

**SYMBIOSIS INTERNATIONAL (DEEMED UNIVERSITY)**  
**Ph D ENTRANCE TEST**

**The Syllabus of Civil Engineering**

**Section 1: Structural Engineering**

**Engineering Mechanics:** System of forces, free-body diagrams, equilibrium equations; internal forces in structures; Friction and its applications; Kinematics of point mass and rigid body; Newton's equations of motion; Impulse-momentum theorem; Work-Energy method; Principle of virtual work.

**Solid Mechanics:** Bending moment and shear force in statically determinate beams and frames; Simple stress and strain relationships; Theories of failures; Simple bending theory, flexural and shear stresses, shear centre; Uniform torsion, buckling of column, combined and direct bending stresses.

**Structural Analysis:** Indeterminate beams and frames, slope and deflection, force and displacement methods of analysis, flexibility, stiffness, moment distribution method, plastic analysis, plastic section modulus, plastic hinge.

**Concrete Structures:** Working stress, Limit state and Ultimate load design concepts; Design of beams, slabs, columns; Bond and development length; Pre-stressed concrete; Analysis of beam sections at transfer and service loads.

**Steel Structures:** Working stress and Limit state design concepts; Design of girders, slabs, columns, column base; welded and bolted connections.

**Section 2: Geotechnical Engineering**

**Soil Mechanics:** Origin of soils, soil structure and fabric; Three-phase system and phase relationships, index properties; Unified and Indian standard soil classification system; Permeability - one dimensional flow, Darcy's law; Seepage through soils - two-dimensional flow, flow nets, uplift pressure, piping; Principle of effective stress, capillarity, seepage force and quicksand condition.

### **Section 3: Water Resources Engineering**

**Fluid Mechanics:** Properties of fluids, fluid statics; Continuity, momentum, energy and corresponding equations; Potential flow, applications of momentum and energy equations; Laminar and turbulent flow; Flow in pipes, pipe networks; Concept of boundary layer and its growth.

**Hydrology:** Hydrologic cycle, precipitation, evaporation, evapo-transpiration, watershed, infiltration, unit hydrographs, hydrograph analysis, ground water hydrology -steady state well hydraulics and aquifers; Application of Darcy's law.

### **Section 4: Environmental Engineering**

**Water and Waste Water:** Quality standards, basic unit processes and operations for water treatment. Drinking water standards, water requirements, basic unit operations and unit processes for surface water treatment, distribution of water.

**Air Pollution:** Types of pollutants, their sources and impacts, air pollution meteorology, air pollution control, air quality standards and limits.

**Municipal Solid Wastes:** Characteristics, generation, collection and transportation of solid wastes, engineered systems for solid waste management (reuse/ recycle, energy recovery, treatment and disposal).

### **Section 5: Transportation Engineering**

**Transportation Infrastructure:** Highway alignment and engineering surveys; Geometric design of highways - cross-sectional elements, sight distances, horizontal and vertical alignments.

**Highway Pavements:** Highway materials - desirable properties and quality control tests; Design of bituminous paving mixes; Design factors for flexible and rigid pavements; Design of flexible pavement using IRC: 37-2012; Design of rigid pavements using IRC: 58-2011; Distresses in concrete pavements.

## **Section 6: Construction Materials & Management**

Structural steel - composition, material properties and behavior; Concrete - constituents, mix design, short-term and long-term properties; Bricks and mortar; Timber; Bitumen. Construction Management: Types of construction projects; Tendering and construction contracts; Rate analysis and standard specifications; Cost estimation; Project planning and network analysis - PERT and CPM.

