

**DEBRA THANA SAHID
KSHUDIRAM SMRITI
MAHAVIDYALAYA**

**Gangaram Chak, Chak Shyampur, Debra, West
Bengal**



PROPOSED SYLLABUS (DRAFT) OF

**M. Sc. in Medical Laboratory
Technology (Immuno-Haematology &
Blood Banking)**

**2-YEAR POST-GRADUATE PROGRAMME
(w.e.f. Academic Year 2024-2025)**

Semester	Paper No.	Course title	Full Marks	Credit	T/P
I	MMLT-101	Clinical Biochemistry	50	4	T
	MMLT-102	Diagnostic Microbiology I-Bacteriology	50	4	T
	MMLT-103	Laboratory Bio-Safety and Total Quality Management	50	4	T
	MMLT-104	Research Methodology & Medical Statistics	50	4	T
	MMLT-195	Clinical Biochemistry	50	4	P
	MMLT-196	Diagnostic Bacteriology	50	4	P
	MMLT-197	Survey Report on Laboratory Bio-Safety and Total Quality Management	50	4	P
	MMLT-198	Research Methodology & Medical Statistics	50	4	P
	TOTAL		400	32	
II	MMLT-201	Biomolecule sensors and Health Life	50	4	T
	MMLT-202	Diagnostic Histotechnology & Cytotechnology	50	4	T
	MMLT-203	Advanced Immunodiagnostic Technology	50	4	T
	MMLT-204	Diagnostic Microbiology II-Virology & Mycology	50	4	T
	MMLT-295	Diagnostic Histotechnology & Cytotechnology	50	4	P
	MMLT-296	Clinical Immuno diagnostic Technology	50	4	P
	MMLT-297	Diagnostic Microbiology II-Virology & Mycology	50	4	P
	MMLT-298	Review work Submission	50	4	P
	TOTAL		400	32	

Semester-I

Paper: MMLT 101: Clinical Biochemistry

Full Marks: 50 Credit: 4

Objective of the Program:

The Clinical Biochemistry program equips students with both knowledge and practical skills. The program focuses on understanding physiological and biochemical processes in the body and their changes during pathological conditions. Students study key biomarkers for diagnosing cardiac, renal, liver, gastric, pancreatic, and cancer-related diseases. They learn specimen preparation techniques for biochemical analysis, including serum, urine, and protein-free filtrates. The program emphasizes applying biochemical markers and laboratory tests for disease diagnosis and management, while also teaching principles of diagnostic test evaluation, including sensitivity and specificity.

Expected Outcome:

By the end of the program, students can:

1. Understand the biochemical and molecular processes in the human body and the biochemical changes that occur under pathological conditions.
2. Develop skill in processing various specimens (blood, serum, urine) and preparing samples for biochemical analysis.
3. Apply various analytical methods such as titrimetric, photometric, and colorimetric for the accurate measurement of biochemical substances.
4. Identify and interpret the role of various biomarkers in diagnosing cardiac, renal, hepatic, gastric, pancreatic, and oncological pathophysiological conditions.
5. Conduct effective screening and diagnostic assessments for various toxins, drugs, and heavy metals.
6. Implement molecular biology techniques, including proteomics, metabolomics, and PCR, for advanced diagnostic and research purposes.

Course Content:

1. Basic concept of physiology and biochemistry and molecular biochemistry of the body. Biochemical changes in the body under pathological condition.
2. Specimen processing for biochemical analysis. Preparation of serum specimen for biochemical analysis. Preparation of protein free filtrate. Processing for urine for biochemical analysis.

3. Titrimetry. Photometry-flame photometry, atomic absorption photometry. Colorimetry-visible spectrophotometer, UV spectrophotometer.
4. Biomarkers for different diseases:
 - Cardiac biomarkers- Troponin, CK-MB, Myoglobin, B-type natriuretic peptide (BNP) for heart failure. Cardiac function tests.
 - Renal biomarkers- N-acetyl- β -D-glucosaminidase (NAG), Glutathione-S-transferase (GST), Alanine aminopeptidase (AAP). Renal tubular acidosis, Urine analysis (protein, glucose, ketone bodies).
 - Liver biomarkers- ALT, AST, ALP, GGT, Bilirubin, hepatobiliary disorders,
 - Gastric biomarkers- Serum pepsinogen
 - Pancreatic biomarker- Amylase, Lipase, Trypsin, CEACAM.
 - Cancer markers- PSA (Prostate), CA125, carcinoembryonic antigen (CEA)
5. Electrolyte Measurement.
6. Overview of proteomics and metabolomics. Oncogenes, Tumor suppressor genes,
7. PCR, Gene Sequencing Study.
8. Screening and Diagnostic Tests, True positive, True negative, False positive, False negative, Sensitivity, Specificity, Cross reaction, and Odd Ratio of the test.
9. General screening for alcohol, methanol and acetone – toxicity assessment. Determination of carbon monoxide– toxicity assessment. Screening of drug like phenothiozine derivative, acetaminophen, carbamazepine, ethosuximide, Phenobarbital, phenytoin, pyrimidine. Chloral hydrate and halogenated hydrocarbons, imipramine, salicylates, digoxin, caffeine, dipyrrylone, cyclosporine.
10. Screening of heavy metals- Hg, As, Fe, Pb and Li.

Paper: MMLT-102: Diagnostic Microbiology I- Bacteriology

Full Marks: 50 Credit: 4

Objective of the Program:

The objective of the program is to provide students with a strong foundation in diagnostic microbiology, focusing on bacteriology. Students will gain knowledge of the history, principles, and tools used in clinical microbiology, along with the mechanisms of bacterial pathogenesis. They will learn techniques for microbial specimen collection, identification of bacterial species using culture media and biochemical tests, and understanding bacterial diseases across various organ systems. The program also covers antimicrobial agents, their mechanisms of action, and methods for evaluating antimicrobial susceptibility.

Expected Outcome:**By the end of the program, students can:**

1. Understand the history and principles of microbiology, including Koch's postulates, taxonomy, and host-microbe interactions.
2. Process clinical specimens, perform bacterial staining techniques, and identify bacterial species using appropriate culture media and biochemical tests.
3. Recognize mechanisms of bacterial pathogenesis and understand the epidemiology of bacterial diseases, including waterborne, airborne, soilborne, and nosocomial infections.
4. Identify bacterial diseases affecting various systems, including the skin, nervous, digestive, urinary, and reproductive systems.
5. Understand the history and mode of action of antibiotics, evaluate antimicrobial susceptibility, and apply these principles in guiding chemotherapy.
6. Demonstrate proficiency in antimicrobial susceptibility testing, including MIC, MBC, and MDR index interpretation, ensuring proper antibiotic safety and drug interaction evaluation.

Course Content:

1. Introduction: History of Microbiology; general principles in clinical microbiology- Koch's postulates; taxonomy; human microbiome in health and disease, host microbe interactions; microbial growth, factors affecting microbial growth; physical and chemical control measures (infection control).
2. Laboratory tools for characterization of microbes: Methods of microbial investigation; clinical specimen collection for microbiological processing, microscopy,
3. Staining techniques- Gram's staining, endospore staining.
4. Culture media- types (synthetic, semi-synthetic, selective, enriched, enrichment, differential media) and culture techniques, Principle, composition and application of specific media- TCBS, MSA, Blood agar, MacConkey agar. biochemical tests for identification- catalase, urease, indole test.
5. Bacterial diseases: Mechanisms of bacterial pathogenesis; role of bacteria in disease, nosocomial infections, epidemiology of bacterial diseases.
6. Water borne bacterial diseases- diarrhea, giardiasis, dysentery, typhoid fever, E.

Coli infection, and salmonellosis.

