



# **MGM INSTITUTE OF HEALTH SCIENCES**

(Deemed to be University u/s 3 of UGC Act, 1956)

**Grade 'A' Accredited by NAAC**

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**CHOICE BASED CREDIT SYSTEM**

**(CBCS)**

**(with effect from 2025-26 Batches)**

## **Curriculum for M.Sc. Medical Laboratory Technology**

Amended as per AC-51/2025, Dated 29/04/2025

### **Amended History**

1. Amended as per AC-51/2025, [Resolution No.3.6(Annexure-8A)], [Resolution No.3.5, (Annexure-7)]; Dated 29/04/2025.



**Resolution No. 3.6 of Academic Council (AC-51/2025):**

Resolved to approve the initiation of the proposed new postgraduate program in **Medical Laboratory Sciences (M.Sc. MLT)**, including the CBCS syllabus, Program Outcomes (POs), and Course Outcomes (COs) for Semesters I and II, commencing from the Academic Year 2025-26. The program will follow a two-year CBCS semester structure, with an intake capacity of 2 students per batch and an annual tuition fee of INR 1,25,000 for the batch admitted from the Academic Year 2025-26 onwards [ANNEXURE-8A & 8B].

**Annexure-8A of AC-51/2025**



**MGM SCHOOL OF BIOMEDICAL SCIENCES**

**(A constituent unit of MGM INSTITUTE OF HEALTH SCIENCES)**

**(Deemed to be University u/s 3 of UGC Act 1956)**

**Grade “A<sup>++</sup>” Accredited by NAAC**

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**CHOICE BASED CREDIT SYSTEM (CBCS)**

**(Academic Year 2025 - 26)**

**Curriculum for**

**M.Sc. Allied Health Sciences**

**M.Sc. Medical Laboratory Technology**

**Semester I & II**

## DIRECTOR'S MESSAGE

### Welcome Message from the Director

Dear Postgraduate Students,

Welcome to **MGM School of Biomedical Sciences (MGMSBS)**, **MGMIHS**, a premier institution dedicated to advancing allied and health sciences education. As you embark on this transformative academic journey, you are joining a community that fosters excellence in research, clinical expertise, and innovation.

MGMIHS, accredited with NAAC 'A++' Grade (CGPA 3.55, 2022) and recognized as a **Category I Institution by UGC**, offers an ecosystem that nurtures both academic and professional growth. With **NIRF (151-200 rank band) recognition, NABH-accredited hospitals, NABL-accredited diagnostic labs, and JCI accreditation for MGM New Bombay Hospital**, we uphold global benchmarks in education and healthcare.

At MGMSBS, our **15 postgraduate programs** are meticulously designed to align with the National Commission for Allied and Healthcare Professionals (NCAHP) standards, National Education Policy (NEP) 2020, and the National Credit Framework (NCrF). We have implemented the **Choice-Based Credit System (CBCS)** to provide academic flexibility while ensuring rigorous training in clinical and technical skills. Our state-of-the-art research laboratories, digital classrooms, and the Central Research Laboratory (CRL) foster an environment that encourages innovation and evidence-based learning.

Postgraduate education at MGMSBS goes beyond theoretical learning—our curriculum integrates **hands-on clinical training, interdisciplinary collaboration, and exposure to real-world healthcare challenges**. We emphasize **research-driven education**, encouraging students to actively participate in **scientific discoveries, publications, and international collaborations**.

Beyond academics, we believe in **holistic development**, with initiatives such as the **AARAMBH Science and Wellness Club**, which promotes **mental well-being, leadership, and professional networking**.

As you step into this **next phase of academic and professional growth**, we encourage you to explore new ideas, engage in impactful research, and contribute meaningfully to the **healthcare ecosystem**. We are confident that your journey at MGMSBS will shape you into **skilled, compassionate, and visionary professionals**, ready to lead in the ever-evolving healthcare landscape.

We look forward to witnessing your achievements and contributions!

**Dr. Mansee Thakur**

Director, MGM School of Biomedical Sciences  
MGM Institute of Health Sciences, Navi Mumbai

## **ABOUT MGM SCHOOL OF BIOMEDICAL SCIENCES**

### **Mission**

To improve the quality of life, both at individual and community levels by imparting quality medical education to tomorrow's doctors and medical scientists and by advancing knowledge in all fields of health sciences through meaningful and ethical research.

### **Vision**

By the year 2020, MGM Institute of Health Sciences aims to be top-ranking Centre of Excellence in Medical Education and Research. Students graduating from the Institute will have the required skills to deliver quality health care to all sections of the society with compassion and benevolence, without prejudice or discrimination, at an affordable cost. As a research Centre, it shall focus on finding better, safer and affordable ways of diagnosing, treating and preventing diseases. In doing so, it will maintain the highest ethical standards.

### **About – School of Biomedical Sciences**

MGM School of Biomedical Sciences is formed under the aegis of MGM IHS with the vision of offering basic Allied Science and Medical courses for students who aspire to pursue their career in the Allied Health Sciences, teaching as well as research.

School of Biomedical Sciences is dedicated to the providing the highest quality education in basic medical sciences by offering a dynamic study environment with well-equipped labs. The school encompasses 23 courses each with its own distinct, specialized body of knowledge and skill. This includes 8 UG courses and 15 PG courses. The college at its growing years started with mere 100 students has recorded exponential growth and is now a full-fledged educational and research institution with the student strength reaching approximately **800** at present.

Our consistent theme throughout is to encourage students to become engaged, be active learners and to promote medical research so that ultimately they acquire knowledge, skills, and understanding so as to provide well qualified and trained professionals in Allied Health Sciences to improve the quality of life.

As there is increased need to deliver high quality, timely and easily accessible patient care system the collaborative efforts among physicians, nurses and allied health providers become ever more essential for an effective patient care. Thus the role of allied health professionals in ever-evolving medical system is very important in providing high-quality patient care.

Last but by no means least, School of Biomedical Sciences envisions to continuously grow and reform. Reforms are essential to any growing institution as it fulfills our bold aspirations of providing the best for the students, for us to serve long into the future and to get ourselves updated to changing and evolving trends in the health care systems.

**Name of the Degree: M. Sc. Medical Laboratory Technology**

**Duration of Study:** The duration of the study for M.Sc. Medical Laboratory Technology will be of 2 years

**Program pattern:**

- First Semester: July
- Second Semester: January
- Third Semester: July
- Fourth Semester: January

**Eligibility Criteria:**

B.Sc. in Medical Laboratory Technology with a minimum 50% mark.

**Selection of eligible candidates:** Selection to the M.Sc. MLT course shall be on the performance in interview conducted by MGM School of Biomedical Sciences, Navi Mumbai.

**Attendance and Monitoring Progress of Study:**

A candidate shall study in concerned department of the institute for the entire period as a full time student. No candidate is permitted to work in any other laboratory/college/hospital etc while studying. No candidate should join any other course of study or appear for any other degree examination conducted by this university or any university in India or Abroad during the period of registration.

A candidate who has put in a minimum of 75% of attendance in theory and practical separately and who has fulfilled other requirements of the course shall be permitted to appear for University Examination.

**Clinical Training Evaluation:**

Students shall be deputed to Pathology, Biochemistry, Microbiology & Blood Bank department wherein they shall undergo practical training of handling patients, processing of different types of samples.

**Medium of Instruction:**

English shall be the Medium of Instruction for all the Subjects of study and for examinations.

**For any query visit the website: [www.mgmsbsnm.edu.in](http://www.mgmsbsnm.edu.in)**

## Program Outcome

Program Outcome	M.Sc. Medical Laboratory Technology
PO1	<b>Advanced Knowledge in Medical Laboratory Science:</b> Acquire thorough knowledge of pathology, microbiology, biochemistry, hematology, immunology, and molecular biology with its applications to demonstrate expertise in clinical laboratory techniques, diagnostic methodologies, and biomedical sciences.
PO2	<b>Proficiency in Laboratory Techniques and Instrumentation:</b> Expertise to perform, utilize and troubleshoot modern diagnostic instruments and technologies in medical laboratory with accuracy and precision.
PO3	<b>Integration of Laboratory Science in Healthcare:</b> Collaborate with healthcare teams for accurate diagnosis and evidence-based laboratory practices for clinical decision-making in real-world situations.
PO4	<b>Quality Assurance and Laboratory Management:</b> Implement quality control and quality assurance measures in laboratory settings. Gain knowledge about application of laboratory accreditation, biosafety, and bioethics in clinical practice.
PO5	<b>Data Analysis and Interpretation:</b> Develop skills for analysis of laboratory data using statistical tools and their interpretation for clinical conditions.
PO6	<b>Professional Ethics and Compliance:</b> Establish an in-depth understanding of professionalism, ethics, legal regulations and safety in laboratory procedures to guarantee compliance with medical laws, patient privacy, and integrity of test results.
PO 7	<b>Research and Innovation:</b> Develop research-oriented thought process by learning about research methodology, innovation incubation and conducting independent / collaborative research in medical laboratory sciences.
PO8	<b>Leadership and Communication Skills:</b> Demonstrate effective leadership, teamwork, and interpersonal communication in laboratory settings with students, laboratory personnel, and healthcare professionals
PO9	<b>Lifelong Learning and Professional Development:</b> Engage in continuous education, professional training and scientific contributions, to stay updated with advancements in the field of diagnosis and healthcare.

<b>SEMESTER – I</b>				
<b>MMLT 101 T</b>	<b>Introduction to Medical Laboratory Technology</b>	<b>Mapped PO</b>	<b>Teaching-Learning Methodology</b>	<b>Assessment Tools</b>
CO1	Comprehend the importance of medical laboratory technology in diagnosing, monitoring, and treating diseases.	PO1, PO2, PO3, PO4, PO5, PO6, PO7, PO8, PO9	Lecture, Discussion, Assignment, Flip classroom, Seminar, E-learning, Posters / Videos	Internal Assessment, Theory exam, Seminar,
CO2	Learn the ethical and legal responsibilities of a medical laboratory professional, including patient confidentiality, consent, and reporting of results.	PO1, PO2, PO3, PO4, PO5, PO6, PO7, PO8, PO9	Lecture, Discussion, Assignment, Flip classroom, Seminar, E-learning, Posters / Videos	Internal Assessment, Theory exam, Seminar,
CO3	Understand and demonstrate fundamental laboratory techniques, such as sample collection, preparation, and analysis.	PO1, PO2, PO3, PO4, PO5, PO6, PO7, PO8, PO9	Lecture, Discussion, Assignment, Flip classroom, Seminar, E-learning, Posters / Videos	Internal Assessment, Theory exam, Seminar,
CO4	Explain the different branches of medical laboratory technology, such as clinical chemistry, microbiology, hematology, immunology, blood banking, and molecular diagnostics.	PO1, PO2, PO3, PO4, PO5, PO6, PO7, PO8, PO9	Lecture, Discussion, Assignment, Flip classroom, Seminar, E-learning, Posters / Videos	Internal Assessment, Theory exam, Seminar,
<b>MMLT 102 T</b>	<b>Haematology and Clinical Pathology</b>	<b>Mapped PO</b>	<b>Teaching-Learning Methodology</b>	<b>Assessment Tools</b>
CO1	Student should be know the basic concepts in hematology and clinical pathology	PO1, PO2, PO3, PO4, PO5, PO6, PO7, PO8, PO9	Lecture, Practical, Demonstration, Group Discussion, Assignment, Flip classroom, Seminar, E-learning, Posters / Videos, Clinical postings, Hand-on training, Industrial visits	Internal Assessment, Theory exam, Practical exam, Viva-voce, Seminar, Log Book, Journal, Clinical postings, Station exercise / OSCE
CO2	Understand importance of tests like Blood Clotting Factor & Bone marrow	PO1, PO2, PO3, PO4, PO5, PO6, PO7, PO8, PO9	Lecture, Practical, Demonstration, Group Discussion, Assignment, Flip classroom, Seminar, E-learning, Posters / Videos, Clinical postings, Hand-on training, Industrial visits/Camps	Internal Assessment, Theory exam, Practical exam, Viva-voce, Seminar, Log Book, Journal, Clinical postings, Station exercise / OSCE
CO3	Should understand clinical	PO1, PO2,	Lecture, Practical,	Internal Assessment,

