MAHATMA GANDHI UNIVERSITY
of
MEDICAL SCIENCES & TECHNOLOGY
JAIPUR

Syllabus

M.Sc. MEDICAL LABORATORY TECHNOLOGY

(2 Years Degree Course)

NOTICE

1. Amendments made by the Board of Management of the University in Rules / Regulations of Graduate Medical Courses shall automatically apply to the Rules/ Regulations of the Mahatma Gandhi University of Medical Sciences & Technology.

2. The University reserves the right to make changes in the syllabus/books/ guidelines, fee–structure or any other information at any time without prior notice. The decision of the University shall be binding on all.

3. The Jurisdiction of all court cases shall be Jaipur Bench of Hon'ble Rajasthan High Court only.

RULES & REGULATIONS
M.Sc. MEDICAL LABORATORY TECHNOLOGY (MLT)
(2 Years Degree Course)

DURATION OF COURSE:
The course shall be of 2 years duration from the date of commencement of academic session

MEDIUM OF INSTRUCTION
English shall be the medium of instruction.

ELIGIBILITY FOR ADMISSION:
For admission a candidate should have passed the B.Sc. Medical Laboratory Technology (MLT) course with minimum 50% marks in the aggregate.

SELECTION OF CANDIDATES:
Selection for M.Sc. MLT Course shall be done by an Admission Board strictly on merit judged on the basis of University Entrance Examination conducted in the month of July / August every year.

ATTENDANCE:

M.Sc. MLT Part I : 75% in theory and M.Sc. MLT Part II : 75% in Theory and Practical separately. Any candidate failing to achieve this, shall not be permitted to appear in the University examination.

ELIGIBILITY AND ENROLMENT:

Every candidate who is admitted to MSc. MLT Course in Mahatma Gandhi Medical College & Hospital shall be required to get himself/herself enrolled with the Mahatma Gandhi University of Medical Sciences & Technology after paying the prescribed enrolment/eligibility fees (upto November 30 of the year of admission without late fees and upto December 31 of the year of admission with late fees) along with the application form duly filled in and forwarded to the University through Principal of the College.

TRAINING:
1. The period of training for M.Sc.(MLT) course shall be of 2 years from the date of admission.
2. M.Sc. (MLT) Part – I and M.Sc. (MLT) Part – II shall be of 1 year each duration.
3. The students who have been registered late in the medical college will not be allowed to appear in the regular examination and they will be required to complete the period of study prescribed and fulfill the requirement of attendance.
4. The candidate will undertake the post graduate training as a full time post graduate in the department concerned. The candidate after passing M.Sc. (MLT) Part I examination (all 3 subjects) shall also be required to participate in the undergraduate training in his/her subject. The head of the department concerned shall certify that the students has been regular and undergone training programme according to the requirements.
5. M.Sc. (MLT) degree will be awarded in following there specialties of laboratory science.

   (a) M.Sc. (MLT) with specialization in **Pathology**
   (b) M.Sc. (MLT) with specialization in **Biochemistry**
   (c) M.Sc. (MLT) with specialization in **Microbiology**

The candidates have to choose the specialization subject prior to course commencement

EXAMINATION AND ASSESSMENT:

1. The examination in M.Sc. (MLT) Part I shall consists of three theory papers only which is common for all the three specialties.
2. The examination in M.Sc (MLT) Part II shall consist of Two Theory papers and practical in the opted specialization.
3. A candidate shall be permitted a maximum of four attempts or 2 years to complete the part I examination from the year of admission.
4. Only those candidates will be allowed to appear at M.Sc. (MLT) Part II examination, who have passed M.Sc. (MLT) Part –I examination completely.

SCHEME OF EXAMINATION:

M.Sc. MLT Part I

1. The Examination in M. Sc. MLT Part I shall consist of three theory papers.
   i. **Paper I (5251)** Pathology 100 Marks
   ii. **Paper II (5252**) Biochemistry 100 Marks
   iii. **Paper III (5253)** Microbiology 100 Marks
2. Each theory paper shall be 3 hours duration.
3. Each paper will be set by the External Examiner of the subject concerned and will be assessed by the Internal Examiner of the subject concerned of the same institution.
4. Pattern of questions to be set and answered shall be as follows:

Name of Paper	No. of questions to be set	No. of questions to be answered
Paper I - Pathology	4	4
Paper II - Biochemistry	4	4
Paper III - Microbiology	4	4

5. In order to pass the examination the candidate must secure a minimum of 50% marks in each theory paper.
6. A candidate who has failed in one or more theory paper of M.Sc. (MLT) Part-I examination must appear in that theory paper in supplementary examination which will be conducted by university within 4 – 6 months.

