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S.No.	Subject Code	Category Code	Subject Name	Maximum Marks Allotted					Total Marks	Contact Hours Per Week			Total Credits
				Theory			Practical			L	T	P	
				End. Sem.	Mid Sem. Exam.	Quiz/ Assignment	End Sem.	Lab Work					
1	CE71	PEC	Professional Elective Course-III	70	20	10	-	-	100	3	1	-	4
2	CE72	OEC	Open Elective Course-II	70	20	10	-	-	100	3	1	-	4
3	CE73	PCC	Environmental Engg.-II	70	20	10	30	20	150	3	-	2	4
4	CE74	PCC	Estimation Costing & Tendering	70	20	10	30	20	150	3	-	2	4
5	CE75	PCC	Structural Design and Drawing-III (RCC)	70	20	10	30	20	150	3	-	2	4
6	CE76	MC	Industrial Training Evaluation	-	-	-	60	40	100	-	-	4	2
			Total	**350**	**100**	**50**	**150**	**100**	**750**	**15**	2	**10**	**22**
7	CE77	DLC	Self-Learning Presentation (SWAYAM/NPTEL/MOOC)	-	-	-	-	-	-	-	-	-	8
8	CE78	MC	NSS/NCC/Swatchhata Abhiyan/Rural Outreach	Qualifier									
Additional Course for Honours or Minor Specialization				Permitted to opt for maximum 8 credits against additional MOOC courses in subject code CE77 for the award of Honours (Minor Specialization).									

Note: 01. Departmental BOS will decide list of three/four elective subjects for each PEC and OEC.
02. MOOC/NPTEL subjects shall be taken with permission of HOD/Coordinator
03. Industrial training presentation & viva shall take place in VII Sem. which students have already done in VI Sem.

Professional Elective Course-III		
S.No.	**Subject Code**	**Subject Name**
1	CE71A	Earthquake Resistant Design
2	CE71B	Advanced Foundation Design
3	CE71C	Bridge Engineering

Open Elective Course-II		
S.No.	**Subject Code**	**Subject Name**
1	CE72A	Project Management
2	CE72B	Computational Methods in Structural Engineeirng
3	CE72C	Environmental Impact Assessment

1 hour lecture (L) = 1 credit	1 hour Tutorial (T) = 1 credit	2 hour Practical (P) = 1 credit

PEC: Professional Elective Course, OEC: Open Elective Course, PCC: Professional Core Course, DLC: Distance Learning Course, MC: Mandatory Course

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Subject Code	Subject Name	Maximum Marks Allotted					Total Marks	Hours/Week			Total Credits
		Theory			Practical						
		End Sem	Mid-sem Exam	Quiz/ Assignment	End sem	Lab work		L	T	P	
CE-71A	Earthquake Resistant Design	70	20	10	-	-	100	3	1	-	4

MODULE-I

Engineering seismology : Interior of earth, plate tectonics, faults, fault line, focus, epicentre, epicentral distance, focal depth, basic parameters of earthquake, measurement of earthquakes, instruments used for measuring earthquakes, magnitude & intensity, , various scales of magnitude, various scales of intensity. Evolution of Indian subcontinent.

MODULE-II

Characteristics of ground motion: waves generated by ground motion and their characteristics, body waves, longitudinal waves and transverse waves, surface waves, Rayleigh waves and love wave, attenuation of wave, consequences of earthquake, ground rupture and ground failure, peak ground acceleration, liquefaction, landslides, tsunamis etc. Seismic zones of India.

MODULE-III

Concept of Earthquake Resistant Design: Objectives of seismic design. IS codal provisions for seismic design of structures, Study of IS 4326 and 1893. Factors affecting earthquake loads, Lateral load analysis of building systems, Computation of earthquake loads on simple buildings using Coefficient method and response spectrum method, distribution of base shear.

MODULE-IV

Ductility: Classification of structural system, multi-storied buildings, design criteria design spectrum, capacity design, examples, ductile detailing of RCC structures. Study of IS 13920 Shear walls, lateral stiffness of shear walls, shear wall-frame combination & its examples.

MODULE-V

Seismic Strengthening of Existing Buildings: Cases histories: learning from earthquakes, seismic strengthening procedures. Study the requirements of IS 13935 and 15988.

