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NOTIFICATION

No. A. 34011/25/2016-P&AR(GSW), the 06th December, 2021. In exercise of the powers conferred by rule 21 of the Mizoram Engineering Service Rules, 2013 as amended from time to time, the State Government, in consultation with the Mizoram Public Service Commission, hereby makes the following regulations, namely:-

1. Short title and commencement.-
   1) These regulations may be called the Mizoram Engineering Service (Departmental Examination) Regulations, 2021.
   2) They shall come into force with effect from the date of its publication in the Official Gazette.

2. Definitions.-
   1) In these regulations, unless the context otherwise requires,
      a) "Commission" means the Mizoram Public Service Commission
      b) "Constitution" means the Constitution of India
      c) "Departmental Examination" means the written examination conducted by the Commission for officers in the Junior Grade of Mizoram Engineering Service and Junior Engineer/Draftsman-I in the feeder grade for promotion to Junior Grade of Mizoram Engineering Service
      d) "Government" means the Government of Mizoram
      e) "Governor" means the Governor of Mizoram
   2) All other words and expressions used in these regulations and not defined shall have the same meanings respectively assigned to them in the Mizoram Engineering Service Rules, 2013 as amended and the respective recruitment rules for the posts of Junior Engineer/ Draftsman-I under Public Works Department, Power and Electricity Department, Public Health Engineering Department and Irrigation and Water Resources Department.

3. Departmental examination.-
   1) Every officer substantively holding posts in the Junior Grade of Mizoram Engineering Service shall appear at a departmental examination conducted under these regulations and shall be required to pass the minimum standard prescribed under regulation 6 before they are considered for promotion to the Senior Grade of Mizoram Engineering Service.
   2) Every officer substantively holding the post of Junior Engineer/Draftsman-I in the feeder grade for promotion to Junior Grade of Mizoram Engineering Service shall appear at a

Departmental Examination conducted under these regulations and shall be required to pass the minimum standard prescribed under regulation 6 before they are considered for promotion to the Junior Grade of Mizoram Engineering Service.

3) Every officer mentioned in sub-regulation (1) and (2) of regulation 3 who are declared by the Commission to have passed any paper before the commencement of these regulations shall be deemed to have passed such paper under these regulations and need not re-appear in the same paper.
4) The Departmental Examination shall be conducted annually by the Commission in the manner as laid down in these regulations.
5) The dates and the venue on which the departmental examination may be held shall be fixed by the Commission.

4. Syllabi for departmental examination.-
1) The number of papers and the syllabi of the departmental examination for officers substantively holding posts in the Junior Grade of Mizoram Engineering Service for promotion to Senior Grade in all the four cadres of Mizoram Engineering Service viz. Public Works Cadre, Power & Electricity Cadre, Public Health Engineering Cadre and Irrigation and Water Resources Cadre shall be as prescribed in the Schedule-I appended to these regulations.
2) The number of papers and the syllabi of the departmental examination for officers substantively holding the post of Junior Engineer/Draftsman-I in the feeder grade for promotion to the Junior Grade of Mizoram Engineering Service in all the four cadres of Mizoram Engineering Service viz. Public Works Cadre, Power & Electricity Cadre, Public Health Engineering Cadre and Irrigation and Water Resources Cadre shall be as prescribed in the Schedule-II appended to these regulations.
3) The syllabi as referred to in sub-regulation (1) and (2) of regulation 4 may be revised by the Government from time to time in consultation with the concerned Departments.

5. Decision on eligibility.-
The decision of the Commission on the eligibility or otherwise of candidates for admission to the Departmental Examination shall be final and no candidates to whom a certificate of admission has not been issued by the Commission shall be admitted to the said examination.

6. Minimum marks.-
Every officer specified in sub-regulation (1) and (2) of regulation 3 shall be required to obtain a minimum of 40 percent of the total marks in each of the Papers prescribed under regulation 4 for passing the Departmental Examination.

7. Result.-
1) The names of the candidates who are declared to have passed all the papers of the departmental examination shall be published by the Commission in the Notice Board as well as the official website of the Commission, preferably within 3 months from the last date of conduct of the examination.
2) The form and manner of communication of the results of the Departmental Examination to individual candidates shall be as decided by the Commission at its discretion.

8. Penalty.-
A candidate who is or has been declared by the Commission to be guilty of :—

(i) Obtaining support for his candidature by the following means, namely :—
  a) offering illegal gratification to; or
  b) applying pressure on; or
  c) blackmailing, or threatening to blackmail any person connected with the conduct of the examination; or
(ii) impersonation; or
(iii) procuring impersonation by any person; or
(iv) submitting fabricated documents or documents which have been tampered with; or
(v) uploading/pasting irrelevant photos in the application form in place of actual photo/signature.
(vi) making statements which are incorrect or false or suppressing material information; or
(vii) resorting to the following means in connection with his candidature for the examination, namely :—
  a) obtaining copy of question paper through improper means;
  b) finding out the particulars of the persons connected with secret work relating to the examination;
  c) influencing the examiners; or
(viii) being in possession of or using unfair means during the examination; or
(ix) writing obscene matter or drawing obscene sketches or irrelevant matter in the scripts; or
(x) misbehaving in the examination hall including tearing of the scripts, provoking fellow examinees to boycott examination, creating a disorderly scene and the like; or
(xi) harassing or doing bodily harm to the staff employed by the Commission for the conduct of their examination; or
(xii) being in possession of or using any mobile phone, (even in switched off mode), pager or any electronic equipment or programmable device or storage media like pen drive, smart watches etc. or camera or bluetooth devices or any other equipment or related accessories either in working or switched off mode capable of being used as a communication device during the examination; or
(xiii) violating any of the instructions issued to candidates along with their admission certificates permitting them to take the examination; or
(xiv) attempting to commit or, as the case may be, abetting the commission of all or any of the acts specified in the foregoing clauses; may in addition to rendering himself liable to criminal prosecution, be liable :-
  a) to be disqualified by the Commission from the examination for which he is a candidate; and/or
  b) to be debarred either permanently or for a specified period :—
    i) by the Commission, from any examination or selection held by them;
    ii) by the State Government to disciplinary action under appropriate rules.

Provided that no penalty under these regulations shall be imposed except after :—
  i) giving the candidate an opportunity of making such representation in writing as he may wish to make in that behalf; and
  ii) taking the representation, if any, submitted by the candidate within the period allowed to him into consideration.

9. Power to relax.-
Where the State Government is of the opinion that it is necessary or expedient so to do, it may, by order and for reasons to be recorded in writing, in consultation with the Mizoram Public Service Commission through the Department of Personnel and Administrative Reforms, relax any of the provisions of these regulations with respect to any class or category of persons.

10. Interpretation.-
If any doubt arises about the interpretation of any of the provisions of these regulations, it shall be referred to the Government in Personnel & Administrative Reforms Department whose decision thereon shall be final.

K. Lalthawmmawia,
Secretary to the Government of Mizoram,
Department of Personnel & Administrative Reforms.

SCHEDULE-I
(See sub-regulation (1) of regulation 4)

SYLLABI FOR DEPARTMENTAL EXAMINATION IN RESPECT OF OFFICERS IN THE JUNIOR GRADE OF MIZORAM ENGINEERING SERVICE

PUBLIC WORKS CADRE (CIVIL WING)

ENGINEERING PAPER – I Duration – 3 hours

PART – A (50 Marks)

1. Engineering and Building Materials
   - Natural Building Materials
   - Brick, cement, Timber, Lime, Lime mortar, Lime Concrete
   - Ferrous Metals. Non-Ferrous Metals
   - Plastic
   - Insulating Materials
   - Glass
   - Paints & Varnishes
   - Damp Proof Material
   - Standard Tests.
2. Building Construction
   - Foundation, depth of foundation
   - Brick Masonry
   - Stone Masonry
   - Design Consideration in Masonry Structures
   - Design load
   - Method of construction
   - Floors
   - Doors & Windows
   - Stairs
   - Roof and Roof Covers
   - Building requirements
   - Panning of Buildings and its Byelaws
   - Form work for Concrete structures.
   - Special consideration for Earthquake Zone, Seismic strengthening Arrangement.

3. Strength of Materials
   - General Knowledge of Simple Stress & Strain
   - Elastic Constant, Axially Loaded Compression Member
   - Shear Force
   - Bending Moments
   - Theory of Simple Bending
   - Beams of uniform strength
   - Deflection of Beams
   - Torsion,
   - Elastic Stability of Column
   - Unsymmetrical bending
   - Moment of inertia
   - Neutral Axis
   - Bending stress.

PART – B (50 Marks)

1. Geotechnical Engineering
   - Definitions
   - Type of Soil
   - Soil Identification and Classification
   - Important Relationship Between Soil Parameters
   - Permeability
   - Theory of Earth Pressure
   - Bearing Capacity of Soil
   - Load tests of Soil
   - Shear strength of soil
   - Types of foundations
   - Soil stabilization.
2. RCC Structures (Working Stress and Limit State)
   - Advantages of RCC
   - Assumption for Design members
   - Permissible stresses
   - Deformed and twisted Bars
   - Permissible stress in Steel Reinforcement
   - Design of RCC Member, Footing, column, beam, slab, T & L beam, lintels, stairs, cantilever, wall and retaining wall.
   - Design of water tank
   - Knowledge of relevant IS Codes.
   - Concrete mix design
   - Admixtures and their applications
3. Steel Structures
   - Structural Design
   - Methods of Design
   - Connection in Steel Members
   - Roof Truss
   - Knowledge of relevant IS Codes.
4. Environmental Engineering, rain Water Harvesting Sanitary Engineering and Plumbing
   - Air and Water Pollution

- Sewerage Systems
- Design Period for different Components
- Construction & Maintenance
- Domestic and Industrial waste.
- Sewerage Pumping
- Sewerage Disposal
- Sewerage Treatment
- Septic tanks, design and functions
- Water Sources
- Purity and quality of good drinking water
- Requirement of water Supply
- Quality of Water
- Water Distribution System
- Water treatment plant
- Plumbing in buildings
- Rain water Harvesting, definition, aquifer, Artificial recharge, bore well, open well, roof top rain water harvesting, Quality of rainwater and methods of treatment.

5. Quality Control and Construction Engineering & Maintenance
   - General Knowledge of quality control
   - Test Frequency of Construction materials for building works
   - Standard Specifications
   - Estimating, Costing and valuation
   - Specifications for buildings
   - Analysis of Rate for building
   - Construction tools, Plants Machineries and Equipment
   - Maintenance of buildings, inspection requirement, repairs and restoration
   - Retrofitting of Concrete structure
   - Special Repairs, Addition & Alteration
   - Register of Building.

