SCHEME OF INSTRUCTION & SYLLABI

Programme Civil Engineering

Scheme of Instructions: Third Year B.Tech. in Civil Engineering

Semester–V

Sr. No.	CourseCategory	CourseCode	CourseTitle	L	T	P	ContactHrs/Wk	CourseCredits	EXAMSCHEME			
									MSE	ISE/CA	ESE	TOTAL
1	PCC	CE0251	Theory of Structures	3	--	--	3	3	30	10	60	100
2	PCC	CE0252	Geotechnical Engineering	3	--	--	3	3	30	10	60	100
3	PCC	ME0253	Environmental Engineering	3	--	--	3	3	30	10	60	100
4	PEC	ME0254	Programme Elective - 01	3	--	--	3	3	30	10	60	100
5	MDM	CE0255	Multi-disciplinary Minor – 03	3	--	--	3	3	30	10	60	100
6	OE	CE0256	Open Elective -03	2	--	--	2	2	30	10	60	100
7	PCC	CE0257	Geotechnical Engineering Lab	--	--	2	2	1	-	25	25	50
8	PCC	CE0258	Environmental Engineering Lab	--	--	2	2	1	-	25	25	50
9	PEC	CE0259	Programme Elective – 01 Lab	--	--	2	2	1	-	25	--	25
10	MDM	CE02510	Multi-disciplinary Minor– 03 Lab	--	--	2	2	1	-	50	--	50
11	EL	CE02511	Minor Project 01	--	--	2	2	1	-	25	--	25
			Total	**17**	**--**	**10**	**27**	**22**	**180**	**210**	**410**	**800**

L-Lecture T-Tutorial P-Practical MSE-MidSemesterExamination ISE/CA-InSemesterEvaluation/ContinuousAssessment ESE-End Semester Examination (ForLaboratoryEnd Semesterperformance)

SCHEME OF INSTRUCTION & SYLLABI

Programme Civil Engineering

Scheme of Instructions: Third Year B.Tech. in Civil Engineering

Semester–VI

Sr. No.	CourseCategory	CourseCode	CourseTitle	L	T	P	ContactHrs/Wk	CourseCredits	EXAMSCHEME			
									MSE	ISE/CA	ESE	TOTAL
1	PCC	CE0261	Design of Concrete Structures -I	3	--	--	3	3	30	10	60	100
2	PCC	CE0262	Concrete Technology	3	--	--	3	3	30	10	60	100
3	PCC	CE0263	Transportation Engineering	3	1	--	4	4	30	10	60	100
4	PEC	CE0264	Programme Elective - 02	3	--	--	3	3	30	10	60	100
5	PEC	CE0265	Programme Elective - 03	3	--	--	3	3	30	10	60	100
6	MDM	CE0266	Multi-disciplinary Minor – 04	2	--	--	2	2	30	10	60	100
7	PCC	CE0267	Structural Design and Drawing I Lab	--	--	2	2	1	-	50	25	75
8	PCC	CE0268	Transportation Engineering Lab	--	--	2	2	1	-	50	25	75
9	EL	CE0269	Industrial Training*	--	--	4	4	2	-	50	--	50
			Total	**17**	**1**	**8**	**26**	**22**	**180**	**210**	**410**	**800**

L-Lecture T-Tutorial P-Practical MSE-MidSemesterExamination ISE/CA-InSemesterEvaluation/ContinuousAssessment
ESE-End Semester Examination (ForLaboratoryEnd Semesterperformance)

CE0251-TOS (Theory of Structures)

Teaching Scheme:		Evaluation Scheme:	
Lecture (Per week)	:03	MSE	:30
Tutorial (Per week)	:00	ISE	:10
Credit	:03	ESE	:60

Course Pre-requisite	StructuralAnalysis–I, Mechanicsof Solids/SOM	
Course Objective	1	Applyclassicaldisplacementmethods(Slope-Deflection,Moment Distribution) in the analysis of indeterminate beams and frames.
	2	UseapproximatemethodssuchasPortalandCantileverMethodsformulti- storey frames.
	3	Formulateandsolvestructuralsystems usingforce method(flexibility) anddisplacementmethod(stiffness).
	4	Understand the numeric matrix formation and hand-computed structural responseusingelementmatrices—abasisforFEMandstructuralsoftware.
Course Outcomes	After Completion of this course students will be able to	
	1	Identifyanddeterminestaticandkinematicindeterminacyofstructuresbasedon their structural form.
	2	Applyslope-deflectionandmomentdistributionmethodstoanalyzecontinuous beams and rigid frames.
	3	Estimateinternalforcesinmultistoreyframesusingapproximateanalysismethods for vertical and lateral loads.
	4	Formulateandsolveindeterminatestructuresusingflexibilityandstiffnessmethods of analysis.

CO-PO Mapping												
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1												
CO2												
CO3												
CO4												
Level of Mapping as: Low 1, Moderate 2, High 3												

Marking Scheme

1. The theory exam shall be consisting of MSE and ESE. The weightage of MSE shall be 30% and of ESE shall be 60%.
2. ESE paper setting weightage will be 25% on syllabus covered for MSE (First Three Units) and 75% on remaining syllabus (Last Three Units).
3. Weightage to optional questions in a theory paper shall be 25 to 30 % of the maximum marks.

Unit No.	Section I	Hours
1	FundamentalsofStructureandAnalysisofRedundant Beams, Typesandclassificationofstructuresbasedonstructuralforms, concept of indeterminacy: static and kinematic indeterminacy. (with Numericals) Analysis of propped cantilever, fixed beam and continuous beams withindeterminacyuptoseconddegreebyconsistentdeformation method, Castiglianos Method,Clayperons Theorem	08Hrs
2	ClassicalDisplacementMethodsforIndeterminate Structures • Slope-Deflectionequationsandapplicationstocontinuous beams and simple rigid frames (with/without settlement). • MomentDistributionMethod:continuousbeamsandrigid frames (sway and non-sway).	06Hrs
3	ApproximateMethodsofFrameAnalysis Approximate analysis of multi-storey building frames for vertical and lateral loads. Portal Method, Cantilever Method, Substitute Frameconceptsandtheirusetoestimatemaximuminternalforces.	06 Hrs
	Section II	
4	Force(Flexibility)MethodofAnalysis/ Displacement Method(stiffness) • Basic concept of flexibility method. • Selection of redundants, formulation of compatibility equations. • Applicationtobeams,indeterminatetrusses,andsimpleframes • Introductiontostiffness method. • Member stiffness matricesforbeamandframeelements and global assembly. Directstiffnessformulation,basicsolutionprocedures(hand calculations).	08 Hrs
5	PlasticAnalysisofStructures • Plastichingeformation,plasticmoment,shape factor. • Collapsemechanismsandbasicstatic/kinematic theorem applications for beams and frames.	06Hrs
6	Introductionto FEM:Engineering applications, advantages, General steps, Element types, Convergence criteria, Coordinate systems, commercial packagespreprocessor, solver and post processor. Principles ofElasticity:Straindisplacementrelations,Stressstrainrelationsfor1D, 2D, and 3D cases, Plain stress and Plain strain conditions	06 Hrs

Term work:

At leastoneassignmentfromeachunit(5questionsminimumineachassignment)
Text Books:

Sr. No.	Title	Author	Publication & Edition
01	StructuralAnalysis–AMatrixApproach	G.S.Pandit& S.P. Gupta,	TataMcGraw-Hill.
02	StructuralAnalysis–Vol.II	S.S.Bhavikatti	VikasPublishing

Reference Books:			
Sr. No.	**Title**	**Author**	**Publication & Edition**
01	BasicStructural Analysis	C.S.Reddy	TataMcGrawHill.
02	MatrixAnalysisofStructures	AslamKassimali	Cengage.Publications

Guidelines regarding the Question Paper Setting**: End Semester Examination**		
Question No.	Unit No.	Marks
1	1	10
2	2	10
3	3	10
4	4	12
5	5	08
6	6	10
	Total	60

PCC CE0252: Geotechnical Engineering

Teaching Scheme:		**Evaluation Scheme:**	
Lecture (Per week)	**:03**	**MSE**	**:30**
Tutorial (Per week)	**:00**	**ISE**	**:10**
Credit	**:03**	**ESE**	**:60**

Course Pre-requisite	Applied Mechanics, Engineering Mathematics, Fluid Mechanics,	
Course Objective	1	To studyindex properties of soil, their significance, determination and interrelationships
	2	To understand engineering properties of soil &their significance in Civil Engineering
	3	To study shear strength parameters of soil, understand concept of earth pressure and evaluation of slope stability
	4	To understand basics of foundation engineering, types of foundation, design concepts and criteria
Course Outcomes	After Completion of this course students will be able to	
	1	Explain significance of Geotechnical Engineering, fundamental relationships &classify soil
	2	Illustrate index and engineering properties of soil
	3	Evaluate soil stresses, shear strength, earth pressure& slope stability
	4	Explain basics of foundation engineering&geotechnical designaspects

CO-PO Mapping												
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2								3		
CO2	3	3								3		
CO3	3	3			2					2		
CO4	3	3	2	2								1
Level of Mapping as: Low 1, Moderate 2, High 3												

Marking Scheme
1. The theory exam shall be consisting of MSE and ESE. The weightage of MSE shall be 30% and of ESE shall be 60%.
2. ESE paper setting weightage will be 25% on syllabus covered for MSE (First Three Units) and 75% on remaining syllabus (Last Three Units).
3. Weightage to optional questions in a theory paper shall be 25 to 30 % of the maximum marks.

Unit No.	Section I	Hours
1	**Soil Properties and classification:** Origin of soil, Application areas of Geotechnical Engineering, Soil phase systems, Weight volume relationship, Index Properties of Soil: e.g. Unit weights, water content, specific gravity, void ratio, porosity, their relationships and significance, Particle size distribution by sieve analysis and sedimentation analysis. Atterberg's consistency limits, Consistency indices, Activity number, Soil structure, Soil classification systems, IS classification of soil, Use of Casagrande plasticity chart	07
2	**Soil Hydraulics: Permeability and Seepage Analysis** Modes of occurrence of water in soil, Darcy's law and its validity, Factors affecting Permeability, Coefficient of permeability of soil by constant head, Variable head method, Permeability of stratified (layered) soil, Concept of total stress, Pore pressure &effective stress, Seepage pressure, Seepage force,Critical hydraulic gradient, Quick sand condition, Piping, Flow net, characteristics, Applications of flow net, methods of flow net construction and Determination of seepage loss	06
3	**Compaction and Consolidation:** Concept of compaction, Standard & modified proctor test, Dry density and moisture content relationship, Zero air void line, Field compaction control, Field compaction equipment and their suitability, Placement water content, factors affecting compaction, Concept of consolidation, Terzaghi's piston and spring analogy model, Compression index, Coefficient of compressibility, Coefficient of volume change, NCC, UCC, OCC Terzaghi's theory of one-dimensional consolidation, Lab consolidation test to find coefficient of consolidation, Coefficient of consolidation by square root of time fitting method and logarithm of time fitting method.	07
	Section II	
4	**Shear Strength of Soil:** Concept of shear stress and shear strength, Mohr-Coulomb's theory and failure envelopes for different types of soils, Terzaghi's total stress and effective stress approach, Factors affecting shear strength of soils.Measurement of shear strength parameters of soil by Direct shear test, Triaxial compression test, under UU, CU & CD conditions, Unconfined compression test and vane shear test	07

5	**Earth Pressure and Analysis of Slope Stability:** Concept of earth pressure, Earth pressure at rest, Active and passive condition, its practical applications. Rankine's earth pressure theory for cohesionless and cohesive soils under dry, Partially and fully submerged condition, Horizontal back fill with surcharge, Tension cracks in soil, Critical height, Coulomb's wedge theory Slope classification, Modes of failure. Infinite and finite slope in cohesive and cohesionless soil, Taylor's stability number, Swedish slip method, Method of slices and concept of friction circle method, Slope improvement methos, Landslide	07
6	**Concepts and fundamentals of Foundation Engineering:** Necessity, objectives, requirements and selection of foundation, Concept of bearing capacity, its analytical and field methods, Considerations and criteria for foundation design. Classification of foundations and their suitability. Geotechnical design concepts of shallow foundation (isolated column footing, combined footing, raft foundation) and settlement calculations. Pile foundation, classification, estimation of pile capacity, under reamed piles.	06

Term work:

A. Performance of at least ten experiments based on the following:	
1.	Determination of specific gravity by pycnometer / density bottle method
2.	Determination of water content by oven drying method / Pycnometer method
3.	Determination of particle size distribution by dry sieve analysis
4.	Determination of particle size distribution by hydrometer analysis
5.	Determination of consistency limits (LL, PL, SL) (minimum two)
6.	Determination of field density by core cutter method
7.	Determination of field density by sand replacement method
8.	Determination of MDD & OMC by standard / Modified proctor test
9.	Determination of coefficient of permeability by variable head method/Constant head method
10.	Determination of shear strength parameters of soil by using direct shear test
11.	Determination of shear strength of soil by Triaixal, Unconfined and Vane shear Test (any one)
B. One assignment per unit with minimum four numerical, wherever applicable.	

Text Books:			
Sr. No.	**Title**	**Author**	**Publication & Edition**
01	Soil Mechanics and Foundation Engineering	B. C. Punmia,	Laxmi Publication
02	Soil Mechanics and Foundation Engineering	K. R. Arora	Standard Publisher
03	Soil Mechanics and Foundation Engineering	S. K. Garg	Khanna Publishers
04	Geotechnical Engineering	V. N. S. Murthy	CRC Press
05	Geotechnical Engineering	C. Venkatramaiah	New age Int. Publication
06	Principles of Geotechnical Engineering	Braja M. Das	Cengage Learning
07	Basic and Applied Soil Mechanics	Gopal Ranjan & A.S.R. Rao	New Age International
08	Geotechnical Engineering	Purushottam Raj	McGraw Hill Publication (4th Edition)

Reference Books:			
Sr. No.	**Title**	**Author**	**Publication & Edition**
01	Geotechnical Engg, Principle and Practice	Donald P Coduto	McMillan Press (PHI)
02	Soil Mechanics	Terzaghi & Peak	Jony Willey and Sons,NY
03	Soil Testing	T. W. Lambe	Willey Eastern Ltd, New Delhi
04	Geotechnical Testing and Instrumentation	Alam Singh	CBS Publisher
05	IS 2720 (Soil testing)	The Bureau of Indian Standards (BIS)	
06	https://nptel.ac.in/courses/105/107/105107066/	NPTELwebsite	

Guidelines regarding the Question Paper Setting**: End Semester Examination**		
Question No.	Unit No.	Marks
1	1	05
2	2	05
3	3	05
4	4	15
5	5	15
6	6	15

PCC ME0253: Environmental Engineering

Teaching Scheme:		**Evaluation Scheme:**	
Lecture (Per week)	**:03**	**MSE**	**:30**
Tutorial (Per week)	**:00**	**ISE**	**:10**
Credit	**:03**	**ESE**	**:60**

Course Pre-requisite		
Course Objective	1	Provide fundamental knowledge of water supply systems
	2	Explain principles and design concepts of water treatment process
	3	Develop understanding of water distribution systems
	4	Introduce concepts of wastewater engineering
	5	Familiarize students with secondary and sludge treatment process
	6	Create awareness of environmental pollution control and management
Course Outcomes	After Completion of this course students will be able to	
	1	Understand water supply systems and quality requirements
	2	Analyze and design water treatment processes
	3	Design water distribution and appurtenance systems
	4	Understand wastewater collection and treatment systems
	5	Evaluate sludge treatment and pollution control methods
	6	Apply environmental management principles and EIA

CO-PO Mapping												
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	1	–	–	2	–	–	1	–	1	
CO2	3	3	3	2	2	2	–	–	1	–	1	
CO3	3	3	3	–	2	2	–	–	1	2	1	
CO4	3	2	2	1	–	3	–	–	1	–	1	
CO5	3	3	2	2	2	3	1	–	1	–	1	
CO6	2	2	2	1	–	3	3	2	2	2	2	
Level of Mapping as: Low 1, Moderate 2, High 3												

Marking Scheme
1. The theory exam shall be consisting of MSE and ESE. The weightage of MSE shall be 30% and of ESE shall be 60%.
2. ESE paper setting weightage will be 25% on syllabus covered for MSE (First Three Units) and 75% on remaining syllabus (Last Three Units).
3. Weightage to optional questions in a theory paper shall be 25 to 30 % of the maximum marks.

