

DEPARTMENT OF CIVIL ENGINEERING

Syllabus for Written Test for Admission to PhD Programmes in Civil Engineering (December 2019)

Structural Engineering

Structural Mechanics

Simple stress and strain relationship: Stress and strain in two dimensions, principal stresses; Bending moment and shear force in statically determinate beams; Theory of simple bending, distribution of bending and shear stresses in different cross-sections; Direct and bending Stresses (Combined bending); Uniform torsion; columns and Struts.

Structural Analysis

Analysis of statically determinate trusses, arches, beams, cables and frames; slope and deflection in statically determinate structures (beams, rigid jointed frames, plain jointed frames, i.e., trusses, miscellaneous structures, such as bent, arch, lamp post, etc.); Analysis of statically indeterminate structures by force/energy methods, displacement methods (slope-deflection, moment distribution methods, stiffness method using joint approach); influence lines for determinate

Concrete Technology

Concrete Technology- properties of fresh and hardened concrete, basics of mix design, non-destructive testing of concrete, Special concretes such as self compacting concrete, fibre reinforced concrete, high strength/performance concrete, roller compacted concrete.

R.C.C. Structures

Concrete design- basic working stress and limit state design concepts, analysis of ultimate load capacity and design of members subjected to flexure, shear, compression and torsion by limit state method, Reinforcement disposition in different RCC structures or parts thereof; Basic elements of prestressed concrete, analysis of beam sections at transfer and service loads.

Steel Structures

Analysis and design of tension and compression members, beams and beam- columns, column bases. Connections- simple and eccentric, beam column connections, plate girders and trusses. Plastic analysis of beams and frames.

Geotechnical Engineering

Soil Mechanics

Origin of soils, soil classification; three-phase system, fundamental definitions, relationship and interrelationships; permeability and seepage; effective stress principle, consolidation and compaction; shear strength.

Foundation Engineering

Sub-surface investigations- penetration tests, plate load tests; Earth pressure theories; Effect of water table, layered soils; Stability of slopes: infinite slopes, finite slopes, stability analysis; Foundation types: foundation design requirements; Shallow foundations: bearing capacity, effect of water table and other factors, stress distribution, settlement analysis in sands and clays; Deep foundations: pile types, static and dynamic formulae, load capacity of piles in sands and clays, negative skin friction, well foundations; Ground improvement.

Transportation Engineering

Highway Engineering

Different modes of transportation, Developments in Highway Engineering in the Indian Context; Basic concepts of Highway Geometric Design, Traffic Engineering, Highway materials and construction including soil stabilization, Design of flexible and rigid Pavements, Distresses in pavements and rehabilitation of pavements, Highway Drainage.

Railway Engineering

Components of permanent way and their functions, coning of wheels, tilting of rails, rail cross-section, creep in rails and rail fastenings; Geometrics: Curves, Gradients, Cant deficiency, widening of gauges; Points and Crossings; Different types of Yards.

Airport Engineering

Airport Planning; Obstructions, Airport Layout and Components thereof, Airport Markings and Lighting, Terminal Area and Airport Drainage.

Water Transportation

Introduction to Water Transportation Systems, harbours and docks, port facilities.

Building Materials, Construction Technology and Management

Materials

Stone, Lime, Glass, Plastics, Steel, FRP, Ceramics, Aluminum, Fly Ash Admixtures, Timber, Bricks; Aggregates: Classification, properties and selection criteria; Cement: Types, Composition, Properties, Uses, Specification and various Tests; Lime and Cement Mortars

Construction

Introduction to Brick Masonry, Stone Masonry, Walls, Damp Proofing, Arches and Lintels, Doors and Windows, Stairs and Staircases, Plastering and Pointing, White washing, distempering and painting, Scaffolding.

Management

Introduction to Construction Management, Construction projects, Planning and Scheduling, Resources Management and Allocation; Construction Project Monitoring and Control

Environmental Engineering

Water Supply Engineering

Sources, Estimation, quality standards and testing of water and treatment; Rural, Institutional and industrial water supply; Physical, chemical and biological characteristics and sources of water, Pollutants in water and its effects, Estimation of water demand; Drinking water Standards, Water Treatment Plants, Water distribution networks.

Waste Water Engineering

Planning & design of domestic waste water, sewage collection and disposal; Plumbing System. Components and layout of sewerage system; Planning & design of Domestic Waste-water disposal system; Sludge management including treatment, disposal and re-use of treated effluents; Industrial waste waters and Effluent Treatment Plants including institutional and industrial sewage management.

Air pollution, Noise pollution and Ecology.

Water Resources Engineering

Fluid Mechanics and Hydraulics

Fluid properties; Fluid Pressure and its Measurement; Hydro-static Forces on Surfaces, Buoyancy and Floatation; Fundamentals of Fluid Flow; Equation of motion and energy equations, Flow through orifices, mouthpieces, notches and weirs; Flow through pipes including pipe networks, water hammer, surge tank; Open Channel Flow including non-uniform flow, hydraulic jumps, etc. Dimensional Analysis.

Irrigation Engineering

Introduction: Different terminologies related to irrigation engineering, different irrigations systems, types of irrigation projects; Hydrology: Hydrologic cycle, terminologies related to hydrologic cycle, precipitation, rainfall, runoff, flood discharge, calculations, unit hydrograph; Crop water requirement: Crop and Crop seasons in India, cropping pattern, duty and delta, soil- water relationship, significant soil characteristics from irrigation considerations, irrigation requirement; Dams: Different types, design considerations, constructional features, appurtenances; Distribution Systems: Canals, different types of canal regulation and cross- drainage works,