M.Sc. MLT Part II

1. The Examination in M. Sc. MLT Part II (With specialization in **Pathology / Microbiology / Biochemistry**) shall consist of :
   i. Theory Examination (two papers of the opted subject)
   ii. Dissertation/ Project Work and
   iii. Practical and Oral Examination

	Maximum Marks	Paper Code		
		Pathology	Biochemistry	Microbiology
Theory – Paper I	80 Marks	5254	5257	5260
Theory – Paper II	80 Marks	5255	5258	5261
Grand Viva	40 Marks			

TOTAL	**200 Marks**			
PRACTICAL		5256	5259	5262
Exercise I	25 Marks			
Exercise II	25 Marks			
Dissertation /Project Work Presentation	25 Marks			
Practical Viva	25 Marks			
TOTAL	**100 Marks**			

2. Each theory paper shall be 3 hours duration.
3. All papers shall be set by the External Examiners.
4. Paper I will be assessed by the External Examiner and Paper II will be assessed by the Internal Examiner viz. Head of the Department of subject concerned.
5. Practical examination shall be conducted by one internal, one external examiner which will be appointed by the university.
6. Pattern of questions to be set and answered shall be as follows:

Name of Paper	No. of questions to be set	No. of questions to be answered
Paper I	4	4
Paper II	4	4

6. In order to pass the examination the candidate must secure a minimum of 50% marks in Theory papers including G. Viva and 50% marks in Practical separately.
7. In case a student passes either in Theory or in Practical only, the student shall be considered to fail in the whole examination and he will have to appear in both the Theory and Practical in the subsequent examination.
8. A candidate shall be permitted a Maximum of four attempts or four years from the date of admission in M.Sc. Part I.

PAPER SETTER/EXAMINER

1. All the examiners, paper setters, theory examination answer books evaluators, Internal and External Examiners for Practical examinations shall be appointed by the President of the University.
2. Qualification of the Paper setter / Examiner: Assistant Professor and above.
3. Paper setter can be an examiner

REVALUATION

No Revaluation shall be permitted in M.Sc. Examination. However, the student can apply for scrutiny of the answer books

GRACE MARKS

No grace marks will be provided in M.Sc. Examination.

M.Sc. MEDICAL LABORATORY TECHNOLOGY COURSE

M. Sc. (MLT) PART-I

Paper – I : PATHOLOGY (100 Marks)

Details of Course

I Basics of Hematology –

1. Haemopoiesis cell composition of normal adult bone marrow.
2. Anaemias – classification, causes and laboratory investigations for anaemias - Iron deficiency anemia, - Megaloblastic anemia, - Hemolytic anemia.
3. Leukemias – classification, morphology and cytochemistry of leukemic cells
4. Haemostasis and its investigations.
5. Basic hematologic investigations and their normal values – Hb, TRBC, TLC, DLC, PCV, ESR, Platelet count, Reticulocyte count, Absolute values, BT, CT, APTT, CRT.
6. Preparation of peripheral blood film and bone marrow aspiration, staining of films & stains used in hematology.
7. Collection, handling of blood, preparation of various reagents used in hematology.
8. Automation in hematology.
9. Quality control, safety and accreditation of laboratory.

II Clinical Pathology –

1. Examination of urine – Physical, Chemical and microscopic examination
2. Semen examination – Routine and special tests
3. Examination of CSF (Routine and special tests)
4. Examination of various body fluids – Pleural fluid, Ascitic fluid, pericardial fluid, synovial fluid etc.
5. Biomedical waste management

III Blood Banking and Immunohematology –

1. Basic principles of immunohematology
2. ABO blood group system
3. Rh blood group system
4. Other blood group system
5. All material and reagents used for different investigations in blood bank.
6. Blood grouping techniques
7. Antibody screening and identification
8. Compatibility testing
9. Donor selection, blood collection and processing
10. Preservation and storage of blood
11. Blood component preparation
12. Screening test
13. Transfusion reaction
14. Quality assurance in transfusion service.

Paper – II : BIOCHEMISTRY (100 Marks)

Details of Course

1. **Cell** :structure & biochemical functions. Membrane - structure & functions.
2. **Chemistry**: of Carbohydrates, Lipids, Proteins, Nucleic acids.

