

## SCHEDULE – I

### Clause No

#### I GENERAL STUDIES (COMPULSORY FOR ALL GRADE/POSTS/BRANCHES)

**TOTAL MARKS – 100**  
Duration of examination – 1 hour

**The break up of marks on various topics will be as follows:-**

<u>Topic</u>	<u>Marks</u>
<b>i) Comprehension of a given passage</b>	20
<b>ii) Usage (corrections)</b>	10
<b>iii) Vocabulary (synonyms &amp; antonyms, idioms &amp; phrases)</b>	10
<b>iv) General knowledge</b>	20
(Questions will include knowledge of Indian and geography of such a nature which the candidates should be able to answer without any special study. Questions on Tripura, its historical topography will also be included.)	
<b>v) Current Affairs</b>	20
(The questions will include knowledge of Indian current events and of such matters of every day observation and experience in their scientific aspects as may be expected of an educated person who has not made a special study of any scientific subject.)	
<b>vi) Mental Ability.</b>	20
<b>Total</b>	<b>100</b>

#### II. ENGINEERING SUBJECT PAPER – I & II(OPTIONAL FOR ALL GRADES /RANCHES)

**TOTAL MARKS – 200(each paper)**  
Duration of examination – 3 hour

The break up of marks will be as follows:

<u>Topic</u>	<u>Marks</u>
<b>i) 15 questions of 6 marks each having answers restricted to 40 words</b>	90
<b>ii) 40 multiple choice type questions of 2 marks each</b>	80
<b>iii) 05 numerical questions of 6 marks each</b>	30
<b>Total</b>	<b>200</b>

## **SCHEDULE-II**

### **SYLLABUS FOR GRADE IV/ ASSISTANT ENGINEER**

#### **CIVIL ENGINEERING PAPER - I**

**TOTAL MARKS – 200**

**DURATION OF EXAMINATION – 3 HOURS**

#### **1. BUILDING MATERIALS**

**Timber :** Different types and species of structural timber, density-moisture relationship, strength in different directions, defects, influence of defects on permissible stress, preservation, dry and wet rots, codal provisions for design, Plywood.

**Bricks:** Types, Indian Standard classification, absorption, saturation factor, strength in masonry, influence of mortar strength on masonry strength.

**Cement:** Compounds of, different types, setting times, strength.

**Cement Mortar:** Ingredients, proportions, water demand, mortars for plastering and masonry.

**Concrete:** Importance of W/C Ratio, Strength, ingredients including admixtures, workability, testing for strength, elasticity, non-destructive testing, mix design methods.

#### **2. SOLID MECHANICS**

Elastic constants, stress, plane stress, Mohr's circle of stress, strains, plane strain, Mohr's circle of strain, combined stress; Elastic theories of failure; Simple bending, shear; Torsion of circular and rectangular sections and simple members.

#### **3. DESIGN OF STEEL STRUCTURES**

Principles of working stress method. Design of connections, simple members, Built-up sections and frames, Design of Industrial roofs. Principles of ultimate load design. Design of simple members and frames.

#### **4. DESIGN OF CONCRETE AND MASONRY STRUCTURES**

Limit state design for bending, shear, axial compression and combined forces. Codal provisions for slabs, beams, walls and footings. Working stress method of design of R.C. members.

Principles of prestressed concrete design, materials, methods of pre stressing, losses. Design of simple members and determinate structures. Introductions to prestressing of indeterminate structures.

Design of brick masonry as per I.S. Codes.

#### **5. CONSTRUCTION PRACTICES, PLANNING AND MANAGEMENT**

**Concreting Equipment:** Weight Batcher, Mixer, vibrator, batching plant, concrete pump. Cranes, hoists, lifting equipment.

**Earthwork Equipment:** Power shovel, hoe, dozer, dumper, trailers and tractor, rollers, sheep foot rollers, pumps.

**Construction, Planning and Management:** Bar chart, linked bar chart, work-break down structures, Activity-on - arrow diagrams. Critical path, probabilistic activity durations; Event-based networks.