	significance urine, Semen, different body fluid analysis	PO3, PO4, PO5, PO6, PO7, PO8, PO9	Demonstration, Group Discussion, Assignment, Flip classroom, Seminar, E-learning, Posters / Videos, Clinical postings, Hand-on training, Industrial visits/Camps, Problem-Based Learning	Theory exam, Practical exam, Viva-voce, Seminar, Log Book, Journal, Clinical postings, Station exercise / OSCE
<b>MMLT 103 T</b>	<b>Basics of Microbiology</b>	<b>Mapped PO</b>	<b>Teaching-Learning Methodology</b>	<b>Assessment Tools</b>
<b>CO1</b>	Provide the student with the study of normal flora and pathogenic microorganisms. Methods for recovery, identification of pathogens, culture techniques, procedures, and antibiotic testing and sterilization techniques.	PO1, PO2, PO3, PO4, PO5, PO6, PO7, PO8, PO9	Lecture, Practical, Demonstration, Group Discussion, Assignment, Flip classroom, Seminar, E-learning, Posters / Videos, Clinical postings, Hand-on training, Industrial visits/Camps, Problem-Based Learning	Internal Assessment, Theory exam, Practical exam, Viva-voce, Seminar, Log Book, Journal, Clinical postings, Station exercise / OSCE
<b>CO2</b>	Should understand Molecular identification of bacterial pathogens.	PO1, PO2, PO3, PO4, PO5, PO6, PO7, PO8, PO9	Lecture, Practical, Demonstration, Group Discussion, Assignment, Flip classroom, Seminar, E-learning, Posters / Videos, Clinical postings, Hand-on training, Industrial visits/Camps, Problem-Based Learning	Internal Assessment, Theory exam, Practical exam, Viva-voce, Seminar, Log Book, Journal, Clinical postings, Station exercise / OSCE
<b>MMLT 104 T</b>	<b>Essentials of Biochemistry and Laboratory Techniques</b>	<b>Mapped PO</b>	<b>Teaching-Learning Methodology</b>	<b>Assessment Tools</b>
<b>CO1</b>	Understand the Classification, Functions and Metabolism of Biomolecules - Carbohydrates, Proteins, Lipids and Nucleic acids with their significance in homeostasis and related disorders	PO1, PO2, PO3, PO4, PO5, PO6, PO7, PO8, PO9	Lecture, Demonstration, Group Discussion, Assignment, Flip classroom, Seminar, E-learning, Posters / Videos, Clinical postings, Industrial visits/Camps, Problem-Based Learning	Internal Assessment, Theory exam, Viva-voce, Log Book, Station exercise / OSCE
<b>CO2</b>	Understand the role of Enzymes and biochemical processes of Cellular Respiration involved in energy production	PO1, PO2, PO3, PO4, PO5, PO6, PO7, PO8, PO9	Lecture, Demonstration, Group Discussion, Assignment, Flip classroom, Seminar, E-learning, Posters / Videos, Clinical	Internal Assessment, Theory exam, Viva-voce, Log Book, Station exercise / OSCE

			postings, Industrial visits/Camps, Problem-Based Learning	
CO3	In depth knowledge of Principle and applications of Good Laboratory Practices.	PO1, PO2, PO3, PO4, PO5, PO6, PO7, PO8, PO9	Lecture, Demonstration, Group Discussion, Assignment, Flip classroom, Seminar, E-learning, Posters / Videos, Clinical postings, Industrial visits/Camps, Problem-Based Learning	Internal Assessment, Theory exam, Viva-voce, Log Book, Station exercise / OSCE
CO4	Proficiency in handling Instruments used in Biochemistry laboratory and their applications in clinical diagnosis.	PO1, PO2, PO3, PO4, PO6, PO7, PO8, PO9	Lecture, Demonstration, Group Discussion, Assignment, Seminar, E-learning, Posters / Videos, Clinical postings, Industrial visits/Camps, Problem-Based Learning	Internal Assessment, Theory exam, Viva-voce, Log Book, Station exercise / OSCE
CO5	Competent knowledge of collection and analysis of various body fluid used for diagnostics	PO1, PO2, PO3, PO4, PO5, PO6, PO7, PO8, PO9	Lecture, Demonstration, Group Discussion, Assignment, Flip classroom, Seminar, E-learning, Posters / Videos, Clinical postings, Industrial visits/Camps, Problem-Based Learning	Internal Assessment, Theory exam, Viva-voce, Log Book, Station exercise / OSCE
CO6	Comprehension of applications of Basic Biochemical Laboratory Techniques with accuracy	PO1, PO2, PO3, PO4, PO5, PO6, PO7, PO8, PO9	Lecture, Demonstration, Group Discussion, Assignment, Flip classroom, Seminar, E-learning, Posters / Videos, Clinical postings, Industrial visits/Camps, Problem-Based Learning	Internal Assessment, Theory exam, Viva-voce, Log Book, Station exercise / OSCE
<b>MMLT 105 P</b>	<b>Hematology and Clinical Pathology</b>	<b>Mapped PO</b>	<b>Teaching-Learning Methodology</b>	<b>Assessment Tools</b>
CO1	Perform and analyze tests like all hematology & Blood Clotting Factor	PO1, PO2, PO3, PO4, PO5, PO6, PO7, PO8, PO9	Practical, Demonstration, Clinical postings, Hand-on training, Industrial visits/Camps, Problem-Based Learning	Internal Assessment, Practical exam, Viva-voce, Log Book, Journal, Clinical postings, Station exercise / OSCE
CO2	Should perform urine, Semen, different body fluid analysis	PO1, PO2, PO3, PO4,	Practical, Demonstration, Clinical	Internal Assessment, Practical exam, Viva-



	experiments under guidance	PO5, PO6, PO7, PO8, PO9	postings, Hand-on training, Industrial visits/Camps, Problem-Based Learning	voce, Log Book, Journal, Clinical postings, Station exercise / OSCE
CO3	Perform lab test for bone marrow	PO1, PO2, PO3, PO4, PO5, PO6, PO7, PO8, PO9	Practical, Demonstration, Clinical postings, Hand-on training, Industrial visits/Camps, Problem-Based Learning	Internal Assessment, Practical exam, Viva-voce, Log Book, Journal, Clinical postings, Station exercise / OSCE
<b>MMLT 106 P</b>	<b>Basics of Microbiology</b>	<b>Mapped PO</b>	<b>Teaching-Learning Methodology</b>	<b>Assessment Tools</b>
CO1	Should perform test for identification of pathogens, culture techniques, procedures, and antibiotic testing and sterilization techniques.	PO1, PO2, PO3, PO4, PO5, PO6, PO7, PO8, PO9	Practical, Demonstration, Clinical postings, Hand-on training, Industrial visits/Camps, Problem-Based Learning	Internal Assessment, Practical exam, Viva-voce, Log Book, Journal, Clinical postings, Station exercise / OSCE
CO2	Should perform Molecular identification of bacterial pathogenes.	PO1, PO2, PO3, PO4, PO5, PO6, PO7, PO8, PO9	Practical, Demonstration, Clinical postings, Hand-on training, Industrial visits/Camps, Problem-Based Learning	Internal Assessment, Practical exam, Viva-voce, Log Book, Journal, Clinical postings, Station exercise / OSCE
<b>MMLT 107 P</b>	<b>Essentials of Biochemistry and Laboratory Techniques</b>	<b>Mapped PO</b>	<b>Teaching-Learning Methodology</b>	<b>Assessment Tools</b>
CO1	Demonstration and analysis of various Body fluids in diagnosis	PO1, PO2, PO3, PO4, PO5, PO6, PO7, PO8, PO9	Practical, Demonstration, Clinical postings, Hand-on training, Industrial visits/Camps, Problem-Based Learning	Internal Assessment, Practical exam, Viva-voce, Log Book, Journal, Clinical postings, Station exercise / OSCE
CO2	Proficiency in calibration and application of Basic Instruments used in the Biochemistry laboratory	PO1, PO2, PO3, PO4, PO5, PO6, PO7, PO8, PO9	Practical, Demonstration, Clinical postings, Hand-on training, Industrial visits/Camps, Problem-Based Learning	Internal Assessment, Practical exam, Viva-voce, Log Book, Journal, Clinical postings, Station exercise / OSCE
<b>CC 001 T</b>	<b>Research Methodology &amp; Biostatistics (Core Course)</b>	<b>Mapped PO</b>	<b>Teaching-Learning Methodology</b>	<b>Assessment Tools</b>
CO1	Describe types of research (qualitative, quantitative, experimental, observational).	PO1, PO2, PO3, PO4, PO5, PO6, PO7, PO8, PO9	Lecture, Group Discussion, Assignment, Flip classroom, Seminar, E-learning, Posters / Videos, Problem-Based Learning	Internal Assessment, Theory exam, Seminar
CO2	Understand sampling methods	PO1, PO2,	Lecture, Group	Internal Assessment,

	(random, stratified, systematic) and their applications in lab-based studies.	PO3, PO4, PO5, PO6, PO7, PO8, PO9	Discussion, Assignment, Flip classroom, Seminar, E-learning, Posters / Videos, Problem-Based Learning	Theory exam, Seminar
CO3	Learn hypothesis testing methods (t-tests, chi-square tests, ANOVA) in medical research.	PO1, PO2, PO3, PO4, PO5, PO6, PO7, PO8, PO9	Lecture, Group Discussion, Assignment, Flip classroom, Seminar, E-learning, Posters / Videos, Problem-Based Learning	Internal Assessment, Theory exam, Seminar
CO4	Understand the structure of scientific reports, theses, and research papers.	PO1, PO2, PO3, PO4, PO5, PO6, PO7, PO8, PO9	Lecture, Group Discussion, Assignment, Flip classroom, Seminar, E-learning, Posters / Videos, Problem-Based Learning	Internal Assessment, Theory exam, Seminar
<b>CC 001 P</b>	<b>Research Methodology &amp; Biostatistics (Core Course)</b>	<b>Mapped PO</b>	<b>Teaching-Learning Methodology</b>	<b>Assessment Tools</b>
CO1	Identify research problems related to medical laboratory technology. Develop appropriate research questions, objectives, and hypotheses.	PO1, PO2, PO3, PO4, PO5, PO6, PO7, PO8, PO9	Practical, Demonstration, Clinical postings, Hand-on training, Industrial visits/Camps, Problem-Based Learning	Internal Assessment, Practical exam, Viva-voce
CO2	Conduct a systematic literature review using databases like PubMed, Google Scholar, and Scopus.	PO1, PO2, PO3, PO4, PO5, PO6, PO7, PO8, PO9	Practical, Demonstration, Clinical postings, Hand-on training, Industrial visits/Camps, Problem-Based Learning	Internal Assessment, Practical exam, Viva-voce
CO3	Use Excel, SPSS, or R for data entry, statistical calculations, and analysis	PO1, PO2, PO3, PO4, PO5, PO6, PO7, PO8, PO9	Practical, Demonstration, Clinical postings, Hand-on training, Industrial visits/Camps, Problem-Based Learning	Internal Assessment, Practical exam, Viva-voce
CO4	Create tables, graphs, and charts to summarize research findings.	PO1, PO2, PO3, PO4, PO5, PO6, PO7, PO8, PO9	Practical, Demonstration, Clinical postings, Hand-on training, Industrial visits/Camps, Problem-Based Learning	Internal Assessment, Practical exam, Viva-voce
<b>MMLT 108 CP</b>	<b>MMLT Clinical Directed Education I</b>	<b>Mapped PO</b>	<b>Teaching-Learning Methodology</b>	<b>Assessment Tools</b>

CO1	Build a robust theoretical foundation, enabling students to understand healthcare practices, disease management, and patient care, thereby empowering them to make informed decisions and adapt to evolving medical technologies.	PO1, PO2, PO3, PO4, PO5, PO6, PO7, PO8, PO9	Clinical Posting in Different Department	Clinical postings, Viva-voce, Seminar, Log Book,
CO2	Emphasize hands-on training, ensuring proficiency in clinical procedures, diagnostic techniques, and the use of advanced medical equipment. This practical exposure will bridge the gap between theory and practice, enhancing students' confidence and competence in delivering quality patient care.	PO1, PO2, PO3, PO4, PO5, PO6, PO7, PO8, PO9	Clinical Posting in Different Department	Clinical postings, Viva-voce, Seminar, Log Book,
CO3	Focus on developing professionalism, empathy, ethical conduct, teamwork, and communication skills—key traits for holistic patient care and effective collaboration in interdisciplinary healthcare teams.	PO1, PO2, PO3, PO4, PO5, PO6, PO7, PO8, PO9	Clinical Posting in Different Department	Clinical postings, Viva-voce, Seminar, Log Book,