Unit No.	Section I	Hours
1	**Water Supply Planning and Water Quality** Introduction to water supply schemes: data collection, components, layout. Design period and factors affecting design period. Water demand and its types, factors affecting demand, and population forecasting methods. Water quality parameters and their significance.Drinking water standards as per BIS and WHO.	06Hrs
2	**Water Treatment Processes** Principles of water treatment and flow sheets. Intake structures: river, canal, reservoir intakes. Water supply layout plan. Aeration: principles, necessity, methods, and design of cascade aerator. Coagulation and flocculation: theory, destabilization of colloids, factors affecting, coagulant selection. Sedimentation: theory, types, design of sedimentation tanks, tube and plate settlers.	06 Hrs
3	**Tertiary Water Treatment, Distribution & Appurtenances** Filtration mechanisms, head loss, negative head loss. Types and design of filters: slow sand, rapid sand, pressure filters. Disinfection principles and methods, break-point chlorination. Water softening and demineralization processes. Service reservoirs: necessity, location, capacity determination. Distribution system layout plan. Transmission mains, pipe materials, testing, corrosion control, thrust blocks. Valves, hydrants, meters, service connections, water audit and DPR preparation.	06 Hrs
	Section II	
4	**Wastewater Collection & Primary Treatment** Sources and characteristics of wastewater. Flow variations and BOD calculations. Storm water estimation. Sewerage systems: types, layouts, sewer types. Design and maintenance of sanitary and storm sewers. Preliminary and primary treatment units: screening, grit chambers, oil and grease traps, primary settling tanks.	06 Hrs

5	**Secondary Treatment, Sludge Treatment & Stream Pollution** Activated Sludge Process: principles, design parameters, modifications, operational issues. Trickling filters. Sludge treatment: anaerobic digestion and reactors. Low-cost wastewater treatment systems. Stream pollution: self-purification, DO sag curve, Streeter–Phelps equation. Wastewater disposal methods and effluent standards as per CPCB and MPCB.	06 Hrs
6	**Solid Waste, Air & Noise Pollution and EIA** Solid waste types, sources, characteristics and functional elements. Treatment methods: composting, incineration, pyrolysis, sanitary landfill. Environmental Impact Assessment concept, EHS.	06 Hrs

Text Books:			
Sr. No.	**Title**	**Author**	**Publication & Edition**
01			
02			
03			
04			
05			

Reference Books:			
Sr. No.	**Title**	**Author**	**Publication & Edition**
01			
02			
03			
04			

3. Question Paper Blue-Print (60 Marks)

Theory Question Paper Pattern

Section	**Question Type**	**Marks**	**Coverage**
Section A	Very Short Answer (6 × 2)	12	All Units
Section B	Short Answer (6 × 4)	24	All Units
Section C	Long Answer (4 × 6)	24	Any Four Units
Total	—	**60 Marks**	—

PCC CE0254: Program Elective - 01 (Advanced Structural Analysis)

Teaching Scheme:		**Evaluation Scheme:**	
Lecture (Per week)	**:03**	**MSE**	**:30**
Tutorial (Per week)	**:00**	**ISE**	**:10**
Credit	**:03**	**ESE**	**:60**

Course Pre-requisite	Applied Mechanics, Engineering Mathematics, Fluid Mechanics,	
Course Objective	1	Understand and apply advanced methods of structural analysis for indeterminate structures.
	2	Analyze special structural systems such as portal frames, arches, cables, and frames using classical and modern approaches.
	3	Interpret influence line diagrams for evaluating responses due to moving loads.
	4	Develop fundamental understanding of Finite Element Method and its application to structural problems.
	5	Analize structures considering plastic behavior, stability, and collapse mechanisms.
	6	Relate theoretical concepts with real-life structural behavior and design philosophy.
Course Outcomes	After Completion of this course students will be able to	
	1	Analyze single-bay portal frames with inclined legs and gable frames using the slope deflection method.
	2	Analyze indeterminate beams and arches using influence line diagrams for moving load effects.
	3	Determine reactions, tension, and geometric parameters of cable structures under various loading and support conditions.
	4	Apply fundamental finite element concepts to analyze plane stress, plane strain, axisymmetric, and basic structural problems.
	5	Analyze two-hinged and three-hinged arches using influence line concepts under moving loads.
	6	Analyze indeterminate structures considering plastic behavior, collapse mechanisms, stability, and second-order effects.

CO-PO Mapping												
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1												
CO2												
CO3												
CO4												
Level of Mapping as: Low 1, Moderate 2, High 3												

Marking Scheme
1. The theory exam shall be consisting of MSE and ESE. The weightage of MSE shall be 30% and of ESE shall be 60%. 2. ESE paper setting weightage will be 25% on syllabus covered for MSE (First Three Units) and 75% on remaining syllabus (Last Three Units). 3. Weightage to optional questions in a theory paper shall be 25 to 30 % of the maximum marks.

Unit No.	Section I	Hours
1	**Slope Deflection Method:** Analysis of single bay portal frames with inclined legs, gable frames.	10Hrs
2	**Influence Lines:** Influence line concept and applications ILD for reactions, shear force and bending moment. Determinate and indeterminate beams. Influence lines for arches.	4 Hrs
3	**Cables Structures:** Introduction, Equation of the cable, General Cable theorem Horizontal reaction for uniformly loaded cable, Tension in the cable supported at same and different levels.	6Hrs
	Section II	
4	**Finite Element Method** Basics of variational and energy principles; fundamentals of finite element method including discretization Element properties, stiffness formulation, assembly, and boundary conditions; applications of FEM to plane stress	6Hrs
5	**Arches:** Types and behavior of arches. Analysis of three-hinged arches. Analysis of two-hinged arches. Horizontal thrust in arches. Influence line concept for arches	4Hrs
6	**Plastic Analysis and Stability:** Stress–strain behaviour of structural steel, Plastic hinge concept and shape factor,Plastic analysis of statically indeterminate beams, Collapse mechanism ofportal frames, Upper bound and lower bound theorems.	6Hrs

Term work:

At least one assignment from each unit

Text Books:			
Sr. No.	**Title**	**Author**	**Publication & Edition**
01	Strength of Materials & Structural Analysis	S. Ramamrutham and R. Narayanan	Dhanpat Rai Publications.
02	Advanced Structural Analysis	Devdas Menon	Narosa Publishing House Revised edition ISBN-13: 978-81-7319-939-4
03	Structural Analysis (Vol. I & II)	S. K. Duggal, V. N. Vazirani & M. M. Ratwani	Khanna Publishers Revised edition 978-81-7409-140-8
04	Structural Analysis	S. S. Bhavikatti	Vikas Publishing

Reference Books:			
Sr. No.	**Title**	**Author**	**Publication & Edition**
01	Structural Analysis	R. K. Bansal	Laxmi Publications.
02	Advanced Structural Analysis	A. K. Jain	Nem Chand Bros. Commonly used core edition
03	Basic Structural Analysis	C. S. Reddy	Tata McGraw HillLatest edition
04	Structural Analysis	R. C. Hibbeler	Pearson Education, 10th / 11th Edition
05	Matrix Analysis of Structures	P. K. Singh	Cengage Learning India

Guidelines regarding the Question Paper Setting**: End Semester Examination**		
Question No.	Unit No.	Marks
1	1	05
2	2	10
3	3	15
4	4	15
5	5	15
6	6	15

Guide lines for Paper Setting:(NEP2.0)

1. The question paper shall contain one question from each unit.
2. One compulsory numerical problem based on Slope Deflection / Flexibility / Stiffness Method shall be included with necessary data tables and coefficients provided in the paper.
3. The questions shall emphasize analytical and numerical problem-solving ability with balanced unit-wise coverage and appropriate difficulty levels.

SECTION–I

Q.1 (Compulsory) (5 Marks) (from Unit 1 or Unit 2 or Unit 3)

Q.2 Solve any two

Q.2a) ------- 5marks

Q.2 b) ------ 5marks

Q.2 c)--------5marks

SECTION–II

Q.3 (Compulsory)

(a) from Unit 4 (5 marks each)

(b) from Unit5 (5 marks each)

(c) from Unit6 (5marks each)

Q.4 (15marks)

Q.5 (15marks)

Q.6 (15 marks)

Solve any two out of Q.4, Q.5, Q.6

Guide lines for Paper Setting: (NEP2.1)

SECTION-I

***Question No. 01iscompulsory**

Q.1----(a)---Unit1

(b) ---Unit2

(c) ----Unit3(Solveanytwo)5markseach

Q.2, Q. 3Q.4fromUnit1,Unit2,Unit3respectively(Solveanytwo)10markseach

SECTION-II

***Q.5 Compulsory**

Q.5----(a)----- **Unit4**

(b)----Unit5

(c) ----- Unit6(Solveanytwo)5markseach

Q.6,Q.7Q.8 from Unit4,Unit5,Unit6respectively(Solveanytwo)10 marks each

End Semester Examination

QuestionNo.	UnitNo.	Marks
1	1	10
2	2	10
3	3	10
4	4	10
5	5	10
6	6	10
Total		60

ME0254 (Programme Elective-01):Construction Methods and Equipment Management

Teaching Scheme		Evaluation Scheme	
Lecture (Per Week)	**03**	**MSE**	**30**
Tutorial (Per Week)	**00**	**ISE**	**10**
Credits	**03**	**ESE**	**60**

Course Pre-requisite	Basic Knowledge of construction equipment	
Course Objective	1	Understand modern construction methods used in civil engineering projects
	2	Study selection, operation, and management of construction equipment
	3	Introduce planning, productivity, and cost aspects of construction machinery
	4	Develop basic decision-making skills in equipment selection and site operations
Course Outcomes (COs)	**After completion of the course, students will be able to:**	
	1	Explain various construction methods used in civil engineering projects
	2	Identify and select appropriate construction equipment
	3	Understand productivity and cost aspects of construction equipment
	4	Apply equipment management principles in construction projects
	5	Analyze safety and maintenance requirements of construction machinery

CO–PO Mapping

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

Level of Mapping as: Low 1, Moderate 2, High 3

Marking Scheme

1. The Theory exam shall be consisting of MSE and ESE. The weightage of MSE shall be 30% and of ESE shall be 60%.
2. ESE paper setting weightage will be 25% on syllabus covered for MSE (First Three Units) and 75% on remaining syllabus (Last Three Units).
3. The number of optional questions marks in a theory paper shall be 25 to 30 percent of the maximum marks.

Unit No	Content	Hours
1	**Introduction to Construction Industry and Construction Planning**	6 Hrs
	Overview of construction industry: Characteristics of construction projects, Types of construction projects (Building, Industrial, Infrastructure), Stakeholders in construction projects **Construction planning concepts:** Importance of construction planning, Relationship between planning, scheduling, and control, Work breakdown structure (WBS) **Construction methods:** Conventional vs modern construction methods, Factors affecting selection of construction methods, Role of Artificial Intelligence in modern construction Methods **Productivity in construction:** Definition of productivity, Factors affecting construction productivity, Methods to improve productivity	
2	**Earthwork and Excavation Equipment**	6 Hrs
	Earthwork in construction: Types of earthwork operations, Soil classification for excavation, Volume calculations for earthwork (Theory) **Excavation equipment:** Power shovels – types and applications, Backhoes and draglines, Clamshell and trenching machines **Bulldozers and scrapers:** Types of bulldozers, Applications of scrapers, Dozing and ripping operations. **Selection of excavation equipment:** Factors affecting equipment selection, Equipment productivity basics, Advantages of mechanized excavation	
3	**Hauling, Lifting, and Material Handling Equipment**	6 Hrs
	Hauling equipment: Dump trucks – types and capacities, Tippers and wagons, Selection of hauling equipment **Conveying equipment:** Belt conveyors, Screw conveyors, Applications in construction **Lifting equipment:** Cranes – types (mobile, tower, crawler), Hoists and winches, Load charts and safety considerations **Material handling planning:** Site layout planning, Equipment coordination, Reduction of material handling cost	
4	**Concrete Construction Equipment and Methods**	6 Hrs
	Concrete production: Batching methods (manual and automated), Mixing equipment – drum mixers, pan mixers, Ready-mix concrete concept **Concrete transportation:** Transit mixers, Pumps and chutes, Buckets and cranes **Concrete placing and compaction:** Methods of placing concrete, Vibrators – internal, surface, and external, Importance of compaction **Formwork and scaffolding:** Types of formwork materials, Conventional and system formwork, Safety aspects of formwork	
5	**Road Construction Equipment and Methods**	6 Hrs
	Highway construction process: Subgrade preparation, Base and sub-base construction, Pavement layers **Road construction equipment:** Motor graders, Road rollers – types and functions, Bitumen sprayers **Bituminous construction equipment:** Hot mix plant, Pavers and finishers, Compaction equipment for bituminous layers **Quality control and safety:** Field quality control tests, Equipment safety measures, Maintenance of road construction equipment	

6	**Equipment Management, Maintenance, and Economics**	**6 Hrs**
	Construction equipment management: Objectives of equipment management, Equipment planning and scheduling, Equipment fleet management **Equipment ownership and operating cost:** Fixed costs, Operating costs, Cost comparison of equipment **Equipment maintenance:** Preventive maintenance, Breakdown maintenance, Maintenance planning, **Replacement and safety:** Equipment replacement policy, Factors affecting replacement decisions, Safety practices in equipment operation	

General Instructions:

1) For the term work of 10 marks, Assignments on each topic are to be conducted as per University rules.

Text Book:			
Sr. No.	**Title**	**Author**	**Publication & Edition**
01	Construction Planning, Equipment, and Methods	Peurifoy, R.L., Schexnayder, C.J., Shapira, A., and Schmitt, R.	**McGraw Hill** 10th Edition
02	Construction Project Management	K. K. Chitkara	**McGraw Hill**
03	Construction ProjectManagement, Theory and Practice	Kumar Neeraj Jha	**Pearson**
04	Construction Equipment and Methods	**R. L. Peurifoy**	**McGraw Hill**

Reference Book:			
Sr. No.	**Title**	**Author**	**Publication & Edition**
01	Construction Planning and Equipment	S. C. Rangwala	Khanna Publication, Delhi December 2020 ISBN-10 : 8900120905 ISBN-13 : 978-8900120905
02	Construction Planning and Equipment	H.K.Das	S.Chand Publication December 2007 ISBN-10 : 8121903459 ISBN-13 : 978-8121903455
03	Advanced Engineering Mathematics	Jack Goldberg	Oxford University Press
04	Applied Mathematics	Navneet D. Sangale	Cengage Publication June 2014 ISBN-10 : 9383971444 ISBN-13 : 978-9383971442
05	Advanced Engineering Mathematics	Erwin Kreyszig	Wiley India
06	Higher Engineering Mathematics	B.V.Ramana	Tata McGraw-Hill July 2017 ISBN-10 : 007063419X ISBN-13 : 978-0070634190
07	Mathematical Methods of Science and Engineering.	KantiB.Datta	Cengage Learning
08	Construction Management	A. K. Kannan	

CE0254: Bridge and Tunnel Engineering (ProgrammeElective–01)

Teaching Scheme:		**Evaluation Scheme:**	
Lecture (Per week)	**:-**	**MSE**	**:-**
Tutorial (Per week)	**:02**	**ISE**	**:25**
Credit	**:01**	**ESE**	**:-**

Course Pre-requisite	Nil	
Course Objective	1	Introducethefundamentalconceptsofbridgeengineering,
	2	Developunderstandingofbridgesuperstructures**,**design methodologies,bearings,expansionjoints,andparapets.
	3	Familiarizestudentswithbridgesubstructures,foundations, andsoil–structureinteraction.
	4	Provideknowledgeoftunnelengineeringfundamentals**,** **i**ncludingclassification,investigation,andsurveyingmethods.
	5	Understand various tunnelingmethods**,**construction techniques,andproblem-solvingmeasures.
	6	To create awareness about tunnel support systems, ground treatmentmethods,services,andsafetyconsiderations**.**
Course Outcomes	After Completion of this course students will be able to	
	1	Understand Classificationofbridgeandsiteselectioncriteria.
	2	Understand the importanceofdifferenttypesofbridgebearings.
	3	Understandbasicprinciplesofbridgeconstructionand Maintenance.
	4	Explain tunnel development in India, classify tunnels, and interpret tunnel investigationmethods andcross-sections.
	5	Understandtunnelingmethodsconformingtosite conditions.
	6	Identify tunnel support systems, ground treatment measures, tunnel services, and safety practices for underground construction.