7. Air borne bacterial diseases- Tuberculosis, Chickenpox, Influenza, Pertussis, Respiratory Syncytial Virus (RSV).
8. Soil borne bacterial diseases- tetanus, anthrax, and botulism.
9. Bacterial Diseases of Skin (Staphylococcal & Streptococcal infections), nervous system (meningitis, leprosy). eyes (ophthalmia neonatorum, conjunctivitis, trachoma), digestive system (periodontal disease, staphylococcal entero-toxicosis, shigellosis, gastroenteritis, cholera, typhoid fever, peptic ulcer, CDAD), urinary system (cystitis pyelonephritis, leptospirosis) and reproductive system (gonorrhea, urethritis, PID, syphilis, LGV, chancroid, vaginosis).
10. Antibiotics: History of chemotherapy, spectrum of antimicrobial activity, survey of major antimicrobial drug groups.
Mode of action of antibiotics - Beta lactams group, sulfonamides, quinolones, Rifampin, chloramphenicol, tetracycline, polymyxin. Interactions between drugs and microbes, interactions between drugs and hosts.
11. Antimicrobial susceptibility testing to guide chemotherapy, MIC, MBC, MDR index, zone of inhibition, antibiotic safety, effects of combinations of drugs.

Paper: MMLT 103: Laboratory Bio-Safety and Total Quality Management

Full Marks: 50 Credit: 4

Objective of the Program:

The Laboratory Bio-Safety and Total Quality Management program is Skill-based Program. This Program aims to equip students with a complete understanding of laboratory safety practices, waste management, and quality control systems. To educate students to make laboratories safe and free from hazards, while ensuring accurate and reliable diagnostic results by following strict quality management rules. To familiarize students with quality control charts and systems such as Levy-Jenning charts and ISO standards (ISO-1589, ISO-9001) and to prepare students for internal and external quality control programs and ensure they understand the customer-centric approach to laboratory management.

Expected Outcome:**By the end of the program, learners can able to:**

1. Know Laboratory biosafety levels and apply appropriate safety measures in various laboratory settings.
2. Implement good microbiological practices and handle laboratory waste efficiently and in compliance with safety protocols.
3. Manage laboratory hazards, including chemical, fire, and biological risks, and apply first-aid measures when necessary.
4. Develop, monitor, and evaluate a laboratory quality management system, ensuring both internal and external quality assurance.
5. Use quality control charts effectively to maintain laboratory precision, accuracy, and sensitivity in test results.
6. Understand and apply ISO standards and total quality management principles to enhance laboratory performance and customer satisfaction.
7. Conduct root cause analysis and implement corrective and preventive actions to improve the overall safety and quality of laboratory operations.

Course Content:

1. Various types of laboratories, Laboratory Biosafety Level Criteria (BSL-1-4). Code of good and safe laboratory practice for support staff.
2. Good Microbiological practices (GMP), Decontamination, sterilization and disposal-Treatment, disposal technologies for health-care waste.
3. Wastes management, life cycle of bio-medical wastes. Emergency procedures- Exposure response plans, spills response, fire and explosion response. Safety organization. General Safety checklist. Hazardous properties of instruments and Laboratory chemicals. Laboratory first-aid measures and kit. Safety equipments. Safety signs and signage system in laboratory and hospital. Total quality management framework of laboratory. Essential elements of Quality Assurance Programme. Internal and external factors for quality control assurance. training and competency, Lab design and facility management.
4. Internal Quality control: control of pre-analytical variables, control of analytical variables, laboratory precision, accuracy & sensitivity, validation of methods. Reference materials and calibrating definitive methods. Sources of variation in laboratory test results. Systemic and random errors.
5. Quality control charts: Levy-Jenning chart, Cusum chart and Gaussian curve. Reference value. Quality Management System (QMS)- ISO-1589,

ISO-9001.

6. Customer focus- customer satisfaction, service quality, SOPS, IQC, EQA, SQC.
7. Statistical quality control (QC), Quality Assurance (QA). Plan-Do Check Act (PDCA) cycle. Root cause analysis- Document and record keeping, Corrective and Preventive Action (CAPA), Audit and review, Customer relationism.
8. Biosafety Regulatory Compliance- Biosafety regulations, Biosecurity, Biosafety audit.

Paper: MMLT 104: Research Methodology & Medical Statistics

Full Marks: 50 Credit: 4

Objective of the Program:

The Research Methodology & Medical Statistics program is Research-based Program. The objective of this program is to provide students the fundamentals of research methods, medical statistics and ethical practices in scientific research. The focus is to develop students' abilities in designing research projects, writing high-quality research reports through literature reviews, hypothesis creation, and the application of statistical tools for analysing biological data.

Expected Outcome:

By the end of the program, students can:

1. Identify and differentiate between various types of research such as basic, applied, action, qualitative, and quantitative research.
2. Formulate a well-structured research project, including setting clear hypotheses and objectives.
3. Conduct thorough literature reviews to support research projects.
4. Develop strong research reports that adhere to quality standards and ethical guidelines.
5. Apply key statistical concepts, including mean, median, mode, standard deviation, t-tests, ANOVA, and chi-square in data analysis.
6. Understand research ethics and use plagiarism detection software to ensure originality.
7. Select appropriate statistical methods for analysing biological samples and interpret data visually using graphs.
8. Critically review scientific literature and effectively use sampling techniques to derive valid conclusions.

Course Content:

1. Types of Research: Basic, applied and action research; qualitative & quantitative research, experimental and quasi- experimental research.
2. Research project formulation
3. Literature Review
4. Research hypothesis
5. Research report writing, quality of report writing.
6. Research ethics, plagiarism software.
7. Review- types and importance
8. Sampling -types
9. Medical statistics: mean, median, mode, SD, SEM
10. Probability, t-test, null hypothesis, co-relation, chi- square,
11. ANOVA, F-test, regression, post-hoc analysis.
12. Selection of appropriate methods for statistical analysis of collected parameters of biological samples.
13. Graphics in statistics.

Paper: MMLT 195: Clinical Biochemistry (P)

Full Marks: 50 Credit: 4

Objective of the Program:

The objective of the program is to enhance practical skills by developing proficiency in conducting routine biochemical tests and analyzing various biochemical markers. Students will learn to accurately determine blood glucose, serum proteins, lipids, electrolytes, and enzymes using standard methods. The program provides hands-on experience in enzyme assays and biochemical parameter evaluation, enabling students to understand and apply specific biochemical techniques for diagnosing and monitoring diseases effectively.

Expected Outcome:**By the end of the program, students can:**

1. Acquire skills in processing specimens such as blood, serum, and urine, and preparing samples for biochemical analysis.
2. Perform and interpret routine biochemical tests with accuracy and precision.
3. Recognize and interpret the significance of various biomarkers in diagnosing cardiac, renal, liver, gastric, pancreatic, and cancer-related conditions.
4. Gain practical skills in enzyme assays and biochemical parameter evaluation.
5. Accurately determine blood glucose, serum proteins, lipids, electrolytes, and enzymes using standard methods.

6. Gain practical experience in using kits and methods for routine biochemical analysis in clinical settings.

Course Content:

1. Routine biochemical test.
2. Determination blood glucose (Glucose-oxidase method).
3. Determination of total protein in serum (Biuret method).
4. Determination of Serum albumin (Dye-binding technique), Alb. Globulin ratio.
5. Blood urea (Oxime method), Serum creatinine
6. Uric acid (phosphotungstate method) (Using Kit),
7. Blood bilirubin (Malloy & Evelyn method),
8. Total cholesterol, Serum triglyceride (Colorimetric method), HDL cholesterol (Modified Lepter method, kit method), LDL, VLDL
9. Serum calcium, sodium, potassium, chloride, phospholipid. Determination of serum and plasma bicarbonate.
10. Enzyme assay in clinical biochemistry- Serum Glutamic Oxaloacetic Transaminase (SGOT) and Serum Glutamic Pyruvic Transaminase (SGPT), Acid phosphatase (ACP), Alkaline phosphatase (ALP), gamma-glutamyl transferase (γ -GT), Lactate dehydrogenase (LDH), Amylase, Lipase Creatine phosphokinase (CPK).