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References:

1. Engineering Seismology - Bruce A. Bolt
2. Elements of Earthquake Engineering - Jai Krishna, A.R. Chandrasekaran
3. IS: 1893 -2016 (part I) Criterion for Earthquake Resistant Design.
4. IS : 4326 - 2013 Earthquake resistant design and construction of buildings.
5. IS : 13920 -2016 Ductile design and detailing of RC structures.
6. IS : 13935 -2013 Seismic evaluation, repair and strengthening of masonry buildings.
7. IS : 15988 -2013 Seismic evaluation and strengthening of existing Reinforced buildings.
8. Earthquake Resistant Design of structures, Pankaj Agrawal and Manish Srikhande.
9. Earthquake Resistant Design of structures, S.K. Duggal.

Course Outcomes-

After the completion of this course student will be able to-

CO1	Implementation of Earthquake Engineering on engineering concepts which are applied in field Structural Engineering
CO2	The theoretical and practical aspects of earthquake resistant along with the planning and design aspects
CO3	Diverse knowledge of earthquake resistant design practices applied to real life problems

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Subject Code	Subject Name	Maximum Marks Allotted					Total Marks	Hours/Week			Total Credits
		Theory			Practical						
		End Sem	Mid-sem Exam	Quiz/ Assignment	End sem	Lab work		L	T	P	
CE-71B	Advanced Foundation Design	70	20	10	-	-	100	3	1	-	4

MODULE -1

Modern methods of soil investigations, Geophysical methods; soil resistivity methods seismic refraction method, stress below ground due to loads.

MODULE -II

Bearing capacity and settlement analysis of shallow foundations: Meyerhof and Hansen's bearing capacity equations, BIS bearing capacity equation, immediate and consolidation settlements in cohesive soil, De-Beer and schmmertman's methods of settlement prediction in non-cohesive soil.

MODULE -III

Classification of piles, load carrying capacity of single piles in clay, silt and sand by dynamic and static methods, Pile load test, Pile group, Negative skin friction, Settlement of pile group.

MODULE – IV

Foundation on expansive soil, Construction on expansive soil, Alteration of soil condition, under-reamed piles. Elements of well foundation, Shape, Depth of scour, well sinking, Tilt, shift and their prevention.

MODULE -V

Stability of slopes, Limit equilibrium method, Method of slices, Simplified Bishop method, Stability Charts. Soil behavior under dynamic loads,Machine foundation: classification, definitions, design principle in brief, Barken's method.

References:

1. J. E. Bowles – Analysis and Design of Foundation.
2. V. N. S. Murthy – Soil Mechanics and Foundation Engineering.
3. K. R. Arora – Soil Mechanics & Foundation Engineering.
4. Alam Singh – Modern Geotechnical Engineering.
5. GopalRanjan and A. S. R. Rao – Basic and Applied Soil Mechanics
6. B. M. Das – Foundation Engineering, CENGAGE Learning

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Course Outcomes-

After the completion of this course students will able to –

CO1	Investigate the soil properties by modern investigation methods
CO2	Calculate bearing capacity and settlement of shallow and deep foundation
CO3	Determine the slope stability using various methods
CO4	Analyze the properties of expansive soil for foundation construction.

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Subject Code	Subject Name	Maximum Marks Allotted					Total Marks	Hours/Week			Total Credits
		Theory			Practical						
		End Sem	Mid-sem Exam	Quiz/ Assignment	End sem	Lab work		L	T	P	
CE-71C	BRIDGE ENGINEERING	70	20	10	-	-	100	3	1	-	4

MODULE -I

Standard Specifications and Code of practice for general requirements of Road Bridges. Design loads for Bridges, IRC loading Standards, Traction Forces and Temperature Effect. General Design requirements. Economic Span of Bridge. Various Types of Bridges.

MODULE -II

Design of Solid Slab and Girder Slab Bridges, Courbon's Theory and Pigeaud' Theory for design of Girders and Slabs.

MODULE -III

Design of Balanced Cantilever Bridges.Design of Cantilever section, Suspended Span and Articulations.

MODULE -IV

Design of Supporting Structures, Piers and Abutments, Solid and Hollow Piers.Single Cellular and Multi Cellular Piers, Design of Bearings.Introduction of Continuous and Arch Bridges.

