Syllabus for the Written MTech (Non-GATE) Entrance Examination- July-December 2021

Department of Civil Engineering

Section-A: Water Resource Engineering/Hydrology/Fluid Mechanics

Surface water hydrology - hydrologic cycle, rainfall and its measurement, mean rainfall, runoff; Flow measurements; Infiltration losses; Storm hydrology; Unit Hydrograph; Storm hydrograph; Reservoir planning - Investigations, life of reservoir; Flood estimation and routing, flood forecasting; Surface and sub-surface drainage, water logging, remedial measures, drainage of land; Ground water hydrology - Introduction, types of aquifers, wells, well yield; Soil-Water-Plant relationships, crop water requirement; Layout of canal system; Types and methods of irrigation.

Fluid properties; Pressure measurement; Hydrostatic forces on plane and curved surfaces; Buoyancy and equilibrium; Stability, metacentric height; Types of flow; Continuity; Energy and momentum equations; Velocity distribution and velocity coefficients, practical applications; Navier Stoke equation; Shear stress and pressure gradient; Flow through pipes, Hagen-Poiseuille equation; Turbulence, Prandtl's mixing length, eddy viscosity; Darcy-Weisbach equation for flow through pipes, friction factor, Moody diagram, minor losses, pipes in series and parallel, equivalent length, pipe network analysis; Water hammer; Boundary layer concept, drag coefficients, control of boundary layer; Dimensional analysis and similitude.

Section-B: Environmental Engineering

Introduction, Population Forecasting and Water Demand, Physical, Chemical and Biological Characteristics of Water and Wastewater, Wastewater Flow, Sewerage system and sewer design, Basic Microbiology: cells, classification and characteristics of living organisms. Metabolic Processes, Microorganisms in Natural Water Systems, Biological Oxidation of Organic Matter. Introduction to Environmental Chemistry, Stoichiometry and Kinetics of Chemical Reactions, Equilibrium Constant and Solubility Products, pH and Alkalinity. Development of Oxygen Sag Model. Flow sheets for Water and Wastewater Treatment, Introduction to Solid Waste, Air Pollution and Noise Pollution.

Particle Fluid Mechanics as applied to the settling of Type I and II suspensions. Design and operation of Sedimentation Tanks. Coagulation and Flocculation. Hydraulics of Filtration, Design and Operation of Filter Units. Disinfection Methods. Ion exchange and Adsorption. Water Softening, Manganese and Iron Removal. Wastewater Treatment – Preliminary, Primary and Secondary Treatment Units. Aerobic and Anaerobic Processes. Purpose, theory and design of aeration units. Sludge treatment and disposal, Wastewater stabilization ponds, Aerated ponds and Oxidation ditches. Site-visits to Water and Wastewater Treatment Works.

Section-C: Structural Engineering

Different types of structures, Loads on the structural system, static and kinematic indeterminacy, Methods of Analysis: Equilibrium equations, compatibility requirements, Introduction to force and displacement methods, Analysis of trusses: plane truss, compound truss, complex truss and space truss, Arches and suspension cables, three hinged arches and suspension cables, Deflection of Beams, various

methods for calculation of deflection, Analysis of indeterminate structures by force methods, flexibility coefficients, Energy methods: Principle of minimum potential energy, principle of virtual work, Castigliano's theorems, Reciprocal theorem, unit load method, Influence line and Rolling loads, beam, frames and arches, Muller- Breslau Principles and its applications to determinate and indeterminate structures.

Classical method of analysis of framed Structures: Slope deflection method, Moments distribution methods, effect of symmetry and antisymmetry, sway correction, Approximate methods: Substitute frame methods for gravity load, Lateral load analysis: Portal and Cantilever methods, Matrix method of structural analysis: Stiffness method: Local and global stiffness matrices, assembly, band storage, solution of resulting simultaneous algebraic equation, boundary conditions, application to plane and space truss, analysis of plane frame, grid and three dimensional frame.

Section-D: Engineering Surveying/and Geoinformatics

Introduction to surveying; linear measurements; chain surveying; compass surveying; accuracy, precision and errors, leveling; plane table; contouring, theodolite surveying, tacheomatric survey; trigonometrical surveying; triangulation; curves; advanced survey instruments; Electronic Distance Measurement, Total station and Global Positioning System, Introduction to photogram-metry and remote sensing. Introduction to Remote Sensing- Definition of Remote Sensing, History and scope of remote sensing, applications example Electromagnetic Radiation (EMR) and atmospheric windows-Sources of EMR, Types of remote sensing.Thermal Emission of Radiation, Black body radiation, Radiation Laws, Spectral signatures, Reflectance characteristics of Earth cover types., Satellite Orbits, platforms and Sensors:Platforms: Airborne and Space borne, Sensors: Passive and Active, resolutions across track and along the track scanning, Optical sensors, and Thermal scanners. Resolutions- Image characteristics: Image resolution: Spatial (IFOV), Spectral, Radiometric and Temporal, Introduction to Image Interpretation and processing:Elements of Image Interpretation, Visual Interpretation;Image Pre-processing: radiometric, atmospheric and geometric corrections.Remote sensing and Image processing analysis: Land use/ Land Cover (LULC) Classification- Supervised and Unsupervised; Accuracy assessment Basics on GIS-Definition, Basics of GIS and History, GIS Database (types, structures) and data Model, Geographic information and spatial data types. Raster and Vector data formats, Data acquisition, Data entry & preparations. Map scanning and digitizing, data conversion, linking of spatial and non-spatial data. Introduction to Open Source GIS and Introduction to GPS concept.