3. **Enzymes** : Nomenclature and classification; mechanism of action; Coenzymes; Isoenzymes
4. **Vitamins and Minerals:** Chemical nature, sources, daily requirement, functions and deficiency.
5. **Chemistry of Blood & Hemoglobin, Plasma proteins**
6. **Organ function test**: LFT, RFT, Pancreatic function tests & Thyroid function tests.
7. **Analytical and Physical Bio-Chemistry** : pH, Buffer systems, osmosis, Donnan equilibrium, free energy, high energy linkages.
8. **Principles and application of** Chromatography, Electrophoresis, Colorimetry & Spectrophotometry
9. **Basic concept of Quality Control**: Quality Assurance, Internal Quality Control, LJ charts, Westgard rules, EQAS

Paper – III : MICROBIOLOGY (100 Marks)

Details of Course

1. **Introduction-**Definition and importance of microbiology**,** classification of microorganisms. Brief morphological features of microbes. General properties of bacteria, Viruses and fungi
2. **Chain of Infection-**Definition of infection-Sources of microbes. Routes of Infection and prevention of hospital acquired infection, Microbial Pathogenicity
3. **Sterilization**-Definition and classification physical methods of sterilization, Use of Autoclave, Preparations and Sterilization of Surgical packs. **Disinfection**-Definition and classification, Methods of disinfection. Principles of cleaning and disinfection of the rubber-goods, Glasswares, Packs, linens, Equipments.
4. **Growth survival of Micro-organism** Microbial Growth, Definition and measurement of bacterial growth, Control of Microbial Growth. **Cultivation of microorganisms -**Growth requirements, Sources of metabolic energy, Nutrition, Environmental and other factors affecting growth, Methods of Cultivation
5. **Collection and transport of specimen**, Standard precautions for prevention of blood borne infection. Collection of culture sources from theatre. Biomedical waste segregation and waste management.
6. **Antimicrobial susceptibility** and assay, chemotheraphy
7. **Bacteriology-** Gram Positive, Gram Negative, Acid Fast Bacilli, Spirochetes Virology: Brief description and Lab diagnosis of Viral Infections: HIV, Hepatitis, Rabies, Polio, Swine flu, Dengue Virus Mycology: Brief description and lab diagnosis of fungal infections Parasitology: Parasites / Helminths, Protozoa.

M. Sc. (MLT) PART – II
[with specialization in PATHOLOGY]

Paper - I : Histopathology & Cytology (80 Marks)

Paper - II : Advanced hematology (80 Marks)

PAPER - I : HISTOPATHOLOGY & CYTOLOGY

I. Histopathology –

1. Organization of histology laboratory – Histological equipments, reception and recording of tissue specimens.
2. Tissue fixation and processing – Fixatives, tissue processing, microtomy including frozen section and decalcification of bony tissue.
3. Theory of staining – Routine H/E staining and other special stains – R.S, V.G, PAS, DPAS, Masson's trichome, Fat stain, AFB, fite stain, PTAH, amyloid staining, Mucicarmine, Stains for pigments, microorganism and parasites.
4. All staining techniques and interpretation.
5. Preparation and quality control of all stains used in histopathology.
6. Immunohistochemistry.
7. Molecular markers of malignant neoplasms.
8. Immunofluorescent techniques.
9. Museum techniques.
10. Automation in histological techniques.
11. Immunopathology – concept of immunity and immune response, cells of immune system, antigen & antibody, complement system, hypersensitivity and autoimmune diseases.

II. Cytology –

1. Collection, preservation, fixation and processing of various cytological specimens.
2. Preparation and quality control of various reagents and stains used in cytology.
3. Cytology of female genital tract, urinary tract, gastrointestinal tract, respiratory tract, effusions and miscellaneous fluids.
4. FNAC – method of aspiration, slide preparation, fixation and staining of smears.
5. Automation in cytology.

PAPER II: ADVANCED HEMATOLOGY

Advanced hematology –

1. Disorders of hemoglobin – structure of hemoglobin and synthesis, normal and abnormal hemoglobin, hemaglobinpathy, sickle cell anemia & thalessemia.
2. Hemolytic anemia – Definition, pathogenesis, classification and clinical features. Laboratory investigations – PBF, specific morphological abnormality, osmotic fragility, sickling test, test for G6PD deficiency, acid elution test, coomb's test LE cell, pearl stain, LAP score, hemogobin A2 estimation, foetal hemoglobin estimation..
3. Aplastic anemia
4. Polycythemia
5. Leukocyte disorders– Leukemoid reaction, myelodysplastic syndrome, myeloproliferative disorders, lymphoproliferative disorders. Cytochemical staining, flowcytometry, definition, classification and diagnostic criterias of leukemia.
6. Plasma cell disorder – definition, clinical features and laboratory investigations.
7. Hemorrhagic disorders – Definition, pathogenesis, clinical features & classification – Vascular disorders, platelet disorders, coagulation disorders and fibrinolysis.