MODULE -V

Steel Bridges subjected to Railway Loading, Truss Bridges, Girder Bridges, Design of Rocker and Roller Bearing.

Book & References Recommended :

1. D. Johnson Victor, *Essentials of Bridge Engineering.*
2. Aswani M.G., Vazirani V.N., Ratwani M.M., *Design of Concrete Bridges.*
3. Ratwani M.M., *Steel Structures Vol. III.*
4. Ponnuswamy S., *Bridge Engineering.*

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Course Outcomes-

After the completion of this course students will able to –

CO1	Explain the design procedure of girders and bridges by using various theories
CO2	Calculate various kinds of loads on a bridge
CO3	Design slab, girder, truss and cantilever steel bridges

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Subject Code	Subject Name	Maximum Marks Allotted					Total Marks	Hours/Week			Total Credits
		Theory			Practical						
		End Sem	Mid-sem Exam	Quiz/ Assignment	End sem	Lab work		L	T	P	
CE-72A	Project management	70	20	10	-	-	100	3	1	-	4

MODULE-I
Preliminary and detailed investigation method: Methods of construction, formwork and centering, Schedule of construction, Job layout, Principles of construction management, Modern management techniques like CPM/PERT with network analysis

MODULE-II
Construction Equipments: Factors affecting selection, Investment and operating cost, Output of various equipments, Brief study of equipments required for various jobs i.e. Earthwork, Dredging, Conveyance, Concreting, Hoisting, Pile driving, Compaction and Grouting

MODULE-III
Contracts: Different types of controls, Notice inviting tenders, Contract document, Departmental method of construction, Rate list, Security deposit and Earnest money, Conditions of contract, Arbitration, Administrative approval, Technical sanction

MODULE-IV
Specifications & Public Works Accounts: Importance, Types of specifications, Specifications for various trades of engineering works, Various forms used in construction works, Measurement book, Cash book, Materials at site account, Imprest account, Tools and plants, Various types of running bills, Secured advance, Final bill

MODULE-V
Site Organization & Systems Approach to Planning: Accommodation of site staff, contractor's staff, Various organization charts and manuals, Personnel in construction, Welfare facilities, Labour laws and human relations, Safety engineering, Problem of equipment management, Assignment model, Transportation model and Waiting line modals with their applications, Shovel truck performance with waiting line method

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Reference Books:-

1. Construction Equipment by Peurify
2. CPM by L.S. Srinath
3. Construction Management by S.Seetharaman
4. CPM & PERT by Weist& Levy
5. Construction, Management & Accounts by Harpal Singh
6. Tendering & Contracts by T.A. Talpasai

Course Outcomes-

After the completion of this course students will able to –

CO1	Illustrate formwork, job layout, construction equipments, various types of contracts. various specification of engineering work, assignment models, functional organization
CO2	Analyse a construction project by forming a network/bar chart
CO3	Draft a tender for a constructional project and measurement of a work

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Subject Code	Subject Name	Maximum Marks Allotted					Total Marks	Hours/Week			Total Credits
		Theory			Practical						
		End Sem	Mid-sem Exam	Quiz/ Assignment	End sem	Lab work		L	T	P	
CE-72B	Computational methods in structural engineering	70	20	10	-	-	100	3	1	-	4

MODULE - I

Matrix formulation for the principle of virtual work and energy principles, principle of contragradience, stiffness and flexibility matrices, Degree of Freedom.Axial, bending, shear and torsional deformations.

Local and Global Element stiffness matrices for bar, beam, shaft, grid, shear wall, beam column, beam with rigid ends, beam on elastic foundation and elements with special boundary conditions. Non-prismatic and curved elements, forces and displacements in general coordinate axes, structure stiffness matrix.

MODULE - II

Basics of the Direct Stiffness method - Analysis of pin-jointed frames, rigid jointed structures,plane grids and composite structures for different loads including temperature, shrinkage,prestressing forces. Elastic stability analysis of 2-D rigid jointed frames, (Sway & Non-sway).

MODULE - III

Concepts of Bandwidth, various storage schemes & equation solvers; Reduction in order of stiffness matrix - use of substructures, static condensation method, Exploiting symmetry, skew symmetry and cyclic symmetry in structures, Imposition of Constraints – Lagrange Multiplier and Penalty Methods.

