

**Syllabus For Laboratory Technician Examination Under Mizoram
Institute Of Medical Education And Research (MIMER)**

GENERAL ENGLISH

(Full Marks : 100)

- (a) Essay Writing (Not more than 300 words) 20 Marks
- (b) Idioms & Phrases (Objective Type/MCQ) 16 Marks
- (c) Comprehension of given passages (Objective Type/MCQ) 12 Marks
- (d) Grammar (Objective Type/MCQ) 20 Marks
Parts of Speech : Nouns, Adjective, Verb, Adverb, Preposition, etc.
- (e) Composition (Objective Type/MCQ) 16 Marks
 - i) Analysis of complex and compound sentences
 - ii) Transformation of sentences
 - iii) Synthesis of sentences
- (f) Correct usage and vocabularies (Objective Type/MCQ) 16 Marks

Technical Paper – I (150 MARKS)

Unit – I	Anatomy and Physiology	16 Marks
Unit – II	Biochemistry (Principles, Metabolism, Analytical Biochemistry, Applied Biochemistry)	60 Marks
Unit – III	Microbiology, (Basic Microbiology, Microbial technique, Bacteriology, Mycology, Immunology, Serology & Virology, Molecular Biology, Applied Microbiology)	60 Marks
Unit – IV	Parasitology	14 Marks

Technical Paper – II (150 MARKS)

Unit – I	Pathology & Clinical Pathology, Basic Laboratory Technique & instruments.	26 Marks
Unit – II	Hematology i) Basic, Technique, Systemic ii) Blood Banking & Immunohaematology	50 (34 + 16) Marks
Unit – III	Histopathology (Basic, Technique)	34 Marks
Unit – IV	Cytopathology (Basic, Technique)	20 Marks
Unit - V	Aptitude Test	20 Marks

DETAILED SYLLABUS

Technical Paper – I (Full Marks - 150)

Unit – I **Anatomy & Physiology **(16 Marks)****

- a) Musculo skeletal system
 - Bones :- types, structure and functions
- b) Digestive System:-
 - Gross anatomy of digestive organs
 - Physiology of Digestion
 - ❖ Digestive juices – Secretion, Composition and functions
- c) Respiratory System:-
 - ❖ Gross anatomy of respiratory organs
 - ❖ Physiology of respiration
 - ❖ Oxygen and Carbon dioxide transport
- d) Cardiovascular System :-
 - ❖ Gross anatomy of heart and blood vessels
- e) Excretory System:-
 - ❖ Gross anatomy of excretory organs
 - ❖ Function of Kidneys, mechanism of urine formation.
 - ❖ Structure and function of Kidney
- f) Reproductive System:-
 - ❖ Gross anatomy of Male & Female reproductive organs
 - ❖ Physiology of menstruation
- g) Cerebro spinal fluid
 - ❖ Formation, composition of CSF
- h) Endocrine System:-
 - ❖ Gross anatomy of endocrine organs
 - ❖ Brief description of Endocrine hormone and their functions.

