SYLLABI

M.Tech

IN

CIVIL ENGINEERING
(Structural Engineering)

2016

Department of Civil Engineering

JAYPEE UNIVERSITY OF ENGINEERING & TECHNOLOGY

A-B ROAD, RAGHOGARH, DT. GUNA-473226 MP, INDIA

TEACHING SCHEME

Master of Technology (M. Tech.)

Branch – Structural Engineering

Year/Sem: I[st] Year/I[st] Sem

S.No.	Subject Code	Subject	Core/ Elective	L	T	P	Credits
1	14M11CE111	Advanced Structural Analysis	Core	3	0	0	3
2	14M11CE112	Structural Dynamics	Core	3	0	0	3
3	14M11CE113	Design of Reinforced Concrete Structures	Core	3	0	0	3
4	14M11CE114	Modeling, Simulation and Computer Applications	Core	3	0	0	3
5	14M14MA213	Elective -1	Elective	3	0	0	3
6	14M17CE171	Concrete Structures Laboratory	Core	0	0	4	2
		Total	**Sub Total**				**17**

List of Electives for DE-1			Core/ Elective	L	T	P	Credits
1	14M14MA213	Advanced Numerical Techniques	Elective	3	0	0	3
2	14M14CE231	Stability of Structures	Elective	3	0	0	3
3	14M14CE135	Plastic Analysis of Structures	Elective	3	0	0	3
4	14M14CE336	Hydraulic Structures	Elective	3	0	0	3
5	14M14CE337	Geo-Environmental Engineering	Elective	3	0	0	3

Year/Sem: I[st] Year/IInd Sem

S.No.	Subject Code	Subject	Core/ Elective	L	T	P	Credits
1	14M11CE211	Solid Mechanics in Structural Engineering	Core	3	0	0	3
2	14M11CE212	Design of Steel Structures	Core	3	0	0	3
3	14M11CE213	Earthquake Resistant Design of Structures	Core	3	0	0	3
4	14M11CE214	Theory of Plates and Shells	Core	3	0	0	3
5	14M14CE***	Elective-2	Elective	3	0	0	3
6	14M17CE271	CAD Laboratory	Core	0	0	4	2
		Total	**Sub Total**				**17**

		List of Electives for DE-2	Core/ Elective	L	T	P	Credits
1	14M14CE238	Finite Element Methods	Elective	3	0	0	3
2	14M14CE435	Construction, Economics and Finance	Elective	3	0	0	3
3	14M14CE332	Ground Improvement Engineering	Elective	3	0	0	3
4	14M14CE433	Analysis and Design of Pavement Systems	Elective	3	0	0	3
5	14M14CE334	Soil Structure Interaction	Elective	3	0	0	3

Year/Sem: IInd Year/IIIrd Sem

SN	Subject Code	Subject	Core/ Elective	L	T	P	Credits
1	14M14CE***	Elective-3	Core	3	0	0	3
2	14M14CE***	Elective-4	Core	3	0	0	3
3	14M19CE391	Seminar-I*	Core	0	0	0	2
4	14M19CE392	Dissertation Part-I*	Core	0	0	24	14
		Total	**Sub Total**				**24**

		List of Electives for DE-3	Core/ Elective	L	T	P	Credits
1	14M14CE131	Design of Industrial Structures	Elective	3	0	0	3
2	14M14CE235	Recent Advances In Construction Materials	Elective	3	0	0	3
3	14M14CE133	Pre-Stressed Concrete Design	Elective	3	0	0	3
4	14M14CE134	Composite Materials and Structures	Elective	3	0	0	3
5	14M14CE136	Analysis and Design of Tall Buildings	Elective	3	0	0	3

		List of Electives for DE-4	Core/ Elective	L	T	P	Credits
1	14M14CE236	Repair And Retrofitting of Structures	Elective	3	0	0	3
2	14M14CE237	Construction Methods And Equipments	Elective	3	0	0	3
3	14M14CE434	Quality and Safety Management in Construction	Elective	3	0	0	3
4	14M14CE436	Research Methodology	Elective	3	0	0	3

