DETAILED SYLLABUS FOR THE POST OF ASSISTANT PROFESSOR IN CIVIL ENGINEERING IN ENGINEERING COLLEGES

(Cat.No. : 722/2021)

(Total Marks- 100)

Module I   (25 marks)

Engineering Mechanics, Mechanics of Structures, Concrete and Construction Technology, Surveying, Quantity surveying and Valuation.

Mechanics-statics-coplanar forces-conditions of equilibrium, support reactions (simply supported and overhanging beams)- Friction-laws of friction-applications, Centre of gravity, moment of inertia of plane areas-Dynamics-rectilinear motion- Newton's laws of motion- curvilinear motion.

 Simple stress and strain relationship in two dimensions- normal and shear stresses & strains-relationship between elastic constants, Bending Moment & Shear force for cantilever beams and Simply supported beams for different types of loading. Bending stresses and shear stresses in symmetrical cross sections-principal stresses -Torsion of solid and hollow circular shafts. Direct and bending stresses in short columns-buckling/crippling load for columns with different end conditions.

Concrete –fresh and hardened properties-mix design- Aggregates – Mechanical & Physical properties- Grading requirements. Construction- planning and scheduling- bar charts,CPM,PERT.

Principles of surveying and levelling, contouring, theory of errors, reduction of levels in levelling. computation of areas and volume, theodolite, triangulation, Total station-working principles.

Quantity surveying & valuation – Building construction – detailed specification, preparation of data and analysis of rates for various items of work. Type of estimates – Detailed estimate for buildings. Valuation methods. GIS, Geoinformatics, Total Action

Module II: Geotechnical Engineering   (15 marks)

Soil Mechanics—basic soil properties -relationship between basic soil properties. Index properties - sieve analysis – well graded, poorly graded and gap graded soils,Stoke's law, hydrometer analysis, relative density, consistency, Atterberg Limits, classification of soils. Permeability of soils -Principle of effective stress -Shear strength of soil, compressibility and consolidation - normally consolidated, under consolidated and over consolidated states - estimation of pre consolidation pressure estimation of magnitude of settlement of normally consolidated clays, coefficient of consolidation. Stability of finite slopes - Toe failure, base failure, slip failure - Factor of safety with respect to cohesion and angle of internal friction - stability number. Compaction of soils - Standard Proctor, Modified Proctor, I.S. light & Heavy Compaction Tests – OMC - Zero Air voids line - Control of compaction. Stresses in soil due to loaded areas - vertical

stress beneath loaded areas of strip, rectangular and circular shapes, Isobars-pressure bulbs-lateral earth pressure – at-rest, active and passive earth pressures - Influence of surcharge, inclined backfill and water table on earth pressure-Earth pressure on retaining walls with layered backfill.

Shallow foundations – ultimate, safe and allowable bearing capacity, failure mechanism, local and general shear failure - factors affecting bearing capacity – influence of water table -allowable bearing capacity of Rafts on sands and clays. Deep foundations - elements of a well foundation – problems encountered in well sinking – methods to rectify tilts and shifts. Pile foundations - point bearing and friction piles - bearing capacity of single pile in clay and sand[I.S. Static formulae] -group action - group efficiency - capacity of Pile groups.

Module III : Structural Engineering and Design of Structures   (15 marks)

Structural Analysis: Analysis of determinate trusses, arches, beams, cables and frames-Deflection of beams, displacements in statically determinate structures and analysis of statically indeterminate structures by force /energy methods, Analysis by displacement methods (slope deflection and moment distribution methods) - influence lines for reaction, shear force and bending moment in simply supported beams and over hanging beams, analysis for different types of moving loads. Plastic hinge concepts- plastic modulus, shape factor, redistribution of moments, collapse mechanisms. Plastic analysis of beams by equilibrium and mechanism methods. Matrix analysis of structures-static and kinematic indeterminacy, force and displacement method of analysis, Flexibility and stiffness methods-analysis of simple structures-plane truss and plane frame. Structural dynamics-degrees of freedom, single degree of freedom subjected to harmonic load, linear systems- free response of damped and undamped systems.

Concrete structures: Limit State method of design- types of limit states- analysis of ultimate capacity and design of members subjected to flexural, shear, compression and torsion by limit state methods. Design of isolated footings -design principles for combined footings. Design of retaining walls and water tanks. Basic elements of pre-stressed concrete- analysis of pre-stressed beams (rectangular and I-sections) at stages of transfer and service. Losses in Prestress.

Steel structures- Analysis and design of tension and compression members, beams, beam-columns, column bases. Connections – simple and eccentric beam column connections, plate girders and trusses. Plastic analysis of beams and frames.

