SYLLABUS FOR RECRUITMENT TO THE POSTS OF JUNIOR ENGINEERING UNDER IRRIGATION & WATER RESOURCES DEPARTMENT, GOVT OF MIZORAM

The examination shall comprise of the following papers:

1)	Paper – I : General English	:	100 Marks (3 hours)
2)	Paper – II : General Knowledge (MCQ)	:	100 Marks (2 hours)
3)	Paper – III : Technical Subject (MCQ)	:	200 Marks (2 hours)
4)	Paper – IV : Technical Subject (MCQ)	:	200 Marks (2 hours)
	Total of Written Examination	:	600 Marks
5)	Personal Interview	:	80 Marks
	Total	**:**	**680 Marks**

DETAILED SYLLABUS:

1) PAPER – I : General English: 100 Marks (3 hours)

a) Précis Writing	:	10 marks
b) Letter Writing	:	15 marks
c) Comprehension of given passages	:	15 marks
d) Grammar: Parts of Speech	:	20 marks
e) Correct Usage and Vocabularies	:	20 marks
f) Formation of Sentence	:	20 marks

2) PAPER – II : General Knowledge (MCQ): 100 Marks (2 hours)

(a) Current events of state, national and international importance	:	12 marks
(b) History of India and Indian National Movement	:	12 marks
(c) Indian and World Geography - Physical, Social, Economic Geography of India and the World	:	12 marks
(d) Indian Polity and Governance - Constitution, Political System, Public Policy, Duties & Rights Issues	:	12 marks
(e) Economic and Social Development Sustainable Development, Poverty, Inclusion, Demographics, Social Sector initiatives, and other related issues	:	12 marks
(f) General issues on Environmental Ecology, Bio-diversity and Climate	:	12 marks
(g) General Science	:	12 marks

The topics listed above shall cover the State of Mizoram wherever applicable.

(h) General awareness on Mizo culture, its heritage and society	:	16 marks

Paper – III: Technical Subject (MCQ): 200 Marks (2 hours)

1. IRRIGATION: 70 marks

- Definition of Irrigation:
  - Explanation of irrigation and its purpose.
  - Role in agriculture and water management.
- Necessity of Irrigation:
  - Importance of irrigation in agriculture.
  - Benefits to crop yield and quality.
  - Impact on food security and rural development.
- Types of Irrigation:
  - Surface irrigation, sub-surface irrigation, sprinkler irrigation, drip irrigation.
  - Advantages and disadvantages of each type.
- Sources of Irrigation Water:
  - Rivers, lakes, wells, reservoirs, and rainwater harvesting.
  - Importance of sustainable water resource management.
- Irrigation Canals:
  - Definition and importance.
  - Structure and components of irrigation canals.
- Perennial Irrigation:
  - Definition and benefits.
  - Comparison with other irrigation methods.
- Different Parts of Irrigation Canals and Their Functions:
  - Main canal, branch canal, distributary, minor canal.
  - Functions and importance of each part.
- Classification of Canals According to Their Alignment:
  - Different types of canal alignments.
  - Factors influencing canal alignment.
- Design of Irrigation Canals:
  - Chezy's Formula: Use in canal design and calculation.
  - Manning's Formula: Application in designing canals, calculation of flow parameters.
  - Kennedy's Silt Theory and Equation: Importance in sediment management.
  - Lacey's Silt Theory and Equation: Use in stable channel design.
  - Critical Velocity Ratio: Definition and application in canal design.
- Various Types of Canal Lining:
  - Different materials used for canal lining.
  - Advantages: Reduced seepage, increased efficiency.
  - Disadvantages: Cost, maintenance.
- Simple Numerical Problems:
  - Solving problems related to canal design using the above formulas.

2. AGRICULTURE FIELD DRAINAGE: 30 marks

- Definition of Drainage:
  - Explanation of agricultural field drainage.
  - Importance in maintaining soil health and crop productivity.
- Water Logging:
  - Definition and understanding of water logging.
  - Types and causes of water logging in agricultural fields.
- Causes and Effects of Water Logging:
  - Natural and anthropogenic causes.
  - Effects on soil health, crop yield, and overall agricultural productivity.
- Detection of Water Logging:
  - Methods to identify and assess water-logged areas.
  - Use of modern techniques (e.g., remote sensing, soil moisture sensors).
- Prevention and Remedies:
  - Techniques to prevent water logging (e.g., proper irrigation practices, soil management).
  - Remedial measures (e.g., drainage systems, crop rotation, soil amendment).
- Surface Drains:
  - Definition and types of surface drainage systems.
  - Design and layout of surface drains.
  - Benefits and limitations.
- Sub-surface Drains:
  - Definition and types of sub-surface drainage systems.
  - Design and layout of sub-surface drains.
  - Benefits and limitations.
- Layout of Drains:
  - Planning and designing effective drainage systems.
  - Factors affecting the layout of drainage systems.
  - Maintenance of drainage systems.

