

CIVIL ENGINEERING
M.E. (STRUCTURAL ENGINEERING AND NATURAL DISASTER MANAGEMENT) – SCHEME OF
INSTRUCTION AND EXAMINATION

I-SEMESTER

Code No.	Course title	Scheme of Instruction		Scheme of Examination			Total	Credits
		Lec.	Tut/drw.	Duration of Exam. (hrs)	Theory/ Lab./Viva	Sess.		
ST-1.1	Theory of Elasticity	4	—	3	70	30	100	4
ST-1.2	Advanced Reinforced Concrete Design	4	—	3	70	30	100	4
ST-1.3	Finite Element Methods of Analysis	4	—	3	70	30	100	4
ST-1.4	Structural Dynamics	4	—	3	70	30	100	4
ST-1.5	Computer Applications in Structural Engineering	2	2	—	50	50	100	3
ST-1.6	Bridge Engineering	2	2	—	50	50	100	3
Total		20 + 4 = 24			380	220	600	22

II-SEMESTER

Code No.	Course title	Scheme of Instruction		Scheme of Examination			Total	Credits
		Lec.	Tut./drw	Duration of Exam. (hrs)	Theory/ Lab./Viva	Sess.		
ST-2.1	Theory of Plates and Shells	4	—	3	70	30	100	4
ST-2.2	Stability of Structures	4	—	3	70	30	100	4
ST-2.3	Structural Reliability	4	—	3	70	30	100	4
ST-2.4	Earthquake Engineering	4	—	3	70	30	100	4
STNDM-2.5	Disaster Management	4	—	3	70	30	100	4
ST-2.6	Rehabilitation and Repair of Structures (Viva-Voce)	2	2	—	50	50	100	3
Total		22 + 2 = 24			400	200	600	23

III-SEMESTER

Code No.	Course title	Scheme of Instruction		Scheme of Examination			Total	Credits
		Lec.	Tut./ Drg.	Duration of Exam. (hrs)	Theory/ Lab./Viva	Sess.		
STNDM-3.1	Foundations for dynamic loading	4	—	3	70	30	100	4
STNDM-3.2	Hydraulic & Marine Structures	4	—	3	70	30	100	4
STNDM-3.3	Elective	4	--	3	70	30	100	2
STNDM-3.4	Thesis	—	—	—				
Total		8 + 4 = 12			210	90	300	10

STNDM-3.3 Elective

- STNDM-3.3a Environmental Impact Analysis
- STNDM-3.3b Advanced Design of Structures
- STNDM-3.3c Fire Resistant Design of Structures
- STNDM-3.3d Wind Analysis and Design of Tall Structures

IV-SEMESTER

STNDM-4.1	Thesis/Dissertation/Project work					100 marks	Credits: 25
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GRAND TOTAL

1600 80

CIVIL ENGINEERING
M.E. (STRUCTURAL ENGINEERING AND NATURAL DISASTER MANAGEMENT)

STNDM 1.1 – THEORY OF ELASTICITY

Plane Stress and Plane Strain: Components of stress, Strain, Hookes law, Stress and strain at a point. Plane stress, Plane strain, Equations of equilibrium, Boundary conditions, Compatibility equations stress foundation.

Two Dimensional Problems in Rectangular Coordinates: Solution by polynomials, Saint Vanant’s principle determination of displacements, Bending of cantilever loaded at the end, Bending of a beam by uniform load.

Two Dimensional Problem in Polar Coordinates: General equations of equilibrium, Stress function and equation of compatibility with zero body forces. Analysis of thick cylindrical shells with symmetrical loading about the axis, Pure bending of curved bars, Strain components in polar coordinates, Rotating disks.

Three Dimensional State of Stress: Differential equations of equilibrium – Boundary conditions for compatibility – Displacements – Equations of equilibrium in terms of displacements – Principle of superposition – Uniqueness of solution.

Torsion: Torsion of straight bars – St. Venant solution – Stress function, Warp function – Elliptic cross section – Membrane analogy torsion of bar of narrow rectangular cross section.

