



A Curriculum

For

**M.Sc. Medical Technology
(Medical Laboratory Technology)**

**Smt. L. P. Patel Institute of Medical Laboratory Technology
(A constituent Institute of Bhaikaka University)**

(Academic Year 2024-25)

Vision

“We will shine as an accredited center of excellence in the field of medical laboratory technology and prepare health care professionals of global relevance who will create disruptive innovations.”

Mission

- To create work environment so that the institute becomes a destination for faculty with skills set to promote research, innovations and start up.
- To develop networking with industry and academia for start ups and innovations and start up.
- To provide educational experiences so that students develop critical thinking and sprit of inquiry.
- To produce experts with practical skills, capacities so that they will work as members and leaders of effective teams.

SUBJECT CURRICULUM

Discipline	Medical Technology
Program	M.Sc. Medical Technology
Specialization	Medical Laboratory Technology
Subject Code	---
Tenure	2 years
Last Revised	July 2024

NOTIFICATION

Subject: Regulations and Curriculum pertaining to M.Sc. Medical Technology [MLT] Program

In exercise of the power conferred under section 22(3) of the Gujarat State Private Universities Act 2009, the Academic Council in its 9th meeting held on 22nd August 2024 Under the agenda item no. 24.02.10 is pleased to approve the curriculum of M.Sc. Medical Technology [MLT] Program at Bhaikaka University.

The curriculum shall come into force from the Academic Year 2024-2025.

**By Order,
REGISTRAR**

ACADEMIC REGULATIONS

1. TITLE OF THE PROGRAM:

This program shall be called as per the name given below under the discipline of Medical Technology at Bhaikaka University, Karamsad. It comes into effect from the Academic Year 2024-25. The relevant regulatory bodies reserve the right to make changes to the regulations at any period of time.

Name of the program shall be; M. Sc. Medical Technology (Medical Laboratory Technology)

2. ELIGIBILITY FOR THE ADMISSION:

M.Sc. MT (Medical Laboratory Technology): The candidate who has passed B.Sc. with Medical Technology (any specialty) or B.Sc. with Microbiology/ Biochemistry/ Zoology/Botany/Physics/Chemistry/ Biotechnology/Genetics/Environmental Science/ Industrial microbiology/ Home science (F&N or F.Sc. & Q.C.) from any recognized university.

3. DURATION OF THE PROGRAM:

Duration of the program M.Sc. in Medical Technology (Medical Laboratory Technology) will be 2 (two) academic years.

4. MEDIUM OF INSTRUCTION:

English will be the medium of instruction for all the subjects and also for the examination of the program.

5. METHOD [S] OF INSTRUCTIONS:

- This program shall include teaching through lectures, practical, demonstration, group discussion, individual learning, kinesthetic or participative learning through traditional methods or by using ICT tools.
- Structured problem-based exercises shall be provided to simulate specific case examples
Audio visual material and/or printed handouts shall be provided to supplement reading and classroom instruction.

6. CREDIT SYSTEM:

This program will have a curriculum in which every course will be assigned certain credits reflecting its weight and contact periods per week as given below:

1 lecture (L)/week (15 Hours) * = 1 credit

1 Tutorial (T)/week (15 Hours) * = 1 credit

1 Practical (P)/week (30 Hours) * = 1 credit

* 1 credit of class room theory, tutorial and demonstration is equal to 15 hours of engagement in a year and 1 credit of practical class is equal to 30 hours of engagement in a year. In addition to theory and laboratory practicals there may be other courses such as seminar. Clinical training/Hospital posting, projects etc., which will be assigned credits as per their contribution in the program without regards to contact periods.

7. ELIGIBILITY TO APPEAR IN ANNUAL EXAMINATION:

- The student must have attended at least 75% of the total classes conducted in each course of the year separately in theory, practical and clinical postings.
- The students must have secured 45% of the total marks in each course of the academic year separately in theory and practical to be eligible to appear in annual examination.

8. ASSESSMENT:

- Assessments should be completed by the academic staff, based on the compilation of the student 's theoretical & clinical performance throughout the education program. To achieve this, all assessment forms and feedback should be included and evaluated.

8.1 INTERNAL ASSESSMENT

- Internal assessment shall be done based on continuous evaluation of the student. It includes mainly two internal examinations (one terminal examination & one preliminary examination). It may also include several unit tests and assignments submitted by the students throughout the year in each subject of the program. In order to award the internal marks in theory and practical, the average of the two internal examinations as well as unit tests, assignments, attendance and participation in curricular/extra-curricular activities shall be considered.