3 SURVEYING AND LEVELLING (Theory): 30 marks

- Concept:
  - Definition and purpose of surveying and levelling.
  - Importance in civil engineering and infrastructure development.
- Terms:
  - Key terms and definitions used in surveying and levelling (e.g., benchmark, datum, back sight, fore sight, etc.).
- Classifications:
  - Different types of surveying (e.g., plane surveying, geodetic surveying).
  - Types of levelling (e.g., simple levelling, differential levelling, profile levelling).
- Aims of Surveying and Levelling:
  - Objectives and goals of conducting surveys and levelling.
  - Applications in planning, design, and construction.
- Plane Table Surveying:
  - Equipment and methods used in plane table surveying.
  - Procedures for conducting plane table surveys.
  - Advantages and limitations.
- Contouring:
  - Definition and importance of contours in surveying.
  - Methods of contouring (e.g., direct method, indirect method).
  - Uses of contour maps in engineering projects.
- Principles of Theodolite Surveying & Traversing:
  - Components and functions of a theodolite.
  - Procedures for theodolite surveying.
  - Traversing techniques and their applications.
  - Adjustments and error corrections in traversing.
- Modern Surveying Methods:
  - Introduction to modern surveying techniques (e.g., total station, GPS, GIS).
  - Applications and advantages of modern methods.
  - Comparison with traditional surveying methods.

4. HYDROLOGY: **30 marks**

- Definition of Hydrology:
  - Study of the movement, distribution, and quality of water on Earth.
  - Importance in water resource management and planning.
- Rainfall:
  - Types of rainfall (convective, orographic, frontal).
  - Measurement and analysis of rainfall data.
- Effective Rainfall and Run-off:
  - Definition and factors affecting effective rainfall.
  - Calculation and significance of run-off in hydrology.
- Catchment Area:
  - Definition and importance.
  - Methods of delineating catchment areas.
  - Impact on water resource planning and management.
- Relationship (between Rainfall, Run-off, and Catchment Area):
  - Understanding the hydrological balance.
  - Factors influencing the relationship.
- Dicken's and Ryve's Formulae:
  - Applications in estimating peak discharge.
  - Understanding and using formulas in hydrological calculations.
- Stream Gauging:
  - Techniques and importance of stream gauging.
  - Methods to measure streamflow and discharge.
- Types of Rain Gauges:
  - Different types (non-recording, recording, tipping bucket, weighing type, etc.).
  - Uses and maintenance of rain gauges.
- Importance of Hydrology:
  - Role in flood control, irrigation planning, water supply management.
  - Environmental and societal impacts.
- Hydrological Cycle:
  - Components and processes (evaporation, condensation, precipitation, infiltration, etc.).
  - Importance in maintaining water balance on Earth.
- Concept of Hydrograph:
  - Definition and components of a hydrograph.
  - Uses in analyzing streamflow and designing hydraulic structures.
- Groundwater Hydrology:
  - Basics of groundwater occurrence and movement.
  - Importance of groundwater in overall water resource management.
  - Methods to assess and manage groundwater resources.

5. WATER REQUIREMENT OF CROPS: **40 marks**

- Concept of Crop Water Requirement:
  - Understanding the total water needed for a crop during its growing season.
  - Factors affecting crop water requirement (climate, crop type, soil type, etc.).
- Field Irrigation Requirement:
  - Definition and importance.
  - Methods to determine field irrigation requirement.
  - Efficiency of different irrigation methods (surface, sprinkler, drip irrigation).
- Crop Season:
  - Definition and importance.
  - Different crop seasons (Kharif, Rabi, Zaid) and their water requirements.
- Duty, Delta, and Base Period:
  - Duty: The area of land that can be irrigated with a unit volume of water.
  - Delta: The depth of water required to mature the crop.
  - Base Period: The time period from the first watering to the last watering for a crop.
  - Relationship among Duty, Delta, and Base Period.
- Gross Command Area (GCA):
  - Definition and importance.
  - Calculation and management of GCA.
- Culturable Command Area (CCA):
  - Definition and differentiation from GCA.
  - Calculation and utilization in irrigation planning.
- Intensity of Irrigation:
  - Concept and importance.
  - Calculation and factors affecting the intensity of irrigation.
- Simple Numerical Problems:
  - Solving problems related to Duty, Delta, Base Period, GCA, CCA, and Intensity of Irrigation.