- Platelet disorders – Thrombocytopenia & thrombocytosis, idiopathic thrombocytopenia purpure (ITP)
- Coagulation disorders – Inherited – hemophilia A & B, Vonwillibrand disease. Acquired – Vit K deficiency, liver disease, DIC
- Investigations of hemorrhagic disorders – Tests of vascular and platelet function – bleeding time, clot retraction, platelet count, platelet aggregation studies, bone marrow examination.
- Tests of coagulation disorders – Screening tests – PT, APTT, Thromboplastin time & thrombin time. Second line tests – mixing experiments, factor assays FDP

8. **Thrombotic disorders – Inherited and acquired, clinical features & investigations. Antiphospholipid antibody syndrome.**

Practical

I. Histopathology:

1. Tissue embedding & paraffin block preparation
2. Section cutting
3. Haematoxylin & Eosin staining
4. Periodic acid Schiff (PAS) staining
5. Staining of acid fast bacilli
6. Stain for lipids – oil red o staining

II. Cytology:

1. Preparation of smears for cervical cytology, fluid cytology & FNAC.
2. PAP staining
3. H/E staining
4. MGG staining

III. Hematology:

1. Hemoglobin estimation
2. Total leukocytes count
3. Total RBC count
4. Platelet count
5. Staining of blood film & interpretation of PBF
6. Differential leukocytes count
7. Packed cell volume (PCV)
8. Erythrocyte sedimentation rate (ESR)
9. Reticulocyte count
10. Sickling test
11. Osmotic fragility test
12. Prothrombin time (PT)
13. Activated partial thromboplastin time (APTT)
14. Cytochemistry of bone marrow smears like myeloperoxidase, periodic acid shiff's (PAS) & Sudan black staining
15. ABO & Rh blood grouping Coomb's test

DISSERTATION / PROJECT WORK

The Dissertation / Project work shall be conducted under the supervision of an allotted guide of the opted subject. The work shall relate to the lab investigations and quality management of the specialisation area of medical laboratory technology.

The candidate shall submit the Dissertation / Project work as a printed copy to the Head of Department atleast one month before commencement of University Theory paper examination otherwise permission to appear in the University examination shall not be granted. The same shall be presented and assessed at the time of Examination.

M. Sc. (MLT) Part – II
[with sepcialization in BIOCHEMISTRY]

Paper - I : General Biochemistry & Metabolism (80 Marks)
Paper-II : Clinical Biochemistry, Analytical techniques & Quality assurance (80 Marks)

PAPER-I : GENERAL BIOCHEMISTRY & METABOLISM

1. History & scope of Biochemistry. Chemistry & biological importance of carbohydrates, proteins & amino acids, lipids, nucleic acids, glycosaminoglycans, glycoproteins.
2. Enzymes & coenzymes – chemistry, nomenclature properties & mode of action of enzymes, Enzyme kinetics, factors affecting enzyme activity, enzyme inhibitions, diagnostic importance of enzymes & isoenzymes.
3. Biological oxidation – General concept of oxidation & reduction. Electron transport Chain (ETC), inhibitors of ETC, Oxidative Phosphorylation, Uncouplers
4. Metabolism of Carbohydrates: Pathways of Glycolysis, TCA cycle, HMP shunt, Glycogen metabolism, Regulation of Blood glucose.
5. Metabolism of Lipids: Beta oxidation of Fatty acids, Fatty acid synthesis, Cholesterol metabolism and ketone Bodies metabolism.
6. Metabolism of Proteins: Transamination, Deamination, Decarboxylation, Urea cycle. Major metabolites of Glycine, aromatic, sulphur containing and branched chain amino acids, Inborn errors.
7. Nucleic acid Metabolism: Outline of metabolism of Purines and Pyrimidines & their disorders
8. Hormones –General mechanism of action, chemistry, functions, synthesis & clinical disorders of various steroid & peptide hormones.
9. Water, Electrolyte and Acid Base balance.
10. Structure functions, classifications of immunoglobulins, antigen – antibody reaction, , immunodiagnostics.