Year/Sem: IInd Year/IVth Sem

SN	Subject Code	Subject	Core/ Elective	L	T	P	Credits
1	14M14CE***	Elective-5	Core	3	0	0	3
2	14M14CE***	Elective-6	Core	3	0	0	3
3	14M19CE491	Seminar-II	Core	0	0	0	2
4	14M19CE492	Dissertation Part-II**	Core	0	0	24	14
		Total	**Sub Total**				**24**

	List of Electives for DE-5		Core/ Elective	L	T	P	Credits
1	14M14CE137	Advanced Steel Design	Elective	3	0	0	3
2	14M14CE138	Wind Resistant Design of Structures	Elective	3	0	0	3
3	14M14CE232	Cable Stayed and Suspension Bridges	Elective	3	0	0	3
4	14M14CE233	Computer Application in Structural Analysis & Design	Elective	3	0	0	3
5	14M14CE234	Masonry Structures	Elective	3	0	0	3

	List of Electives for DE-6		Core/ Elective	L	T	P	Credits
1	14M14CE331	Design of Substructures	Elective	3	0	0	3
2	14M14CE132	Bridge Engineering	Elective	3	0	0	3
3	14M14CE437	Nanotechnology and Concrete	Elective	3	0	0	3
4	14M14CE333	Soil Dynamics and Machine Foundations	Elective	3	0	0	3

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14M11CE111   Advanced Structural Analysis

Basic concepts, Degree of static and kinematic indeterminacy, Matrix algebra, Solution of simultaneous equations by Gaussian Elimination, Flexibility and Stiffness Matrices, System Approach: Development of stiffness matrix, Applications of stiffness method to continuous beams, trusses and frames. Effect of temperature and pre-strain. Element Approach: Element stiffness, 2D truss element and beam element, Transformation matrix, Assembly of global stiffness matrix, Storage requirement of stiffness matrix i.e. full storage, banded storage and skyline storage, Effect of node and element numbering, Boundary conditions, Application of stiffness method to beams, trusses and frames. Computer Applications, Material and Geometrical Non-Linearity, Application of Virtual Work and Energy Principles.

14M11CE112   Structural Dynamics

Concept of degrees of freedom and constraints, Equations of motion, Newton's Law and De Alembert's Principle, Response of single degree of freedom systems to initial conditions, Response to harmonic excitation, Dynamic amplification factor, Transmissibility, Base Isolation, Response to non harmonic excitations such as impulse, step loading and blast loading, Duhamel's Integral, Earthquake response analysis, Response spectrum, Theory of vibration pick-ups, Estimation of dynamic characteristics through experimental investigations, Multi degree of freedom systems, Orthogonality of mode shapes, Mode superposition method for seismic analysis.

14M11CE113   Design of Reinforced Concrete Structures

Deflections of Reinforced Concrete Beams and Slabs; Estimation of Crack Widths in Reinforced Concrete Beams; Inelastic Analysis of Reinforced Concrete Beams and Frames; Design of Shear Walls, Cast-in-Situ Beam-Column Joints, strong-column weak-beam philosophy; Deep Beams, Chimneys, Ribbed Slabs; Design of Reinforced Concrete Members for Earthquake Resistance, Fire Resistance; Software Applications, Virendeel Girders, Concrete Trusses.

14M11CE114   Modeling, Simulation and Computer Applications

Generalization of Finite Element concept: Mathematical models, numerical models and Physical models. Deterministic and stochastic models. Concepts of simulation: Lagrange multiplier and Penalty function. Non-linear analysis – total and updated Lagrangian formulation. Geometric non-linear analysis, truss, beam, material non-linear analysis, Constitutive model, Plasticity. Dynamic problems and Finite Element analysis. Competitive situations: Optimization, Single and multiple objectives optimizations, Pareto optimal solutions. Introduction to linear and geometric programming. Zero degree and single degree of difficulty. Growth and Decay processes: Discrete and continuous systems. Differential and Integral equation approach, Fibonacci growth. Probability Distributions: Binomial and Poisson distributions, Normal, Lognormal and pareto distributions. Generation of random numbers: Uniform variable, normal and lognormal variables. Queuing theory: Montecarlo methods, solutions of Laplace equations in two dimensions.

