damping repair techniques b) RCC Buildings Identify the locations of cracks/distress in various RCC structural elements, Various causes of failure of RCC frame, Causes of dampness in roof slab and its repair techniques, Repair methods for cracks in various RCC structural elements, Repairs for corroded RCC elements , Repair methods for honeycomb and large voids.	
Unit 5	Structural Audit of Building <u>What is a structural audit?</u> , Importance of structural audit, <u>Benefits of a structural audit</u> , Necessity of Structural Audit, Objectives of Structural Audit, Methodology, Common NDT methods, Various steps involved in structural audit, Structural audit format, Case Studies , IS Codes for structural audit, Criteria's to decide building is structurally safe or not, structural stability certificate .	7 Hrs

Text Books and IS Codes:

10. Maintenance and Repairs of Structures Salil P. Deshpande, Akshay P. Joshi , Nirali Prakashan Building Repair and Maintenance Management, P.S.Gahlot , Sanjay Sharma., CBS Publishers & Distributors Pvt. Ltd., New Delhi, 2016, ISBN: 81-239-1243-9.
11. A Laboratory Manual for Maintenance and Repairs of Structures, Maharashtra State Board of Technical Education, Mumbai
12. P.K.Guha , Maintenance and Repair of Buildings, , New Central Book Agency (P) Ltd., New Delhi, 2011, ISBN: 81-7381-073-7.
13. Arun Kelkar , Building: Structural Audit, Repairs and Restoration Arun Kelkar Majestic Publishing House, Thane, 2015 ISBN: 978-93-83678-93-8.
14. Nayak B. S, Maintenance Engineering for civil Engineers. Khanna Publication, New Delhi ISBN: 978-81-7409-051-7
15. Maintenance and Repairs of Buildings Hutchin Son, BD Newnes-Butterworth, London (UK) ISBN : 0408001917
16. M.S.Shetty , Concrete Technology-Theory and Practice S. Chand & Co. Pvt. Ltd., New Delhi, 2016, ISBN:978-81-219-0003-4
17. Ravi Ranade, "Structural Diagnosis, Repair & Retrofitting of RCC Structures RCC Structure
18. ACI 562-12 - Code Requirements for Evaluation, Repair, and Rehabilitation of Concrete Buildings.
19. CPWD Handbook on Repair and Rehabilitation of RCC Structures , Central Public Works Department (CPWD), Government of India, New Delhi , Published 2002.
20. S.P 25-1984 - Hand book on causes and prevention of cracks in buildings
21. Philip.H.Perkins: Concrete Structures-repair water proofing and protection; Elsevier Science Ltd
22. S. Champion :Failures and repair of concrete structures ; John Wiley & Sons
Jacob Feld :Construction failures ; Wiley.

- 23.IS-4326 - Code of practice for earthquake resistant design and construction of buildings,
 24.IS-456 – design of plain and reinforcement concrete, IS-800 – design of steel structures,
 25. IS-15988-2013 – Seismic evaluation and strengthening of existing reinforced concrete buildings – guideline

Table 1: Mapping of Course Outcomes with Program Outcomes:

Course Outcome	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PSO1	PSO2
CO1	3	2	2	1	2	2	2						
CO2	3	2	3	1	2		2						1
CO3	3	3	3	2	2	2	2						2
CO4	2	3	2	2	2	2							
CO5	2	2	3	1	1	2						1	

3-High 2 – Medium 1 – Low

Assessment: ISE I: Shall be on the basis of Class Tests/ Assignments/ Quizzes/ Field visits/ Presentations/ Course Projects on First and Second unit
 ISE II: Shall be based on class test on third and fourth units
 ISE III: Shall be on the basis of Class Tests/ Assignments/ Quizzes/ Field visits/ Presentations/ Course Projects on Fifth unit

Table 2: Recommended Assessment Pattern

Assessment Pattern Level No.	Knowledge Level	Class Test	Teacher's Assessment	End Semester Examination
K1	Remember	02	02	07
K2	Understand	03	03	08
K3	Apply	05	05	15
K4	Analyze	06	06	20
K5	Evaluate	04	04	10
K6	Create	00	00	00
100	Total Marks	20	20	60