PAPER-II : CLINICAL BIOCHEMISTRY, ANALYTICAL TECHNIQUES & QUALITY ASSURANCE

Clinical Biochemistry:

1. Chemistry, composition and diagnostic importance of Body fluids: lymph, CSF, ascitic, pleural & synovial fluids.
2. Organ function tests: liver, kidneys, thyroid gland, adrenal gland, pancreas & gastric functions.
3. Major biochemical investigations for Diabetes mellitus, Cardio vascular disease, Chronic kidney disease, Chronic Liver disease, Electrolyte & acid base imbalance sepsis & Infertility.
4. Tumor & Cancer Markers: Carcinogens, Oncogene, Clinical applications of tumor markers.
5. Radio isotopes and their clinical applications.

Analytical techniques:

1. Automation in laboratory: Basic concept, Types of autoanalyzers- principle & applications
2. Analytical techniques: principle and applications of Photometry, Colorimetry, Spectrophotometry, ELISA, RIA, CLIA

3. Principle and applications of Recombinant DNA technology, Polymerase Chain Reaction(PCR)

Quality Assurance:

1. Total Quality Management of Laboratories
2. Quality planning and Quality improvement
3. Implementation of Internal Quality Control program: basic steps, sources of error and their correction methods,
4. CAPA - corrective action & preventive action
5. Sources of variation in laboratory results
6. Record keeping, documentation, Standard operating Procedures
7. Statistical analysis of QC data, Levy-Jennings Chart, Westgard rules
8. EQAS
9. Current trends in laboratory accreditation, ISO certification

Practical

1. Identification of substances of Physiological importance – Carbohydrates, Proteins, Lipids.
2. Urine analysis – Normal & Pathological.
3. Colorimetric estimation – Glucose, Urea, Creatinine etc.
4. Estimation using semi & fully automated analyzers:
   a. Glucose
   b. Components of LFT, RFT, Lipid profile, diabetic profile etc.
   c. Enzymes of diagnostic importance- amylase, lipase, CPK, CPK-MB, Troponin I, LDH etc.
5. Estimation of hormones, vitamins, tumor markers and other biomarkers by ELISA, RIA, CLIA etc.
6. Biochemical analysis of fluids: CSF, ascitic & pleural fluids etc.
7. Analysis of arterial blood gases & electrolytes
8. Fractionation & Identification of, a) Amino acids b) Sugar c) Proteins d) Lipoproteins by
   a. Thin Layer & Paper Chromatography.
   b. Various diagnosis using HPLC
   c. Gel electrophoresis & Paper Electrophoresis.
   d. Capillary electrophoresis of Plasma proteins
9. Calculation of coefficient of variation, coefficient of correlation, plotting LJ charts
10. Total Quality Management of Laboratory:
    a. Specimen collection, handling & storage of sample.
    b. Methods of standardization & calibration.
    c. Methods of quality control & assessment.
11. Interpretation and correlation of various biochemical parameters with different clinical conditions.

DISSERTATION / PROJECT WORK

The Dissertation / Project work shall be conducted under the supervision of an allotted guide of the opted subject. The work shall relate to the lab investigations and quality management of the specialisation area of medical laboratory technology.

The candidate shall submit the Dissertation / Project work as a printed copy to the Head of Department atleast one month before commencement of University Theory paper examination otherwise permission to appear in the University examination shall not be granted. The same shall be presented and assessed at the time of Examination.

M. Sc. (MLT) Part – II
[with sepcialization in MICROBIOLOGY]

Paper - I : General Microbiology (80 Marks)
Paper - II : Clinical Microbiology (80 Marks)