Departmental elective-I

14M14MA213   Advance Numerical Techniques

Newton-Raphson Method for two or more variables .Muller's Method, Graeffe's Root-Squaring Method, Lin-Bairstow's Method. Least Square Method, Iterative methods for A x= b, SOR method, Jacobi Method, Householder's Method for eigen values and vectors. Interpolation using Divided Differences, Hermite Interpolation, cubic splines. Orthogonal polynomials, Gra Schmidt orthogonalization process, Chebyshev polynomials, economization of power series, numerical integration, Romberg integration, Newton-Cotes integration formulae, Gaussian Quadrature. Single step- methods, multi step methods, predictor-corrector method for initial value problems. Finite difference methods for elliptic (Laplace equation), parabolic (heat equation) and hyperbolic equations (wave equation). Method of weighted residuals, Rayleigh- Ritz method, finite element method for one dimensional problem.

14M14CE231   Stability of Structures

Criteria for design of structures: stability, strength, and stiffness; Classical concept of stability; Stability of discrete systems: linear and nonlinear behavior; Stability of continuous systems: stability of columns: axial–flexural buckling, lateral bracing of columns, combined axial-flexural-torsion buckling; Stability of frames: member buckling versus global buckling, slenderness ratio of frame members; Stability of beams: lateral-torsion buckling; Stability of plates: axial-flexural buckling, shear flexural buckling, buckling under combined loads; Introduction to inelastic buckling and dynamic stability.

14M14CE135   Plastic Analysis of Structures

Ductility of metals: Concept of plastic design, Overloaded factors, Ultimate load as design coition. Analysis of Indeterminate Structures: Hinge formation in indeterminate structures, Redistribution of moments, Assumption made for structure subjected to bending only. Minimum Weight Design: Concept, assumption, Design of frame with prismatic members, Elements of linear programming and its application to minimum weight design problems. Deflection: Assumption, Calculation of deflection at ultimate loads, Permissible rotations. Secondary Design Considerations: Influence of direct load, shear local bucking, lateral bucking, repeated loading and brittle fracture on moment capacity. Design of eccentrically loaded columns. Problem of incremental Collapse, shake down analysis. Special considerations for design of structures using light gauge metals.

14M14CE336   Hydraulic Structures

Advanced topics in the design and construction of dams: gravity dams, arch and buttress dams and earthen dams. Spillways, stilling basin, Intake works, tunnels and penstocks, gates, surge tanks, power house structures. Energy Dissipation Devices: Use of hydraulic jump in energy dissipation, Factors affecting design, types of energy dissipation and their hydraulic design. Theory of Seepage: Seepage force and exit gradient, salient features of Bligh's Creep theory, Lane's weighted Creep theory and Khosla's theory Determination of uplift. Pressures and floor thickness. Cross Drainage Works: Definitions, choice of type, hydraulic design considerations. Aqueducts their types and design, siphon aqueducts their types and design considerations, super passages, canal siphons and level crossings.

14M14CE337   Geo-environmental Engineering

Sources and effects of subsurface contamination; Physical, Chemical and biological characteristics of solid wastes; Soil-waste interaction; Contaminant transport; Laboratory and field evaluation of permeability; Factors affecting permeability; Waste disposal on land. Types of landfills: Sitting criteria; waste containment principles; Types of barrier materials; Planning and design aspects relating to waste disposal in landfills, in ash ponds and tailing ponds, and in rocks. Environmental monitoring around landfills; Detection, control and remediation of subsurface contamination; Engineering properties and geotechnical reuse of waste, demolition waste dumps; Regulations; Case studies.

14M17CE171   Concrete Structure Laboratory

LIST OF EXPERIMENTS:

Experiment.No.1: Normal consistency & specific surface area of hydraulic cement.

Experiment.No.2: Soundness test & Compressive strength of hydraulic cement.

Experiment.No.3: LOI & percentage of silica & alumina of cement or pozzolona.

Experiment.No.4: Free lime and sodium oxide & potassium oxide test of cement or pozzolona.

Experiment.No.5: Marsh funnel viscosity test and specific gravity test.

Experiment.No.6: Air Permeability test on cement mortar.

Assignment: Concrete Mix Design of required grade as per IS Codes.

Experiment.No.7: Air Entrainment test on freshly prepared concrete

Experiment.No.8: Influence of W/C ratio on workability & strength.

Experiment.No.9: Compressive strength of concrete of normal & accelerated cured concrete.

Experiment.No.10: Non Destructive Testing (NDT) of Concrete.