Table 3: Assessment Table

Assessment Tool	CO1	CO2	CO3	CO4	CO5
	K1 to K6	K1 to K6	K1 to K6	K1 to K6	K1 to K6
Class Test	10	10			
Teacher's Assessment	04	04	04	04	04
ESE	12	12	12	12	12

CEPE 3009: FINITE ELEMENT METHOD

Teaching Scheme	Examination Scheme	
Lectures : 03 Hrs/ week	ISE I (Class Test-1)	15 Marks
Tutorials : 00	ISE II (Class Test-2)	15 Marks
Credits : 03	ISE III (Teacher's Assessment)	10 Marks
	End Semester Examination	60 Marks
	Total Marks	100

Pre-requisites:

Basics of Solid Mechanics and Structural Analysis

Course Description:

This course is for the Undergraduate students from Civil engineering field. The objective of the course is to apprise the students about the basics of the Finite Element Technique, a numerical tool for the solution of different classes of problems in solid mechanics. It is intended to cover the analysis methodologies for 1-D, 2-D and to certain extent 3-D problems with its advantages and disadvantages.

Course Outcomes: After Successful completion of the course, Student will be able to:

Course Outcomes	
CO 1	To describe finite element method, identify different types of finite element suitable for different structural members and demonstrate constitutive relations & energy principles.
CO 2	To demonstrate displacement models for various elements and to formulate element stiffness matrix and load vectors.
CO 3	To compute the stiffness matrix for isoparametric element. To choose appropriate isoparametric elements for the structure to be analyzed.
CO 4	To formulate the governing equilibrium equation of FEM for analysis of various structures.
CO 5	To Analyze bar and truss member by using finite element method.

Detailed Syllabus:

Unit 1	Introduction to Finite Element Analysis: Introduction to finite element method, Types of finite elements, Differential Equilibrium Equations, Strain-displacement relation, linear constitutive relation, Principle of stationary potential energy-application to finite element methods, some numerical techniques in FEM.	7 Hrs
Unit 2	Element Properties: Displacement models- convergence requirements, compatibility requirement, Natural Coordinate system- shape function, Interpolation function, linear and quadratic elements (Triangular Elements,	7 Hrs

	Rectangular Elements), Lagrange and Serendipity Elements, Solid Elements, Strain displacement matrix-Element stiffness matrix and nodal load vector.	
Unit 3	Isoparametric Elements: Isoparametric elements- Four noded quadrilateral element, Triangular elements, Computation of stiffness matrix for isoparametric elements, Numerical integration (Gauss quadrature), Convergence criteria for isoparametric elements.	7 Hrs
Unit 4	Finite Element Method-Solution Technique: Assemblage of elements- Obtaining global stiffness matrix and global load vector, Governing equilibrium equation for static problem, Application of boundary conditions, Solution to resulting simultaneous equations using direct approach, Solution by Galerkin's method, Computation of stresses.	7 Hrs
Unit 5	Finite Element Method- Application to Bar, beam and trusses Analysis of Beams and Rigid Frames, Beam Analysis Using two Noded Elements, Analysis of Rigid Plane Frame Using 2 Noded Beam Elements.	7 Hrs

Reference Books:

