EComp. No.: 6615

GOVERNMENT OF MIZORAM
PUBLIC HEALTH ENGINEERING DEPARTMENT
....

NOTIFICATION

Dated Aizawl, the 24th August, 2026

No.A.12031/5/2023-PHE : In the interest of public service, the Governor of Mizoram is pleased to notify Syllabus for direct recruitment to the posts of Bacteriologist (Level-8) and Chemist (Level-8) under Public Health Engineering Department, with immediate effect, as shown in the **Annexure** enclosed herewith.

This issues with the approval of DP&AR(GSW) vide I.D No.A.12045/17/2025-P&AR(GSW) dated 17.08.2026

Sd/- ZODINGPUII
Secretary to the Govt. of Mizoram
Public Health Engineering Department

Memo No. A. 12031/5/2023-PHE : **Dated Aizawl, the 24th August, 2026**

Copy to :-

1. Secretary to Governor, Mizoram.
2. P.S. to Chief Minister, Mizoram.
3. P.S to Speaker/Ministers/Leader of Opposition/Dy. Speaker/Ministers of State/Govt. Deputy Chief Whip/Vice Chairman, State Planning Board, Mizoram
4. Sr. PPS to Chief Secretary, Government of Mizoram
5. Secretary, Mizoram Public Service Commission
6. Engineer-in-Chief, PHE Department
7. Chief Engineer, PHED Zone- I, Zone -II, & Director, PMU,JJM
8. All Superintending Engineers under PHE Department
9. Under Secretary, DP&AR (GSW)/MPSC
10. All Executive Engineers under PHE Department
11. Controller, Printing & Stationery with 5 (five) spare copies for publication in Mizoram Gazette.
12. Website Manager, PHED for uploading in the Department Website.
13. Guard file.

E-in-C	
C E (Hq&WR)	
S E (U)	
S E (M)	
DD Admn /	
DD (F&A)	

Office of the Engineer-in-Chief
PHED
Receipt No .....
Date .....
Section .....

(NGURSANGZUALI SAILO)
Under Secretary (A) to the Govt. of Mizoram
Public Health Engineering Department

SYLLABUS FOR DIRECT RECRUITMENT TO THE POST OF CHEMIST (LEVEL-8) UNDER PUBLIC HEALTH ENGINEERING DEPARTMENT

PAPER	SUBJECT	MARKS	DURATION
Paper – I (Conventional Type & MCQ with negative marking)	General English	**100**	3 hours with additional time of 60 minutes for visually handicapped/ cerebral palsy candidates
Paper – II (MCQ with negative marking)	General Knowledge	**100**	2 hours with additional time of 40 minutes for visually handicapped/ cerebral palsy candidates
Paper – III (Environmental Engineering) ***(Technical Paper)*** (MCQ with negative marking)	Unit-I : Environmental Management. Unit-II : Environmental Chemistry Unit-III : Air and Noise Pollution Unit-IV: Water Resources and Environmental Hydraulics	50 50 50 50	2 hours with additional time of 40 minutes for visually handicapped/ cerebral palsy candidates
	Total	**200**	
Paper – III (Chemical Engineering) ***(Technical Paper)*** (MCQ with negative marking)	Unit-I : Chemical Engineering Materials. Unit-II: Process calculations in Chemical Engineering Unit-III: Chemical Engineering Thermodynamics Unit-IV: Heat Transfer Unit-V : Mass Transfer	30 50 40 40 40	2 hours with additional time of 40 minutes for visually handicapped/ cerebral palsy candidates
	Total	**200**	
Paper – III (Chemistry) ***(Technical Paper)*** (MCQ with negative marking)	Unit-I: Organic Chemistry Unit-II: Inorganic Chemistry Unit-III: Chemistry in Everyday Life Unit-IV: Industrial Chemistry	70 70 30 30	2 hours with additional time of 40 minutes for visually handicapped/ cerebral palsy candidates
	Total	**200**	
Paper – IV (Environmental Engineering) ***(Technical Paper)*** (MCQ with negative marking)	Unit-I: Solid Waste Management Unit-II: Rural Water Supply and Sanitation Unit-III: Advanced Wastewater Treatment Unit-IV: Environmental Issues	50 50 50 50	2 hours with additional time of 40 minutes for visually handicapped/ cerebral palsy candidates
	Total	**200**	
Paper – IV (Chemical Engineering) ***(Technical Paper)*** (MCQ with negative marking)	Unit-I: Chemical Reaction Engineering Unit-II: Fluid mechanics Unit-III: Instrumentation and Process Control Unit-IV: Plant Design & Economics Unit-V : Chemical Technology	50 30 40 40 40	2 hours with additional time of 40 minutes for visually handicapped/ cerebral palsy candidates
	Total	**200**	

Paper – IV (Chemistry) *(Technical Paper)* (MCQ with negative marking)	Unit-I: Physical Chemistry Unit-II: Analytical Chemistry Unit-III: Environmental Chemistry	80 70 50	2 hours with additional time of 40 minutes for visually handicapped/ cerebral palsy candidates
	Total	**200**	

DETAILED SYLLABUS:

1) **General English .....: 100 Marks (3 hours)**
   (a) Precis Writing .....: 10 Marks
   (b) Letter Writing.....: 10 Marks
   (c) Comprehension of given passages.....: 10 Marks
   (d) Essay.....: 10 Marks
   (e) Grammar: Parts of Speech
   (MCQ with negative marking).....: 20 Marks
   (f) Correct usage and Vocabularies
   (MCQ with negative marking).....: 20 Marks
   (g) Formation of Sentence (MCQ with negative marking).....: 20 Marks