CO-PO Mapping											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	2	1	-	-	1	1	-	-	-	-
CO2	3	3	3	2	2	-	1	-	-	-	-
CO3	3	3	2	2	1	-	1	-	-	-	-
CO4	3	2	1	1	-	2	1	-	-	-	-
CO5	3	3	2	2	2	-	1	-	-	-	-
CO6	3	3	2	2	2	1	2	1	-	-	-
Level of Mapping as: Low 1, Moderate 2, High 3											

Marking Scheme:			
Journal – 10 Marks	Attendance - 5Marks	CaseStudy–5Marks	Viva-Voce–5 Marks

Unit No.	Section I	Hours
1	**StudyofIRCCodes for RoadBridges** Studyofrelevant IRC codes(IRC:5,6,18,27,45,78) with emphasison loads,clearances,anddesignprovisions.	2 Hrs
2	**Study of Bridge Components** Identification and detailed study of superstructure, substructure, foundations, bearings, and expansion joints using drawings/models	2 Hrs
3	**Bridge Construction &Maintenance** Construction methods and maintenance of bridges	2 Hrs
4	**Study of Bridge Bearings and Expansion Joints** Studyoftypes,functions,forcesonbearings,and expansionjointsused in highway bridges.	2 Hrs

5	**Tunnel Classification, History and Cross-Sections**
	• History of tunnel development tin India with IKSperspective
	• Classification of tunnels based on:
	  • Purpose
	  • Conveyance
	  • Geological strata
	  • Alignment
	  • Shapeand size
	• Standard cross-sections:
	  • Highway tunnels
	  • Railway tunnels
	Neat labeled sketches
		2 Hrs

6	**TunnelingMethodsandShallowTunnelingTechniques** • Tunnelingmethods: • Softground tunneling • Hardrocktunneling • Shallowtunneling • Deep tunneling • Shallowtunnelingtechniques: • Cut and cover • Coverandcut • Pipe jacking • Jackedboxexcavation • Methodsofmuckdisposal • Problemsencounteredandremedial measures	2 Hrs
7	**TunnelSupportSystems,GroundTreatmentand Safety** • Tunnelsupportsystems: • Timbering • Steelribs • Rockbolts • Shotcrete	2 Hrs

	• Introductiontogroundtreatment methods: • Grouting • Dewatering • Ground freezing • Tunnel services: • Lighting • Ventilationanddust control • Drainagesystem • Tunnelinghazards: • Explosions • Flooding • Safetyandpreventive measures	
8	**SiteVisittoBridgeorTunnelProjectwithReport** Visit to a nearby bridge or tunnel construction/completed project and preparation of a detailed report covering: • Location and purpose of the structure • Type of bridge/tunnel and materials used • Construction methodology • Major components observed • Safety measures adopted • Challenges faced and solutions Photographs and observations	6Hrs

Text Book/ Reference Books:			
Sr. No.	**Title**	**Author**	**Publication & Edition**

CE0255Multi-disciplinary Minor-03: - Infrastructure Engineering

Teaching Scheme		**Evaluation Scheme**	
Theory (Per week)	**03**	**MSE**	**:30**
Tutorial (Per week)	**-**	**ISE**	**:10**
Credit	**03**	**ESE**	**:60**

Course Pre-requisite	-	
Course Objective	1	To give overview of Indian infrastructure assets
	2	To learn methodologies for sustainable infrastructure and working of public private partnershipmodels
	3	To learn about urban and ruralinfrastructure
Course Outcomes	After Completion of this course students will be able to	
	1	Outline and learn the salient features of theinfrastructure assets of India
	2	Understand in details the primary infrastructure assets like Highways, Railways,Airports, Power sector, Renewable energy sector, Ports and Dams.
	3	Learn about working of public private partnership models
	4	Build concepts about the rural infrastructure in India

CO-PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	2	-	-	-	2	-	-	1	-	2
CO2	3	2	1	-	1	2	-	-	1	-	2
CO3	2	2	1	-	-	2	1	-	1	3	2
CO4	2	1	-	-	-	3	1	-	1	-	2

Level of Mapping as: Low 1, Moderate 2, High 3

Marking Scheme

1. The theory exam shall be consisting of MSE and ESE. The weightage of MSE shall be 30% and of ESE shall be 60%.
2. ESE paper setting weightage will be 25% on syllabus covered for MSE (First Three Units) and 75% on remaining syllabus (Last Three Units).
3. Weightage to optional questions in a theory paper shall be 25 to 30 % of the maximum marks.

Unit No.	Content	Hours
1	**Overview of Indian Infrastructure Assets** Concept of infrastructure - Need for infrastructure planning and engineering, Infrastructure development scenario in India, Scope for infrastructure management.	7Hrs
2	**Urban Infrastructure and Rural Infrastructure** Urban infrastructure- Water- Dams- Bridges- CanalsHousing- Roads- Railways- Ports- Airports- Energy- Power Rural Infrastructure: Alternate construction materials- Rural housing technologies- Rural roadsRural water supply and sanitation	8Hrs
3	**Energy Infrastructure** Energy Infrastructure- Components of energy- Power generation- Transmission- Distribution- Oil &gas- Coal- Renewable energy sources like solar, wind, tidal, geothermal	7Hrs
4	**Sustainable Infrastructure** Methodologies for development and management of sustainable infrastructure- Privatization ofInfrastructure- Working of public privatepartnership models (Build Operate and Transfer, BuildOperate Lease and Transfer, Build Own Operate)- Infrastructure laws for cost estimation,designingand maintaining infrastructure.	8Hrs
5	**Strategies for Infrastructure Projects** Risk Management Framework For Infrastructure Projects, Shaping The Planning Phase of Infrastructure Projects To Mitigate Risks, Designing Sustainable Contracts,Sustainable Development Of Infrastructure,Innovative Design And Maintenance OfInfrastructure Facilities.	6 Hrs
6	**Challenges in Infrastructure Planning** Mapping And Facing The Landscape Of Risks In Infrastructure Projects, Economic AndDemand Risks, Socio-Environmental Risks, CulturalRisks In International,Infrastructure Projects, Legal And ContractualIssues In Infrastructure, Challenges InConstruction And Maintenance Of Infrastructure	6 Hrs

Text Books:

Sr. No.	Title	Author	Publication & Edition
01	Infrastructure Development and Financing: Towards a Public Private Partnership	Raghuram G	Macmillan Publishers, New Delhi, 2001.
02	Law Relating to Infrastructure Projects	Joshi P	Taxman Publishers New Delhi, 2001.
03	Infrastructure Development	Alagiri D	ICFAI University Press Hyderabad, 2007.

GeneralInstructions:

1) For the termworkof25marks,batchwisetutorialsaretobeconducted.Thenumberof Students per batch per tutorial should be as per University rules.
2) Numberoftutorialsshouldbeat leastsix(Allunitsshouldbecovered).

TextBook:			
Sr. No.	**Title**	**Author**	**Publication& Edition**
01	Railway,BridgeandTunnel Engineering	KetkiB.Dalal&K.S.	Rangwala
02	Tunnel Engineering, (2015)	SaxenaS.C	DhanpatRaiPublications
03	Elements of Bridge, Tunnel & Railway Engineering	S.P. Bindra	DhanpatRaiPublications

ReferenceBook:			
Sr. No.	**Title**	**Author**	**Publication& Edition**
01	TunnelEngineering	S.K.Arora&S.P. Bindra	DhanpatRaiPublications
02	Concrete Bridge Practice, (Analysis, Design Economics)	RainaV.K.,	4thEdition,Shroff Publishers,Mumbai
03	BridgeEngineering	J.S.Alagia	CharotarPublication House, Anand
04	DesignofBridgeStructures	J.Jagadesh&M.A. Jayaram.	

CE0256Open Elective- III:- Smart City

Teaching Scheme		Evaluation Scheme	
Theory (Per week)	**:02**	**MSE**	**:30**
Tutorial (Per week)	**:-**	**ISE**	**:10**
Credit	**:02**	**ESE**	**:60**

Course Pre-requisite	-	
Course Objective	1	To make aware about code of practice for Smart & sustainable City
	2	To understand the concept of smart city and associated challenges
	3	To carry out feasibility study for infrastructure planning
Course Outcomes	After Completion of this course students will be able to	
	1	Understand the concept of smart & sustainable city and associated challenges
	2	Identify latest technologies used in Infrastructural Planning
	3	Evaluate feasibility analysis for infrastructural planning
	4	Apply various smart technique used for Smart City development

CO-PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	2	-	-	-	3	1	-	1	-	2
CO2	3	2	2	-	3	2	-	-	1	-	2
CO3	2	3	2	2	1	2	-	-	1	3	2
CO4	2	2	3	-	3	2	-	-	1	2	2

Level of Mapping as: Low 1, Moderate 2, High 3

Marking Scheme

1. The theory exam shall be consisting of MSE and ESE. The weightage of MSE shall be 30% and of ESE shall be 60%.
2. ESE paper setting weightage will be 25% on syllabus covered for MSE (First Three Units) and 75% on remaining syllabus (Last Three Units).
3. Weightage to optional questions in a theory paper shall be 25 to 30 % of the maximum marks.

Unit No.	Content	Hours
1	Introduction to Smart cities Introduction to smart & sustainable cities- Definition, dimensions, scope Smart Cities –Global Standards and Performance Benchmarks, Practice Code, Principal stakeholders, key trends in smart cities developments, Concept of Sustainable cities	7Hrs
2	Smart Cities Planning and Development Planning for Urban Infrastructure, Introduction to city planning, key trends in smart cities developments, Sustainable features for smart cities. Role of Planner in the provision of urban networks for different services, Case Study.	8Hrs
3	Infrastructure Planning and Development for smart Cities Feasibility studies for infrastructure projects, planning for major infrastructure projects, Various Infrastructure Program and policies by MOUD, PPP (DBOOT, BOOT, etc.) in infrastructure projects. Dimension of smart cities, Financing smart cities development, Governance of smart cities, Smart Cities Regulations & Smart Techniques, Case Study.	7Hrs
4	Transportation system for Smart Cities Urbanization and urban mobility, urban land use and transport. Concepts of sustainable mobility, public transportation, pedestrians and bicyclists and parking, fundamentals of the intelligent transportation systems (ITS).	8Hrs
5	Sanitation, sewerage system, flood management, conservation system. Policy for Smart City: Integrated infrastructure management systems forsmart city, Infrastructure management system applications for existingsmart city.	6 Hrs
6	Worldwide policies for smart city Government of India policyfor smart city, Mission statement & guidelines, Smart cities in India, Case studies of smart city.	6 Hrs

Text Books:			
Sr. No.	**Title**	**Author**	**Publication & Edition**
01	A city for all: valuing differences and working with diversity	Jo Beall (1997)	Zed books limited, London (ISBN: 1- 85649-477-2).
02	Inclusive and sustainable urban planning: a guide for municipalities Volume 3: Urban Development Planning (2007)	UN-Habitat	United Nations Human Settlements Programme (ISBN: 978- 92-1-132024-4).
03	Insights into inclusive growth, employment and wellbeing in India	Arup Mitra	Springer (2013), New Delhi (ISBN: 978- 81-322-0655-2
04	Mission statement &guidelines on Smart City Scheme	http://smartcities.gov.in/upload/uploadfiles/files/Smart City Guidelines(1).pdf	Government of India - Ministry of Urban Development

PCCE0257: Geotechnical Engineering Lab.

Teaching Scheme:		**Evaluation Scheme:**	
Lecture(Per week)	**:00**	**MSE**	**:00**
Practical (Per week)	**:02**	**ISE**	**:25**
Credit	**:01**	**ESE**	**:25**

Course Pre-requisite	Applied Mechanics, Engineering Mathematics, Fluid Mechanics	
Course Objective	1	To impart skills to perform laboratory experiments for determination of index and engineering properties of soil
	2	To interpret the experiment results and draw valid conclusions
Course Outcomes	After Completion of this course students will be able to	
	1	Demonstrate skill to conduct laboratory experiments as per standard procedure to determine soil properties.
	2	Analyze soil properties and describe soil performance

CO-PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3		3					2	2		
CO2	3	3	2	3	2			2		2		

Level of Mapping as: Low 1, Moderate 2, High 3

Marking Scheme:

1. The In-semester evaluation ISE will be of 25 marks based on laboratory/ term work.

2. End semester evaluation will be of 25 marks based on external oral examination

Term work: Journal consist of experiment performances and assignments.

List of the experiments/activity:		Type	Hours
A. Performance of at least ten experiments based on the following:			
1	Determination of specific gravity by pycnometer / density bottle method	O	2
2	Determination of water content by oven drying method / Pycnometer method	O	2
3	Determination of particle size distribution by dry sieve analysis	O	2
4	Determination of particle size distribution by hydrometer analysis	O	2
5	Determination of consistency limits (LL, PL, SL) (minimum two)	O	2
6	Determination of field density by core cutter method	O	2
7	Determination of field density by sand replacement method	O	2
8	Determination of MDD & OMC by standard / Modified proctor test	O	2
9	Determination of coefficient of permeability by variable head method/Constant head method	O	2
1	Determination of shear strength parameters of soil by using direct shear test	O	2
1	Determination of shear strength of soil by Triaixal, Unconfined and Vane shear Test (any one)	O	2
B. One assignment per unit with minimum four numerical, wherever applicable		S	

O: Operational **S:** Study

Reference Books:			
Sr. No.	**Title**	**Author**	**Publication & Edition**
01	Soil Testing	T. W. Lambe	Willey Eastern Ltd, New Delhi
02	IS 2720 (Soil testing)	The Bureau of Indian Standards (BIS)	
03	Geotechnical Testing and Instrumentation	Alam Singh	CBS Publisher
04	Soil Mechanics and Foundation Engineering	B. C. Punmia	Laxmi Publication
05	Soil Mechanics and Foundation Engineering	K. R. Arora	Standard Publisher
06	Soil Mechanics and Foundation Engineering	S. K. Garg	Khanna Publishers

PCC CE0258: Environmental Engineering Lab.

Teaching Scheme:		Evaluation Scheme:	
Lecture(Per week)	**:00**	**MSE**	**:00**
Practical (Per week)	**:02**	**ISE**	**:25**
Credit	**:01**	**ESE**	**:25**

Course Pre-requisite		
Course Objective	1	
	2	
Course Outcomes	After Completion of this course students will be able to	
	1	
	2	

CO-PO Mapping												
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1												
CO2												
Level of Mapping as: Low 1, Moderate 2, High 3												

Marking Scheme:
2. The In-semester evaluation ISE will be of 25 marks based on laboratory/ term work. 2. End semester evaluation will be of 25 marks based on external oral examination

Term work: Consists of journal containing part A,B,C &D

- Students shall perform **any 10 experiments in total from part A & B**
- Experimental results must be compared with **BIS / CPCB / WHO standards** wherever applicable.