Paper: MMLT 196: Clinical Bacteriology (P)

Full Marks: 50 Credit: 4

Objective of the Program:

The objective of the Clinical Bacteriology practical program is to equip students with essential laboratory skills for identifying and analyzing bacterial pathogens. Students will learn to follow safety protocols, prepare various culture media, perform quality control of media and reagents, and validate sterilization procedures. The program focuses on practical aspects such as sample collection, staining techniques, bacterial identification through biochemical tests, and antimicrobial susceptibility testing. It also covers proper disposal of contaminated materials, biological spill management, and advanced pathogen identification using PCR techniques.

Expected Outcome:**By the end of the program, students can:**

1. Adhere to laboratory safety protocols, including sterilization and aseptic practices.
2. Prepare and validate specific culture media, and perform quality control of reagents and sterilization processes.
3. Collect clinical samples and conduct semi-quantitative analyses such as urine, sputum, and blood cultures.
4. Apply various staining techniques (Gram, AFB, Albert, capsule, endospore) for bacterial identification.
5. Perform biochemical tests to identify bacteria and assess antimicrobial susceptibility using disc diffusion, MIC, MBC, and antibiogram methods.
6. Safely dispose of contaminated materials, manage biological spills, and maintain stock cultures in the laboratory.

Course Content:

1. Laboratory safety protocols- sterilization, aseptic practices,
2. Preparation of culture media- specific media, anaerobic and aerobic culture media.
3. Preparation of reagents, quality control of media, reagents etc. and validation of sterilization procedures.
4. Collection of clinical samples for microbiological processing, semi-quantitative analysis of urine by standard loop test for significant bacteriuria, sputum culture, blood culture.
5. Gram stain, AFB stain, Albert stain, capsule stain, endospore stain,
6. Different biochemical tests for bacterial identification, antimicrobial susceptibility testing by disc diffusion and MIC, MBC, antibiogram,
7. Disposal of contaminated materials, biological spill management, maintenance of stock cultures, case study of bacterial infections,
8. Identification of bacterial pathogens by PCR.

Paper: MMLT 197: Survey Report on Laboratory Bio-Safety and Total Quality Management

Full Marks: 50 Credit: 4

Visit Biochemistry/Pathology/Microbiological Laboratories and prepare Survey Report on Laboratory Bio-Safety and Total Quality Management

Objective of the Program:

The objective of the program is to provide students with practical exposure to laboratory bio-safety practices and total quality management (TQM) systems. Through visits to biochemistry, pathology, or microbiology laboratories, students will observe and understand the implementation of safety protocols, risk management, and quality control procedures. The program aims to equip students with the skills to evaluate laboratory environments and prepare comprehensive reports on bio-safety and quality management practices.

Expected Outcome:

By the end of the program, students can:

1. Identify and assess laboratory bio-safety protocols, including sterilization, waste management, and hazard control.
2. Understand and evaluate total quality management practices in clinical laboratories.
3. Analyse the implementation of quality control measures, including calibration and validation processes.
4. Prepare detailed reports on laboratory visits, outlining observations related to bio-safety and quality management.
5. Apply theoretical knowledge of laboratory bio-safety and TQM to real-world clinical settings.
6. Gain practical visions into the management of laboratory safety and quality in biochemistry, pathology, and microbiology laboratories.

Paper: MMLT 198: Research Methodology & Medical Statistics (P)**Full Marks: 50 Credit: 4****Objective of the Program:**

The objective of this program is to equip students with hands-on experience in research report writing, review article preparation, and the practical application of statistical methods. Students will gain the skills necessary to analyse and interpret statistical data in medical research, focusing on central tendencies, correlation, dispersion, and advanced tests like ANOVA and t-tests.

Expected Outcome:**By the end of the program, students can:**

1. Write and present a well-organized research report or review article on a relevant scientific topic.
2. Apply statistical methods to solve problems involving central tendencies (mean, median, mode), correlation, and dispersion.
3. Perform predictive statistical analysis and interpret the results for research purposes.
4. Conduct and interpret advanced statistical tests like ANOVA, F-test, and t-test.
5. Utilize statistical tools and software to analyse research data effectively.
6. Critically assess research outcomes using quantitative methods to support scientific decision-making.

Course Content:

1. Assignment of research report writing/ Review article
2. Problems on statistics: central tendencies, prediction statistics, co-relation, dispersion, ANOVA, F-test, t test.

Paper: MMLT 201: Biomolecule sensors and Healthy Life (CBCS)**Full Marks: 50 Credit: 4****Objective of the Program:**

The Biomolecule Sensors and Health Life program is knowledge-based. This program aims to provide students with a foundational understanding of biomolecule sensors and their role

in assessing health conditions. It focuses on how these sensors are used to evaluate critical physiological and biochemical markers for managing and improving health.

Expected Outcome:

Upon completion of the program, students will be able to:

1. Understand the general concept and features of biomolecule sensors.
2. Assess key health indicators such as glucose, cholesterol, and blood pressure, and interpret their levels as normal, borderline, or risk.
3. Apply knowledge of biomolecule sensors to evaluate and manage pathophysiological conditions such as diabetes, hypertension, and renal function disorders.

Course Content:

1. General concept of Biomolecule sensors, Features of biomolecule sensors in general.
2. Preconditioning of the body for correct assessment of Bio-molecule sensors.
3. Importance of Bio-molecule sensors for amelioration of pathophysiological conditions.
4. Fasting, postprandial & Random blood glucose level assessment and normal range, border line, and risk level.
5. Cholesterol, TG, LDL, HDL- Normal, Borderline and risk level.
6. Blood pressure- Age, Life phase specific, Normal range, borderline, risk level.
7. Hb level- Life phase specific, gender specific-Normal range, Border line, Risk level.
8. HbA1C- Level, Diabetic level, Risk level.
9. Urea, Uric acid, and Creatinine in plasma-General importance for Renal Function & Gout. Normal range, Border line, Risk level.
10. Plasma Protein Level-Normal level, Border line, Risk Level.

Paper: MMLT 202: Diagnostic Histotechnology & Cytotechnology

Full Marks: 50 Credit: 4

Objective of the Program:

The objective of the program is to provide students with a complete understanding of diagnostic histotechnology and cytotechnology, emphasizing both fundamental and advanced laboratory techniques. Students will learn about the preparation, processing, and staining of tissue and cellular specimens, with a focus on diagnostic accuracy in pathology. They will also be introduced to advanced staining techniques, automated imaging systems,

and emerging technologies such as liquid biopsy, cytocentrifugation, and regenerative medicine. The program also covers the application of artificial intelligence and digital image analysis in histology and cytology.

Expected Outcome:

By the end of the program, students can:

1. Understand and operate vital laboratory equipment for histology and cytology, including tissue processors, section cutting tools, and automated imaging systems.
2. Conduct the preparation and staining of tissue and cellular specimens, using techniques like multiplex immunohistochemistry (MIHC) and immunofluorescence cytotechnology.
3. Apply advanced techniques such as cryo-sectioning, fluorescence in situ hybridization (FISH), and mass spectrometry-based immunohistochemistry (MS-IHC).
4. Identify and resolve common problems in tissue sectioning and cytological specimen preparation.
5. Perform diagnostic analysis using advanced cytological techniques like liquid biopsy, cytocentrifugation, and digital imaging.
6. Implement laboratory safety measures, particularly in handling hazards specific to cytology labs.
7. Utilize artificial intelligence and automated imaging for enhanced diagnostic precision in histology and cytotechnology.