Experiment.No.11: Bend & re-bend test of steel bars by Universal testing Machine (UTM).

Experiment.No.12: Durability test of concrete by rapid chloride ion permeability test (RCPT).

Year/Sem: Ist Year/IInd Sem

14M11CE211   Solid Mechanics in Structural Engineering

State of stress in a body, Tensor notations, Differential equations of equilibrium, Invariants of the stress tensor, Theory of strain, Displacement components, strain components and relation between them, Generalized Hooke's law, Solution of the elasticity problem in terms of displacements, Basic equations of the theory of elasticity, Lame's equations, Plane problem in Cartesian co-ordinates, Plane problem in polar co-ordinates, Shrink fits, Rotating disks with uniform thickness, Plate with hole, Torsion in prismatic bars, Saint Venant's method, Solution of torsion problem in terms of stresses Strain energy, Elastic plastic behavior, Design philosophy, Linear elastic and plastic behavior, Tresca and Von Mises yield criteria, Visco-elastic behavior.

14M11CE212   Design of Steel Structures

Properties of steel: mechanical properties, hysteresis, ductility; Hot-Rolled Sections: compactness and non-compactness, slenderness, residual stresses; Design of steel structures: inelastic bending – curvature, plastic moments, design criteria - stability , strength, drift; Stability criteria: stability of beams – local buckling of compression flange & web, lateral-torsional buckling, stability of columns - slenderness ratio of columns, local buckling of flanges and web, bracing of column about weak axis, method of design - allowable stress design, plastic design, load and resistance factor design; Strength Criteria: beams – flexure, shear, torsion, columns - moment magnification factor, effective length, P-M interaction, bi-axial bending, joint panel zones; Drift criteria: P-Ä effect, deformation-based design; Connections**:** types – welded, bolted, location – beam column, column-foundation, splices.

14M11CE213   Earthquake Resistant Design of Structures

Behavior of buildings and structures during past earthquakes and lessons learnt goals of earthquake resistant design. Linear static procedure for seismic load calculation – IS 1893 – 2002, combination of gravity and seismic action. Multi-modal and Multi-directional response spectrum analysis. Earthquake resistant measures at planning stage:

Geotechnical and architectural considerations, irregularities, earthquake resistant measures in sloping roofs, staircase, foundations and general construction details IS : 4326 –1993, principals of earthquake resistant design – behavior of concrete and steel, confined concrete, the capacity design method; Study of IS 13920 – 1993, behavior of masonry structures during earthquakes, analysis and behavior of masonry in filled RC frames, earthquake resistant measures in masonry buildings.

14M11CE214   Theory of Plates and Shells

Some results from differential geometry: curves in 3D space – parameterized equation for curves, arc length as a parameter; surfaces - parametric description, curvilinear co-ordinates, first and second fundamental forms, principal curvature co-ordinates, derivatives of unit vectors, equations of Gauss and Codazzi; Membrane theory of shells: equilibrium equations, applications to shells of revolution under axi-symmetric loads, applications to cylindrical shells under asymmetric loads, strain-displacement relations , application in calculation of displacements; Bending theory of shells: kinematic assumptions and strain displacement relations, stress measures and equilibrium equations, constitutive relations, cylindrical shell under axi-symmetric loads, bending of cylindrical shells; Bending theory of flat plates: thin plates, Kirchoff theory - strain displacement relations, stresses and stress resultants, constitutive equations, equilibrium equations, boundary conditions, derivation of theory from principle of virtual work, rectangular plates-solution by double Fourier series, circular plates, edge effects, anisotropic and layered plates, thick plates-Reissner-Mindlin-Naghadi type theories, moderate deflection analysis and buckling of plates.