	A. Water Quality Analysis (Any six experiments)	Type	Hours
1.	pH, Acidity and Alkalinity of Water	O	2
2.	Determination of Chlorides Content	O	2
3.	Determination of Hardness – Total, Temporary and Permanent	O	2
4.	Measurement of Turbidity	O	2
5.	Residual Chlorine Determination	O	2
6.	Total Dissolved Solids (TDS) using Electrical Conductivity	O	2
7.	Dissolved Oxygen (DO) by Winkler Method/DO meter	O	2
8.	Most Probable Number (MPN) Test	O	2
9.	Optimum Dose of Alum by Jar Test	O	2
10.	Determination of Fluoride / Iron Content(any one)	O	2
B.	**Municipal Wastewater Characterization (Any 4 Experiments)**		
1.	pH and Alkalinity of Wastewater	O	2
2.	Total Solids, Suspended Solids and Dissolved Solids	O	2
3.	Biochemical Oxygen Demand (BOD)	O	2
4.	Chemical Oxygen Demand (COD)	O	2
5.	Sulphates / Oil & Grease(any one)	O	2
C.	**Design / Analysis Problems (Mandatory)**		
1.	Design/analysis of water treatment units	S	
2.	Design/analysis of water distribution systems	S	
3.	Design/analysis of sanitary sewers and wastewater treatment units	S	
D.	**Field Visits to water treatment and sewage treatment plant and preparation of reports (Mandatory).** **The report should contain:** Process flow diagram, Description of units, Plant capacity, Observations and learning outcomes	S	

Type **O:** Operational **S:** Study

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Reference Books:			
Sr. No.	**Title**	**Author**	**Publication & Edition**
01			
02			
03			
04			
05			
06			

Evaluation Scheme

In-Semester Evaluation (ISE) – 25 Marks

Component	Marks
Laboratory Performance & Journal	15
Design / Analysis Problems	05
WTP & STP Visit Reports	05
Total	**25 Marks**

End-Semester Examination (ESE) – 25 Marks

(External Practical & Oral)

Component	Marks
Practical Experiment	15
Oral / Viva-Voce	10
Total	**25 Marks**

CE0259: Program Elective - 01 (Advanced Structural Analysis Lab)

Teaching Scheme		Evaluation Scheme	
Lecture (Per week)	**:00**	**MSE**	**:00**
Practical (Per week)	**:02**	**ISE**	**:25**
Credit	**:01**	**ESE**	**:00**

Course Pre-requisite	Elements of Engineering Mechanics, Solid Mechanics, Strength of Materials, Theory of Structures, Design of concrete structures	
	After completion of this laboratory course, students will be able to:	
Course Objective	1	Understand and apply advanced methods of structural analysis for indeterminate structures.
	2	Analyze special structural systems such as portal frames, arches, cables, and frames using classical and modern approaches.
	3	Interpret influence line diagrams for evaluating responses due to moving loads.
	4	Develop fundamental understanding of Finite Element Method and its application to structural problems.
	5	Analize structures considering plastic behavior, stability, and collapse mechanisms.
	6	Relate theoretical concepts with real-life structural behavior and design philosophy.
Course Outcomes	After Completion of this laboratory course, students will be able to	
	1	Analyze single-bay portal frames with inclined legs and gable frames using the slope deflection method.
	2	Analyze indeterminate beams and arches using influence line diagrams for moving load effects.
	3	Determine reactions, tension, and geometric parameters of cable structures under various loading and support conditions.
	4	Apply fundamental finite element concepts to analyze plane stress, plane strain, axisymmetric, and basic structural problems.
	5	Analyze two-hinged and three-hinged arches using influence line concepts under moving loads.
	6	Analyze indeterminate structures considering plastic behavior, collapse mechanisms, stability, and second-order effects.

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CO-PO Mapping												
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	2	2	3	1		1	1			1
CO2	3	3	2	3	3	1		1	1			1
CO3	3	3	2	3	2	1		1	1			1
CO4	3	3	2	2	3	1		1	1			1
CO5	3	3	2	3	2	1		1	1			1
CO6	3	3	2	3	3	2		1	1			1
Level of Mapping as: Low 1, Moderate 2, High 3												

Unit No.	Contents
1	**Slope Deflection Method**
	Students shall apply the slope deflection method to analyze indeterminate structures. Numerical problems shall be solved for single-bay portal frames, inclined leg frames, and gable frames to determine support moments, end moments, and internal forces, followed by drawing bending moment diagrams (BMDs).
2	**Influence Lines:**
	Students shall construct and use influence line diagrams for reactions, shear force, and bending moment in statically determinate and indeterminate beams and arches. Numerical examples shall be solved to evaluate the effect of moving loads on structural response.
3	**Cables Structures:**
	Students shallanalyze cable structures by solving numerical problems related to the equation of cable and general cable theorem. Problems shall include determination of horizontal reactions and cable tensions for uniformly distributed loads, considering supports at same and different levels.
4	**Finite Element Method**
	Students shallsolve numerical problems using the finite element method based on variational and energy principles. Exercises shall include discretization, element property evaluation, stiffness matrix formulation, assembly, application of boundary conditions, and analysis of plane stress problems.
5	**Arches:**
	Students shallsolve numerical problems on arch structures, focusing on three-hinged and two-hinged arches. Analysis shall include determination of horizontal thrust, internal forces, and influence line diagrams for arches under different loading conditions.
6	**Plastic Analysis and Stability**
	Students shall perform plastic analysis of statically indeterminate beams and portal frames by solving numerical examples. Problems shall include determination of collapse loads, plastic hinge formation, and collapse mechanisms, along with basic

	stability considerations.

General Instructions:

1) Number of assignments should be at least six (All units should be covered).
2) Each assignment shall contain a minimum of four numerical problems, comprehensively covering the entire syllabus prescribed for that unit

Marking scheme:

Assignments on each Unit, ISE:25 Marks

Text Books:			
Sr.No.	**Title**	**Author**	**Publication & Edition**
1	Strength of Materials & Structural Analysis	S. Ramamrutham and R. Narayanan	Dhanpat Rai Publications.
2	Advanced Structural Analysis	Devdas Menon	Narosa Publishing HouseRevised edition ISBN-13: 978-81-7319-939-4
3	Structural Analysis (Vol. I & II)	S. K. Duggal, V. N. Vazirani & M. M. Ratwani	Khanna Publishers Revised edition 978-81-7409-140-8
4	Structural Analysis	S. S. Bhavikatti	Vikas Publishing 4th Edition

Reference Books:			
Sr. No.	**Title**	**Author**	**Publication & Edition**
1	Structural Analysis	Bansal, R.K	Laxmi Publications.
2	Advanced Structural Analysis	A. K. Jain	Nem Chand Bros.Commonly used core edition
3	Basic Structural Analysis	C. S. Reddy	Tata McGraw Hill Latest edition
4	Structural Analysis	R. C. Hibbeler	Pearson Education 10th /11th Edition
5	Matrix Analysis of Structures	P. K. Singh	Cengage Learning India Latest SI edition

CE0259 (Programme Elective – 01: Construction Methods and Equipment Management Lab

Teaching Scheme		**Evaluation Scheme**	
Lecture (Per Week)	**00**	**MSE**	**00**
Tutorial/ Practical(Per Week)	**02**	**ISE**	**25**
Credits	**01**	**ESE**	**00**

Course Pre-requisite	Basic Knowledge of construction equipment	
Course Objective	1	To provide practical exposure to construction methods and equipment
	2	To understand equipment productivity, cost, and selection through exercises
	3	To familiarize students with real site practices, drawings, and case studies
	4	To develop analytical and reporting skills related to construction operations
Course Outcomes (COs)	**After completion of the course, students will be able to:**	
	1	Identify construction equipment used for various site operations
	2	Calculate productivity and output of construction equipment
	3	Analyze equipment selection based on site conditions
	4	Estimate equipment costs and maintenance requirements
	5	Prepare professional technical reports related to construction activities

CO–PO Mapping

CO / PO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**
CO1	3	–	2	–	–	–	3	–	2	–	–
CO2	3	3	2	–	–	2	3	3	2	–	–
CO3	2	3	2	–	–	3	2	3	2	–	–
CO4	2	2	–	–	–	3	2	2	–	–	–
CO5	–	–	–	2	2	2	–	–	–	2	2

Level of Mapping as: Low 1, Moderate 2, High 3

Marking Scheme:

1. The In-semester evaluation ISE will be of 25 marks based on laboratory/ term work.
2. End semester evaluation will be of 25 marks based on external oral examination

Term work: Journal consist of experiment performances and assignments.
Minimum 8 experiments to be conducted

List of the experiments/activity /practical work		Type	Hours
01	**Study of Earthmoving Equipment:** Study of excavators, backhoes, bulldozers, and scrapers Identification of parts, functions, and applications	S	2
02	**Study of Hauling and Lifting Equipment:** Study of dumpers, trucks, cranes, hoists Load capacity, working range, and safety features	S	2
03	**Productivity Calculation of Excavation Equipment:** Calculation of output of excavator / backhoe Factors affecting productivity, Sample numerical problems	S	2
04	**Productivity Analysis of Hauling Equipment:** Calculation of cycle time of dump trucks Estimation of hourly and daily output	S	2
05	**Equipment Selection for Earthwork Operation:** Case study-based equipment selection Comparison of two equipment alternatives Justification based on cost and productivity	S	2
06	**Study of Concrete Construction Equipment:** Mixers, batching plants, transit mixers, concrete pumps Concrete placing and compaction equipment	S	2
07	**Study of Road Construction Equipment:** Motor grader, rollers, pavers, hot mix plant Application in different pavement layers	S	2
08	**Equipment Cost Analysis:** Fixed cost calculation, Operating cost calculation Owning vs hiring decision	S	2
09	**Equipment Maintenance Planning:** Preventive vs breakdown maintenance Maintenance schedule preparation	S	2
10	**Site Visit / Video-Based Case Study:** Site visit to construction project **OR** Video demonstration of modern construction equipment Preparation of observation report	S	2

S: Study type

Reference Books:			
Sr. No.	**Title**	**Author**	**Publication & Edition**
01	Construction Planning, Equipment and Methods	Peurifoy et al.	
02	Construction Planning and Equipment	S.C. Rangwala	
03	CPWD Specifications and Schedule of Rates		
04	Equipment manufacturer manuals (CAT, JCB, L&T, Volvo)		

CE02511: Minor Project

Teaching Scheme:		Evaluation Scheme:	
Lecture (Per week)	**:00**	**MSE**	**:30**
Practical (Per week)	**:02**	**ISE**	**:10**
Credit	**:01**	**ESE**	**:60**

Course Pre-requisite	Applied Mechanics, Engineering Mathematics, Fluid Mechanics,	
Course Objective	1	Developcriticalthinkingandproblem-solvingskillsincivilengineeringproject execution.
	2	Fostercreativityand innovationin designingpracticalsolutions.
	3	Enhancecollaborationandteamworkthroughgroup-based projectwork.
	4	Improvecommunication skillsforeffectiveproject documentationandpresentation
Course Outcomes	After Completion of this course students will be able to	
	1	Applyengineeringconceptstodevelopamini-projectfromidea to execution.
	2	Analyzeprojectchallengestodevelopefficient solutions.
	3	Composecomprehensivetechnicalreportsanddeliver professionalpresentationstocommunicateprojectoutcomeseffectively.

CO-PO Mapping												
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1												
CO2												
CO3												
CO4												
Level of Mapping as: Low 1, Moderate 2, High 3												

Assessments Scheme
OneIn-SemesterEvaluationistobeplannedsoastohavecontinuousassessment - Internal Presentations (Every two (2) weeks), Final Presentation and Report Submission.

Course Content

Mini Project will involve practical and experimental work on various technical and social issues related to civil engineering. Students will have the opportunity to explore different areas, including:

- Experimental Studies: Conducting minor experiments to analyze civil engineering problems and propose innovative solutions.
- Computer- Based Analysis and Design: Using software tools for structural analysis, design, and simulation of civil engineering projects.
- Structural Audit and Health Monitoring: Assessing the condition of existing structures, identifying defects, and suggesting maintenance or rehabilitation measures.
- Innovative Civil Engineering Materials: Exploring new materials with improved strength, durability, and sustainability for construction.
- Environmental Impact Assessment: Evaluating the effects of civil engineering projects on the environment and proposing mitigation strategies.
- Water Resource Management: Designing small-scale water supply schemes, irrigation systems, and rainwater harvesting solutions.
- Sanitation and Waste Management: Planning and designing sewerage systems, solid waste management, and wastewater treatment solutions.
- Transportation Engineering: Analyzing and improving road networks, traffic management, and transportation systems for better efficiency and safety.
- The list above is suggestive only and does not limit the scope of this course. Any other areas related to civil engineering can be explored to complete a task under mini project course.

Forworkloadcalculationminimumloadis1Hr/week, for one group of Four to Five students. (As per AICTE Guide Lines).

Guidelines:

1. Group Formation:

   The mini-project is a group activity, with each group consisting of a minimum of four (4) students and a maximum of five (5) students.

2. Batch Structure:

   Each batch shall consist of five (5) to six (6) groups. A single faculty member should not be assigned more than one batch. The students can have domain specific faculty working as a guide for the project.

3. Project Selection:

   Students must interact with the course coordinator and conduct a comprehensive literature surveyor need analysis to identify a relevant project topic. Based on this study, students must define the title, aim, and objectives of the mini-project.

4. Proposal Submission:

   Students must develop a detailed methodology, specifying the software requirements, critical issues involved in analysis, design, and implementation. The project proposal must be submitted within the first week of the semester.

5. Software Utilization:

   The use of relevant softwaretoolsforanalysisanddesignisencouraged.

6. Project Completion & Report Submission: The completed mini-project along with detailed documentation in the form of a technical report must be submitted before the end-semester assessment.

7. PresentationSchedule:

   a) SynopsisPresentation:Initialprojectproposalpresentation.

   b) InternalPresentations:Everytwo(2)weeks,studentgroupsmustpresenttheirprogressaspart of In-Semester Evaluation-I (ISE-I).

   c) FinalPresentation:Thecompletedproject alongwithfinalreport,willbepresentedaspartof the In-Semester Evaluation-II (ISE-II).

Note: The students have flexibility to choose a topic in continuation with topic worked with during Community Field Project in fifth semester & can be continued further in Main Project work in final year of academics.

PCC-CE0261:Design ofConcreteStructures-I

TeachingScheme		EvaluationScheme	
Lecture(Perweek)	**:03+01***	**MSE**	**:30**
Tutorial(Perweek)	**:-**	**ISE**	**:10**
Credit	**:03**	**ESE**	**:60**

Note: -*Required4lecturecreditwillbe03.

CoursePre-requisite	BasicknowledgeofEngineeringMechanics,StrengthofMaterials,Structural Analysis, and properties of concrete and steel is required.	
CourseObjective	1	TounderstandtheconceptofRCCstructuraldesign
	2	Toconceivetheelementary,deignofdifferentstructural elements.
	3	Toimpartknowledgeofstrengthdeterminationofdifferentkindsof R.C.elementsusingI.S. Code.
CourseOutcomes	AfterCompletionofthiscoursestudentswillbeableto	
	1	Understandthebasicdata(BasicMechanics,Mathematics,and structural analysis) required for design of concrete structures.
	2	Understandthedesignprocessofconcretestructure
	3	Understandtheapplicationoflimit statemethodforstructural element such as footing, column, beam slab, staircase etc.
	4	Designtheindividualmembersandhencebuilding.

CO-POMapping												
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	2	3	3				3				
CO2	3	2	2	3				3				
CO3	3	2	2	3				3				
CO4	3	2	2	3				3				
LevelofMappingas:Low1,Moderate 2,High3												

MarkingScheme
1. The Theory examshall be consisting of MSE andESE. Theweightageof MSEshall be 30% and of ESE shall be 60%.
2. ESE paper setting weightagewill be 25% onsyllabus coveredforMSE (First Three Units)and 75% on remainingsyllabus (LastThree Units).
3. The number of optionalquestions marks in atheory paper shallbe 25 to 30percent of the maximummarks.