PUBLIC WORKS CADRE (CIVIL WING)

ENGINEERING PAPER – II Duration – 3 hours

PART – A (50 Marks)

1. Surveying
   - Fundamental Definitions and concept
   - Chain Surveying
   - Compass Surveying
   - Theodolite and Total Station Theodolite
   - Traverse Survey
   - Contour survey
   - Levelling
   - Calculation of Area
   - Special/modern instruments for surveying
   - Reconnaissance, ground survey and final location survey.
2. Geometric Design of Highways
   - Width of formation,
   - Right of way

- Height of structures
- Extra Widening of pavement
- Width of pavement
- Camber
- Super elevation
- Design Speed
- Stopping Sight Distance
- Circular curve
- Gradient
- Transition curve
- Vertical curve
- Passing place.

3. Construction of Road formation.
   - Jungle clearance
   - Tree cutting
   - Design of cut slope
   - Earth work; Cut and fill
   - Blasting methods in excavation, control blasting, transportation and storage of blasting materials.
   - Disposal of excavation materials and stabilization of slopes.
4. Drainage
   - Hydrological study
   - Road side drain
   - Cath water drains
   - Sub-surface drainage
   - Treatment of water log area
   - causeway
   - Culvert.
5. Protection work
   - Types of retaining walls
   - Breast wall
   - Toe wall
   - Check dam
   - Gabion wall and its specifications
   - Design and methods for various retaining walls.
6. Slope Stabilization
   - Landslide prone area mapping
   - Landslide investigation
   - Slip circle and analysis of landslide
   - Erosion control
   - Stability Analysis
   - Reinforced earth
   - Rock slope protection and Rock bolting.

PART – B (50 Marks)

1. Pavement
   - Pavement materials & Properties
   - Types of pavement advantage and dis-advantages
   - Design parameter for Rigid and flexible pavement

- Traffic count, and wheel load survey
- Traffic projection for design period
- Design life
- Design load
- Pavement components
- Pavement design for Flexible & Rigid
- Pavement evaluation for strengthening & Design
- Preparation of sub-grade layer
- Stages of Pavement Construction
- Temperature requirement for bituminous construction.

2. Road Construction Equipment
   - Selection of correct plants and Equipment
   - Various machineries and equipment for road construction
   - Output factors
   - Optimum output.
3. Quality Control
   - Quality of material
   - Method of Tests
   - Test frequencies and requirement
   - Knowledge of IRC specification.
4. Bridge and Dam
   - Site selection
   - Selection of bridge type
   - Design of Abutment and Pier
   - Design of super structures
   - Selection of site for Gravity and Earthen Dam
   - Design of Gravity and Earthen Dam.
5. Maintenance and Road Safety
   - inspection and maintenance requirement for culvert, Retaining wall, Side drain, side beam, shoulder
   - Inspection of Bridge
   - Inspection and maintenance requirement of Flexible and Rigid pavement.
   - Road side amenities
   - Arboriculture
   - Traffic sign
   - Road marking.
6. Estimating, Analysis and specification for Road and Bridge work.

PUBLIC WORKS CADRE (MECHANICAL WING)
(Common for Mechanical and Electrical Engineers)

ENGINEERING PAPER – I Duration – 3 hours

PART – A (50 Marks)

1. General Study of Various Types of Machinery & Equipment used in Public Works Department.
   - Engine Operation and design, its performance and testing
   - Lubrication

- Cooling system
- Fuel & Fuel system
- Ignition system
- Electrical system
- Transmission system
- Maintenance.

2. Alternative to Petrol and Diesel Engine Detail Study About the Pros and Cons of Such Alternative.
3. Construction Equipments.
   - Basic Principles and Devices
   - Prime Movers
   - Earth Moving Equipments
   - Conveying Equipments
   - Hoisting Equipments
   - Pumping and de-watering Equipments
   - Aggregate and concrete production Equipments
   - Piles and Pile driving Equipments
   - Earth compaction and bituminous carpeting Equipment.
4. Planning and Application Construction Equipment
   - Planning and selection of construction equipments advantages and disadvantages of using machine.
   - Output production estimate and output production equipment.
5. Electrical Machines
   - Basic principle of generator and motor.
6. AC Machines.
   - Synchronous machines-Single phase and Three phase.
   - Induction machine Single phase and Three phase.
7. DC Machines.
   - Main construction features.
   - Function of commutator for motoring and generating action.
8. Application of DC Machines.
   - DC Generators.
   - DC Motors.
   - Maintenance of DC Machines.
9. Transformer.
   - Application and construction details of single phase and three phase transformer.
   - EMF Equation of a transformer.
10. Losses in a Transformer.
    - Type of Losses.

PART – B (50 Marks)

1. Economic of Construction Equipment.
   - Principles of Engineering and Economics.
   - Depreciation and calculation of depreciated cost.
   - Working life of construction equipments.
   - Procedure for calculation of number of equipments required for a particular work.
   - Calculation of Units cost for a particular work using construction equipment.

2. Preventive Maintenance of Repair
   - Inter-changeability of spare part.
   - Inventory management principles aspects and method of maintenance.
   - Servicing and servicing facilities.
   - Field repair facilities.
   - Inspection of equipments.
   - Workshop for major repairs.
3. Hire Charges of Construction Equipment
   - Different component of hire charges.
   - Calculation of different compound hire charges.
   - Procedure of accounting and crediting for different component of hire charges.
4. Any other topics concerning Mechanical Engineering Works
5. Physical Concept of Corona.
   - Condition effecting corona.
   - Effects of corona.
   - Remedial measures.
   - Advantage of corona.
6. Distribution System.
   - Feeders and distributors.
   - Planning a distribution system.
7. Cables.
   - Advantages and Disadvantages of underground cable system.
   - Types of cable and cables construction.
   - Factors determining selection of LT power cables.
   - Laying of underground cables.
8. Faults in underground distribution system and methods of location.

ENGINEERING PAPER – II Duration – 3 hours

PART – A (50 Marks)

1. Welding and Related Processes
   - Different types of Welding and its importance in fabrication in Modern Industries.
   - Oxygen cutting, Brazing & Soldering and its application.
2. Measurement and Inspection
   - Standard of Measurements and measuring tools used in machine shops.
   - Linear Measurement, Angular Measurement, Taper Measurement, Surface Measurement.
   - Comparator and Ganges.
3. General Study of the following Machine Tools and its Application
   - Lathe Machine
   - Milling Machine
   - Drilling and Boring Machine
   - Grinding Machine
   - Strapping and planning Machine.
4. Study salient features of diesel generating set and its maintenance.
5. Electrical Diagrams.
   - Types of diagrams and methods of representation for wiring diagram.
   - Design of simple light, fans and alarm circuits.

6. Design considerations of Electrical Installations.
   - Single phase/Three phase AC Supply.
   - Voltage Tolerances.
   - Conductors and cables and rating of cables.
   - Voltage drop.
7. Protection of Electric installation against over load, short circuit and earth fault.
   - General requirement of Earthing and earthing and soil resistivity.
   - Types of Earthing.
8. General requirements of electrical installations.
   - Layout wiring, conductors cross sectional area for final sub-circuit wiring and power sub-circuit wiring.
   - Distribution of mains and sub-main in single/three phase supply installation and sub-circuits for light and fans and power sub- circuits.
9. Testing of electrical Installations.
10. Difference between Neutral and Earth wires.

PART – B (50 Marks)

1. Procedure followed to condemnation of old and unserviceable machinery and equipment.
2. General principle construction and application of refrigeration equipment.
3. Any other topics concerning mechanical engineering works.
4. Types of Electrical Loads.
   - Factors determining system of wiring and types of wiring.
   - Service connections.
5. Design considerations of Electrical Installation in different types of buildings.
   - Small residential/medium large residential installations.
   - Large Installations
   - Small Industries (motor circuit wiring).
6. Design of Illumination schemes.
   - Types of lighting arrangements.
   - Lighting system for different occupancies.
   - Design consideration of good lighting schemes.
   - Co-efficient of utilization.
   - Mounting height and spacing of fittings.
   - Depreciation factor.
   - Calculation of Illumination.

PUBLIC WORKS CADRE (ARCHITECT WING)

ENGINEERING PAPER – I Duration – 3 hours

PART – A (50 MARKS)

1. BASIC DESIGN AND VISUAL ARTS

   The understanding the elements and principles of design as the building blocks of creative design will be facilitated through exercises that will develop originality, expression, skill and creative thinking. The grammar of design and visual composition will be explored through two dimensional compositions and three dimensional models using various media for representation. The objective is to enable the understanding of the relationship between the grammar of design and architecture

2. ARCHITECTURAL DESIGN

This studio based course synthesizes the knowledge gained from other courses and is central to the learning and practice of architecture. This course will engage in using conventional methods and linear processes of design to more exploratory nonlinear methods. The scale and complexity will increase progressively from lower semesters to senior semesters. The range should begin with small single activity/ single space projects to large urban design projects.

3. ARCHITECTURAL GRAPHICS AND DRAWING

Various mediums and techniques of art for artistic expression; free hand drawing; orthogonal projection of geometrical forms and representation; architectural and building representation through 2 dimensional and three dimensional drawings; measured drawing of building elements and simple building forms; presentation in graphic form all elements of building design; study of shades and shadows, textures, tones, colors etc.; rendering using manual mode as well as digital; hands on working with various mediums and materials.

4. HISTORY OF ARCHITECTURE AND CULTURE

Architecture as evolving within specific cultural contexts including a aspects of politics, society, religion, climate; geography and geology, etc. through history both in the Western context as well as in the Indian sub-continent; Development of architectural form with reference to Technology, Style and Character- Examples from every historical style illustrating the same.

5. PRINCIPLES/THEORY OF ARCHITECTURE

Principles and percepts of issues as related to architectural design in theory and practice; Appreciation of architecture with respect to man and his behavior; Nature and Design; Principles of organization on Nature; Ideas and Intent in design - Intuitive, contextual, Iconic, Experiential, Environmental, Energy based, Symbolic, Modular; Ideologies/ philosophies from the practice of architecture through contemporary history; design communication through graphics.

6. URBAN DESIGN

Urban design as a discipline; Components of a city and their interdependent roles; Determinants of urban form; Evolution of historic urban form.; Theories and illustrations of Urban design and the interpretation of the urban form in different ways and layers; Identity and ‘place’ making; architectural codes and imageability; contemporary urban issues ; sustainable urban design; case studies.

7. HUMAN SETTLEMENTS PLANNING

Elements and characteristics of human settlements; origins; determinants and their evolution through the course of history; Settlements as expression of political aspirations; Various planning concepts in urban, rural and regional level development plans in the context of India; Changing scenario in the context of Globalization.

8. HOUSING

Social Housing post WW II ; Issues concerning housing in the Indian Context; Various agencies involved in the production of housing; Factors that influence housing affordability; Various schemes and policies of the government in the housing sector; Standards and guidelines for housing; Housing design typologies and the processes involves in housing project development; Case studies and post occupancy evaluation.

9. LANDSCAPE DESIGN

Man and Nature; Landscape traditions; Elements and principles of landscape design; Aspects of outdoor design and site planning in enhancing and improving the quality of building environs, functionally and aesthetically; Site structure relationship; Analytic, artistic and technical aspects of designing open spaces at different scales; Role of Landscape design in sustainability; Overview of ecological balance; Impacts of human activities and the need for environmental protection and landscape conservation.