SEMESTER – II				
MMLT 109 T	Immunohematology & Blood Transfusion	Mapped PO	Teaching-Learning Methodology	Assessment Tools
CO1	Understand antigen-antibody reactions and their role in blood group identification.	PO1, PO2, PO3, PO4, PO5, PO6, PO7, PO8, PO9	Lecture, Practical, Demonstration, Group Discussion, Assignment, Flip classroom, Seminar, E-learning, Posters / Videos, Clinical postings, Hand-on training, Industrial visits/Camps, Problem-Based Learning	Internal Assessment, Theory exam, Practical exam, Viva-voce, Seminar, Log Book, Journal, Clinical postings, Station exercise / OSCE
CO2	Understand ABO and Rh blood group systems, their genetics, and clinical significance, Cell separation and components.	PO1, PO2, PO3, PO4, PO5, PO6, PO7, PO8, PO9	Lecture, Practical, Demonstration, Group Discussion, Assignment, Flip classroom, Seminar, E-learning, Posters / Videos, Clinical postings, Hand-on training, Industrial visits/Camps, Problem-Based Learning	Internal Assessment, Theory exam, Practical exam, Viva-voce, Seminar, Log Book, Journal, Clinical postings, Station exercise / OSCE
CO3	Should Know blood donation procedures, donor selection criteria, and screening tests.	PO1, PO2, PO3, PO4, PO5, PO6, PO7, PO8, PO9	Lecture, Practical, Demonstration, Group Discussion, Assignment, Flip classroom, Seminar, E-learning, Posters / Videos, Clinical postings, Hand-on training, Industrial visits/Camps, Problem-Based Learning	Internal Assessment, Theory exam, Practical exam, Viva-voce, Seminar, Log Book, Journal, Clinical postings, Station exercise / OSCE
MMLT 110 T	Immunology and Serology	Mapped PO	Teaching-Learning Methodology	Assessment Tools
CO1	Understand the structure and function of the immune system, including primary and secondary lymphoid organs	PO1, PO2, PO3, PO4, PO5, PO6, PO7, PO8, PO9	Lecture, Practical, Demonstration, Group Discussion, Assignment, Flip classroom, Seminar, E-learning, Posters /	Internal Assessment, Theory exam, Practical exam, Viva-voce, Seminar, Log Book, Journal, Clinical postings, Station

			Videos, Clinical postings, Hand-on training, Industrial visits/Camps, Problem-Based Learning	exercise / OSCE
<b>CO2</b>	Understand antigen-antibody reactions and their significance in immunity and disease diagnosis, hypersensitivity reactions (Type I-IV), their mechanisms, and clinical implications.	PO1, PO2, PO3, PO4, PO5, PO6, PO7, PO8, PO9	Lecture, Practical, Demonstration, Group Discussion, Assignment, Flip classroom, Seminar, E-learning, Posters / Videos, Clinical postings, Hand-on training, Industrial visits/Camps, Problem-Based Learning	Internal Assessment, Theory exam, Practical exam, Viva-voce, Seminar, Log Book, Journal, Clinical postings, Station exercise / OSCE
<b>CO3</b>	Understand the principles of graft rejection, HLA typing, and immunosuppressive therapy. applications of immunotherapy, CRISPR gene editing, and emerging trends in immunology	PO1, PO2, PO3, PO4, PO5, PO6, PO7, PO8, PO9	Lecture, Practical, Demonstration, Group Discussion, Assignment, Flip classroom, Seminar, E-learning, Posters / Videos, Clinical postings, Hand-on training, Industrial visits/Camps, Problem-Based Learning	Internal Assessment, Theory exam, Practical exam, Viva-voce, Seminar, Log Book, Journal, Clinical postings, Station exercise / OSCE
<b>MMLT 111 T</b>	<b>Advances in Clinical Biochemistry and Quality Control</b>	<b>Mapped PO</b>	<b>Teaching-Learning Methodology</b>	<b>Assessment Tools</b>
<b>CO1</b>	Comprehensive knowledge of Principle and applications of Quality Control and Automation in Biochemistry Laboratory	PO1, PO2, PO3, PO4, PO5, PO6, PO7, PO8, PO9	Lecture, Demonstration, Group Discussion, Assignment, Flip classroom, Seminar, E-learning, Posters / Videos, Clinical postings	Internal Assessment, Theory exam, Practical exam, Viva-voce, Seminar, Log Book, Journal, Clinical postings, Station exercise / OSCE
<b>CO2</b>	Analyse the Role of Vitamins, Minerals and Electrolytes in Human Health with respect to biochemical functions and deficiency manifestations	PO1, PO2, PO3, PO4, PO7, PO8, PO9	Lecture, Demonstration, Group Discussion, Assignment, Flip classroom, Seminar, E-learning, Posters / Videos, Clinical	Internal Assessment, Theory exam, Practical exam, Viva-voce, Seminar, Log Book, Journal, Clinical postings, Station exercise / OSCE

			Postings, Case-study, Workshops	
CO3	Understand the different types of plasma proteins and its related disorders specifically Jaundice and Hemoglobinopathies	PO1, PO2, PO3, PO4, PO5, PO6, PO7, PO8, PO9	Lecture, Demonstration, Group Discussion, Assignment, Flip classroom, Seminar, E-learning, Posters / Videos, Clinical Postings, Case-study, Workshops	Internal Assessment, Theory exam, Practical exam, Viva-voce, Seminar, Log Book, Journal, Clinical postings, Station exercise / OSCE
CO4	Explore Biochemistry of Hormones and their mechanism of action.	PO1, PO2, PO3, PO4, PO5, PO7, PO8, PO9	Lecture, Demonstration, Group Discussion, Assignment, Flip classroom, Seminar, E-learning, Posters / Videos, Clinical Postings, Case-study, Workshops	Internal Assessment, Theory exam, Practical exam, Viva-voce, Seminar, Log Book, Journal, Clinical postings, Station exercise / OSCE
CO5	Mastery to Analyse and Interpret Biochemical Laboratory Tests to assess organ dysfunction and disease progression.	PO1, PO2, PO3, PO4, PO5, PO6, PO7, PO8, PO9	Lecture, Demonstration, Group Discussion, Assignment, Flip classroom, Seminar, E-learning, Posters / Videos, Clinical postings, Hand-on training, Industrial visits/Camps, Problem-Based Learning	Internal Assessment, Theory exam, Practical exam, Viva-voce, Seminar, Log Book, Journal, Clinical postings, Station exercise / OSCE
CO6	Insightful knowledge of advanced Biochemistry Techniques with their applications in Diagnosis	PO1, PO2, PO3, PO4, PO5, PO6, PO7, PO8, PO9	Lecture, Group Discussion, Demonstration, Assignment, Flip classroom, Seminar, E-learning, Posters / Videos, Clinical postings, Industrial visits/Camps, Problem-Based Learning	Internal Assessment, Theory exam, Practical exam, Viva-voce, Seminar, Log Book, Journal, Clinical postings, Station exercise / OSCE
<b>MMLT 112 P</b>	<b>Immunohematology &amp; Blood Transfusion</b>	<b>Mapped PO</b>	<b>Teaching-Learning Methodology</b>	<b>Assessment Tools</b>
<b>CO1</b>	Demonstrate ABO and Rh blood grouping using forward	PO1, PO2, PO3, PO4,	Practical, Demonstration,	Internal Assessment, Practical exam, Viva-

	and reverse typing.	PO5, PO6, PO7, PO8, PO9	Clinical postings, Hand-on training, Industrial visits/Camps, Problem-Based Learning	voce, Log Book, Journal, Clinical postings, Station exercise / OSCE
<b>CO2</b>	Perform major and minor crossmatching using saline, enzyme, and AHG methods, Conduct Direct and Indirect Antiglobulin Tests (DAT & IAT).	PO1, PO2, PO3, PO4, PO5, PO6, PO7, PO8, PO9	Practical, Demonstration, Clinical postings, Hand-on training, Industrial visits/Camps, Problem-Based Learning	Internal Assessment, Practical exam, Viva-voce, Log Book, Journal, Clinical postings, Station exercise / OSCE
<b>CO3</b>	Demonstrate proper phlebotomy techniques for blood donation, basic steps in blood component separation	PO1, PO2, PO3, PO4, PO5, PO6, PO7, PO8, PO9	Practical, Demonstration, Clinical postings, Hand-on training, Industrial visits/Camps, Problem-Based Learning	Internal Assessment, Practical exam, Viva-voce, Log Book, Journal, Clinical postings, Station exercise / OSCE
<b>MMLT 113 P</b>	<b>Immunology and Serology</b>	<b>Mapped PO</b>	<b>Teaching-Learning Methodology</b>	<b>Assessment Tools</b>
<b>CO1</b>	Demonstrate agglutination and precipitation techniques for detecting antigen-antibody interactions	PO1, PO2, PO3, PO4, PO5, PO6, PO7, PO8, PO9	Practical, Demonstration, Clinical postings, Hand-on training, Industrial visits/Camps, Problem-Based Learning	Internal Assessment, Practical exam, Viva-voce, Log Book, Journal, Clinical postings, Station exercise / OSCE
<b>CO2</b>	Maintain biosafety measures and quality control standards in immunology testing.	PO1, PO2, PO3, PO4, PO5, PO6, PO7, PO8, PO9	Practical, Demonstration, Clinical postings, Hand-on training, Industrial visits/Camps, Problem-Based Learning	Internal Assessment, Practical exam, Viva-voce, Log Book, Journal, Clinical postings, Station exercise / OSCE
<b>CO3</b>	Able to perform Analyze Hypersensitivity Reactions	PO1, PO2, PO3, PO4, PO5, PO6, PO7, PO8, PO9	Practical, Demonstration, Clinical postings, Hand-on training, Industrial visits/Camps, Problem-Based Learning	Internal Assessment, Practical exam, Viva-voce, Log Book, Journal, Clinical postings, Station exercise / OSCE

<b>MMLT 114 P</b>	<b>Advances in Clinical Biochemistry</b>	<b>Mapped PO</b>	<b>Teaching-Learning Methodology</b>	<b>Assessment Tools</b>
CO1	Proficiency in estimation and interpretation of various Biochemical tests for diagnosis	PO1, PO2, PO3, PO4, PO5, PO6, PO7, PO8, PO9	Practical, Demonstration, Clinical postings, Hand-on training, Industrial visits/Camps, Problem-Based Learning, Case-study	Internal Assessment, Practical exam, Viva-voce, Log Book, Journal, Clinical postings, Station exercise / OSCE
CO2	Demonstration of principle, working and applications of advanced Biochemical techniques	PO1, PO2, PO3, PO4, PO5, PO6, PO7, PO8, PO9	Practical, Demonstration, Clinical postings, Hand-on training, Industrial visits/Camps, Problem-Based Learning	Internal Assessment, Practical exam, Viva-voce, Log Book, Journal, Clinical postings, Station exercise / OSCE
<b>MMLT 115 CP</b>	<b>MMLT Clinical Directed Education II</b>	<b>Mapped PO</b>	<b>Teaching-Learning Methodology</b>	<b>Assessment Tools</b>
CO1	Build a robust theoretical foundation, enabling students to understand healthcare practices, disease management, and patient care, thereby empowering them to make informed decisions and adapt to evolving medical technologies.	PO1, PO2, PO3, PO4, PO5, PO6, PO7, PO8	Practical, Clinical Posting, Demonstration, Case-study, Clinical Simulation	Practical Exam, Station Exercise, Viva-voce, Case- Study
CO2	Emphasize hands-on training, ensuring proficiency in clinical procedures, diagnostic techniques, and the use of advanced medical equipment. This practical exposure will bridge the gap between theory and practice, enhancing students' confidence and competence in delivering quality patient care.	PO1, PO2, PO3, PO4, PO5, PO6, PO7, PO8	Practical, Clinical Posting, Demonstration, Case-study, Clinical Simulation	Practical Exam, Station Exercise, Viva-voce, Case- Study
CO3	Focus on developing professionalism, empathy, ethical conduct, teamwork, and communication skills—key traits for holistic patient care and effective collaboration in	PO1, PO2, PO3, PO4, PO5, PO6, PO7, PO8	Practical, Clinical Posting, Demonstration, Case-study, Clinical Simulation	Practical Exam, Station Exercise, Viva-voce, Case- Study



	interdisciplinary healthcare teams.			
<b>SEC 001 T</b>	<b>Innovation and Entrepreneurship</b>	<b>Mapped PO</b>	<b>Teaching-Learning Methodology</b>	<b>Assessment Tools</b>
CO1	Define the role of innovation and entrepreneurship in the medical laboratory and healthcare industry.	PO1, PO2, PO3, PO4, PO5, PO6, PO7, PO8, PO9	Lecture, Group Discussion, Assignment, Flip classroom, Seminar, E-learning, Posters / Videos, Problem-Based Learning	Internal Assessment, Theory exam, Seminar
CO2	Analyze current challenges in laboratory diagnostics and identify areas for innovation.	PO1, PO2, PO3, PO4, PO5, PO6, PO7, PO8, PO9	Lecture, Group Discussion, Assignment, Flip classroom, Seminar, E-learning, Posters / Videos, Problem-Based Learning	Internal Assessment, Theory exam, Seminar
CO3	Explore opportunities in point-of-care testing (POCT), AI-driven diagnostics, and personalized medicine.	PO1, PO2, PO3, PO4, PO5, PO6, PO7, PO8, PO9	Lecture, Group Discussion, Assignment, Flip classroom, Seminar, E-learning, Posters / Videos, Problem-Based Learning	Internal Assessment, Theory exam, Seminar
CO4	Learn how to take calculated risks and adapt to the evolving medical diagnostics field.	PO1, PO2, PO3, PO4, PO5, PO6, PO7, PO8, PO9	Lecture, Group Discussion, Assignment, Flip classroom, Seminar, E-learning, Posters / Videos, Problem-Based Learning	Internal Assessment, Theory exam, Seminar
CO5	Understand funding options, including venture capital, angel investors, and government grants for healthcare innovations.	PO1, PO2, PO3, PO4, PO5, PO6, PO7, PO8, PO9	Lecture, Group Discussion, Assignment, Flip classroom, Seminar, E-learning, Posters / Videos, Problem-Based Learning	Internal Assessment, Theory exam, Seminar
<b>SEC 002 T</b>	<b>One Health (NPTEL)</b>	<b>Mapped PO</b>	<b>Teaching-Learning Methodology</b>	<b>Assessment Tools</b>
CO1	Recognize the importance of a multidisciplinary approach in disease prevention and control.	PO1, PO2, PO3, PO4, PO5, PO6, PO7, PO8, PO9	Lecture, Group Discussion, Assignment, Flip classroom, Seminar, E-learning, Posters / Videos, Problem-Based Learning	Online NPTEL MCQ test

