

Syllabus

Test the Post of Assistant Professor in Civil Engineering

(A: 10 Marks)

Selection of site of a building, planning, Orientation of buildings. Building bye laws- general concept. Functional requirements of building. Planning for residential buildings. Parts of the building. Design Loads: Dead load, live load, wind load, seismic load, snow load and other loads as per BIS Definition and scope of town planning. Concept of Town Planning. Physical Planning and Social Planning. Principles governing selection of site and town layout. Basic elements of city plan. Land use Pattern and Zoning, Industrial Concept of zones and interrelationship. Neighbourhood planning, garden city concept, satellite town.

Building Material: Concrete, mortar, stone, bricks, timber, steel, glass etc

Masonry: Stone, Brick., and hollow block masonry

Causes and effects of dampness, various methods of damp proofing of buildings, Shoring, underpinning and scaffolding.

Descriptions of: Floors, Roof & Roof covering, Doors & windows, Staircase, Plastering & pointing, Painting, Wall cladding, Expansion & construction joints in buildings.

Ventilation & Air conditioning: Purpose of ventilation. Methods of ventilation, systems of ventilation. Rate of ventilation. Systems of air conditioning. Acoustics and Sound Insulation: General principles, sound absorbing materials, insulation of walls and floors. Acoustical correction, optimum time of reverberation

Fire Protection: Behaviours of different materials. Methods of fire proofing of walls, structural steel & wood.

(B: 15 Marks)

Principles of surveying, compass survey, levelling, Plane Table Surveying, Two & three point problems and their solutions. Theodolite Surveying, Traverse computation, Systems of co-ordinates, Adjustment of traverse.

Tacheometric Surveying: Theory of stadia tacheometer. Fixed hair stadia tacheometer and stadia rods. Tangential tacheometry, substance methods of tacheometry. Errors and precision in tacheometric surveying.

Contours and contouring: Characteristics of contours, Contour interval for various purposes, Contour gradients, Uses of contour maps. Direct and indirect methods of contouring. Interpolation of contours. Volume of reservoir from contour map.

Curves: Necessity of curves. Classification of curves-simple, compound, Reverse and vertical curves, transition curves

Hydrographic Surveying, Tunnel Surveying. Correlation of surface and underground surveys.

Triangulation: Principles, objectives and classification. Triangulation layouts and figures. Station markers and signals Satellite stations. Strength of figure. Computation and adjustments in triangulation. Weight of observation, Least squares method, most probable values. Adjustment of quadrilateral and polygon with central station.

Curvature and atmospheric refraction, single and reciprocal observations, Eye and object (axis-signal) correction.

Photogrammetry: Introduction, limitation. Types of photographs, Aerial Photogrammetry, Photo coordinate system, Geometry and scale of vertical photographs. Ground coordinates from vertical photograph, Relief displacement. Flight planning, Planimetric mapping, photomaps and mosaics. Stereoscopy, Parallax, difference in elevation. Introduction to photo interpretation and remote sensing.

Electronic Surveying: Principles, working of Geodimeter. Tellurometer and distomat Radar system. Accuracy of different electronic distance measuring methods.

(C: 15 Marks)

Fluid, its physical properties. Ideal and Real fluids. Newtonian and Non-Newtonian fluids.

Principles of fluid statics: Pressure at a point, Absolute, gauge and vacuum pressures. Pressure measurements by manometers, Pressure gauges and Transducers. Total pressure and centre of pressure on plane and curved immersed surfaces. Buoyancy, Floatation, Equilibrium of floating bodies, Metacentre and determination of metacentric height.

Kinematics of flow: Concepts of fluid flow – steady and unsteady flows, uniform and non-uniform flows, laminar and turbulent flows. Rotational and irrotational flows, Vorticity. Condition for two dimensional irrotational flows. Continuity equation in Cartesian co-ordinates. Stream function and Velocity potential for two dimensional flow, Laplace equation. Flownet and its characteristics.

Equation of motion, energy and momentum applications: General hydrodynamic equations, Euler's equation of motion in Cartesian co-ordinates, Bernoulli's equation. Energy equation and its applications, Fluid masses subjected to uniform accelerations. Free and forced vortex flows. Momentum equation and its applications, Navier Stoke's equation

Flow through pipes: Reynold's experiment, Minor losses, loss of head due to friction, Darcy's Weisbach equation, Hydraulic gradient and total energy lines. Pipes in series and parallel. Equivalent pipeline, Bye pass, Flow through branched and uniformly tapped pipes. Flow measurement through pipes. Transmission of power through pipes, Water hammer in pipes, Allevi's equation,

Dimensional analysis and similitude: Principle of dimensional homogeneity. Buckingham's pi theorem. Dimensional analysis of typical flow problems. Geometric, Kinematic and dynamic similarity. Important dimensional-less numbers and significance. Planning and operation of undistorted models of typical flow problems. Merits, demerits and planning of distorted models.

Flow through opening - Orifices, mouthpieces, nozzles, sluice gates, flow under varying head. Orifice discharging free, Jet, Vena contracta, co-efficient of contraction, velocity and discharge.

