

## **B.Sc. Medical Lab Technology**

### **Programme Summary**

Duration: 3 years + 6 months internship

### **Eligibility**

10+2 with at least 45% marks in PCB/PCM or DMLT from any state technical board or university.

### **Program outcomes:**

- Perform routine clinical laboratory procedures within acceptable quality control parameters in Hematology, Biochemistry, Microbiology, Serology, Histopathology, Blood banking, Urinalysis and other body fluids under the supervision of Pathologist or technologist.
- Learn proper care and safe use of basic laboratory glassware and equipment including the cell counter, microscope, centrifuge, incubator, colorimeter, analytical balance, microtome .
- Learn the role of the phlebotomist and display professional behavior in dealing with patients, their family, and public.
- Appropriately and successfully collection of blood specimens through venipuncture and capillary puncture .
- Learn to maintain quality control system in pathology lab in order to improve efficiency and accuracy of various investigations.
- Learn about the morphological variations of various blood cells and discuss their clinical importance.
- Learn normal ranges/values for all common hematology /Biochemical parameters and their clinical significance.
- Discuss theory and principles of haemostasis including synthesis of various extrinsic and intrinsic coagulation factors of plasma and platelet function.
- Learn primary aspects of the blood bank including ABO-Rh and other common blood group systems, their antigens and antibodies compliment, agglutination, antiglobulin, antibody identification, transfusion therapy, transfusion reactions, and hemolytic disease of the newborn.
- Learn immunology and serology basics such as antigens, antibodies, compliments, Antigen-antibody reaction, immunity , inflammation, vaccines etc.
- Learn various gram positive and gram negative bacteria, viruses and fungi causing diseases to human beings.
- Learn various microbial diseases and their methods of lab investigations. Discuss principles, rationale use and interpretation of culture media to isolate and identify different microbes found in blood, urine or other body fluid cultures. Demonstrate proficient use of routine media.
- Explain and perform all phases of the Gram stain including smear preparation, stain, evaluation, reading, reporting and interpretation.

- Describe principle, rationale uses and interpretation of routine biochemical tests for organism identification. Demonstrate proficient use of routine biochemical tests.
- Identify basic guidelines for safe use of chemicals including proper labeling, protective measures, location and use of SDS, and disposal of hazardous chemicals.
- Discuss the principle and limitations of each dipstick test for chemical analysis of the urine.
- Operate and maintain laboratory equipment, utilizing appropriate quality control and safety procedures.
- Study routine tissue processing and freeze drying technique in histopathology. Study of various staining techniques to identify premalignant or malignant condition.
- Study of various aspiration techniques such as FNAC.

**Course outcomes:**

S.No	Course code	Course name	Maximum Marks (theory+Lab)	Course Outcomes
1	BMLT 101	Human Anatomy & Physiology	70+30	<p>The prime concern of this subject is to learn the terminology of the subject and basic knowledge of cells &amp; tissues and to understand anatomy of human body.</p> <p>After successful completion of this course students are expected to be able to understanding the structure and function of organs and organ systems in normal human body. Discuss the physiology of the nervous, musculoskeletal, respiratory, and cardiovascular systems from a regional perspective.</p> <p>Analyze and describe the structures and functions of human anatomy and physiology from a regional perspective for the following regions: head and neck, thoracic, abdomino-pelvic, and upper and lower extremities.</p> <p>Compare and contrast the major bones and their processes as they relate to each region of the body. Describe briefly the basic components and functions of the digestive, urinary, and endocrine systems.</p>
2	BMLT 102	Basic Pathology	70+30	<p>The syllabus of pathology aims at preparing the students in basic understanding of diseases and their pathogenesis.</p> <p>Introduction to Hematology. Laboratory organization and safety measures.</p> <p>Study of Formation, composition and functions of blood. Learn to anticoagulants, mode of action of anticoagulants and their merits and demerits. Demonstrate Collection, preservation, transport and handling and disposal of blood samples.</p> <p>To learn Basic hematology and estimation of haematocrit values, physiological variations, normal and absolute values, and quality assurance in hematology.</p> <p>Pathology of inflammation in response to microbial invasion. Pathology of specific chronic infective disorders : Tuberculosis, Leprosy, Syphilis, and rheumatological disorders.</p> <p>Introduction to blood banking technology.</p>
3	BMLT 103	Clinical Biochemistry	70+30	<p>This syllabus has been formulated to impart basics knowledge of biochemistry, apparatus, units, equipment, and volumetric analysis in the Clinical Biochemistry.</p> <p>Students will be able to demonstrate an understanding of fundamental biochemical principles, such as the structure/function of bio-molecules</p> <p>To Learn introduction to Clinical Biochemistry and role of medical microbiologist, ethics, responsibility, safety measure and hazards in clinical biochemistry lab and first aid in laboratory accidents.</p> <p>Unit of measurements and calibration of volumetric apparatus. Colorimetry, spectrophotometry, flame-</p>