Departmental elective-II

14M14CE238   Finite Element Methods

Structural stiffness analysis, Introduction, Matrix Algebra and Gaussian Elimination, The structural element, One Dimensional Problems, Trusses, Assembly and analysis of a structure; Transformation of co-ordinates. Finite elements of a column, Element characteristics, Two Dimensional Problems, Plane stress and plane strain, Interpolation Functions, Numerical Integration and Modeling Considerations, Element characteristics, Two Dimensional Iso-parametric Elements, Assessment of accuracy, Some practical applications. Axi-Symmetric stress analysis, some improved elements in two dimensional problems, Beams and Frames, Bending of plates, Techniques for Nonlinear Analysis, Three Dimensional Problems in Stress Analysis, Heat Conduction and Seepage Problems

14M14CE435   Construction, Economics and Finance

Construction accounting, Income statement, Depreciation and amortization, Engineering economics, Time value of money, discounted cash flow, NPV, ROR, Pl, Bases of comparison, Incremental rate of return, Benefit-cost analysis, Replacement analysis, Break even analysis, Risks and uncertainties and management decision in capital budgeting. Taxation and inflation. Work pricing, cost elements of contract, bidding and award, revision due to unforeseen causes, escalation. Turnkey activities, Project appraisal and project yield. Working capital management, financial plan and multiple source of finance. International finance, Budgeting and budgetary control, Performance budgeting, appraisal through financial statements, Practical problems and case studies.

14M14CE332   Ground Improvement Engineering

Need for improvement, Engineering properties of soft, weak and compressible deposits; Principles of treatment-loading (static and dynamic); Compaction, Preloading, dewatering, admixtures, grouting, heat treatment, ground freezing, inclusion, anchorage, micro-piles, stone columns, heavy tamping Electro-kinematic stabilization, Physical and Chemical improvement. Soil reinforcement, principles, geo-synthetics. Vertical drains, Ground anchorage, rock bolting, soil nailing, deep mixing with lime cement. Emerging trends and case studies.

14M14CE333   Analysis and Design of Pavement Systems

Subsystems of Pavement Design; Basis of Pavement Design; Development of various design methods for highway and airport pavements; Pavement support conditions, Properties of components and design tests; Materials of Construction and Construction procedures for different types; Soil Stabilizations methods; Quality control and tolerance; Mathematical models for pavement systems; Landing gears; vehicle pavement interaction; Computer Programming for various pavement analysis and design methods; pavement management process, pavement, evaluation and performance; Design alternatives-Analysis, Evaluation and Selection.

14M14CE334   Soil Structure Interaction

Contact pressure distribution, foundation models, Limit analysis of rafts and foundations; Soil structure interaction studies pertaining to buried structures; Analysis and design of deep foundations; Modern trends in the design of earth retaining structures and case studies.

14M17CE271   CAD Laboratory

List of Experiments:

Experiment.No.1: Spreadsheet for calculating and drawing shear force and bending moment diagrams of determinate beams.

Experiment.No.2: Spreadsheet for designing a singly reinforced beam.

Experiment.No.3: Spreadsheet for designing a doubly reinforced beam.

Experiment.No.4: Primavera – Creating and analyzing a project – Project 1 part 1

Experiment.No.5: Primavera – Creating and analyzing a project – Project 1 part 2

Experiment.No.6: Primavera – Creating and analyzing a project – Project 2 part 1

Experiment.No.7: Primavera – Creating and analyzing a project – Project 2 part 2

Experiment.No.8: STAAD.Pro – Analysis of beams and plane frames

Experiment.No.9: STAAD.Pro – Analysis of Trusses

Experiment.No.10: STAAD.Pro – Analysis of a building for Gravity loads

Experiment.No.11: STAAD.Pro – Analysis of a building for Wind loads

Experiment.No.12: STAAD.Pro – Analysis of building for Earthquake load

Year/Sem: IInd Year/IIIrd Sem
Departmental elective-III

14M14CE131   Design of Industrial Structures

Planning of industrial structures, Design of braced and unbraced industrial portals in steel, Design of gantry girder, Design of single and multi bay industrial sheds in steel and concrete. Design of tie rods, sag rods, girt angles and purlins under action of dead, live and wind loads. Design of chimneys under combination of dead load, wind load and temperature stresses., Design of masts and cooling towers, Design of storage structures like bunkers and silos

using Airy's and Jansen's theories. Design of large span roof structures and suspension roof structures, Machine foundations, Design of foundations for impact and rotary and reciprocating type machines. Analysis and design of Virendeel Girders

14M14CE235   Recent Advances in Construction Materials

Foams and light weight materials, fiber reinforced concrete. Types of fibers, workability, mechanical and physical properties of fiber reinforced concrete, Industrial waste materials in concrete, their influence on physical and mechanical properties and durability of concrete, Concrete at high temperature, High strength concrete, changes in concrete with time, corrosion of concrete in various environments, corrosion of reinforcing steel, electro chemical process, measures of protection, Ferro-cement, materials and properties polymers Civil Engineering Polymers, fibers and composites, fiber reinforced plastic in sandwich panicles, modeling. Architectural use and aesthetics of composites. Adhesives and sealants, structural elastomeric bearings and resilient seating. Moisture barriers, polymer foams and polymers in building Physics, polymer concrete composites.