8.2 EXTERNAL ASSESSMENT

- External assessment shall include theory and practical examinations conducted as a part of the annual examinations of each subject (course) as per the schedule decided by the college and university.
- The scheme of question paper for theory and practical examinations will be as prescribed by the regulatory body.

9. ACADEMIC PROGRESSION:

- The student will be allowed to appear for the annual examination of the second year if he/she has not cleared any of the courses of the first year of the program.
- These rules will be strictly applicable and no complaint/request will be entertained from the students who may be detained under any of the disciplinary action.

10. DISSERTATION:

- Each candidate pursuing M.Sc. MT (MLT) program is required to carry out dissertation work on selected research project under the guidance of a recognized postgraduate teacher of the institute. The results of such a work shall be submitted in the form of dissertation thesis / research project.
- The dissertation/ research project is aimed to train a graduate student in research methods and techniques. It includes identification of problem, formulation of a hypothesis, search and review of literature, getting acquainted with recent advances, designing of a research study, collection of data, critical analysis, interpretation of results and drawing conclusions.
- Every candidate shall submit the research proposal to the IEC/College/Academic of the University in the prescribed performa, a synopsis containing particulars of proposed dissertation/ research project work within six months from the date of commencement of the course on or before the date notified by the Institute.

- The synopsis shall be sent after duly signed by the candidate, research guide and head of the institute subjected to get approval from the Institutional Ethics Committee (IEC)
- No change in the dissertation topic/ research project or guide shall be made without prior approval of the IEC/University.
The dissertation/ research project should be written under the following headings:

- Introduction
- Aims or objectives of study
- Review of literature
- Methodology
- Result
- Discussion
- Conclusion
- Summary
- References
- Tables
- Annexure

- The written text of dissertation/ research project shall not be less than 50 pages and shall not exceed 100 pages excluding references, tables, questionnaires and other annexure. It should be neatly typed in double line spacing on one side of paper (A4 size, 8.27" x 11.69") and bound properly. Spiral binding should be avoided. A declaration by the candidate for carrying out research work should also be included, and the guide, head of the department and head of the institution shall certify the dissertation/ research project.
- Four copies of Dissertation/ research project shall be submitted to the Institute/university, through proper channel, along with a soft copy (CD), 1 months on or before the Preliminary examination. It shall be assessed by two examiners appointed by the university, one internal and one external. 100 marks shall be awarded for Dissertation/ research project. Acceptance of the dissertation/ research project is a pre-requisite for a candidate to be permitted to appear for final examination. If there are corrections in the dissertation / research project suggested by the examiner(s), the candidate may make such corrections and may be allowed to re-submit in time and if approved can appear for the examination.

11. AWARD OF GRADES:

- The student must secure minimum 45 % of marks in theory and practical examination separately to pass in the final University Examination.
- In case a student fails to secure minimum 45% marks in any theory or practical course, he/she shall reappear for the supplementary examinations or the annual examination of that course. However, his/her marks of the internal assessment shall be carried over and he/she shall be entitled for the grade obtained on passing.

11.1. ALLOCATION OF GRADE POINTS:

The student shall be awarded a final letter grade at the end of the academic year for each course as per the table shown below;

Table 1: Letter grades and Grade Points

Letter Grade	Grade Points	Marks
O (Outstanding)	10	≥90
A+ (Excellent)	9	85-89
A (Very Good)	8	75-84
B+ (Good)	7	65-74
B (Above Average)	6	55-64
C+ (Average)	5	45-54
F (Fail)	4	<45
Ab (Absent)	0	--

11.2 DECLARATION OF CLASS:

The class shall be awarded on the basis of CGPA as follows;

Class	CGPA
First Class with Distinction	≥ 7.50
First Class	6.00 to 7.49
Second Class	4.8 to 5.59
Pass Class	<4.8

11.3 DECLARATION OF CLASS:

- The class shall be awarded on the basis of following;

Class	Details
First Class with Distinction	A successful candidate obtaining 75% and more marks of the grand total aggregate in the first attempt shall be declared to have passed these subjects with Distinction
First Class	A successful candidate obtaining 60% and more and less than 75% of the marks of the grand total aggregate in the first attempt shall be declared to have passed these subjects with first class
Second Class	A successful candidate obtaining 50% and more and less than 60% of the marks of the grand total aggregate in the first attempt shall be declared to have passed these subjects with Second class
Pass Class	Those candidates who do not fall in any above criteria's, but fulfil the requirement of passing of the whole course, will be shown as "PASS" in the grade card/mark sheet

12. PROGRAM OUTCOMES:

PO1: Improvement and understanding of paramedical science:

Students will make use of their subject-matter expertise to effectively render healthcare services.