10. SITE PLANNING

Site and its content in architectural creations; Influencing factors which governs the sitting of a building or group of buildings in a given site; Topography analysis; Scientific techniques of site analysis- case studies; Methodology of preparing a site analysis diagram and mapping; Codes and building regulations; Site utilities and Infrastructure planning. Integration of Renewable Energy systems as per ECBC.

11. SPECIFICATIONS, COST ESTIMATION AND BUDGETING

Specifications of various building works as per NBC and ECBC; Writing specifications for materials and various items of work; Systems of taking out quantities and estimating for all trades involved in construction of medium complexity; preparation of Bill of Quantities (BOQ); Cost estimating for building works (material and labor); valuation report preparation; Budgeting for specific projects.

PART – B (50 MARKS)

1. VERNACULAR ARCHITECTURE

Vernacular architecture as a process and not a product; Determinants of vernacular form; Overview of the various approaches and concepts to the study of vernacular architecture; Various vernacular architectural forms in the various regions of India; Impact of Colonial rule on the vernacular architecture and settlements in India.

2. INTERIOR DESIGN

Vocabulary of interior design; Overview of interior and furniture design and design movements through history; various components of interior space and treatment and finishes; Interior lighting, Interior landscape and furniture. Design based studio exercises on ergonomics, materials and working parameters.

3. DISASTER MITIGATION AND MANAGEMENT

Disasters, their significance and types; Relationship between vulnerability, disasters, disaster prevention and risk reduction is understood. Inter- relationship between disasters and development; Disaster Risk Reduction (DRR); Disaster Risk Management in India; Disaster Management Act and Policy; Role of GIS and Information Technology Components in Preparedness, Risk Assessment, Response and Recovery Phases of Disaster; Disaster Damage Assessment; applications and case studies.

4. GREEN BUILDINGS AND RATING SYSTEMS

Passive design considerations; active systems; design for energy efficient building- day lighting and natural ventilation; technologies for alternative sources of energy; Net Zero buildings; software tools for the design of a building and the performance evaluation of a building with respect to energy; Rating systems: IGBC, LEED, GRIHA.

5. BUILDING PERFORMANCE AND COMPLIANCE
Building performance assessment and energy simulation tools, understanding of National Building Code (NBC) and Energy Conservation Building Code (ECBC) of India to provide minimum requirements for energy efficient design and construction of buildings; various compliance approaches; Building Envelope; Comfort Systems; Lighting systems; Electrical and renewable energy systems

6. EARTHQUAKE RESISTANT ARCHITECTURE
Fundamentals of Earthquake and the basic terminology; Historical experience; Site Planning and Performance of Ground and Buildings; Seismic codes and building configuration; Seismic design and detailing of non-engineered construction; Seismic design and detailing of RC and steel buildings; Design of non-structural elements; architectural design for Seismic resistance.

ENGINEERING PAPER – II Duration – 3 hours

PART – A (50 MARKS)

1. BUILDING MATERIALS
Properties and behavior of both natural and man-made building materials such as bricks, stones, metals, timber, glass, steel and finishing materials in contemporary buildings; Application of these materials in construction; Effects of sun, rain, wind and other climatic and environmental conditions on various building materials and built environment and the science of design for creating effective human comfort conditions within the built environment. understanding of parameters like U-factor, R-value, Thermal mass, Solar heat gain coefficient (SHGC), Visible light transmittance (VLT), etc.

2. BUILDING CONSTRUCTION
Traditional and conventional knowledge systems that enable construction of a complete building; various structural systems and methods of construction and detailing of buildings of medium complexity using natural and manmade materials including foundation, walls, roofs, staircase, joinery and finishes; Technology that informs the construction of contemporary buildings using various structural systems and materials. Evaluation of overall assembly U- factor of different building and construction system for various climatic zones as per ECBC. The course will combine lecture and studio exercises whose results will be in the form drawings and models, culminating in a studio which will translate an architectural design into working drawings which are good for construction either in manual/ digital mode.

3. APPLIED MECHANICS
Forces and structural systems; analysis of plane trusses; Properties of Sections; Elastic properties of solids; elastic constants; bending of beams; deflection of beams; theory of columns; Statically indeterminate beams; concepts in analysis of structure

4. STRUCTURAL DESIGN AND SYSTEMS
Understanding the structural concepts and behavior of structural elements- load bearing structures, framed structures, composite systems, steel structures- - simple calculations for columns, beams, frames, footings, slabs, walls etc. using various systems and relating the knowledge acquired to architectural design.

5. CLIMATOLOGY
Climatology as a science for the study of weather conditions averaged over a period of time; the elements of climate; study of human comfort; design of solar shading devices; Heat flow through building envelopes; Air movement due to natural and built form; Design strategies in different climate zones; vernacular and contemporary responses to climate through case studies; analysis using appropriate software; assessment of appropriateness of various Renewable Energy Systems based on climatic conditions.

PART – B (50 MARKS)

1. BUILDING SERVICES
Study of and design and detailing for water supply, drainage, sewage disposal, garbage disposal, electrification, illumination, air conditioning, fire hazard protection, acoustical treatment, rainwater harvesting, etc. in buildings and building premises, disaster management systems, intelligent energy conservation systems, electronic security and surveillance systems for buildings, etc. .; compliance requirements w.r.t. National Building Code and Energy Conservation Building Code.

2. SURVEYING AND LEVELING
Principles of surveying and leveling, use of various survey and leveling instruments, carrying out surveys of land of medium complexity (field work); preparation of survey plans.

3. ACOUSTICS
Science of sound; conditions for good hearing; appropriate materials for sound insulation; approaches in history for acoustic planning; planning for good hearing conditions in auditoriums, classrooms, churches and halls, conference rooms, etc.; analysis using software and simple design exercises; application of codes; case studies

4. ENVIRONMENTAL LAB
Lab based course which will involve measurements; documentation and recording; analysis and design using hand held and digital tools and through simulation using appropriate software focusing on areas such as thermal performance of built environment, natural and artificial lighting and ventilation and wind movement; evaluate performance of Renewable Energy Systems, Fenestration, Opaque Construction, etc. as per test standards specified in NBC and ECBC.

5. ENVIRONMENTAL SCIENCE FOR ARCHITECTURE (MHRD)
Natural systems; Complex relationships between the built and natural environments; Impact of pollution on natural and man-made environments; Strategies to transform the built environment to meet the risks of climate change; Bio-mimicry - the study of natural structures and processes- in helping to solve man-made problems and enabling design; Concepts of urban ecology and landscape urbanism; case studies; integration of Renewable Energy Systems in built environment

POWER AND ELECTRICITY CADRE

ENGINEERING PAPER – I Duration – 3 hours

(Common Paper for all Engineers in Electrical Wing under Power and Electricity Cadre)

PART – A (50 MARKS)

1. Departmental Guidelines & Construction Standards:
    1. Operation & Maintenance Guidelines for Lines & Substations issued by P&E Department.
    2. General conditions for Execution and Maintenance of Deposit Works (Electromechanical), 2018 issued by P&E Department.
    3. Prevailing P&E Department's Schedule of Rates (SOR) – Preparation of cost estimates etc.
    4. Electricity Safety Manual issued by P&E Department.
2. All India Rules and Acts with Amendments:
    1. The Electricity Act, 2003 with subsequent amendments.
    2. CEA (Deviation Settlement Mechanism & related matters) Regulations, 2014 with subsequent amendments

PART – B (50 MARKS)

1. JERC (M&M) Regulations with amendments:
   1. JERC for Manipur & Mizoram (Electricity Supply Code) Regulations, 2013 including subsequent amendments.
   2. JERC for Manipur & Mizoram (Grid Code) Regulations, 2010 including subsequent amendments.
   3. JERC for Manipur & Mizoram (Standard of Performance for Distribution and Transmission Licensees) Regulations, 2014 with subsequent amendments.

ENGINEERING PAPER – II Duration – 3 hours

(Electricals/Electronics/Electrical & Electronics/Electronics & Communication/ Electronics & Telecommunication Engineers under Electrical Wing)

PART – A (50 MARKS)

A. THEORETICAL KNOWLEDGE:

1) Electrical current and Ohms law: Unit of resistance; law of resistance; resistivity; resistance in conductors; Ohm's law; variation of resistance with temperature.
2) Network theorem: Resistance in series and parallel; Kirchhoff's current and voltage law; Thevenin's theorem; Star- Delta and Delta-star transformation.
3) Power and Energy: Unit of power; power formula from voltage and current; formula for power losses in transmission and distribution lines; unit of energy; conversion of horse power to energy; Joules' law of electric heating.
4) Capacitance & Inductance: Unit of capacitance; capacitance in series and parallel; capacitive reactance; importance of capacitor in electrical networks; unit of inductance; inductive reactance; significance of inductance in electrical networks.
5) Electromagnetic Induction: Production of EMF and current; Faraday`s law of electromagnetic induction; Lenz`s law; self inductance and mutual inductance.
6) AC Fundamentals: Difference between AC and DC; generation of alternating voltage; time period; frequency; amplitude; phase difference; RMS value.
7) AC Circuits: AC through resistance and inductance; AC through resistance and capacitance; resistance, inductance and capacitance in series; definition and formula of active, reactive and apparent power and their unit of measurement; power triangle; power factor; power factor formula; significance of power factor in electrical circuits/networks.
8) Polyphase Circuits: Phase sequences; interconnection of 3 phases; star or wye (Y) connection; value of phase voltage and current in Y connection; Delta (?) or Mesh connection; balance Y/? and ?/Y conversion.
9) Alternators/ AC generators: Basic principles, how ac generator produces electricity; what is stator and rotor?; relationship between number of magnetic poles; speed of rotor and frequency of EMF.
10) AC Transmission and Distribution: Classification of distribution and transmission lines based on voltage; effect of voltage on transmission efficiency; line losses; classification of short, medium and long transmission lines; Skin effect; Ferranti effect; Corona effect in high voltage transmission lines; design, construction and maintenance of 132kV lines.
11) Electronics in Power Control System: Semiconductor; Diode; Transistor; Thyristor; conversion of AC to DC; rectifier (half wave and full wave); diode rectifier bridge; thyristor rectifier bridge; advantage of thyristor bridge over diode bridge; filter circuits.