Analysis of Stress and Strain in Three Dimensions: Introduction – Principal stresses, - Determination of principal stress – Stress invariants – Maximum shearing stress strain at point.

Shear Centre, Unsymmetrical Bending, Curved Flexural members – Simple problems

Books:

1. “Theory of Elasticity” by Timoshenko and Goodier, McGraw Hill Company.
2. “Applied Elasticity” by C.T. Wang.
3. “Advanced Strength of Materials” by Denhartog.

STNDM 1.2 – ADVANCED REINFORCED CONCRETE DESIGN

Deflection of Reinforced Concrete Beams and Slabs: Introduction, Short-term deflection of beams and slabs, Deflection due to imposed loads, Short-term deflection of beams due to applied loads, Calculation of deflection by IS 456, Deflection calculation by Eurocode, ACI simplified method, Deflection of continuous beams by IS 456, Deflection of slabs.

Estimation of Crack width in Reinforced Concrete Members: Introduction, Factors affecting crack width in beams, Mechanisms of flexural cracking, Calculation of crack width, Simple empirical method, Estimation of crack width in beams by IS 456, Shrinkage and thermal cracking.

Redistribution of Moments in Reinforced Concrete Beams: Introduction, Redistribution of moments in fixed beam, Positions of points of contraflexure, Conditions for moment redistribution, Final shape of redistributed bending moment diagram, Moment redistribution for a two-span continuous beam, Advantages and disadvantages of moment redistribution, Modification of clear distance between bars in beams (for limiting crack width) with redistribution, Moment-curvature ($M - \psi$), Relation of reinforced concrete sections, ACI conditions for redistribution of negative moments.

Approximation Analysis of Grid Floors: Introduction, Analysis of flat grid floors, Analysis of rectangular grid floors by Timoshenko’s plate theory. Analysis of grid by stiffness matrix method, Analysis of grid floors by equating joint deflections, Comparison of methods of analysis, Detailing of steel in flat grids.

Design of Reinforced Concrete Members for Fire Resistance: Introduction, ISO 834 standard heating conditions, Grading or classifications, Effect of high temperature on steel and concrete, Effect of high temperatures on different types of structural members, Fire resistance by structural detailing from tabulated data, Analytical determination of the ultimate bending moment, Capacity of reinforced concrete beams under fire, Other considerations.

Earthquake Forces and Structural Responses: Introduction, Bureau of Indian standards for earthquake designs, Earthquake magnitude and intensity, Historical development, Basic seismic coefficients and seismic zone factors, Determination of design forces, Choice of method for multi-storeyed buildings, Difference between wind and earthquake forces, Torsion in buildings, Partial safety factors for design, Distribution of seismic forces, Analysis of structures other than buildings, Ductile detailing, Increased values of seismic effect for vertical and horizontal projections, Proposed changes in IS 1893 (Fifth revision).

Ductile Detailing of Frames for Seismic Forces: Introduction, General principles, Factors that increase ductility, Specifications of materials for ductility, Ductile detailing of beams – Requirements, Ductile detailing of columns and frame members with axial load (P) and moment (M) – Requirements. Shear walls, Joints in frames.

Inelastic Analysis of Reinforced Concrete Beams and Frames: Introduction, Inelastic behaviour of reinforced concrete, Stress-strain characteristics of concrete, Stress-strain characteristics of steels, Moment curvature relation (M-curves), Concept of plastic hinges (Moment rotation at plastic hinges), Effect of shear on rotation capacity, Inelastic or non-linear analysis of reinforced concrete beams, Allowable rotation for collapse load analysis, Baker's method for plastic analysis of beams and frames.

Durability and Mix Design of Concrete: Introduction, Types of cements produced in India, Durability of concrete, Carbonation and atmospheric corrosion of steel, Chloride penetration and steel corrosion, Presence of salts and steel corrosion, sulphates and concrete disintegration, Curing of concrete (IS 456 Clause 13.5), Summary of recommendations for durability of concrete, Polymer concrete, Mix design of concrete, Design of ordinary grade concrete, Design of high strength concrete, Design of very high strength concrete mixes, Mix design method.