PO2: Patient treatment methods and clinical services:

Students will use fundamental scientific concepts to choose pertinent investigations while offering patient care in an effective and economical manner. They ought to establish plans for sickness avoidance alongside healthcare improvement.

PO3: Intellectual proficiency:

The student will be competent to supervise diagnostics and clinical administration procedures and troubleshoot concerns.

PO4: Aptitudes for interaction:

In order to give stakeholders and the healthcare team pertinent information, students will be able to express themselves concisely and adaptably. They will be provided with purposeful counseling approaches to promoting lifestyle changes that will optimize health.

PO5: Research/ Exploration (investigation):

The ability for students to think critically on their own will be significant, as will be their ability to communicate verbally as well as in writing.

PO6: Ethics and accountability:

Students will comprehend the fundamental principles of clinical ethics and legislation so they may use them in their practice as healthcare practitioners.

Students should be able to:

- Describe and apply the fundamental ideas of clinical ethics to real-world scenarios and circumstances
- To provide patients with access to healthcare resources fairly, equally, and without bias, discrimination, or undue influence.
- Establish an understanding and effectively apply fundamental legal principles to their practice.
- Embrace professional responsibility for the beginning, maintaining, and closure of patient-provider conversations.

PO7: Leadership, mentorship and teamwork:

Where necessary, the student must assume a leadership position to assure optimal clinical outcomes and patient satisfaction. They must be able to effectively manage both themselves and other people, as well as respond to planned and unknown circumstances on their own and with confidence.

PO8: Responsibility and public accountability

The students will be exposed to community service that is guided by study and the practice of medicine. They will encourage creative solutions to effectively address community requirements. They will do their duties with a focus towards an emerging and enduring healthcare system.

PO9: Sustainability and the surroundings

Students will apply effective biological waste management and disposal strategies in order to preserve the environment, community wellness, and safety.

PO10: Continuous learning

The student should be committed to continuous improvement in skills and knowledge while harnessing modern tools and technology.

Program objectives will aim at making the students being able to:

- Perform objective self-assessments of their knowledge and skills; learn and refine existing skills; and acquire new skills
- Apply newly gained knowledge or skills to patient care
- Enhance their personal and professional growth and learning by constant introspection and utilizing experiences
- Search (including through electronic means), and critically evaluate medical literature to enable its application to patient care
- Develop a research question and be familiar with basic, clinical and translational research in its application to patient care

Name of the Institute: Smt. L.P.Patel Institute of Medical Laboratory Technology

Name of the Program: M.Sc. in Medical Technology (Medical Laboratory Technology)

Year of the Program: First year

Total Regular Subjects	07
Total Credit	40

CURRICULUM & CREDIT FRAME WORK

Course Code	Course Title	Hours Per Week			Marks		Total Marks	Credit
		L	T/D	P	Internal	External		
Core Courses		L	T/D	P	Internal	External		
24MCL0101	Basics of Clinical Pathology, Histopathology, Hematology & Immunohematology	4	--	--	30	70	100	4
24MCL0102	General Biochemistry	4	--	--	30	70	100	4
24MCL0103	Microbiology -Basic	4	--	--	30	70	100	4
24MRM0101	Bio-statistics & Research Methodology	2	--	--	20	40	60	2
24MCL0104	Practical: Pathology	---	1	2	20	40	60	2
24MCL0105	Practical: Biochemistry	---	1	2	20	40	60	2
24MCL0106	Practical: Microbiology	---	1	2	20	40	60	2
24MCL0107	Clinical Laboratory Education (studentship)	--	20	--	100	--	100	20
Total		14	23	6	270	370	640	40
Total hours		1280						

Name of the Institute: Smt. L.P.Patel Institute of Medical Laboratory Technology

Name of the Program: M.Sc. in Medical Technology (Medical Laboratory Technology)