Unit – II **Biochemistry (60 marks)**

- a) Introduction and scope of Biochemistry, cleaning and care of laboratory glass ware and equipments, preparation and storage of Distilled water, Analytical balance, calorimeter, spectrophotometer, pH Meter, flame photometer, S.I. unit of measurement, Preservation and disposal of biological sample, Basic statistics – mean, median, modes, SD, CV, normal reference ranges. Acid and base, pH, buffer solution, indicator, standard solution, storage of chemicals, water, electrolytes, acid base balance
- b) * Carbohydrate, Lipids, Proteins – Classification, Properties, Biological importance, functions.
- Amino acids, nucleic acids, Enzymes, Co-enzymes – Definition, classifications, Biological role/importance.
- c) Glycolysis, TCA-cycle, Electron transport chain, Pentose Phosphate Pathway, Glyconeogenesis, Gluconeogenesis, Cori-cycle, Blood sugar and its regulation.
- d) Fatty acid, cholesterol, lipoproteins, Purine ribonucleotide – Biosynthesis, utilization, Ketone bodies formation and its utilization.
- e) Amino acids, vitamins, mineral – classification, Biological role, deficiency state.
- Transamination, Deamination, Biological importance of catecholamine, GABA, Serotonin, Histamine, Melanin.
- f) * Tumour – markers – Brief history, classifications, clinical applications, Laboratory test (AFP,CEA,PSA)
- Liver function test, renal function test.
 - Thyroid function test, Enzymes and co-enzyme in diagnosis of the diseases, Hormone analysis.
 - Cardiac function test
 - Qualitative test for – Carbohydrates, lipids, proteins, Bence Jonce's Protein
 - Estimation of Serum electrolytes, and bicarbonates Blood sugar
 - Quantitative test for organic constituent (Urea, uric acid, creatinine) inorganic constituent (sodium, Potassium, calcium, ammonia, chloride, Phosphate, bicarbonate and sulphate in urine with clinical significance and study of abnormal constituent or urine (glucose, Protein ketone bodies, blood, bile salt, bile pigments).
- g) * **Radio Immuno Assay (RIA)**
- Enzyme Link Immuno sorbent Assay (ELISA)
 - Chromatography (thin layer paper, gas, liquid Electrophoresis, (gel electrophoresis, liquid electrophoresis)

Unit - III **Microbiology - (60 marks)**

a) * Introduction, brief history of Microbiology, origin of microbial life – theory of spontaneous generation.

*Safety measures in microbiology

- Classifications and nomenclature of bacteria (five kingdom concept)
- Sterilization – Principle, methods, antiseptic, disinfectants.
- General characteristic of Bacteria, anatomy of bacteria (shape, size, components)
- Growth and nutrition of bacteria, classification of bacteria on the basis of nutritional requirements, measurement of cell mass and factor affecting growth.
- Cultivation of microbes (Bacteria)
- Culture technique (media preparation and inoculation)
- Isolation of Pure cultures (streak plate, spread plate, pours plate and serial dilution)
- Identification of microbes by colony morphology.

b) Bacteriology, Normal Micro flora of human body, Germ theory of diseases, microbial infection (types, sources and transmission)

- Bacterial toxin (Endotoxin & exotoxin)
- Bacterial morphology, isolation, identification, Pathogenicity, Lab diagnosis (Culture, Biochemical test, Hanging drop method for motility, Anaerobic, aerobic culture methods of staphylococcus, streptococcus, *Neisseria Gonorrhoea*, *N. meningitidis*, *Clostridium tetani* & *C. perfringens*)
- *E.coli*, *Vibrio cholera*, *Salmonella typhi*, Shigella, *Mycobacterium / Mycobacterium tuberculosis*, Spirochetes- *Treponema pallidum*.
- Collection, preservation, transportation of clinical specimens for microbial investigation.
- Bacteriological methods of examination of blood, faeces, pus, sputum, throat swab and urine
- Antibiotic sensitivity test (Disc diffusion and broth dilution methods)
- Hospital acquired infections and their control.
- Waste disposal and management

c) Instruments & Glass ware:

- Autoclave, Incubator, Laminar Airflow,
- Hot air oven, water bath, vortex shaker,
- Petri dish, test tube, screw cap tube, glass spreader/ L-rods, Pasteur pipettes.

d) Medical Mycology:

- Classification and nomenclature of fungi
- General characteristics, structures, reproduction, cultivation