2) **General Knowledge** (MCQ).....: **100 Marks (2 hours)**
   (a) Current events of state, national and international importance.....: 12 marks
   (b) History of India and Indian National Movement.....: 12 Marks
   (c) Indian and World Geography
   - Physical, Social, Economic.....: 12 Marks
   (d) Indian Polity and Governance – Constitution, Political System, Public Policy, Duties & Rights Issues.....: 12 Marks
   (e) Economic and Social Development, Sustainable Development, Poverty, Inclusive Economy, Demographics, Social Sector initiatives, and other related issues..... ....: 12 Marks
   (f) General issues on Environmental Ecology, Bio-diversity and Climate.....: 12 Marks
   (g) General Science.....: 12 Marks
   The topics listed above shall also cover the State of Mizoram wherever applicable.
   (h) General awareness on Mizo culture, its heritage and society.....: 16 Marks

3) **Technical Subject Paper-I (MCQ with negative marking) : 200 Marks (2 hours)**

4) **Technical Subject Paper-II (MCQ with negative marking): 200 Marks (2 hours)**

*Notes **regarding Negative Marking:***

1) There will be penalty (negative marking) for every wrong answer given by a candidate in the MCQ type questions.

2) For each question for which a wrong answer has been given by the candidate, one third of the marks assigned to that question will be deducted as penalty.

3) *If a candidate gives more than one answer to one question, it will be treated as wrong answer even if any one of the given answers happens to be correct and there will be same penalty as above for that question.*

4) *If any question is left blank, i.e. no answer is given by the candidate, there will be no penalty for that question.*

DETAILED SYLLABUS FOR DIRECT RECRUITMENT TO THE POST OF CHEMIST (LEVEL-8) UNDER PUBLIC HEALTH ENGINEERING DEPARTMENT

ENVIRONMENTAL ENGINEERING
PAPER-III
(Technical Paper - I)
Full Marks: 200

Sl.No.	Details	Marks
Unit-I	**Environmental Management:** Goals and components of Environmental Management, Socio-economic context. Sustainability and sustainable development, issues and constraints, Environmental values and ethics.EIA– Definition, History and Objective, Role, Benefits and flaws of EIA in India, EIA Procedures, Environmental Impact Statement, Key elements of EIA: Screening, scoping identifying and evaluating impacts, mitigations and issuing environmental statements. Environmental Clearance (EC)- Process for New Projects: Screening, scoping, public consultation, MoEF questionnaire for environmental clearance, critical environmental issues and formulation of strategies of EMP, Risk Assessment Environmental Policy and Law. Environmental Audit-eco marks and eco labelling.	50
Unit-II	**Environmental Chemistry:** Covalent and ionic bonding. Chemical equations, concentration and activity. Structure and chemistry of organic molecules. Radioactivity of elements. Chemical equilibria. Thermodynamics and kinetics of chemical reactions. Principles of water chemistry: Water quality parameters and their measurement; Acid- base equilibria, Buffer solution. Solubility of gases in water. Complexation , precipitation and redox reactions. Inorganic and organic contaminants in water and their speciation. Organic matter, nitrogen, phosphorous, potassium, cation exchange capacity, base saturation and sodium absorption ratio in soil. Composition of the atmosphere, reactivity of trace substances in the atmosphere. Urban atmosphere-smog and particulate pollution. Chemistry of ozone formation and stratosphere.	50
Unit-III	**Air and Noise Pollution:** Natural and anthropogenic sources of pollution. Atmospheric sources, sinks, transport. Indoor air pollution and effects on health and environment. Gases and particulate matter. Air quality standards- Primary and secondary pollutants. Air quality indices- Visibility and Particulate pollutants- measurement and control methods. Control of particulate air pollutants using gravitational settling chambers, cyclone separators, wet collectors, fabric filters (Bag-house filter), electrostatic precipitators (ESP). Measurement of gaseous pollutants and control methods-absorption, adsorption, condensation and combustion; Control of sulphur oxides, nitrogen oxides, carbon monoxide, and hydrocarbons; Vapour-liquid and vapour-solid equilibria. Fick's law and interfacial mass transfer. Automotive emission	50

	controls, fuel quality, diesel particulate filters, catalytic convertors. Air quality management: Point, line and area sources; Inventory; Influence of meteorology, topography, dispersion modeling. Sources of noise pollution and health effect. Standards, measurement and control methods of noise pollution.	
Unit-IV	**Water Resources and Environmental Hydraulics:** Structure, properties and distribution of water, Water quality- chemical, physical and biological. Threats to water resources, water conservation. Water cycle and water balance - precipitation, infiltration, evapo- transpiration, runoff. Surface run-off models. Rain water harvesting and storage. Geologic formations as aquifers, confined and unconfined aquifers and their parameters - porosity, permeability, transmissivity and storage coefficient. Concepts of mechanics, properties of fluids, pressure measurement. Hydrostatic force on surfaces. Buoyancy and flotation. Laminar and turbulent flow. Flow through Pipes and pipe networks. Boundary layer theory. Forces on immersed bodies. Flow measurement in channels and pipes. Kinematics of flow. Continuity, momentum and energy equations. Channel hydraulics - specific energy, critical flow, hydraulic jump, rapid and gradually varied flow. Design of lined and unlined channels.	50
	Total	**200**