Course Content:

1. Laboratory equipment for histology. Vacuum embedding bath, automated tissue processor. Section cutting and its technique.
2. Fixatives, Dehydration, clearing agents, embedding –Technique of section cutting, problems in section cutting, preparation of histological slide and mounting.
3. Use of different staining procedure for confirmation of pathological condition.
4. Techniques of tissue sections in cryo cut and its importance.
5. Advance Staining Technique-Multiplex Immuno Histochemistry (MIHC)
 - Fluorescent MIHC
 - Tyramide Signal Amplification (TSA)
 - Quantitative IHC
 - Digital Image Analysis

- Automated Imaging System
 - Dual enzyme-based staining & Fluorescence based staining
 - Tissue Micro Array (TMA)
 - Chromogenic in situ hybridization (CISH) & Fluorescence in situ hybridization (FISH) combined with IHC.
6. Phosphorylation-specific immunohistochemistry, proximity ligation assay (PLA), Mass spectrometry-based immunohistochemistry (MS-IHC) Laser capture microdissection (LCM) automated images analysis in histology and AI.
 7. Laboratory equipments for cytology.
 8. Specimen preparation in cytotechnology. Stains & staining technique in cytology.
 9. Process of collection, fixative, Errors of cytology, PAP stain.
 10. Hazards in cytology Lab.
 11. Immuno-fluorescence Cytotechnology.
 12. Liquid biopsy & circulating tumor cells (CTCs)
 13. Advanced cytological technique:
 - Cytocentrifugation
 - Sure Path and Thin Prep
 14. Regenerative medicine and Tissue engineering
 15. **Immunotechnology:**
 - IEH/IEC
 - IFH/IFC
 16. Marker study, ABC Technique, PAP Technique
 17. Direct and Indirect FIHC
 18. Confocal microscopy
 19. Automated Image Analysis and Artificial intelligence (AI)

Paper: MMLT 203: Advanced Immunodiagnostic Technology

Full Marks: 50 Credit: 4

Objective of the Program:

The Advanced Immunodiagnostic Technology program is knowledge-based and skill-based. This program aims to provide students with an in-depth understanding of the immune system and advanced immunological diagnostic techniques. The focus is on understanding immunity, immune responses, and applying immunodiagnostic methods for detecting diseases and immune disorders.

Expected Outcome: Expected Outcome:

Upon completing this program, students can able to:

1. Understand the immune system, types of immunity, and the role of immune organs.
2. Apply immunodiagnostic techniques, such as antigen-antibody reactions, serological tests, and immune response evaluations.
3. Diagnose autoimmune diseases, immunodeficiency disorders, and hypersensitivity using advanced immunological methods.
4. Perform various serological and immunological tests for infectious and non-infectious diseases, including pregnancy tests, WIDAL, VDRL, CRP, and TORCH panel tests.

Course Content:

1. Basic concept of Immune system.
2. Types of immunity, cellular, humoral, active, passive, natural, and acquired immunity. Primary and secondary immune organs.
3. Immunoglobins—type, structure and their specific importance.
4. Antibody development and antigen-antibody reaction, type of reaction.
5. Basic concept of immunization. Primary and secondary response of immunization. Vaccination and Booster dose.
6. Basic concept of immunodeficiency diseases.
7. Basic concept of immunosuppression - role in organ transplantation.
8. Auto immune disease: Hashimoto's disease, myasthenia gravis, RA and Lupus erythromatosus.
9. Basic types of hypersensitivity, Erythroblastosis fetalis.
10. Immunodiagnosis
11. Single-cell immunology
12. Immunometabolism
13. Immuno-oncology
14. Mucosal immunology
15. Neuroimmunology
16. Vaccine development
17. Nano medicine in Immunology
18. Synthetic immunology
19. In situ immuno sensitivity
20. Collection and preparation of specimen used in serological laboratory.
21. Principle of sero-diagnostic tests: precipitation, flocculation, agglutination, neutralization and coagulation.
22. Serological test for syphilis (STS) and VDRL, CRP, RPR test.

23. WIDAL test for Salmonella typhi.
24. Serodiagnosis test for dengue, AIDS, SARS-CoV, Rubella, Toxoplasmosis, Leishmaniasis, Trypanosomiasis. TORCH panel test.
25. Immunological test for pregnancy (direct and indirect).
26. Intradermal hypersensitivity test – Mantoux test.
27. ASO test.

Paper: MMLT 204: Diagnostic Microbiology II-Virology, Mycology and Parasitology

Full Marks: 50 Credit: 4

Objective of the Program:

The Diagnostic Microbiology II - Virology, Mycology, and Parasitology program is skill-based. This program aims to provide students with a comprehensive understanding of viruses, fungi, and parasites, their pathogenesis, laboratory diagnosis, and treatment. The course covers the identification, classification, and clinical management of infections caused by these pathogens.

Output of this program:

Upon completing this program, students can able to:

1. Understand the taxonomy, structure, and classification of viruses, fungi, and parasites.
2. Diagnose viral, fungal, and parasitic infections using various laboratory techniques such as microscopy, staining, culture methods, and molecular tests.
3. Apply knowledge of antiviral and antifungal drugs to manage infectious diseases.
4. Identify parasitic pathogens and understand their life cycles, clinical manifestations, and management.

Course Content:

1. Virology- History of virology; Baltimore classification, taxonomy and classification of viruses; general properties and structure of viruses, viral structure and propagation.
2. Viral diseases and their laboratory diagnosis: Mechanisms of viral pathogenesis; role of viruses in disease; viral diseases of skin (warts, smallpox, chickenpox, herpes simplex, measles, rubella), nervous system (poliomyelitis, rabies), cardiovascular and lymphatic systems (Burkitt's lymphoma, mononucleosis, CMV infections, chikungunya, viral hemorrhagic fevers), respiratory system (common

- cold, pneumonia, RSV, flu), digestive system (mumps, hepatitis, gastroenteritis), reproductive system (genital herpes, warts, AIDS); prion diseases.
3. Clinical symptoms and management of viral diseases.
 4. Antiviral agents: Mode of action of antivirals; nucleoside analogs, non-nucleoside polymerase inhibitors, protease inhibitors, anti-influenza drugs.
 5. Mycology- History of medical mycology; taxonomy and classification of medically important fungi; general characteristics and reproduction of pathogenic fungi.
 6. Fungal diseases: Pathogenesis of fungal disease; role of fungi in disease; superficial mycoses (pityriasis), cutaneous mycoses (dermatophytoses), subcutaneous mycoses (sporotrichosis, chromoblastomycosis, mycetoma, phaeohyphomycoses), systemic mycoses (histoplasmosis, coccidioidomycosis, blastomycosis, talaromycosis), opportunistic mycoses (candidiasis, aspergillosis, cryptococcosis, mucormycoses, pneumocystosis).
 7. Laboratory diagnosis: Staining and direct microscopy; macroscopic characterization by fungal culture; biosensors for direct detection of invasive mycoses.
 8. Antifungal agents: Mode of actions of major antifungal drugs; systemic and topical antifungal drugs; combination antifungal therapy; antifungal resistance.
 9. Definition of host, vector, carrier, Paratenic hosts, accidental host, and zoonosis.
 10. Pathogenesis, Clinical feature, and management of Parasitic diseases- Protozoan parasite (Amebiasis, Leishmaniasis, Trypanosomiasis, Giardiasis, Cryptosporidiosis)
 11. Helminthic diseases (Lymphatic filariasis, Schistosomiasis, Ascariasis, taeniasis).