High performance concrete.

References:

1. "Advanced Reinforced Concrete Design" by P.C. Varghese.
2. "Reinforced Concrete" by Park & Paulay.

STNDM 1.3 – FINITE ELEMENT METHOD OF ANALYSIS

Introduction: A brief history of F.E.M. Need of the method, Review of basic principles of solid mechanics, Equations of equilibrium, Boundary conditions, Compatibility, Strain displacement relations, Constitutive relationship.

Theory relating to the formulation of the finite element method, Coordinate system (local and global), Basic component – A single element. Derivation of stiffness matrix, Assembly of stiffness, Matrix boundary conditions – All with reference to trusses under axial forces.

Concept of element, Various element shapes, Triangular element. Discretisation of a structure, Mesh refinement Vs. Higher order element, Inter connections at nodes of displacement models on inter element compatibility.

Three dimensional analysis – Various elements used, Tetra-hedrons, Hex-hedrons. Requirements on representation of element behaviour functions, Polynomial series. Isoparametric representation and its formulation.

Books:

1. “The Finite Element Method in Engineering Science” by Zienkiewicz, P., McGraw Hill, 1971.
2. “Finite Element Analysis Fundamentals” by Richard H. Gallagher, Prentice Hall, 1975.
3. “Introduction to Finite Element Method” by Desai, C.S. and Abela, J.F., Van Nostrand, 1972.
4. “Finite Element Methods for Engineers” by Reger, T. Fenner, The Macmillan Ltd., London, 1975.
5. “Fundamentals of Finite Element Techniques for Structural Engineers” by Drabba, C.A. and Conner, J.J., John Wiley and Sons, 1971.
6. “Numerical Methods in Finite Element Analysis” by Klaus Jurgen and Edward, L., Wilson, Prentice Hall of India, New Delhi, 1978.

STNDM 1.4 – STRUCTURAL DYNAMICS

One Degree Systems: Undamped systems, Various forcing functions damped systems, Response to pulsating force, Support motion.

Lumped Mass Multi-degree System: Direct determination of natural frequencies, Characteristic shapes, Stodola-Vianelle method, Modified Rayleigh-Ritz method, Lagrange’s equation, Model analysis of multi degree systems, Multistorey rigid frames subjected to lateral loads, Damping in multi degree systems.

Structures with distributed mass and load, Single span beams, Normal modes of vibration, Forced vibrations of beams, Beams with variable cross-section and mass.

Approximate design methods, Idealized system, Transformation factors, Dynamic reactions response calculations, Design example (RC beam, Steel beam, RC slab), Approximate design of multi degree systems.

Matrix Approach: Coordinates and lumped masses, Consistent mass matrix, Undamped force vibration of a system with one degree freedom, Response of single degree freedom undamped system, Viscous damped vibration of a single degree freedom system, Undamped vibration of multi degree freedom system, Orthogonality of natural modes, Normal coordinates.

Books:

1. “Structural Dynamics” by John M. Biggs.
2. “Structural Analysis” by A. Ghali & A.M. Neville.

STNDM 1.5 – COMPUTER APPLICATIONS IN STRUCTURAL ENGINEERING

Computer Oriented Methods in Structural Analysis:

Stiffness method: Developing a computer program for the analysis of Grid Floors by using stiffness method.

Flexibility Method: Developing a computer program for the analysis of Portal Frames by using flexible method.

Finite Difference Method (FDM): Determination of deflections of plates by using FDM & Determination of natural frequency in a beam.

Finite Element Method (FEM): Discussion of engineering problems to demonstrate the versatility of finite element method. Coordinate system (local & global), Definition of stiffness matrix for a truss element and a beam element, Element assembly into global stiffness matrix, Boundary conditions.

Software Applications in Structural Engineering (by using STAAD, STRAP, STRUDS, etc.):

Analysis of reinforced concrete (RCC) and steel structures.

Analysis of plane and space truss and frames subjected to gravity and lateral loads.

Determination of natural frequency of a beam.