Paper – IV: Technical Subject (MCQ): 200 Marks (2 hours)

1. HYDRAULICS STRUCTURES: 60 marks

- Definition, Necessity & Objective:
  - Explanation of hydraulic structures.
  - Importance and objectives in water resource management.
- General Layout:
  - Components and design considerations of hydraulic structures.
  - Layout planning for efficient water flow and management.
- Functions of Different Parts of a Barrage:
  - Detailed functions of piers, gates, sluices, energy dissipaters, etc.
  - Operational significance of each part.
- Difference Between Weir and Barrage:
  - Structural and functional differences.
  - Advantages and limitations of each.
- Definition of Regulatory Work & Types of Their Functions:
  - Explanation of regulatory works
  - Types and purposes of regulatory structures.
- Cross and Head Regulators:
  - Functions and importance in irrigation systems.
  - Design and operational aspects.
- Falls:
  - Purpose and types of falls in irrigation canals.
  - Design principles and energy dissipation methods.
- Energy Dissipaters:
  - Necessity for energy dissipation in hydraulic structures.
  - Types and design of energy dissipaters.
- Outlets – Different Types:
  - Various types of water outlets (e.g., orifice, sluice, pipe outlets).
  - Applications and design considerations.
- Escapes:
  - Definition and necessity.
  - Types and functions of escape structures in irrigation systems.
- Definition, Functions, and Necessity of Aqueduct, Siphon, Super-passage, Level Crossing, Inlet and Outlet:
  - Detailed explanation of each structure.
  - Importance and design considerations.
- Constructional Details:
  - Materials and methods used in constructing hydraulic structures.
  - Durability and maintenance aspects.

- Dam Classification:
  - Types of dams: Earthen, masonry, concrete.
  - Importance and applications of each type.
- Earthen Dams:
  - Types, necessity, and advantages.
  - Causes of failure and protection measures.
- Masonry and Concrete Dams:
  - Structural features and construction techniques.
  - Forces acting on the dam and stress analysis at the base.
- Spillways:
  - Types and functions of spillways.
  - Design considerations for effective flood control.
- River Training Works:
  - Purpose and methods of river training.
  - Techniques to control and manage river flow.

2. CONCRETE TECHNOLOGY: **40 marks**

- Concrete as Construction Material:
  - Introduction to concrete and its importance in construction.
  - Composition and properties.
- Cement:
  - Types of cement and their properties.
  - Manufacturing process.
  - Tests for quality assurance.
- Aggregates:
  - Types of aggregates (fine and coarse).
  - Properties and grading.
  - Importance in concrete mix.
- Water:
  - Role of water in concrete.
  - Quality requirements for mixing and curing.
  - Water-cement ratio.
- Admixtures:
  - Types and functions of admixtures.
  - Impact on concrete properties and performance.
- Properties of Hardened Concrete:
  - Strength (compressive, tensile, flexural).
  - Durability and permeability.
  - Shrinkage and creep.
  - Thermal properties.

- Proportioning of Concrete Mixes:
  - Principles of mix design.
  - Methods of mix proportioning (nominal mix, design mix).
  - Factors affecting mix design.
- Production of Concrete:
  - Batching, mixing, and transporting.
  - Placing, compacting, and curing.
  - Equipment and methods used.
- Special Concrete:
  - Types of special concrete (e.g., high-strength, lightweight, self-compacting, fiber-reinforced).
  - Applications and properties.
- Quality and Control of Concrete:
  - Standards and specifications.
  - Quality control tests (slump test, compressive strength test, etc.).
  - Factors affecting quality and methods to ensure it.
- Repair & Rehabilitation Technology for Concrete Structures:
  - Common defects and deterioration in concrete structures.
  - Techniques for repair and strengthening.
  - Materials and methods used in rehabilitation.