MODULE - IV

Analysis of continuum structures - Fundamental equations of theory of elasticity (2D), basic concepts of Finite Element Analysis, derivation of generalized element stiffness matrix and load vectors, convergence requirements, stiffness matrices for various elements using shape functions, Triangular and Rectangular elements. (PSPS).

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MODULE - V

Two Dimensional Isoparametric elements, shape functions for Simplex.Lagrangian and Serendipity family elements in natural coordinates, computation of stiffness matrix for isoparametric elements, degrading of elements, plate bending elements.

Reference Books:-

1. Ghali A & Neville M., Structural Analysis - A Unified Classical and Matrix Approach, Chapman and Hall, New York.
2. Weaver William & Gere James M., Matrix Analysis of Framed structures, CBS Publishersand Distributors, New Delhi.
3. Cook R.D., Concepts and Applications of Finite Element Analysis, Wiley, New York.
4. Gallagher R., Finite Element Analysis Fundamentals, Prentice-Hall, Englewood Cliffs, NJ.
5. Rubenstein M.F., Matrix Computer Analysis of structures, Prentice Hall, Englewood Cliffs, N.J.
6. Zeinkiewicz O.C & Taylor R.L., The Finite Element Method, McGraw Hill, London

Course Outcomes-

After the completion of this course students will able to –

CO1	Apply matrices method (stiffness and flexibility matrices) for different structural elements
CO2	Examine the structures by stiffness matrices method for different loads including temperature, shrinkage, prestressing forces.
CO3	Modify the matrices in order to increase the efficiency for solving time taking computational problems by various methods
CO4	Analyze the continuum structures and two dimensional Isoperimetric elements using finite element concept

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Subject Code	Subject Name	Maximum Marks Allotted					Total Marks	Hours/Week			Total Credits
		Theory			Practical						
CE-72C	Environmental Impact Assessment	End Sem	Mid-sem Exam	Quiz/ Assignment	End sem	Lab work	100	L	T	P	4
		70	20	10	-	-		3	1	-	

MODULE-I

Concept of EIA: Introduction of EIA, Utility and scope of EIA, Significant Environmental Impacts,Stage of EIA, Environmental Inventory, Environmental Impact Statement (EIS)

MODULE-II

Methods of Impact Identification: Environmental Indices and indicators for describing the affectedenvironment, matrix methodologies, network, checklist, and other method.

MODULE-III

Impact analysis: Framework, statement predication and assessment of impact of air, water, noise andsocio-economic environment.

MODULE-IV

Preparation of written documentation: Initial planning phase, detailed planning phase, writing phase,organizing relevant information, co-ordination of team writing effort.

MODULE-V

Public Participation in Environmental Decision making: Basic definitions, Regulatory requirements, advantages & disadvantages of Public Participation, Selection of Public participation techniques, Practical considerations for implementation.

Reference Books:-

1. A. K. Srivastav, Environment Impact Assessment, APH Publishing
2. John Glasson, RikiTheivel& S. Andrew Chadwick Introduction to ELA" University College London Press Limited
3. Larry W Canter, "Environment Impact Assessment" More Hill Inc., New York.
4. Ministry of Environment & Forests, Govt. of India 2006 EIA Notification
5. Rau GJ and Wooten C. D." EIA Analysis Hand Book" McGraw Hill

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Course Outcomes-

After the completion of this course students will able to –

CO1	Explain the significance of environment impact assessment
CO2	Identify the environmental impact using various methods
CO3	Assess the impact of various environmental agencies and summarize EIA report
CO4	Demonstrate role of public in environmental decision making.

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Subject Code	Subject Name	Maximum Marks Allotted					Total Marks	Hours/Week			Total Credits
		Theory			Practical						
		End Sem	Mid-sem Exam	Quiz/ Assignment	End sem	Lab work		L	T	P	
CE-73	Environmental Engg.-II	70	20	10	30	20	150	3	-	2	4

MODULE-I:
Sewerage schemes and their importance, collection & conveyance of sewage, storm water quantity, fluctuation in sewage flow, flow through sewer, design of sewer, construction & maintenance of sewer, sewer appurtenances, pumps & pumping stations.