- Medically important Division of fungi
 - Morphology, culture characteristics, Pathogenicity, Lab diagnosis of Common Pathogenic fungi, (*Aspergillus Sp.*, *Candida Sp.*, *Cryptococcus Sp.*, Dermatophytes, *Penicillium Sp.*)
- e) Immunology
- Introduction, Antigens (Types and properties) Antibodies/ Immuno globin types and properties)
 - Antigen – antibody reactions and their applications (Agglutination, precipitation, complement fixation and neutralization tests)
 - Immunity (Innate & Acquired)
 - Hypersensitivity
 - Immunodeficiency diseases
- f) Serology
- Quality control measures in serology
 - Common serological technique and their applications (VDRL, Widal, RA test, ASO, Pregnancy test, Hbs Ag and HCV, HIV, mantoux test)
- g) Medical Virology
- Classification, nomenclature, general characteristics (Morphology, chemical, biological properties and multiplication)
 - Cultivation of viruses (chick embryo, cell culture and animals)
 - Bacteriophages (lytic and lysogenic cycles)
 - Morphology, cultural characteristics, Pathogenicity and Laboratory diagnosis of the following viruses
 - ❖ Poliomyelitis
 - ❖ Mumps
 - ❖ Measles
 - ❖ Hepatitis A,B,C
 - ❖ Cytomegalovirus
 - ❖ Rabies
 - ❖ HIV/AIDS
- h) Molecular Biology
- Introduction
 - DNA & RNA
 - Isolation of DNA (Genomic & Plasmid)
 - Plasmids (types and Importance)
- i) Principles, methods and application of
- ELISA, Immunofluorescence test, Western Blot
 - PCR

Unit - IV Parasitology (14 marks)

- a) Introduction, classification, characteristics of human parasites
- Collection, storage and transportation of specimens, preservation of parasites
 - Morphology, transmission, life cycle, Pathogenicity and Lab. Diagnosis of :-
 - ❖ *Entamoeba histolytica*, *Giardia Lamblia*, *Trichomonas vaginalis*, *Leishmania donovani* and *L. tropica*. Plasmodia species, *Toxoplasma gondii*, nematodes- Intestinal flukes, Blood flukes, Lung flukes, Liver fluke.
- b) Common vectors of human diseases (mosquito, flies, ticks and fleas)

Technical PAPER – II (Full Marks – 150 Marks)

Unit – I: Pathology & Clinical Pathology , Basic Lab. Techniques & Instruments (26 Marks)

- (a) Pathology – definition, Branches
- Acute and Chronic inflammation (definition, characteristics)
 - Sub acute, granulomatous inflammation (definition, characteristics)
 - Changes in inflammation
 - Chemical mediators of inflammation
- (b) Cell Injury
- definition, causes, Ischaemia, necrosis
 - apoptosis, degeneration, dehydration
- (c) cellular adaptation of growth and differentiation (Atrophy, Hypertrophy, Hyperplasia, Metaplasia, Dysplasia, Anaplasia)
- (d) Neoplasia (Benign and Malignant, definition, characteristics, etiology, spread)
- (e) Cell of Immune System (B&T lymphocytes, macrophage, dendritic and langerhan's cells, NK Cells)
- (f) Laboratory organization, role of laboratory technicians and responsibilities, safety measures, instruments, reporting and recording, common laboratory accidents and its preventions, handling of infectious materials, preventions and disposal, reagents and its storage.
- (g) Types of solution (isotonic, hypotonic, hypertonic) quality control – (Principles and types)
- (h) Routine examination and clinical significant of –
- Urine
 - Stool
 - Body fluids (Ascitic fluid, pleural fluids, pericardial fluid, synovial fluids, CSF seminal fluids, sputum)

- Medico legal importance of semen analysis and abnormal morphology of sperm

Unit – II: (i) Haematology (34 Marks)