Year of the Program: Second year

Total Regular Subjects	07
Total Credit	40

CURRICULUM & CREDIT FRAME WORK

Course Code	Course Title	Hours per week			Marks		Total Marks	Credit
		L	T/D	P	Internal	External		
Core Courses								
24MCL0201	Clinical Hematology, histopathology & Cytology	4	--	--	30	70	100	4
24MCL0202	Clinical Pathology (applied & Blood Banking)	4	--	--	30	70	100	4
24MCL0203	Clinical Biochemistry	4	--	--	30	70	100	4
24MCL0204	Systemic & Clinical Microbiology	4	--	--	30	70	100	4
24MCL0205	Practical: Clinical Pathology & Histopathology	--	1	2	30	70	100	2
24MCL0206	Practical: Clinical Biochemistry	--	1	2	30	70	100	2
24MCL0207	Practical: Microbiology	--	1	2	30	70	100	2
24MCL0208	Dissertation	--	12	--	--	--	100	12
24MCL0209	Clinical Laboratory Education (studentship)	--	06	--	--	--	100	6
Total		16	21	6	210	490	900	40
Total hours		1280						40

Note:

1) Abbreviations: L-Lecture, T-Tutorial, D-Demonstration and P-Practical

2) Considering eight months per academic year as working months, total contact hours per year shall be 1280 (One thousand two hundred and eighty)

3) The Annual Theory Examination of all Core Courses shall be of 03 hours except the course 23BRM0101 Bio-statistics & Research Methodology which shall be of 02 hours.

**Detailed Curriculum
of
M.Sc. Medical Technology
(Medical Laboratory Technology)**

First Year

Subject Code- 24MCL0101

Subject Name: Basics of Clinical Pathology, Histopathology, Haematology and Immunohematology

Name of the Institute: Smt. L.P. Patel Institute of Medical Laboratory Technology

Name of the Program: M.Sc. in Medical Technology (Medical Laboratory Technology)

Year of the Program: Year 1

Course Code	24MCL0101	Total Credit	4
Title of Subject	Basics of Clinical Pathology, Histopathology, Haematology and Immunohematology	Total Hours/Week	4 Hours
Course Objectives	<ul style="list-style-type: none">● Develop a comprehensive understanding of the anatomy and physiology of the urinary and intestinal tracts, and acquire skills in the collection, preservation, and examination of urine and stool specimens using both traditional and automated methods.● Gain a deep understanding of the anatomy, physiology, and formation of cerebrospinal fluid (CSF) and other body fluids, focusing on their normal constituents and clinical significance.● Acquire essential knowledge in histopathology, including the proper techniques for the collection, handling, and fixation of tissue specimens, and the use of instruments and reagents in histological analysis.● Understand the composition and functions of blood, the cardiovascular system, and the mechanisms of hemostasis, with a focus on the roles of the bone marrow, liver, and spleen.● Understand the processes of hematopoiesis, erythropoiesis, leucopoiesis, and thrombopoiesis, along with the use of hematological instruments, blood collection techniques, and the application of anticoagulants and stains in hematological analysis.● Develop a thorough understanding of immunohematology, including the principles of blood group systems (ABO, Rh, Bombay, etc.) and their clinical relevance in transfusion medicine.		
Course Content			
Unit	Description	Weightage	
1	Urine & Stool: Anatomy and physiology of urinary tract 1.1 Formation of urine 1.2 Anatomy, physiology of intestinal tract Urine and Stool Examination: Indications, Collection Methods, Preservation, Physical, Chemical & Microscopic examination, Automation in Urinalysis	18%	