MECHANICS OF MATERIALS: **30 marks**

- Stress-Strain Diagram:
  - Understanding of stress-strain curves for different materials.
  - Elastic and plastic behavior, yield point, ultimate strength, and fracture.
- Stress Strain Relations:
  - Hooke's Law and modulus of elasticity.
  - Poisson's ratio and volumetric strain.
  - Relationship between stress and strain for different loading conditions.
- Complex Stresses and Strain:
  - Analysis of biaxial and triaxial stress states.
  - Principal stresses and strains.
  - Mohr's circle for stress and strain analysis.
- Analysis of Beams:
  - Types of beams and loading conditions.
  - Shear force and bending moment diagrams.
  - Calculation of bending stresses and shear stresses in beams.
- Torsion:
  - Torsional stress and strain in circular shafts.
  - Angle of twist and power transmission.
  - Torsion of non-circular shafts and thin-walled tubes.
- Columns & Struts:
  - Buckling of columns under axial load.
  - Euler's formula for long columns.
  - Rankine's formula for short columns and intermediate length columns.
- Slope and Deflection of Beams:
  - Calculation of slope and deflection using various methods (double integration method, Macaulay's method, moment area method).
  - Importance in the design and analysis of structural elements.

ESTIMATING & COSTING: **40 marks**

- Concept of Estimating:
  - Definition and purpose of estimating.
  - Types of estimates (preliminary, detailed, revised, supplementary).
- Method of Measurement:
  - Standard methods of measurement for various construction works.
  - Units of measurement for different materials and activities.
- Calculating Quantities:
  - Techniques for calculating quantities of materials and labor.
  - Preparation of quantity take-offs and bill of quantities.
- Estimating of Earth Work:
  - Methods for estimating earthwork volumes (cutting, filling).
  - Use of cross-sections and contour plans in earthwork estimation.
- Road Work:
  - Estimation of quantities for road construction (pavement, sub-base, base course).
  - Calculation of materials for different layers and components.
- Concrete Works:
  - Estimation of quantities for concrete mix, formwork, and reinforcement.
  - Calculation of concrete volumes for foundations, beams, slabs, columns.
- Flooring and Finishing:
  - Estimation of materials and labor for flooring works (tiles, marble, terrazzo).
  - Calculation for plastering, painting, and other finishing works.
- Steel & Timber Work:
  - Estimation of steel reinforcement for RCC works.
  - Calculation of quantities for timber structures (trusses, frames).
- Estimating, Abstracting, and Billing of Complete Items of Works:
  - Preparation of detailed estimates for complete projects.
  - Abstracting quantities and preparing bills of quantities.
  - Billing procedures and documentation.
- Cost Analysis:
  - Analysis of rates for various construction activities.
  - Factors affecting cost and methods for cost control.
- General and Detailed Specification:
  - Understanding specifications for materials and workmanship.
  - Writing detailed specifications for different items of work.

5. GEO-TECHNICAL ENGINEERING: 30 marks

- Classification of Soils:
  - Different soil classification systems (e.g., Unified Soil Classification System, AASHTO).
  - Soil types and their properties.
- Soil Structures:
  - Understanding of soil structure (e.g., granular, cohesive).
  - Formation and characteristics of different soil structures.
- Soil Mass & Fundamental Concepts and Principles:
  - Soil as a three-phase system.
  - Concepts of void ratio, porosity, degree of saturation, and unit weight.
- Index Properties:
  - Determination of index properties such as specific gravity, moisture content, Atterberg limits.
  - Importance in soil classification and behavior prediction.
- Permeability:
  - Darcy's Law and coefficient of permeability.
  - Laboratory and field methods for determining permeability.
- Seepage Analysis:
  - Principles of seepage and flow nets.
  - Application of seepage analysis in engineering problems.
- Compaction:
  - Importance of soil compaction in engineering.
  - Standard and modified Proctor tests.
  - Factors affecting compaction and field compaction methods.
- Consolidation:
  - Concept of consolidation and consolidation settlement.
  - Terzaghi's one-dimensional consolidation theory.
  - Laboratory methods for determining consolidation parameters.
- CBR Method:
  - California Bearing Ratio (CBR) test procedure and significance.
  - Use of CBR values in pavement design.
- Shear Strength:
  - Mohr-Coulomb failure criterion.
  - Laboratory and field methods for determining shear strength.
  - Importance in slope stability and foundation design.
- Stability of Slopes:
  - Types of slope failures and factors affecting stability.
  - Methods of slope stability analysis.
  - Techniques for improving slope stability.

- Soil Exploration & Site Investigation:
  - Objectives and methods of soil exploration.
  - Types of site investigation (preliminary, detailed).
  - Techniques for sampling and in-situ testing.
- Foundation Engineering:
  - Types of foundations (shallow and deep).
  - Bearing capacity and settlement analysis.
  - Design principles for different types of foundations.