PART – B (50 MARKS)

B. PRACTICAL KNOWLEDGE

1) Transformers: Power and distribution transformers; transformer maintenance; prevention of lightning strike (direct and indirect); transformer protection from faults; load balancing of transformer; importance of earthing in transformer; desirable earth resistance value for distribution and power transformer; testing and commissioning of power and distribution transformers.
2) Earth Resistance and Soil Resistivity: Instruments used for measurement and method with diagrams showing how to measure earth resistance and soil resistivity.
3) Power Substation: Selection of site; need for power substation and voltage transformation.
4) Outdoor equipments in Power Substation: Importance of current and potential/capacitive voltage transformers ; connection for primary side and secondary side of CT and PT; lightning arresters, circuit breakers and their working principles; maintenance of outdoor equipments such as lightning arresters, CT &PT, transformers, isolators and circuit breakers.
5) Indoor equipments in Power Substation: Control & Relay (C&R) panels and switchgears; electrical measuring instruments such as ammeter, frequency meter, voltmeter, wattmeter (kW/MW) and energy meter in panels and their connections with panel wirings; types of relays (electromechanical, electronic, digital and numerical); different kinds of relays (O/C & EF, transformer protection, transmission line protection) and their working principles; calculation of multiplying factor of energy meter; installation, testing, commissioning and maintenance of battery banks and battery chargers.
6) Transmission and Distribution lines: Design, construction and maintenance of LT lines (bare and aerial bunched cables); 11kV lines (bare and aerial bunched cables); 33kV overhead lines (pole type) and 132kV overhead lines.

ENGINEERING PAPER – II Duration – 3 hours

(Mechanical Engineers under Electrical Wing)

PART – A (50 MARKS)

A. THEORETICALKNOWLEDGE:

1) Hydraulic Turbines: Classification of water turbines; specific speed of water turbine; efficiencies of water turbine; cavitation in turbines, cavitation parameters and measures to avoid cavitation; types of water turbine governor, selection of hydraulic turbines; purposes of testing of turbines and, data to be measured.
2) Hydraulic Pumps: Working principle of reciprocating pump and centrifugal pump; specific speed of centrifugal pump; accessories and starting of centrifugal pump; Power of pump driving motor; efficiencies of centrifugal pump; priming of centrifugal pump and self priming devices; cavitation in centrifugal pump; suction lift or suction head and net positive suction head of centrifugal pump; multi-stage centrifugal pumps, deepwell pump or vertical turbine pump; essential data required in selection of centrifugal pumps; purposes of testing of pumps and Data to be measured.
3) Hydrostatic system: Hydraulic crane, hydraulic lift, hydraulic jack.
4) Air Compressor: Classification, principles of operation, efficiencies of compressor; losses in compressor; multi-stage compressor; control of compressors
5) Gas Turbines: Classification, purpose of gas turbine for power generation; air-fuel ratio and pressure ratio in gas turbine; effect of regeneration; effect of intercooling.

6) Theory of Machines: Law of Belting; creep in belts; classification of chains; power transmitted by chains; types of gears; terminology of gear tooth; law of gearing; spiral gear; worm and worm gear; gear train – simple, compound, reverted and epicyclic gear train; functions of flywheel and governor; stability and isochronisms in governor; hunting of centrifugal governor; controlling force of governor; governor effort and power.
7) Heat Transfer, Refrigeration and Air-Conditioning: Modes of heat transfer; heat transfer with extended surfaces (fins); capacity of refrigerator; refrigerants; condensers; evaporators; expansion devices; basics of air-conditioning equipment; psychometric chart and application to air-conditioning; psychometric processes; requirement of comfort air-conditioning.
8) Production Engineering: Gas welding; arc welding; resistance welding; advanced welding process; drilling; boring; grinding; finishing processes; cutting tool materials; tool life; non-conventional machining process.
9) Industrial Engineering/Management: Concept and factor governing plant location; plant layout; factors affecting material handling equipment; maintenance of material handling equipments; advantages of work study; break-even analysis.

PART – B (50 MARKS)

B. PRACTICAL KNOWLEDGE

1) Transformers: Power and distribution transformers; transformer maintenance; prevention of lightning strike (direct and indirect); transformer protection from faults; load balancing of transformer; importance of earthing in transformer; desirable earth resistance value for distribution and power transformer; testing and commissioning of power and distribution transformers.
2) Earth Resistance and Soil Resistivity: Instruments used for measurement and method with diagrams showing how to measure earth resistance and soil resistivity.
3) Power Substation: Selection of site; need for power substation and voltage transformation.
4) Outdoor equipments in Power Substation: Importance of current and potential/capacitive voltage transformers ; connection for primary side and secondary side of CT and PT; lightning arresters, circuit breakers and their working principles; maintenance of outdoor equipments such as lightning arresters, CT &PT, transformers, isolators and circuit breakers.
5) Indoor equipments in Power Substation: Control & Relay (C&R) panels and switchgears; electrical measuring instruments such as ammeter, frequency meter, voltmeter, wattmeter (kW/MW) and energy meter in panels and their connections with panel wirings; types of relays (electromechanical, electronic, digital and numerical); different kinds of relays (O/C & EF, transformer protection, transmission line protection) and their working principles; calculation of multiplying factor of energy meter; installation, testing, commissioning and maintenance of battery banks and battery chargers.
6) Transmission and Distribution lines: Design, construction and maintenance of LT lines (bare and aerial bunched cables); 11kV lines (bare and aerial bunched cables); 33kV overhead lines (pole type) and 132kV overhead lines.

ENGINEERING PAPER – II Duration – 3 hours

(Computer Science Engineers under Electrical Wing)

PART – A (50 MARKS)

A. THEORETICALKNOWLEDGE:

1) Database Management Systems: Data Models, Schemas & Instances, Three Schema Architecture & Data Independence; Database language & Interface, DBMS Architecture; RDBMS, Relational Database Schemas, CREATE, DELETE & UPDATE Operations; SQL, SQL commands, Data Definition and Data types.
2) Operating Systems: System Components, Operating System services; System Calls, Process Management, Threads; Scheduling, Scheduling Algorithms, Critical Section Problem; Semaphores, Deadlocks, Deadlock Recovery.
3) Computer Networks: Network hardware (LAN, MAN,WAN, wireless etc); OSI Model, TCP/IP Model; Guided Transmission Media & types, Wireless Transmission; Ethernet, Wireless LAN, Broadband, Bluetooth, MAC layer; Network layer in the Internet, DNS, HTTP, EMAIL, VoIP; Transport layer Protocols; Cryptography, VPN, Firewalls, Wireless security, Digital Signatures.

PART – B (50 MARKS)

B. PRACTICAL KNOWLEDGE :

1) Transformers: Power and distribution transformers; transformer maintenance; prevention of lightning strike (direct and indirect); transformer protection from faults; load balancing of transformer; importance of earthing in transformer; desirable earth resistance value for distribution and power transformer; testing and commissioning of power and distribution transformers.
2) Earth Resistance and Soil Resistivity: Instruments used for measurement and method with diagrams showing how to measure earth resistance and soil resistivity.
3) Power Substation: Selection of site; need for power substation and voltage transformation.
4) Outdoor equipments in Power Substation: Importance of current and potential/capacitive voltage transformers ; connection for primary side and secondary side of CT and PT; lightning arresters, circuit breakers and their working principles; maintenance of outdoor equipments such as lightning arresters, CT &PT, transformers, isolators and circuit breakers.
5) Indoor equipments in Power Substation: Control & Relay (C&R) panels and switchgears; electrical measuring instruments such as ammeter, frequency meter, voltmeter, wattmeter (kW/MW) and energy meter in panels and their connections with panel wirings; types of relays (electromechanical, electronic, digital and numerical); different kinds of relays (O/C & EF, transformer protection, transmission line protection) and their working principles; calculation of multiplying factor of energy meter; installation, testing, commissioning and maintenance of battery banks and battery chargers.
6) Transmission and Distribution lines: Design, construction and maintenance of LT lines (bare and aerial bunched cables); 11kV lines (bare and aerial bunched cables); 33kV overhead lines (pole type) and 132kV overhead lines.

ENGINEERING PAPER – I Duration – 3 hours

(Civil Wing)

PART – A (50 MARKS)

1. Hydrology :
   Data collection, water availability assessment, stream gauging – preparation of discharge sites, segmentation, discharge measurement and computation.
2. Filed Investigation :
   a) Silt collection
   b) Topographical survey for run-of-the-river and storage schemes
   c) Geological survey
   d) Construction materials survey
3. Assessment of Power Potential and Optimization of installed capacity :
   a) Power Potential
   b) Determination of net head
   c) Assessment of power potential for run of the river and storage schemes
   d) Assessment of power potential with scanty data
   e) Optimization studies for determination of installed capacity

PART – B (50 MARKS)

1. Civil Works for Hydel Schemes :
   a) Diversion structures – Trenches weir and raise type weir, Gravity Dam, Earthen Dam, Rockfill Dam.
   b) Power channel/water conductor system – Desilting Tank, Forebay, Structure.
   c) Penstock.
   d) Power House.
   e) Tail Race
2. Electro-Mechanical Equipments :
   a) General knowledge on type of turbines, ranges, selection of type of turbine.
   b) General knowledge on hydro-mechanical equipments for Small Hydel Projects
3. Building Construction :
   a) Stone masonry works
   b) Brick masonry works
   c) Plastering, pointing, painting, distempering, white washing, damp proofing, termite proofing

ENGINEERING PAPER – II Duration – 3 hours

(Civil Wing)

PART – A (50 MARKS)

1. Geo-technical Engineering :
   Type of Soil, Classification of soil, Darcey's Law, permeability, Terzaghi's theory of one dimensional consolidation, compaction of soil, earth pressure at rest, active and passive pressure at rest - Rankine's theory, Immediate consolidation and secondary settlement, stability of slope.

2. Structural Engineering :
   Design of RCC cantilever and counterfort retaining wall, Design of Septic tank, Design of doubly reinforced beam, Design of isolated column footing.
3. Quality Control :
   Quality of materials, checking and testing, knowledge of relevant technical specifications.

PART – B (50 MARKS)

1. Estimating for costing, analysis of rates and specification.
2. Statutory Clearances mandatory of Hydel Projects (Forest clearance, environmental clearance, wildlife clearance), Environment Impact Assessment (EIA) and Environment Impact Management (EIM) reports.
3. Right to fair compensation and transparency in land acquisition, Re-habilitation and Re-settlement Act 2013 (including amendments from time to time).

PUBLIC HEALTH ENGINEERING CADRE

ENGINEERING PAPER – I Duration – 3 hours

(Common for Civil, Electrical and Mechanical Engineers)

PART – A (50 MARKS)

1. Rain Water Harvesting
2. Pumps for Drinking Water Supply
   Different types, operation & maintenance of pumps for water supply
3. Water Supply
   Survey and investigation of water supply scheme. Selection of site for reservoir. Intake structures – different types of intakes, factors affecting selection for location of intakes. Population forecasting – different methods, merits and demerits. Drinking water standards (CPHEEO).
   Water Demand
   Per capita Consumption - Factors affecting percapita demand, population forecasting, different methods with merits and demerits.
   Types of Water demand - domestic demand, institutional and commercial, public uses, fire demand.
4. Quality of Water
   Examination of Water - Objectives, Physical, Chemical and Micro-biological Examination.
   Drinking Water Standards - CPHEEO & WHO Standards.
5. The Mizoram Water Supply (Control) Acts & Rules.
6. Conveyance for Water Supply :
   Characteristics of GI, DI, CI, ERW, HPDPE, PVC Pipes.
7. Hand pump Tube wells
   Types of HPTW. Importance of HPTW. Installation of Indian Mark-III.
8. Water Hammer
   Concept and Remedial measures.
9. Different Types of Motor Starters
10. Concept of Alternating Current / Direct Current
11. Water Treatment
    - Schematic flow diagram of conventional water treatment plant.
    - Various units of Water Treatment Plant.