Paper: MMLT 295: Diagnostic Histotechnology & Cytotechnology (P)

Full Marks: 50 Credit: 4

Objective of the Program:

The Diagnostic Histotechnology & Cytotechnology program is to equip students with hands-on skills in histotechnology and cytotechnology, focusing on specimen preparation, tissue fixation, sectioning, and staining techniques. Students will learn to handle laboratory equipment such as microtomes and various staining protocols, and gain proficiency in immunohistochemistry techniques like the ABC method and peroxidase-anti peroxidase method. Emphasis is placed on the practical application of these techniques in diagnostic histology and cytology, including the preparation and identification of cytological specimens for evaluation. This program aims to provide students with a thorough understanding of the techniques and tools used in histology and cytology for diagnosing diseases.

Expected Outcome:**By the end of the program, students can:**

1. Prepare different fixatives and handle tissue decalcification, dehydration, and embedding processes.
2. Skillfully sharpen microtome knives, perform section cutting, and apply freeze-drying techniques for cryo sectioning.
3. Prepare and apply a wide range of histological stains, including haematoxylin, eosin, trichrome, and PAS stain, for tissue and cell evaluation.
4. Conduct advanced immunohistochemistry techniques such as the ABC method and peroxidase-anti peroxidase staining.
5. Prepare cytological fixatives and stains, and perform cytological evaluations using techniques like Papanicolaou staining.
6. Differentiate between benign and malignant cells through cytological analysis.
7. Apply practical skills in handling and processing histological and cytological specimens for accurate diagnosis.

Course Content:

1. Fixation of tissue –Preparation of different fixative.
2. Sharpening of the microtome knife.
3. Decalcification of calcified tissue.
4. Dehydration of tissue-preparation of graded alcohol- clearing of fixed tissue, and embedding-paraffin block preparation /gelatin, celloidin water soluble wax.
5. Section cutting in microtome and freeze-drying techniques for section cutting in cryocut.
6. Stain preparation- haematoxylin, types, eosin, trichrome stain, phosphotungstic acid, iron haematoxylin, PAS stain, Prussian blue stain, gram staining, acid fast staining, sudan-III and IV stain. Van Gieson stain, Pearl stain (for FC), Purpurin/Von Kossa stain (Bone in tissue calcification), Reticulin. Staining techniques using above stains.
7. ABC Technique, Peroxidase -anti-peroxidase method in immunohistochemistry.
8. Cytological fixatives and stain and their preparation. Preparation of given percentage of alcohol from commercially available ethyl alcohol.
9. Preparation of specimen for cytological evaluation, processing. Fixation staining, Papanicolaou staining techniques, Crystal violet staining. Identifying characteristics of benign and malignant cells.

Paper: MMLT 296: Clinical Immuno diagnostic Technology (P)

Full Marks: 50 Credit: 4

Objective of the Program: The objective of this program is to provide students with practical skills in immunodiagnostic techniques. It focuses on hands-on training in blood grouping, antibody measurement, antigen-antibody reactions, immunoglobulin assays, and various serological and immunological tests. The program also aims to familiarize students with modern diagnostic techniques such as PCR and RT-PCR used for detecting infectious diseases.

Expected Outcome:

By the end of the program, students can:

1. Accurately determine ABO blood grouping and Rh typing.
2. Perform and interpret antibody measurement using Radial Immuno-Diffusion (RID) technique.
3. Conduct antigen-antibody reaction tests using Ouchterlony and precipitating ring methods.
4. Perform quantitative assays of immunoglobulins (IgG, IgM) using ELISA.
5. Understand and apply precipitation, agglutination, and coagulation tests in diagnostics.
6. Conduct and interpret serological tests such as VDRL, WIDAL, RPR, ASO, CRP, RA, and STS, including for SARS-CoV2.
7. Carry out immunological tests for pregnancy using direct and indirect methods.
8. Perform and interpret Mantoux tests.
9. Understand and demonstrate PCR and RT-PCR techniques for diagnosing viral infections.

Course Content:

1. Determination of 'ABO' blood grouping and 'Rh' typing.
2. Antibody measurement by Radial immuno-diffusion (RID) technique.
3. Antigen-Antibody reaction testing by precipitating ring. Ouchterlony test.
4. Quantitative assay of Immunoglobins in plasma (IgG,IgM) (ELISA)
5. Study of precipitation, agglutination, and coagulation test.
6. VDRL test, WIDAL test, RPR, ASO test, SARS-CoV2.
7. CRP test, RA test, AIDS test (Western Blot), STS test.
8. Immunological test for pregnancy (direct and indirect).
9. Mantoux test
10. PCR and RT-PCR Demonstration

Paper: MMLT 297: Diagnostic Microbiology II-Virology, Mycology and Parasitology (P)

Full Marks: 50 Credit: 4

Objective of the Program:

The objective of the program is to provide students with hands-on experience and practical skills in the diagnosis of viral, fungal, and parasitic infections. Students will learn techniques for cell culture, detection of various viral pathogens using ELISA and PCR, and the identification of fungi and parasites through microscopic and macroscopic methods. The program emphasizes understanding the methodologies for antifungal susceptibility testing and case studies of mycoses, as well as the identification of significant parasitic infections.

Expected Outcome:

By the end of the program, students can:

1. Perform cell culture techniques and detect viral infections such as measles, dengue, HBV, HCV, and HIV using ELISA and PCR methods.
2. Utilize different fungal culture media and apply microscopic techniques for the identification of fungi, including India Ink, KOH preparation, and Gram staining.
3. Conduct antifungal susceptibility testing and analyse case studies related to mycoses.
4. Stain and identify malaria parasites using appropriate methods.
5. Slide identify various parasites, including microfilaria, Taenia solium, Ascaris, and Entamoeba histolytica, and recognize different stages of malaria.
6. Apply the skills and knowledge acquired to accurately diagnose and manage infectious diseases caused by viruses, fungi, and parasites in a clinical laboratory setting.

Course Content:

1. Demonstration- cell culture laboratories, detection of measles, dengue (MAC-ELISA), HBV, HCV and HIV by ELISA, application of PCR in detection of different viral infections.
2. Use of different fungal culture media, microscopic identification of fungi by India Ink preparation, KOH preparation, Gram stain, lactophenol cotton blue stain, macroscopic identification of fungi by culture, antifungal susceptibility testing, case study of mycoses.
3. Staining for malaria parasites
4. Slide identification of Microfilaria, Taenia solium, Ascaris, Entamoeba histolytica, and different stages of malaria.

Paper: MMLT 298: Review Work Submission

Full Marks: 50 Credit: 4

Objective of the Program:

The objective of the program is to enhance students' critical thinking, research, and analytical skills through the preparation and submission of a comprehensive review work on a selected topic within the field of medical laboratory technology. Students will involve in extensive literature review, synthesizing current knowledge, identifying gaps, and presenting their findings in a structured manner. This process aims to foster a deeper understanding of specific subjects and improve their ability to communicate scientific concepts effectively.

Expected Outcome:

By the end of the program, students can:

1. Conduct thorough literature reviews on selected topics, demonstrating the ability to gather, evaluate, and synthesize information from various sources.
2. Judgmentally analyse and interpret research findings, identifying trends, gaps, and implications for practice in medical laboratory technology.
3. Develop well-structured review papers that clearly articulate their research question, methodology, findings, and conclusions.
4. Present their work in a professional format, adhering to academic standards for citations and references.

5. Enhance their ability to engage in scholarly discourse and contribute to the body of knowledge in their chosen field.
6. Apply the skills gained in this program to future research.

Course Content:

Student prepare and submit a review work on related topic.