Dynamic analysis (Response spectrum) of plane frames.

Analysis of water tanks by using plate elements.

Design of Reinforced Concrete Members:

Design, detailing and estimating of beams, slabs, columns and foundations, Shear wall design.

Design of Steel Members:

Design of truss members.

Design of beams and columns.

References:

1. "The Finite Element Method" by Zienkiewicz, O.C., McGraw Hill Publications, London.
2. "Concepts and Applications of Finite Element Analysis" by Cook, R.D.
3. Reference Manual for STADD, STRAP, STRUDS, ANAYS, NISA, etc.

STNDM 1.6 – BRIDGE ENGINEERING

Loading Standards.

Design of Balanced Cantilever Bridge.

Design of Bow String Girder Bridge.

Design of prestressed concrete girder and box girder bridges considering only primary torsion, Design of end block.

Bridge Bearing: Types of bearings, Elastomeric bearing.

Piers, Abutments, Wing walls factors effecting and stability, Well foundations. Design of well, Construction, Open sinking of walls, Plugging, Sand filling and casting of well cap.

II-SEMESTER

STNDM 2.1 – THEORY OF PLATES AND SHELLS

Bending of Long Rectangular Plates to a Cylindrical Surface: Differential equation for cylindrical bending of plates – Uniformly loaded rectangular plates with simple supported edges and with built in edges.

Pure bending of plates slopes – Curvatures of bent plates – Relations between bending moments and curvature – Particular cases – Strain energy in pure bending – Limitations.

Symmetrical Bending of Circular Plates: Differential equation – Boundary conditions.

Simply supported rectangular plates under sinusoidal loading – Naviers solution and its application to concentrated load – Levy's solution for uniformly distributed load or hydrostatic pressure – Bending of rectangular plates by moments distributed along the edges – Differential equation of rectangular plate within plane and lateral forces.

Membrane analysis:

- a) Shells of revolution (axi-symmetrical loading), Spherical shells, Conical shells, Elliptical shell of revolution, Torus, Hyperboloid of revolution of one sheet, Shells of uniform strength membrane deformation.
- b) Membrane analysis of shells of translation, Circular cylinder, Diretrix, Parabola, Cycloid, Catenary and Membrane deformations.
- c) Membrane analysis of shells of general shape: Anticlastic, Synclastic shells, Hyperbolic paraboloid, Candella shells, Conoid, Elliptic paraboloid, Rotational paraboloid.

Bending analysis of cylindrical shell: Beam method, Schorer method, Finsterwalder method.

Classification analysis.

Text Book:

1. "Theory of Plates and Shells" by Timoshenko, S. and Wernowsky-Krieger.

References:

1. "Stresses in Shells" by Flugge.
2. "Design and Construction of Shells" by Ramaswamy, G.S.

ST 2.2 – STABILITY OF STRUCTURES

Buckling of Columns: Method of neutral equilibrium, Critical load of the Euler column, Linear column theory – An eigen value problem, Effective length concept, Higher order differential equation for columns initially bent columns, Effect of shear stress on buckling, eccentrically loaded columns, beam columns (Beam columns with concreted lateral load, distributed, load end moment), Inelastic buckling of columns, Double modulus theory, Tangent modulus theory, Shanley theory of inelastic column behaviour.

Approximate Methods of Analysis: Conservation of energy principles, Calculation of critical loads using approximate deflection curve, Principle of stationary potential energy, Raleigh-Ritz method, Buckling load of column with variable cross-section, Galerkin's method, Calculation of critical load by finite differences, Unevenly spaced pivot points, Matrix stiffness method, Effect of axial load on bending stiffness-slope deflection equations, Buckling of column loaded along the length using energy methods.

Buckling of Frames: Modes of buckling, Critical load of a simple frame using neutral equilibrium, Slope deflection equations and matrix analysis.

Lateral buckling of cantilever and simply supported beams of rectangular and I-sections and use of energy method and finite differences.

Buckling of Plates: Differential equation, Strain energy of bending, Critical load, Finite difference approach inelastic buckling of plates.

