SYLLABUS FOR WRITTEN TEST

Name of the Post: LABORATORY ASSISTANT (Civil 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) **Strength of Materials & Theory of Structures:** Normal stress, shearing stress, Normal strain, Hooke's Law, Stress-strain behavior of mild steel, Poisson's Ratio, Shearing strain, Torsion of Circular Shaft, Relations among load, Shear and Bending Moment, Shear and Bending-Moment Diagrams, Pure Bending, Bending of Members Made of several Materials, Shearing Stresses in a Beam, Mohr's Circle for Plane Stress, Principal Stresses, Maximum Shearing Stress, Euler's Formula for Pin-Ended Columns and columns with other End conditions. Equation of the Elastic Curve by Double Integration Method, Slope and Deflection of Determinate Beams by Moment-Area Theorems, Deflections and Slope by Energy Methods, Castigliano's Theorem, and Degree of Indeterminacy, Rolling loads and Influence lines for Determinate Beams, Trusses, and Floor Girders, Cables and Three-Hinged Arch.

(iii) **Concrete Technology**: Properties, Advantages and uses of concrete, cement aggregates, standard tests, the 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.

(iv) **Surveying:** Principles of surveying, measuring distance, chain surveying, working of the prismatic compass, compass traversing, bearings, local attraction, plane table surveying, theodolite traversing, adjustment of the theodolite. Levelling, Definition of terms used in levelling, contouring, curvature and refraction corrections, temporary and permanent adjustments of dumpy level, contouring methods, uses of a contour map, tachometric survey, curve setting, earthwork calculation, advanced surveying equipment. Total station applications in civil engineering.

(v) **Geotechnical Engineering**: Origin of soil, phase diagram, Definitions-void ratio, porosity, degree of saturation, water content, the 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, standard tests, 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, quick sand, consolidation of soils. Principles of consolidation, degree of consolidation, pre- consolidation 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 ofsoils, plate load test, and standard penetration test.

(vi) **Water Resources Engineering:** Hydrology: rainfall, stream flow measurements, runoff, hydrographs, flood studies, reservoir and channel routing, flood forecasting, flood protection measures, river training works, well hydraulics; Irrigation: Command area, duty and delta, canal outlets, crop-water requirement.

(vii) **Fluid Mechanics:** Properties of Fluid, Manometry, Forces on Plane and Curved surfaces, Flow classification, Continuity Equation, Momentum Equation, and Energy Equation and their Applications, Orifices, Venturimeter, Weirs and Notches, Laminar and Turbulent Flow through Pipes, Darcy Weisbach Equation, Moody Diagram, Steady Uniform Flow in Open Channels, Manning's Formula.

(viii) **Transportation Engineering:** Highway Geometric Design: Cross sectional elements, Sight distances, horizontal and vertical alignments; Types and components of Pavement structures, Design of Flexible Pavements; Traffic Characteristics: Road user and vehicular characteristics, traffic volume studies, O-D studies and traffic capacity studies;

(ix) **RCC & Steel Design**: Methods of design, design of singly and doubly reinforced sections, rectangular and Tee beams, shear, torsion and development length, footings one- and two-way slabs, short and long column. Design of riveted, bolted and welded connections, tension and compression members, splicing and lacing, Beam column connection, roof trusses.

(x) **Environmental Engineering:** Estimation of quantity of water, per capita demand, population forecasting, water quality parameters, treatment of water, distribution system, Estimation of quantity of sewage, dry weather flow and storm runoff, sewer appurtenances, characteristics of sewage, treatment and disposal of sewage, sludge digestion.

(xi) **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 and Measurement book.

Signed by
Khumkon Mossang
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