Module IV: Fluid Mechanics and Water Resources Engineering   (15 marks)

Fluid mechanics and Hydraulics-Fluid properties, fluid statics, buoyancy and floatation-kinematics of fluid flow, types of fluid flow, types of flow lines. Dynamics of fluid flow- Euler's equation, Bernoulli's equation, Momentum Principle. Flow through orifices- different types of orifices, flow over a sharp

edged orifice. Hydraulic coefficients. Flow over rectangular weirs, Flow through pipes, Boundary layer theory-Drag and lift on Immersed bodies.

Hydrology-Hydrologic cycle-rainfall, evaporation, infiltration, mass curve and hyetograph, runoff. Hydrograph analysis-Unit hydrograph. Irrigation– necessity, benefits and ill effects. Duty and delta, computation of design discharge of conveyance channels, Irrigation efficiencies. Stream flow measurement-estimation of stream flow by area velocity method. Reservoirs-types of reservoirs, zones of storage reservoir, reservoir planning, storage capacity and yield of reservoirs. Ground water- vertical distribution of groundwater, water table, aquifer properties. Open channel flow -uniform flow, critical flow and gradually varied flow, specific energy concept, hydraulic jump, gradually varied flow.

Dimensional analysis and model studies - dimensions, dimensional homogeneity, methods of dimensional analysis, Rayleigh method, dimensionless numbers, scale ratios, types of models, Concepts of distorted and undistorted models.

Diversion head works- functions of components, Weir and barrage- Causes of failure of weirs on permeable soils - Design of vertical drop weir. Irrigation canals, canal alignment- cross section of unlined canals- Design of canals through alluvial soils. Cross drainage works-Type of aqueducts. Regulation Works - Canal falls-importance, Canal regulators- Regulator cum road bridge- Head regulators and cross regulators. Design procedures of aqueduct, canal fall, cross regulator.

Gravity dam – stability analysis and modes of failure, functions of various components. Arch dams-Thin cylinder theory. Earth dams-causes for failure and design criteria. Spillways- Effective length of spillway.

Module V-Traffic and Transportation Engineering (15 marks)

Highway Engineering- geometric design of highways, Design controls and criteria, Design of highway cross section elements. Sight distance, Stopping sight distance, Overtaking sight distance, Design of horizontal alignment and Vertical alignment. Highway materials, design and construction, Desirable properties and testing of road aggregates, bituminous materials and sub grade soil. Flexible and rigid pavements, Factors influencing the design of pavements, CBR method and IRC guidelines for flexible pavements. Construction of bituminous pavements, Types and causes of failures in flexible and rigid pavements.

Traffic characteristics: Types of road intersections, Traffic control devices, Traffic signs, Road markings and Traffic signals.

Airport Engineering: Aircraft characteristics and their influence on planning of airports, Components of airport, Selection of site for airport. Runway orientation, basic runway length and corrections required, Geometric design of runways.

Railway Engineering: Components and their Functions, Geometric design of railway track: Horizontal curves, radius – superelevation -cant deficiency - transition curves - gradients - different types - Compensation of gradients. Railway operation and control: Points and Crossings– Signaling, interlocking of signals and points - Principles of track circuiting.

Tunnel Engineering: Tunnel sect, transferring centre, tunnel driving procedure, tunnel lining, ventilation, lighting and drainage of tunnels.

Harbour Engineering– classification, features, requirements, winds and waves in the location and design of harbours. Break waters - necessity and functions, classification, forces acting on break water. Docks – Functions and types.

Module VI- Environmental Engineering   (15 marks)

Water demand, quantification of water demand through population forecasting, Factors affecting consumption-Fluctuations in demand**.** Quality of water - Drinking water standards - Physical, chemical and biological analysis. Filtration- Types of filters.

Treatment of water-Theory and principles of Sedimentation tanks- Stoke's law- Types of settling (Type I & Type II)- Coagulation- Mixing- Flocculation, Design of Sedimentation tanks (circular and rectangular)- Clariflocculators. Methods for disinfection of water -Methods of distribution

Wastewater- Sources and flow rates. Sewers, Design of circular sewers under full and partial flow. Sewage, sewerage, systems of sewerage. Sewage characteristics- Physical, chemical and biological parameters, Biological oxygen demand, first stage BOD, Chemical oxygen demand, Relative stability, Population equivalent.

Waste water disposal systems. Treatment of sewage-Preliminary and Primary treatment- Secondary treatment methods. Design of Septic tank and Imhoff tank, Principle and working of Oxidation ditch and oxidation ponds. Sludge treatment and disposal.

NOTE: - It may be noted that apart from the topics detailed above, questions from other topics prescribed for the educational qualification of the post may also appear in the question paper. There is no undertaking that all the topics above may be covered in the question paper