MODULE-II:
Characteristics and analysis of waste water cycles of decomposition, physical, chemical & biological parameters. Oxygen demand i.e. BOD & COD, TOC, TOD, ThOD, Relative Stability, population equivalent, instrumentation involved in analysis, natural methods of waste water disposal i.e. by land treatment & by dilution, self-purification capacity of stream, oxygen sag analysis.

MODULE-III:
Unit operations for waste water treatment, preliminary treatment such as screens, grit chamber, floatation tank, sedimentation and chemical clarification, role of micro-organism in biological treatment, Sewage filtration- theory & design.

MODULE-IV:
Methods of Biological Treatment (Theory & Design) - Activated Sludge process, Oxidation ditch, stabilization ponds, aerated lagoon, anaerobic lagoons, septic tank &inhoff tank, sources & treatment of sludge, sludge thickening and digestion sludge drying beds, sludge disposal.

MODULE-V:
Advanced Waste Water treatment - Diatomaceous earth filters, ultrafiltration, Adsorption by activated carbon, Phosphorus removal, Nitrogen removal, Physico-chemical waste water treatment, Solid waste disposal - classification, composition, collection, & disposal methods. Rural sanitation - collection & disposal of refuse, sullage& night soil.

Reference Books :-

l. Water Supply & Sanitary Engg. - G.S. Birdie - DhanpatRai Publishing Company,(P) Ltd. New Delhi
2. Waste Water Engg. by B.C. Punmia - Laxmi Publication (P) Ltd. New Delhi

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3. Environmental Engg. - M.L. Davis & D.A. Cornwell - McGraw Hill Company
4. Chemisfy for Environmental Engg. - Sawyer & Mc Carty - McGraw Hill Book Company New Delhi
5. Water & Waste Water Technology - Mark J Hammer - Prentice - Hall of India, New Delhi
6. Waste Water Engineering - Metcalf & Eddy - McGraw Hill Book Company New Delhi

List of experiments:

1. To study the various standards for waste water.
2. To study the sampling techniques for waste water.
3. To determine the alkalinity in water sample.
4. To determine the acidity in water sample.
5. Determination of Dissolved Oxygen in the water and waste water sample.
6. Determination of Biological Oxygen demand of a waste water sample.
7. Determination of Chemical Oxygen demand of a waste water sample
8. Determination of various types of solids in the waste water sample
9. Determination of bacterial number by membrane filter Technique
10. Determination of bacterial colonies by standard plat count method

Course Outcomes-

After the completion of this course students will able to –

CO1	Apply matrices method (stiffness and flexibility matrices) for different structural elements
CO2	Examine the structures by stiffness matrices method for different loads including temperature, shrinkage, pre stressing forces.
CO3	Modify the matrices in order to increase the efficiency for solving time taking computational problems by various methods
CO4	Analyze the continuum structures and two dimensional isoperimetric elements using finite element concept

After the completion of this lab students will able to –

CO1	Perform common environmental experiments relating to water and wastewater quality, and know which tests are appropriate for given environmental problems.
CO2	Apply the laboratorial results to problem identification, quantification, and basic environmental design and technical solutions.

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Subject Code	Subject Name	Maximum Marks Allotted					Total Marks	Hours/Week			Total Credits
		Theory			Practical						
CE-74	Estimating costing and tendering	End Sem	Mid-sem Exam	Quiz/ Assignment	End sem	Lab work	150	L	T	P	4
		70	20	10	30	20		3	-	2	

MODULE – I

Introduction: Purpose and importance of estimates, principles of estimating. Methods of taking out quantities of items of work. Mode of measurement, measurement sheet and abstract sheet; bill of quantities.Types of estimate, plinth area rate, cubical content rate, preliminary, original, revised and supplementary estimates for different projects.

MODULE-II

Rate Analysis: Task for average artisan, various factors involved in the rate of an item, material and labour requirement for various trades; preparation for rates of important items of work. Current schedule of rates (C.S.R.)

MODULE-III

Detailed Estimates: Preparing detailed estimates of various types of buildings, R.C.C. works, earth work calculations for roads and estimating of culverts Services for building such as water supply, drainage and electrification.

MODULE-IV

Cost of Works: Factors affecting cost of work, overhead charges, Contingencies and work charge establishment, various percentages for different services in building. Preparation of DPR.

MODULE-V

Valuation: Purposes, depreciation, sinking fund, scrap value, year's purchase, gross and net income, dual rate interest, methods of valuation, rent fixation of buildings.

