



# **HINDUSTAN PETROLEUM CORPORATION LIMITED**

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**CIN NO: L23201MH1952GOI008858**

## **SYLLABUS FOR CIVIL ENGINEERING POSITIONS**

### **1. Structural Engineering**

**Engineering Mechanics:** System of forces, free-body diagrams, equilibrium equations; Internal forces in structures; Frictions and its applications; Centre of mass; Free Vibrations of un damped SDOF system.

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

**Structural Analysis:** Statically determinate and indeterminate structures by force/ energy methods; Method of superposition; Analysis of trusses, arches, beams, cables and frames; Displacement methods: Slope deflection and moment distribution methods; Influence lines; Stiffness and flexibility methods of structural analysis.

**Construction Materials:** Construction Materials: Structural Steel - Composition, material properties and behaviour; Concrete - Constituents, mix design, short-term and long-term properties.

**Construction Management:** Types of construction projects; Project planning and network analysis - PERT and CPM; Cost estimation.

**Concrete Structures:** Working stress and Limit state design concepts; Design of beams, slabs, columns; Bond and development length; Prestressed concrete beams.

**Steel Structures:** Working stress and Limit state design concepts; Design of tension and compression members, beams and beam- columns, column bases; Connections - simple and eccentric, beam-column connections, plate girders and trusses; Concept of plastic analysis - beams and frames.

**Repair and Rehabilitation of RCC and masonry structure-** Types and causes of deterioration, Prevention measure, materials of repair, maintenance and repair strategies, strengthening of existing structures

### **2. Geotechnical Engineering**

**Soil Mechanics:** Three-phase system and phase relationships, index properties; Unified and Indian standard soil classification system; Permeability - one dimensional flow, Seepage through soils – two - dimensional flow, flow nets, uplift pressure, piping, capillarity, seepage force; Principle of effective stress and quicksand condition; Compaction of soils; One- dimensional consolidation, time rate of consolidation; Shear Strength,

Mohr's circle, effective and total shear strength parameters, Stress-Strain characteristics of clays and sand; Stress paths.

**Foundation Engineering:** Sub-surface investigations - Drilling bore holes, sampling, plate load test, standard penetration and cone penetration tests; Earth pressure theories - Rankine and Coulomb; Stability of slopes – Finite and infinite slopes, Bishop's method; Stress distribution in soils – Boussinesq's theory; Pressure bulbs, Shallow foundations – Terzaghi's and Meyerhoff's bearing capacity theories, effect of water table; Combined footing and raft foundation; Contact pressure; Settlement analysis in sands and clays; Deep foundations - dynamic and static formulae, Axial load capacity of piles in sands and clays, pile load test, pile under lateral loading, pile group efficiency, negative skin friction.

### 3. Water Resources Engineering

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

**Hydraulics:** Forces on immersed bodies; Flow measurement in channels and pipes; Dimensional analysis and hydraulic similitude; Channel Hydraulics - Energy-depth relationships, specific energy, critical flow, hydraulic jump, uniform flow, gradually varied flow and water surface profiles.

**Hydrology:** Hydrologic cycle, precipitation, evaporation, evapo-transpiration, watershed, infiltration, unit hydrographs, hydrograph analysis, reservoir capacity, flood estimation and routing, surface run-off models, ground water hydrology - steady state well hydraulics and aquifers; Application of Darcy's Law.

### 4. Environmental Engineering

**Water and Waste Water Quality and Treatment:** Basics of water quality standards – Physical, chemical and biological parameters; Water quality index; Unit processes and operations; Water requirement; Water distribution system; Drinking water treatment.

Sewerage system design, quantity of domestic wastewater, primary and secondary treatment. Effluent discharge standards; Sludge disposal; Reuse of treated sewage for different applications.

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

## **5. Transportation Engineering**

Transportation Infrastructure: Geometric design of highways - cross-sectional elements, sight distances, horizontal and vertical alignments.

Geometric design of railway Track- Speed & Cant.

Highway Pavements: Highway materials - desirable properties and tests; Desirable properties of bituminous paving mixes; Design factors for flexible and rigid pavements; Design of flexible and rigid pavement using IRC codes.

## **6. Geomatics Engineering**

Principles of surveying; Errors and their adjustment; Maps - scale, coordinate system; Distance and angle measurement - Levelling and trigonometric levelling; Traversing and triangulation survey; Total station; Horizontal and vertical curves.

## **7. Building Architectural and Maintenance work**

Structural and architectural use of wood and Plywood work, wood Surface finishing, Building interior and external painting, toughen glass work, Aluminum work, Internal & External Cladding work (Example- Glass cladding, Aluminum Composite panel etc.), false ceiling , false flooring, Plumbing work, various methods of terrace waterproofing, Roof cladding ,termite and pest control treatment.

## **8. Innovative Technology in Construction**

Monolithic concrete construction using aluminum or composite formwork, Expanded polystyrene core panel system, Light gauge sheet framed structure, Industrialized 3-S system using RCC precast with or without shear wall column beams, Speed floor system, Glass Fiber reinforced Gypsum panel building, Factory made fast track Modular system

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**NOTE: The syllabus/topics mentioned are indicative in nature. Candidates are expected to possess significant knowledge/proficiency pertaining to the relevant subjects and their qualifying degree.**