ENVIRONMENTAL ENGINEERING
PAPER-IV
(Technical Paper - II)
Full marks: 200

Sl. No.	Details	Marks
UNIT-I	**Solid Waste Management:** Sources and impacts of solid waste. Characteristics of solid waste. Sampling – physical, chemical, and biological analysis. Collection and transportation. Biological processing and Thermal processing. Sanitary Landfill–Process, mechanism, classification, types, site considerations, maintenance of site.	50
UNIT-II	**Rural Water Supply and Sanitation:** Concept and scope of sanitation in rural areas. Magnitude of problem of water supply and sanitation, National policy. Various approaches for planning of water supply systems in rural areas. Selection and development of preferred sources of water, springs, wells, Infiltration wells, radial wells, and infiltration galleries. Collection of raw water from surface source. Specific problems in rural water supply and treatment e.g. iron, manganese, fluorides, Low cost treatment. Improvised methods and compact system of treatment of surface and ground waters such as MB settlers, slow sand filter, chlorine diffusion cartridges. Water supply through spot sources, hand pumps, open dug wells Planning of distribution system in rural areas Water supply during fairs, festivals and emergencies, Treatment and disposal of wastewater /sewage various methods of collection and Disposal of night soil. Onsite sanitation system and community latrines.	50
UNIT-III	**Advanced Wastewater Treatment:** Types of industries and industrial pollution, Environmental legislations related to prevention and control of industrial effluents. Condition of waste stream. Sampling – Grab, Composite and integrated samples. Waste minimization, Equalization, Neutralization, Oil separation, Flotation. Waste management Approach, Waste Audit, Volume and strength reduction, Material and process modifications, Recycle, reuse and by product recovery, Zero effluent discharge. Sources, Characteristics, waste water treatment flow sheets for -Textile, Tannery, Dairy, Sugar, Pulp and Paper, Distillery, Steel plants. Hazardous waste, introduction, definitions, sources, characterization, health effects, legislations, physico-chemical treatment of hazardous waste, biological treatment. Sources, measures and health effects; nuclear power plants and fuel production; waste generation from nuclear power plants; disposal options.	50
UNIT-IV	**Environmental Issues:** Global effects of air pollution - Greenhouse gases, global warming, climate change, urban heat islands, acid rain, ozone hole. Ecology, ecosystem and biodiversity. Factors influencing increase in population, energy consumption,	50

	and environmental degradation.	
	Total	**200**

DETAILED SYLLABUS FOR DIRECT RECRUITMENT TO THE POST OF CHEMIST (LEVEL-8) UNDER PUBLIC HEALTH ENGINEERING DEPARTMENT

CHEMICAL ENGINEERING
PAPER-III
(Technical Paper - I)
Full marks: 200

Sl. No.	Details	Marks
UNIT-I	**Chemical Engineering Materials:** Crystal structure. Plastic deformation of single and poly-crystalline materials. Plain carbon steels, Stainless steels, Wear-resisting steels, non-ferrous alloys. Corrosion- types of corrosion and protection. Electrochemistry of corrosion. Techniques to measure corrosion rate. Heat treatment of ferrous and non-ferrous materials. Composite materials. Metallic implant materials. Concepts of Bio-ceramics.	30
UNIT-II	**Process calculations in Chemical Engineering:** Calculation-unit and dimension. Conversion of units, mole concept, basic concept, stoichiometric and composition relationship, conversion and yield, limiting-excess-reactant. Ideal gas law calculations, real-gas relationships, vapour pressure of immiscible liquids, solution based on Raouly's Henry and Dalton's temperature. Absolute humidity, relative humidity, saturation, dry and wet bulb temperature. Gas synthesis, acid-alkali productions recycle. Thermochemistry-law of constant heat summation. Combustion calculation.	50
UNIT-III	**Chemical Engineering Thermodynamics:** Laws of thermodynamics and its application. Limitations of First Law. PVT relationships and its application. Maxwell's relations, Joule- Thomson co-efficient. Fugacity, activity and chemical potential. VLE, for ideal/non-ideal, single and multi-component systems. Chemical reaction equilibria.	40
UNIT-IV	**Heat Transfer:** Equation of energy, steady and unsteady heat conduction, convection and radiation, thermal boundary layer and heat transfer coefficients, boiling, condensation and evaporation, types of heat exchangers and evaporators and their process calculations; design of double pipe, shell and tube heat exchangers, and single and multiple effect evaporators.	40
UNIT-V	**Mass Transfer:** Fick's laws, molecular diffusion in fluids, mass transfer coefficients, film, penetration and surface renewal theories; momentum and heat and mass transfer analogies; stage-wise and continuous contacting and stage efficiencies; HTU&NTU concepts; design and operations of equipment for distillation, adsorption, membrane separations(micro-filtration, ultra-filtration, nano-filtration and reverse osmosis).Humidification and crystallization.	40

	Total	**200**

CHEMICAL ENGINEERING
PAPER-IV
(Technical Paper - II)
Full marks: 200

Sl. No.	Details	Marks
UNIT-I	**Chemical Reaction Engineering:** Theories of reaction rates; kinetics of homogeneous reactions, interpretation of kinetic data, single and multiple reactions in ideal reactors, kinetics of enzyme reactions (Michaelis-Menten and Monod models), non-ideal reactors; residence time distribution, single parameter model; non-isothermal reactors; kinetics of heterogeneous catalytic reactions; diffusion effects in catalysis; rate and performance equations for catalyst deactivation.	50
UNIT-II	**Fluid mechanics:** Normal forced in fluids. Newtonian and Non-Newtonian fluids, Laminar and turbulent flows, pressure drop and friction factor, velocity profiles, nature of turbulence. Flow in boundary layers, basic equation of fluid flow, momentum and energy. Bernoulli's Equation, Navier-Stokes equation, drag force and drag coefficient, terminal and settling velocities, buoyancy and stability. Techniques of flow measurement. Mixing of fluids, types of mixers and their selection.	30
UNIT-III	**Instrumentation and Process Control:** Measurement of process variables; sensors and transducers; P&ID equipment symbols; process modeling and linearization, transfer functions and dynamic responses of various systems, systems with inverse response, process reaction curve, controller modes (P, PI, and PIO); control valves; transducer dynamics; analysis of closed loop systems including stability, frequency response, controller tuning, cascade and feed forward control.	40
UNIT-IV	**Plant Design & Economics:** Principles of process economics and cost estimation including depreciation and total annualized cost, cost indices, rate of return, payback period, discounted cash flow, optimization in process design and sizing of chemical engineering equipments such as heat exchangers and multistage contactors.	40
UNIT-V	**Chemical Technology:** Inorganic chemical industries (sulfuric acid, phosphoric acid, chlor-alkali industry), fertilizers (Ammonia, Urea, SSP and TSP); natural products industries (Pulp and Paper, Sugar, Oil, and Fats); petroleum refining and petrochemicals; polymerization industries (polyethylene, polypropylene, PVC and polyester synthetic fibers)	40
	Total	**200**