1. C.S.Krishnamoorthy, Finite Element Analysis, Tata McGraw-Hill
2. S.S. Bhavikatti, Finite Element Analysis, New Age International Publisher.
3. David V. Hutton, Fundamentals of Finite Element Analysis, McGraw Hill
4. D. Maity, Computer Analysis of Framed Structures, I.K. International Pvt. Ltd. New Delhi.
5. Erik G. Thompson, Introduction to the Finite Element Method: Theory, Programming and Applications, John Wiley.
6. H. C. Martin and G. F. Carey, Introduction to Finite Element Analysis - Theory and Application, NewYork, McGraw-Hill.
7. Irving H. Shames, Clive L. Dym, Energy and Finite Element Methods in Structural Mechanics; New Age International.
8. K. J. Bathe, Finite Element Procedures, Prentice-Hall of India, New Delhi, India.
9. M. Mukhopadhyay, Matrix, Finite Element, Computer and Structural Analysis, Oxford and IBH Publishing Co. Pvt. Ltd., New Delhi, India.
10. O. C. Zienkiewicz and Y.K. Cheung, The Finite Element Method in Structural and Solid Mechanics, McGraw Hill, London.
11. P.E. Ceruzzi, A History of Modern Computing, The MIT Press, Cambridge, MA, 1998.
12. R. D. Cook, D. Malkus, M. E. Plesha and R.J. Witt, Concepts and Applications of Finite Element Analysis, Wiley.
13. S.S. Rao, Finite Element Analysis, Elsevier Butterworth-Heinemann.
14. W. Weaver Jr. and J. M. Gere, Matrix Analysis of Framed Structure, CBS Publishers & Distributors, New Delhi, India.



Table 1: Mapping of Course Outcomes with Program Outcomes:

Course Outcome	PO1	PO2	PO3	PO4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PSO1	PSO2
CO1	3	3	1	1	2							3	1
CO2	3	3	2	1	2							3	2
CO3	3	3	3	1	2							3	2
CO4	3	3	3	1	2							3	2
CO5	3	3	3	1	2							3	1

1 – Low 2 – Medium 3 – High

Assessment: ISE I: Shall be on the basis of Class Tests/ Assignments/ Quizzes/ Field visits/ Presentations/ Course Projects on First and Second unit

ISE II: Shall be based on class test on third and fourth units

ISE III: Shall be on the basis of Class Tests/ Assignments/ Quizzes/ Field visits/ Presentations/ Course Projects on Fifth unit

Table 2: Recommended Assessment Pattern

Assessment Pattern Level No.	Knowledge Level	Class Test	Teacher's Assessment	End Semester Examination
K1	Remember	04	00	06
K2	Understand	10	04	10
K3	Apply	16	06	44
K4	Analyze	00	00	00
K5	Evaluate	00	00	00
K6	Create	00	00	00
Total Marks 100		30	10	60

Table 3: Assessment Table

Assessment Tool	CO1	CO2	CO3	CO4	CO5
	K1 to K3	K1 to K3	K1 to K3	K1 to K3	K1 to K3
Class Test	06	06	03	-	-
Teacher's Assessment	-	-	03	06	06
ESE	08	10	10	16	16

CEPE 3010: Design of Bridges		
Teaching Scheme	Examination Scheme	
Lectures : 04 Hrs/ week	ISE I	15 Marks
Tutorials : 00	ISE II	15 Marks
Credits : 03	ISE III	10 Marks
	End Semester Examination	60 Marks
	Total Marks	100

Pre-requisites:

Basic design of Steel and Concrete structures, Structural Analysis, pre-stress concrete.

Course Description:

Bridge is an important infrastructure facility required for the passage of railways, road ways, and footpaths and even for carriage of fluids. Further, the constant increase in traffic loads associated with the economic growth in modern societies imparts large demands to build such structures. Therefore, the study of analysis and design of bridges is essential for the structural engineering students. This course offers an opportunity to civil engineering student themselves to develop to cater need of society.

Course Outcomes: After Successful completion of the course, Student will be able to:

Course Outcomes	
CO 1	To identified various types of bridges, suitability and new construction techniques.
CO 2	To understand design loads and various theories for designing bridges.
CO 3	To Analyze and design small to medium span of reinforced concrete slab culverts, T beam bridges as per IRC specifications.
CO 4	To relate design principles of pre-stressed concrete in the design of T-beam bridges, box girder bridges, balanced cantilever bridges.
CO 5	To Analyze and design of substructure part of bridges.

