भारतीय प्रौद्योगिकी संस्थान जोधपुर
Indian Institute of Technology Jodhpur

Syllabus for the post of JUNIOR TECHNICAL SUPERINTENDENT (Post Code 5206)
(CIVIL & INFRASTRUCTURE ENGINEERING)
(Written Test & Skill Test)

Written Test – 60 Marks
Skill Test – 40 Marks

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 undamped SDOF system.

Solid Mechanics: Bending moment and shear force in statically determinate beams; Simple stress and strain relationships; Simple bending theory, flexural and shear stresses, shear centre; 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 and Management: 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.

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.

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 runoff models, ground water hydrology - steady state well hydraulics and aquifers; Application of Darcy's Law.

Irrigation: Types of irrigation systems and methods; Crop water requirements - Duty, delta, evapotranspiration; Gravity Dams and Spillways; Lined and unlined canals, Design of weirs on permeable foundation; cross drainage structures.

Environmental Engineering

Basic concepts of chemistry: Nature of matter, Laws of chemical combination, Dalton's atomic theory: concept of elements, Atoms and molecules. Atomic and molecular masses, Mole concept and molar mass, Percentage composition, Empirical and molecular formula, Chemical reactions, Stoichiometry and calculations based on stoichiometry.

Water supply - Public water supply system and demand - Types of demand - Per capita demand -Prediction of population. Intakes - Types of intakes-Description of intakes-Infiltration galleries and infiltration wells in river beds - Necessity of pumps - Types of pumps - Pipes for conveyance of water.

Water treatment - Sedimentation –Types of sedimentation - Coagulation - Coagulants and their choice- Types of sedimentation tanks – filtration - R.O process. Distribution system - Gravity, pumping and combined system. Wastewater treatment - Primary and secondary treatments -

Screens – Skimming tanks - Grit chambers - Sedimentation tanks – Filters - Types and description of filters – Activated sludge process- Septic tanks - Construction and working of septic tanks- BOD, COD, DO, Nitrogen, Phosphorus and Fluoride testing; Disinfection method; Microbiological tests

Solid Waste Management: Types of waste, Methods of solid waste disposal - Incineration, Dumping, Sanitary landfill, Composting - energy from waste.

Air pollution: Air pollutants, Acid rain, Ozone depletion, Greenhouse effect, Global warming, Industrial technologies to remove air pollutants

Transportation Engineering

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

Geometric design of railway Track – Speed and Cant.

Concept of airport runway length, calculations and corrections; taxiway and exit taxiway design.

Highway Pavements: Desirable properties and tests for highway materials; Desirable properties of bituminous paving mixes; Design factors for flexible and rigid pavements; Design of flexible and rigid pavement using IRC codes, Design of Bituminous (hot, cold, warm) Mixes and Concrete Mix for pavements, Pavement Evaluation Methods.

Traffic Engineering: Traffic studies on flow and speed, peak hour factor, accident study, statistical analysis of traffic data; Microscopic and macroscopic parameters of traffic flow, fundamental relationships; Traffic signs; Signal design by Webster's method; Types of intersections; Highway capacity.

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.

Photogrammetry and Remote Sensing: Scale, flying height; Basics of remote sensing and GIS.