

**Syllabus for the posts of Assistant Engineer (Civil, Mechanical & Electrical)
in Irrigation Department, Haryana**

Syllabus - AE Civil Engineering

- (i) Building Materials and Construction- Stones, Timber, Bricks, Cement, Mortar, Concrete, Masonry, Steel.
- (ii) Solid Mechanics- Stresses, Strains, Failures, Theories of Solid Material, Simple Bending and Torsion Theories, Shear Centre.
- (iii) Graphic Static- Force Polygon, Stress diagram.
- (iv) Structural Analysis - Analysis of trusses and frames, Introduction to plastic Analysis.
- (v) Design of Metal Structure - Working stress and ultimate strength design of simple structures.
- (vi) Design of Concrete and Masonry Structures- Design of masonry walls, working stress design of plain, reinforced and prestressed concrete, ultimate strength design of reinforced and prestressed concrete.
- (vii) Fluid Mechanics, Water Resources Engineering –Open channel and pipe flow. Hydrology Design of canals and hydraulics structures.
- (viii) Soil Mechanics and Foundation Engineering and their general principles. Strength parameters, Earth pressures Theories, Design of Shallow and Deep foundations.
- (ix) Transportation Engineering including Railway Engineering and Surveying, Roads Super-elevation, Ruling gradient pavements, Traffic controls, Design Considerations.
- (x) Environmental Engineering – Water purifications, Sewerage treatment and disposal.
- (xi) Construction Planning and Management – Elements of construction practice. Bar charts, CPM, PERT.

Syllabus - AE Mechanical Engineering

- (i) Thermodynamics: Laws, Properties of ideal gases and vapours, Power Cycles, Gas Power Cycles, Gas Turbine Cycles, Fuels and Combustion.
- (ii) IC Engines: CI and SI engines Detonation, Fuel injection and car-buration. Performance and Testing. Turbojet and Turbo-prop Engines, Rocket Engines, Elementary Knowledge of Nuclear Power Plants and Nuclear Fuels.
- (iii) Steam Boiler, Engines, Nozzles and Steam Turbines Modern boilers, Steam Turbines types Flow of Steam through nozzles. Velocity diagrams for impulse and Reaction Turbines. Efficiencies and Governing.
- (iv) Compressors, Gas Dynamics and Gas Turbines Reciprocating Centrifugal and axial flow compressor. Velocity diagrams, Efficiency and Performance, Effect of Mechanical number on flow, isentropic flow. Normal Shocks and Flow through nozzles Gas Turbine Cycle with multistage compression. Reheating and Regeneration.

- (v) Heat Transfer, Refrigeration and Air-conditioning, Conduction, Convection and Radiation, Heat exchangers, types, combined Heat Transfer, Overall Heat Transfer coefficient, Refrigeration and heat pump cycles. Refrigeration systems. Coefficient of performance. Psychometrics and psychometric chart, Comfort indices, Cooling and dehumidification methods. Industrial-Air-conditioning Process. Cooling and heating loads calculations.
- (vi) Properties and classification of fluid. Fluid statics, kinematics and dynamics; principles and applications. Manometry and Buoyancy. Flow of ideal fluids. Laminar and turbulent flows, Boundary layer theory. Flow over immersed bodies. Flow through pipes and open channels. Dimensional analysis and similitude technique. Non-dimensional specific speed and classification of fluid mechanics in general. Energy transfer relation performance and operation of pumps and of impulse and reaction water turbines. Hydrodynamic power transmission.
- (vii) Theory of Machines: Velocity and acceleration (i) of moving bodies (ii) in machines. Klein's construction, Inertia forces in machines. Cams, Gears and Gearing. Fly wheels and Governors, Balancing of Rotating and Re-ciprocating masses. Free and forced vibrations of systems. Critical speeds and whirling of shafts.
- (viii) Machine Design: Design of Joints- Treaded fasteners and Power Screws-Keys, Cotter Coupling-Welded Joints. Transmission system-Belt and chain drives-wire ropes-shafts. Gears- *Sprocket and Rolling bearings.
- (ix) Strength of Materials : Stress and strain in two dimensions; Mohr's circles: relations between Elastic Constants.
Beams-Bending moments, shearing forces and deflection.
Shafts-combined bending, direct and torsional stresses.
Thick Walled cylinder and spheres under Pressure, Springs Struts and columns, Theories of failure.
- (x) Engineering Materials; Alloys and Alloying Materials, heat treatment; Composition, properties and uses, Plastics and other newer engineering materials.
- (xi) Production Engineering: Metal Machinery: Cutting Tools: Tool Materials, Wear and Machinability, measurement of cutting forces.
Process: Machining Grinding, Boring, Gear, Manufacturing, Metal forming, Metal Casting and joining, Basic, Special Purpose, Programme and numerically controlled machine tools, Jigs and fixtures (locating elements).
- (xii) Industrial Engineering: Work study and work measurement Wage incentive, Design of Production System and Product Cost, Principles of Plant layout.
- (xiii) Production Planning and Control Material handling, Operations Research, Linear Programming queuing Theory, Value Engineering, Network Analysis CPM and PERT. Use of computers

Syllabus - AE Electrical Engineering

- (i) Electrical Circuits: Network theorems, Response of network to step, ramp, impulse and sinusoidal inputs. Frequency domain analysis. Two port networks, elements of network synthesis. Signal-flow graphs.
- (ii) EM Theory: Electrostatics: Magnetostatics using vector methods. Fields in dielectrics in conductors and in magnetic materials. Time varying fields, Maxwell's equations. Planewave propagation in conducting & dielectric media, properties of Transmission lines.
- (iii) Material Science (Electric Materials): Band Theory. Behaviour of dielectrics in static and alternating fields. Piezoelectricity. Conductivity of Metals. Super conductivity, Magnetic Properties of materials. Ferro and ferri-magnetism. Conduction in Semiconductors, Hall effect.
- (iv) Electrical Measurements: Principles of Measurement. Bridge measurement of Circuit parameters Measuring Instruments. VTVM and CRO, Q-Meter, Spectrum analyser. Transducers and measurement of non-electrical quantities, Digital measurements, telemetering data recording and display.
- (v) Elements of Computation: Digital system, algorithms, flow-charting, Storage: Type statements, array storage, Arithmetic expression, logical expressions. Assignments statements, Programme structure, Scientific and Engineering applications.
- (vi) Power Apparatus and Systems: Electromechanics: Principles of electro-mechanical energy conversion. Analysis of DC, synchronous and Induction Machines. Fractional horse-power motors. Machines in Control Systems. Transformers, Magnetic circuits and Selection of motor for drives. Power System: Power generation; Thermal, Hydro and Nuclear Power Transmissions, Coroma, Bundle conductors, Power System Protection. Economic operations, Load frequency-control, stability analysis.
- (vii) Control Systems: Open-loop and closed loop systems, Response analysis, Root-locus technique, stability, compensation and design techniques. State-variable approach.
- (viii) Electronics and Communications: Electronics: Solid state devices and circuits. Small signal amplifier design. Feedback amplifiers, Oscillators and operational amplifiers, FET circuits and linear ICs. Switching circuits Boolean algebra, Logic circuits, Combinational and sequential digital circuits. Communications: Signal analysis. Transmission of signals. Modulation and Detection. Various types of communication systems. Performance of communication systems.