- Sedimentation - Different types of settling tank/Sedimentation Tank.
- Coagulation and Floculation
- Filtration viz. - Rapid Sand Filter and Slow Sand Filter with their mechanisms,design, construction, operation and maintenance.
- Commissioning of water treatment plant.
- Disinfection viz. Chlorination.

12. General Concept of Cement Works
    Water cement ratio, setting of cement, curing of cement concrete work, ingredients of cement concrete and their physical properties.
13. PERT and CPM Network Analysis

PART-B (50 marks)

1. Rural Sanitation
   Conservancy, public latrine, night soil collection and disposal, trenching and composting methods. Two pit latrines, septic tank, soak pit.
2. Waste water disposal
   Necessity for sanitation. Methods of sewage disposal. Types of sewerage systems and their suitability.
3. Solid waste
   Definition, scope and importance of solid waste management, functional elements of solid waste management, classification and characteristics of sources of solid wastes. Municipal and Hospital/ Biomedical waste. Quantity/Generation rate.
4. Sanitary Landfill
   Definition, Methods.
5. Recycle and Reuse
   Material and energy recovery operations. Reuse in other industries. Environmental significance and reuse.
6. Definition
   Sanitation, Sewage, Sewer, Sewerage, Sullage, Garbage.

ENGINEERING PAPER – II Duration – 3 hours

(Civil Engineers)

PART – A (50 MARKS)

1. Fluid Mechanics
   - Classification of flow.
   - Flow through pipes.
   - Open channel flow.
2. Building Materials
   - Stones, Bricks, hollow blocks, Concrete blocks, steel and their characteristics/properties
3. Soil Mechanic and Foundation Engineering/Geotechnical Engineering
   - Factors affecting bearing capacity of soil.
   - Factors influencing selection & depth of foundation.
   - Types of shallow foundations viz. isolated footings, combined footing, strap footing.
4. Water Treatment
   - Design & functions of different units of Water Treatment Plant
     (a) Sedimentation - Coagulation, Floculation etc.

(b) Filtration (rapid & slow sand filtration)
(c) Disinfection (chlorination)

5. Sources of Water
   - Surface and subsurface sources - Suitability with regard to quality and quantity.
6. Cement Concrete Works
   - Ingredients of cement concrete and their properties.
   - Water cement ratio.
   - Different types of cement.
   - Taking out quantities of ingredients of cement concrete.
   - Batching and Proportioning of ingredients of cement concrete.
   - Mixing of ingredients of cement concrete.
   - Transportation of concrete mix.
   - Placing/Pouring of concrete mix.
   - Compaction and consolidation of concrete.
   - Setting of cement.
   - Shoring, scaffolding and formwork of cement concrete work.
   - Simple Designs – RCC footing, RCC Column, RCC Slab, RCC Beams viz. Cantilever, Simply Supported, Fixed and Continuous.
   - Requirement of Reinforcement for various RCC structures.
   - Spacing of Reinforcement.
   - Development length.
   - Cover to Reinforcement.
   - Plastering of cement concrete.
   - Curing of cement concrete works.
7. Water Tanks
   - Fundamentals
     a) Minimum requirement of reinforcement.
     b) Maximum free water cement ratio.
     c) Minimum grade of cement concrete.
     d) Limit on cement content of cement concrete.
     e) Reduction of stresses in steel.
     f) Thickness of wall and base floor.
     g) Development length.
     h) Cover to reinforcement.
     i) Cover slab or dome.
     j) Lightning arrestor, ventilation, testing of water tank after completion.

PART-B (50 MARKS)

1. Solid Waste Management
   Characteristics & classification, treatment, processing techniques.
2. Incineration
   - Incinerators process.
   - Types.
   - Prevention of air pollution.
   - Pyrolsis.
3. Composting
   - Aerobic and anaerobic composting.
   - Factors affecting composting.

- Mechanical and semi-mechanical processes.
- Vermicomposting.

4. Sanitary Landfill
   Trench area. Ramp and pit method. Site selection. Basic steps involved. Cell design. Prevention of site pollution. Leachate collection and control methods. Gas collection systems.
5. Quantity of Sewage
   - Computation of design sewage flow.
   - Estimation of storm flow.
   - Rational method and empirical formulae of design of storm water drain.
   - Time of concentration.
6. Design of Sewers
   - Hydraulic formulae for velocity of sewage flow in sewer.
   - Effects of flow variations on velocity in sewer.
   - Self cleansing and non souring velocities.
   - Design of hydraulic elements for circular sewers.
7. Materials of Sewers
   - Sewers materials.
   - Shapes of sewers.
   - Laying of sewers.
   - Jointing and testing of sewers.
   - Ventilation and cleaning of sewers.
8. Sewer Appurtenances
   - Catch basins.
   - Manholes.
   - Lampholes.
   - Flushing tanks.
   - Oil and greasetraps.
   - Drainage traps.
   - Basic principles of house drainage.
   - Typical layout plan showing house drainage connections.
   - Maintenance of house drainage.
9. Sewage Pumping
   - Need for sewage pumping.
   - Types of pumps.
   - Pumping stations.
10. Analysis of Sewage
    - Physical, chemical and biological characteristics.
    - Concepts of aerobic and anaerobic activity.
    - More emphasis on BOD and COD.
    - Sampling significance.
    - Techniques and frequency.
11. Disposal of Effluents
    - By dilution.
    - Self purification.
    - Oxygen sag curve.
    - Zones of purification.
    - Sewage farming.
    - Sewage sickness.
    - Disposal of sewage standards on land and water.
    - Chlorination of sewage.

12. Treatment of Sewage
    - Flow diagram of conventional sewage treatment plant.
    - Components of primary treatment – screening, grit chambers, skimming tanks, primary sedimentation tanks and their functions.
    - Components of secondary treatment – trickling filter – theory and operation, types and their functions.
    - Activated sludge process – principle and flow diagram, methods of aeration, modification – methods of sludge disposal, sludge drying beds. Sludge digestion and filter beds.
13. Miscellaneous Treatment Methods
    - Septic tanks and oxidation pond.
    - Design.
    - Introduction to Rotating Biological Contactor (RBC), Upflow Anaerobic Sludge Blanket (UASB), Sequencing Batch Reactor (SBR).
14. IS Code of Practice (1) 456 (latest edition)
    (2) 3370 – Part-I, II, III & IV (latest edition)

ENGINEERING PAPER – II Duration – 3 hours

(Electrical Engineers)

PART – A (50 MARKS)

1. Electrical Materials
   Conductors, Semi-conductors and Insulators, Super-conductivity, Insulators for electrical and electronic applications. Magnetic materials. Ceramics, Properties and applications
2. Electrical Circuits
   Circuits elements, Kirchoff's Laws. Network Theorems and applications, Three phase circuits.
3. Measurements and Instrumentation
   Units and Standards, measurement of current, Voltage, power, Power-factor and energy. Indicating instruments, Measurement of resistance, inductance, Capacitance and frequency.
4. Earthing :
   Knowledge of Earthing, Lighting Arrestor, Surge Protection, measurement of earth resistivity.
5. Power factor:
   Knowledge of Power factor, measurement and its improvement.
6. Battery and its maintenance.

PART-B (50 MARKS)

1. Electrical Machines Theory
   Electric and magnetic fields, conductors and magnetic materials.
2. Electrical Machines and Power Transformers
   Magnetic Circuits , Testing of Electrical Machines like Induction Motor, Transformer & Switch-gear, Losses and efficiency, Parallel operation, Basic concepts in rotating machines, EMF, torque,
3. Power systems
   Power transmission lines, Voltage control, Load flow studies, Load frequency control, Power system Protection, Circuit breakers & Relays.

4. Digital Electronics
   Semiconductor device physics, PN junctions and transistors, rectifier circuits, voltage regulator AC to DC Converters; 1-phase and 3-phase Inverters.
5. Operation & maintenance
   Operation and Maintenance of Induction Motor, Alternator, Transformer, Battery & Charger and Switch-gears.
6. Different types of Starters
   DOL, Auto-Transformer, Star Delta & Soft Starter.
7. Solar Power System

ENGINEERING PAPER – II Duration – 3 hours

(Mechanical Engineers)

PART – A (50 MARKS)

1.	Theory of machines	i)	Motion
		ii)	Mechanism
		iii)	Friction
2.	Thermal Engineering	i)	IC and CI Engines
		ii)	Fuels and combustion
		iii)	Lubrication
3.	Operation Research	i)	Network analysis (PERT/CPM)
		ii)	Water supply plant maintenance
4.	Welding and related processes:	i)	Different types with respect to water supply
		ii)	Oxygen cutting, brazing and soldering
5.	Properties of Metals	i)	Steel
		ii)	Cast Iron
		iii)	Galvanised Iron
		iv)	Ductile Iron
		v)	ERW

PART-B (50 MARKS)

1.	Pump	i)	Different types of Pump
		ii)	Selection of Pump
		iii)	Testing of pump
2.	Operation and Maintenance :	i)	Engines/ D.G set
		ii)	Pumps
		iii)	Electric motor
3.	Water Supply	i)	Selection and layout plan of water pumping station.
		ii)	Layout of pumps and equipments in pump house (motor/ pump/panels/valves/ common header/ cable trenches etc.)
		iii)	Population forecast
		iv)	Calculation of Water Demand
		v)	Design of pumping main
		vi)	Design of power for pump
		vii)	Water Distribution system

6.	Machine tools	i)	Drilling and boring machine and its application
		ii)	Grinding machine and its application
		iii)	Lathe machine and its application
		iv)	Air compression and its applications.

IRRIGATION AND WATER RESOURCES CADRE

ENGINEERING PAPER – I Duration – 3 hours

(Common for Civil and Agricultural Engineers)

PART – A (50 MARKS)

1. Irrigation and Drainage Engineering:
   - Irrigation wells: Hydraulics of well, Design of Irrigation Wells, Well Construction Procedure
   - Irrigation pumps: Positive displacement pumps, Centrifugal pumps, Vertical turbine pumps, Submersible pumps, selection of pumps, power requirements, efficiency and economics of pumps
   - Measurement of irrigation water: Methods of water measurement, weirs, Parshall Flumes, Orifices and Meter gates.
   - Water conveyance and control: Surface water distribution system, underground pipeline
   - Soil- plant-water relationship: water requirement of crops, conjunctive use of water,
   - Water application method: Methods of irrigation (surface, sub-surface and pressurized irrigation) and their efficiencies. Depth and frequency in irrigation, duty of water.
   - Design of canals (both lined and unlined), cross drainage, head regulator and canal outlet. Design of pipes for irrigation.
   - Cropping pattern, concept of multiple cropping, inter-cropping. Criteria for scheduling of irrigation, ways and means of reducing losses of irrigation.
   - Principle and design of weirs on permeable and impermeable foundation, energy dissipation.
   - Optimum depth of water table, causes of water-logging, effects of water-logging, detection and solution to water-logging.
   - Essential requirements of a drain, classification of drains, design of surface and sub-surface drainage system, combination of surface and sub-surface drains.