Matrix approach for Frames: Criterion for determination of critical loads, Stiffness influence coefficients for members without axial load, Derivation of stability functions, Problem involving Non-sways, Modified stiffness of beams, Frames with sway, Multi-bar frames.

References:

1. "Principles of Structural Stability Theory" by Alexander Chajes.
2. "Theory of Elasticity Stability" by Timoshenko and Gere.

STNDM 2.3 – STRUCTURAL RELIABILITY

Concepts of Structural Safety: General, Design methods.

Basic Statistics: Introduction, Data reduction, Histograms, Sample correlation.

Probability Theory: Introduction, Random events, Random variables, Functions of random variables, Moments and expectation, Common probability distribution, Extremal distribution.

Resistance Distributions and Parameters: Introduction, Statistics of properties of concrete, Statistics of properties of steel, Statistics of strength of bricks and mortar, Dimensional variations, Characterization of variables, Allowable stresses based on specified reliability.

Probabilistic Analysis of Loads: Gravity loads, Wind load.

Basic Structural Reliability: Introduction, Computation of structural reliability.

Monte Carlo Study of Structural Safety: General, Monte Carlo method, Applications.

Level 2 Reliability Methods: Introduction, Basic variables and failure surface, First-order second-moment methods (FOSM).

Reliability Based Design: Introduction, Determination of partial safety factors, Safety checking formats, Development of reliability based design criteria, Optimal safety factors, Summary of results of study for Indian standard – RCC design.

Reliability of Structural Systems: Preliminary concepts as applied to simple structures.

References:

1. "Structural Reliability Analysis and Design" by Ranganatham, R.
2. "Structural Reliability" by Melchers, R.E.

STNDM 2.4 – EARTHQUAKE ENGINEERING

Earthquakes, Epicenter, Hypocenter and earthquake waves, Measurement of ground motion, Seismic regions, Intensity and Isoseismals of an earthquake, Magnitude and energy of an earthquake, Consequences of earthquakes, Seismic zoning.

Earthquake Response of Linear Systems: Earthquake excitation, Equation of motion, Response quantities, Response history, Response spectrum concept, Deformation, Pseudo-velocity, and Pseudo-acceleration, Response spectra, Peak structural response from the response spectrum, Response spectrum characteristics, Elastic design spectrum, Comparison of design and response spectra, Distinction between design and response spectra, Velocity and acceleration response spectra, Appendix 6: E1 Centro, 1940 Ground motion.

Earthquake Analysis of Linear Systems:

Part-A: Response history analysis, Modal analysis, Multistorey buildings with symmetric plan, Multistorey buildings with unsymmetric plan, Torsional response of symmetric-plan builds, Response analysis for multiple support excitation, Structural idealization and earthquake response.

Part-B: Response Spectrum Analysis: Peak response from earthquake response spectrum, Multistorey buildings with symmetric plan, Multistorey buildings with unsymmetric plan.

Earthquake Response of Linear Elastic Buildings: Systems analyzed, Design spectrum and Response quantities, Influence of T_1 and p on response, Modal contribution factors, Influence of T_1 on higher-mode response, Influence of p on higher-mode response, heightwise variation of higher-mode response, How many modes to include.

Aseismic Design of Structure: Design data and philosophy of design, Seismic coefficients, Permissible increase in stresses and load factors, Multistorey buildings, Base shear, Fundamental period of buildings, Distribution of forces along the height, Dynamic analysis, Effective weight, Miscellaneous considerations, Earthquake resistant construction of buildings, Ductility provisions in reinforced concrete construction, Water towers, Introduction, Behaviour under earthquake loads, Design features, Water tower as a rigid jointed space frame, Hydrodynamic pressures in tanks, Stack like structures, Introduction, Fundamental period of vibration, Seismic coefficient, Dynamic bending moment, Shear diagram, Bridges, Introduction, Seismic force, Live load, Super structure, Substructure, Hydrodynamic pressures on dams, Introduction, Zanger's method, Vertical component of reservoir load, Concrete or masonry gravity dams, Introduction, Natural period of vibration, Virtual mass, Dynamic displacements and accelerations, Dynamic shears and moments, Geometric method of stress analysis, Earth and rock fill dams, Introduction, Fundamental period of vibration, Stability of slope, Retaining walls, Introduction, Active and passive pressure due to fill, Point of application, Earth pressure due to uniform surcharge, Effect of saturation.