**PERT network:** Time-cost study, crashing; Resource allocation.

**CIVIL ENGINEERING  
PAPER - II**

**TOTAL MARKS - 200  
Duration of Examination – 3 Hours**

**1. (a) FLUID MECHANICS, OPEN CHANNEL FLOW, PIPE FLOW:**

Fluid Properties, Pressure, Thrust, Buoyancy; Flow Kinematics; Integration of flow equations; Flow measurement; Relative motion; Moment of momentum; Viscosity, Boundary layer and Control, Drag, Lift; dimensional Analysis, Modeling; Cavitation; Flow oscillations; Momentum and Energy principles in Open channel flow, Flow controls, Hydraulic jump, Flow sections and properties; Normal flow, Gradually varied flow; Surges; Flow development and losses in pipe flows, Measurements; Siphons; Surges and Water hammer; Delivery of Power Pipe networks.

**(b) HYDRAULIC MACHINES AND HYDROPOWER:**

Centrifugal pumps, types, performance parameters, scaling, pumps in parallel; Reciprocating pumps, air vessels, performance parameters; Hydraulic ram; Hydraulic turbines, types, performance parameters, controls, choice; Power house, classification and layout, storage, pondage, control of supply.

**2. (a) HYDROLOGY:**

Hydrological cycle, precipitation and related data analyses, PMP, unit and synthetic hydrographs; Evaporation and transpiration; Floods and their management, PMF; Streams and their gauging; River morphology; Routing of floods; Capacity of Reservoirs.

**(b) WATER RESOURCES ENGINEERING:**

Multipurpose uses of Water: Soil-Plant-Water relationships, irrigation systems, water demand assessment; Storages and their yields, ground water yield and well hydraulics; Water logging, drainage design; Irrigation revenue; Design of rigid boundary canals, lining of canals; Sediment transport in canals; Non-Overflow and overflow sections of gravity dams and their design, Energy dissipaters and tail water rating; Design of head works, distribution works, falls, cross-drainage works, outlets; River training.

**3. ENVIRONMENTAL ENGINEERING**

**(a) WATER SUPPLY ENGINEERING:**

Sources of supply, yields, design of intakes and conductors; Estimation of demand; Water quality standards; Control of Water-borne diseases; Primary and secondary treatment, detailing and maintenance of treatment units; Conveyance and distribution systems of treated water, leakages and control; Rural water supply; Institutional and industrial water supply.

**(b) WASTE WATER ENGINEERING:**

Urban rain water disposal; Systems of sewage collection and disposal; Design of sewers and sewerage systems; pumping; Characteristics of sewage and its treatment, Disposal of products of sewage treatment, stream flow . Plumbing Systems, Rural and semi-urban sanitation.

**(c) SOLID WASTE MANAGEMENT:**

Sources, classification, collection and disposal; Design and Management of landfills

**4 (a) SOIL MECHANICS:**

Properties of soils, classification and interrelationship; Compaction behavior, methods of compaction and their choice; Permeability and seepage, flow nets, Inverted filters; Compressibility and consolidation; Shearing resistance, stresses and failure; soil testing in laboratory and in-situ; Stress path and applications; Earth pressure theories, stress distribution in soil; soil exploration, samplers, load tests, penetration tests.

**(b) FOUNDATION ENGINEERING:**

Types of foundations, Selection criteria, bearing capacity, settlement, laboratory and field tests; Types of piles and their design and layout, Foundations on expansive soils, swelling and its prevention, foundation on swelling soils.

**5. (a) SURVEYING:**

Classification of surveys, scales, accuracy; Measurement of distances - direct and indirect methods; optical and electronic devices; Measurement of directions, prismatic compass, local attraction; Theodolites - types; Measurement of elevations - Spirit and trigonometric leveling; Relief representation; Contours; Digital elevation modeling concept; Establishment of control by triangulations and traversing - measurements and adjustment of observations, computation of coordinates; Field astronomy, Concept of global positioning system; Map preparation by plane tabling and by photogrammetry; Remote sensing concepts, map substitutes.

**(b) TRANSPORTATION ENGINEERING:**

Planning of highway systems, alignment and geometric design, horizontal and vertical curves, grade separation; Materials and construction methods for different surfaces and maintenance; Principles of pavement design; Drainage.

Traffic surveys, Intersections, signaling; Mass transit systems, accessibility, networking.

**MECHANICAL ENGINEERING  
PAPER – I**

**TOTAL MARKS - 200  
Duration of Examination – 3 Hours**

**1. STRENGTH OF MATERIALS:**

Stress and strain in two dimensions, Principal stresses and strains, Mohr's construction, linear elastic materials, isotropy and anisotropy, stress-strain relations, uniaxial loading, thermal stresses. Beams: Bending moment and shear force diagram, bending stresses and deflection of beams. Shear stress distribution. . Torsion of shafts, helical springs. Combined stresses, thick-and thin-walled pressure vessels. Struts and columns. Strain energy concepts and theories of failure.