				<p>photometry, analytical balance etc. (principles, instrumentations and applications).</p> <p>To the study the Structure, Classification and function of carbohydrates, lipid, proteins, nucleic acid and enzymes in biological system.</p> <p>Qualitative tests for glycosuria, pentosuria, galactosuria, proteinuria, microalbuminuria and Bence Jones Proteinuria and their clinical significance. Qualitative test of urine for uric acid, urea and creatinine. Quantitative estimation of 24 hrs urine for albumin and 17-ketosteroids and their clinical significance.</p>
<b>4</b>	<b>BMLT104</b>	<b>Preventive Medicine and Health Care</b>	70+30	<p>After completion of this syllabus students are able to tailor their education plan to meet their own interests in Preventive Medicine. This may include content areas such as occupational medicine, addiction medicine, or infectious diseases.</p> <p>To learn water, air and noise pollution: Removal of water hardness, purification of water and standards of water quality.</p> <p>To understand the concepts of Hygiene and sanitation: Sanitation barriers, excreta disposal and disposal of hospital waste. Incineration and disinfection.</p> <p>To study Infections and control: Microbial pathogenicity, source and spread of infections in community.</p> <p>To demonstrate the prophylactic immunization: rationale of immunization, immune response and duration of immunity. Various national immunization programs and vaccine schedules.</p> <p>To understand the concepts of Reproductive, Family planning and Child Health Care Programs.</p> <p>To learn bacteriology examination of water, milk, food and air.</p> <p>To study of health care by balance diet and yoga. Normal constituents of diet, various diet programs, balance diet. Health Planning and Management.</p>
<b>5</b>	<b>BMLT 105</b>	<b>Microbial Biology</b>	70+30	<p>After successful completion of this course students are expected to be able to: Demonstrate theory and practical skills in microscopy and their handling techniques and staining procedures.</p> <p>Understand the basic microbial structure and function and study the comparative characteristics of prokaryotes and eukaryotes and also Understand the structural similarities and differences among various physiological groups of bacteria/archaea.</p> <p>This subject gives a general insight into the history, basics of microbiology and imparts knowledge about equipment used in microbiology. Discovery of micro-organisms. Contribution of Robert Koch, Antony Van Leeuwen Hock, Louis Pasteur, Bordot, Paul Ehrlich, Alexander Fleming, Matchnikoff, Needham, Tyndall Jenson, Joseph Lister, Kal Land Steiner etc.</p> <p>To study of Morphology and Nature of bacteria, Classification and identification of bacteria, Sterilization and disinfection.</p>

				<p>To learn Cultural Medias, Cultivation of bacteria and Growth and Nutrition of Bacteria.</p> <p>To demonstrate the lab. Organization, Management, Recording of Results and Quality Control in Medical Microbiology.</p>
6	<b>BMLT 106</b>	<b>Technical Methods in Microbial Biology</b>	70+30	<p>This course make the students to know handling of instruments and sterilization techniques</p> <p>To demonstrate the safety measures in Microbiology Laboratory : Occurrence of lab infections, route of infections in laboratory, safety measures precaution in use of pathogens in teaching. Lab organization, management, recording of results and quality control in Medical Microbiology Lab.</p> <p>To study of various types of Microbiological Instruments such as microscope, pH meter Autoclave, Incubator, Hot air oven, Laminar Air Flow, Colony Counter, Muffle Furnace, Refrigerator, Inoculator, Mac-intos Field-jar etc.</p> <p>To learn Instruments used in immunology : Electrophoresis, Immunodiffusion, starplate, chromatography, ELISA reader, automatic washer and RIA equipments etc.</p> <p>To understand the concepts of Preparation of stains used in microbiology lab.</p> <p>To learn care and management of experimental animals.</p> <p>To learn Culture and Drug Sensitivity tests.</p>
7	<b>Practical Paper I</b>	<b>Laboratory course -I</b>	70+30	To impart practical knowledge based on theory papers BMLT 101 / BMLT 102.
8	<b>Practical Paper II</b>	<b>Laboratory course - II</b>	70+30	To impart practical knowledge based on theory papers BMLT 103 / BMLT 104.
9	<b>Practical Paper III</b>	<b>Laboratory course - III</b>	70+30	To impart practical knowledge based on theory papers BMLT 105 / BMLT 106.
<b>2<sup>nd</sup> year</b>				
1	<b>BMLT 201</b>	<b>Clinical Biochemistry – I</b> [Separative and Instrumental Techniques]	70+30	<p>The syllabus has been formulated to impart basics knowledge of biochemistry, apparatus, units, equipment, and volumetric analysis in the Clinical Biochemistry.</p> <p>To learn thin layer Chromatography, gas liquid Chromatography, Colorimetry, flame photometry, Atomic absorption spectroscopy etc</p> <p>To learn the Paper and gel electrophoresis for hemoglobin, urinary proteins, serum, CSF &amp; LDH.</p> <p>To understand the concepts of Immunochemical, Immunoprecipitation, Immunofixation and radial immunodiffusion tests, ELISA,RIA, Polymerase chain reaction (PCR), Osmometry, Semi autoanalyzer.</p> <p>Students will use current biochemical and molecular techniques to plan and carry out experiments. They will generate and test hypotheses, analyze data using statistical methods where appropriate, and appreciate the limitations of conclusions drawn from experimental data.</p>