Books:

1. "Elements of Earthquake Engineering" by Jaikrishna and Chandrasekharan, Saritha Prakasham, Meerut.
2. "Dynamics of Structures, Theory and Applications to Earthquake Engineering" by Anil K. Chopra, Prentice Hall of India.

STNDM 2.5 – DISASTER MANAGEMENT

Concept of Disaster Management. Types of Disasters. Disaster mitigating agencies and their organisational structure at different levels.

Overview of Disaster situations in India: Vulnerability profile of India and vulnerability mapping including disaster – prone areas, communities, places.

Disaster preparedness – ways and means; skills and strategies; rescue, relief, reconstruction and rehabilitation.

Case studies: Lessons and experiences from various important disasters in India.

Seismic vulnerability of urban areas. Seismic response of R.C. frame buildings with soft first storey. Preparedness for natural disasters in urban areas. Sulbh technology for sanitation improvement in urban habitat. Landslide hazards zonation mapping and geo-environmental problems associated with the occurrence of landslides. A statistical approach to study landslides. Landslide casual factors in urban areas. Roads and landslide hazards in Himalaya. The use of electrical resistivity method in the study of landslide. Studies in Rock-mass classification and landslide management in a part of Garhwal-Himalaya, India. Urban earthquake disaster risk management. Using risks-time charts to plan for the future. Lateral strength of masonry walls. A numerical model for post earthquake fire response of structures. Cyclone resistant house for coastal areas. Disaster resistant construction role of insurance sector. Response of buried steel pipelines carrying water subjected to earthquake ground motion. Preparedness and planning for an urban earthquake disaster. Urban settlements and natural hazards. Role of knowledge based expert systems in hazard scenario.

Book:

1. "Natural Hazards in the Urban Habitat" by Iyengar, C.B.R.I., Tata McGraw Hill.
2. "Natural Disaster management", Jon Ingleton(Ed), Tulor Rose, 1999
3. "Disaster Management", R.B. Singh (Ed), Rawat Publications,2000
4. "Anthropology of Disaster management", Sachindra Narayan, Gyan Publishing House,2000

STNDM 2.6 – REHABILITATION AND REPAIR OF STRUCTURES

Materials: Construction chemicals, Mineral admixtures, Composites, Fibre reinforced concrete, High performance concrete, Polymer-impregnated concrete.

Techniques to Test the Existing Strengths: Destructive and non destructive tests on concrete.

Repairs of Multistorey Structures: Cracks in concrete, Possible damages to the structural element beams, Slab, Column, Footing, etc., Repairing techniques like Jackchu, Grouting, External prestressing, Use of chemical admixtures, Repairs to the fire damaged structure.

Repairs to Masonry Structures & Temples: Damages to masonry structures – Repairing techniques, Damages to temples – Repairing techniques.

Foundation Problems: Settlement of soils – Repairs, Sinking of piles – Repairs.

Corrosion of Reinforcement: Preventive measures – Coatings – Use of SBR modified cementitious mortar, Epoxy resin mortar, Acrylic modified cementitious mortar, Flowing concrete.

Temporary Structures: Need for temporary structures under any Hazard, Various temporary structures, Case studies.

Case Studies: At least 10 case studies.

References:

1. “Renovation of Structures” by Perkins.
2. “Repairs of Fire Damaged Structures” by Jagadish, R.
3. “Forensic Engineering” by Raikar, R.N.
4. “Deterioration, Maintenance and Repair of Structures” by Johnson, McGraw Hill.
5. “Concrete Structures: Repairs, Water Proofing and Protection” by Philip H. Perkins, Applied Sciences Publications Ltd., London, pp.302.
6. “Durability of Concrete Structure: Investigation, Repair, Protection” Edited by Geoffmangs, E. & FN SPON, An Imprint of Chapman & Hall, pp.270.
7. “Structural Failure” by Tomoss Weirzbicki, Norman Jones, Wiley Interscience, pp.551.
8. “Deterioration, Maintenance and Repair of Structures” by Johnson, McGraw Hill, pp.375.
9. “Design and Construction, Failures, Lessons from Forensic Investigation” by Dov Kaminetzky, McGraw Hill, pp.600.