- (a) * Introduction to haematology
- * Blood - components, collection, anticoagulants, preparation of smears & quality
 - * Haemoglobin, TLC, DLC with absolute count, WBC, Red cell indices, Reticulocytes (methods of estimation, clinical significant)
 - * Erythropoiesis, Granulopoiesis, Megakaryopoiesis (normal, abnormal & clinical significant)
 - * Blood parasites, bone marrow smears
- (b) * Haemoglobin (normal and abnormal, Biosynthesis, Haemoglobinopathies and its investigation)
- (c) RBC – structure, erythropoietin, functions
- (d) WBC – Physiology, pathological variation
- (e) Platelets – functions, purpuras, investigation of disorders, thrombocytosis, thrombocytopaenia
- (f) Haemostasis (Coagulation) – Normal mechanism, abnormal, investigation of abnormal haemostasis)
- * Thrombosis – definition, causes
- (g) Leukaemia – definition, classification (FAB), Acute & Chronic leukaemias, Lab. features of Acute & Chronic leukaemia (AML, ALL, CML, CLL) Aleukaemic Leukaemia, Leukaemoid reaction, Myelodysplastic syndrome (definition Lab. features)
- (h) Anaemias (Normochromic, Normocytic, Megaloblastic, Microcytic hypochromic, Anaemia of infections, Haemolytic Anaemias) – Definition, classification, causes, laboratory, features and investigations)
- (i) Thalassaemia (Trait, Minor, Major)
- Sideroblastic Anaemia
 - Pancytopenia, Aplastic Anaemias, Pure red cells aplasia (Definition, causes, lab. investigation etc)
- (j) * Coagulation disorders, lab. diagnosis, causes, haemophilia, DIC
- * lymphoma – definition, causes, classification, lab. features/diagnosis
 - * Myeloma – definition, causes, classification, lab. features/diagnosis
 - * Polycythaemia – definition, causes, classification, lab. features/diagnosis

* Purpuras – definition, causes, classification, lab. features/diagnosis

(k) Staining – Leishman’s stain, MGG, Giemsa’s, PAS, Sudan B-Black, Iron, Fats, NAP, Acid Phosphatase, Esterase (Principle, composition, methods & results)

(ii) Blood Banking & Immuno Haematology (16 Marks)

(a) Introduction

- Blood bank organization, equipments, donor registration
- Blood groups – types, technique of grouping
- Donor’s selection, collection of blood
- Preservatives (storage), laboratory screening of blood for transfusion

(b) * Cross matching, compatibility testing

* Coomb’s test

* Transfusion reaction

* Antigens, Antibodies (properties, production), Complements, Sensitization, Agglutination, Haemolysis, Neutralization, Precipitation, Complement fixation, Immune response.

(c) Diseases transmitted through blood and their screening, Haemolytic diseases of new born.

(d) Blood component preparation and its uses, Haemaphereis, Massive transfusion, Autologous transfusion, exchange transfusion.

Unit – III: Histopathology – Basic & Technique (34 Marks)

(a) * Cells and tissues – definition, cells and its organelles, function, cell cycle, mitosis meiosis

* Epithelial tissues, definition, classifications & functions

* Connective tissues (bone & cartilage)

* Muscle tissues

* Nerve tissues

(b) Histology of different systems & organs - Respiratory system, Alimentary system, Excretory systems, Reproductive system (male & female), Endocrine system.

(c) Histopathology technique –

- Sample reception, registering, labeling
- Fixative & fixation, (definition, classification, details of fixative, aims & object, fixation and preservation)
- Decalcification (definition, methods & test of end point decalcification)
- Grossing (definition, material required)
- Processing of tissues (manual & automatic)

- Waxes (types of waxes)
 - Microtomies (types of microtome, knives, honing & stropping)
 - Dehydration, clearing, impregnation, embedding or blocking (definition, chemicals used etc)
 - Section cutting, mounting, labeling
- (d) Demonstration of (staining)
- Nucleic acids
 - Lipids
 - Proteins
 - Nerve cells
 - Muscles
 - Bone
 - Carbohydrates
 - Amyloid
 - Pigments
 - Micro organism & parasites
- (e) Biopsies of
- Renal biopsy, Lymph node biopsy
 - Liver biopsy, muscle biopsy
 - Kidneys, nerves fibres, skin biopsy
(Processing, fixation, blocking, staining)
- (f) Museum technique
- (g) Immunohistochemistry (definition, purposes)
- (h) Staining
- Theory, progressive & regressive, metachromasia, mordants, Accentators
 - Staining preparation, procedures of –
 - Haematoxyline and Eosin stain
 - MGG stain ;connective tissue stains,
 - Giemsa’s stain ; mucicarmine stains
 - Z.N. stain
 - PAS stain