2	BMLT 202	<b>Clinical Biochemistry – II</b> [Metabolic and Blood Chemistries]	70+30	<p>This syllabus has been formulated to impart basics knowledge of Carbohydrate metabolism, lipid metabolism, protein metabolism.</p> <p>To learn the Principle, assay procedures and clinical significance of Glucose, Proteins, A/G, urea, BUN, uric acid, creatinin cholesterol, Bilirubin (Direct and Indirect).</p> <p>To learn about the electrolytes, Quantitative estimation of sodium, potassium, calcium, chloride, lithium, phosphorus, magnesium and their clinical significance.</p> <p>To the study of Acid base balance test, Xylose Absorption test and insulin tolerance test, Urea and creatinin clearance tests, Renal function tests, Glycosylated Hb &amp; Liver function tests.</p> <p>Students will be able to demonstrate an understanding of fundamental biochemical principles, such as the structure/function of bio-molecules, metabolic pathways, and the regulation of biological and biochemical processes.</p>
3	BMLT 203	<b>Medical Microbiology - I</b> [Bacterial Pathogens & Associated Diseases]	70+30	<p>After successful completion of this course students are expected to be able to:</p> <p>Demonstrate theory and practical skills in microscopy and their handling techniques and staining procedures.</p> <p>Understand the basic microbial structure and function and study the comparative characteristics of prokaryotes and eukaryotes and also Understand the structural similarities and differences among various physiological groups of bacteria/archaea.</p> <p>Understand the normal microflora of human body, Skin, Respiratory System, Gastrointestinal and Genitourinary tracts. Source of infection, mode of spread and portals of entry.</p> <p>Understand the pathogenecity, mode of infection, incubation period and toxigenecity of <i>Staphylococcus</i>, <i>Streptococcus</i>, <i>Pneumococcus</i>, <i>Neisseria</i>, <i>Bordetella</i>, <i>Haemophilus</i>, <i>Salmonella</i>, <i>Shigella</i>, <i>Proteus</i>, <i>Pseudomonas</i>, <i>Loefflerella</i>, <i>Vibrio</i>, <i>Escherichia coli</i> <i>Clostridia</i>, <i>Corynbacteria</i>, <i>Erysipelothrix</i>, <i>Listeria</i>, <i>Mycobacteria</i>, <i>Brucella</i>, <i>Yersenia</i>, <i>Pasteurella</i> &amp; <i>Francisella</i>.</p> <p>To learn host Parasite interaction in bacterial infections. Pathogenic properties of bacteria (colonization of surfaces, invasion of tissue, production of exo and indo toxins). Anti bacterial defense of the host.</p> <p>Understand the concepts of Physiology and Biochemistry of Bacteria : Protein, Carbohydrate, lipids and nucleic acid as antigens.</p>
4	BMLT 204	<b>Medical Microbiology-II</b> [Technical Methods in Medical	70+30	<p>After successful completion of this course students are expected to be able to: Know various Culture media and their applications and also understand various physical and chemical means of sterilization</p> <p>Know General bacteriology and microbial techniques for isolation of pure cultures of bacteria, fungi and</p>