III-SEMESTER

STNDM 3.1 – FOUNDATIONS FOR DYNAMIC LOADING

Elements of Soil Dynamics: Free and forced vibrations with and without damping for single degree of freedom, Natural frequency of foundation soil system – Barken, Pressure bulb concept, Pauw’s analogy and Vibration isolation.

Wave Propagation: Waves in elastic half space, Elements of seismic methods, Steady state vibrations, Influence of soil condition on shaking intensity and associated structural damage and land slides.

Elastic Properties of Soil: Field and laboratory methods, Stress strain characteristics of soil under dynamic loads, Damping properties, Bearing capacity of soil under dynamic loads by pseudo static analysis.

Liquefaction and Ground Improvement: Mechanism, Laboratory methods, Evaluation of liquefaction in the field, Factors affecting liquefaction, Anti liquefaction measures. Ground improvement in cohesionless soils – Dynamic compaction, Vibroflotation, Blasting, Compaction piles and Grouting.

Foundations: Foundation types, Design principles, Special foundations for high speed machines and earthquake zones.

Text Books:

1. “Soil Dynamics & Machine Foundations” by Swami Saran.
2. “Soil Dynamics” by Shamsheer Prakash.

3. "Hand Book of Machine Foundations" by Srinivasulu, P. and Vydyanathan.
4. "Foundation Dynamics" by Jumkies.
5. "Principles of Ground Improvement Techniques" by Hausemen.

References:

1. "Dynamics of Bases and Foundations" by Barken.
2. "Vibration of Soil and Foundation" by Richart.
3. Relevant IS Codes.
4. "Foundations Engineering Hand Book" by Nayak, N.V.
5. Foundation Engineering Hand Book.

STNDM 3.2 – HYDRAULIC AND MARINE STRUCTURES

Gravity Dams and Spillways: Force acting on gravity dams and spillways including earthquake effects, 2-D stress analysis, Stress distribution around openings in a gravity dam.

Earth and Rock Fill Dams: Seepage analysis for homogeneous dams and zoned dams, Stability analysis for an earth dam by slip circle analysis – Ordinary method of slices, Bishop's method, and Spencer's method, including earthquake effects.

Floods: Flood routing in reservoirs and rivers, Dam break/breach analysis, Flood control.

Wave, Tides, and Storm Surges: Linear wave theory, Higher order wave theories, Wave prediction, Wave shoaling, Refraction, Diffraction, Reflection, Breaking and Run up. Tidal characteristics, Tide prediction, Storm surge computation.

Marine Structures: Wave forces on small and large cylinders, Sea walls, Design of break waters and jetties.

Text Books:

1. "Engineering for Dams" by Creager, W.P., Justin, J.D. and Hinds, J., Vol.II, Wiley Eastern Pvt. Ltd., 1968.
2. "Soil Mechanics" by Lambe, T.W. and Witman, R.V., Wiley Eastern Ltd., 1979.
3. "Open Channel Flow" by Hanif Choudhry, M., Prentice Hall of India, 1994.
4. "Mechanics of Wave Forces on Offshore Structures", Turgut Sarpkaya and Michael Issacson, Van Nosstrand Reinhold Company, 1981.
5. "Shore Protection Manual", U.S. Army Coastal Engineering Res. Centre, Vols.I, II and III, Superintendent of Documents, U.S. Govt. Printing Office, Washington D.C.

STNDM 3.3(a) – ENVIRONMENTAL IMPACT ANALYSIS

Introduction to E.I.A., Definition of E.I.A. and E.I.S., Guidelines for preparation of environmental impact statements.