UnitNo.	Content	Hours
1	**IntroductiontoRCC**	**07**
	Introduction- Stress strain behavior of concrete and steel, Behavior of RCC, Permissible stresses in steel and concrete, Design philosophies, Various limits states, Characteristics strength and Characteristic load, Load factor, Partial safety factors. Limit state of collapse (flexure): Analysis and Design of Singly Reinforced rectangular sections	
2	**Limitstateofcollapse(flexure)**	**09**
	AnalysisandDesignofDoublyReinforced rectangular sections,Singly reinforced T and L beams.	
3	**Limitstateofcollapse(shearandbond)**	**08**
	Limit state of collapse (shear and bond): Shear failure, Types of Shear reinforcement, Design of Shear reinforcement, Bond-types, Factors affecting bond Resistance, Check for development length. (No Numericals on bond)	
4	**Designofslabs&staircase**	**09**
	Oneway,twowaywithdifferentsupportconditionsasperIS:456,Cantilever slab. And Design of Simply Supported Doglegged staircase.	
5	**DesignofColumns**	**07**
	Analysis and Design of axially loaded column introduction of eccentrically (uniaxial)loadedcircularandrectangularcolumns,IntroductionofInteraction diagram.	
6	**DesignofFootings**	**08**
	Designofisolatedrectangularcolumnfootingwithconstantdepthsubjectedto axial load and moment	

TextBook:

Sr.No.	Title	Author	Publication&Edition
01	FundamentalsofReinforced Concrete.	Sinha and Roy	S.ChandandcompanyLtd.RamNagar, New Delhi.
02	Limitstatetheoryand design of concrete structure	Shah and Karve	Structurespublications
03	ReinforcedConcreteDesign–Limitstate	A.K.Jain	Chandbrothers,Roorkee
04	ReinforcedConcreteDesign	B.C.Punmia,	LaxmipublicationsNew Delhi

ReferenceBook:			
Sr. No.	**Title**	**Author**	**Publication&Edition**
01	DesignofReinforcedConcrete structure	S.Ramamrutham	DhanapatRaiPublications
02	LimitStateDesignof Reinforced Concrete	P.C.Varghese	PrenticeHall,NewDelhi
03	Special publications -16 BureauofIndianstandards		
04	IS456-2000Bureauof Indian standards		

PCC-CE0262: Concrete Technology

Teaching Scheme		Evaluation Scheme	
Lecture (Per week)	**:03**	**MSE**	**:30**
Tutorial (Per week)	**:-**	**ISE**	**:10**
Credit	**:03**	**ESE**	**:60**

Course Pre-requisite	Basic Civil Engineering	
Course Objective	1	To understand process of concrete manufacturing and to study properties of fresh concrete.
	2	To study mix design of concrete by using IS code method and ACI method
	3	To study different Non Destructive Tests (NDT).
	4	To study different types of special concrete and their manufacturing.
Course Outcomes	After Completion of this course students will be able to	
	1	Explain the fundamentals of process of making good quality concrete and its elastic properties.
	2	Understand the fresh and hardened properties of concrete.
	3	Design the concrete mix proportion as per Indian standard code of practice.
	4	Demonstrate Non Destructive Testing (NDT) and evaluate quality of existing concrete.
	5	Understand different types of special concrete and their applications.

CO-PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	2	1	-	-	1	2	1	-	-	-
CO2	3	3	3	1	2	1	2	1	-	-	1
CO3	3	3	3	3	3	2	2	2	2	1	-
CO4	3	2	2	1	1	2	3	1	-	-	-

Marking Scheme

MSE: 30

ISE: 10

ESE: 60

Total: 100

Unit	Content	Hours
1	**Ingredients of Concrete:**	7
	Cement: Manufacturing process of cement, chemical composition, grades of cement, hydration, types of cement, Tests for cement: fineness, Standard consistency, setting time, soundness and compressive strength. **Aggregates**: classification, requirements, Tests for coarse aggregates: specific gravity, grading of aggregate, Flakiness index, Elongation Index, Impact value, abrasion value, crushing value. Tests for fine aggregates: specific gravity, sieve analysis, fineness modulus. Alkali aggregate reaction, bulking of sand, Artificial and Recycled aggregate. **Water**: general requirements, quality of water.	
2	**Fresh Concrete:**	6
	Workability: factors affecting, different tests for measurement of workability. Segregation, bleeding. Manufacturing process of concrete: batching, mixing, transportation, compaction, curing of concrete, curing methods.	
3	**Admixtures in concrete:**	5
	a) Chemical Admixtures: Plasticizers, Super plasticizers, Retarders, Air entraining agents, IS 9103Specifications b) Mineral Admixtures: Fly ash, Silica Fume, GGBS, Rice husk ash, metakaolin	
4	**Concrete Mix Design:**	7
	Objectives of mix design, different methods of mix design, factors affecting mix proportions, quality control of concrete, statistical methods, acceptance criteria, Numerical on mix design by ACI 211.1-1991, IS 10262- 2009andIS 456 -2000. Mix design of fly ash concrete by IS 10262 – 2009.	
5	**Hardened concrete:**	7
	Strength of concrete: w/c ratio, gel/space ratio, gain of strength with age, maturity concept of concrete, effect of maximum size of aggregate on strength. Test on hardened concrete: compressive strength, comparison of compressive strength between cube test and cylinder test, flexural strength. Relation between compressive and tensile strength. Elastic constants, factors affecting modulus of elasticity, definition and factors affecting creep and shrinkage. Nondestructive testing: Schmidt's rebound hammer, Ultrasonic pulse velocity method.	
6	**Special Concretes and Durability of concrete:**	6
	a. Special Concretes: Light weight concrete, Polymer modified concrete, concept of fibre reinforced concrete, High performance concrete, Pumpable concrete, Roller compacted concrete, Self compacting concrete. b. Durability of concrete: Significance, Permeability and Durability, Chemical Attack, Sulphate attack, Attack by Seawater, Acid attack, Chloride attack, Carbonation of concrete and its determination.	

Text Book:			
Sr.No.	**Title**	**Author**	**Edition/Publication**
01	Concrete Technology	Shetty, M.S.	S. Chand Publication.
02	Concrete Technology	Gambhir, M.L.	Tata McGraw Hill.
03	Concrete Technology	Santakumar, A.R.	Oxford University Press.
04	Concrete Mix Design by	A. P. Remideos	Himalaya Publishing House

Reference Book:			
Sr.No.	**Title**	**Author**	**Edition/Publication**
01	Concrete Technology	A. M. Neville, J. J. Brooks,	Pearson Education India
02	Properties of Concrete	A. M. Neville	Pearson Education India
03	Concrete Technology	R.S. Varshney	Oxford and IBH
04	Microstructure and properties of concrete	P. Kumar Mehta	Prentice Hall.SP-26

IS Codes :	
01	IS: 10262-2009, Recommended guidelines for Concrete Mix Design
02	IS: 456-2000, Indian Standard Plain and Reinforced Concrete

Guidelines for Paper Setting:

End Semester Examination

Guidelinesregarding theQuestionPaperSetting:		
Question No.	**Unit No.**	**Marks**
01	1, 2, 3	15
02	4	15
03	5	15
04	6	15

PCC-CE0231: TRANSPORTATIONENGINEERING

Teaching Scheme		**Evaluation Scheme**	
Lecture (Per week)	**:03**	**MSE**	**:30**
Tutorial (Per week)	**:00**	**ISE**	**:10**
Credit	**:03**	**ESE**	**:60**

Course Pre-requisite	EngineeringMechanics, andBasicCivilEngineering.	
Course Objective	1	Understandtheroaddevelopmentprocess.
	2	Recallthecurrentschemesof highwaydevelopmentinIndia.
	3	Understandtherailinfrastructurecomponents.
	4	DescribethecomponentsofAviation Infrastructure.
	5	Discusstheelementsof waterfrontstructures.
	6	Explainthetunnelimportanceforinfrastructure development.
Course Outcomes	After Completion of this course students will be able to	
	1	Understand road development, planning principles, geometric design, sight distance, drainage and highway cross-section elements as per IRC standards.
	2	Apply concepts of traffic flow, traffic analysis, regulation, intersection design and highway capacity for safe and efficient transportation systems..
	3	Explain components of permanent way, track behavior, geometric design, points & crossings and modern railway transport systems.
	4	Understand airport planning, site selection, runway design, airport layout, markings, lighting and passenger facilities.
	5	Explain harbor planning, layout, coastal protection works, dock types and terminal facilities for safe ship operations.
	6	Understand tunnel geometry, tunneling methods, lining, ventilation, drainage and modern tunneling technologies like TBM and trenchless construction.

CO-PO Mapping												
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1			1			2			2		2	
CO2		1			1	3			1			
CO3					1	3	1			1	1	
CO4	3	1	1		1	2			2	1	1	
CO5	2				1	2	1		2			
CO6		1	1			2					2	

Level of Mapping as: Low 1, Moderate 2, High 3

CO	PSO1	PSO2	PSO3
CO1		1	
CO2		1	1
CO3			
CO4	2	1	

Marking Scheme

1. The Theory exam shall be consisting of MSE and ESE. The weightage of MSE shall be 30% and of ESE shall be 60%.
2. ESE paper setting weightage will be 25% on syllabus covered for MSE (First Three Units) and 75% on remaining syllabus (Last Three Units).
3. The number of optional questions marks in a theory paper shall be 25 to 30 percent of the maximum marks.

Unit No.	Content	Hours
1	**IntroductiontoHighway Engineering**	**06**
	Brief History of Road Development in India, Current Road Network Statistics. Objects of Planning, Planning Surveys and their Interpretation. Introduction to, IRC, NHAI, NHDP Phases. Terrainclassification,designspeed,vehicularcharacteristics,highwaycross-sectionelements. Sightdistance:Introductiontosightdistance,reactiontime,analysisofsafesight distance, analysis of overtaking sight distance, intersection sight distance.	
2	**GeometricDesign of Highways**	**07**
	Design of horizontal alignment: Highway alignment & Surveys, horizontal curves, super elevation, radius at horizontal curves, widening of pavements, transition curves. Design of vertical alignment: types of gradients, grade compensation, analysis of vertical curves, Safe system approach. Designof Highway Drainage:Objects,Requirements,ImportanceandTypesof Highway Drainage.	
3	**IntroductiontoTrafficEngineering**	**05**
	Introduction to Traffic Engineering: Definition, objectives and scopeofTraffic Engineering, Traffic Flow, Statistical Analysis of Traffic Data, Traffic Regulation and Control, Types of intersection, Highway capacity	
4	**IntroductiontoRailway Engineering**	**07**
	Elements of permanent way – Rails, Sleepers, Ballast, rail fixtures and fastenings, Track Stress, coning of wheels, creep in rails, defects in rails– Route alignment surveys, conventional and modern methods Geometric design of railways, gradient, super elevation, widening of gauge on curves,	

	Points and Crossings. Electrification of railways, sleeper-less tracks, Modern Transit Rail Transport such as Metro, Hyper loop, Bullet Train etc	
5	**IntroductiontoAirport Engineering** Air transport characteristics, airport classification, airport planning: objectives, components, criteria for airport site selection and typical airport layouts, Runway Design, Orientation, Wind Rose Diagram, Runway length, Passenger Facilities and Services, Runway and Taxiway Markings, Pavement and lighting, recent development in International Airports..	**05**
6	**IntroductiontoDocks,Harbors,andTunnel Engineering:** Definition of Basic Terms, Planning and Design of Harbors, Requirements, Classification, Harbor Layout and Terminal Facilities, Wave action on Coastal Structures and Coastal Protection Works. Dry dock and wet dock differentiation. Introduction,SizeandShapeofTheTunnel,TunnelingMethodsinHardRock&Soft Material, Tunnel Lining, Tunnel Lighting, Drainage and Ventilation, Tunneling usingTunnel Boring Machine, Trenchless Construction Method (TCM).	**05**

General Instructions:

1) For the term work of 10 marks, batch wise tutorials are to be conducted. The number of Students per batch per tutorial should be as per University rules.
2) Number of tutorials should be at least six (All units should be covered).

Text Book :

Sr. No.	Title	Author	Publication & Edition
01	Highway Engineering	SKKhannaandCEGJusto	NemChandBros,Roorkee
02	HighwayEngineering	LRKadiyali	KhannaPublishers,NewDelhi
03	ACourseinRailwayEngineering	SaxenaSubhashCandSatyapalArora	DhanpatRaiand Sons, Delhi.
04	RailwayEngineering,	SatishChandraandAgarwal M.M,	2ndEdition,OxfordUniversity Press,New Delhi.
05	AirportPlanningandDesign	KhannaSK,AroraMGandJainSS,	NemchandandBrothers, Roorkee.

06	Docks&HarborEngineering	BindraS.P	DhanpatRajPublications,NewDelhi

Reference Book :			
Sr. No.	**Title**	**Author**	**Publication & Edition**
01	Principles, Practice and Design of Highway Engineering‖,	S.K. Sharma,	S. Chand Publishing, New Delhi.
02	Principles of Transportation Engineering‖,	ParthaChakraborty and Animesh das,	Prentice Hall
03	Transportation Engineering‖,	Subramanyam. K.P,	Scitech Publications, Chennai.
04	Transportation Engineering, Volume II: Railways, Airports, Docks andHarbours	C Venkatramaiah,	Universities India Publisher.
05	Railways Track Engineering‖,	J.S. Mundrey,	Tata McGraw Hill, Delhi.

PCC CE0264: Program Elective02:- Advanced Design of RC Structures

Teaching Scheme		**Evaluation Scheme**	
Theory (Per week)	**03**	**MSE**	**:30**
Tutorial (Per week)	**-**	**ISE**	**:10**
Credit	**03**	**ESE**	**:60**

Course Pre-requisite	-	
Course Objective	1	To understand the concept and design of large span concrete roofs and deep beam
	2	Toanalyze the stresses in chimney, design of chimney
	3	To understand the design of elevated water tank and its elements and retaining wall
	4	To understand yield line analysis and design of slab.
Course Outcomes	After Completion of this course students will be able to	
	1	Analysis and design of large span concrete roofs anddesign flat slab as per IS 456-2000
	2	Analysis and design deep beams
	3	Analysis of stresses in concrete chimney and design the chimney
	4	Analysis and design overhead water tank with codal provision of 3370-2009

	5	Analysis and design of cantilever and counter fort retaining wall
	6	Describe yield line theory and analyze rectangular and circular slab by yield linetheory

CO-PO Mapping											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	3	3	2	1	-	-	-	1	-	2
CO2	3	3	3	2	1	-	-	-	1	-	2
CO3	3	3	3	2	1	1	-	-	1	-	2
CO4	3	3	3	2	1	2	-	-	1	-	2
CO5	3	3	3	2	1	2	-	-	1	-	2
CO6	3	3	2	2	-	-	-	-	1	-	2
Level of Mapping as: Low 1, Moderate 2, High 3											

Unit No.	Content	Hours
1	Large span concrete roofs with detail ClassificationBehavior of Flat slabs, Direct design and equivalent frame method with Codal provisions	**6**
2	Analysis of deep beams and design as per IS 456-2000	**6**
3	Analysis of stresses in concrete chimneys with un cracked and cracked sections, Codalprovisions, Design of chimney.	**6**
4	Overhead water tanks, rectangular and circular with flat bottom, spherical and conical tank roofs,Staging, Design based on IS 3370 -2009	**6**
5	Analysis and Design of cantilever and counter fort retaining walls with horizontal and inclinedsurcharge.	**6**
6	Yield line analysis of slabs, virtual work and equilibrium method of analysis, simply supportedrectangular slabs with corners held down uniform and concentrated loads, design of simplysupported rectangular and circular slabs	**6**

Text Books:			
Sr. No.	**Title**	**Author**	**Publication & Edition**
01	Reinforced Concrete Structural Elements-	Purushothaman. P	Tata Mc Graw Hill
02	Design and Construction of Concrete Shell	G.S.Ramaswamy	

	Roofs		
03	Reinforced Concrete	Ashok K Jain	Nem Chand Bros. Roorkee
04	Plain and Reinforced Concrete	Jain &Jaikrishna, Vol. I & II	Nem Chand Bros. Roorkee
05	Reinforced Concrete Chimneys	Taylor C Pere	
06	Yield Line Analysis of Slabs	Jones L L, Thomas and Hudson	
07	Reinforced Concrete	Mallick & Gupta	Oxford & IBH
08	IS 456-2000		
09	IS2210-1998- Criteria for design of reinforced concrete shell structures and folded plates		
10	IS 4998-1998- Criteria for design of reinforced concrete chimneys		
11	IS 3370- 2009- Part (1 to 4) Code of Practice for concrete structures for the storage ofliquids		

Reference Book:			
Sr.No.	**Title**	**Author**	**Edition/Publication**

Guidelines regarding question paper setting

END SEMESTER EXAMINATION PAPER PATTERN

Question No.	Based on Unit No.	Marks

CE0264Program Elective 02: -Air Pollution and Control

Teaching Scheme		Evaluation Scheme	
Theory (Per week)	**03**	**MSE**	**:30**
Tutorial (Per week)	**-**	**ISE**	**:10**
Credit	**03**	**ESE**	**:60**

Course Pre-requisite	-	
Course Objective	1	To introduce the fundamentals of air pollution including atmospheric structure, sources, and characteristics of particulate and gaseous pollutants.
	2	To understand the effects of air pollutants on living and non-living systems and the role of meteorological factors in air pollution dispersion.
	3	To familiarize students with air pollution monitoring methods, air quality standards, and regulatory control mechanisms.
	4	To impart knowledge of engineering control techniques for particulate and gaseous pollutants and air pollution management strategies in India.
Course Outcomes	After Completion of this course students will be able to	
	1	Explain the structure of the atmosphere, sources, and characteristics of particulate and gaseous air pollutants.
	2	Analyze the effects of air pollution on human health and the

		environment, considering major air pollution episodes and meteorological influences.
	3	Apply air pollution monitoring techniques, air quality standards, and regulatory frameworks for air quality assessment.
	4	Select and describe suitable control technologies for the removal of particulate and gaseous pollutants and outline air pollution control strategies in India.

