

ASSISTANT ENGINEERS (Civil) & ASSISTANT TECHNICAL OFFICERS (Civil)
COMMON TO CIVIL AND MECHANICAL ENGINEERING

Qualification: DIPLOMA

1) SOLID MECHANICS:

- i) Forces: Different types of forces, gravitational, frictional, axial, tensile or compressive. Law of Parallelogram and triangle of forces, polygon of forces, problems.
- ii) Centre of gravity and moment of inertia. Simple plane figures, Simple machines, law of machine, Mechanical advantage, velocity ratio and efficiency, wheel and axle, pulleys and simple screw jack-problems.
- iii) Simple Stresses and strains: Different types of stresses and strains, stress-strain diagram for ductile materials. Factor of safety, ultimate strength and working strength, elastic constants, Poisson ratio. Deformations, volume changes. Relations between elastic constants. Hooke's Law. Compound rods, temperature stresses, strain energy, impact loading.
- iv) Riveted and welded joints, different modes of failures, efficiency of joints, thin cylindrical shells, longitudinal and circumferential stresses and volume changes.
- v) Shear force and bending moment diagrams for simply supported, over hanging and cantilever beams. Relation between intensity of loading, shear force and bending moment.
- vi) Theory of simple bending: Assumptions, basic flexure formula, bending stresses, modulus of section, moment of resistance. Circular bending. Distribution of shear stress in common structural sections.
- vii) Deflection in cantilever and simply supported beams under simple loading-propped cantilever beams subjected to simple loading, determination of reaction. SF and BM diagrams.
- viii) Simple plane and pin-jointed trusses: Stresses by method of joints and method of sections.
- ix) Torsion: Assumptions, basic formula of torsion, power transmission by shafts of uniform circular sections close-coiled springs, strain-energy in simple beams and shafts, sudden and impact loading. Principal stresses and principal planes. Mohr's circle of stress.
- x) Thin cylinders under internal pressure stresses and volume changes.
- xi) Columns and struts: Direct and bending stresses, core of section. Short and long columns under axial loading-various end-conditions. Euler and Rankine formulae, Slenderness ratio, simple built-up columns.

2) FLUID MECHANICS:

- i) Introduction: Scope of hydraulics in Engineering. Definition and properties of fluid.
- ii) Fluid pressure and its measurement: Atmospheric pressure, Gauge pressure and absolute pressure. Piezometer, Manometer-U-tube, Inverted U-tube, and differential manometers.
- iii) Pressure on plane surface immersed in liquid-Horizontal, vertical and inclined plane surface.
- iv) Flow of fluids: Type of flow-uniform flow, non-uniform flow, streamline flow, Turbulant flow, steady flow and unsteady flow, Energies in fluid motion-Datum head, pressure head and velocity head. Total energy of fluid in motion - Bernoulli's theorem. Practical application of Bernoulli's theorem - flow measurement- pitot tube venturimeter - Orificemeter.

- v) Flow through orifices and Mouth Pieces: Definition of orifice, types of orifices, Vena contracta, coefficient of velocity, coefficient of contraction, coefficient of discharge. Submerged and partially submerged orifices. Flow through orifices
- vi) under variable heads - Time of emptying a rectangular tank through orifices. Mouth pieces - different types of problems.
- vii) Notches and Weirs: Definition of notch, types of notches - Rectangular notch, Triangular notch and trapezoidal notch. Discharge over a rectangular, triangular and a trapezoidal notches.
- viii) Flow through pipes: Major and minor losses - Loss of head at entrance, loss of head due to sudden enlargement, due to sudden contraction, loss of head at exit of the pipe. Frictional loss in pipe-Chezy formula and Daycy's formula.
- ix) Hydraulic gradient and total energy line. Discharge through parallel pipes and branched pipes connected to a reservoir. Flow through syphon pipe.
- x) Hydraulic transmission of power-flow through nozzle at the end of a pipe line-diameter of nozzle for Max H.P. available. Water hammer and its effect. Laminar and turbulent flow in pipes-Critical velocity and Reynold number.
- xi) Impact of jets: Formulae for the force of jet on a fixed vertical flat plate, fixed inclined flat plates, moving flat plates, series of flat plates fixed on the rim of a wheel. Force of jet striking at the centre and at the top of a fixed curved blade and moving curved blade, velocity triangles. Work done, power and efficiency in the above cases. Simple problems. Water turbines: Introduction to water turbines. Use of water turbines in Hydroelectric power stations line sketch showing layout of hydro-electric power plant with head race, dam, sluice gate, pen stock turbine, generator and tail race. Classification of turbines - impulse and reaction turbines brief sub-classification of axial, radial and tangential flow type. Pelton wheel, Francis turbine and Kaplan turbine, power and efficiency of turbines.
- xii) Centrifugal pump: Installation, mountings and other accessories. Priming of centrifugal pump. Efficiency, cavitation. Simple problems on work, power and efficiency

3. Water Supply Engineering

Sources of water: surface and sub-surface water, aquifers, yield from wells, Infiltration galleries, types of intakes and design of intakes, collection and conveyance of water; water demand and its variations, estimation of water demand; quality of water, characteristics, water-borne diseases, water sampling and analysis, water quality standards;

Water Treatment: unit operations and processes for water treatment, sedimentation, coagulation and flocculation, filtration, disinfection, water softening, removal of colour, iron and manganese; aeration, Defluoridation of water, demineralisation of water, R.O. process, principles and design of various water treatment units;

Distribution of treated water, systems of water distribution, layouts of distribution systems, components of distribution systems, valves, analysis and design of the water distribution systems, Storage and distribution reservoirs; leakages and control in water distribution system; Rural water supply;

4.(i) Wastewater Engineering

Systems of sewage collection, conveyance, and disposal; estimation of quantity of sewage and storm water, sewerage systems, sewer appurtenances, material for sewers, laying of sewers, Design of sewers, operation and maintenance of sewerage systems; pumping of sewage; Characteristics of sewage, sampling and analysis of sewage, unit operations and process for wastewater treatment, aerobic, anaerobic, facultative and anoixic processes, principles and design of various wastewater