PART – B (50 MARKS)

1. Reinforced Concrete Structures and Farm Structures:
   - Concept of Working stress method of design of RCC structures, theory of singly and doubly reinforced beams and slabs.
   - Concept of Limit State Method.
   - Design of water tanks, silo and aquaducts.
   - Site selection, design and construction of farm houses, cattle-shed, dairy barn, poultry-shed etc.
   - Building materials: stones, bricks, lime, cement, aggregates, tiles, mortars concrete.
2. Estimating and Costing:
   - Estimating quantities of various items in civil works like building, canals and canal head-works, reservoirs etc.
   - Estimating cost of various items of works based on SOR.
   - Estimation of cut and fill earth volume in terraces and land leveling and costing.
   - Method of DPR preparation as per prevailing guidelines followed by the department.

ENGINEERING PAPER – II Duration – 3 hours

(Agriculture Engineers)

PART – A (50 MARKS)

1. Hydrology:
   - Meteorology- weather, climate, atmospheric pressure, humidity
   - Hydrologic cycle, precipitation, evaporation, transpiration; frequency of point rainfall, unit and synthetic hydrograph;
   - Concept on Evaporation, transpiration, evapotranspiration, infiltration, infiltration capacity, infiltration rate, factors affecting infiltration, methods of determination of infiltration.
   - Rain gauging, computation of Average rainfall over a basin, rainfall records, estimation of missing rainfall record.
   - Discharge measurements: methods of discharge measurements, selection of gauge site, types of gauges, slope-Area method, other method of discharge estimation
   - Runoff: Runoff process, runoff cycle, factors affecting runoff, classification of catchments, estimation of runoff.
   - Flood estimation, classification of flood, flood frequency, principles of flood control-flood routing, flood management.
2. Soil and Water Conservation Engineering:
   - Scope of soil and water conservation; mechanics and types of erosion, their causes.
   - Soil erosion control measures- biological and engineering.
   - Gully control structures- temporary and permanent.
   - Permanent soil conservation structures like chute, drop and drop inlet spillways.
   - Water harvesting and moisture conservation. Farm pond/small earthen dam and percolation pond.

PART – B (50 MARKS)

1. Surveying and Leveling:
   - General principles of surveying, surveying instruments, Measurement of distances, direction and heights.
   - Principles of leveling, classification of leveling, concept of profile leveling, cross & L-sectioning.
   - Contouring, characteristics of contours, interpolation of contours, contour drawing. Leveling and land grading.
   - Scale, contour interval, area to be covered/extend of surveys for river surveys such as X-Section, L-Section, Reservoir, Dam, Barrages/Weir, Canal and water conveying system, Canal Structures, Command Area survey including Survey for Drainage System.
   - Concept on application of Remote sensing Technology and Global Positioning System for Planning of water resources projects.
2. Farm Machinery & Power:
   - Agricultural mechanization and its scope.
   - Power transmission, ground drive, power take off and control system in mechanical farm power.
   - Operation and maintenance of farm machinery for primary and secondary tillage.
   - Traction theory. Sowing, transplanting and intercultural implements.

ENGINEERING PAPER – II Duration – 3 hours

(Civil Engineers)

PART – A (50 MARKS)

1. Hydrology:
   - Meteorology- weather, climate, atmospheric pressure, humidity
   - Hydrologic cycle, precipitation, evaporation, transpiration; frequency of point rainfall, unit and synthetic hydrograph;
   - Concept on Evaporation, transpiration, evapotranspiration, infiltration, infiltration capacity, infiltration rate, factors affecting infiltration, methods of determination of infiltration.
   - Rain gauging, computation of Average rainfall over a basin, rainfall records, estimation of missing rainfall record.
   - Discharge measurements: methods of discharge measurements, selection of gauge site, types of gauges, slope-Area method, other method of discharge estimation
   - Runoff: Runoff process, runoff cycle, factors affecting runoff, classification of catchments, estimation of runoff.
   - Flood estimation, classification of flood, flood frequency, principles of flood control-flood routing, flood management.
2. Geo-Technical Engineering:
   - Properties and Classification of soils.
   - Index properties of soil, Atterburg limits, void ratio, moisture content, permeability.
   - Flow under Hydraulic Structures, uplift and quick sand condition.
   - Active and passive earth pressure, earth pressure at rest, Rankine's theory of Active Earth pressure.
   - Concept of Well Hydraulics.

PART – B (50 MARKS)

1. Surveying and Leveling:
   - General principles of surveying, surveying instruments, Measurement of distances, direction and heights.
   - Principles of leveling, classification of leveling, concept of profile leveling, cross & L-sectioning.
   - Contouring, characteristics of contours, interpolation of contours, contour drawing. Leveling and land grading.
   - Scale, contour interval, area to be covered/extend of surveys for river surveys such as X-Section, L-Section, Reservoir, Dam, Barrages/Weir, Canal and water conveying system, Canal Structures, Command Area survey including Survey for Drainage System.
   - Concept on application of Remote sensing Technology and Global Positioning System for Planning of water resources projects.
2. Construction Planning & Management:
   - Planning & Management: Construction activity, schedules, bar charts.
   - Network Analysis: Concept on Critical Path Method (CPM) and Programme Evaluation and Review Technique (PERT) analysis.
   - Terminology, float times, crashing of activities, time estimates and its calculation.
   - Selection of technique, Concept on Resources Planning and Resources Allocation.

COMMON ACCOUNTS PAPER FOR OFFICERS IN ALL WINGS UNDER ALL THE CADRES OF JUNIOR GRADE OF MIZORAM ENGINEERING SERVICE

ACCOUNTS PAPER – I Duration – 3 hours

PART – A (50 Marks)

1. Standard Forms of contracts, forms for bills and vouchers, used for payments.
2. Funding of Object/Works.
3. Works of inescapable nature.
   a) Emergent Works.
   b) Urgent Works.
4. Documents of Accounts.
   a) Bill register
   b) Contractors Ledger
   c) Register of works
   d) Materials account
   e) Cash Books
5. Budget
   a) General
   b) Budget Authority
   c) Consolidated Fund of India
   d) Demands for grants
   e) Recoveries, appropriation bill, vote on account
   f) Budget head of account
   g) Suspense
   h) Charged expenditure
   i) Scheme works
   j) Savings, excesses and supplementary demands
   k) Appropriation Accounts
   l) Re-appropriation
   m) Allotment of funds.
6. Construction Works
   a) Detailed Project Report/ Detailed Estimate
   b) Provision for contingencies and its utilization
   c) Departmental charges
   d) Administrative approval & Expenditure Sanction
   e) Technical sanction
   f) Schedule of Rates (SOR)
   g) Deposit works
   h) Specialised works

PART – B (50 Marks)

1. Bidding System
   a) E-Tendering
   b) Types of Tenders
   c) Tender with 2(two)/3(three) bid system
   d) Engineering, Procurement & Construction (EPC) contracts
   e) Preparation of NIT

f) Invitation of tender for works
g) Publicity of tenders
h) Time limit for publicity of tenders
i) Formalities for re-invitation of tenders
j) Tendering limits of contractors enlisted with central/state government departments
k) Debarment of contractors with blemish records.

2. Contract Management
a) Earnest money, opening and accepting of tenders, rates of earnest money
b) Mode of deposit
c) Refund of earnest money
d) Justification of tenders
e) Forfeit of earnest money
f) Procedure for conducting negotiation
g) Acceptance of tender
h) Performance guarantee
i) Signing of agreement
j) Security Deposit & Forms of Security deposit
k) Re-payment/ Re-transfer of security deposit
l) Documentation of accounts
m) Mobilisation advance
n) Plan, Machinery & Shuttering material advance
o) Secured Advance
p) Measurement of work
q) Measurement of inadmissible items
r) Advance payments for work done measured/not measured
s) Documentation of hindrances
t) Extension of time (EOT) & rescheduling of milestone
u) Completion certificate
v) Time schedule for payment
w) Authority to pass the bills
x) Deduction of income tax at source
y) Deduction of goods and services tax
z) Conditions for refund of security deposit & performance guarantee

3. Arbitration and Litigation
a) Pre-arbitration & Arbitration mechanism
b) Acceptance/ Challenge of award
c) Court case
d) Dispute redressal committee

References:
1. CPWD Works Manual.
2. Standard Operating Procedure for CPWD Works Manual.

ACCOUNTS PAPER – II Duration – 3 hours

PART – A (50 Marks)

1. General outlines of system of Accounts.
i) Classification of transaction
ii) System of Account

2. Relation with Account Officer
   i) General
   ii) Inspection by the Audit/Account Officers
   iii) Results of Audit
3. Stores
   i) Stock
   ii) Tools and Plant
   iii) Road Metal
4. Transfer Entries
5. Revenue Receipts
   i) General
   ii) Irrigation Revenue
   iii) Licence fee of building and land
   iv) Refund & Remission
6. Works Accounts
   i) General
   ii) Cash Payment
   iii) Issue of material
   iv) Adjustment
   v) Works Abstract
   vi) Register of Work
   vii) Construction Ledger
7. Accounts Procedure for Lump-sum Contract
   i) General
   ii) Payment for Work done
   iii) Forms of Bill
   iv) Subsidiary Works Accounts
8. Item rate contract
9. Non-Government Works
   i) Introduction
   ii) Deposit works

Reference: CPWD Accounts Code

PART – B (50 Marks)

1. CCS (Conduct) Rules 1964
   (i) Rule 3 : General
   Rule 3 'A' : Promptness and Courtesy
   Rule 3 'B' : Observance of Government's Policies
   Rule 3 'C' : Prohibition of sexual harassment of working women
   (ii) Rule 7 : Demonstration and Strikes
   (iii) Rule 22 : Consumption of Intoxicating drinks and Drugs
2. GFR
   i) General System of financial management (Rule 7-32)
   ii) Works (Rule 130-141)
   iii) Procurement of Goods (Rule 142-176)
3. CCS (Leave Rules) 1972
   i) Kinds of leave due and admissible including special kinds of leave
   ii) Grant of and return from leave

4. CCS(CCA) Rules 1965
   i) Penalties and disciplinary authorities
   ii) Suspension.
5. Central Treasury Rules
   i) General instruction for handling cash
   ii) Procedure for paying money into Government account

SCHEDULE-II
(See sub-regulation (2) of regulation 4)

SYLLABI FOR DEPARTMENTAL EXAMINATION IN RESPECT OF OFFICERS HOLDING THE POST OF JUNIOR ENGINEER/DRAFTSMAN-I

PUBLIC WORKS CADRE

ENGINEERING PAPER Duration – 3 hours

(Civil Engineering)

PART – A (50 Marks)

1. Surveying for building works
   - Unit of Measurements
   - Care and uses of Survey Instruments
   - Preparation of Building Plan, Elevation and Sectional drawings
   - Reading and writing of Architectural Drawings.
2. Building Materials
   - Natural Building Materials
   - Brick, cement, Timber, Lime, Lime mortar, Lime Concrete, Plastic, Paints & Varnishes, Damp Proof Material.
   - Characteristics
   - Common tests for quality control
3. Building Construction
   - Types of Foundations in buildings, depth of foundation
   - Soil bearing capacity of various types of soil, common test for quality control.
   - Buildings Byelaws
   - Form work for Concrete structures
4. Analysis of Rates, Estimating quantities of materials, Transportation cost, Preparation of Estimate/DPR, methods of measurement for building works.
5. RCC Structures
   - Basic theory and property of RCC
   - Bond length, Anchorage length, Development length & splicing
   - Permissible stress in Concrete & Steel Reinforcement
   - Stresses: Compressive, Tensile, Shear, Stress & Strain relation
   - Water cement Ratio, Slump test, Gradation of Aggregate curing, compaction of concrete and form work.
6. Standard Specification for various items of Building Works.