CO2	Understand biosafety protocols and quality control measures in laboratory testing.	PO1, PO2, PO3, PO4, PO5, PO6, PO7, PO8, PO9	Lecture, Group Discussion, Assignment, Flip classroom, Seminar, E-learning, Posters / Videos, Problem-Based Learning	Online NPTEL MCQ test
CO3	Utilize big data, AI, and digital health tools in disease tracking and diagnostics	PO1, PO2, PO3, PO4, PO5, PO6, PO7, PO8, PO9	Lecture, Group Discussion, Assignment, Flip classroom, Seminar, E-learning, Posters / Videos, Problem-Based Learning	Online NPTEL MCQ test
CO4	Apply laboratory research to develop vaccines, diagnostics, and disease control strategies.	PO1, PO2, PO3, PO4, PO5, PO6, PO7, PO8, PO9	Lecture, Group Discussion, Assignment, Flip classroom, Seminar, E-learning, Posters / Videos, Problem-Based Learning	Online NPTEL MCQ test

OUTLINE OF COURSE CURRICULUM														
M.Sc Medical Laboratory Technology (MMLT)														
Semester I														
Code No.	Core Course	Credits/Week					Hrs/Semester					Marks		
		Lecture (L)	Tutorial (T)	Practical (P)	Clinical Posing/ Rotation (CP)	Total Credits (C)	Lecture (L)	Tutorial (T)	Practical (P)	Clinical Posing/ Rotation (CP)	Total (hrs.)	Internal Assement (IA)	Semester End Exam (SEE)	Total
Discipline Specific Core Theory														
MMLT 101 T	Introduction to Medical Laboratory Technology	3	-	-	-	3	45	-	-	-	45	20	80	100
MMLT 102 T	Haematology and Clinical Pathology	3	-	-	-	3	45	-	-	-	45	20	80	100
MMLT 103 T	Basics of Microbiology	3	-	-	-	3	45	-	-	-	45	20	80	100
MMLT 104 T	Essentials of Biochemistry and Laboratory Techniques	3	-	-	-	3	45	-	-	-	45	20	80	100
CC 001 T	Research Methodology & Biostatistics (Core Course)	3	-	-	-	3	45	-	-	-	45	-	50	50
Discipline Specific Core Practical														
MMLT 105 P	Haematology and Clinical Pathology	-	-	2	-	1	-	-	30	-	30	10	40	50
MMLT 106 P	Basics of Microbiology	-	-	2	-	1	-	-	30	-	30	10	40	50
MMLT 107 P	Essentials of Biochemistry and Laboratory Techniques	-	-	2	-	1	-	-	30	-	30	10	40	50
MMLT 108 CP	MMLT Clinical Directed Education I	-	-	-	9	3	-	-	-	135	135	-	50	50
CC 001 P	Research Methodology & Biostatistics (Core Course)	-	-	4	-	2	-	-	60	-	60	-	50	50
Total		15	0	10	9	23	225	0	150	135	510	110	590	700
OUTLINE OF COURSE CURRICULUM														
M.Sc. Medical Laboratory Technology (MMLT)														
Semester II														
Code No.	Core Course	Credits/Week					Hrs/Semester					Marks		
		Lecture (L)	Tutorial (T)	Practical (P)	Clinical Posing/ Rotation (CP)	Total Credits (C)	Lecture (L)	Tutorial (T)	Practical (P)	Clinical Posing/ Rotation (CP)	Total (hrs.)	Internal Assement (IA)	Semester End Exam (SEE)	Total
Discipline Specific Core Theory														
MMLT 109 T	Immunohematology & Blood Transfusion	3	-	-	-	3	45	-	-	-	45	20	80	100
MMLT 110 T	Immunology and Serology	3	-	-	-	3	45	-	-	-	45	20	80	100
MMLT 111 T	Advances in Clinical Biochemistry	4	-	-	-	4	60	-	-	-	60	20	80	100
Discipline Specific Core Practical														
MMLT 112 P	Immunohematology & Blood Transfusion	-	-	2	-	1	-	-	30	-	30	10	40	50
MMLT 113 P	Immunology and Serology	-	-	2	-	1	-	-	30	-	30	10	40	50
MMLT 114 P	Advances in Clinical Biochemistry	-	-	2	-	1	-	-	30	-	30	10	40	50
MMLT 115 CP	MMLT Directed Clinical Education - II	-	-	-	15	5	-	-	-	225	225	-	50	50
Skill Enhancement Course														
SEC 001 T	Innovation and Entrepreneurship	3	-	-	-	3	45	-	-	-	45	-	100	100
SEC 002 T	One Health (NPTEL)													
Total		13	0	6	15	21	195	0	90	225	510	90	510	600

# FIRST YEAR

## M.Sc. Medical Laboratory Technology

### SEMESTER-I

Code No.	Core Subjects
<b>Discipline Specific Core Theory</b>	
MMLT 101 T	Introduction to Medical Laboratory Technology
MMLT 102 T	Haematology and Clinical Pathology
MMLT 103 T	Basics of Microbiology
MMLT 104 T	Essentials of Biochemistry and Laboratory Techniques
CC 001 T	Research Methodology & Biostatistics (Core Course)
<b>Discipline Specific Core Practical</b>	
MMLT 105 P	Haematology and Clinical Pathology
MMLT 106 P	Basics of Microbiology
MMLT 107 P	Essentials of Biochemistry and Laboratory Techniques
MMLT 108 CP	MMLT Clinical Directed Education I
CC 001 P	Research Methodology & Biostatistics (Core Course)

<b>Name of the Program</b>	<b>M.Sc. Medical Laboratory Technology</b>
<b>Semester</b>	<b>Semester I</b>
<b>Name of the Subject</b>	<b>Introduction to Medical Laboratory Technology</b>
<b>Subject Code</b>	<b>MMLT 101 T</b>

<b>Teaching Objective</b>	<ul style="list-style-type: none"> <li>Basics of Medical Lab Technology, Definitions</li> <li>Rules &amp; Regulations while working in Labs.</li> </ul>
<b>Learning Outcomes</b>	<ul style="list-style-type: none"> <li>Students should be aware of Code of Conduct related to Laboratory working</li> <li>Should be well known about professionalism, ethics and confidentiality of patients</li> </ul>

<b>Sr. No.</b>	<b>Topics</b>	<b>No. of Hrs.</b>
1	Historical evolution of medical diagnostics, Importance of MLT in healthcare, Role and responsibilities of medical laboratory technologists	<b>10</b>
2	Code of ethics and professionalism in medical diagnostics, Introduction to Pathological Conditions and Diseases.	<b>12</b>
3	Fundamental laboratory techniques, such as sample collection, preparation, and analysis.	<b>10</b>
4	<ul style="list-style-type: none"> <li><b>Diagnosis and Monitoring:</b> MLT plays a crucial role in diagnosing various medical conditions, monitoring disease progression, and assessing the effectiveness of treatments.</li> <li><b>Preventive Healthcare:</b> Through screening tests and early detection, laboratory tests help in identifying diseases before they manifest or worsen, enabling timely interventions.</li> <li><b>Research and Development:</b> MLT professionals contribute to research, helping to develop new diagnostic tests, improve existing technologies, and advance the field of medicine.</li> </ul>	<b>13</b>
<b>Total</b>		<b>45 hrs</b>

**Reference book:**

1. *A Handbook of Medical Laboratory (Lab) Technology: Editor) Second Edition. V.H. Talib (Ed.)*
2. *Medical Laboratory Technology. Methods and Interpretations – RamnikSood (volume 1&2)*

<b>Name of the Program</b>	<b>M.Sc. Medical Laboratory Technology</b>
<b>Semester</b>	<b>Semester I</b>
<b>Name of the Subject</b>	<b>Hematology &amp; Clinical Pathology</b>
<b>Subject Code</b>	<b>MMLT 102 T</b>

<b>Teaching Objective</b>	<ul style="list-style-type: none"> <li>The student should be aware basic principles of hematology like anticoagulants, constituents of blood and acquire skills of blood collection.</li> <li>The student should be able to perform, stain smears in Hematology.</li> </ul>
<b>Learning Outcomes</b>	<ul style="list-style-type: none"> <li>The B.Sc. graduate should have sound knowledge and basic skills of working in a pathology lab</li> </ul>

<b>Sr. No.</b>	<b>Topics</b>	<b>No. of Hrs.</b>
1	<ul style="list-style-type: none"> <li>Blood Cell Morphology and Classification, Erythrocytes (Red Blood Cells- Morphology, Lifespan, Functions, Anemias: Classification and Morphological Changes, Leukocytes (White Blood Cells), Granulocytes: Neutrophils, Eosinophils, Basophils, Agranulocytes: Lymphocytes, Monocytes. Leukemias and Lymphomas: Classification and Morphological Changes. Platelets (Thrombocytes), Structure, Lifespan, Functions Disorders: Thrombocytopenia, Thrombocythemia.</li> <li>Hemostasis and Coagulation Disorders, Hemostasis: Overview of the Process- Vascular Phase, Platelet Plug Formation, Coagulation Phase, Clot Retraction, Fibrinolysis, Coagulation Factors and Pathways, Intrinsic, Extrinsic, Common Pathways.</li> <li>Disorders of Hemostasis, Hemophilia, Von Willebrand Disease, Disseminated Intravascular Coagulation (DIC)</li> </ul>	<b>15</b>
2	<ul style="list-style-type: none"> <li>Hemoglobinopathies and Thalassemias, Hemoglobin Structure and Function, Normal Hemoglobin (HbA), Hemoglobin Variants, Hemoglobinopathies, Sickle Cell Disease, Hemoglobin C Disease, Thalassemias, Thalassemias, Alpha and Beta Thalassemias: Genetics and Clinical Presentation.</li> <li>Flow Cytometry in Hematological Analysis, Principles of Flow Cytometry, Cell Sorting, Cell Surface Antigens, Fluorescence Detection, Applications in Hematological Analysis, Immunophenotyping of Leukemias and Lymphomas, Interpretation of Flow Cytometry Results.</li> </ul>	<b>10</b>
3	<ul style="list-style-type: none"> <li>Hematological Malignancies and Leukemia, Introduction to Hematological Malignancies, Leukemias, Lymphomas, Myelomas.</li> <li>Types of Leukemia, Acute Lymphoblastic Leukemia (ALL), Acute Myeloid Leukemia (AML), Chronic Lymphocytic Leukemia (CLL), and Chronic Myeloid Leukemia (CML), Pathophysiology, Diagnosis, and Classification.</li> <li>Bone Marrow Examination and Interpretation, Indications for Bone Marrow Examination, Diagnosis and Staging of Hematological Disorders, Bone Marrow Aspiration and Biopsy Procedures, Collection, Processing, Staining, Interpretation of Bone Marrow Smears and Biopsy Sections</li> </ul>	<b>10</b>