Unit – IV: Cytology (Basic, technique) (20 Marks)

- (a) Definition of cytology, material for operation and establishment of cytology laboratory, role of cytology in the diagnosis, branches of cytology
- (b) * Reception, registration, numbering and supply of material for collecting specimens.
- *Preparation of cytological smears
 - * Cytological fixation – aims & objects, chemical use for cytological fixation & methods of fixation
 - * Progressive changes of the cells

- * Nuclear criteria of malignancy
- (c) * Exfoliative cytology – definition, source of samples for exfoliative cytology
 - *Body cavity fluid (Pleural effusion, Pericardial effusion, Ascitic fluids, sputum, urine, synovial fluids, CSF, Pus and Abscess)
 - Methods of collection, fixation, methods of cytopreparations & staining
 - Clotted & blood fluids (methods of cytopreparations)
 - Cellular components in Benign and malignant effusion, acute and chronic inflammations
- (d) Interventional cytology,(FNAC) Fine Needle Aspiration Cytology
 - Definition
 - Application, methods
 - Role of FNAC
 - Common sites
 - Advantage & disadvantage, limitations
 - Complications, precaution & contra-indications
 - Preparation of smears
 - General properties of wet and dry smears
 - Imprint, crush smears, biopsy sediments, cell block preparations
- (e) Aspiration of specific lesion eg. cyst, thyroid, lung, peritoneum, prostate, testis, radiological imaging aids for FNAC
- (f) Methods of collection, fixation and cytopreparation of samples from – Female Genital tracts, Respiratory tracts, Gastro-intestinal tracts, urinary tracts etc.
- (g) Staining
 - Pap's stain
 - Chemical requirements, preparation of various chemicals for pap's stain
 - Various pap's stain methods
 - Types of haematoxylene and its preparation
 - Stain maintenance
 - Preparation of graded alcohols (50%, 60%, 70%, 80% , 85%)
 - Preparation of 0.5%Hcl, Lithium Carbonate, EA modified, 0.2%Hcl, 1% Ammonium hydroxide in 70% ethanol, Orange G-6
 - Bismark Brown, EA-50, EA-36
 - Procedures of Pap's stain
 - MGG stain
 - Giemsa's stain
 - Modified pap's stain
 - PAS stain, Alcian Blue Staining
 - Mayers & South Gate Mucicarmine stain
 - Gram's stain
 - ZN stains
- (h)** Quality controls (Internal & External) definition, methods, advantage.

Unit - V Aptitude Test (20 Marks)

(a) Numerical And Figurework Tests: (4 Marks)

These tests are reflections of fluency with numbers and calculations. It shows how easily a person can think with numbers. The subject will be given a series of numbers. His/Her task is to see how the numbers go together to form a relationship with each other. He/She has to choose a number which would go next in the series.

(b) Verbal Analysis And Vocabulary Tests: (6 Marks)

These tests measure the degree of comfort and fluency with the English language. These tests will measure how a person will reason with words. The subject will be given questions with alternative answers, that will reflect his/her command of the rule and use of English language.

(c) Visual And Spatial/3-D Ability Tests: (4 Marks)

These tests are used to measure perceptual speed and acuity. The subject will be shown pictures where he/she is asked to identify the odd one out; or which comes next in the sequence or explores how easily he/she can see and turn around objects in space.

(d) Abstract Reasoning Tests: (6 Marks)

This test measures the ability to analyse information and solve problems on a complex, thought based level. It measures a person's ability to quickly identify patterns, logical rules and trends in new data, integrate this information, and apply it to solve problems.