14M14CE133   Pre-Stressed Concrete Design

Definition, Basic Principles, Types of pre-stressing, Systems of pre-stressing, Loss of pre-stress, materials used, Advantages and disadvantages. Critical load condition, Permissible stresses, Various suggested methods of design, Dimensionless Design variables, Solution of equations, Design Procedure based on flexure, Minimum weight design, Cable layout and profile of tendons, Design by load balancing method, Code provisions. Allowable stress considerations, Non-dimensionalised allowable stress equations and their solution, Shrinkage Stresses. Two span continuous beams and their analysis, Application of moment distribution method, Design of continuous beams, Continuous beams with variable section. One way and two way slabs, Beam and slab construction, Principal Stresses, failure due to shear, combined bending and shear, Bond, Pre-stressing cable at the centroidal axis, Symmetric multiple cable, cable with eccentricity, Inclined cables, Spalling and bursting stresses. Compression members, Tension members, Pre-stressed Concrete Pavements, Folded plates and Shells, Arches, Dams, Rigid frames, Cylindrical tanks.

14M14CE134   Composite Materials and Structures

Definition of Composite Materials, Classification of Composite Materials, Role of matrix in a composite materials, Polymer matrices, Classification of Polymer, Metal Matrices, Ceramic matrices, Comparison of polymer matrix, Metal matrix and ceramic Matrix, Role of fibers in composites, Comparison of fibers, Role of interface in the fiber matrix composite. Characterization of composites, Analysis of an Orthotropic Lamina and laminated Composites, Elastic properties of Unidirectional Laminate, cross ply laminate, Angle ply laminates, Short fiber composite materials, Experimental Characterization of Composites. Composite Structures: need, behavior, idealization and construction. Interaction between composite components. Component method and idealization. Codal specifications for composite structures, case study.

14M14CE136   Analysis and Design of Tall Buildings

Principles of Planning, Technological Planning, Mechanical systems, Fire rating, local consideration, structures elements, types of structural systems for tall buildings, Shear Walls and their arrangement. Loads on Tall Buildings, Gravity loads, live loads, wind loads and seismic loading, Codal Provisions. Discussion of relevant codes of practices and loading standards. Analysis off Tall Buildings with and without Shear Walls, Approximate analysis for gravity loads, lateral loads. Analysis of tube-in-tube constructional and 3-Dimensional analysis of shear core buildings, stability, stiffness and fatigue, factor of safety and load factor, Design of Tall Buildings. Procedures of

elastic design, ultimate strength design and limit state design of super structures including structural connections. Case studies.

Departmental elective-III

14M14CE236   Repair and Retrofitting Of Structures

Principles of retrofitting, objective and principles of intervention, design steps for intervention, criteria for repair and retrofitting, repair materials and techniques, seismic vulnerability evaluation of buildings, feasibility assessment, design considerations, analytical and experimental techniques, retrofit design and implementation, techniques of retrofitting and improving structural integrity of masonry buildings, codes of practices for repair and retrofitting, techniques of retrofitting of RC buildings and structural elements, retrofitting of bridges and dams and heritage structures, retrofitting of structures by seismic base isolation, case studies of retrofitting of structures.

14M14CE237   Construction Methods and Equipments
Factors affecting selection of equipment, technical and economic, construction engineering fundamentals, Analysis of production outputs and costs, characteristics and performances of equipment for Earth moving, Erection, Material transport, Pile driving, Dewatering, Concrete construction (including batching, mixing, transport and placement) and Tunneling.