4	<ul style="list-style-type: none"> <li>• Urine Analysis: Physical, Chemical &amp; Microscopic examination.</li> <li>• Universal safety precaution, Biomedical wastes management</li> <li>• Semen processing (Fructose, Dilution &amp; Neubauer chamber loading)</li> <li>• Stool sample processing – Smear preparation for microscopy, occult blood testing, along with Benedict's test for reducing substances.</li> <li>• Special procedures like hanging drop preparation, H Pylori detection.</li> </ul>	10
<b>Total</b>		<b>45 hrs</b>

### MMLT 105 P – Hematology & Clinical Pathology

Sr. No.	Topics	No. of Hrs.
1	General principles of Haematology techniques, blood collection, anticoagulants, fixation, processing, routine staining, Haemoglobin, Automation in Hematology	10
2	TLC, DLC, Peripheral smear (CBC report), platelet counts, cell counter working	5
3	Smear preparation for microscopy, occult blood testing, along with Benedict's test for reducing substances. Special procedures like hanging drop preparation, H Pylori detection.	10
4	Reticulocyte staining and identification, Differential count-staining and identification of cell	5
<b>Total</b>		<b>30 hrs</b>

#### Reference Books:-

1. *A Handbook of Medical Laboratory (Lab) Technology: Editor) Second Edition. V.H. Talib (Ed.)*
2. *Medical Laboratory Technology. Methods and Interpretations – RamnikSood (volume 1&2)*
3. *Practical Pathology P. Chakraborty Gargi Chakraborty New Central Book Agency, Kolkata.*
4. *Theory & Practice of Histological Techniques John D. Bancroft et.al. Churchill Livingstone Printed in China.*

<b>Name of the Program</b>	<b>M.Sc. Medical Laboratory Technology</b>
<b>Semester</b>	<b>Semester I</b>
<b>Name of the Course</b>	<b>Basic of Microbiology</b>
<b>Course Code</b>	<b>MMLT 103 T</b>

<b>Teaching Outcomes</b>	<ul style="list-style-type: none"> <li>• Introduce students to the basic concepts of microbiology, including the types and characteristics of microorganisms (bacteria, viruses, fungi, protozoa, etc.).</li> <li>• Teach students about the structure, function, and classification of microorganisms</li> <li>• Provide knowledge about how microorganisms cause infections, their virulence factors, and the process of pathogenesis.</li> </ul>
<b>Learning Outcomes</b>	<ul style="list-style-type: none"> <li>• Theory and Lab courses provide the student with the study of normal flora and pathogenic microorganisms.</li> <li>• Methods for recovery, identification of pathogens, culture techniques, procedures, and antibiotic testing and sterilization techniques.</li> <li>• Get an idea of universal safety precautions.</li> </ul>

<b>Sr. No.</b>	<b>Topics</b>	<b>No. of Hrs.</b>
1	<ul style="list-style-type: none"> <li>• Microbial Classification and Diversity, Types of Microorganisms: Bacteria, Viruses, Fungi, Protozoa, The Three-Domain System: Bacteria, Archaea, Eukaryota,</li> <li>• Microbial Growth and Cultivation Methods, Factors Affecting Microbial Growth: Temperature, pH, Nutrients,</li> <li>• Types of Media: Selective, Differential, Enriched, Cultivation Techniques: Streak Plate, Liquid Culture, Serial Dilution.</li> <li>• Sterilization and Disinfection Techniques, Physical Methods: Autoclaving, Dry Heat, Filtration, Chemical Methods: Alcohol, Formaldehyde, Bleach, Radiation: UV, Gamma, X-rays.</li> <li>• Introduction to Bacterial Identification and Classification, Basic Shapes and Arrangements: Cocci, Bacilli, Spirilla</li> </ul>	15
2	<ul style="list-style-type: none"> <li>• Identification of Bacteria, Gram Staining, Biochemical Tests, Morphological Characteristics,</li> <li>• Common Bacterial Pathogens: Staphylococcus, Streptococcus, Escherichia coli, etc. Gram Staining: Positive and Negative, Diagnostic Tests: Catalase Test, Oxidase Test, Coagulase Test,</li> <li>• Antibiotic Susceptibility Testing, Importance of Antibiotic Susceptibility Testing, Disk Diffusion (Kirby-Bauer) Method, Zones of Inhibition and Interpretation, MIC (Minimum Inhibitory Concentration) Determination, Broth Dilution, E-Test.</li> </ul>	10
3	<ul style="list-style-type: none"> <li>• Molecular Methods: Polymerase Chain Reaction (PCR), DNA Amplification for Specific Pathogen Detection, Real-time PCR and Quantitative PCR.</li> <li>• DNA Sequencing and Phylogenetic Analysis, Genomic Approaches for Accurate Identification and Evolutionary Relationships among Microorganisms</li> </ul>	10



4	<ul style="list-style-type: none"> <li>• Infection Control and Hospital Epidemiology: Principles of Infection Control, Hand Hygiene, Isolation Precautions, Sterilization, Disinfection, Preventing Healthcare-Associated Infections (HAIs).</li> <li>• Hospital Epidemiology, Surveillance, Outbreak Investigation, Epidemiological Studies, Role of Infection Prevention and Control Committees.</li> </ul>	10
<b>Total</b>		<b>45 hrs</b>

### MMRIT 106 P – Basic of Microbiology

Sr. No.	Topics	No. of Hrs.
1	Types of Microscopes Morphology of Bacteria Gram's Stain ZN Stain Special Stain- Albert's, Capsule Stain Collection of samples, transport, Processing Antibiotic Sensitivity Test Serological Tests Precipitation, Agglutination Immunochromatographic Tests	10
2	Sterilization Dry heat Sterilization Moist Heat Disinfection Culture Media Culture Methods Biochemical Tests	10
4	Gel Electrophoresis, Polymerase Chain Reaction, ELISA Test	10
<b>Total</b>		<b>30 hrs</b>

#### Reference Books:

1. Microbiology for Nursing and Allied Sciences. Dr. Arora 2<sup>nd</sup> Edition
2. Textbook of Microbiology for Nurses Anantnarayan 1<sup>st</sup> Edition
3. Practical and Applied Microbiology Anuradha De 4<sup>th</sup> Edition
4. Text Book of Microbiology Anantnarayan 10<sup>th</sup> Edition

<b>Name of the Program</b>	<b>M.Sc. Medical Laboratory Technology</b>
<b>Semester</b>	<b>Semester I</b>
<b>Name of the Course</b>	<b>Essentials of Biochemistry and Laboratory Techniques</b>
<b>Course Code</b>	<b>MMLT 104 T</b>

<b>Teaching Objective</b>	<ul style="list-style-type: none"> <li>• Elaborate and Demonstrate the Classification, Functions and Metabolism of Biomolecules - Carbohydrates, Proteins, Lipids and Nucleic acids with their clinical significance, analysis in clinical samples and disorders.</li> <li>• Understand the role of Enzymes in diagnosis and biochemical processes of Cellular Respiration involved in energy production.</li> <li>• Elucidate the clinical significance of Acid-Base balance in homeostasis and related disorders.</li> <li>• In-depth knowledge of Principle and applications of Good Laboratory Practices</li> <li>• Demonstrate comprehensive knowledge for the calibration, handling and applications of Biochemical Laboratory Instruments and Techniques with accuracy in clinical diagnosis.</li> <li>• Competent knowledge of collection and analysis of various body fluid used for diagnostics.</li> </ul>
<b>Course Outcomes</b>	<ul style="list-style-type: none"> <li>• Understand the Classification, Functions and Metabolism of Biomolecules - Carbohydrates, Proteins, Lipids and Nucleic acids with their significance in homeostasis and related disorders</li> <li>• Understand the role of Enzymes and biochemical processes of Cellular Respiration involved in energy production</li> <li>• In depth knowledge of Principle and applications of Good Laboratory Practices.</li> <li>• Apprehend the clinical significance of Acid-Base balance in homeostasis and related disorders.</li> <li>• Competent knowledge of collection and analysis of various body fluid used for diagnostics</li> <li>• Comprehension of calibration and applications of Basic Biochemical Laboratory Techniques with accuracy and their applications in clinical diagnosis.</li> </ul>

<b>Sr. No.</b>	<b>Topic</b>	<b>No. of Hrs.</b>
1	Metabolism of Carbohydrates and disorders: <ul style="list-style-type: none"> <li>• Classification and Functions</li> <li>• Overview of Glycolysis, Glycogenesis, Glycogenolysis, Gluconeogenesis</li> <li>• Glycogen Storage Disorders</li> <li>• Regulation of Blood Glucose</li> <li>• Diabetes Mellitus, Diabetic Profile: Fasting, Post-prandial and Random Glucose, GTT, HbA1c and Glycosuria</li> </ul>	6
2	Metabolism of Proteins and disorders: <ul style="list-style-type: none"> <li>• Classification and Functions of Proteins</li> <li>• Structural Organization of Proteins, Chaperones</li> </ul>	5

	<ul style="list-style-type: none"> <li>• Catabolism of Amino acids, Transamination, Urea cycle, Oxidative deamination</li> <li>• Aminoaciduria and Proteinuria</li> </ul>	
3	Metabolism of Lipids and disorders: <ul style="list-style-type: none"> <li>• Classification and Functions, Essential fatty acids</li> <li>• Cholesterol &amp; its clinical significance</li> <li>• Beta oxidation of fatty acids</li> <li>• Fatty liver, Ketone body metabolism, Atherosclerosis</li> </ul>	5
4	Metabolism of Nucleic Acids: <ul style="list-style-type: none"> <li>• Purines, pyrimidines and nucleotides</li> <li>• Catabolism of Purines</li> <li>• Structure of DNA and RNA</li> <li>• Replication, Transcription and Translation</li> </ul>	5
5	Enzymes <ul style="list-style-type: none"> <li>• Classification of enzymes</li> <li>• Mechanism of enzyme action</li> <li>• Factors affecting enzyme activity</li> <li>• Enzyme Inhibition</li> <li>• Diagnostic uses of Enzymes and Isoenzymes</li> </ul>	4
6	Cellular Respiration <ul style="list-style-type: none"> <li>• Oxidative Phosphorylation</li> <li>• Electron Transport Chain and ATP synthesis</li> <li>• Inhibitors and Uncouplers</li> </ul>	2
7	Acid Base Balance and disorders <ul style="list-style-type: none"> <li>• Osmosis, Henderson-Hasselback equation</li> <li>• Regulation of Acid base balance</li> <li>• Disorders of Acid-Base balance</li> </ul>	4
8	Good Clinical Practices <ul style="list-style-type: none"> <li>• Universal Precautions</li> <li>• Biosafety and Biohazards</li> <li>• Biomedical Waste Management</li> <li>• Lab Ethics and Rights of Patient</li> <li>• Standard Operating Protocol (SOP)</li> </ul>	4
9	Body Fluids <ul style="list-style-type: none"> <li>• Phlebotomy and Anticoagulants</li> <li>• Cerebrospinal Fluid analysis</li> <li>• Ascitic Fluid analysis</li> <li>• Pleural Fluid analysis</li> <li>• Urine analysis</li> </ul>	4
10	Basic Biochemical Laboratory Techniques: Principle, Working, Types and Applications <ul style="list-style-type: none"> <li>• Colorimeter and Spectrophotometer</li> <li>• Semi Autoanalyzer</li> <li>• pH Meter</li> <li>• Blood Gas Analyzer</li> <li>• Electrolyte analyser</li> <li>• High Performance Liquid Chromatography</li> </ul>	6

	<ul style="list-style-type: none"> <li>• Nephelometer</li> <li>• Water Distillation and Deionization plants</li> </ul>	
<b>Total</b>		<b>45 hrs</b>

### MMLT 107 P: Essentials of Biochemistry and Quality Control

<b>Sr. No.</b>	<b>Topic</b>	<b>No. of Hrs.</b>
1	Estimation and Interpretation of Plasma Glucose	2
2	Qualitative Estimations for Proteins.	2
3	Determination of Beer-Lambert's Law	2
4	Calibration of pH Meter and Estimation of pH	2
5	Estimation of Abnormal Urine components	2
6	Calibration of test on Semi-Autoanalyzer	2
7	HbA1C (Demonstration)	2
8	CSF analysis and interpretation	2
9	Pleural and Ascitic fluid analysis and interpretation	2
10	Paper Chromatography	2
11	Electrophoresis	2
12	PAGE (Demonstration)	2
13	Blood Gas Analyzer (Demonstration)	2
14	Electrolyte Analyzer (Demonstration)	2
15	Water Distillation Plant (Demonstration)	2
<b>Total</b>		<b>30 hrs</b>