PAPER-I : GENERAL MICROBIOLOGY

1. **Introduction to Microbiology**: History and scope of microbiology, safety methods in microbiology laboratory, universal safety precautions, common glasswares for microbiology and its cleaning & sterilization, Disposal of waste materials in microbiology.
2. **Microscope:** Principles, Methods of Safe working, Different Parts, Preparation of smears for examination, Application of following microscopes: Bright field, Dark field, Phase Contrast, Fluorescent, Electron Microscopy, Micrometry
3. **Bacterial Morphology**: Shape and arrangement of bacterial cells, ultrastructure of cell wall, cytoplasmic memebrane, outer envelope, flagella, fimbria and pili, cytoplasmic matrix, nucleoid, cytoplasmic inclusions, endospores-formation and germination, cell-wall synthesis.
4. **Staining methods for bacteria**: Principle, preparation of smear, preparation of reagents & stains, Different types of Staining-Simple Staining, Gram, Staining, Acid Fast Staining, Negative Staining, Flagellar Staining, Spore Staining, Staining of volutin granules.
5. **Culture Media:** Preparation of Culture media, types of culture media, Quality control of Culture media, Incubation and purification methods in bacteriology, Isolation & Identification of Bacteria, Preservation of bacteria.
6. **Biochemical Test for Identification:** Sugar fermentation test, Litmus milk, Indole production Methyl Red test (MR), Voges – Proskauer test, Citrate utilisation, Nitrate reduction test, Production of ammonia, Urease test, Hydrogen sulphide production, Catalase production, Oxidase reaction.
7. **Bacterial Genetics**: Structure and replication of bacterial DNA plasmids, Mutation, Transfer of genetic material, Recombinant DNA Technology.
8. **Antimicrobial agents**: Antibiotics and mode of action, MIC and MBC, antibiotic resistance, Antimicrobial sensitivity testing.

PAPER-II: CLINICAL MICROBIOLOGY

1. Collection of specimens for bacteriological investigations
2. Methods of culture, techniques and organisms encountered in: CSF, blood culture, sputum, pus, urine, stool, UTI, endocarditis, Bone and joint infections
3. Causative agents and investigations in case of :
   a. PUO
   b. Tuberculosis
   c. Leprosy
   d. Meningitis
   e. Eye infections
   f. Food poisoning, gastroenteritis, diarrhoea
   g. Respiratory tract infections
   h. Sexually transmitted diseases
   i. Dental infections
   j. Zoonotic Infections
   k. Blood transfusion and associated infections

l. Immunoprophylaxis against diseases
m. Surveillance sampling
n. O.T Sterility testing
o. Bacteriological examination of water, milk, food and air
p. Processing of clinical samples for pathogens
q. Hospital infections
r. Quality control in microbiology
s. Laboratory control of antimicrobial therapy
t. Basic molecular biology in relation to diagnosis of infectious diseases.

PRACTICALS

1. Microscopy-Handling and general maintenance
2. Staining procedures-Preparation of stains and staining methodology
3. Cultivation-Media preparation – details of ingredients, pH measurement, preparation of reagents, buffers, glass wares etc and quality control
4. Antimicrobial agents-Preparation, susceptibility testing, quality control, MIC, MBC
5. Sterilization and disinfection-Handling of main types of filters, preparation procedures for autoclaving hot air oven, testing of disinfectants
6. Collection of specimens for Microbiological investigations such as Blood, Urine, Throat swab, Rectal swab, Stool, Pus (swabs), OT and other specimens
7. Complete Characterisation of bacteria of medical importance including morphology, cultural, biochemical, serological, antimicrobial, susceptibility pattern and any other biological properties as well as molecular methods.
8. Collection of relevant clinical samples: Blood for culture and serological test, Urine for culture, Swabs for microscopy and culture
9. Body fluids for microscopy and culture
10. Storage and transport of the clinical specimens: Preparation of smears from clinical material, Microscopic Examination
11. Gram stain: Ziehl – Neelsen stain, Stool for ova and cyst, Blood smear for parasites (MP, Mf), Albert stain for diphtheria
12. Negative Staining

DISSERTATION / PROJECT WORK

The Dissertation / Project work shall be conducted under the supervision of an allotted guide of the opted subject. The work shall relate to the lab investigations and quality management of the specialisation area of medical laboratory technology.

The candidate shall submit the Dissertation / Project work as a printed copy to the Head of Department atleast one month before commencement of University Theory paper examination otherwise permission to appear in the University examination shall not be granted. The same shall be presented and assessed at the time of Examination.

MODEL PAPER

M.Sc. Part – I **Patho.I**
5251

M.Sc. (MLT) Part – I (Main) Examination month year

Paper – I
PATHOLOGY

Time: Three Hours
Maximum Marks: 100

Attempt all Questions.
All the parts of one question should be answered at one place in sequential order.
Illustrate your answers with suitable diagrams, wherever necessary.