PART – B (50 MARKS)

1. Surveying
   - Description, use and care of various types of survey instrument for Road work
   - Contour survey
   - Levelling
   - Hill road survey
   - Different stages of road survey.
   - Preparation of DRP Estimate
   - Measurement of Road works.
2. Geometric Design of Highways
   - Formation width of Different class of road
   - Right of way
   - Hight of structures
   - Extra Widening of pavement
   - Width of pavement
   - Camber
   - Circular curve
   - Gradient
   - Transition curve
   - Vertical curve
   - Passing place.
3. Construction of Road Formation
   - Jungle clearance
   - Tree cutting
   - Design of cut slope
   - Earth work
   - Disposal of excavation materials.
4. Road Construction Materials
   - Pavement materials & Physical Properties
   - Common test for quality control.
5. Bridge, Culvert and Drainage
   - Survey for bridge site
   - Bridge site selection & requirement
   - Importance Road side drain
   - Cath water drains
   - Causeway
   - Culvert.
6. Protection work
   - Types of retaining walls
   - Construction Procedure
   - Size of stone
7. Pavement
   - Types of pavement
   - Composition of Rigid Pavements
   - Joints in Rigid pavement, Dowel Bars
   - Traffic count, and wheel load survey
   - Components of Flexible pavement
   - Preparation of subgrade layer
   - Stages of Pavement Construction
   - Temperature requirement for bituminous construction
   - Rolling of Pavement layers

ENGINEERING PAPER Duration – 3 hours

(Electrical Engineering)

PART – A (50 Marks)

1. Detail Study of Internal Electrification System used in Public Works Department
   - Illumination; Laws of illumination, simple calculation of illumination, requirement and selection
   - Electrical Plan and Drawing; simple electrical plan drawing for internal electrification
   - Circuit Diagram; Simple circuit diagram, drawing for internal electrification
   - Earthing; different type, importance and construction
   - Wiring; Different types of internal electrification wiring, LT Panel Board, Distribution Board, Switch Board, Panel Board DB, Point wiring
2. Estimating and costing
   - Simple Estimation and costing for internal wiring
3. Maintenance
   - Fault diagnosis
   - Repairing of Internal Electrification

PART – B (50 MARKS)

1. Generator Set & Transformer
   - General Principle
   - Periodic Maintenance
   - Installation of Transformer and maintenance
2. Electrical Measuring Instruments
   - General Principle
   - Uses
3. Air Conditioning and Refrigeration
   - General principle
   - Periodic Maintenance
4. Lift/Elevator
   - General principle
   - Periodic Maintenance

ENGINEERING PAPER Duration – 3 hours

(Mechanical Engineering)

PART – A (50 Marks)

1. Detail Study of Various type of Machine and Equipment used in Public Works Department
   - Uses
   - Functions
   - Maintenance
2. Fundamental of Diesel and Petrol Engines
   - Operation
   - Advantages and disadvantages
   - Periodic and daily maintenance
   - Cooling and lubrication system
   - Trouble shooting and fault diagnosis.

PART – B (50 MARKS)

1. Survey Report
   - Preparation of survey report
   - Repair Estimate
   - Maintenance of Log Book
   - History sheet.
2. Welding, Soldering and Brazing
   - Different Methods
   - Technique
   - Application
3. Measuring Tools & Instruments Used in Machine Shops
   - General studies
   - Uses
   - Applications.

ENGINEERING PAPER Duration – 3 hours

(Draftsman Grade-I)

PART – A (50 Marks)

1. ARCHITECTURAL DESIGN
   - Basic Design – Elements and principles, comparison of designed and non-designed objects ;
   - Standard dimensions and space requirements, visual textures and tonal variations, dimensional relationships ;
   - Importance of scale in architecture- human scale and monumental scale; interrelation of form, function and circulation in architectural design ;
   - Elementary principles of Architectural Design on the basis of structure, function and aesthetics ;
   - Design of small structures and objects of interest with respect to form and construction ;
   - Building details – functional use of materials ;
   - Barrier free design – Standard dimension, space standards, accessibility, choice of materials and arrangement of spaces ;
   - National Building Code norms.
2. CLIMATOLOGY
   - Necessity of studying climatology in architecture ;
   - Concept of thermal comfort-different factors determining thermal comfort of human being in a built environment ;
   - Thermal conductivity of building materials and their impact in thermal comfort ;
   - Effect of sun in architecture- orientation of sun, azimuth and altitude ;
   - Light – visual efficiency, day lighting, source and factor concept, design variables;
   - Energy efficient building design .
3. BUILDING MATERIALS AND CONSTRUCTION
   - Building materials ;
   - Sources, general and special characteristics ;
   - Composition, physical and chemical properties ;
   - Advantages and disadvantages of use of various materials, sustainability of use ;
   - Stones, bricks, clay, lime, cement, timber, cement concrete, steel, glass ;
   - Insulation materials, sealants and adhesives, protective and decorative coatings, water proofing and damp proofing materials ;

- Building construction ;
- Components of buildings – technical terms, definitions and pictorial representation;
- Foundations – definition, purpose, types ;
- Brick masonry, masonry bonds – English bond, Flemish bond, Raking bond ;
- Stair – technical terms, classifications ;
- Doors and windows – types of doors, classifications of windows ;
- Roofs and roof coverings – technical terms, classification, types, GI sheet roof covering

4. BUILDING SERVICES
   - Electrical services-types, wiring systems, types of ear thing, main and distribution boards ;
   - Fire safety – Fire fighting equipments in buildings, fire detection system, fire alarm system, regulations and requirements, dry and wet risers, automatic sprinklers;
   - Lighting – renewable energy sources, importance of light in architecture, perception of light and color ;
   - Mechanical equipment for vertical transportation, physically handicapped mechanical safety systems ;
   - Ventilation – Natural or mechanical, principles of natural ventilation, Air-conditioning-control of quality, quantity, temperature and humidity ;
   - Acoustics ;
   - Intelligent buildings.
5. ENVIRONMENTAL POLLUTION AND CONTROL
   - Quantity of water – purpose of demand, factors affecting rate of demand ;
   - Sources of water and their characteristics, rainfall and runoff ;
   - Quality of water – meaning of pure water, maintenance of purity of water, water quality analysis;
   - Conveyance of water ;
   - Distribution System – general considerations, methods of distribution, methods of layout of pipe distribution ;
   - Pipe appurtenances – Necessity ;
   - Purpose and principles of sanitation ;
   - Collection and conveyance of sewage – methods of carrying and collecting sewage ;
   - Design and construction of sewers ;
   - Sewer appurtenances ;
   - House drainage – principles, types of traps ;
   - Treatment and disposal of sewage.
6. SURVEY THEORY
   - General principles, classifications, purpose of survey, common terms and definitions used ;
   - Surveying instruments and their adjustments ;
   - Chain surveying ;
   - Compass surveying ;
   - Plane table surveying and leveling ;
   - Survey using digital theodolite and total station ;
   - Surveying of a site for computing earthwork.
7. ESTIMATION & COSTING AND BUILDING SPECIFICATIONS
   - Glossary of technical terms ;
   - Stages of detailed estimate ;
   - Analysis of rates ;
   - Detailed specification for various items of works – earthwork, stone, cement, brick, steel, plastering, pointing, flooring, painting, doors and windows, glazing, false ceiling, GCI sheet roofing, AC sheet roofing.

PART – B (50 MARKS)
(PRACTICALS IN COMPUTER APPLICATION)

1. Autocad 2D Drafting - 35 Marks
2. Excel Worksheet - 15 Marks

POWER AND ELECTRICITY CADRE

ENGINEERING PAPER Duration – 3 hours

(Electrical Engineering)

PART – A (50 Marks)

1. Preparation of estimates for construction of 11kV and LT Lines including Distribution Transformer Sub-Stations
2. Survey, Construction, Testing, Commissioning, Operation and Maintenance of Distribution Lines and Distribution Transformer Sub-Stations
3. Knowledge of The Electricity Acts 2003 and CEA (Measurement relating to Safety and Electric Supply) Regulation 2010 including subsequent amendments
4. Operation and Maintenance of Hydel Power Station
5. Testing, Commissioning, Operation and Maintenance of Battery Banks and Battery Charger
6. Earthing – Method of earthing and method of earth resistance measurement and testing, standard norms of earth resistance value

PART – B (50 Marks)

1. Electric measurement and measuring instruments : Voltmeter, Frequency Meter, Wattmeter, Energy Meter (Calibration & Testing)
2. Losses in Electrical Transmission, Transformation & Distribution System (including AT & C Losses)
3. Knowledge of prevailing P&E Department SOR
4. JERC for Manipur & Mizoram (Electricity Supply Code) Prevailing Tariff Schedule
5. JERC for Manipur & Mizoram (Electricity Supply Code) Prevailing Supply Code

ENGINEERING PAPER Duration – 3 hours

(Civil Engineering)

PART – A (50 Marks)

1. Description, Care and use of Survey Instruments, Preparation of Plan, Elevation, Sectional drawings and reading & writing of design and architectural drawings
2. Construction materials commonly used, their characteristics quality and properties, bricks, stone masonry, coarse and fine aggregate, re-enforcement steel, cement, timber etc. and common test for quality test control
3. Analysis of Rates, Estimating quantities of materials & transport, preparation of estimates/method of measurement
4. Basic theory and properties of RCC curtailment of steel re-inforcement, bond length, stress-compressive, tensile, sheer, neutral axis, stress strain diagram
5. Water Cement Ratio, Slump test, Gradation of aggregate, curing and compaction of concrete, formwork

6. Hill road survey-different stages of survey, Estimating and measurement of road works, Road geometry, camber, super elevation, gradient, side slope, curves, classification of roads
7. Stone masonry works, construction, procedures for retaining wall, size of stone etc.

