

CIVIL ENGINEERING

1. HYDROLOGY

Hydrologic cycle: Measurement and analysis of rainfall; Factors affecting run-off; Methods of estimation of run-off; Different methods of measuring of velocity and discharge; Factors affecting infiltration; Infiltration indices; Measurement of Infiltration capacity.

Occurrence and movement of ground water; Darcy's Law; Co-efficient of permeability; Types of wells; Hydraulics of wells; Construction and development of wells; Testing of wells.

2. GROUND WATER HYDROLOGY

Geologic formations. Types of aquifers and wells. Ground water measurements, Hydraulics of wells. Aquifer properties. Determination of aquifer properties. Steady and unsteady flow through confined aquifers.

3. SOIL AND WATER CONSERVATION

Modern concept of conservation, conservation of ecological balance and environment, examples of renewable and non-renewable resources.

Mechanical composition of soils, analysis based on particle size distribution, causes and effect of soil erosion, erosion control measures.

Principles of Watershed Management.

4. WATER REQUIREMENTS

Consumptive use – its measurement, Crop period/ Base period, Duty and Delta of water, determination of canal capacity and storage requirement, Losses and efficiencies in irrigation, Measurement of evaporation.

5. IRRIGATION PRACTICES

Land levelling and shaping, Types of Irrigation – Sub-surface, Surface and Overhead.

Water logging – causes and remedial measures, Drainage of irrigated lands – surface and sub-surface.

Estimation of spillway, design of flood discharge, principles of flood control, Stream bank erosion and its control.

6. IRRIGATION STRUCTURES

Irrigation canals layout and design, Regulation structures, Cross drainage works and canal outlets.

Principles of design of small hydraulic structures – surface flows and sub-surface flows. Theories of Seepage and Design of Weir Barrages, Design of small earthen dams and solid masonry dam.

7. SURVEYING

Classification of surveys, scales, accuracy; Measurement of distance by direct and indirect methods, optical and electronic devices, Measurement of directions, Prismatic compass, local attractions; Theodolites – types, Measurement of elevations, trigonometric levelling, contours, Establishment of control by triangulation and traversing. Measurements and observation, Computation of co-ordinates; Errors and their corrections of measurement of length, bearing horizontal and vertical angles and levelling operation. Correction due to refraction and curvatures, Map preparation by plane tabling and photogrammetry; Field astronomy, concept of global positioning system; Remote sensing concepts, map substitutes.

8. THEORY AND ANALYSIS OF STRUCTURE

Plain stress and strain, combined stress, Mohr's Circle of stress-strain; Elastic theories of failure, simple bending, shear, torsion of circular and rectangular sections, columns and struts.

Analysis of determinate structures. Different methods of analysis of indeterminate structures – moment distribution, slope-deflection. Analysis of determinate arches.

9. CONCRETE AND STEEL STRUCTURE DESIGN

Kinds of building materials – their properties. Timber work, brickwork and R.C construction. Design of simple R.C structures, codal provisions as per IS-456 for design of concrete structures and IS-875 for loading classes. Roof truss. Design of tubular structure, codal provisions as per IS-800 for design of steel structures including foundation.

Estimation of Buildings, roads and sheds.

Specification and Quality Assurance and Control, Principles of construction. Planning and management, CPM & PERT.

Design principles for small bridges and culverts.

10. SOIL MECHANICS AND FOUNDATION

Properties of soil, classification and inter-relationship; Definition of terms used; Soil testing in laboratory and in-situ; compaction behaviour, methods of compactions and their choice; permeability and seepage, flow nets, flow under hydraulic structures, uplift and quick sand condition inverted filters, unconfined and direct shear stress, tri-axial test, shearing resistance, Earth pressure theories, stability of slopes; compressibility and consolidation. Theories of consolidation, pressure distribution in soils, soil stabilisation, soil exploration and penetration test, pore water pressure.

Types of foundation, selection criteria, bearing capacity, settlement, laboratory and field tests, codal provisions in all types of shallow foundations. Foundation in expansive soils, swelling and its prevention. Design of retaining walls, wells, sheet piles.

11. PUMPS

Types of pumps; Pump characteristics and selection of pumps; Calculation of pump capacity.

12. HYDRAULICS

Fluid properties and definitions. Flow kinematics, continuity momentum and energy equations applicable to fluid flow. Bernoulli's theorem, flow through conduits, flow through open channels. Hydraulic jump, flow through pipes and losses in pipe flows, siphons, pipe network, forces in pipe ends, hydraulic energy grade line, water hammer. General equation for head loss in pipes. Energy losses through pipe fittings. Measurement of discharge through pipes and open channel.