Detailed Syllabus:

Unit 1	Introduction: Components and Classification of Bridges, Investigations, preliminary planning and design principle, Choice of type of bridges, New era methodology/technology for design and construction of bridges.	7 Hrs
Unit 2	Design Loading and Theories Types of load on highway bridge: I.R.C. and other international specifications on live loads for road bridges, Various forces acting on bridges, Load distribution theories: Courbon's Method, Hendry Jaeger	7 Hrs

	Method, Grillage analogy, Pigeaud's curves.	
Unit 3	Design of Simply Supported RCC Bridges: Superstructure: General design considerations, Analysis and design of RCC slab culverts, slab and girder type, Tee beam and slab bridges.	7 Hrs
Unit 4	Design of RCC Continues Bridges: Design of pre-stressed concrete T beam bridges, Box girder bridges, Balanced cantilever bridges, skew and curved bridges, super-elevation in curved bridges.	7 Hrs
Unit 5	Design of Substructure And Seismic Provision: Substructure : Various parts of substructures, Various types of substructures, Loads acting on substructures, Design of pier and pier cap, Design of different types of foundation – Open, pile & well foundation, Seismic resistant design provisions, load test on bridges.	7 Hrs

Reference Books:

1. N. Krishna Raju, "Design of Bridges" Oxford and IBH Publishing Co., Bombay, Calcutta, New Delhi, (Pb 2019).
2. Johnson Victor. D, "Essentials of Bridge Engineering", Oxford Publishing Company. (Pb 2017)
3. Design of Concrete Bridges: As per Latest IRC Codes by Praveen Nagarajan, willey publication, (Pb 2020).
4. Taylor, F.W., Thomson, S.E., and Smulski E., "Reinforced Concrete Bridges", John Wiley and Sons, New York.
5. Raina V.K. "Concrete Bridge Practice", Tata McGraw Hill Publishing Company, New Delhi, 1991.
6. M.J. Ryall, G.A.R Parke, J.E. Harding, "The Manual of Bridge Engineering", Thomas Telford Publishers.
7. R. Rajagopalan, "Bridge Superstructure", Tata McGraw- Hills Publishing Company Limited.
8. Chen Wai-Fah, Duan Lian, Bridge Engineering Handbook - Fundamentals, CRC Press.
9. Chen Wai-Fah, Duan Lian, Bridge Engineering Handbook - Superstructure Design, CRC Press.
10. Chen Wai-Fah, Duan Lian, Bridge Engineering Handbook - Construction & Maintenance, CRC Press.
11. Chen Wai-Fah, Duan Lian, Bridge Engineering Handbook - Seismic Design, CRC Press.
12. Chung C. Fu, Wang Shuqing, Computational Analysis & Design of Bridge Structures, CRC Press.
13. Indian road congress (IRC): (5-2015), (6-2017), (22-2015), (24-2010), (78-2014), (112-2020).
14. Indian standard codes (latest versions): (456-2000), (1893-2016), (1343-2012).



Table 1: Mapping of Course Outcomes with Program Outcomes:

Course Outcome	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO
CO1	2	2	2	1	2	2	2						
CO2	3	2	3	1	2		2						
CO3	3	3	3	2	2	2	2						
CO4	2	3	2	2	2	2							
CO5	2	2	3	1	1	2							

1 – Low 2 – Medium 3 – High

Assessment: ISE I: Shall be on the basis of Class Tests/ Assignments/ Quizzes/ Field visits/ Presentations/ Course Projects on First and Second unit

ISE II: Shall be based on class test on third and fourth units

ISE III: Shall be on the basis of Class Tests/ Assignments/ Quizzes/ Field visits/ Presentations/ Course Projects on Fifth unit

Table 2: Recommended Assessment Pattern

Assessment Pattern Level No.	Knowledge Level	Class Test	Teacher's Assessment	End Semester Examination
K1	Remember	04	03	07
K2	Understand	04	03	08
K3	Apply	06	02	15
K4	Analyze	08	01	20
K5	Evaluate	08	01	10
K6	Create	00	00	00
Total Marks 100		30	10	60

Table 3: Assessment Table

Assessment Tool	CO1	CO2	CO3	CO4	CO5
	K1 to K5	K1 to K5	K1 to K5	K1 to K5	K1 to K5
Class Test	04	04	10	08	04
Teacher's Assessment	02	02	02	02	02
ESE	08	08	16	16	12

Approved in XXVth Academic Council
Dated: 18th April 2023