CO-PO Mapping											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	2	-	-	-	3	1	-	1	-	2
CO2	3	3	-	1	-	3	1	-	1	-	2
CO3	3	2	2	2	2	3	1	-	1	-	2
CO4	3	2	3	2	1	3	1	-	1	-	2
Level of Mapping as: Low 1, Moderate 2, High 3											

Unit No.	Content	Hours
1	**Unit: 1** The structure of the atmosphere, Definition and Scope of Air Pollution, Sources of airpollution: Natural and artificial, quantity and composition of particulate & gaseous pollutant,Unit of measurements.	8
2	**Unit-2** Effect of different air pollutants on living and non-living things. Preventive measures toovercome bad effects. Various air pollution Episodes.	4
3	**Unit- 3** The meteorology and air pollution: Different Meteorological factors &thereeffects, lapse rate and stability of atmosphere, inversion phenomenon, various meteorological factors likeprecipitation, humidity, temperature. wind patterns, direction, velocity and fluctuations,models of diffusion and dispersion plume behaviour.	8
4	**Unit: 4** Introduction to application of software for air quality. Air pollution monitoring andregulatory control, Ambient Air quality standards, emission limits, ambient air & stacksampling, equipment for ambient airand stack sampling, methods of sampling, pollutionmonitoring of existing sources and new installations.	6
5	**Unit: 5** Control of pollutant emission at source, alternative fuels, process	6

	change,removal methodsfor particulate, principles of particulate removals, various types of particulate controlequipment, settling chamber, cycloneseparatorsand scrubbers, fabric filters, electrostaticprecipitators.	
6	**Unit: 6** a) Principles of removal of gaseous pollutants. Vehicular pollution, composition, quantity &control. b) Status of air pollution in India, air pollution control act and strategy foreffective control of air pollution.	6

Text Books:			
Sr. No.	**Title**	**Author**	**Publication & Edition**
01	Environmental Engineering	Peavy & Rowe	
02	Air Pollution	Wark and Warner	
03	Air Pollution and Control	Martin Crawford	Tata McGraw Hill Publication, 1st Edition,1976.

Reference Book:			
Sr.No.	**Title**	**Author**	**Edition/Publication**
1	Air Pollution	Martin Crawford	
2	Air Pollution and Industry	R.D.Ross	
3	Environmental Pollution Control Engineering,	Rao C.S.	Wiley Eastern Ltd.,New Delhi,1996.
4	Environmental engineering	Peavy & Rowe.	
5	Air Pollution Control	Rao M.N. and Rao H.V.N.	Tata-Mc Graw-Hill, New Delhi, 1996.

Guidelines regarding question paper setting

1.

END SEMESTER EXAMINATION PAPER PATTERN

Question No.	**Based on Unit No.**	**Marks**

CE0264Program Elective02:-Foundation Engineering

Teaching Scheme		**Evaluation Scheme**	
Theory (Per week)	**03**	**MSE**	**:30**
Tutorial (Per week)	**-**	**ISE**	**:10**
Credit	**03**	**ESE**	**:60**

Course Pre-requisite	Geotechnical Engineering	
Course Objective	1	To study different types of soils, foundation and their applications.
	2	To learn the stability analysis of structure using specific foundation system.
	3	To study the analysis of load carrying capacity of foundations.
	4	To enhance the knowledge about structural foundations in weak soils.
	5	To learn dynamic analysis of foundations for industrial machines
	6	To study the types & analysis process for earth & water retaining structures.
Course Outcomes	After Completion of this course students will be able to	
	1	Understand the different types of foundations & their

		necessities.
	2	Select the suitable foundation system based on soil and loading conditions.
	3	Calculate dimensions and capacity of shallow foundations
	4	Design the foundations for Industrial machines under dynamic loadings.
	5	Understand suitable technique for weak soil to enhance the stability of foundations.
	6	Analyse the earth and water retaining structures used for special functions.

CO - PO Mapping											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	2	-	-	-	1	-	-	1	-	2
CO2	3	3	2	-	-	1	-	-	1	-	2
CO3	3	3	2	2	-	-	-	-	1	-	2
CO4	3	3	3	2	1	-	-	-	1	-	2
CO5	3	2	2	2	1	2	-	-	1	-	2
CO6	3	3	2	2	-	2	-	-	1	-	2
Level of Mapping as: Low 1, Moderate 2, High 3											

Unit No.	Content	Hours
1	**Shallow Foundations** 1.1 Types & shapes of shallow foundation, minimum depth of foundation 1.2 Calculation of bearing capacity of soil by Terzaghi's theory, IS Codemethod &Skempton's approach 1.3 Concept of proportioning of footings (Isolated), calculation of immediateand consolidation settlement, foundation on slopping ground etc. 1.4Different shapes, bending moment diagrams & Dimensional analysis ofrectangular & Trapezoidal combined footings 1.5 RCC design of Isolated box & slopped type footings withreinforcementdetails	6
2	**Raft Foundation** 2.1 Introduction to raft or mat foundation, necessity & types of rafts 2.2 Analysis of bearing capacity and settlements of raft or mat foundation 2.3 Design guidelines for raft foundation, types of raft design, floating foundation & problems associated with floating foundation. 2.4 Analysis of raft or mat foundation by Rigid method (Conventional method)& Elastic plate method (IS Code method) 2.5 Calculation of soil pressure at different points in a raft foundation	6
3	**Pile Foundation**	6

	3.1 Introduction, necessity, advantages and classification of piles 3.2 Calculation of load capacity of single pile by static formulae in cohesive &cohesionless soils and by dynamic formulae, pile load test etc. 3.3 Group action of files, efficiency of group of piles, feld's rule, Seiler-Keeney formula, Converse-Labarre formula etc. 3.4 Concept of negative skin friction and its estimation, settlement in pile foundation, estimation of load on single pile in a group of pile etc. 3.5 Calculation of group capacity of pile in cohesive soil, under reamed pile –its application and installation techniques	
4	**Machine Foundations** 4.1 Introduction to machine foundation, types of machine foundations, termsrelated to dynamic loadings, static and dynamic design criteria etc. 4.2Permissible amplitude of vibrations for different types of machines, calculation of probable amplitude, amplitude ratio & maximumamplitude,criteria for design of machine foundations, 4.3 Design criteria for foundations of reciprocating machines (IS2974-Part-I), design criteria for foundations of impact type machines (IS2974Part-II) 4.4 Vibration Isolation & Its methods, vibration effects on soil etc.	6
5	**Sheet Piles** 5.1 Introduction to sheet piles, types and uses of sheet piles 5.2 Analysis & design of cantilever sheet pile walls in cohesive &cohesionless(granular) soils, 5.3 Anchored bulkhead, free earth support and fixed earth support method 5.4 Introduction to coffer dams, different types of coffer dam, uses ofcofferdams, construction techniques of cofferdams etc	
6	**Foundations in difficult soils and soil stabilization** 6.1 Introduction to difficult or weak soils, foundations in expansive soils,foundations in soft & compressible soils 6.2 Problems associated with foundation installation- ground water loweringand drainage, shoring and underpinning, different methods, damage andvibrations due to constructional operations. 6.3 Introduction to soil stabilization, methods of stabilization & theirapplications - mechanical stabilization, cement stabilization, limestabilization, bituminous stabilization, chemical stabilization &stabilization by grouting	

Text Books:

1. "Foundation Engineering", by P. C. Varghese, Prentice Hall India Learning PrivateLimited

2. "Raft Foundation Design and Analysis with a Practical Approach", by SharatChandra Gupta, New age Publisher 1997

3. “Pile foundation Design & Construction”, by Satyendra Mittal, CBS Publishers &Distributers Pvt. Ltd.

4. “Soil Mechanics and Foundations” by B. C. Punamia& Ashok Kumar Jain, LaxmiPublications

5. “Soil Mechanics and Foundation Engineering”, by Purushotama Raj, Published byPearsonEducation India, Ltd.

6. “Foundation Engineering”, by B. J. Kasmalkar, Pune VidyarthiGrihaPrakashan

7. “Handbook of Machine foundations”, by Srinivasulu P, Vaidyanathan C.V

8. “Foundation Design Manual for Practicing Engineer”, by Narayan Nayak, DhanapatRai Publications Pvt. Ltd.

9. “Soil Mechanics & Foundation Engineering”, by S. K. Gerg, Khana Publishers

10. “Foundation Design”, by W. C. Teng, Prentice Hall of India Pvt. Ltd., New Delhi

11. “Foundations for Industrial Machines – Handbook for practicing Engineers”, Dr. K.G. Bhatia, D-CAD Publications

Reference books:

1. “Foundation Engineering Handbook- I”, Van Nostrand Reinhold Company, 1975 byWinterkorn H.F. and Fang H. Y

2. “Principles of Foundation Engineering”, by Braja. M. Das, Cengage India PrivateLimited

3. “Foundation Analysis & Design”, by Joseph Bowles, McGraw-Hill Education; 5thedition March 2001

4. “Foundation Design “, by W. C. Teng, Prentice Hall of India PVT. LTD, New Delhi

5. “Foundation Design”, by N. S. V. Kamesware Rao, John Wiley & Sons Inc.

6. “Advance Foundation Engineering”, by T. G. Sitharam, CRC Press, 1st Edition 2019

7. “Design Applications of Raft Foundations”, by J. A. Hemsley, Published on 2000 byThomas Telford

8. “Soil Mechanics & Foundation Engineering”, by V. N. S. Murthy, CBS Publishers &Distributors.

Guidelines regarding question paper setting

1.

END SEMESTER EXAMINATION PAPER PATTERN

Question No.	Based on Unit No.	Marks

CE0264Program Elective 02: Airport Engineering

Teaching Scheme		Evaluation Scheme	
Theory (Per week)	**03**	**MSE**	**:30**
Tutorial (Per week)	**-**	**ISE**	**:10**
Credit	**03**	**ESE**	**:60**

Course Pre-requisite	-	
Course Objective	1	To understand the fundamentals of Airport Engineering
	2	To determine the runway orientation, design of runway and airport facilities
	3	To plan geometric design, and construction of various facilities of the Airport
	4	To know the operational management of the various facilities of the Airport.
Course Outcomes	After Completion of this course students will be able to	
	1	Explain Airport Engineering in the Context of Regional Mass Transportation Systems
	2	Apply design principles of planning to Airport

		Infrastructure
	3	Evaluate Parking Configurations and Apron Facilities.
	4	Design Runways, Taxiways, Aprons, and Cargo Facilities.

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	2	-	-	-	3	1	-	1	-	2
CO2	3	3	2	1	1	2	-	-	1	-	2
CO3	2	2	2	1	-	2	-	-	1	-	2
CO4	3	3	3	2	1	2	-	-	1	-	2
Level of Mapping as: Low 1, Moderate 2, High 3											

Unit No.	Content	Hours
1	History of Air transportation, policy of air transportation, air transport activities. Airport Engineering- Aircraft characteristics and their influence on airportplanning.	6
2	Airportplanning: topographical and geographicalfeatures, air trafficcharacteristics, and development of newairports,factors affecting airport site selection Airport obstruction: Zoning laws,classificationofobstruction, imaginary surfaces, approachzones, turning zones.	6
3	Runway orientation, wind rose diagrams, and basicrunway length. Correction ofrunway length, airport classification,geometric design, airport capacity, run way configuration, taxiwaydesign, geometric standards	6
4	Exit taxiways, holding aprons, location of terminal buildings, aircraft hangers and parking. Airportmarking and lighting: marking and lighting of runways, taxiways and approach areas.	6
5	Terminal area, planning of terminal building, Apron: size of the gateposition, number of gateposition, aircraft parking system; Hanger:general planning considerations, blast considerations.	6
6	Airtraffic control: Air traffic control aids, Enroute aids, landing aids. Airport Drainage: requirement of airport drainage, design data,surface drainage design, subsurfacedrainage design.	6

Text Books:

1. Airport Engineering by G.V. Rao. Rao, Tata McGraw Hill

2. Airport Planning & Design, by Khanna and Arora, Nemchand Bros, Roorkee

Reference books:

1. Airport Planning & Design by Khanna &Arrora.

Guidelines regarding question paper setting

1.

END SEMESTER EXAMINATION PAPER PATTERN

Question No.	Based on Unit No.	Marks

CE0265 Program Elective 03: Design of Bridges

Teaching Scheme		Evaluation Scheme	
Theory (Per week)	**03**	**MSE**	**:30**
Tutorial (Per week)	**-**	**ISE**	**:10**
Credit	**03**	**ESE**	**:60**

Course Pre-requisite	-	
Course Objective	1	To understand the types of bridges and its suitability.
	2	To understand the design concept of bridges i.e. Superstructure and substructure.
Course Outcomes	After Completion of this course students will be able to	
	1	Classify the types of bridges and its components.
	2	Assess the different kinds of loading on the bridge.
	3	Design the different types bridges.
	4	Analyze the substructures of the bridges.

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11

CO1	3	2	-	-	-	1	-	-	-	-	-
CO2	3	3	-	2	-	-	-	-	-	-	-
CO3	3	3	3	-	2	1	2	-	-	-	2
CO4	3	3	2	2	2	-	-	-	-	-	-
Level of Mapping as: Low 1, Moderate 2, High 3											

Unit No.	Content	Hours
1	**Unit No. 1** Introduction & Brief History of bridges, Classification, Importance of bridges, Components ofbridges: Substructure-superstructure, Investigation for Bridges.	6
2	**Unit No. 2** Standard specification for Road Bridges. I.R.C. bridge code, width of carriage way, clearances,loads to be considered i.e. D.L., L.L., Impactload, wind load, Earthquake load, Longitudinal force,Centrifugalforce,buoyancy, Earth pressure, water current force, thermal force etc.	4
3	**Unit No. 3** General design considerations. For R.C.C. & P.S.C. bridges. Traffic aspects for highway bridges.Aesthetics of bridge design, Relative costsof bridge components. Design of reinforced concrete,deckslab,Pigeaud's theory, beam and slab and T – beam, Courbon's theory.	8
4	**Unit No. 4** Construction Techniques – Construction of sub structure footing, piles, cassions, construction ofreinforced earth retaining wall and reinforcedearth abutments, super structure – erection method forbridgedeckconstruction by cantilever method, Repair, Strengthening, andRehabilitationofExisting Bridges.	6
5	**Unit No. 5** Design of sub structure–Abutments, Piers, Approach slab. (Numerical on Abutments, Pier)	6
6	**Unit No. 6** Different types of bridge Bearing and expansion joints , forces on bearings, Types of bearings,design of unreinforced elastomeric bearings,expansion joints. (Numerical on Bearings)	6

Text Books:

1. Design of Bridge Structures, -T.RJagadeesh and M.A.Jayaram, PHI Publications.

2. Bridge Enginnering – Rangwala, Charotar Publications.

3. Principles and practice of Bridge Engineering, S.P. Bindra ,Dhanapat Rai Publications.

Reference Books

1. Reinforced Concrete Structures – Vol. II by Dr. B. C. Punmia, Ashok Kumar Jain, ArunKumar Jain, Laxmi Publications.

2. Concrete Bridge Practice, Analysis, Design and Economics by Dr. V. K. RAINA, TataMcGraw- Hills Publishing Company Limited.

3. Bridge Engineering by S. Ponnuswamy, Tata McGraw-Hills Publishing Company Limited.

4. Design of Bridges by N. Krishna Raju, Oxford & IBH Publishing Co. Pvt. Ltd., New Delhi.

5. IRC Codes – IRC: 5, IRC: 6, IRC: 18, IRC: 27, IRC: 45, IRC: 78, IRC: 83.

Guidelines regarding question paper setting

1.