		Microbiology]		<p>algae</p> <p>Learn the role of laboratory in the diagnosis and control of infections. Management and quality control of medical microbiology laboratory.</p> <p>Learn the specimen collection from patients, clinics and hospitals and Specimen collection for epidemiological investigations.</p> <p>Learn the Morphology, Staining, Cultural Character of Bacteria. Selective cultural medias, indentification by special tests, biochemical reactions and sero-typing, pathogenesis of Gram's postivie cocci ( Cluster forming, chain forming and diplo cocci), Neisseria, Bordetella , Haemophilus, Corynebacterium, Mycobacterium, Atypical Mycobacterium, Anthrax bacillus, Brucella, Yersenia, Pasteurella etc.</p> <p>To understand the concepts of Microbial drugs sensitivity test's and its clinical interpretation.</p>
5	BMLT 205	Pathology & Allied Subjects-I (Hematology)	70+30	<p>After completion of this course students will acquire and demonstrate competency in laboratory safety and in routine and specialized pathology laboratory skills applicable to microbiological research or clinical methods, including accurately reporting observations and analysis.</p> <p>To learn Coagulation and its mechanism of coagulation, coagulation regulation, hypercoaguable states, different types of bleeding disorders, role of platelets in haemostasis.</p> <p>To the study of various types of anaemia and its etiological causes, lab diagnosis and changes in the blood morphology due to anaemia.</p> <p>Discussion on Leucocytosis, neutropenia and pancytopania their causes.</p> <p>To the study of hematological malignancies: such as Leukemia, Lymphomas, Multiple myeloma and their identification and clinical features and lab investigation.</p> <p>To learn the Various Parasites in blood and their clinical significance. Lab investigations and methods of identification.</p>
6	BMLT 206	Pathology and Allied Subjects – II (Histotechnology)	70+30	<p>At the end of the course the students should be able to :</p> <ul style="list-style-type: none"> <li>• Diagnose routine and complex clinical problems on the basis of Histopathology (Surgical Pathology) and Cytopathology specimens, Blood and Bone Marrow examination and various tests under the domain of Laboratory Medicine (Clinical Pathology, Clinical Biochemistry/Chemical Pathology) as well as Blood Banking (Transfusion Medicine).</li> <li>• Interpret clinical and laboratory data with reasonable accuracy.To demonstrate the Reception recording</li> </ul>

				<p>and labeling of histology specimens in the histopathology lab.</p> <p>To learn the various histological techniques used in histopathology lab and during the tissue processing such as Fixation, fixatives, embedding, Decalcification, Microtomy, mounting etc</p> <p>To learn the dye chemistry theory, routine staining procedures H and E, Special staining procedures for connective tissues carbohydrates, amyloids and pigments. Meta chromasia and meta chromatic dyes.</p> <p>To understand the concepts of Museum techniques and faults &amp; remedies during the section cutting.</p>
7	<b>Practical Paper I</b>	<b>Laboratory course -I</b>	70+30	To impart practical knowledge based on theory papers BMLT 201 / BMLT 202
8	<b>Practical Paper II</b>	<b>Laboratory course - II</b>	70+30	To impart practical knowledge based on theory papers BMLT 203 / BMLT 204.
9	<b>Practical Paper III</b>	<b>Laboratory course - III</b>	70+30	To impart practical knowledge based on theory papers BMLT 205 / BMLT 206.
<b>3<sup>rd</sup> Year</b>				
1	<b>BMLT 301</b>	<b>Clinical Biochemistry – 1</b> (Biostatistics, Automation & Endocrinology)	70+30	<p>This syllabus has been formulated to impart basics knowledge bio-static for clinical quality control. Standard deviation, standard error, coefficient of variation, normal distribution, t-test and chi-square test.</p> <p>Students will use current biochemical and molecular techniques to plan and carry out experiments. They will generate and test hypotheses, analyze data using statistical methods where appropriate, and appreciate the limitations of conclusions drawn from experimental data</p> <p>To understand the concepts of establishment and maintenance of quality control for laboratory tests based upon medical usefulness.</p> <p>To discuss normal ranges of various bio-metabolites and their confidence limits.</p> <p>To demonstrate the Automation, Handling of automatic analyzers, management of hospital laboratory.</p> <p>To learn the Toxicology with screening &amp; drug interference with laboratory findings and Endocrinology &amp; their clinical interpretation.</p>