**DEBRA THANA SAHID KSHUDIRAM
SMRITI MAHAVIDYALAYA**
Gangaram Chak, Chak Shyampur, Debra, West Bengal



PROPOSED SYLLABUS (DRAFT) OF

**M. Sc. in Medical Laboratory
Technology (Immuno-Haematology & Blood
Banking)**

2-YEAR POST-GRADUATE PROGRAMME
(w.e.f. Academic Year 2024-2025)

	Course No.	Course title	Full Marks	Credit
III	MMLT-301	Patient Safety and Quality Life	50	4
	MMLT-302	Sero-diagnostic Technology	50	4
	MMLT-303	Advanced Immuno-Haematology	50	4
	MMLT-304	Blood Components fractionation techniques	50	4
	MMLT-395	Lab- Sero-Diagnostic Technology (P)	50	4
	MMLT-396	Lab-Immuno-Haematology (P)	50	4
	MMLT-397	Survey Report on Blood Bank (P)	50	4
	MMLT-398	End-term Report (1 st +2 nd +3 rd)	50	4
	TOTAL		400	32
IV	MMLT-401	Blood donation, Blood Bank &Transfusion Therapy	50	4
	MMLT-402	Computer Application, Health Information System & Artificial Intelligence	50	4
	MMLT-403	Recent Advances in Blood Bank	50	4
	MMLT-404	Clinical Research, Forensic Science & Advance Techniques in Laboratory Medicine	50	4
	MMLT-495	Blood donation, Blood Bank &Transfusion Therapy (P)	50	4
	MMLT-496	Computer Application, Health Information System & Artificial Intelligence (P)	50	4
	MMLT-497	Recent Advances in Blood Bank	50	4
	MMLT-498	Internship and Report Submission	50	4
	TOTAL		400	32

Semester-III

Paper: MMLT 301: Patient Safety and Quality Life

Full Marks: 50 Credit: 4

Objective of the Program:

To provide knowledge and practical understanding of patient safety, quality care, and ethical practices, with focus on infection control, hygiene, patient rights, end-of-life care, education, advocacy, and lifestyle modification for better patient management.

Expected Outcome:

By the end of the program, students can:

1. Understand and apply infection control and hygiene practices.
2. Maintain sanitation, disinfection, and sterilization standards.
3. Recognize and respect patient rights.
4. Provide compassionate end-of-life and hospice care.
5. Educate patients on self-care and prevention of contagious diseases.
6. Act as effective patient advocates.
7. Promote healthy lifestyle and dietary modifications for better patient care.

Course content:

1. Infection control in general
2. Hygiene & sanitation, disinfection, sanitization and sterilization.
3. Patient right
4. End of life care – Hospice care
5. Patient education – Self-care practice, teaching about contagious disease
6. Patient advocacy
7. Lifestyle and food style modification for patient care

Paper: MMLT 302: Sero-diagnostic Technology

Full Marks: 50 Credit: 4

Objective of the Program:

To provide knowledge of serological and immunological principles in disease diagnosis, focusing on antigen–antibody reactions, monoclonal antibody production, hypersensitivity, vaccination, and serological testing for infectious and immune disorders.

By the end of the program, students can:

1. Understand antigens, antibodies, and their interactions.
2. Explain monoclonal antibody production and applications.
3. Describe immunological reactions and techniques.
4. Identify hypersensitivity and immunosuppression.
5. Explain vaccination and transplant immunology.
6. Understand the immunological basis of tumors.
7. Perform serological screening and confirmatory tests for infectious diseases.

Course content:

1. Antigens: Immunogen, allo-antigen, soluble antigen, Red blood cell antigens, epitopes,
2. Monoclonal antibodies: Hybridoma technology, applications of Mab.
3. Principle of immunological reaction. Immunotechniques.
4. Hypersensitivity reactions, and immunosuppression.
5. Vaccination-schedule, Transplantational immunology.
6. Immunological basis of tumor formation.
7. Different serological screening and confirmative test for different infectious diseases.

Paper: MMLT 303: Advanced Immuno-Haematology

Full Marks: 50 Credit: 4

Objective of the Program:

To provide advanced knowledge of immuno-haematology, including molecular genetics, blood group identification, antibody detection, and transfusion medicine, with emphasis on modern tools like genomics, NGS, AI, and clinical applications in transplantation and autoimmune disorders.

Expected Outcome:

By the end of the program, students can:

1. Understand blood group systems, molecular typing, and antibody detection.
2. Perform pre-transfusion testing and cross-matching.
3. Apply genomic, NGS, and AI tools in immuno-haematology.
4. Recognize TRIM, HLA typing, and autoimmune correlations.
5. Understand clinical and research applications in transfusion medicine.

Course content:

1. Molecular blood typing, ABO blood group systems: History and genetics of ABO antigens, Biosynthesis of blood group antigens, Antigenic sites (Epitope), weaker antigenic variants, Bombay Phenotype, ABO antibodies, Rh Blood Group System: History, genetics, molecular genetics, nature of Rh Antigens, partial D, weak D, other variants of Rh, Rh null, Rh antibodies, factors influencing Rh immunization, functional role of Rh antigens
Other blood group systems: Lewis, P, Ii, MNSs, Kell, Duffy, Celano, In, Private antigens, public antigens.
2. Antenatal serology, hemolytic disease of the newborn due to ABO incompatibility, Rh Incompatibility and other allo-antibodies
3. Red cell serology techniques, their advantages and disadvantages, cell and serum grouping, detection of weak A and B antigens and weak D/Partial D cases, troubleshooting in red blood cell serology
4. Genomics and genetic markers
5. Next-generation sequencing (NGS)
6. Antibody identification and characterization
7. Transfusion related immuno-modulation (TRIM)
8. High throughput screening
9. AI & Machine learning- AI and ML algorithm to predict antibody (Ab) development, optimized blood matching process, Grouping and transfusion outcomes.
10. Extended phenotyping
11. Blood group antigen (Ag) engineering
12. Immuno-haematology in stem cell transplantation
13. Clinical trial and novel therapeutics
14. Basic principles of immunohaematology, Application of blood groups: Population Genetics, Forensic medicine, Transfusion medicine.
15. Pre transfusion testing, Different methods of cross matching, cross matching in special circumstances, emergency cross matching, electronic cross matching.
16. Principles of direct and indirect antiglobulin test, enzyme techniques, albumin detection technique, detection of blood group antibodies, identification of their Specificity, clinical significance of antibody detection, differentiation between auto and allo-antibodies

17. Gel technology techniques, Micro plate techniques
18. Antigen antibody reaction: Antigen concentration, antibody concentration, enhancing media, other factors influencing antigen antibody reaction, Immunoassays: ELISA,
19. Cells of immune system: Phagocytic cells, Antigen presenting cells, T cells, T cell subsets, B cells, CD Markers, Flowcytometry for counting T & B cells
20. Autoimmune disorders : Basis of Autoimmunity and examples.
21. HLA antigens, HLA antibodies, HLA Serology, Histocompatibility matching: Molecular methods, Molecular methods in Immunology

Paper: MMLT 304: Blood components fractionation techniques Full Marks: 50 Credit: 4

Objective of the Program:

To provide knowledge and practical skills in blood collection, donor management, and modern techniques for preparation, processing, and preservation of blood components with emphasis on quality and safety in transfusion practices.

Expected Outcome:

By the end of the program, students can:

1. Understand donor selection, counselling, and safety.
2. Operate blood collection equipment and manage donation camps.
3. Perform component separation, preservation, and plasma fractionation.
4. Handle apheresis systems and ensure product quality.
5. Apply automation and quality control in blood banking.