END SEMESTER EXAMINATION PAPER PATTERN

Question No.	Based on Unit No.	Marks

Program Elective-III:-Open Channel Hydraulics

Teaching Scheme		Evaluation Scheme	
Theory (Per week)	**03**	**MSE**	**:30**
Tutorial (Per week)	**-**	**ISE**	**:10**
Credit	**03**	**ESE**	**:60**

Course Pre-requisite	-	
Course Objective	1	To Study the fundamental principles governing openchannel hydraulics required to the design ofengineering systems
	2	To studyvarious types of open channel flow and their analysis
	3	To study and understand the techniques,skillsand modern mathematical tools to applied to the river engineering problems
Course Outcomes	After Completion of this course students will be able to	
	1	Apply knowledge of open channel flow for designing

		most efficient channel section andcomputations of flow parameters
	2	Analyze the Gradually varied, rapidly varied and spatially varied flow and apply tocomplex field problems
	3	Design erodible channels by applying the knowledge of sediment transportation.
	4	Collect, analyse the data and apply similitude to river models

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	3	3	-	2	-	2	-	-	-	-
CO2	3	3	2	3	2	-	2	-	-	-	-
CO3	3	3	3	-	2	1	3	-	-	-	1
CO4	2	3	-	3	3	-	-	-	2	2	-
Level of Mapping as: Low 1, Moderate 2, High 3											

Unit No.	Content	Hours
1	**Unit : 1** Basic Fluid Flow Concepts: Basic equations (Continuity, Energy,Momentum) applied to OCF,Energy and Momentum correction factors,First and Second hydraulic exponent, Uniform flowcomputations by using section factor curve ,Determination of Rugosity coefficient 'n',Flowinchannel transitions, Measurement of velocity of channel flow and sediment concentration in the flowby various methods. River Gauging by different methods.	6
2	**Unit : 2** Non-Uniform Flow in Open Channel: Computation of GVF in prismaticchannels and Naturalchannels by different methods, Hydraulic jump inrectangular and nonrectangular channels, Locationof Jump, Jumponslopingfloor , Use of jump as Energy Dissipater (recommended byUSBR and IS),Spatially-Varied Flow, Side weir, Bottom racks	6
3	**Unit : 3** Flow in Non-linear alignment and Nonprismatic Channels: Nature ofFlow, Spiral Flow, EnergyLoss, Superelevation, Cross Waves, DesignConsiderations for Subcritical and Supercriticalflow, Standing waveflume, Venturi flume, Flow between bridge piers, Flow through culvert,Flowthrough Trash Racks.	6
4	**Unit : 4** Unsteady Flow in Open Channels: Gradually Varied Unsteady Flow, Flood routing, RapidlyVaried Flow, Waves and their classification,Celerity of a wave, Positive and negative Surges, SDam-break problem, Introduction to HEC RAS software	6
5	**Unit : 5** a) Dispersion in Open Channels: Diffusion and dispersion, Some	6

	classical solutions of thediffusion equation, Discharge measurement using tracer techniques b) Hydraulics of Mobile Bed Channels: Initiation of motion of sediment, Bed forms, SedimentLoad, design of Erodible Channels, Regime Theory for Alluvial Channels	
6	**Unit : 6** Hydraulic Models: Fixed bed river models (Distorted and Undistorted), Moveable bed Models,Model materials and construction, Physicalmodel calibration and verification, Special-Purposemodels	6

Reference Books

1 Open Channel Hydraulics: By, Richard H. French, McGraw-Hill International Student Edition

2 Flow Through Open Channels: By, K. G. RangaRaju, Tata McGraw Hill Publsh. Co. Ltd.

3 Flow in Open Channels: By, K. Subramanyam, Tata McGraw Hill Publsh. Co. Ltd.

4 Open-Channel Flow: By, M. Hanif Chaudhary, Prentice-Hall International Publications

5 Mays, L. W., Water Resources Engineering, John Wiley and Sons, New York, 2001.

6 Rajesh Srivastava., Flow Through Open Channels, Oxford University Press, 2008.

7 Open Channel Flow by Madan Mohan Das.

8 Open Channel Hydraulics: By, VenTe Chow, McGraw-Hill International Editions

Guidelines regarding question paper setting

1.

END SEMESTER EXAMINATION PAPER PATTERN

Question No.	Based on Unit No.	Marks

CE0265 Program Elective03:-Smart City, Green Building

Teaching Scheme		**Evaluation Scheme**	
Theory (Per week)	**03**	**MSE**	**:30**
Tutorial (Per week)	**-**	**ISE**	**:10**
Credit	**03**	**ESE**	**:60**

Course Pre-requisite	-	
Course Objective	1	To understand the definition, concept & objectives of the green building and to imbibe basics of green design.
	2	To understand planning specifications of green building.
	3	To understand the definition, concept & objectives of the smart city.
	4	To understand the policies of smart city.
Course Outcomes	After Completion of this course students will be able to	
	1	Demonstrate green concept skills and apply tools of green

		building assessment.
	2	Select appropriate green building material and technique.
	3	Acquaint knowledge on smart cities planning and development.
	4	Develop work break down structure, scheduling and project management of smart cities.

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	2	2	-	3	2	3	-	-	-	-
CO2	3	2	3	-	2	2	3	-	-	-	-
CO3	2	2	2	-	-	3	2	-	-	-	-
CO4	2	2	3	-	2	2	2	-	2	2	3
Level of Mapping as: Low 1, Moderate 2, High 3											

Unit No.	Content	Hours
1	**Unit 1: Concept of Green Buildings** a) Definition of Green Buildings, typical features of green buildings, Necessity, Initiatives,Green buildings in India, Green buildingAssessment- Green Building Rating Systems(BREEAM, USGBC,LEED, IGBC, TERI-GRIHA, GREEN STAR), Criteria for rating,Energy efficient criteria, environmental benefits economic benefits,health and socialbenefits, Major energy efficiency areas for building,Life cycle cost of buildings, Codesand Certification Program b) Green Design: Definition, Principles of sustainable development in Building Design,Characteristics of Sustainable Buildings, sustainably managed Materials, IntegratedLifecycle design of Materials and Structures (Concepts only)	6
2	**UNIT 2: Green Building Materials,** Green Building Materials: Sustainably managed Materials, depleting natural resources of building materials; renewable and recyclable resources; energy efficient materials; Embodied Energy of Materials, Green cement, Biodegradable materials, Smart materials, Manufactured Materials, Volatile Organic Compounds (VOC's), Natural Non-Petroleum Based Materials, Recycled materials, Renewable and Indigenous Building Materials, Engineering evaluation of these materials.	6
3	**UNIT 3: Green Building Planning and Specifications** Green Building Planning and Specifications: Environment friendly and cost-effective Building Technologies, Integrated Life cycle design of Materials and Structures, Green Strategies for Building Systems, Alternative Construction Methods, Energy Conservation Measures in Buildings, Waste & Water management and Recycling in Sustainable Facilities, Heating, Ventilation and Air Conditioning, Passive Solar & Daylight, Plumbing and its Effect on Energy Consumption.	6
4	**UNIT 4: Introduction to Smart cities** a) Introduction of Smart City, Concept of smart city, Objective for smart cities, History of ASmart city world and India. Need to develop smart city. Introduction to city planning, Concept, principle	6

	stakeholders, key trends in smart cities developments. b) Intelligent transport systems: Smart vehicles and fuels, GIS, GPS, Navigation system, traffic safety management, mobility services, E-ticketing	
5	**UNIT 5: Project management and Policies in Smart Cities** a) Project management: Phases, Stages of project and work break down Structure, Project organization structure, Planning, Scheduling and CPM,Project cost analysis, resource allocation &leveling, Line of balancingtechnique, Project monitoring and control, Project risk management.Storage and conveyance system of water, sustainable water and	6
6	**UNIT 6: Policies in Smart Cities** Sanitation, sewerage system, flood management, conservation system. Policy for Smart City: Integrated infrastructure management systems forsmart city, Infrastructure management system applications for existingsmart city. Worldwide policies for smart city Government of India policyfor smart city, Mission statement & guidelines, Smart cities in India, Case studies of smart city.	6

Text Books:

1. Alternative Building Materials and Technologies - By K S Jagadeesh, B V Venkata Rama Reddy & K S Nanjunda Rao - New Age International Publishers

2. Integrated Life Cycle Design of Structures - By AskoSarja - SPON Press

3. Green Buildings (McGraw hill publication): by Gevorkian

4. Smart City on Future Life - Scientific Planning and Construction by Xianyi Li

5. The Age of Intelligent Cities: Smart Environments and Innovation-for-all Strategies (Regions and Cities) by Nicos Komninos

6. Mission statement &guidelines on Smart City Scheme". Government of India - Ministry of Urban Development

List of free reference guides/resources available on the net:

1. http://smartcities.gov.in/upload/uploadfiles/files/Smart City Guidelines

2. IGBC reference guide

3. Free abridged versions of LEED reference guides.

Guidelines regarding question paper setting

1.

END SEMESTER EXAMINATION PAPER PATTERN

Question No.	Based on Unit No.	Marks

CE0265 Program Elective03 :-Traffic Engineering

Teaching Scheme		Evaluation Scheme	
Theory (Per week)	**03**	**MSE**	**:30**
Tutorial (Per week)	**-**	**ISE**	**:10**
Credit	**03**	**ESE**	**:60**

Course Pre-requisite	-	
Course Objective	1	Provide an insight on traffic and its components, factors affecting road traffic.
	2	Provide an insight on traffic movements and speed studies.
	3	Provides clear understanding on conducting varioustypes of traffic surveys, data collection,analysis, inference and presentation.
	4	To identify the role of various modes of MassTransportation like Bus and Rail and itsPlanning and Management
	5	Learn the objectives, benefits in ITS and functional areas in

		ITS.
Course Outcomes	After Completion of this course students will be able to	
	1	Acquire and apply knowledge of traffic, its components, factors affecting road traffic.
	2	Analyse traffic speed study data and its presentation.
	3	Apply the knowledge of sampling data in conducting various surveys and analysis
	4	Understand various modes of mass transit system.
	5	Use the advantages of ITS and suggest the appropriate technologies for field conditions

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	2	-	-	-	2	-	-		-	-
CO2	2	3	-	2	-	-	-	-	2	-	-
CO3	2	3	-	3	2	-	-	2	2	-	-
CO4	2	2	2	-	-	3	-	-	-	-	-
CO5	2	2	2	-	3	2	-	-	-	-	-
Level of Mapping as: Low 1, Moderate 2, High 3											

Unit No.	**Content**	**Hours**
1	**Unit: 1** Introduction: Infrastructure &its role in developing society; Transport sector in India – policyframework; Development plans – Airports,Highways –National highway development program(NHDP); JNNURM, Asian highways network(AH).	5
2	**Unit: 2** Traffic characteristics: Traffic characteristics – Road user characteristics, General humancharacteristics, Physical characteristics. Vision eye –movement peripheral vision, Visualattention, Visual sensitivity to lightandcolour, glare vision and recovery perception of space.Hearing,Stability sensation, Time factor in response, Theory of PIEV modifyingfactors,conditional responses; Vehicular Characteristics – types,dimensions, resistance, powerrequirement for different resistance,change in direction – minimum turning radius, off tracking,slip angle.	6
3	**Unit: 3** a) Traffic Engineering & Speed Analysis: Introduction, Speed studies,journey time and delaystudies, Sampling in traffic studies &application,Traffic surveys-types of volume countPlanning, Problems on PCU, moving observer method and spot speed. b) Traffic operation and management.Traffic systems management andTravel demand management - Congestion management-Costeffectivemanagement measures, Traffic control aids, Street furniture, RoadArboriculture–Traffic Regulation, Traffic Sign and Road Markings.	7
4	**Unit: 4**	5

	Trip generation and distribution: Factors governing trip generation and attraction –Applicationof Regression Analysis- Methods of tripdistribution; Growth and Synthetic Models Calibrationand Application of gravity model.- Category analysis.	
5	**Unit: 5** a) Introduction to intelligent transportation systems (ITS) – Definition, Objectives, HistoricalBackground, Benefits of ITS -ITS Data collectiontechniques –Detectors, Automatic vehiclelocation (AVL), AutomaticVehicle Identification (AVI), Geographic Information Systems (GIS),Video data collection. b) ITS functional areas – Advanced traffic management systems(ATMS), Advanced travellerinformation Systems (ATIS), Commercialvehicle operations (CVO), Advanced vehicle controlsystems (AVCS),Advanced Public transportation systems (APTS), Advanced ruraltransportation systems (ARTS).	7
6	**Unit: 6** Specialized traffic studies:Parking Studies: Parking inventory, statistics,parking surveys; in out, license palate, on-streetand off-street parking.AccidentStudies:Accident data collection, statistics, safety audit, safetymeasures. Fuel consumption and emission studies: Consumption models,pollutants, air quality models,mitigation measures. Tolloperation:Design and configuration, queuing theory, operation andmaintenance issues.	6

Text books:

1. Kadiyali L.R. and N.B. Lal (2004): Principles and Practice of HighwayEngineeringIncluding Expressways and Airport Engineering), Khanna Publishers, New Delhi.

2. Kadiyali L.R. (1994): Traffic Engineering and Transport Planning, Khanna Publishers, NewDelhi.

3. ParthaChakroborty and Animesh Das (2003): Principles of Transportation Engineering,Prentice-Hall India, New Delhi.

Reference Books

1. Black John (1981): Urban Transportation Planning. Croom Helm Ltd. London.

2. BPR (1970): Urban Transportation Planning: General Information and Introduction to System

360. Bureau of Public Roads, Washington D.C.

3. Bruton M.J. (1975): Introduction to Transportation Planning. II Edn. Hutchinson, London

4. Drew D.R. (1968): Traffic Flow Theory and Control, McGraw-Hill, New York.

5. Hutchinson B.G. (1974): Principles of Urban Transport Systems Planning. McGraw-Hill BookCo., New York.

6. McShane W.R. and Roess R.P. (1990): Traffic Engineering, Prentice-Hall Inc., New Jersey

7. Pignataro L.J. (1973): Traffic Engineering: Theory and Practice, PrenticeHall Inc., NewJersey.

8. Putman S.H. (1983): Integrated Urban Models. Pion Ltd., London.

9. Wilson A.G. (1970): Entropy in Urban and Regional Modelling. Pion Ltd., London 10.WellsG.R. (1970): Traffic Engineering – An Introduction, Griffins, London.

11. Wohl M. and Martin B.V. (974): Traffic System Analysis of Engineers and Planners,McGraw-Hill Book Co., New York.

12. Papacostas, C.A., Fundamentals of Transportation Engineering', Prentice-Hall of IndiaPrivate Limited, New Delhi.2000.

13. Road Development Plan, Indian Road Congress, November 2000.

14.Roess, RP.,McShane,WR.andPrassas,ES.(1998), Traffic Engineering,Prentice Hall

15. www.nhai.org

Guidelines regarding question paper setting

1.

END SEMESTER EXAMINATION PAPER PATTERN

Question No.	Based on Unit No.	Marks

PCC-CE0266: Multi Disciplinary Minor- 04 (Concrete Technology)

Teaching Scheme		Evaluation Scheme	
Lecture (Per week)	**:02**	**MSE**	**:30**
Tutorial (Per week)	**:-**	**ISE**	**:10**
Credit	**:02**	**ESE**	**:60**

Course Pre-requisite	Basic Civil Engineering	
Course Objective	1	To understand process of concrete manufacturing and to study properties of fresh concrete.
	2	To study mix design of concrete by using IS code method and ACI method
	3	To study different Non Destructive Tests (NDT).
	4	To study different types of special concrete and their manufacturing.
Course Outcomes	After Completion of this course students will be able to	
	1	Explain the fundamentals of process of making good quality concrete and its elastic properties.
	2	Understand the fresh and hardened properties of concrete.
	3	Design the concrete mix proportion as per Indian standard code of practice.
	4	Demonstrate Non Destructive Testing (NDT) and evaluate quality of existing concrete.
	5	Understand different types of special concrete and their applications.