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Reference books:-

1. Chakraborti M "Estimating and Costing" Published by the author 21 B, Bhabananda Road,Calcutta,2002.
2. Dutta B N "Estimating and Costing in Civil Engineering" UBS Publishers' Distributors Ltd., New Delhi, 1999.
3. Birdie G S "Estimating and Costing" Dhanpat Rai & Sons, Delhi,1994.
4. Kohli D. D.,KohliR.C.,'Estimating and Costing",S.Chand&Company,New Delhi,2004
5. Spence Gedder,"Building and Public Works Administration, Estimating and Costing",Newnes Publishers,London,UK,1950.

LIST OF EXPERIMENTS

1. Preparation of detailed estimate.
2. Detailed estimate for services of plumbing and water supply or Electrification work.
3. Detailed estimate for earth work for the road construction or arched culvert.
4. Rate analysis for at least 8 items of construction.
5. Preparation of DPR of Civil Engineering Project.
6. Analysis of rate for brick work
7. Analysis of rate for plaster work
8. Estimate quantity of reinforcement
9. Preparation for approximate estimate for road project
10. Estimating cost of building on plinth area method

Course Outcomes-

After the completion of this course students will able to –

CO1	Illustrate various type of estimate, their purpose and importance.
CO2	Analyse the rates of important item, material and labour requirement for various trades.
CO3	Prepare detailed estimates of construction works such as building, earth work, water supply, etc.
CO4	Evaluate gross income based on depreciation of property, mortgage and lease problems.

After the completion of this lab students will able to –

CO1	Will have a basic knowledge on methods and types of estimation and its merits and demerits
CO2	Have knowledge on specifications and tendering process for contracts
CO3	Will have the ability to understand the types, formation, terms and conditions in contracts and arbitration

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Subject Code	Subject Name	Maximum Marks Allotted					Total Marks	Hours/Week			Total Credits
		Theory			Practical						
		End Sem	Mid-sem Exam	Quiz/ Assignment	End sem	Lab work		L	T	P	
CE-75	Structural Design & Drawing-III (RCC)	70	20	10	30	20	150	3	-	2	4

MODULE-I
Design of Multi-storey Buildings - Sway and non sway buildings, Shear walls and other bracing elements.

MODULE-II
Earth Retaining Structures: Cantilever and counter fort types retaining walls.

MODULE-III
Water Tanks: Tanks on ground and underground tanks: Square, rectangular, circular tanks, Overhead tanks: square, rectangular, circular &intze tanks.

MODULE-IV
Silos and Bunkers

MODULE-V
T-beam & Slab bridges- for highway loading (IRC Loads).Prestressing concepts materials, systems of prestressing& losses Introduction to working & limit State Design.

Reference Books:

1. R.C.C. by O.P. Jain Vol. II
2. R.C.C. by B.C. Punamia
3. Essentials of Bridge engineering . D.J. Victor
4. Bridge Engineering - Ponnuswamy
5. Advanced R.C.C. Desigr by N.K. RAJU
6. N. krishnaRaju, Prestressed Concrete, Tata McGraw Hill, New Delhi.
7. Pre stresses concrete . T.Y. Lin

List of experiments

1 .Design and drawing of multistory building.
2. Design and drawing of cantilever retaining walls.

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Jabalpur - 482011

3. Design and drawing of counter fort retaining wall.
4. Design and drawing of water tanks resting on ground.
5. Design and drawing of underground water tank.
6. Design and drawing of overhead water tanks.
7. Design and drawing of silos.
8. Design and drawing of bunkers.
9. Design and drawing of RCC slab for highway loading
10. Compressive, Split-tensile and Flexural Strength of testing samples.

Course Outcomes-

After the completion of this course students will able to –

CO1	Explain bracing elements, shear wall, sway/non-sway buildings, prestressing systems
CO2	Analyze slab bridges, prestressed concrete beams and slabs
CO3	Design multi storey building, retaining walls, overhead and underground water tank. silos and bunkers.

After the completion of this lab students will able to –

CO1	To develop basic understanding of reinforced concrete as a construction material.
CO2	To develop understanding of various design philosophies and their differences.

DEAN
Academic
JEC, Jabalpur (M.P.)

Head of the Department,
Department of Civil Engineering,
Government Engineering College
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