PART – B (50 Marks)

1. Identification of site for Small Hydel Project, selection of site for stream gauging, measurement of water discharge using (1) V-notch (2) Rectangular notch (3) Current matter and (4) Floating method
2. Power potential calculation and general knowledge gross head, net head, design head, rated head, head losses
3. Topographical survey of run-of-the-river schemes: scales contour intervals and particulars of survey require for river, general layout, diversion weir, water conductor/power alignment, forebay, penstock, power house & switchyard
4. General knowledge on live storage, dead storage, firm power, secondary power, load factor, installed capacity, peak load, average load, and dependability
5. Standard specifications of various items of work

PUBLIC HEALTH ENGINEERING CADRE

ENGINEERING PAPER Duration – 3 hours

PART – A (50 Marks)
(Common for Junior Engineers in Civil, Electrical and Mechanical Engineering)

1. Rain Water Harvesting
2. Pumps for Drinking Water Supply
3. The Mizoram Water Supply (Control) Acts & Rules
4. Conveyance of Water
   Pipes viz. GI, DI, CI, ERW, HDPE, PVC, Advantages & Disadvantages, Pipe Appurtenances.
5. Water Supply
   Survey and investigation of water supply scheme. Selection of site for reservoir. Intake structures – different types of intakes, factors of selection and location of intakes.
6. Hand Pump Tube Wells
   Types of HPTW. Importance of HPTW.
7. Estimating of various works like –
   a) Earthwork
   b) Masonry - Stone
      - Brick
   c) Concrete - Cement Concrete
      - Reinforced Cement Concrete
   d) Retaining Wall
   e) Building - RCC Building
      - Assam Type Building
8. Analysis of Rates
9. Septic Tank – Design & Construction
10. Economical Section of Open Channel viz. Rectangular and Trapezoidal Section
11. Rural Sanitation
    Conservancy, public latrine, night soil collection and disposal, trenching and composting methods. Two pit latrines, septic tank, soak pit.

12. Solid Waste Management-
    (a) Characterization
    (b) Segregation
13. Storm Water Drainage

PART – B (50 Marks)
(Junior Engineers in Civil Engineering)

1. Building Materials
   - Stones, Bricks, hollow blocks, Concrete blocks and their characteristics/properties
2. Soil Mechanics & Foundation Engineering / Geotechnical Engineering
   - Safe Bearing Capacity of soil (SBC)
   - RCC isolated footing
3. Water Treatment
   - Various Units of Water Treatment Plant viz. Sedimentation Filtration, Disinfection
4. Quality of Water
   - Drinking Water Standards
   - Permissible limit for Turbidity, PH, Iron
5. Population Forecasting
6. Demand of Water
   - Per capita consumption, Factors affecting per capita demand, population forecasting, different methods with merits and demerits
   - Types of water demand – domestic demand, institutional and commercial, public uses, fire demand
7. Cement Concrete Works
   - Ingredients of cement concrete and their properties.
   - Water cement ratio.
   - Different types of cement.
   - Taking out quantities of ingredients of cement concrete.
   - Proportioning of ingredients of cement concrete.
   - Mixing of ingredients of cement concrete.
   - Transportation of concrete mix.
   - Placing/Pouring of concrete mix.
   - Compaction and consolidation of concrete.
   - Curing of cement concrete works.
   - Setting of cement.
   - Shoring, scaffolding and formwork of cement concrete work.
   - Simple Designs – RCC footing, RCC Column, RCC Slab, RCC Beams viz. Cantilever, Simply Supported, Fixed and Continuous.
   - Requirement of Reinforcement for various RCC structures.
   - Spacing of Reinforcement.
   - Development length.
   - Cover to Reinforcement.
   - Plastering of cement concrete.
8. Water Tanks
   - Fundamentals

   a) Minimum requirement of reinforcement.
   b) Maximum free water cement ratio.
   c) Minimum grade of cement concrete.

d) Limit on cement content of cement concrete.
e) Reduction of stresses in steel.
f) Minimum thickness of wall and base.
g) Development length.
h) Cover to reinforcement.
i) Cover slab or dome.
j) Lightning arrestor, ventilation, testing of water tank after completion.

9. Drainage Systems
   - Storm water and sullage disposal.
   - Rain water harvesting and uses.
10. Communicable Diseases
   - Terminology.
   - Classification.
   - Methods of communication.
   - General methods of control.
11. Refuse Collection & Disposal
   - Garbage.
   - Ash.
   - Rubbish.
   - Collection methods.
   - Transportation.
   - Disposal of salvaging, dumping controlled tipping, incineration, composting and dung.
   - Disposal of digestor, bio-gas plant.

PART – B (50 Marks)
(Junior Engineers in Electrical Engineering)

1. Electrical Materials and Internal Electrification
   Conductors, Semi-conductors and Insulators, Circuit Diagram/Drawing, load calculation and simple estimation for Internal Wiring
2. Earthing :
   Knowledge of Earthing, Types of earthing and its importance.
3. Power factor:
   Knowledge of Power factor, measurement and its improvement.
4. Tools and Plants:
   ools and Plants required for maintenance of Electrical System of Water Supply Scheme (Pumping Scheme)
5. Electrical Machines Theory
   Electric and Magnetic fields, conductors and magnetic materials.
6. Electrical Machines and Power Transformers
   Testing of Electrical Machines like Induction Motor, Transformer & Switch-gear.
7. Operation & Maintenance
   Operation and Maintenance of Induction Motor, Alternator, Transformer, Battery & Charger and Switch-gears.
8. Different types of Starters ;
   DOL, Auto-Transformer, Star Delta & Soft Starter.
9. Power System :
   Components, operation and maintenance of Transmission Line (Upto 33kV)
10. Switch-gears:
   Knowledge of Protective and Measuring Instruments for Electrical System/Sub- Station.

PART – B (50 Marks)
(Junior Engineers in Mechanical Engineering)

1	Theory of Machines	:	i)	Motion
			ii)	Mechanism
2.	Thermal Engineering	:	i)	IC and CI engines
			ii)	Fuels and combustion
3.	Water Supply	:	i)	Population forecast
			ii)	Design of pumping main
			iii)	Design of power for pump
4.	Survey and preparation of repair estimate of pumping equipments			
5.	Different types of pipes used for water supply, their life period and jointing procedures			
6.	Pumps	:	i)	Different types of pump
			ii)	Characteristics of pump
7.	Operation and Maintenance	:	i)	Engine/ Diesel Generating Set
			ii)	Pumps
8.	Operation Research	:	i)	Water supply plant maintenance
9.	Welding and related processes:		i)	Different types and application
10.	Maintenance of Log books for water supply plants			

IRRIGATION AND WATER RESOURCES CADRE

ENGINEERING PAPER Duration – 3 hours

PART – A (50 Marks)

1. Basic principles of surveying, classification of surveying, survey scales, different types of survey instruments, their uses and application. Definition of term used in contour surveying, used and objective of contour survey, characteristics of contour lines.
2. Mensuration and calculation of volume, etc of works and materials, preparation of estimates.
3. Characteristics and properties of commonly used construction materials such as cement, sand, bricks, masonry, stone aggregate, timber and steel. Properties of hardened concrete, different method of measuring and proportioning of concrete mixes, water cement ratio, faults in concrete mix and remedial measures, slump test and grade of concrete, curing of concrete.
4. Properties of R.C.C, stress in steel and concrete, position of neutral axis, lever arm, under-reinforced, balanced and over-reinforced sections, strength requirements of cement concrete, permissible working (or design) stress for concrete, concrete coverings outside steel, general design principles for RC slabs, beams, column and RCC tanks.

PART – B (50 Marks)

1. Definition of various terms such as hydrology, rainfall, effective rainfall and runoff, catchment area. Types of rain gauges, importance of hydrology, concept of hydrological cycle.
2. Concept of crop water requirement, field irrigation requirement, crop seasons, duty, delta and base period- their relationship, gross command area, culturable command area, intensity of irrigation.
3. Definition and functions of different parts of weir & barrage, difference between weir and barrage, definition & function of regulatory work such as cross and head regulator, falls, energy dissipators, definition & functions and necessity of- aqueduct, siphon, classification of dam, type of dam, necessity & advantages of dam.

4. Definition of Irrigation, necessity of irrigation, types of irrigation, sources of irrigation water, concept of irrigation canals, different parts of irrigation canals and their functions, hydraulic design of irrigation canals- Manning's formula, various types of canal lining-advantages and disadvantages.

COMMON ACCOUNTS PAPER FOR OFFICERS HOLDING THE POST OF JUNIOR ENGINEER/DRAFTSMAN-I

ACCOUNTS PAPER Duration – 3 hours

PART – A (50 Marks)

1. Forms for bills and vouchers, used for payments.
2. Works of inescapable nature.
   a) Emergent Works.
   b) Urgent Works.
3. Documents of Accounts.
   a) Bill register
   b) Materials account
4. Construction Works
   a) Detailed Project Report/ Detailed Estimate
   b) Administrative approval & Expenditure Sanction
   c) Technical sanction
   d) Schedule of Rates (SOR)
5. Bidding System
   a) Tender with 2(two)/3(three) bid system
   b) Invitation of tender for works
   c) Time limit for publicity of tenders
   d) Tendering limits of contractors enlisted with central/state government departments
6. Contract Management
   a) Earnest money, opening and accepting of tenders, rates of earnest money
   b) Forfeit of earnest money
   c) Performance guarantee
   d) Signing of agreement
   e) Security Deposit & Forms of Security deposit
   f) Documentation of accounts
   g) Mobilisation advance
   h) Plan, Machinery & Shuttering material advance
   i) Secured Advance
   j) Measurement of work
   k) Measurement of inadmissible items
   l) Advance payments for work done measured/not measured
   m) Documentation of hindrances
   n) Extension of time (EOT) & rescheduling of milestone
   o) Completion certificate
   p) Deduction of income tax at source
   q) Deduction of goods and services tax
7. General outlines of system of Accounts.
   a) System of Account

8. Relation with Account Officer
   i) General
   ii) Inspection by the Audit/Account Officers
9. Stores
   i) Stock
   ii) Tools and Plant
   iii) Road Metal
10. Item rate contract

References:

1. CPWD Works Manual.
2. Standard Operating Procedure for CPWD Works Manual
3. CPWD Accounts Code

PART – B (50 Marks)

1. CCS (Conduct) Rules, 1964
   i) Rule 3 : General
      Rule 3 'A' : Promptness and Courtesy
      Rule 3 'B' : Observance of Government's policies
   ii) Rule 7 : Demonstration and Strikes
   iii) Rule 22 : Consumption of intoxicating drinks and drugs

2. CCS (Leave Rules), 1972
i) Kinds of leave due and admissible including special kinds of leave
ii) Grant of and return from leave

3. CCS (CCA) Rules, 1965
i) Penalties and disciplinary authorities
ii) Suspension

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