Course content:

1. Donor motivational Techniques, Types of blood donors, Donor selection process- medical interview and medical examination.
2. Blood collection room equipment, their principles, and use, emergency medicines. pre-donation counselling, bleeding time determination of the donor, post donation care, post donation counseling, Screening of blood units for mandatory tests.
3. Blood Donation drive: Awareness programs prior to blood donation drive, Camp site, staff requirement, management of camp, transportation of blood units from camp site to blood bank. Preservation of donated blood, blood preservation solutions, additive solutions.

Apheresis procedures and products, preparation of multiple products on cell separators, Maintenance of cell separator equipment. Autologous blood donation.

4. Types of blood components, advantages of blood component preparation, Selection of blood bags for component preparation, Whole blood collection for component preparation, Component separation and processing, preparation of red blood cell concentrate, Fresh frozen plasma, platelet concentrate, cryoprecipitate, washed red blood cells, frozen red blood cells, Factors affecting the quality of blood components, automation in blood component preparation.
5. Plasma fractionation: Principles, manufacturing of different plasma derivatives Component testing, Labelling, Transportation and storage of blood components.
6. Preparation of leukoreduced blood products, Leukocyte filters, component extractors. Metabolic changes in blood components during storage, release of cytokine during storage.

Paper: MMLT 395: Lab- Sero-Diagnostic Technology (P)

Full Marks: 50 Credit: 4

Objective of the Program:

To provide practical knowledge and hands-on skills in performing various serological and immunological diagnostic tests used in disease detection.

Expected Outcome:

By the end of the program, students can:

1. Perform basic precipitation and agglutination tests.
2. Detect immunoglobulins using SRID and Ouchterlony methods.
3. Conduct common serological tests like WIDAL, RPR, ASO, RA, and CRP.
4. Perform ELISA and infectious disease screening (HIV, Hepatitis, TORCH, Dengue).
5. Follow lab safety, quality control, and proper reporting procedures.

Course content:

1. Precipitation, agglutination and coagulation.
2. Detection of immunoglobulin, SRID, Ouchterlony double diffusion.
3. Qualitative indirect enzyme immunoassay for the detection of serum antinuclear antibodies. RPR and titer estimation, WIDAL test and titer estimation, ASO test and titer estimation, RA test and CRP test and titer estimation, HIV test and hepatitis profile.

TORCH panel. Dengue and Lupus erythematosus. *Helicobacter pylori* and titer estimation. Montoux test.

Paper: MMLT 396: Lab-Immuno-Haematology (P)

Full Marks: 50 Credit: 4

Objective of the Program:

To provide practical skills in performing haematological and immuno-haematological tests for disease diagnosis. The course aims to train students in blood sample handling, component testing, enzyme assays, and identification of hematologic disorders using modern laboratory techniques.

Expected Outcome:

By the end of the program, students can:

1. Collect blood and perform basic hematology tests.
2. Operate autoanalyzers and enzyme assays.
3. Detect G-6-PD deficiency, iron status, and hemoglobin variants.
4. Prepare bone marrow smears and identify abnormalities.
5. Perform coagulation, fragility, and immuno-haematology tests.

Course content:

1. Collection of blood samples, types of anticoagulants, Basic hematologic investigations and their normal values – Hb, TRBC, TLC, DLC, PCV, ESR, Platelet count, Reticulocyte count, Absolute values, PT, INR, APTT.
2. Demonstration of auto analyser.
3. Determination of G-6-PD.
4. Detection of iron in prepared smear. Determination of iron and total iron binding capacity (TIBC) in serum.
5. Haemoglobin electrophoresis (demonstration) including glycosylated Hb.
6. Preparation of bone marrow smear and its staining and identification of mega karyocytes. Plasma recalcification time, Determination of fibrinogen, Protamine sulphate test. Leukaemia and Sickle cell anaemia detection.
7. T-cell, B-cell preparations.
8. Red cell pyruvate kinase assay. Naked Eye Single Tube Red Cell Osmotic Fragility test (NESTROF test), Acidified serum test and sucrose lysis test.

Paper: MMLT 397: Survey Report on Blood Bank (P)**Full Marks: 50 Credit: 4****Objective of the Program:**

To enable students to understand the organization, functioning, and management of a blood bank through field visits and surveys. The course aims to provide practical exposure to blood collection, processing, storage, and quality control procedures.

Expected Outcome:

By the end of the program, students can:

1. Understand blood bank operations and workflow.
2. Observe donor selection, collection, and testing.
3. Learn component preparation, storage, and quality control.
4. Prepare a survey report based on observations.

Course content:

Survey Report on Blood Bank (P)

Paper: MMLT 398: End-term Report (1st +2nd +3rd)**Full Marks: 50 Credit: 4****Objective of the Program:**

To assess the overall academic progress and practical learning of students through compilation and presentation of reports from the first, second, and third-year courses.

Expected Outcome:

By the end of the program, students can:

1. Compile and analyze practical and theoretical knowledge gained over three years.
2. Present findings and interpretations in a structured report format.
3. Demonstrate understanding, accuracy, and professional documentation of laboratory practices.
4. Reflect on their learning outcomes and skill development throughout the course.

Course content:

Submission of End-term Report (1st +2nd +3rd).

Semester-IV

Paper: MMLT 401: Blood Donation, Blood Bank & Transfusion Therapy

Full Marks: 50 Credit: 4

Objective of the Program:

To provide knowledge on blood donation, blood banking, transfusion therapy, and related safety, ethical, and quality aspects.

Expected Outcome:

By the end of the program, students can:

1. Understand blood collection, storage, and transfusion procedures.
2. Manage transfusion reactions and blood bank operations.
3. Apply safe and ethical transfusion practices.
4. Follow quality control and hemovigilance protocols.

Course content:

1. Historical perspective of blood transfusion, National and State Blood Transfusion Council,
2. Management of Blood Bank Issue Counter- Criteria for acceptance of requisition form, inspection of blood component prior to issue. Blood administration, transfusion filters, post transfusion care, Therapeutic plasma exchange, Judicious use of donated blood;
3. Management of different types of anemia, management of bleeding disorder in patient, Neonatal transfusion, Transfusion practices in surgery, Transfusion therapy for oncology and trans plantation patients. Hemolytic transfusion reaction- immediate and delayed; immune and non-immune reaction pathophysiology;
4. Laboratory invigilation for HTR Tests to detect bacterial contamination in blood, Non-hemolytic transfusion reactions- Immediate and delayed, febrile reaction, allergic reaction, clinical signs and symptoms. Acute transfusion related lung injury, alloimmunization, Iron overload, Graft versus host disease. Strategies to prevent transfusion reactions, Inventory management.
5. Transfusion transmissible infections- Viral, parasitic, spirochaetal and bacterial infections. Pathogen inactivation or reduction techniques.
6. Components of therapy- RBC, Platelets, Plasma, Cryoprecipitate

7. Indication and Contra-indication (Restrictive vs Liberal Transfusion strategies, Patient blood managements)
8. Transfusion reaction & safety
Acute hemolytic transfusion reaction (AHTR), Febrile non-hemolytic transfusion reaction (FNHTR), Transfusion-related acute lung injury (TRALI), Transfusion -associated circulatory overload (TACO), Infectious disease transmission
9. Technological advances
Pathogen interaction technologies, Leukoreduction, Genomic typing and extended phenotyping
10. Specialized Transfusion Practices
Massive transfusion protocol (MTP), Neonatal and paediatric transfusions, Transfusion in oncology
11. Ethical legal consideration
12. Emerging trends and research: - Artificial blood substitutions, Immuno-modulation and precision in medical invention
13. Quality control and auditing: - Hemovigilance, Continuous quality improvement, Blood supply chain management, educational training

Paper: MMLT 402: Computer Application, Health Informatics & Artificial Intelligence

Full Marks: 50 Credit: 4

Objective of the Program:

To provide basic knowledge of computer applications, health informatics, bioinformatics, and artificial intelligence in medical laboratory science.