Q. 1 Define and classify anemia. Describe in brief the laboratory investigations required for iron deficiency anemia. (25)

Q. 2 What is compatibility testing or cross matching of blood? Describe method for major cross matching. (25)

Q. 3 Write in brief –
a) Anticoagulants used in hematology (12½)
b) Principle and methods of tests done in chemical examination of urine (12½)

Q. 4 Write short notes on (any five) (25)
a) Activated partial thromboplastin time (APTT)
b) Segregation of biomedical waste by color coding according to BMW rule – 2016
c) Forward blood grouping
d) Preanalytical errors in hematology laboratory
e) Semen analysis
f) Reticulocyte count
g) Erythrocyte sedimentation rate (ESR)

MODEL PAPER

M.Sc. Part – I **Biochem.I**
5252

M.Sc. (MLT) Part – I (Main) Examination month year

Paper – II
BIOCHEMISTRY

Time: Three Hours
Maximum Marks: 100

Attempt all Questions.
All the parts of one question should be answered at one place in sequential order.
Illustrate your answers with suitable diagrams, wherever necessary.

Q. 1. Define and classify Enzymes. Discuss the factors which affect Enzymes action. Write a note on isoenzymes giving suitable examples. [25]

Q. 2. Discuss the structure of Hemoglobin. Write a note on different types of Hemoglobin along with their biological importance. [25]

Q. 3. (a) Discuss the sources, daily requirement functions and deficiency disorders of Vitamin D. [$12^1/_2$]
(b) What are the major function of Calcium? Write a note on disorders of Calcium deficiency.
[$12^1/_2$]

Q. 4. Write short notes on. (any five) [25]
a) Buffer systems
b) Structure of cell membrane
c) Principle of Electrophoresis
d) High energy compounds
e) Renal Function Test
f) Types of RNA
g) Lipoproteins.

MODEL PAPER

M.Sc. Part – I **Microbio.III**
5253

M.Sc. (MLT) Part – I (Main) Examination month year

Paper – III
MICROBIOLOGY

Time: Three Hours
Maximum Marks: 100

Attempt all Questions.
All the parts of one question should be answered at one place in sequential order.
Illustrate your answers with suitable diagrams, wherever necessary.

Q.1. Define Sterilization and Disinfection. Enumerate the methods of sterilization and disinfection. Explain the principle, components and procedure of Autoclave. [25]

Q.2. Describe the various categories of biomedical waste and methods of disposal of waste in different categories. [25]

Q.3. (a) Methods of Antibiotic Susceptibility Testing [$12^1/_2$]
(b) Microbial Pathogenicity [$12^1/_2$]

Q.4. Short notes (Any 5 out of 7) [5x5=25]
a) General characteristics of Bacteria
b) Hospital Acquired Infections
c) Bacterial Growth Curve
d) Sources of Infection
e) Lab Diagnosis of HIV
f) Acid Fast Bacilli
g) Ethylene oxide (ETO) Sterilization

MODEL PAPER

M.Sc. Part – II **Patho.I**
5254

M.Sc. (MLT) Part – II (with specialization in Pathology) (Main) Examination month year

PATHOLOGY

Paper – I
Histopathology and Cytology

Time: Three Hours
Maximum Marks: 80

Attempt all Questions.
All the parts of one question should be answered at one place in sequential order.
Illustrate your answers with suitable diagrams, wherever necessary.

Q. 1 Define tissue fixation, Describe various methods of tissue fixation, What are the characteristics of a good fixative ? (20)

Q. 2 Define exfoliative cytology. Describe the steps of papanicolon cytological staining and discuss the types of cells seen in a normal pap smear. (20)

Q. 3 a) Describe steps of regressive haematoxylin and eosin staining (10)
b) Reticulin staining of tissue sections (10)

Q. 4 Write short notes on (any four) (20)
a) Frozen section
b) Decalcification of bone
c) Boueins fluid
d) Fite staining
e) Antigen retrieval in immunohistochemistry
f) Rotary microtome

MODEL PAPER

M.Sc. Part – II **Patho.II**
5255

M.Sc. (MLT) Part – II (with specialization in Pathology) (Main) Examination month year

PATHOLOGY

Paper – II
Advanced Hematology

Time: Three Hours
Maximum Marks: 80

Attempt all Questions.
All the parts of one question should be answered at one place in sequential order.
Illustrate your answers with suitable diagrams, wherever necessary.

