



Annex I

I. Indicative Syllabus for Junior Engineer (Civil)

Paper I: Building materials, Estimating, Costing and Valuation, Surveying, Soil Mechanics, Hydraulics, Transportation Engineering, Environmental Engineering.

(i) **Building Materials:** Physical and chemical properties, classification, standard tests, uses and manufacture/ quarrying of materials e.g. building stones, silicate based materials, cement (Portland), asbestos products, timber and wood based products, laminates, bituminous materials, paints, varnishes.

(ii) **Estimating, Costing and Valuation:** estimate, glossary of technical terms, analysis of rates, methods and unit of measurement, item of works-earthwork, Brickwork (Modular & traditional bricks), RCC work, shuttering, timber work, painting, flooring and plastering, boundary wall, brick building, water tank, septic tank, bar bending schedule, centre line method, mid-section formula, trapezoidal formula, Simpson's rule. Cost estimate of septic tank, flexible pavements, tube well, isolates and combined footings, steel truss, piles and piles caps. Valuation-value and cost, scrap value, salvage value, assessed value, sinking fund, depreciation and obsolescence, methods of valuation.

(iii) **Surveying:** Principles of surveying, measurement of distance, chain surveying, working of prismatic compass, compass traversing, bearings, local attraction, plane table surveying, theodolite traversing, adjustment of theodolite, leveling, definition of terms used in leveling, contouring, curvature and refraction corrections, temporary and permanent adjustments of dumpy level, methods of contouring, uses of contour map, tachometric survey, curve setting, earth work calculation, advanced surveying equipment.

(iv) **Soil Mechanics:** Origin of soil, phase diagram, definitions-void ratio, porosity, degree of saturation, water content, specific gravity of soil grains, unit weights, density index and interrelationship of different parameters, grain size distribution curves and their uses. Index properties of soils, Atterberg's limits, ISI soil classification and plasticity chart. Permeability of soil, coefficient of permeability, determination of coefficient of permeability, unconfined and confined aquifers, effective stress, quicksand, consolidation of soils. Principles of consolidation, degree of consolidation, preconsolidation pressure normally consolidated soil, e-log p curve, computation of ultimate settlement. Shear strength of soils, direct shear test, vane shear test, triaxial test. Soil compaction, laboratory compaction test, maximum dry density and optimum moisture content, earth pressure theories, active and passive earth pressures, bearing capacity of soils, plate load test, standard penetration test.

(iv) **Hydraulics:** Fluid properties, hydrostatics, measurements of flow, Bernoulli's theorem and its application, flow through pipes, flow in open channels, weirs, flumes, spillways, pumps and turbines.

(v) **Transportation Engineering:** Highway engineering-cross sectional elements, geometric design, types of pavements, pavement materials - aggregates and bitumen, different tests, Design of flexible and rigid pavements - Water Bound Macadam (WBM) and Wet Mix Macadam



(WMM), gravel road, bituminous construction, rigid pavement joint, pavement maintenance, Highway drainage.

vi) **Environmental Engineering:** Quality of water, source of water supply, purification of water, distribution of water, need of sanitation, sewerage systems, circular sewer, oval sewer, sewer appurtenances, sewage treatments. Surface water drainage. Solid waste management - types, effects, engineered management system. Air pollution pollutants, causes, effects, control. Noise pollution - cause, health effects, control.

Paper II: Theory of structures. Concrete technology, RCC design and Steel design

(i) **Theory of structures:** Elasticity constants, types of beams-determinate and indeterminate, bending moment and shear force diagrams of simply supported, cantilever and over hanging beams. Moment of area and moment of inertia for rectangular and circular sections, bending moment and shear stress for tee, channel and compound sections, chimneys, dams and retaining walls, eccentric loads, slope deflection of simply supported and cantilever beams, critical load and columns, Torsion of circular section.

(ii) **Concrete Technology:** Properties, advantages and uses of concrete, cement aggregates, importance of water quality, water cement ratio, workability, mix design storage, batching, mixing, placement, compaction, finishing and curing of concrete, quality control of concrete, hot weather and cold weather concreting, repair and maintenance of concrete structures.

(iii) **RCC Design:** RCC beams-flexural strength, shear strength, bond strength, design of singly reinforced and double reinforced beams, cantilever beams. T-beams, lintels. One way and two way slabs, isolated footings. Reinforced brick works, columns, staircases, retaining wall, water tanks (RCC design questions may be based on both Limit State and Working Stress methods).

(iv) **Steel Design:** Steel design and construction of steel columns, beams, roof trusses, plate girders.



II. Indicative Syllabus for Junior Engineer (Electrical)

Paper I

1. Basics of Electrical Engineering
2. Lighting design of office areas
3. Transformers, working principles, protection types, preventive maintenance
4. Pumping systems.
5. Various type of motors, various starting methods of various types of motors
6. Substation design and layout including DG set installations.
7. Type of earthing, testing, lightening arrestor, etc.

Paper II

1. Basic 'knowledge of' air conditioning & refrigeration
2. Inverters, rectifiers, UPS systems
3. Energy conservation techniques
4. LT distribution system, cabling/ internal wiring system, panel design and faultfinding, preventive maintenance, etc.
5. Testing of electrical installation.
6. Basics of elevators, design, electrical safeties, protections controllers, etc.
7. Basics of CCTV system. Fire and Smoke Alarm system, UPS.
8. Knowledge of Indian Electricity Rules
9. Switchgears & protection used in HT/ LT installations.