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. Electrolyte measurement.

3. Titrimetry. Photometry-flame photometry, atomic absorbption photometry. Clorimetry-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 tubuler 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 phenothiozyne derivative, acetaminophens carbamazepine, ethosuximide, Phenobarbital, phenytoin, pyrimidine. Chloral hydrate and halogenated hydrocarbons, impramine, salicylates, digoxin, caffeine, deryphylline, cyclosporine.
10. Screening of heavy metals- Hg, As, Fl, 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 (Clorimetric 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 foe 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 Tchnique, 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, Trypanosonsiosis. 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. Skill fully sharpens 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, sudden-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 deferent 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.