2	<p>Body fluids:</p> <p>2.1 CSF: Anatomy and Physiology of meninges, Formation and Circulation, Normal Constituents</p> <p>2.2 Other body fluids: Anatomy, physiology and formation of Pleural, Pericardial, Peritoneal, Synovial, Seminal and Gastric fluid, Normal Constituents</p>	14%
3	<p>Histopathology:</p> <p>3.1 Introduction to histology, histopathology</p> <p>3.2 Instruments and reagents used in histopathology</p> <p>3.3 Collection, Handling, Grossing and Labelling of tissue specimen</p> <p>Fixation and Fixatives: Definition, Aims, Methods, Properties, Classification, Preparation, Uses, Advantages and Disadvantages</p>	18%
4	<p>Physiology of Blood</p> <p>4.1 Composition and functions of blood</p> <p>4.2 Anatomy and Physiology of cardio-vascular system</p> <p>4.3 R.E. System: Functions, Components, Structure and Role of bone marrow, liver, spleen</p> <p>4.4 Principle and mechanisms of normal hemostasis</p> <p>4.5 Plasma coagulation factors</p> <p>4.6 Mechanism and stages of coagulation, Fibrinolysis</p>	15%
5	<p>Hematology</p> <p>5.1 Hematopoiesis: Definition, Cell hierarchy, Sites, Process and Regulation</p> <p>5.2 Erythropoiesis: Definition, Stages with morphology, Requirements, Regulation</p> <p>5.3 Leucopoiesis: Definition, Agranulopoiesis, Granulopoiesis, Stages with morphology, Regulation</p> <p>5.4 Thrombopoiesis: Definition, Stages with morphology, Regulation, Ultrastructure of platelets</p> <p>5.5 Destruction of blood cells</p> <p>5.6 Structure of hemoglobin: Heme & Globin</p> <p>5.7 Red cell membrane</p> <p>5.8 Instruments in hematology</p> <p>5.9 Blood collection: Arterial sampling, Venipuncture, Vacutainer Method, Finger stick method</p> <p>5.10 Anticoagulants: Types, Preparation, Mode of action, Uses, Advantages and Disadvantages</p> <p>5.11 Diluting haematological fluids</p> <p>5.12 Haematological stains</p>	20%

6	Immunohematology & Blood group systems 6.1 Principle of Immunohematology, Red Cell Antigens, Natural and Immune Antibodies 6.2 ABO Blood Group System: Formation of ABO antigens, ABO antibodies, Blood Group Genetics 6.3 Rhesus (Rh) Blood Group System 6.4 Bombay and Para Bombay Blood Group, Other blood group systems and clinical importance	15%
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List of Reference Books

1	Clinical hematology: Wintrobe's
2	De-Gruchy's Clinical hematology in medical practice: Franki
3	Practical hematology: Dacie & Lewis
4	Blood banking and transfusion medicine: Makroo
5	Hematology for students and practitioners: Dr. Ramnik Sood
6	Clinical Diagnosis and management by laboratory methods: John Bernard Henry (20th Edi.)

Course Outcome: At the end of the course, Students will be able to:

C01	To accurately collect, preserve, and analyze urine and stool samples using both traditional and automated methods, applying their knowledge of the urinary and intestinal tracts to interpret results.
C02	To describe the formation, normal constituents, and clinical importance of cerebrospinal fluid and other body fluids, applying this understanding in laboratory analysis and diagnosis.
C03	To be proficient in the collection, handling, and fixation of tissue specimens, and will be able to use histological instruments and reagents effectively for accurate tissue analysis.
C04	To demonstrate a solid understanding of blood composition and function, including the mechanisms of hemostasis, and will be able to relate these concepts to the roles of the cardiovascular and reticuloendothelial systems.
C05	To develop skill in performing hematological tests, including the processes of hematopoiesis, erythropoiesis, leucopoiesis, and thrombopoiesis, and will be competent in using hematological instruments, blood collection techniques, and stains.
C06	To develop thorough understanding of blood group systems and immunohematology, enabling them to apply this knowledge in the context of blood transfusions and other clinical practices related to transfusion medicine.

Examination Scheme				
Continuous Assessment (30 marks)			External	Total
Internal examinations	Projects / Assignments	Attendance	Annual examination	
20	05	05	70	100

Course Code: 24MCL0102
Subject Name: General Biochemistry

Name of the Institute: Smt. L.P. Patel Institute of Medical Laboratory Technology

Name of the Program: M.Sc. in Medical Technology (Medical Laboratory Technology)