Expected Outcome:

By the end of the program, students can:

1. Use computer software for data analysis and reporting.
2. Understand health information systems and bioinformatics tools.
3. Apply AI concepts in diagnostics and research.
4. Ensure ethical use of technology in laboratory medicine.

Course content:

1. Basic idea of computer- Computer Hardware, Software, Operating system, Computer operation.
2. Basic idea about MS Word & MS Excel MS Power Point. Clinical data analysis, presentation through computer, data storage and database formation, data bank.
3. Use of internet in Medical Laboratory Science. Common trouble shooting during computer operation.
4. General idea about health information system, Idea about data, information and intelligence, Components of health information system and uses, Sources of health information.
5. Introduction of bioinformatics-Definition of database, types, biological database, computer languages for bioinformatics, application of bioinformatics,
6. Bioinformatics resources –NCBI, EBI, PubMed, BioMed Central,
7. Basic concept of sequence similarity, identity, and homology. Genome analysis, Phylogenetic tree, Motif analysis.
8. Diagnostic accuracy
9. Automation and Efficiency of medical laboratories.
10. Data analysis and Interpretation
11. Personalized medicine
12. R & D in laboratory medicine
13. AI, ethical and regulatory consideration.
14. Real-time monitoring of laboratory devices.

Paper: MMLT 403: Recent Advances in Blood Bank**Full Marks: 50 Credit: 4****Objective of the Program:**

To provide advanced knowledge of modern technologies, automation, and regulatory practices in blood banking and transfusion medicine.

Expected Outcome:

By the end of the program, students can:

1. Understand automation, QC, and regulatory standards in blood banks.
2. Apply genomics, AI, and data management in transfusion practices.

3. Perform and monitor advanced blood collection and processing techniques.
4. Comprehend cellular therapy, stem cell banking, and personalized transfusion medicine.

Course content:

1. Automated blood collection and processing
2. Blood product pathogen reduction, Quality control of blood grouping reagents, QC of anti-human globulin reagent, bovine albumin, Normal saline. Quality control of blood bags. Quality control of different blood bank Components, sterility test on component.
3. Cellular therapy and stem cell banking
4. Genomics of blood transfusion
5. Point-of-care blood testing
6. Bio-informations and data managements
7. AI and Machine learning for donor behaviour, manage inventory, optimize blood collecting strategy.
8. Personalized transfusion medicine
9. Extended blood self-life.
10. Universal blood donor
11. Automation in blood banking. Calibration, validation and maintenance of blood bank equipment, QC of blood bank techniques, internal and external QC.
12. Organization of blood bank services, Blood bank premises and infrastructure, Regional blood transfusion centre and blood storage centres, Blood bank management system.
13. Regulations for blood bank operation: Drugs and cosmetics law, National blood policy, standards in blood banking, licensing procedures.
14. Recruitment and training of blood bank personnel, Proficiency testing. Blood Bank Accreditation. Automation in blood banking. Nucleic acid testing, Apheresis, Stem cells.

Paper: MMLT 404: Clinical Research, Forensic Science & Advance Techniques in Laboratory Medicine

Full Marks: 50 Credit: 4

Objective of the Program:

To provide students with advanced knowledge of clinical research methods, forensic applications, and modern diagnostic techniques used in laboratory medicine.

Expected Outcome:

By the end of the program, students can:

1. Understand principles of ECG, EEG, and advanced diagnostic instruments.
2. Apply molecular and chromatographic techniques in disease diagnosis.
3. Utilize flow cytometry, PCR, blotting, and mass spectrometry effectively.
4. Recognize the role of digital pathology, AI, and telemedicine in modern diagnostics.

Course content:

1. Physiological basis of ECG and EEG. Recording method followed in ECG and EEG.
2. Basic principle of centrifugation (ordinary, ultra and cold). Semi-auto/autoanalyzer, spectrofluorometer, flame photometer, luminometer, sonicator, lyophilizer, ELISA reader,
3. Flow cytometry- basic principle, protocol and their application in bio-medical science.
4. Fundamentals of emerging technologies in medical sciences-Melanoma biopsies, Electronic aspirin, Robotic check-ups, Stem cell and organ therapy.
5. PCR in diagnosis of diseases. Southern, Northern and Western Blot in diagnostic field.
6. Mass Spectrometry- Principle, procedure and application for diagnosis of diseases.
7. Modern techniques for laboratory diagnosis of pathogenic bacteria-mycobacterial, Genomics, transcriptomics, proteomics and metabolomics - Principle and application for diagnosis of various diseases.
8. Identification of uncultured pathogens; DNA and protein gel electrophoresis.
9. Separation Methods -An introduction to chromatographic separation, paper chromatography, TLC, Gas chromatography, High Pressure Liquid Chromatography (HPLC), UPLC and FPLC.
10. Clinical applications of molecular biology for infectious diseases-immunological, biochemical, electron microscopy.
11. Point-of -care testing (POCT)

12. Digital pathology and AI

13. Telepathology, Teleradiology, and Remote-diagnostics

Paper: MMLT 495: Laboratory Blood Donation, Blood Bank & Transfusion Therapy (P)

Full Marks: 50 Credit: 4

Objective of the Program:

To train students in practical aspects of blood banking, including blood component testing, quality control, and maintenance of blood products.

Expected Outcome:

By the end of the program, students can:

1. Maintain blood stock and perform sterility testing.
2. Measure factor VIII and fibrinogen levels in FFP.
3. Assess pH and quality parameters of platelet concentrates.

Course content:

Maintenance of blood stock, Measurement of factor VIII level in FFP, Measurement of fibrinogen level in FFP, Sterility test on platelet concentrates. Sterility test on whole blood, Measurement of pH and other platelet parameters.

Paper: MMLT 496: Computer Application, Health Information System & Artificial Intelligence (P)

Full Marks: 50 Credit: 4

Objective of the Program:

To provide hands-on training in computer applications, health informatics tools, and AI-based techniques used in laboratory data analysis and reporting.

Expected Outcome:

By the end of the program, students can:

1. Use software for cell count and measurement.
2. Operate photomicrograph and UV-spectrophotometer systems.
3. Perform statistical data analysis using computer software.

Course content:

Use of software for cell count, cell diameter measurement. Photomicrograph system. UV-spectrophotometer. Statistical analysis of data in computer using software.

Paper: MMLT 497: Recent Advances in Blood Bank**Full Marks: 50 Credit: 4****Objective of the Program:**

To train students in modern blood bank practices, automation, quality control, and safe transfusion techniques.

Expected Outcome:

By the end of the program, students can:

1. Perform automated blood processing and QC.
2. Operate and maintain blood bank instruments.
3. Apply NAT, apheresis, and data management tools.
4. Follow safety and quality standards in transfusion services.

Course content:

1. Demonstration of automated blood collection and component separation.
2. Quality control of reagents, blood bags, and components.
3. Calibration and maintenance of blood bank instruments.
4. Demonstration of Nucleic Acid Testing (NAT) and apheresis.
5. Study of pathogen reduction and stem cell banking techniques.
6. Use of software for blood bank data management.
7. Visit to regional blood transfusion centre and report preparation.
8. Case study on transfusion reactions and corrective actions.

Paper: MMLT 498: Internship & Report Submission**Full Marks: 50 Credit: 4****Objective of the Program:**

To provide practical exposure to real laboratory settings and develop professional skills through hands-on training in clinical, diagnostic, and research laboratories.

Expected Outcome:

By the end of the program, students can:

1. Apply theoretical knowledge in practical laboratory work.
2. Perform routine and advanced diagnostic procedures.
3. Prepare and present an internship report demonstrating acquired skills and experience.

Course content:

Internship & Report Submission