**2. FLUID MECHANICS.**

Properties and classification of fluids, Manometer, forces on immersed surfaces, Center of pressure, Buoyancy, Elements of stability of floating bodies. Kinematics and Dynamics. Irrotational and incompressible. Inviscid flow. Velocity potential, Pressure field and Forces on immersed bodies. Bernoulli's equation, fully developed flow through pipes, Pressure drop calculations, Measurement of flow rate and Pressure drop. Integral approach, Laminar and turbulent flows, Separations. Flow over weirs and notches. Open channel flow, Hydraulic jump. Dimensionless numbers, Similitude and modelling. One-dimensional isentropic flow, Normal shock wave, Flow through convergent - divergent ducts, Oblique shock-wave.

**3. THEORY OF MACHINES:**

Cams. Gears and gear trains. Flywheels. Governors. Balancing of rigid rotors and field balancing. Balancing of single and multicylinder engines. Critical speeds and whirling of shafts Automatic controls.

**4. MACHINE DESIGN :**

**Design of Joints:** Cotters, keys, Splines, Welded joints, Threaded fasteners, joints formed by interference fits. Design of friction drives: couplings and clutches, belt and chain drives, power screws.

**Design of Power transmission Systems:** gears and gear drives shaft and axle, wire ropes.

**Design of Bearings:** hydrodynamics bearings and rolling element bearings.

**5. FLUID MACHINERY AND STEAM GENERATORS:**

Performance, Operation and control of hydraulic Pump, impulse and reaction Turbines, Specific speed, Classification. Energy transfer, Coupling, Power transmission, Steam generators, Fire-tube and water-tube boilers. Flow of steam through Nozzles and Diffusers, Wetness and condensation. Various types of steam and gas Turbines. Partial admission. Reciprocating, Centrifugal and axial flow Compressors, Multistage compression, role of Mach Number, Reheat, Regeneration, Efficiency, Governance.

**MECHANICAL ENGINEERING  
PAPER –II**

**TOTAL MARKS –200  
Duration of Examination – 3 Hours**

**1. THERMODYNAMICS:**

Cycles and IC Engines, Basic concepts, Open and Closed systems. Heat and work. Zeroth, First and Second Law, Application to non-Flow and Flow processes. Entropy, Availability. Properties of ideal gases and vapours. Standard vapour, Gas power and Refrigeration cycles. Two stage compressor. C-I and S.I. Engines. Pre-ignition, Detonation and Diesel-knock, Fuel injection and Carburetion, Supercharging. Turbo-prop and Rocket engines, Engine Cooling, Emission & Control. Measurement of Calorific values. Conventional and Nuclear fuels, Elements of Nuclear power production.

**2. HEAT TRANSFER, REFRIGERATION AND AIR-CONDITIONING:**

Modes of heat transfer. One dimensional steady and unsteady conduction. Composite slab and Equivalent Resistance. Heat dissipation from extended surfaces, Heat exchangers, Overall heat transfer coefficient, Empirical correlations for heat transfer in laminar and turbulent flows and for free and forced Convection, Thermal boundary layer over a flat plate. Fundamentals of diffusive and connective mass transfer, Black body and basic concepts in Radiation, Enclosure theory, Shape factor.. Heat pump and Refrigeration cycles and systems, Refrigerants. Condensers, Evaporates and Expansion devices, Psychrometry, Charts and application to air conditioning, Sensible heating and cooling, Effective temperature, comfort indices, Load calculations, Solar refrigeration, controls, Duct design.

**3. ENGINEERING MATERIALS:**

Basic concepts on structure of solids. Crystalline materials. Defects in crystalline materials. Alloys and binary phase diagrams. Structure and properties of common engineering materials. Heat treatment of steels. Plastics, Ceramics and composite materials. Common applications of various materials.

**4. INDUSTRIAL ENGINEERING:**

**Production Planning and Control:** Forecasting - Moving average, exponential smoothing, Operations, scheduling; assembly line balancing, Product development, Break-even analysis, Capacity planning, PERT and CPM.

**Control Operations:** Inventory control ABC analysis, EOQ model, Materials requirement planning. Job design, Job standards, Work measurement, Quality Management - Quality analysis and control.

**Operations Research:** Linear Programming - Graphical and Simplex methods, Transportation and assignment models.

**Value Engineering:** Value analysis for cost/value.