DEPARTMENT OF CIVIL ENGINEERING
ALIGARH MUSLIM UNIVERSITY, ALIGARH
SYLLABUS OF SRUCTURAL ENGINEERING FOR PHD ENTRANCE TEST 2018-19

SECTION - A
Multiple Choice Questions

Part I - Multiple Choice Questions on Research Methodology **(40 marks)**

Writing Skill: Tenses, parts of speech, clauses, subject- verb agreement, Idioms and phrases, reading comprehension, word-meaning, synonyms-antonyms, hyponyms,

Logical and Analytical Reasoning.

Programming Skills: Data types, assignments, conditional statement, branching and looping, input and output statements.

Mathematics and Statistics: Algebra, Ordinary Differential Equation (ODE), Numerical Analysis, Real and Complex Analysis, Vector Analysis, Measure of Central Tendency, Probability Distribution Function.

Part II - Multiple Choice Questions from Syllabus of Civil Engineering. **(20 marks)**

SECTION – B
Subjective Questions

(20 marks)

Theory of Elasticity and Plasticity: Theory of stresses, infinitesimal and finite strain, strain-displacement relationships, elastic constants. Stress and displacements functions, plane problems in Cartesian and polar co-ordinates. Elements of plasticity, failure and yield criteria, flow rule. Velocity field, plastic stress-strain relationships, incremental plasticity

Plates and Shells: Background and basic concepts; Basic concepts, governing equations and boundary conditions of plates. Solution of Plates; Solution of rectangular and circular plates by classical methods: Navier's and Levy's methods. Membrane theory of cylindrical shells; Introduction, types of shell surface, classification, basic concepts, equations of equilibrium, application of Fourier series for membrane stresses, numerical solutions, limitations of membrane theory. Bending theory of cylindrical shells; Flugge's differential equation, Donnell's theory, D-K-J characteristic equation, Schorer's theory, shell analysis using tables, design consideration.

Advanced Structural Analysis: Introduction to Matrix methods in skeletal structural analysis: force and displacement methods. Application of force method to plane and space frames problems. Application of displacement method to plane and space frames problems. Analysis of Frames, Organization of computation, programming considerations. Non-linear analysis due to plasticity in frames.

Advanced Concrete Design: Limit state design: Basic concepts and philosophies, design of RC members in flexure, shear and torsion, members subjected to combined stresses, slender column, safety and serviceability, control of cracks and deflections, design of RC framed structures with ductile detailing. Yield line analysis of slabs, yield line mechanism, equilibrium and virtual work methods, Hillerberg's strip method. Pre-stressed Concrete, Design of pre-stressed members for bending, shear, torsion and bond, End blocks. Pre-stressed continuous beams and frames, slab and grid floor, tension and compression members, circular pre-stressing, pipes, tanks and special structures.

Finite Element Analysis: Finite element method and other classical methods, historical background, advantages & disadvantages, finite element modeling – discretization, nodes, elements types and shapes. Basic equations in elasticity – stress and strain vectors, Hooke's law, strain-displacement relationship, equilibrium equations, generalized compatibility equations. Finite element analysis of one dimensional problem. Generation of stiffness matrix by displacement and energy method, energy and variational approaches (Rayleigh-Ritz method), numerical solutions. Iso-parametric elements and shape functions. Co-ordinate systems, Element shapes, Strain displacement matrix, Higher order elements: 1D, 2D and 3D. Finite element analysis of two dimensional problems, Symmetry, Plane stress and plane strain problems, bending of thin plates, Introduction to nonlinear FE analysis.

Structural Dynamics: Types of Vibration and Ground motions, Undammed and Damped Single Degree of Freedom System, Response of SDOF System to Harmonic Loading. Response to General Dynamic and Impulsive Loading, Duhamel's Integration, Fourier analysis and Response in the Frequency Domain. Free Vibration of Lumped Multi Degree of Freedom System. Approximate Methods For Obtaining Natural Frequencies and Mode Shapes. Frequency Domain Analysis of Lumped Multi Degree of Freedom System Using Normal Mode Theory, Time Domain Analysis Using Numerical Integration Scheme. Principle of Virtual Work, Rayleigh's and Modified Rayleigh's Method, Dynamic Analysis of Systems with Distributed Properties.

Advanced Steel Design: Loads, classification and design procedures, plate girder bridges and truss girder bridges. Steel Chimneys; Analysis and design of steel chimneys and elevated steel water tanks. Towers; Analysis and design of transmission line and microwave towers. Tubular Sections; Structural behavior of tubular sections, analysis and design of tubular sections, brittle fracture and fatigue in steel structures, plastic design of steel structure.

Construction Planning and Management: Overview of construction, development and organization of projects, Construction organization structure, Construction finance management, scope of financial management, working capital management, capital investment decision. Construction materials and Equipment management; Economy in material management, inventory management and control, purchase and store management, specialized buying and vendors management. Equipment performance characteristics, selection, planning and matching of construction equipment, equipment management. Safety & Environment at Work Place and Human resource management; Basic Rules for personal Safety, Public Safety and safety of equipment at construction sites, Safety management in construction Industry, Environment at construction sites, , construction human resources management; introduction to human resource management, labor legislation, industrial relations, women in construction, Environment issues in construction. Construction contract management; Legal aspects of contract, contract procedures and document, important contract clauses, quality control during construction; Construction accounting; nature and role of accounting, accounting process and book of accounts, accounting conventions and final account, inventory valuation and depreciation.

Earthquake Resistant Design of Structures: Characteristics of earthquakes: Earthquake terminology, magnitude, intensity, measurement of ground motion, frequency-magnitude relationship, liquefaction. Strong ground motion: Acceleration time histories, parameters (peak ground acceleration/velocity/displacement), response spectrum, site effects. Earthquake analysis of structures: Idealization of structures, response spectrum analysis, equivalent force concepts, torsionally coupled systems. Concepts of earthquake resistant design: objectives, ductility, ductility reduction factor, over-strength, response reduction factor, design response spectrum, lateral stiffness, building configuration, base isolation, concept of structural control. Building codes: Performance of buildings in past earthquakes, historical perspective of code development, Indian code (IS: 1893), provisions for buildings, Retrofitting and strengthening of structures (IS: l3935) Detailing for reinforced concrete and masonry buildings, provisions of IS: 13920, IS: 4326.

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