DETAILED SYLLABUS FOR DIRECT RECRUITMENT TO THE POST OF CHEMIST (LEVEL-8) UNDER PUBLIC HEALTH ENGINEERING DEPARTMENT

CHEMISTRY
PAPER-III
(Technical Paper - I)
Full marks: 200

Sl. No.	Details	Marks
UNIT-I	**Organic Chemistry:** Hydrocarbons- alkanes, alkenes, alkynes, oxygen containing compounds- aldehydes and ketones, oxygen containing organic compounds- ether and epoxides. Ammino acids, peptides and proteins. Enzyme and catalysis. Reaction mechanisms. Pericyclic reactions, electrolytic and cycloaddition reaction. Organic synthesis- formation of carbon-carbon bond, electrophilic and nucleophilic carbon species. Heterocycles. Steriochemistry. Principles and functions of UV, IR, NMR spectroscopy and Mass Spectrometry. Biomolecules (Proteins, Lipids, carbohydrates).	70
UNIT-II	**Inorganic Chemistry:** Atomic structure. Chemical bonding- ionic, covalent and metallic bond. Periodic Table. Oxidation and reduction. Transition Elements and Lanthanides. Organometallic compounds. S-block and p-block Elements. Coordination Chemistry. Acid base concepts. Noble gases. Nuclear Chemistry. Units of radioactivity	70
UNIT-III	**Chemistry in Everyday Life:** Classification and hazards of polymers, polymerization reactions. Uses of plastics. Paper manufacturing process and impact on environment, types of paper. Natural dyes and synthetic dyes. Classes and chemical composition of dyes. Toxicology of cosmetics. Fats and oils, saturated and unsaturated fatty acids, saponification number. Vitamins and minerals. Antacids, Antihistamine. Green chemistry and synthetic chemistry- green chemistry in chemical laboratory.	30
UNIT-IV	**Industrial Chemistry:** Fermentation process, microbial biomass, microbial enzyme. Food chemistry and food processing. Treatment of tannery effluents. Chemistry of lead azide, nitroglycerine and nitrocellulose, picric acid. Synthetic gas and synthetic petrol. Hazards and uses of coal gas, water gas and oil gas.	30
	Total	**200**

CHEMISTRY
PAPER-IV
(Technical Paper - II)
Full marks: 200

Sl. No.	Details	Marks
UNIT-I	**Physical Chemistry:** States of matter. Atomic structure. Thermodynamics. Redox reaction. Ionic equilibria. Electrochemistry. Surface Chemistry. Nuclear Chemistry. Phase Equilibria. Chemical Kinetics.	80
UNIT-II	**Analytical Chemistry:** Principles and application of spectroscopy and Chromatographic techniques. Separation method. Solvent extraction. Electroanalytical method. Volumetric analysis. Gravimetric methods.	70
UNIT-III	**Environmental Chemistry:** Oxygen and ozone chemistry. Acid rain. Soaps and detergents. Water quality criteria. Dissolved Oxygen, BOD and COD, Eutrophication. Hardness and softening of water. Water pollution and major water pollutants. Waste Management and recycling. Chemical Toxicology	50
	Total	**200**

SYLLABUS FOR DIRECT RECRUITMENT TO THE POST OF BACTERIOLOGIST (LEVEL-8) UNDER PUBLIC HEALTH ENGINEERING DEPARTMENT

PAPER	SUBJECT	MARKS	DURATION
Paper-I (Conventional Type and MCQ with Negative Marking)	General English	**100**	3 hours with additional time of 60 minutes for visually handicapped/ cerebral palsy candidates
Paper-II (MCQ with Negative Marking)	General Knowledge	**100**	2 hours with additional time of 40 minutes for visually handicapped/ cerebral palsy candidates
Paper-III (Microbiology) ***(Technical Paper)*** (MCQ with negative marking)	Unit-I : General Microbiology Unit-II : Culture Media and Culture Methods Unit-III : Microbial genetics Unit-IV : Microbial Metabolism	50 50 50 50	2 hours with additional time of 40 minutes for visually handicapped/ cerebral palsy candidates
		200	
Paper-III (Biochemistry) ***(Technical Paper)*** (MCQ with negative marking)	Unit-I : Biochemistry Unit-II : Biomolecules Unit-III : Cell Biology Unit-IV : Fundamentals of enzymology Unit-V : Metabolism	50 30 20 40 60	2 hours with additional time of 40 minutes for visually handicapped/ cerebral palsy candidates
		200	
Paper-III (Chemistry) ***(Technical Paper)*** (MCQ with negative marking)	Unit-I : Organic Chemistry Unit-II : Inorganic Chemistry Unit-III : Chemistry in Everyday Life Unit-IV : Industrial Chemistry	70 70 30 30	2 hours with additional time of 40 minutes for visually handicapped/ cerebral palsy candidates
		200	
Paper-III Medical Laboratory Science ***(Technical Paper)*** (MCQ with negative marking)	Unit-I : Biochemistry Unit-II : Microbiology Unit-III : Bacteriology Unit-IV : Virology and Mycology	50 60 50 40	2 hours with additional time of 40 minutes for visually handicapped/ cerebral palsy candidates
		200	
Paper-IV (Microbiology) ***(Technical Paper)*** (MCQ with negative marking)	Unit-I : Immunology Unit-II : Molecular biology techniques and Bioinstrumentation Unit-III : Applied Microbiology Unit-IV : Microbiology of air, water and soil	50 50 50 50	2 hours with additional time of 40 minutes for visually handicapped/ cerebral palsy candidates
		200	