Notches and Weirs: rectangular, triangular and trapezoidal notches and weirs. Proportional weirs, Ogee profile, Flow under varying head.

Laminar Flow: Simple solution of Navier Stokes equations, Hagen-Poiseulli's equation, Plane Poiseuille flow and Couette flow, Effect of Viscosity on Fluid flow:, Shear stress distribution, Equation of motion

for laminar flows, Stoke's law, Measurement of viscosity, Flow through parallel plates, Laminar flow through pipes, cavitations.

Turbulent Flow: Nature of turbulence, Reynold's momentum exchange concept and Prandtl's mixing length theory, Turbulent flow in pipes, equation for velocity, distribution and friction coefficient, velocity distribution in smooth pipes, rough pipes. Nikuradse's curves, Moody's diagram.

Introduction to boundary layer theory, Development of boundary layer over a thin flat plate, Laminar and turbulent boundary layers, boundary layer thickness and boundary shear (by momentum integral equation), boundary layer separations and control. The Prandtl boundary layer equation. Solution for laminar boundary layer. Smooth and rough flat surfaces.

Flow round a body – Drag, Skin friction drag, Pressure drag and friction drag on two dimensional bodies submerged bodies. Wave drag, lift induced drag, Flow past sphere and cylinder.

Flow through open channels: Uniform steady flow in open prismatic channels, Discharge formulae of Chezy's, Manning's, Bazin's and Kutter's. Specific energy and discharge curves. Alternate depth and critical depth. Critical state of flow. Hump and channel contraction, Broad crested weir, Parshall flume. Dynamic equation of gradually varied flow in prismatic channels, Classification and analysis of surface curves. Rapidly varied flow, Hydraulic jump in prismatic channels, Specific force curve, Conjugate depths, Hydraulic jump elements and energy loss, Location of the jump, surges and waves.

Hydraulic turbines: Impact of free jet on curved vanes, types of hydraulic turbines, determination of vane angles, main dimensions and efficiencies. Study of Pelton, Francis and Kaplan turbines, Bulb turbines. Governing of hydraulic turbines, Surge tank, Unit quantities, Specific speed, Characteristic curves and their uses. Problem of cavitation in turbines, Selection of turbines. Centrifugal Pumps: Energy recuperation devices – volute casing, vortex chamber and diffuser ring. Pump efficiencies. Effects of variation of discharge and speed of the pump, Specific speed. Characteristics curves. Pumps in series and parallel. Multistage pumps and compressors.

(D: 20 Marks)

Soil and rock, Soil mass constituents. Definition of water content, Specific gravity, Void ratio, Porosity, degree of saturation, air voids, density index etc. Phase relationship.

Group index, Unified and I.S. Soil classifications, field identification tests. Soil structure, basic clay minerals. Flocculated and dispersed clays.

Bearing capacity of soil. Terzaghi's analysis of bearing capacity of shallow foundations, skempton's and hansen's formula, local and general shear failure. Bearing capacity determination.

Soil water, Permeability of soil and its determination.

Seepage and seepage pressure. Quick sand phenomena. Effective and total pressures. Laplace equation for seepage. Flow net and its uses, Piping; uplift pressure, Principle of drainage by Electro-osmosis.

Principle of soil compaction and determination of field density. Field compaction and its control. Vertical pressure distribution in soil. Boussinesq's, equation. Vertical stress due to circular, rectangular and strip loaded areas, Contact pressure distribution.

Foundation: Function of foundation , requirement of foundation . Settlements of foundation Failure of foundation. Shallow & Deep Foundation, Wall foundation, isolated footing, raft foundation & Grillage foundation Pile foundation, pile driving machinery, pile caps.

Mohr circle of stress, shear strength of soil, its strength of sand and clays. Sensitivity and thixotropy, Skempton's pore pressure coefficient. Stress path .

Active, passive and at rest earth pressures, Rankine and Coulomb's earth pressure theories, Rebhann's and Culmann's construction for cohesionless soil back fill. Uniformly distributed surcharge. Bell's equation for cohesive back fill. Stability of retaining wall, earth pressure on sheet piling and bulkheads.

Stability of slopes. Causes of slope failures. Stability analysis by Swedish and friction circle method for total and effective stresses, Taylor's method. Stability under sudden drawdown condition, Remedial measures.

One-dimensional consolidation of soil, Consolidation test. Terzaghi's one-dimensional consolidation theory and its use in predicting rate of settlement. Total and differential settlements. Over consolidated and normally consolidated soils.

Soil stabilisation, Mechanical stabilisation with lime, cement, bitumen, hygroscopic and water proofing chemicals. Electrochemicals and thermal stabilisation.

(E: 20 Marks)

Sources of water supply, quantity of water per capita variation in seasonal and hourly consumption. Forecast of pollution. Standards of purity for public water supplies. Lakes, canal and rivers intakes. Raw water pumping. Quiescent and continuous flow types of tanks. Design & Theory of various units of water treatment plant. Disinfection – uses of excess lime, ozone, ultraviolet rays, chlorine and chloramines for disinfection, water softening.