CO-PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	2	1	-	-	1	2	1	-	-	-
CO2	3	3	3	1	2	1	2	1	-	-	1
CO3	3	3	3	3	3	2	2	2	2	1	-
CO4	3	2	2	1	1	2	3	1	-	-	-

Marking Scheme

MSE: 30

ISE: 10

ESE: 60

Total: 100

Unit	Content	Hours
1	**Ingredients of Concrete:**	7
	Cement: Manufacturing process of cement, chemical composition, grades of cement, hydration, types of cement, Tests for cement: fineness, Standard consistency, setting time, soundness and compressive strength. **Aggregates**: classification, requirements, Tests for coarse aggregates: specific gravity, grading of aggregate, Flakiness index, Elongation Index, Impact value, abrasion value, crushing value. Tests for fine aggregates: specific gravity, sieve analysis, fineness modulus. Alkali aggregate reaction, bulking of sand, Artificial and Recycled aggregate. **Water**: general requirements, quality of water.	
2	**Fresh Concrete:**	6
	Workability: factors affecting, different tests for measurement of workability. Segregation, bleeding. Manufacturing process of concrete: batching, mixing, transportation, compaction, curing of concrete, curing methods.	
3	**Admixtures in concrete:**	5
	a) Chemical Admixtures: Plasticizers, Super plasticizers, Retarders, Air entraining agents, IS 9103Specifications b) Mineral Admixtures: Fly ash, Silica Fume, GGBS, Rice husk ash, metakaolin	
4	**Concrete Mix Design:**	7
	Objectives of mix design, different methods of mix design, factors affecting mix proportions, quality control of concrete, statistical methods, acceptance criteria, Numerical on mix design by ACI 211.1-1991, IS 10262- 2009andIS 456 -2000. Mix design of fly ash concrete by IS 10262 – 2009.	
5	**Hardened concrete:**	7
	Strength of concrete: w/c ratio, gel/space ratio, gain of strength with age, maturity concept of concrete, effect of maximum size of aggregate on strength. Test on hardened concrete: compressive strength, comparison of compressive strength between cube test and cylinder test, flexural strength. Relation between compressive and tensile strength. Elastic constants, factors affecting modulus of elasticity, definition and factors affecting creep and shrinkage. Nondestructive testing: Schmidt's rebound hammer, Ultrasonic pulse velocity method.	
6	**Special Concretes and Durability of concrete:**	6
	a. Special Concretes: Light weight concrete, Polymer modified concrete, concept of fibre reinforced concrete, High performance concrete, Pumpable concrete, Roller compacted concrete, Self compacting concrete. b. Durability of concrete: Significance, Permeability and Durability, Chemical Attack, Sulphate attack, Attack by Seawater, Acid attack, Chloride attack, Carbonation of concrete and its determination.	

Text Book:			
Sr.No.	**Title**	**Author**	**Edition/Publication**
01	Concrete Technology	Shetty, M.S.	S. Chand Publication.
02	Concrete Technology	Gambhir, M.L.	Tata McGraw Hill.
03	Concrete Technology	Santakumar, A.R.	Oxford University Press.
04	Concrete Mix Design by	A. P. Remideos	Himalaya Publishing House

Reference Book:			
Sr.No.	**Title**	**Author**	**Edition/Publication**
01	Concrete Technology	A. M. Neville, J. J. Brooks,	Pearson Education India
02	Properties of Concrete	A. M. Neville	Pearson Education India
03	Concrete Technology	R.S. Varshney	Oxford and IBH
04	Microstructure and properties of concrete	P. Kumar Mehta	Prentice Hall.SP-26

IS Codes :	
01	IS: 10262-2009, Recommended guidelines for Concrete Mix Design
02	IS: 456-2000, Indian Standard Plain and Reinforced Concrete

Guidelines for Paper Setting:

End Semester Examination

Guidelinesregarding theQuestionPaperSetting:		
Question No.	**Unit No.**	**Marks**
01	1, 2, 3	15
02	4	15
03	5	15
04	6	15

PCC-CE0267: Concrete Technology Lab

Teaching Scheme		Evaluation Scheme	
Practical (Per week)	**:02**	**MSE**	**:**
Tutorial (Per week)	**:**	**ISE**	**:25**
Credit	**:01**	**ESE**	**:25**

Marking Scheme

Perform At least any 10 experiments from following:

Exp. No.	Experiment Title
01	To determine fineness of cement by Sieve analysis and/or Blaine's air permeability method.
02	To determine the standard consistency of cement using Vicat's apparatus.
03	To determine initial and final setting time of cement.
04	Determination of soundness of cement by Le-Chatelier's apparatus and/or Auto Clave test.
05	To determine the compressive strength of cement.
06	Determination of particle size distribution of fine, coarse and all in aggregate by sieve analysis (grading of aggregate).
07	Determination of specific gravity of fine aggregates.
08	Determination of specific gravity and water absorption of coarse aggregates.
09	To determine flakiness and elongation index of coarse aggregates.

10	To determine workability of fresh concrete by using slump cone.
11	To determine compaction factor for workability of fresh concrete
12	To determine workability of fresh concrete by using Vee Bee Consitometer.
13	Nondestructive test on concrete by: Rebound Hammer Test, Ultrasonic Pulse Velocity Test.
14	Tests for compressive strength of concrete cubes for M20 or M30 (ACI 211.1-91, IS 10262- 2009 and IS 456 2000).

Text Book :

Sr.No.	Title	Author	Edition/Publication
01	Concrete Technology	Shetty, M.S.,	S. Chand Publication.
02	Concrete Technology	Gambhir, M.L.,	Tata McGraw Hill.
03	Concrete Technology	Santakumar, A.R.	Oxford University Press.
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03	Concrete Technology	R.S. Varshney	Oxford and IBH
04	Microstructure and properties of concrete	P. Kumar Mehta	Prentice Hall.SP-26

IS Codes :

01	IS: 10262-2009, Recommended guidelines for Concrete Mix Design
02	IS: 456-2000, Indian Standard Plain and Reinforced Concrete

Structural Design and Drawing-I

Teaching Scheme		Evaluation Scheme	
Lecture (Per week)	**:-**	**MSE**	**:-**
Practical (Per week)	**:04**	**ISE**	**:50**
Credit	**:02**	**ESE**	**:25**

MSE:MidSemesterEvaluation ISE:InSemesterEvaluation ESE:EndSemesterExamination

CoursePre-requisite	-	
CourseObjective		1. Toapplyholisticapproachofplanning,analysis, segmentation & design of RCC building. 2. Tounderstandtheknowledgeofhowtousethecodal provision in I.S.456-2000, S.P.16 for design 3. Tounderstandthereinforcementdetailingofvarious structures as per codal provision S.P.34 4. Togetanexposuretothemethodofanalysis&designusingsoft ware.
CourseOutcomes	AfterCompletionofthiscoursestudentswillbeableto	
		1. Translatetheideasintoworkableplans 2. ClassifytheComponents 3. Designtheunits&hencethestructureasawhole 4. Draftthedetailsforexecution 5. Toreadandunderstandthesupplieddrawingorexecution on site.

Termworkshallconsistofdetaileddesign&drawingofthefollowingR.C.structuresbyLimit State Method.

UnitNo.	Content	Hours
1	Residential two storied building. (Minimum60 sqmt. per floor) Drawingspreparedshallindicateductilitydetailsaspertheprovision in IS:13920. (This Project should be in a group of 4-6 students)	**12**
2	AnyONEfromthefollowing:(IndividualStudentshouldperformthisproject) a) Retainingwall(cantileverorcounterforttype) b) Designoffooting(Raftfoundation/pile foundation)	**12**
3	AnalysisanddesignofRCCframedstructureusingsoftware.	**12**

Note:Atleastonesitevisit to beconductedtoshowtheonsitedetailing

TextBooks:

1. ReinforcedConcreteDesign—*S.UnnikrishnaPillai,DevdasMenon*Edition:3rd Edition
2. DesignofReinforcedConcreteStructures—*N.Subramanian*
3. LimitStateDesignofReinforcedConcrete—*P.C.Verghese*
4. ReinforcedConcreteStructures—LimitStateDesign—*A.K.Jain*Edition:Latest

Reference Books:

1. DetailedReinforcedConcreteDesign—*S.Ramamrutham*
2. DesignofReinforcedConcrete&Detailing—*M.L.Gambhir*
3. DuctileDetailingofReinforcedConcreteStructures(BasedonIS13920)

I.S.Codes:

1. IS456:2000–CodeofPracticeforPlain&ReinforcedConcrete
2. IS875(Part1–4)–Loads(Dead,Live,Wind,Seismic)
3. IS1893–EarthquakeResistantDesign
4. IS13920–DuctileDetailingofRCStructures
5. IS2911–PileFoundations
6. SP16–DesignAidsforReinforcedConcrete

Titleof theCourse:	**HIGHWAYMATERIALSANDTRAFFIC ENGINEERING LABORATORY**	**L**	**T**	**P**	**Credit**
Course Code:	**UCVPC0633**	**-**	**-**	**2**	**1**

CoursePre-Requisite:

ConcreteTechnologyLab,andEngineeringMechanics.

CourseDescription:

Experimentswillhelpstudentsunderstandthe properties ofbituminous materialsandaggregates, and their selection for various pavement designs and performance tests.

CourseLearningObjectives:

1. Makethestudentabletoperformexperimentsasperstandard procedure.
2. Drawinferencefromconductedexperiments.
3. Applythe knowledgein reallife practices.

Course Outcomes:

CO	Afterthecompletionofthecoursethestudent shouldbeable to	Bloom'sCognitive	
		Level	**Descriptor**
CO1	UnderstandbitumenpropertiesthroughIS/IRC-standardteststo assess its suitability for pavements.	2	Understand
CO2	CompareaggregatepropertieswithIRCrecommendations using IS-standard tests to evaluate quality.	3	Apply
CO3	ConductmixdesignandperformancetestingasperIS/IRC standards to evaluate bituminous pavement characteristics	3	Apply

CO-POMapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	2	3								2
CO2	3	2		1							
CO3	3	3	2	3							

CO	PSO1	PSO2	PSO3
CO1		2	
CO2	2	1	
CO3	2	1	2

Assessments:

TeacherAssessment:

- TwocomponentsofCourseEvaluation

Assessment	Marks
ISE	25
ESE (OE)	25

- ISEInternalMarksbased onAssignments,Declaredtest/Quiz/SiteVisitReport,Discussionsetc.
- ESEOE:Assessment isbasedon OE.

Course Contents:

Experiment1: Specific gravityof binder	**2 Hrs**
Experiment2:BitumenPenetration	**2 Hrs**
Experiment3:SofteningPoint	**2 Hrs**
Experiment4:FlashPointandFirePointTest	**2 Hrs**
Experiment5: Ductilitytest	**2 Hrs**
Experiment 6: Viscosityof bitumen	**2 Hrs**
Experiment7: Strippingvalue of aggregate	**2 Hrs**
Experiment8:CBRValueTest	**2 Hrs**
ANYTWO OFTHE FOLLOWING:	
Experiment12:TrafficVolumeStudy	
Experiment13:ParkingStudy	
Experiment14:AccidentStudy	

RecommendedTextbooks:

1.KhannaandJusto, HighwayEngineeringLab manual,Nemchand&Bros.,Roorkee.

2. Khistry, C.J.," Transportation Engineering - AnIntroduction ", Prentice Hall of IndiaLtd., NewDelhi.
3. S.K. Sharma, HighwayEngineering
4. AllrelevantISandIRC codes.
5. MoRTH5thRevision.

ReferencesBooks:

1. PaulH.Wright,—HighwayEngineering‖,7thEditionWILEY
2. Subramanyam.K.P,—TransportationEngineering‖,ScitechPublications,Chennai.
3. AASHTOcodes

UnitwiseMeasurablestudentsLearningOutcomes:

ULO	Afterthecompletionofthecoursethestudent shouldbeable to
ULO1	Determinethe specific gravityof binders.
ULO2	Determinethe consistencyofmaterialand gradethebituminousmaterial.
ULO3	Determinethesofteningpoint.
ULO4	FindFlash andFirepointofbituminousbinder.
ULO5	Examineductilityvalueofbituminousbinder.
ULO6	Identifyviscosityofbituminous binder.
ULO7	Determinestrippingvalueofroadaggregates.
ULO8	DetermineCaliforniaBearingRatioValueofsoilsubgrade.
ULO9	PerformmixdesignofbituminousmaterialusingMarshall Apparatus.
UL10	AssesstheeffectofagingonbituminousbinderusingtheRollingThinFilm Oven Test.
UL11	Evaluatetheskidresistanceofpavementstoensuresafetyandperformance.
UL12	Conductatrafficvolumestudytoanalyzetrafficpatternsandassessroadway capacity.
UL13	Performaparkingstudytoevaluateparkingdemand,supply,andutilizationfor effectivemanagement.
UL14	Analyzeaccidentdatatoidentifypatternsandproposemeasuresforroadsafety improvements.

PCC-CE0269: Industrial Training

Teaching Scheme		Evaluation Scheme	
Lecture (Per week)	**:**	**MSE**	**:**
Practical (Per week)	**:-04**	**ISE**	**:50**
Credit	**:02**	**ESE**	**:**

Course Pre-requisite	Basic Civil Engineering	
Course Objective	1	Expose students to real industrial working environments and professional practices in civil engineering and allied industries.
	2	Bridge the gap between theoretical knowledge and practical application through hands-on experience in industry.
	3	Develop professional skills**,** including communication, teamwork, discipline, and work ethics.
	4	Familiarize students with industrial safety practices, project management, and resource utilization.
		Enhance students' ability to observe, analyze, and document engineering activities performed in the industry.
Course Outcomes	After Completion of this course students will be able to	
	1	Demonstrate awareness of industrial safety practices, time management, and resource utilization in the workplace.
	2	Understand and describe industrial processes, construction practices, and operational procedures used in civil engineering industries.
	3	Apply professional communication, teamwork, and workplace etiquette while interacting with industry professionals.
	4	Prepare a comprehensive industrial training report describing activities performed, observations, and learning outcomes during the internship.

I. RATIONALE

Globalization has prompted organizations to encourage a skilled and innovative workforce. Internships are educational and career development opportunities that provide practical and hands-on experience in a particular field or discipline.

Industrial training provides students an opportunity to become familiar with modern industry practices and apply the knowledge and skills acquired in the classroom to real-world situations. It also enables students to understand the working environment of industries before entering the professional world.

Keeping this in view, **industrial training is incorporated in all diploma programmes** as it helps students develop **practical skills, soft skills, and life skills**, thereby preparing them for professional careers.

II. INDUSTRY / EMPLOYER EXPECTED OUTCOME

The aim of this course is to help the student attain the following **industry-identified competency** through various teaching-learning experiences:

Apply skills and practices to industrial processes.

V. GENERAL GUIDELINES FOR ORGANIZING INDUSTRIAL TRAINING

The industry/organization selected for industrial training/internship may include:

- Government organizations
- Public Limited companies
- Private Limited companies
- Startups
- Centres of Excellence
- Skill Centers / Skill Parks

1. Duration of Training

- **4 Weeks (1 Month)**

2. Period / Time Slot

- Internship shall be conducted **between the 5th and 6th semester**.
- It shall **commence immediately after completion of the 5th semester examinations**.

3. Industry Area

Students may undergo training in:

- Engineering programme allied industries
- Large, medium, or small-scale industries
- Government / Semi-Government sectors

VI. ROLE(S) OF DEPARTMENT AT THE INSTITUTE

The concerned department at the institute shall perform the following activities:

Activity	Timeline
Progressive assessment of industrial training by mentor	Each week during training period
Assessment of training by institutional mentor and industry mentor	During 6th Semester

Suggestions

1.The department may take help from **alumni or parents of students** having contacts in industries for securing placements.
2.Students will normally be placed as per their preferences. In case of higher demand for a particular industry, allocation will be based on students' potential. Preference will be given to students who arrange placement through parents or relatives.
3.**Principal/HOD/Faculty** should brief students about **industrial safety norms, rules, and discipline** before sending them for training.
4.Faculty members should monitor the progress of students during training through **industry visits or online interaction**, reviewing attendance, discipline, and report preparation each week.

VII. ROLES AND RESPONSIBILITIES OF STUDENTS

1.Students may consult their mentor to identify suitable industries for training. If they have contacts through parents or relatives, they may use them to secure placements.
2.Students must submit the **required forms and training letters**, duly signed by institutional authorities, to the industry mentor on the **first day of training**.
3.Students must carry their **Institute Identity Card** during the training period.
4.Students must follow the **industrial dress code**. If no specific protocol is given, **college uniform must be worn compulsorily**.