14M14CE434   Quality and Safety Management in Construction

Introduction to quality: Planning and control of quality during design of structures. Quantitative techniques in quality control. Quality assurance during construction, inspection of materials and machinery. In process inspection and test, preparation of quality manuals, check-list and inspection report. Establishing quality assurance system. Quality standards/codes in design and construction. Concept and philosophy of total quality management (TQM). Training in quality and quality management systems (ISO-9000). Concept of safety. Factors affecting safety; Physiological, Psychological and Technological. Planning for safety provisions. Structural safety. Safety consideration during construction, demolition and during use of equipment. Management of accidents/injuries and provision of first aid. Provisional aspect of safety. Site management with regard to safety recommendations. Training for safety awareness and implementation. Formulation of safety manuals. Safety legislation, standards/codes with regard to construction. Quality vs. Safety. Case Studies.

14M14CE436   Research Methodology

Conceptualization of an innovative project, literature search and analysis, research and experiment design, developing a research plan – case studies, Biological data types (Quantitative & Qualitative), Sampling methods, Data collection, Processing and statistical analysis, Critical assessment and evaluation of research and project proposals, report writing and interpretation, preparation, presentation and submission of manuscript, translation of a research project into a commercial venture-case studies

10M19CE391   Project Seminar-I
Student will be given projects in the area of subjects taught upto that semester. The student will do a project based on literature review, small experiments wherever possible and prepare a report. There will be one mid-term evaluation, a presentation at the end followed by a viva-voce examination.

10M19CE392   Dissertation Part-I

Students will complete project work in the area of environmental engineering under the supervision of guide. The students will do project based on literature review; experiments if possible and write a thesis report. Total credits assigned for project work are 26. Twelve credits will be evaluated in the third semester and will be carried over to fourth semester for final evaluation of project work.

Year/Sem: IInd Year/IVth Sem
Departmental elective-V

14M14CE137   Advanced Steel Design

Plastic Design, Plastic Hinge, Plastic Collapse Load, Plastic Analysis of Frames; Wind Loads on Industrial Buildings, Braced and Unbraced Industrial Frames; Transmission Line Towers, Analysis by Tension Coefficients, Member Selection; Steel Tanks and Stacks, Different Configurations and components of Elevated Circular Tanks; Steel Stacks, Design Considerations; Design in Light Gauge Steel; Aluminum Structures; Residual Stresses.

14M14CE138   Wind Resistant Design of Structures

Short and long term statistics of wind, wind mechanics; effect of wind on tall structures; buildings, chimneys; Towers etc. Wind effect on bridges, wind tunnel testing; Statistical analysis of wind; Different codes of practices related to wind; Field studies on wind Engineering, case studies. Application of relevant IS codes to practical design Wind gust loading:- Basic concepts, spectral description structural response of the line-like structure, Aerodynamics damping Aerodynamics instability: Vortex shedding, Along wind and ovalling excitation - design impact and counter measures, Aeroelastic excitation: galloping - flutter. Design Wind speeds and risk coefficients, Design wind pressure and pressure coefficients, Vortex shedding, gust factors. Approximate methods.

14M14CE232   Cable Stayed and Suspension Bridges

Introduction, structural behavior, advantage and disadvantages over other type of bridges. Analysis of a loaded cable, cable carrying point loads and UDL, cables with ends at different level, cable subjected to temperature stresses, suspension bridge with two hinged and three hinged stiffening girders, influence lines for bending moment and shear force-temperature stresses in stiffening girder. Construction and case studies. Comparison of cable stayed and suspension bridges.

14M14CE233   Computer Applications in Structural Analysis And Design

Engineering design principles, interactive design using workstations and software tools. Software and software engineering, System and Software Requirements Analysis: Computer based systems, computer systems engineering, system analysis, requirements analysis fundamentals, structured analysis and its extensions, object oriented analysis and data modeling. Design and Implementation of Software: Software design fundamentals, data-flow oriented design, object oriented design, data oriented design methods, programming languages and coding. Software Quality Assurance: Software quality and software quality assurance, software testing techniques, software testing strategies, software maintenance, reverse engineering techniques. Application Software in Civil Engineering: Introduction and application of softwares like STAAD III, STAAD PRO, ATENA, ADINA, ANSYS, DIANA, project work and application to practical problems.