Element of E.I.-Agency activities, Environmental settings, Environmental Attributes: Air, Water, Land, Ecology, Noise, Socio-Economic, Culture and Human aspects (settlements-Rehabilitations).

Environmental impacts – Identification, Measurement – Aggregation, Secondary and cumulative impacts. Criteria for selection of methodology, Impact assessment methodologies, Procedure for reviewing environmental impact-statements. Case studies.

Environmental impact analysis – Energy production, Impact analysis, Cost benefit analysis, Material recycling, Environmental impact mitigation and control measures.

Environmental Protection Act and Standards. State laws and local ordinances. Land use planning priorities and management, Environmental auditing.

References:

1. "Environmental Impact Analysis" by Urban & Jain.
2. "Environmental Impact Analysis" by Canter, McGraw Hill Publishers.

STNDM 3.3(b) – ADVANCED DESIGN OF STRUCTURES

Fold Plate: Whitney method, Simpson method.

Shell: Lundgren beam method, Schore method.

Design of Quay walls, Moorings, Breakwaters Simplified.

Design of transmission towers.

STNDM 3.3(c) – FIRE RESISTANT DESIGN OF STRUCTURES

Materials properties in fire, Classification systems for high temperature concretes.

Design of structures at normal temperatures – Loads, Structural analysis, Material properties, Probability of failures.

Design of structures under fire conditions – Design equate loads for fire design, Structural analysis. Design of individual members exposed to fire – Tension members – Compression members – Beams.

Design structural assemblies exposed to fire – Frames – Redundancy – Disproportionate collapse – Continuity – Plastic design.

Mechanical properties steel at elevated temperatures. Components of strain, Thermal strain, Creep strain, Stress-related strain.

Design of steel buildings exposed to fire – Multistorey steel framed buildings.

Concrete structures – Behaviour of concrete structures in fire. High strength, lightweight, Fibre reinforced and prestressed concrete. External reinforcing.

Fire resistance ratings, Verification methods, Generic ratings, Projection systems.

Mechanical properties of concrete at elevated temperatures. Test methods, Components of strain, Thermal strain, Stress-related strain.

Design of concrete members exposed to fire member design, Simply supported slabs and beams shear strength, Continuous slabs and beams axial restraint, Columns, Walls and Frames.

References:

1. “Fire Safety in Buildings” by Jain, V.K.
2. “Structural Design for Fire Safety” by Andrew H. Buchanan.

STNDM 3.3(d) – WIND ANALYSIS AND DESIGN OF TALL STRUCTURES

Introduction: Basic wind speed, Design wind speed, Design wind pressure, Offshore wind velocity, Wind pressures and forces in buildings/structures, External pressure coefficients for various roofs, Dynamic effects.

Design of Tall Buildings: Analysis of tall buildings for lateral loads, Cantilever method, Portal method, Factor method; Design of structures for wind; Computer application in analysis & design.

Design of Shear Wall: Introduction, Types of shear walls, Behaviour of cantilever wall with rectangular cross-section, Flange cantilever shear walls, Moment-Axial load interaction for shear wall section, Interaction of shear walls and rigid jointed frames, Shear walls with openings, Coupled shear walls.

Design of Steel Towers, Trestles and Masts: Introduction, Loads on towers, Analysis of towers, Masts, Trestles, Stresses in trestles due to vertical loads and horizontal loads, Design of members in towers, Design of foundations.

Design of Chimneys (RCC): Introduction, Wind pressure, Stresses in chimney shaft due to self weight and wind, Stress in horizontal reinforcement due to wind shear, Stresses due to temperature difference. Design of RC chimney.

Design of Steel Chimneys: Introduction, Types of chimneys, Forces acting on steel chimneys, Design of various components, Stability of steel chimney.

Books:

1. “Reinforced Concrete Structures” by Park, R. & Paulay, T.

2. "Design of Steel Structures", Vol.-II, Ramachandra.
3. "Reinforced Concrete Structures" by Punmia, Jain & Jain.
4. "Tall Chimneys" by Manohar, S.N.