Different types of pipes used in water supply practice, joints in pipes, valves, distribution of water, Design of distribution system. Alignment, laying and jointing of pipes, Service reservoir and fittings service connection, detection and prevention of wastage of water, Metering, Rural Water Supply & sanitation.

Systems of drainage, Surface drainage, Under drainage, Separate, Combined and Partially combined system. House drainage – conservancy and water carriage systems, Various types of pipes used in waste water management practice, various types of joints, junctions, various types of traps, water closets, urinals and lavatory basins, waste and antisiphonage pipes. Alignment and gradient of drains. Inspection chambers. Testing of drains. Ventilation of drains.

Layout of sewerage systems, Design of sewerage network, estimation of sewage quantity, estimating storm water by time of concentration method. Sewers appurtenances, Manholes, Flushing of sewers. Ventilation of sewers. Aerobic and anaerobic process of treatment. Sewage screening, grit separation, sewage pumping, Various means of disposal of sewage. Septic tank, Imhoff tank, contact beds, percolating filters. Activated sludge process. Nature of sewage sludge. Sludge treatment, sludge gas. Collection and disposal of refuse. Principles, theory and design of various units of waste water treatment plants

Basic principles of Solid waste management, transfer stations, composting, Basics of reuse, recovery and recycling. Waste to energy, land filling methods and operations. Biomedical waste management, Hazardous waste management.

Sources of air pollution, various types of pollutants, Dispersion of pollutants, atmospheric stability conditions, plume behaviours, estimation of effective height of stacks, Gaussian Plume Model. Global environmental problems, effects of air pollution on human, vegetation, animals & atmosphere etc.

Control of particulate matter at source. Various air pollution control devices. Noise pollution its causes and effects.

(F: 20 Marks)

Hydrology: Descriptive hydrology, hydrological cycle, hydrologic budget.

Precipitation, measurement and related data analyses, Hydrologic abstractions, Water losses, Evaporation and its estimation, transpiration, evapotranspiration, measurement of evapotranspiration, infiltration. Rainfall Runoff relationships, estimation quantity of runoff, flood estimation. Storm hydrograph, factors affecting flood hydrograph, unit and synthetic hydrographs, its application, storage routing. Streams and their gauging; Routing of floods; Capacity of Reservoirs. Regression and Correlation analysis.

Ground water: Forms of subsurface water, Aquifer properties and well irrigation: source of ground water, types of wells, steady flow into a well, Unsteady flow in a confined aquifer, well loss, specific capacity, Ground water budget, construction, yield, maintenance and development of wells.

River Engineering: River morphology; River training, embankments and Dikes, guide banks, groynes, Levees, spurs, Pitched island, cut off, bed pitching , butter panelling, design of launching apron, bank protection, Classification rivers on alluvial plains ,degrading, aggrading and meandering.

Sediment transport – Origin and formation of sediments, stream erosion and deposition, definition of regime of flow, plane bed, ripple and dune regime, transition regime, anti-dune regime, introduction to bed loads, suspended load and wash load.

Reservoir planning: Reservoir, economic considerations, environmental effects, yield, capacity of reservoir, mass curve for inflow and demand. Reservoir sedimentation, site selection and flood routing through reservoirs.

Dams: Basic principles for design and construction features of dams and spillways, forces on gravity dam, stability analysis, causes of failure, stress analysis, elementary profile, design of gravity dams, foundation treatment. Structural joints, keys and water seals, galleries, outlets.

Earth dams: Types, methods of construction, design and stability analysis. Estimation and control of seepage, slope protection. Brief description of Arch, Buttress dams, rockfill dams, coffer dams.

Hydro-Power: General features and components of hydropower station.

Irrigation Practices: Irrigation and its importance, assessment of water requirements for crops, factors affecting water-requirement of crops, consumptive use of water, determination of irrigation water requirement, command area, delta, duty, base period, relation between delta, duty and base period, Kor depth and Kor period. factors affecting duty and methods of improvement, methods of irrigation, canal and well irrigation comparison.

Canal irrigation: Canal alignment, design principles of irrigation, curves in canals, canal losses, estimation of design discharge of a canal, design by Kennedy and Lacey's theories, Tractive force concepts in canal design, construction and maintenance, canal outlets, lining of canals.

Canal Head Works: Selection of site, components parts, Weirs and Barrages, Bligh's and Khosla theory, Computation of uplift pressure and exit gradient.

Canal Regulation Structures: Canal fall, types, Sarda fall, Glacis fall, Design of Distributaries head regulator, Cross regulator, control of sediment entry into an off taking canal, canal escapes.

Cross-drainage structures: Needs, types of cross drainage (CD) structures, selection of suitable CD structures, design of cross-drainage structures, waterway and headway of the stream, head loss through cross-drainage structures, energy dissipation.

Canal outlets, ejectors and extractors, tail escape, fish ladder.

Spillways, gates and outlet works, types of spillways, dynamic force on overflow spillways, energy dissipation below spillways, wing wall.

Brief description of various types of crest gates, sluice ways, intake and trashrack.

Water-logging – Definition, adverse effects of water-logging, causes of water-logging, anti-water logging measures, Drainage system design.