14M14CE234   Masonry Structures

Properties of constituents: units - burnt clay, concrete blocks, mortar, grout, reinforcement; Masonry bonds and properties: patterns, shrinkage, differential movement, masonry properties - compression strength; Stresses in masonry walls: vertical loads, vertical loads and moments - eccentricity & kern distance, lateral loads - in-plane, out-of-plane; Behavior of masonry walls and piers: axial and flexure, axial-shear and flexure, Behavior of Masonry Buildings: unreinforced masonry buildings - importance of bands and corner & vertical reinforcement, reinforced masonry buildings - cyclic loading & ductility of masonry walls; Behavior of masonry infill's in RC frames: strut action; Structural design of masonry in buildings: methods of design – WSD, USD, seismic design - seismic loads, code provisions, in-fills, connectors, ties; Seismic evaluation and strengthening of masonry buildings: methods - in-situ, non-destructive testing; Construction practices and new materials.

Departmental elective-VI

14M14CE331   Design of Substructures

Introduction to shallow, mat and deep footings, Design of strap, Raft and combined footings, Design of pile footings, Caps for piles, design of different components of well foundations, Footings subjected to eccentric loading, uplift and overturning, Soil-Structure interaction, Sub grade reaction method, Geotechnical design considerations, Site and soil conditions, Soil liquefaction, Evaluating the liquefaction potential by Standard Penetration Tests, by Cone Penetration Tests, by Shear Wave Velocity, Liquefaction of clayey soil, Mitigation of Liquefaction Hazard by site modification, Mitigation of Liquefaction Hazard by Structural Design, Seismic Settlement, Subsidence and Differential Compaction, Fault Rupture, Lateral Seismic Earth Pressures. Case Studies

14M14CE132   Bridge Engineering

Definition, components of a bridge, classifications, importance of bridge. Investigation of Bridges: need for investigations, selection of bridge site, preliminary data to be collected, design discharge and its determination, linear waterway, economical span, vertical clearance above HFL, scour depth, choice of bridge type. Standard Specifications: for road bridges, I.R.C. loadings, code provisions on width of carriage way, clearances, loads considered etc. standard specifications for railway bridges, Railway bridge code. Reinforced Concrete Bridges: T-beam bridge, Courbon's theory for load distribution, balanced cantilever bridges, illustrative examples, pre-stressed concrete bridges, Slab Bridges. Sub Structure: Types of piers and abutments, design forces, design of piers and abutments. Bearing and Joints: Various types of expansion bearing and fixed bearings, elastomeric bearings, joints and their types. Introduction to construction, inspection and maintenance of bridges.

14M14CE437   Nanotechnology and Concrete

Concrete; Durability; High performance concrete; Mechanical properties; Molecular structure; Nanostructure materials; Nanotechnology: Definition and applications need, fundamental cement hydration concepts related to nano cement. Possible performance and fabrication techniques. Sustainable development; Transportation infrastructure.

14M14CE333   Soil Dynamics and Machine Foundations

Nature of dynamic loads, stress conditions on Soil elements under Earthquake loading, Theory of vibrations, Behavior of retaining walls during earthquakes, modification of Coulomb's theory, Modified Cullman's construction, Analytic solution for c- soils, Indian Standard Code of Practice, General, Failure Zones and ultimate bearing capacity. Criteria for satisfactory action of a footing, Earthquakes loads on footings. Dynamic analysis for vertical loads, Theory, criterion of liquefaction, factor affecting liquefaction, Laboratory studies on liquefaction in Tri-axial shear and Oscillatory simple shear, Evaluation of Liquefaction Potential, Vibration table studies,

Liquefaction behavior of Dense sands, Introduction, Criteria for a satisfactory machine foundation, Methods of analysis, Degrees of freedom of a Block foundation, soil spring stiffness, vibrations of a block. Indian Standards for design of reciprocation machine foundation. Design procedure for Block Foundation, Vibration Isolation & Screening of Waves.

10M19CE491   Project Seminar-II

Student will be given projects in the area of subjects taught upto that semester. The student will do a project based on literature review, small experiments wherever possible and prepare a report. There will be one mid-term evaluation, a presentation at the end followed by a viva-voce examination.

10M19CE492 Dissertation Part-II

Students will complete project work in the area of environmental engineering under the supervision of guide. The students will do project based on literature review; experiments if possible and write a thesis report. Total credits assigned for project work are 26. Twelve credits will be evaluated in the third semester and will be carried over to fourth semester for final evaluation of project work.