Paper-IV (Biochemistry) *(Technical Paper)* (MCQ with negative marking)	Unit-I : Microbiology Unit-II : Biochemical Techniques Unit-III : Immunology Unit-IV : Molecular Biology Unit-V : Biostatics & Applied biochemistry Unit-VI : Environmental Biochemistry	40 40 30 30 30 30	2 hours with additional time of 40 minutes for visually handicapped/ cerebral palsy candidates
		200	
Paper-IV (Chemistry) *(Technical Paper)* (MCQ with negative marking)	Unit-I : Physical Chemistry Unit-II : Analytical Chemistry Unit-II : Environmental Chemistry	80 70 50	2 hours with additional time of 40 minutes for visually handicapped/ cerebral palsy candidates
		200	
Paper-IV MLT/ MLS *(Technical Paper)* (MCQ with negative marking)	Unit-I : Haemotology Unit-II : Human Anatomy and Physiology Unit-III : Immunology, Immunopathology and Molecular Biology Unit-IV : Histopathology	60 50 50 40	2 hours with additional time of 40 minutes for visually handicapped/ cerebral palsy candidates
		200	

DETAILED SYLLABUS:

1) **General English** .....: **100 Marks (3 hours)**
   - (a) Precis Writing .....: 10 Marks
   - (b) Letter Writing.....: 10 Marks
   - (c) Comprehension of given passages.....: 10 Marks
   - (d) Essay.....: 10 Marks
   - (e) Grammar: Parts of Speech (MCQ with negative marking).....: 20 Marks
   - (f) Correct usage and Vocabularies (MCQ with negative marking).....: 20 Marks
   - (g) Formation of Sentence (MCQ with negative marking).....: 20 Marks

2) **General Knowledge** (MCQ).....: **100 Marks (2 hours)**
   - (a) Current events of state, national and international importance.....: 12 marks
   - (b) History of India and Indian National Movement.....: 12 Marks
   - (c) Indian and World Geography
     - Physical, Social, Economic.....: 12 Marks
   - (d) Indian Polity and Governance – Constitution, Political System, Public Policy, Duties & Rights Issues.....: 12 Marks
   - (e) Economic and Social Development, Sustainable Development, Poverty, Inclusive Economy, Demographics, Social Sector initiatives, and other related issues..... ....: 12 Marks
   - (f) General issues on Environmental Ecology, Bio-diversity and Climate.....: 12 Marks
   - (g) General Science.....: 12 Marks

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

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

3) **Technical Subject Paper-I (MCQ with negative marking) : 200 Marks (2 hours)**

4) **Technical Subject Paper-II (MCQ with negative marking): 200 Marks (2 hours)**

Notes regarding Negative Marking:

1) *There will be penalty (negative marking) for every wrong answer given by a candidate in the MCQ type questions.*
2) *For each question for which a wrong answer has been given by the candidate, one third of the marks assigned to that question will be deducted as penalty.*
3) *If a candidate gives more than one answer to one question, it will be treated as wrong answer even if any one of the given answers happens to be correct and there will be same penalty as above for that question.*
4) *If any question is left blank, i.e. no answer is given by the candidate, there will be no penalty for that question.*

SYLLABUS FOR DIRECT RECRUITMENT TO THE POST OF BACTERIOLOGIST (LEVEL-8) UNDER PUBLIC HEALTH ENGINERRING DEPARTMENT

MICROBIOLOGY
PAPER-III
(Technical Paper – I)
FULL MARKS: 200

Sl.No	Details	Marks
Unit-I	**1.General Microbiology** Historical development in Microbiology, contributions of Leuwenhock, Louis Pasteur, Robert Koch, Alexander Fleming and Edward Jenner. Microbial Diversity- general properties and principles of classification of microorganisms and classification of bacteria. Biochemical and molecular identification of bacteria, archaebacteria and eubacteria. Structure of bacterial cell- cell membrane, cell walls, surface structure.	50
Unit- II	**Culture Media and Culture Methods** Types of media-solid, liquid, semisolid, synthetic, complex, enriched, differential, selective. Culture methods- Pour plate, spread plate, streak plate. Anaerobic culture methods- GasPak jar, Mc Intosh and Fildesjar. Isolation of pure culture. Acidic, basic and neutral stains. Staining techniques- simple staining, negative staining, spore staining, Gram stain and acid-fast stain. Structural staining- endospore, flagella, capsule granule and negative staining.	50
Unit-III	**Microbial genetics** Physical organization of bacterial genomes. Experiments to prove DNA as genetic material, DNA replication, Extrachromosomal genetic material, Types of plasmids -structure and replication, Transposons- types, mechanism of transportation. Genetic exchange mechanism in bacteria- Transformation, Conjugation and Transduction. Mechanisms of antibiotic resistance transfer in bacteria. Gene expression in prokaryotes - Central Dogma, Mechanisms and enzymes involved in transcription and translation. Control of gene expression in Prokaryotes –Induction, Repression, Positive Control, Negative Control –Lac operon. Mutation – Spontaneous and Induced, Mutagens- Physical and Chemical agents. Auxotrophs. Reversion and suppression. Ames test, DNA repair mechanisms in bacteria- Excision Repair and SOS repair. Methods to study unculturable bacteria – metagenome, Microbiome .	50
Unit-IV	**Microbial metabolism** Bacterial Nutrition, nutritional types of bacteria, Preservation and transport of bacteria. Growth requirements and conditions influencing the bacterial growth, Bacterial growth curve- lag phase, log phase, stationary phase, death phase, growth kinetics, cell division, sporulation, germination. Enumeration and quantification of bacteria. Microbial photosynthesis. Microbes in extreme environment. Enzymes, factors affecting enzyme activity, transition state in enzyme catalysed reactions, high energy compounds- ATP and GTP, role of NAD and NADPH. Bacterial metabolism- Carbohydrate metabolism- glycolysis, alcoholic fermentation, TCA cycle, electron transport chain, substrate level and oxidative phosphorylation, pentose phosphate pathway. Transamination and Nitrogen fixation.	50
	Total	200