2	<b>BMLT 302</b>	<b>Clinical Biochemistry – II</b> (Diagnostic Enzymology)	70+30	<p>After completion of this course student is able to understand the basics about enzymes, enzyme activity determination, units for expressing enzyme activity, factors affecting enzyme activity and mechanisms responsible for abnormal enzyme levels.</p> <p>To learn isoenzymes such as serum CPK, CK – MB, LDH, SGOT (AST), SGPT (ALT), Cholinesterase HBDH, amylase, alpha amylase, lipase, aldolase and myoglobin.</p> <p>Learn about Serum leucine, amino peptidase, alkaline, acid phosphatases, fructosamine test in semen.</p> <p>Learn the Gastric analysis, pentagastrin test, histamine &amp; caffeine stimulation tests, thyroid function test and infertility profile.</p>
3	<b>BMLT 303</b>	<b>Medical microbiology – i</b> (Pathogenic Viruses and Misc. Microbes)	70+30	<p>After successful completion of this course students are expected to be able to learn the microbes such as Actinomyces, Nocardia, Donovanias, Treponema, Chlamydia, Rickettsiae, Mycoplasma and its pathogenesis and lab diagnosis.</p> <p>To understand the concepts of Pox – virus, Herpes Virus, Adenoviruses, Orthomyxoviruses, Paramyxovirus, Miscellaneous Viruses, Picorna Viruses.</p> <p>To learn the Hepatitis, Encephalitis Yellow fever, Dengue fever, Rabies.</p> <p>To demonstrate the cell culture and observation of effect of viruses on cell and its technique, procedure and interpretation of results.</p>
4	<b>BMLT 304</b>	<b>MEDICAL MICROBIOLOGY – II</b> [Technical Methods in Medical Microbiology]	70+30	<p>This syllabus has been formulated to impart basic knowledge about preparation of container and swabs for collections of specimens for microbial examinations, transport of specimen, and documentation of specimen in laboratory. Flowchart of lab diagnostic procedures.</p> <p>At last students will use current biochemical and molecular techniques to plan and carry out experiments.</p> <p>To demonstrate the preservation of Micro-organisms, periodic subculture method, cold storage, freezing, deep freezing, lyophilization methods. Total and viable counts of bacteria.</p> <p>Learn the concepts of Immunology, sero-diagnosis and advanced diagnostic techniques of torch profile, myco, dot, IgG, IgA, IgM and IgE testing, Australia Ag (HBs) etc.</p> <p>To learn test for bacterial sensitivity to antimicrobial agents and their interpretation.</p>

5	<b>BMLT 305</b>	<b>PATHOLOGY &amp; ALLIED SUBJECTS-I</b> ( <i>IMMUNOPATHOLOGY &amp; TRANSFUSION MEDICINE</i> )	70+30	<p>After completion of this course students will acquire and demonstrate competency in laboratory safety and in routine and specialized pathology laboratory skills.</p> <p>To learn the immunity, antigens, antibodies &amp; Immunoglobulin, cells and organs of the immune system, Humoral &amp; Cellular immune response.</p> <p>To understand the concepts of detection of various allergic agents and immunopathology of allergy.</p> <p>To learn Pathogenesis and Lab diagnosis of Rheumatological diseases, inflammation megaloblastic anaemias, iron deficiency, haemolytic anemia and leukemia</p> <p>To understand the concepts of detection of Cancer immunology &amp; Tumor markers.</p> <p>To demonstrate the tissue typing for kidney transplant &amp; bone marrow transplant.</p> <p>To demonstrate the Laboratory investigations in coagulation disorder, bleeding disorder and Platelet functions tests.</p> <p>To learn the cytogenetics in hematology and Radioisotopes and their applications.</p>
6	<b>BMLT 306</b>	<b>PATHOLOGY AND ALLIED SUBJECTS - II</b> ( <i>HISTOPATHOLOGY &amp; CYTOLOGY</i> )	70+30	<p>To study the types of tissue seen in histopathology i.e Connective tissue, Epithelial tissue, Glandular tissue, Benign/ Malignant tumor tissue, Bone tissue etc.</p> <p>To study the handling of fresh histological specimen.</p> <p>To learn about freeze drying and cryostat.</p> <p>To study about identification and demonstration of lipids.</p> <p>To learn about various staining techniques for identification and demonstration of microorganisms in tissue.</p> <p>To study about various enzymes demonstration in tissues such as phosphatases, dehydrogenase, oxidase and peroxidases, etc.</p> <p>To learn about Electron Microscopy and Ultra microtomy.</p> <p>To learn about Aspiration Cytology like FNAC for premalignant lesions.</p> <p>To learn about hormonal assessment by cytological techniques.</p>
7	<b>Practical Paper I</b>	<b>Laboratory course -I</b>	70+30	To impart practical knowledge based on theory papers BMLT 301 / BMLT 302.
8	<b>Practical Paper II</b>	<b>Laboratory course - II</b>	70+30	To impart practical knowledge based on theory papers BMLT 303 / BMLT 304.
9	<b>Practical Paper III</b>	<b>Laboratory course - III</b>	70+30	To impart practical knowledge based on theory papers BMLT 305 / BMLT 306.