#### Reference Books:

1. Clinical Biochemistry, An Illustrated Colour Text, Michael Murphy, Rajeev Srivastava, Kevin Deans, Latest Edition
2. Textbook of Medical Biochemistry, MN Chatterjea and Rana Shinde, Latest Edition
3. Textbook of Medical Biochemistry for Medical Students, DM Vasudevan, Latest Edition
4. Harper's Illustrated Biochemistry, Latest Edition
5. Manual of Practical Biochemistry, Rafi MD, Latest Edition
6. Textbook of Medical Laboratory Technology - Vol 1 and 2, B. Godkar, Darshan P. Godkar, Latest Edition
7. Harper's Illustrated Biochemistry, Latest Edition
8. Fundamentals Biochemistry, Donald Voet, Judith G. Voet, Charlotte W. Pratt., Latest Edition
9. Biochemistry, Dr. U. Satyanarayana and Dr. U. Chakrapani, Latest Edition
10. Biochemistry for Medical Laboratory Technology, Harbans Lal, Latest Edition

**MMLT 108 CP: MLT Directed Clinical Education – I**

<b>Course Outcomes</b>	<ul style="list-style-type: none"><li>• Build a robust theoretical foundation, enabling students to understand healthcare practices, disease management, and patient care, thereby empowering them to make informed decisions and adapt to evolving medical technologies.</li><li>• Emphasize hands-on training, ensuring proficiency in clinical procedures, diagnostic techniques, and the use of advanced medical equipment. This practical exposure will bridge the gap between theory and practice, enhancing students' confidence and competence in delivering quality patient care.</li><li>• Focus on developing professionalism, empathy, ethical conduct, teamwork, and communication skills—key traits for holistic patient care and effective collaboration in interdisciplinary healthcare teams.</li></ul>
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Students will gain additional skills in clinical procedures, interaction with patients and professional personnel. Students will apply knowledge from clinical learning experience under the supervision of senior technologist. Students are tested on intermediate clinical Laboratory skills. **(Total -135 hrs.)**

<b>Name of the Program</b>	<b>M.Sc. Medical Laboratory Technology</b>
<b>Semester</b>	<b>Semester I</b>
<b>Name of the Subject</b>	<b>Research Methodology &amp; Biostatistics (Core Course)</b>
<b>Subject Code</b>	<b>CC 001 T</b>

<b>Teaching Objective</b>	<ul style="list-style-type: none"> <li>The course is intended to give an overview of research and statistical models commonly used in medical and bio-medical sciences. The goal is to impart an intuitive, understanding and working knowledge of research designs and statistical analysis. The strategy would be to simplify, analyze the treatment of statistical inference and to focus primarily on how to specify and interpret the outcome of research.</li> </ul>
<b>Course Outcomes</b>	<ul style="list-style-type: none"> <li>Student will be able to understand develop statistical models, research designs with the understating of background theory of various commonly used statistical techniques as well as analysis, interpretation &amp; reporting of results and use of statistical software.</li> </ul>

<b>Sr. No</b>	<b>Topic</b>	<b>No. of Hrs.</b>
<b>A</b>	<b>Research Methodology:</b>	<b>23</b>
1	<b>Scientific Methods of Research:</b> Definition of Research, Assumptions, Operations and Aims of Scientific Research. Research Process, Significance and Criteria of Good Research, Research Methods versus Methodology	4
2	<b>Research Designs:</b> Observational Studies: Descriptive, explanatory, and exploratory, Experimental Studies: Pre-test design, post-test design, Follow-up or longitudinal design, Cohort Studies, Case – Control Studies, Cross-sectional studies, Intervention studies.	5
3	<b>Sampling Designs:</b> Census and Sample Survey, Need and importance for Sampling, Implications of a Sample Design, Different Types of Sample Designs (Probability sampling and non-probability sampling), Systematic sampling, Stratified sampling, Cluster sampling, Multi-stage sampling, Sampling with probability proportional to size, Sequential sampling.	5
4	<b>Measurement in Research:</b> Measurement Scales, Sources of Error in Measurement,	3
5	<b>Methods of Data Collection:</b> Types of data, Collection of Primary Data, Observation Method, Interview Method	4
6	Research Ethics and plagiarism	2
<b>B</b>	<b>Biostatistics</b>	<b>22</b>
7	<b>Data Presentation:</b> Types of numerical data: Nominal, Ordinal, Ranked, Discrete and continuous. Tables: Frequency distributions, Relative frequency, Graph: Bar charts, Histograms, Frequency polygons, scatter plots, line graphs	3
8	<b>Measures of Central Tendency and Dispersion:</b> Mean, Median, Mode, Range, Inter quartile range, variance and Standard Deviation, Coefficient of variation, grouped mean and grouped standard deviation (including merits and demerits).	3

9	<b>Testing of Hypotheses:</b> Definition, Basic Concepts, Procedure for Hypothesis Testing, power of test, Normal distribution, Parametric Tests including Z-test, t-test, and ANOVA	4
10	<b>Chi-square Test:</b> Chi-square as a Non-parametric Test, Applications.	2
11	<b>Measures of Relationship:</b> Correlation and Simple Regression Analysis	3
12	<b>Non-parametric test:</b> Sign test, Wilcoxon signed-Rank Test, Wilcoxon Rank Sum Test: Mann-Whitney U test, Kruskal Walli's test, Friedman's test, and Spearman Rank correlation test.	3
13	<b>Vital Health Statistics:</b> rate, crude rate, age specific rate, Measurement of fertility, Rate, Measures of mortality.	4
<b>Total</b>		<b>45 hrs</b>

### CC 001 P–Research Methodology & Biostatistics

Sr. No.	Topics	No. of Hrs
<b>A</b>	<b>Research Methodology</b>	
1	Research Article Presentation (Seminar)	5
<b>B</b>	<b>Biostatistics</b>	
2	Data Presentation	4
3	Measures of Central Tendency and Dispersion	6
4	Testing of Hypotheses	16
5	Chi-square Test	4
6	Measures of Relationship	6
7	Analysis of Variance	5
8	Non parametric or Distribution-free Tests	8
9	Computer Application Using Statistical Software including SPSS	6
<b>Total</b>		<b>60 hrs</b>

#### Reference Books:

1. Daniel WW. Biostatistics: A foundation for analysis in the health sciences. 10th ed. Wiley; 2013.
2. Gupta SC, Kapoor VK. Fundamentals of mathematical statistics. Sultan Chand & Sons; 2020 Sep.
3. Kothari CR, Garg G. Research methodology: Methods and techniques. 2019.
4. Mahajan BK. Methods in biostatistics for medical students and research workers. 7th ed. Jaypee Brothers Medical Publishers; 2010.
5. Murthy MN. Sampling theory and methods. Statistical Publishing Society; 1967.
6. Singh YK. Fundamental of research methodology and statistics. New Age International; 2006.

**Resolution No. 3.5 of Academic Council (AC-51/2025):**

Resolved to approve the submitted list of recommended books for M.Sc. Clinical Nutrition and the course on **Biostatistics and Research Methodology** [ANNEXURE-7].

Annexure-7 of AC-51/2025

**Biostatistics & Research Methodology Books List**

<b>Subject</b>	<b>Book Name</b>	<b>Author</b>
<b>Biostatistics &amp; Research Methodology</b>	Biostatistics: A Foundation for Analysis in the Health Sciences (10th ed.)	Daniel WW.
	Biostatistical Analysis (5th ed.)	Zar JH.
	Research Methodology: Methods and Techniques	Kothari CR, Garg G.
	Methods in Biostatistics for Medical Students and Research Workers (7th ed.)	Mahajan BK.
	Sampling Theory and Methods	Murthy MN.
	Fundamentals of Research Methodology and Statistics	Singh YK.
	Fundamentals of Biostatistics (8th ed.)	Rosner B.
	An Introduction to Medical Statistics (4th ed.)	Bland M.



# FIRST YEAR

## M.Sc. Medical Laboratory Technology

### SEMESTER- II

Code No.	Core Subjects
<b>Discipline Specific Core Theory</b>	
MMLT 109 T	Immunohematology & Blood Transfusion
MMLT 110 T	Immunology and Serology
MMLT 111 T	Advances in Clinical Biochemistry and Quality Control
<b>Discipline Specific Core Practical</b>	
MMLT 112 P	Immunohematology & Blood Transfusion
MMLT 113 P	Immunology and Serology
MMLT 114 P	Advances in Clinical Biochemistry and Quality Control
MMLT 115 CP	MMLT Directed Clinical Education – II
<b>Skill Enhancement Course</b>	
SEC 001 T	Innovation and Entrepreneurship
SEC 002 T	One Health (NPTEL)

<b>Name of the Program</b>	<b>M.Sc. Medical Laboratory Technology</b>
<b>Semester</b>	<b>Semester II</b>
<b>Name of the Course</b>	<b>Immunohematology &amp; Blood Transfusion</b>
<b>Course Code</b>	<b>MLT 109 T</b>

<b>Teaching Outcomes</b>	<ul style="list-style-type: none"> <li>• Introduce students to the basic concepts of microbiology, including the types and characteristics of microorganisms (bacteria, viruses, fungi, protozoa, etc.).</li> <li>• Teach students about the structure, function, and classification of microorganisms</li> <li>• Provide knowledge about how microorganisms cause infections, their virulence factors, and the process of pathogenesis.</li> </ul>
<b>Learning Outcomes</b>	<ul style="list-style-type: none"> <li>• Theory and Lab courses provide the student with the study of normal flora and pathogenic microorganisms.</li> <li>• Methods for recovery, identification of pathogens, culture techniques, procedures, and antibiotic testing and sterilization techniques.</li> <li>• Get an idea of universal safety precautions.</li> </ul>

<b>Sr. No.</b>	<b>Topics</b>	<b>No. of Hrs.</b>
1	<b>Introduction to Immunohematology</b> <ul style="list-style-type: none"> <li>• Basics of blood groups and their clinical significance</li> <li>• Historical development of blood transfusion</li> <li>• Structure and function of antigens and antibodies in blood</li> </ul> <b>Blood Group Systems</b> <ul style="list-style-type: none"> <li>• <b>ABO Blood Group System:</b> Genetics, inheritance, and clinical importance</li> <li>• <b>Rh Blood Group System:</b> Rh antigen, Rh incompatibility, and hemolytic disease of the newborn (HDN)</li> <li>• Other blood group systems: Kell, Kidd, Duffy, Lewis, and MNS systems</li> </ul>	5
2	<b>Blood Typing &amp; Crossmatching</b> <ul style="list-style-type: none"> <li>• Principle and techniques of forward and reverse blood grouping</li> <li>• Crossmatching methods: Major and minor crossmatch</li> <li>• Interpretation of discrepancies in blood grouping</li> </ul> <b>Antibody Screening &amp; Identification</b> <ul style="list-style-type: none"> <li>• Methods for detecting irregular antibodies</li> <li>• Techniques for antibody identification (Direct &amp; Indirect Antiglobulin Test)</li> <li>• Clinical significance of unexpected antibodies</li> </ul>	10
3	<b>Blood Collection &amp; Processing</b> <ul style="list-style-type: none"> <li>• Donor selection criteria and screening tests</li> <li>• Blood collection procedures, anticoagulants, and storage</li> <li>• Component separation (Packed RBCs, Platelets, Plasma, Cryoprecipitate)</li> </ul> <b>Blood Transfusion Practices</b> <ul style="list-style-type: none"> <li>• Indications for blood transfusion</li> <li>• Transfusion reactions: Hemolytic &amp; non-hemolytic reactions</li> <li>• Prevention and management of transfusion reactions</li> </ul>	10
4	<b>Hemolytic Disease of the Newborn (HDN)</b> <ul style="list-style-type: none"> <li>• Causes, diagnosis, and treatment of HDN</li> <li>• Role of Rh immune globulin (RhIg) in prevention</li> </ul>	10

	<b>Apheresis &amp; Blood Component Therapy</b> <ul style="list-style-type: none"> <li>Principles and types of apheresis (plasmapheresis, plateletpheresis)</li> <li>Therapeutic applications of apheresis</li> </ul>	
5	<b>Quality Control &amp; Regulatory Aspects</b> <ul style="list-style-type: none"> <li>Blood bank quality assurance and standard operating procedures</li> <li>Regulatory guidelines (FDA, AABB, WHO)</li> <li>Ethical and legal considerations in blood donation and transfusion</li> </ul> <b>Recent Advances in Blood Transfusion &amp; Immunohematology</b> <ul style="list-style-type: none"> <li>Automation in blood banking</li> <li>Molecular techniques in blood grouping</li> <li>Stem cell transplantation and cord blood banking</li> </ul>	10
<b>Total</b>		<b>45 hrs</b>