Year of the Program: Year 1

Course Code	24MCL0102	Total Credit	4
Title of Subject	General Biochemistry	Total Hours/Week	4 Hours
Course Objectives	<ul style="list-style-type: none"> ● Know different fields of biochemistry with their clinical importance and recent advances. ● Know the operation, working principle and application of instruments commonly used in the clinical biochemistry laboratory. ● Know preparation, handling and storage of each reagents and samples used in clinical biochemistry laboratory. ● Explain all the bio-molecules with their physical and chemical properties and biomedical importance 		
Course Content			
Unit	Description	Weightage	
1	Introduction & General aspects 1.1 Introduction to Clinical Biochemistry 1.2 Study of weights, volumes and Units, Inter conversion of units, Measurements, Preparation of solution, Normal range 1.3 Different anticoagulants used in Clinical Biochemistry, its application and Mechanism of Action 1.4 Hazards in the Laboratory	15%	
2	General Biochemistry of Carbohydrates 2.1 Digestion and absorption 2.2 Types, functions and importance	11%	
3	General Biochemistry of Proteins 3.1 Digestion and absorption 3.2 Amino acids, Peptides, Protein, Hemoglobin, Hemoglobinopathies, Plasma Proteins, abnormalities, Collagen, Disorders of collagen, Immunoglobulins	11%	
4	General Biochemistry of Lipids 4.1 Digestion and absorption 4.2 Classification, types, function, TAG, Phospholipids other compound lipids, Cholesterol, Prostaglandins, Fatty Acids	10%	
5	Biophysics: 5.1. pH, Blood buffers maintenance of body pH, Disorders of acid base balance, Viscosity, Surface tension, Colloids, Donnan membrane equilibrium	10%	
6	Nucleic acids: 6.1 Nucleobases, Nucleosides, Nucleotides, Nucleic acids, DNA and RNAs	10%	

7	Enzymology 7.1 Definition characteristics, Factors affecting enzyme action, Enzyme inhibition, Isoenzymes	10%
8	Nutrition 8.1 Principles of nutrition, Balanced diet, BMR, Kwashiorkor, Marasmus and Obesity 8.2 Vitamins: Water and Fat Soluble Minerals: Calcium, Iron, trace elements	10%
9	Instrumentation 9.1 Automation in Clinical Biochemistry Laboratory 9.2 Colorimetry, Spectrophotometer, Chromatography, Flame photometry, Fluorimetry, Electrophoresis 9.3 Autoanalyzers, Electrolyte analyzer, Gas analyser 9.4 RIA, ELISA, Chemiluminescent.	13%

List of Reference Books:

1	Textbook of Biochemistry: D.M. Vasudevan, Sree Kumari S
2	Textbook of Biochemistry: U. Satyanarayana
3	Medical clinical biochemistry: M. N. Chatterjee
4	Clinical guide to lab test: M.M. Tietz

Course Outcome: At the end of the course, Students will be able to:

C01	To develop a basic understanding of clinical biochemistry, including unit conversions, solution preparation, the use of anticoagulants, and laboratory safety.
C02	To explain the digestion, absorption, and functions of carbohydrates, proteins and lipids understand their significance in metabolism.
C03	To develop understand key biophysical concepts such as pH, blood buffer systems, and colloidal stability, and their importance in maintaining acid-base balance.
C04	To apply nutritional principles, understand the importance of a balanced diet, and identify the consequences of malnutrition and deficiencies in vitamins and minerals.
C05	To be proficient in using various instruments and techniques in the clinical biochemistry lab, including automation, colorimetry, spectrophotometry, and immunoassays.

Examination Scheme				
Continuous Assessment (30 marks)			External	Total
Internal examinations	Projects / Assignments	Attendance	Annual examination	
20	05	05	70	100

Course Code: 24MCL0103
Subject Name: Microbiology - Basic

Name of the Institute: Smt. L.P. Patel Institute of Medical Laboratory Technology

Name of the Program: M.Sc. in Medical Technology (Medical Laboratory Technology)