Q. 1 Describe clinical features and investigations required in a case of hemophilia A. (20)

Q. 2 What is the clinical significance of osmotic fragility test? Describe the method in detail for performing the osmotic fragility test. What are the findings of osmotic fragility test in case of spherocytosis? (20)

Q. 3 a) Which are clinical conditions associated with abnormal hemoglobin. (10)
b) Pathogenesis of disseminated Intravascular coagulation (DIC) (10)

Q. 4 Write short notes on (any four) (20)
a) Pearl staining of bone marrow smears
b) Leukaemoid reaction
c) Coombs test
d) Antiphospholipid antibody syndrome
e) Flowcytometry
f) Morphological features of myeloblast

MODEL PAPER

M.Sc. Part – II **Biochem.I**
5257

M.Sc. (MLT) Part–II (with specialization in Biochemistry) (Main) Examination month year

BIOCHEMISTRY

Paper – I

General Biochemistry & Metabolism

Time: Three Hours
Maximum Marks: 80

Attempt all Questions.
All the parts of one question should be answered at one place in sequential order.
Illustrate your answers with suitable diagrams, wherever necessary.

Q. 1. With the help of flow chart, describe Urea cycle. Write a note on diagnostic importance of Blood urea. [20]

Q. 2. Enumerate the major electrolytes of human body system. Write a note on their diagnostic importance. [20]

Q. 3. (a) What is Uric acid? Outline the process of formation of Uric acid. Write a note on its diagnostic importance. [10]
(b) Discuss the structure & types of Immunoglobulins. [10]

Q. 4. Write short notes on. (any four) [20]
a) Transamination
b) Glycosuria
c) Diagnostic importance of enzymes (with examples)
d) Thyroid hormones
e) Ketosis
f) Oxidative Phosphorylation

MODEL PAPER

M.Sc. Part – II **Biochem.II**
5258

M.Sc. (MLT) Part–II (with specialization in Biochemistry) (Main) Examination month year

BIOCHEMISTRY

Paper – II

Clinical Biochemistry, Analytical techniques & Quality assurance

Time: Three Hours
Maximum Marks: 80

Attempt all Questions.
All the parts of one question should be answered at one place in sequential order.
Illustrate your answers with suitable diagrams, wherever necessary.

Q. 1. Discuss various types of auto analyzers used in clinical Biochemistry. [20]

Q. 2. What do you mean by Quality Management system? Discuss the basic steps for implementation of Internal Quality control in Biochemistry Lab. [20]

Q. 3. (a) Enumerate the various markers of cardiovascular disease. Write a note on diagnostic importance of cardiac enzymes in Myocardial Inunction(MI). [10]
(b) Enumerate the various Liver Function Tests. Discuss the role of Bilirubin estimation in identification of different types of Jaundice. [10]

Q. 4. Write short notes on. (any four) [20]
a) Biochemical analysis of CSF
b) Tumar Marker
c) Principle & application of PCR
d) EQAS
e) Major components of SOP
f) Sources of variation in lab results.

MODEL PAPER

M.Sc. Part – II **Microbio.I**
5260

M.Sc. (MLT) Part–II (with specialization in Microbiology) (Main) Examination month year

MICROBIOLOGY

Paper – I
General Microbiology

Time: Three Hours
Maximum Marks: 80

Attempt all Questions.
All the parts of one question should be answered at one place in sequential order.
Illustrate your answers with suitable diagrams, wherever necessary.

Q.1. Explain the Structure of bacterial cell with the help of a suitable diagram and differentiate between eukaryotic & prokaryotic cell with example. [20]

Q.2. Write down various staining techniques. Enumerate each technique with their principle, procedure & interpretation. [20]

Q.3. (a) Culture Media and its types with examples [2x10=20]
(b) Mutation

Q.4. Short notes (any four) [4x5=20]
a) Universal Safety Precautions
b) Koch Postulates
c) Bacterial Flagella
d) Drug Resistance
e) Plasmids
f) Antimicrobial agents and their mode of action

MODEL PAPER

M.Sc. Part – II **Microbio.II**
5261

M.Sc. (MLT) Part–II (with specialization in Microbiology) (Main) Examination month year

MICROBIOLOGY

Paper – II
Clinical Microbiology

Time: Three Hours
Maximum Marks: 80

Attempt all Questions.
All the parts of one question should be answered at one place in sequential order.
Illustrate your answers with suitable diagrams, wherever necessary.

Q.1. Enumerate the causes of Urinary Tract Infections & discuss in detail the lab diagnosis of Escherichia coli. [20]

Q.2. Classify Mycobacteria. Discuss the laboratory diagnosis & immunoprophylaxis of pulmonary tuberculosis [20]

Q.3. (a) Zoonotic diseases [2x10 = 20]
(b) Sexually Transmitted diseases

Q.4. Short notes (any four) [4x5 = 20]
a) VDRL Test
b) Tuberculin Test
c) Enteric fever
d) Botulism
e) Meningitis
f) Dental caries