### MMLT 112 P - Immunohematology & Blood Transfusion

Sr. No.	Topics	No. of Hrs.
1	<ul style="list-style-type: none"> <li>Forward and reverse ABO blood grouping</li> <li>Rh (D) typing and weak D testing</li> <li>Interpretation of blood grouping discrepancies</li> </ul>	5
2	<ul style="list-style-type: none"> <li>Major and minor crossmatch</li> <li>Immediate spin, saline, and anti-human globulin (AHG) crossmatching</li> </ul>	5
3	<ul style="list-style-type: none"> <li>Direct Antiglobulin Test (DAT)</li> <li>Indirect Antiglobulin Test (IAT)</li> <li>Screening and identification of irregular antibodies</li> </ul>	5
4	<ul style="list-style-type: none"> <li>Blood donor selection and screening</li> <li>Phlebotomy techniques for blood donation</li> <li>Blood component separation (Packed RBCs, Platelets, Plasma, Cryoprecipitate)</li> </ul>	5
5	<ul style="list-style-type: none"> <li>Direct and indirect Coombs test</li> <li>Detection of maternal-fetal incompatibility</li> <li>Rh antibody titration</li> <li>Pre-transfusion compatibility testing</li> <li>Identification and management of transfusion reactions (hemolytic, febrile, allergic)</li> </ul>	5
6	<ul style="list-style-type: none"> <li>Plateletpheresis and plasmapheresis principles</li> <li>Molecular techniques in blood group typing (if available)</li> <li>Automation in blood banking</li> </ul>	5
<b>Total</b>		<b>30 hrs</b>

#### Reference Books:

1. A Handbook of Medical Technology-second edition, BY V.H. Talib,CBS Publishers
2. Textbook of Medical Laboratory Technology, Volume 1, 3rd Edition by Praful Ghodkar
3. Textbook of Medical Laboratory Technology, Volume 2, 3rd Edition by Praful Ghodkar
4. Medical Laboratory Technology (Volume 1): Procedure Manual for Routine Diagnostic, Kanai Mukharjee
5. Medical Laboratory Technology (Volume 2): Procedure Manual for Routine Diagnostic, Kanai Mukharjee

<b>Name of the Program</b>	<b>M.Sc. Medical Laboratory Technology</b>
<b>Semester</b>	<b>Semester II</b>
<b>Name of the Course</b>	<b>Immunology &amp; Serology</b>
<b>Course Code</b>	<b>MMLT 110 T</b>

<b>Course Outcomes</b>	<ul style="list-style-type: none"> <li>• This subject gives a general insight into the history, basics of microbiology; bacterial genetics, immunology and serology.</li> <li>• To imparts knowledge about equipment used in microbiology, safety precautions</li> <li>• To imparts knowledge about equipment used in microbiology, safety precautions</li> <li>• This paper will provide knowledge of serological techniques, and Vaccines</li> </ul>
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<b>Sr. No.</b>	<b>Topics</b>	<b>No. of Hrs.</b>
1	<ul style="list-style-type: none"> <li>• Immune System Components and Functions, Innate Immunity, Physical Barriers, Phagocytosis, Inflammation, Complement System, Adaptive Immunity, B Cells: Antibody Production and Functions, T Cells: Cell-Mediated Immunity, Helper T Cells, Cytotoxic T Cells, Major Histocompatibility Complex (MHC) and Antigen Presentation, Immune Responses: Humoral and Cellular Immunity</li> </ul>	10
2	<ul style="list-style-type: none"> <li>• Antigen-Antibody Interactions, Antigens: Types and Characteristics,</li> <li>• Antibodies (Immunoglobulins): Structure and Classes, Antibody-Antigen Binding: Affinity, Avidity, Epitopes, Immunological Memory and Secondary Immune Response.</li> <li>• Diagnostic Immunological Techniques, Enzyme-Linked Immunosorbent Assay (ELISA), Western Blotting: Principles and Applications, Immunofluorescence and Flow Cytometry, Immunohistochemistry: Tissue Staining.</li> <li>• Hypersensitivity Reactions and Allergies, Types of Hypersensitivity Reactions, Type I (Immediate) to Type IV (Delayed) Hypersensitivity, Mechanisms, Mediators, and Clinical Manifestations, Allergic Diseases, Allergic Rhinitis, Asthma, Anaphylaxis. Treatment Approaches: Antihistamines, Epinephrine.</li> </ul>	15
3	<ul style="list-style-type: none"> <li>• Immunological Disorders (Autoimmune Diseases and Immunodeficiencies), Autoimmune Diseases, Rheumatoid Arthritis, Lupus, Type 1 Diabetes, Multiple Sclerosis,</li> <li>• Mechanisms of Autoimmunity: Loss of Tolerance, Molecular Mimicry. Immunodeficiencies, Primary (Congenital). Immunodeficiencies, Secondary (Acquired) Immunodeficiencies: HIV/AIDS.</li> <li>• Flow Cytometry and Immunophenotyping, Advanced Principles of Flow Cytometry, Multiparameter Analysis, Compensation, and Quality Control. Immunophenotyping in Clinical Immunology, Identifying Immune Cell Populations, Subset Analysis</li> </ul>	15
4	<ul style="list-style-type: none"> <li>• Immunotherapies and Monoclonal Antibodies, Immunotherapy Approaches, Immune Checkpoint Inhibitors, Adoptive T-cell Therapy, Vaccines as Immunotherapeutic Agents. Monoclonal Antibodies (mAbs), Production, Mechanisms of Action, Therapeutic Uses: Cancer Treatment, Autoimmune Diseases.</li> </ul>	5
<b>Total</b>		<b>45 hrs</b>

**MMLT 113 P - Immunology & Serology**

<b>Sr. No.</b>	<b>Topics</b>	<b>No. of Hrs.</b>
1	Demonstrate & Interpret agglutination and precipitation techniques for detecting antigen-antibody interactions.	5
2	Widal test for typhoid fever. VDRL/RPR test for syphilis screening. ASO test for streptococcal infections.	10
3	Conduct Enzyme-Linked Immunosorbent Assay (ELISA) for detecting infections (e.g., HIV, Hepatitis B). Perform Radioimmunoassay (RIA) Perform skin prick tests for allergy detection.	10
4	Perform Rheumatoid Factor (RF) test for rheumatoid arthritis. Conduct C-Reactive Protein (CRP) test to detect inflammation.	5
<b>Total</b>		<b>30 hrs</b>

**Reference Books:**

1. Microbiology for Nursing and Allied Sciences. Dr. Arora 2<sup>nd</sup> Edition
2. Textbook of Microbiology for Nurses Anantnarayan 1<sup>st</sup> Edition
3. Practical and Applied Microbiology Anuradha De 4<sup>th</sup> Edition
4. Text Book of Microbiology Anantnarayan 10<sup>th</sup> Edition

<b>Name of the Program</b>	<b>M.Sc. Medical Laboratory Technology</b>
<b>Semester</b>	<b>Semester II</b>
<b>Name of the Course</b>	<b>Advances in Clinical Biochemistry and Quality Control</b>
<b>Course Code</b>	<b>MMLT 111 T</b>

<b>Teaching Objective</b>	<ul style="list-style-type: none"> <li>• In depth knowledge of Quality Control and Automation in Biochemistry Laboratory</li> <li>• Describe the Role of Vitamins and Minerals in Human Health with respect to biochemical functions and deficiency manifestations.</li> <li>• Explain Hormonal Regulation and plasma proteins specifically with metabolism and related disorders.</li> <li>• Demonstrate the Analysis and Interpretation of various Biochemical Laboratory Tests for organ dysfunction and disease progression.</li> <li>• Give Insights on Advanced Biochemistry Techniques with their applications.</li> </ul>
<b>Course Outcomes</b>	<ul style="list-style-type: none"> <li>• Comprehensive knowledge of Principle and applications of Quality Control and Automation in Biochemistry Laboratory</li> <li>• Analyze the Role of Vitamins, Minerals and Electrolytes in Human Health with respect to biochemical functions and deficiency manifestations</li> <li>• Understand the different types of plasma proteins and its related disorders specifically Jaundice and Hemoglobinopathies.</li> <li>• Explore Biochemistry of Hormones and their mechanism of action.</li> <li>• Mastery to Analyze and Interpret Biochemical Laboratory Tests to assess organ dysfunction and disease progression.</li> <li>• Insightful knowledge of advanced Biochemistry Techniques with their applications in Diagnosis</li> </ul>

<b>Sr. No.</b>	<b>Topic</b>	<b>No. of Hrs.</b>
1	Quality Control and Automation: <ul style="list-style-type: none"> <li>• Principle, Calibration and Maintenance of Auto Analysers</li> <li>• Automation in Laboratory and POCT</li> <li>• Internal and External Quality Control</li> <li>• Levey–Jennings chart, Westgard Rules, Gaussian Distribution Curve</li> </ul>	7
2	Vitamins, Minerals and Electrolytes. <ul style="list-style-type: none"> <li>• Vitamins: Sources, Functions and Deficiency manifestations</li> <li>• Minerals: Sources, Functions and Deficiency manifestations of Sodium, Potassium, Chloride, Calcium; Phosphorus, Iodine</li> <li>• Iron - Absorption, Transport, Storage and Regulation of Iron</li> </ul>	12
3	Plasma Proteins <ul style="list-style-type: none"> <li>• Albumin, Globulin, Fibrinogen, Prothrombin</li> <li>• Synthesis and Breakdown of Heme</li> <li>• Jaundice types, causes and laboratory diagnosis</li> <li>• Hemoglobinopathies (Sickle Cell Anemia and Thalassemia) and Myoglobinuria</li> </ul>	7

4	<b>Hormones</b> <ul style="list-style-type: none"> <li>• Definition and Classification of Hormones</li> <li>• Mechanism of Hormone action</li> </ul>	4
5	<b>Organ Function Tests - I: Clinical Significance, Normal Ranges and Interpretation</b> <ul style="list-style-type: none"> <li>• Liver Function Tests: Total, Direct and Indirect Bilirubin, SGPT, SGOT, ALP, Total Protein and A/G ratio</li> <li>• Renal Function Tests: Urea, Creatinine, GFT, Clearance tests (Urea, Creatinine and Inulin)</li> <li>• Pancreatic Function tests: Amylase and Lipase</li> </ul>	10
6	<b>Organ Function Tests - II: Clinical Significance, Normal Ranges and Interpretations</b> <ul style="list-style-type: none"> <li>• Cardiac Profile: Cardiac Proteins and Cardiac Enzymes</li> <li>• Reproductive Profile: LH, FSH, Prolactin, Estrogen, Progesterone, Testosterone, AMH</li> <li>• Thyroid Profile: Free T3, Free T4, Total T3, Total T4, TSH and Anti TPO antibodies</li> </ul>	10
7	<b>Advanced Biochemical Laboratory Techniques: Principle, Working and Applications</b> <ul style="list-style-type: none"> <li>• Dry Chemistry</li> <li>• Enzyme Linked Immunosorbent Assay (ELISA)</li> <li>• Chemiluminescence Immunoassay (CLIA)</li> <li>• Polymerase Chain Reaction (PCR)</li> <li>• Microarray</li> <li>• Flow Cytometry</li> </ul>	10
<b>Total</b>		<b>60 hrs</b>

### **MMLT 114 P: Advances in Clinical Biochemistry and Quality Control**

<b>Sr. No.</b>	<b>Topic</b>	<b>No. of Hrs.</b>
1	Estimation and Interpretation of Total Cholesterol	2
2	Estimation and Interpretation of Serum HDL	2
3	Estimation and Interpretation of Serum Triglyceride	2
4	Estimation and Interpretation of Total Bilirubin, Direct Bilirubin and Indirect Bilirubin	2
5	Estimation and Interpretation of Total Protein, Albumin and A/G Ratio	2
6	Estimation and Interpretation of AST & ALT	2
7	Estimation and Interpretation of Alkaline Phosphatase	2
8	Estimation and Interpretation of Amylase	2
9	Estimation and Interpretation of Lipase	2
10	Estimation and Interpretation of Blood Urea and BUN	2
11	Estimation and Interpretation of Serum Creatinine, Urine Creatinine and Creatinine clearance.	2
12	Estimation and Interpretation of Uric acid	2
13	Estimation and Interpretation of serum Calcium and Phosphorus	2
14	Estimation and Interpretation of Hormones using ELISA	2
15	Estimation and Interpretation of Vitamin D, Vitamin B 12 and Folic acid (Demonstration)	2
<b>Total</b>		<b>30 hrs</b>