MICROBIOLOGY
PAPER-IV
(Technical Paper-II)
FULL MARKS: 200

Sl.No	Details	Marks
UNIT-I	**Immunology** Components of mammalian immune system, molecular structure of Immunoglobulins or Antibodies. Humoral & Cellular immune responses, T-lymphocytes and immune response (cytotoxic T-cell, helper T-cell, suppressor T-cells). Antibody affinity maturation class switching. Clonal selection theory, allotypes and idiotypes, allelic exclusion, heavy chain gene transcription, genetic basis of antibody diversity, alternate pathways of transcript splicing, somatic mutation, role of antibody, monoclonal antibodies. Immunity to different organisms, pathogen defense, inactivation of host-immune effector mechanisms. Blood grouping, Antigen-Antibody reactions, agglutination, immuno – electrophoresis, ELISA, RIA and Coomb's test. Passive and active immunization. Recombinant vaccines, bacterial vaccines, viral vaccines., cytokines, adjuvants.	50
UNIT- II	**Molecular biology techniques and Bioinstrumentation** Basic principles and applications of centrifugation. Basic principle and applications of Two-dimensional electrophoresis. Concept of Chromatography (Paper Chromatography, Ion-Exchange Chromatography, HPLC) Microscopy- Light microscopy, Bright and dark microscopy, Fluorescene microscopy. Basic principles and applications of colorimetry and turbidometry, Spectrophotometry: Principles and application –UV, Visible Spectrophotometry, Beer Lambert's Law. PCR- components and principle, types of PCR- mechanisms and application, RT-PCR, Principles of ribotyping, RFLP, RAPD, DNA fingerprinting, DNA footprinting, and DNA sequencing.	50
UNIT - III	**Applied Microbiology** Fermentation, types of fermentation. Fermentation media, sterilization, control of foaming, product recovery, and purification. Industrial products derived from microbes, organic acid–citric acid, industrial enzymes amylase and proteinase. amino acid - glutamic acid and lysine. Antibiotics- penicillins and streptomycins . Immobilization of microbes and enzymes- methods used. Role of microbes in food industry - Molds, yeasts and bacteria. Principles of food preservation, physical methods- high temperature - low temperature – drying, chemical additives-organic acids and their salts, nitrites and nitrates, sulfur dioxide and sulfites, wood smoke. Beneficial and harmful microbes. Properties, Pathogenicity and laboratory identification of - *Staphylococci, Streptococci, Pneumococcus, Neisseria, Corynebacterium, Bacillus, Clostridium, E.coli, Proteus, Klebsiella, Shigella, Salmonella, Vibrio, Mycobacterium* and *Treponema.* Properties, Pathogenicity and laboratory identification of -*Pseudomonas, Haemophilus, Brucella, Bordetella, Yersinia, Helicobacter, Leptospira* and *Actinomycete.* Prevention and Control of Bacterial Infections. Vaccines against pathogenic bacteria.	50

UNIT- IV	**Microbiology of air, water and soil** Microbiology of water, water pollution , water borne pathogens. Indicator organisms, bacteriological examination of water, purification and disinfection of water. Microbiology of sewage, BOD, COD, Waste water treatment. Microbial control of pests and diseases. Composting, biogas, biodegradation, bioremediation, bioleaching.	50
	Total	**200**

SYLLABUS FOR DIRECT RECRUITMENT TO THE POST OF BACTERIOLOGIST (LEVEL-8) UNDER PUBLIC HEALTH ENGINEERING DEPARTMENT

BIOCHEMISTRY
PAPER-III
(Technical Paper-I)
FULL MARKS- 200

Sl. No.	DETAILS	MARKS
UNIT I	**Biochemistry:** Scope and significance of Biochemistry. Chemical reactions and biomolecules in living organisms. Physical properties of molecules. Ionic equilibria- acids and bases, ph and pka, buffers, biological buffers. Chemical bonding & Concentration units. Ionic bonding, covalent bonding, hydrogen bonding, Molarity and molality, equivalent weight, normality, percentage. Van der waal's forces, hydrophobic interaction.	50
UNIT-II	**Biomolecules:** Chemistry and reactions of monosaccharides .Biologically important disaccharides. Reducing and non-reducing sugars. Amino acids. Properties, classification and biological role and functions of proteins, lipids, nucleic acids.	30
UNIT-III	**Cell Biology:** Morphology of cell. Role of cytoskeletal elements in entry of infectious agents. Cell division- mitosis and meiosis, Cell cycle and its regulation. Active and passive transport of membrane.	20
UNIT-III	**Fundamentals of enzymology:** Classification and nomenclature of enzymes; enzyme kinetics. ; Biological oxidation, Redox reactions in biology, Free energy. Laws of Thermodynamics and its application to biological systems. Electron Transfer Chain, Oxidative and substrate-level Phosphorylation, Inhibitors and uncouplers. ATP synthase.	40
UNIT-IV	**Metabolism:** General features of metabolism, anabolism and catabolism, metabolic principles; ATP as energy currency. Difference between anaerobic and aerobic ATP production. Glycolysis and Tricarboxylic acis cycle. Glyconeogenesis, Glycogenesis, Glycogenolysis and ketogenesis. Alcoholic and lactic acid fermentation. Oxidation of fatty acids. Transamination, deamination and decarboxylation. Urea cycle and its significance Nucleotide metabolism. Disease related to metabolism	60
	Total	**200**