Year of the Program: Year 1

Course Code	24MCL0103	Total Credit	4
Title of Subject	Microbiology - Basic	Total Hours/Week	4
Course Objectives	<ul style="list-style-type: none"> ● Understand the basic structure and function of microbes, including differences between prokaryotes and eukaryotes, and explore the normal microflora of the human body and their role in health and disease. ● Gain knowledge of the immune system, including the functions of cells and organs, immune responses, and the mechanisms of innate and acquired immunity. ● Learn about hypersensitivity reactions, immune system defects, and modern immunological techniques, including monoclonal antibodies and vaccine production. ● Identify common pathogenic parasites, understand their transmission and pathogenesis, and learn methods for infection control and disease prevention. ● Study the characteristics of medically important fungi, including staining techniques and the processing of clinical samples, with an emphasis on hospital-acquired infections and biomedical waste management. 		
Course Content			
Unit	Description	Weightage	
1	History and Classification 1.1 History and Pioneers in Microbiology: Contributions of Antony Van Leeuwenhoek, Louis Pasteur, Joseph Lister, Robert Koch (Koch's Postulates) 1.2 Bacterial Taxonomy: Nomenclature and Classification in Brief	5%	
2	Morphology and Physiology of Bacteria 2.1 Microscopy, Stained preparation, Size & Shape 2.2 Morphology of bacteria: Structures of a bacterial cell and their functions 2.3 Physiology of Bacteria: Nutrition, Gaseous requirement, temperature requirement and other growth requirements	10%	
3	General Microbiology 3.1 Sterilization and disinfection 3.2 Culture media 3.3 Culture methods 3.4 Identification of Bacteria 3.5 Antibiotic Sensitivity Testing 3.6 Bacteriology of Air and Water	15%	
4	Bacterial genetics: 4.1 Basic principles of molecular biology, Mutation, Gene transfer Molecular genetics as applicable to Medical Microbiology: (In brief) genetic engineering, DNA probe, blotting technique, Genetic mapping	5%	

5	Normal flora of human body 5.1. Role of normal microbial flora	5%
6	Infection 6.1 Sources of infection 6.2 Modes of transmission 6.3 Factors predisposing to microbial pathogenicity 6.4 Types of infectious diseases	
7	Basic Immunology - I 7.1 Antigens 7.2 Immunoglobulin 7.3 Immunity 7.4 Complement system	14%
8	Antigen and antibody reactions 8.1 General Features of antigen-antibody reaction 8.2 Precipitation, Agglutination 8.3 Complement Fixation Test 8.4 Neutralization, Opsonization 8.5 Immunofluorescence, RIA, EIA 8.6 Western Blot 8.7 Immunochromatography	
9	Basic Immunology - II Immune System & Immune response 9.1 Structure and function of Immune system: Organ and cells of immune system (In brief), Major Histocompatibility Complex 9.2 Immune Response: 9.3 Humoral Immune response, Primary & secondary immune response, Fate of antigen in tissue, Production of antibodies 9.4 Cellular Immune Response: Scope of CMI, Induction of CMI, Cytokines, 9.5 Immunological tolerance 9.6 Theories of Immune responses	10%
10	Clinical Immunology 10.1 Hypersensitivity: Classification and Immunological basis 10.2 Auto-immunity: Mechanisms and classification of auto immune disorders 10.3 Immunodeficiency Diseases: Immunological basis of Primary and secondary Immunodeficiency Diseases 10.4 Transplantation immunology: Classification of transplants, Allograft reaction, Factors favouring allograft survival, Graft-vs.-host reaction 10.5 Tumor immunology: Immune response in malignancy, Tumor antigens Immunological surveillance. Measurement of immunity	12%
11	Parasitology Morphology, life cycle, laboratory diagnosis of following parasites Protozoa: 11.1 <i>Entamoeba, Giardia, Trichomonas,</i>	12%

	11.2 <i>Leishmania, Trypanosoma,</i> 11.3 <i>Plasmodium,</i> 11.4 <i>Toxoplasma, Cryptosporidium</i> Helminthology 11.5 <i>Taenia, Echinococcus, Hymenolepis</i> 11.6 <i>Schistosomes</i> 11.7 <i>Trichuris, Strongyloides, Ancylostoma</i> <i>Ascaris, Enterobius, Wuchereria bancrofti</i>	
12	Mycology: 12.1 The morphology and reproduction in fungi 12.2 Classification of fungi Morphology, diseases caused and laboratory diagnosis of: 12.3 Opportunistic fungi - Cryptococcus, Candidiasis, Aspergillus, Zygomycetes 12.4 Fungi causing superficial mycoses- Dermatophytes 12.5 Subcutaneous mycoses – Mycetoma 12.6 Systemic infections-Blastomyces, Coccidioides, Paracoccidioides, Histoplasma	12%

List of Reference Books:

1	Text book of microbiology: Ananthnarayana & Paniker's
2	Text book of microbiology: Chakraborty
3	Microbiology: Prescott, Harley and Klein's
4	Parasitology: K.D. Chatterjee
5	Medical Lab. manual for Tropical countries: Monica Chessbrough
6	Practical Medical Microbiology: Mackey & Mac Cartney

Course Outcome: At the end of the course, Students will be able to:

C01	Develop thorough understanding of microbial structures and the role of normal microflora in human health.
C02	Grasp the functions of the immune system and its components, applying this to clinical practices.
C03	Identify immune reactions and disorders, and apply immunological techniques.
C04	Identify pathogenic parasites and implement infection control measures.
C05	Perform analysis of medically important fungi and manage hospital infections and biomedical waste.