**Reference Books:**

1. Clinical Biochemistry, An Illustrated Colour Text, Michael Murphy, Rajeev Srivastava, Kevin Deans, Latest Edition
2. Textbook of Medical Biochemistry, MN Chatterjea and Rana Shinde, Latest Edition
3. Textbook of Medical Biochemistry for Medical Students, DM Vasudevan, Latest Edition
4. Harper's Illustrated Biochemistry, Latest Edition
5. Manual of Practical Biochemistry, Rafi MD, Latest Edition
6. Textbook of Medical Laboratory Technology - Vol 1 and 2, B. Godkar, Darshan P. Godkar, Latest Edition
7. Harper's Illustrated Biochemistry, Latest Edition
8. Fundamentals Biochemistry, Donald Voet, Judith G. Voet, Charlotte W. Pratt., Latest Edition
9. Biochemistry, Dr. U. Satyanarayana and Dr. U. Chakrapani, Latest Edition
10. Biochemistry for Medical Laboratory Technology, Harbans Lal, Latest Edition



**MMLT 115 CP: MMLT Directed Clinical Education – II**

<b>Course Outcomes</b>	<ul style="list-style-type: none"><li>• Build a robust theoretical foundation, enabling students to understand healthcare practices, disease management, and patient care, thereby empowering them to make informed decisions and adapt to evolving medical technologies.</li><li>• Emphasize hands-on training, ensuring proficiency in clinical procedures, diagnostic techniques, and the use of advanced medical equipment. This practical exposure will bridge the gap between theory and practice, enhancing students' confidence and competence in delivering quality patient care.</li><li>• Focus on developing professionalism, empathy, ethical conduct, teamwork, and communication skills—key traits for holistic patient care and effective collaboration in interdisciplinary healthcare teams.</li></ul>
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Students will gain additional skills in clinical procedures, interaction with patients and professional personnel. Students apply knowledge from previous clinical learning experience under the supervision of a senior technologist. Students are tested on intermediate clinical Lab diagnosis skills. **(Total –225 hrs.)**

## SKILL ENHANCEMENT COURSES

<b>Name of the Program</b>	<b>M.Sc. Medical Laboratory Technology</b>
<b>Semester</b>	<b>Semester II</b>
<b>Name of the Subject</b>	<b>Innovation and Entrepreneurship</b>
<b>Subject Code</b>	<b>SEC 001 T</b>

<b>Course Outcome</b>	<ul style="list-style-type: none"> <li>• Students will grasp the concepts of innovation, its ecosystem, and the role of various stakeholders such as government policies, startups, and innovation hubs.</li> <li>• Cultivating an entrepreneurial mindset and leadership qualities necessary for driving innovation and leading ventures.</li> <li>• Understanding the intersection of technology and innovation and leveraging emerging technologies for entrepreneurial ventures.</li> </ul>
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<b>Sr. No.</b>	<b>Topics</b>	<b>No. of Hrs.</b>
1	Innovation and Innovation Eco-System, The Policy Framework, Startup Landscape and Innovation Hubs, - Digital India and Make in India, - Linking Innovation with Intellectual Property Rights, Raising Finance for Startups in India, Innovation in Indian Context, Writing a business plan	<b>15</b>
2	Creativity and Research, Converting Researches to Innovation: Innovation Types and Models, Product Development, IPR and its Commercialization, Support System to Develop Culture of Research and Innovation, Commercialization of research and innovation, Fund raising – Research and Innovation, Envisioning Innovation and Scenario Building	<b>15</b>
3	Introduction to Innovation in Entrepreneurship, Idea Generation and Validation, Design Thinking in Entrepreneurship, Business Model Innovation, Technology and Innovation, Funding Innovation, Entrepreneurial Mindset, Leadership & amp; Intellectual Property, Scaling and Growth Strategies, sustainability & amp; Social Innovation	<b>15</b>
<b>Total</b>		<b>45 hrs</b>

<b>Name of the Program</b>	<b>M.Sc. Medical Laboratory Technology</b>
<b>Semester</b>	<b>Semester II</b>
<b>Name of the Subject</b>	<b>One Health (NPTEL)</b>
<b>Subject Code</b>	<b>SEC 002 T</b>

<b>Course Outcomes</b>	<ul style="list-style-type: none"> <li>• A comprehensive understanding of One Health's role in global health challenges, emphasizing interconnectedness among human, animal, and environmental health.</li> <li>• Topics include research ethics, disease surveillance, and successes in controlling emerging infectious diseases.</li> <li>• Students explore disease emergence, transmission, antimicrobial resistance, and food safety, gaining insights into effective public health strategies.</li> </ul>
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<b>Sr. No.</b>	<b>Topics</b>	<b>No. of Hrs.</b>
1	<b>Introduction to One Health :</b> <ul style="list-style-type: none"> <li>• Introduction to the One Health One Medicine Concept and National &amp; International health/public health agencies</li> <li>• Global Health vs One Health</li> <li>• Basics of Research Ethics</li> <li>• Integrated human and animal disease surveillance systems</li> <li>• Recent success of One Health in control of emerging infectious diseases and the application of One Health in the control of endemic zoonoses in resource-poor communities</li> </ul>	5
2	<b>Emerging Infectious Diseases and Antimicrobial Resistance:</b> <ul style="list-style-type: none"> <li>• Emerging infectious diseases</li> <li>• Process of disease emergence and assessment of the risk factors</li> <li>• Mechanisms of pathogen cross over across species boundaries and emerging infectious disease transmission, and its relevance in the 21st century</li> <li>• Importance of disease detection, Identification and monitoring in public health and the gaps in current health systems approaches and importance of Genome Sequencing</li> <li>• Introduction to disease vectors and basics of Medical Entomology</li> <li>• The factors influencing an emerging disease (whether is controlled or becomes endemic/epidemic as illustrated by different emerging diseases -STDs, HIV/AIDS, avian influenza, SARS, Ebola)</li> <li>• Antimicrobial resistance a global threat and Importance of antibiotic stewardship program</li> <li>• Introduction of Food Safety and Food Borne Diseases</li> </ul>	10
3	<b>One Health Application in Management of Zoonotic Diseases:</b> <ul style="list-style-type: none"> <li>• What are zoonotic diseases &amp; its role in our changing world</li> <li>• Understanding of bacterial, viral and parasitic zoonotic diseases; critical evaluation of its control measures, awareness of local, national and global factors and Influences</li> <li>• Biogeography of zoonosis</li> <li>• The integration of human, animal and ecosystem health in the control and prevention of these diseases</li> <li>• Community engagement for zoonotic disease control in humans and animals through One Health</li> </ul>	10

4	<b>Applied Epidemiology &amp; Public Health in One Health Research:</b> <ul style="list-style-type: none"> <li>• Basics of Epidemiological Studies</li> <li>• Rapid Response system, Disaster Management and Outbreak Investigation Plans</li> <li>• Basic statistical methods and their application and the measurement of disease frequency</li> <li>• Principles of survey design and the concepts of sampling</li> <li>• Mixed method research</li> </ul>	5
5	<b>One Health and Health Policy:</b> <ul style="list-style-type: none"> <li>• Introduction to health policy</li> <li>• Political and institutional challenges in implementing One Health and the importance of a unified policy to address the shared health threats of humans and animals</li> </ul>	5
6	<b>Media &amp; Community engagement for One Health:</b> <ul style="list-style-type: none"> <li>• Risk Communication and Pandemic Preparedness</li> <li>• How ICMR and other Public Health Institutes tackled and managed pandemic situation in the country</li> <li>• Role of community in disease control &amp; ways for community engagement</li> <li>• Uses of different types of media for communication and impact of the media on public attitudes to disease</li> </ul>	10
<b>Total</b>		<b>45 hrs</b>

**\*Note:** Attain the NPTEL Course with title and course code as “**One Health (Course Code: noc25-ge25) (NPTEL)**”.

## Scheme of University Examination Theory for PG Program:

General structure / patterns for setting up question papers for Theory / Practical courses, their evaluation weightages for PG programs of MGMSBS are given in the following tables

### Marks scheme for the University exam:

Final theory marks will be 100 marks (80 marks University Theory exam + 20 Marks Internal assessment).

Question		Marks distribution	Marks allotted per section	Marks
Sec: A	MCQ	10 x 1 M = 10	10	10
Sec: B	SAQ	3/4 x 5 M = 15	15	35
Sec: B	LAQ	2/3 x 10 M = 10	20	
Sec: C	SAQ	3/4 x 5 M = 15	15	35
Sec: C	LAQ	2/3 x 10 M = 10	20	
<b>Total</b>				<b>80 Marks</b>

### Marks Scheme for the University Examination (50 Marks)

Final theory marks will be 50 marks University Theory exam pattern Research Methodology & Biostatistics (Core course)

Question	Question No.	Question Type	Marks Distribution	Marks
Sec: A	1.	LAQ (2 out of 3)	2 X 10 Marks = 20	20
Sec: B	2.	SAQ (6 out of 8)	6 X 05 Marks = 30	30
<b>Total</b>				<b>50 Marks</b>

### Marks Scheme for the University Examination (100 Marks)

Final theory marks will be 100 marks University Theory exam pattern Elective Course

Question	Question No.	Question Type	Marks Distribution	Marks
Sec: A	1.	LAQ (10 out of 12)	10 X 10 Marks = 100	100
<b>Total</b>				<b>100 Marks</b>

### Practical exam pattern: Total 40 marks with following breakup:

Exercise	Description	Marks
Q No 1	Practical exercise - 1	1 x 15=15 M
Q No 2	Station exercise	2 x 5M=10 M
Q No 3	Viva	10M
Q No 4	Journal/ Logbook	5M
<b>Total</b>		<b>40 Marks</b>

**Practical exam pattern for Research Methodology & Biostatistics (Core course)****Total 50-marks distribution:**

<b>Exercise</b>	<b>Description</b>	<b>Marks</b>
Q No 1	<b>Practical/Problem-Solving:</b> These questions can assess statistical analysis, research design, hypothesis testing, or interpretation of data etc	2 × 10 marks each) = <b>20 marks</b>
Q No 2	Identification of study designs, Critical appraisal of research papers, Application of biostatistical tools, Sampling techniques etc	(4 × 5 marks each) = <b>20 marks</b>
Q No 3	<b>Viva Voce (Oral Examination)</b> Assessing conceptual clarity, application of research methodology, and statistical reasoning.	<b>10 marks</b>
<b>Total</b>		<b>50 Marks</b>

**Practical to be conducted at respective departments and marks submitted jointly by the parent department to the university.**

**Breakup of theory IA calculation for 20 marks**

<b>Description</b>	<b>Marks</b>
Internal exam (at department)	15 marks
Seminar	5 marks
<b>Total</b>	<b>20 Marks</b>

**Breakup of practical IA calculation:**

<b>Description</b>	<b>Marks</b>
Internal exam (at department)	10 marks
Viva	5 marks
Journal/ Logbook	5 marks
<b>Total</b>	<b>20 Marks</b>

**Note** –20 marks of practical to be converted to 10 marks weightage for submission to the university.

**Model Checklist for Evaluation of the Clinical Directed Posting (PG)**

Name of the student: \_\_\_\_\_ Date: \_\_\_\_\_

Program: \_\_\_\_\_

Semester: \_\_\_\_\_ Name of the Internal faculty/Observer: \_\_\_\_\_

Name of the External Faculty/Observer: \_\_\_\_\_

Core Competencies		
	Marks allotted	Marks obtained
Students will begin to develop critical thinking abilities utilizing the allied health personnel roles of communicator and caregiver. Students will learn principles of professional allied health personnel practice and provide direct care to individuals within a medical surgical setting while recognizing the diverse uniqueness of individuals with health alterations.		
<b>Clinical Teaching</b>		
a. Demonstrate beginning competency in technical skills.	10	
<b>Independent Work by Student guided by faculty</b>		
a. Develop effective communication skills (verbally and through charting) with patients, team members, and family	2.5	
b. Identify intra and inter-professional team member roles and scopes of practice. Establish appropriate relationships with team members.	2.5	
<b>Hands on practical work by students</b>		
a. Protect confidentiality of electronic/manual health records data, information, and knowledge of technology in an ethical manner	05	
<b>Independent work by student</b>		
a. Demonstrate expected behaviors and complete tasks in a timely manner. Arrive to clinical experiences at assigned times. Maintain professional behavior and appearance.	05	
<b>Log book</b>	10	
<b>Viva</b>	10	
<b>Attendance</b>	05	
<b>Total</b>	<b>50 Marks</b>	

Sign of Internal Examiner: \_\_\_\_\_

Sign of External Examiner: \_\_\_\_\_



# MGM INSTITUTE OF HEALTH SCIENCES

(Deemed to be University u/s 3 of UGC Act, 1956)

**Grade 'A' Accredited by NAAC**

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