BIOCHEMISTRY
PAPER-IV
(Technical Paper-II)
FULL MARKS- 200

Sl. No.	DETAILS	MARKS
UNIT-I	**Microbiology:** Germ theory of disease. Introduction to microorganisms- acellular (& cellular. Morphology, Nutrition, Reproduction of Bacteria. Basic growth media, types of media. Microbial growth in solid and liquid media, factors affecting microbial growth. Methods of sterilization of media, reagents and control of microbes (Physical and chemical methods). Isolation of Pure culture: Serial dilution, Streaking, Spreading and Pour Plate methods, staining techniques.	40
UNIT-II	**Biochemical Techniques:** Principle and applications-pH Meter, Colorimeter and UV- visible spectroscopy, chromatography. electrophoresis, microscopy and spectroscopy.	40
UNIT-III	**Immunology:** Concept of innate and adaptive immunity. Cytokine families, interferons. Antigens-Nature and types. Antigen-antibody interactions-properties, strength and types. Immunology response- Hypersensitivity, Autoimmunity and autoimmune disorders.	30
UNIT-IV	**Molecular Biology:** Evidence for DNA as genetic material; DNA replication mechanism-DNA polymerases. Repair of DNA damage. Concept of mutation, Types of mutations.	30
UNIT-V	**Biostatistics & Applied biochemistry-** Importance of statistical analysis in biological data management. Sampling schemes. Standard deviation. Test of significance(F&t test). Enzymes in foods and beverages. Principles of bioreactors and downstream in processing. Ethanol and its application in biological system.	30
UNIT-VI	**Environmental Biochemistry:** Biochemical effects of air, water and soil pollution. Greenhouse gases and global warming. Toxic compounds in foods and water. Heavy metal poisoning, radioactive hazards, Endocrine disrupting chemicals, antibiotic resistance. Sewage treatment.	30
	Total	200

SYLLABUS FOR DIRECT RECRUITMENT TO THE POST OF BACTERIOLOGIST (LEVEL-8) UNDER PUBLIC HEALTH ENGINERRING DEPARTMENT

CHEMISTRY
PAPER-III
(Technical Paper-I)
FULL MARKS- 200

Sl. No.	DETAILS	MARKS
UNIT I	**Organic Chemistry** Hydrocarbons- alkanes, alkenes, alkynes, oxygen containing compounds- aldehydes and ketones, oxygen containing organic compounds- ether and epoxides. Ammino acids, peptides and proteins. Enzyme and catalysis. Reaction mechanisms. Pericyclic reactions, electrolytic and cycloaddition reaction. Organic synthesis- formation of carbon-carbon bond, electrophilic and nucleophilic carbon species. Heterocycles. Steriochemistry. Principles and functions of UV, IR, NMR spectroscopy and Mass Spectrometry. Biomolecules (Proteins, Lipids, carbohydrates).	70
UNIT-II	**Inorganic Chemistry** Atomic structure. Chemical bonding- ionic, covalent and metallic bond. Periodic Table. Oxidation and reduction. Transition Elements and Lanthanides. Organometallic compounds. S-block and p-block Elements. Coordination Chemistry. Acid base concepts. Noble gases. Nuclear Chemistry. Units of radioactivity	70
UNIT-III	**Chemistry in Everyday Life** Classification and hazards of polymers, polymerization reactions. Uses of plastics. Paper manufacturing process and impact on environment, types of paper. Natural dyes and synthetic dyes. Classes and chemical composition of dyes. Toxicology of cosmetics. Fats and oils, saturated and unsaturated fatty acids, saponification number. Vitamins and minerals. Antacids, Antihistamine. Green chemistry and synthetic chemistry- green chemistry in chemical laboratory.	30
UNIT-IV	**Industrial Chemistry** Fermentation process, microbial biomass, microbial enzyme. Food chemistry and food processing. Treatment of tannery effluents. Chemistry of lead azide, nitroglycerine and nitrocellulose, picric acid. Synthetic gas and synthetic petrol. Hazards and uses of coal gas, water gas and oil gas.	30
	Total	**200**

CHEMISTRY
PAPER-IV
(Technical Paper-II)
FULL MARKS- 200

Sl. No.	DETAILS	MARKS
UNIT-I	**Physical Chemistry** States of matter. Atomic structure. Thermodynamics. Redox reaction. Ionic equilibria. Electrochemistry. Surface Chemistry. Nuclear Chemistry. Phase Equilibria. Chemical Kinetics.	80
UNIT-II	**Analytical Chemistry** Principles and application of spectroscopy and Chromatographic techniques. Separation method. Solvent extraction. Electroanalytical method. Volumetric analysis. Gravimetric methods.	70
UNIT-III	**Environmental Chemistry** Oxygen and ozone chemistry. Acid rain. Soaps and detergents. Water quality criteria. Dissolved Oxygen, BOD and COD, Eutrophication. Hardness and softening of water. Water pollution and major water pollutants. Waste Management and recycling. Chemical Toxicology	50
	Total	200

SYLLABUS FOR DIRECT RECRUITMENT TO THE POST OF BACTERIOLOGIST (LEVEL-8) UNDER PUBLIC HEALTH ENGINERRING DEPARTMENT

Medical Laboratory Technology (MLT)/ Medical Laboratory Science (MLS)
PAPER-III
(Technical Paper - I)
FULL MARKS: 200

Sl. No	DETAILS	Marks
Unit-I	**Biochemistry** Introduction and scope of Biochemistry, cleaning and care of laboratory glass ware and equipments, preparation and storage of distilled water . Units of Measurement, Calibration of volumetric apparatus. Analytical balance. Metabolism of Carbohydrate, Protein. Lipids, Nucleic acid, enzyme-classification and functions. Basic principles and mechanisms of Spectrophotometry, Colorimetry, Photometry, Chromatography and Electrophoresis. Hazards and safety measures, Quality control and assurance in Biochemistry laboratory.	50
Unit-II	**Microbiology** Introduction, brief history of Microbiology, microbe relationship. origin of microbial life – theory of spontaneous generation. Safety measures in microbiology-instruments and glasswares. Sterilization- Principle and methods- Autoclave, Incubator, Laminar Air Flow, Hor Air Oven, Water bath, Petri dish, Test tube, Screw cap, L-rods, Pasteur pipettes. Radiation and Filtration. Antiseptic and disinfectants. Types, principle and operation mechanism of Microscopy. Classification of of microbes- prokaryotes and Eukaryotes. Bacterial anatomy. Nutritional requirements of bacteria and classification, growth curve. Types of microbial culture- Synchronous, Static, Continuous Culture. Classification of Culture Media and Uses. Quality control and automation in Culture Media. Biomedical Waste Management-Segregation, Treatment and Disposal.	60
UNIT- III	**Bacteriology** Bacterial Culture- instruments and procedures. Staining techniques in bacteriology- Simple staining, Negative staining, Gram's stain, Spore staining. Principle, procedures and interpretation of biochemical tests for identification of different bacteria- Catalase, Coagulase, Indole, Methyl Red,	50

	Nitrate reduction, Carbohydrate fermentation, Bile solubility, H_2S production. Definition, classification and characteristics of Escheria Coli, Citrobacter, Salmonella, Shigella, Vibrio, Aeromones, Spirochites, Chlamydia, Pseudomonas. Diagnosis of Septicemia and bacteremia, Tuberculosis, Enteric fever. Antibiotic susceptibility testing in bacteriology. Nucleic acid techniques in diagnostic PCR. Automation in bacterial culture detection. Bacteriological examination of water, milk, food. Epidemiological markers. Preservation methods for microbes.	
UNIT-IV	**Virology and Mycology** Viruses- structure, classification and multiplication. Collection, transportation and storage of sample. Staining techniques and viral culture. EIA, PCR, Immunofluorescence. Taxonomy and classification of fungi. Culture media used in mycology. Morphological, cultural characteristics of fungal laboratory contaminants.	40
	Total	**200**

Medical Laboratory Technology (MLT)/Medical Laboratory Science (MLS)
PAPER-IV
(Technical Paper-II)
FULL MARKS: 200

Sl. No	DETAILS	Marks
UNIT-I	**Haematology** Introduction to haematology. Blood- Composition, function and components. Anticoagulants- types and preference of anticoagulants. Haemoglobin- Types, structure, synthesis and degradation. Quality assurance in haematology. Anaemia- Different types of anaemia. Quantitative disorders of Leukocytes cause and significance. Thrombosis- definition and causes. Types and causes of bleeding disorders. Laboratory diagnosis of bleeding disorders. Haemoglobinometry. Haemocytometry. Staining techniques in Haematology. Concepts of autoimmunity and autoimmune diseases. Vaccines. Blood banking- history and discovery of various blood group system. Compatibility test in blood transfusion. Complications and hazards of blood transfusion. Artificial blood.	60
UNIT-II	**Human Anatomy and Physiology** Cell structure, classification and Cell division. Classification of tissues, structure and functions. Blood composition and function. Muscular skeletal system, Respiratory system, Cardiovascular system, Lymphatic system. Digestive system, Urinary system, Genital system, Nervous system, Endocrine system. Structure and function of sense organ. Liver structure and function. Body fluids and their significance. Types of body fluids, total body water, fluid balance. Body fluids and Homeostasis. Electrolytes and ions.	50
UNIT-III	**Immunology, Immunopathology and Molecular Biology** History and introduction to immunology. Types of immunity and their mechanisms. Types of antigens and determinants of antigenicity. Types, structure and properties of immunoglobulin. Antigen- Antibody reactions- classification, mechanisms and application. Principles, procedures and application of ELISA, Immuno-fluorescence. Serological tests- principle, procedure and interpretation immune response. Hypersensitivity- types and mechanisms. Autoimmunity and autoimmune diseases. Types of vaccine and definition. Transplant immunology. Polymerase Chain Reaction. DNA- chemical composition, replication, repair. Regulation of prokaryotic and eukaryotic gene expression. Cell Cycle.	50
UNIT-IV	**Histopathology** Histotechnology, care and maintenance and safety measures in histopathology. Compound microscope, Microscopy, various types of microscopes, Micrometry and Morphometry. Various types of fixatives in histopathology. Decalcification agent and techniques. Demonstration of proteins, nucleic acids, carbohydrates, lipids, fats, bacteria and fungi. Enzyme Histochemistry.	40
	Total	**200**