Examination Scheme				
Continuous Assessment (30 marks)			External	Total
Internal examinations	Projects / Assignments	Attendance	Annual examination	
20	05	05	70	100

COURSE CODE: 24MRM0101**Subject Name: Biostatistics & Research Methodology**Name of the Institute: Smt. L.P. Patel Institute of Medical Laboratory TechnologyName of the Program: M.Sc. in Medical Technology (Medical Laboratory Technology)Year of the Program: Year 1

Course Code	24MRM0101	Total Credit	2
Title of Subject	Bio-statistics & Research Methodology	Total Hours/Week	2

Examination Scheme

Continuous Assessment (20 marks)			External	TOTAL
Internal examinations	Projects / Assignments	Attendance	Annual examination	
10	05	05	40	60

Course Objectives	<ul style="list-style-type: none"> ● Understand the fundamental concepts and significance of research in Medical Technology. ● Learn about different types of research designs and methodologies. ● Gain knowledge on various data collection techniques and tools. ● Understand basic statistical concepts and data analysis techniques. ● Learn about ethical issues and guidelines in research. ● Develop skills in writing research proposals, reports, and scientific papers. ● Apply research methodology concepts in designing and conducting a small-scale research project.
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Course Content

Unit	Description	Weightage
1	Introduction to Research: 1.1 Definition and purpose of research 1.2 Types of research: Basic, Applied, Clinical, and Translational 1.3 Importance of research in medical technology 1.4 The research process: Steps from idea to publication	15%
2	Research Design: 2.1 Types of research designs: Descriptive, Analytical, Experimental, Quasi-experimental 2.2 Qualitative vs Quantitative research 2.3 Cross-sectional and Longitudinal studies	20%
3	Data Collection (in brief) 3.1 Primary vs Secondary data 3.2 Data collection methods: Surveys, Interviews, Observations, Questionnaires 3.3 Tools for data collection: Designing surveys and questionnaires	15%
4	Data Analysis (in brief) 4.1 Introduction to statistical concepts: Mean, Median, Mode, Standard Deviation 4.2 Data analysis techniques: Descriptive and Inferential statistics 4.3 Interpreting and presenting data: Tables, Graphs, Charts	20%

5	Ethical Considerations in Research 5.1 Importance of ethics in research 5.2 Informed consent and confidentiality 5.3 Plagiarism and Research misconduct	15%
6	Research Writing 6.1 Structure of a research proposal: Title, Abstract, Introduction, Methodology, Results, Discussion, Conclusion, References 6.2 Referencing styles: APA, MLA, Chicago, Vancouver 6.3 Presenting research findings: Oral and Poster presentations 6.4 Writing research reports and scientific papers	15%
REFERENCE BOOKS 1. Research Methodology: A Step-by-Step Guide for Beginners" by Ranjit Kumar 2. The Practice of Research in Health Care" by Hugh McLaughlin 3. Biostatistics: A Foundation for Analysis in the Health Sciences" by Wayne W. Daniel 4. Articles from relevant medical and scientific journals		

Course Outcome: At the end of the course, Students will be able to:

C01	Apply biostatistical principles and research methodology competently for accurate data interpretation in healthcare research.
C02	Implement sampling techniques effectively, ensuring research reliability and validity.
C03	Utilize probability distributions for precise parameter estimation and inferential statistics.
C04	Conduct significance tests rigorously for hypothesis evaluation and interpretation.
C05	Employ correlation and regression analysis proficiently to predict outcomes in healthcare research.

COURSE CODE: 24MCL0104**Practical: Pathology**Name of the Institute: Smt. L.P. Patel Institute of Medical Laboratory TechnologyName of the Program: M.Sc. in Medical Technology (Medical Laboratory Technology)Year of the Program: Year 1

Course Code	24MCL0104	Total Credit	2
Title of Subject	Practical: Pathology	Total Hours/Week	2 hours (P) 1 hour (T/D)
Course Objectives	<ul style="list-style-type: none"> ➤ Familiarize students with fundamental hematological techniques, including blood collection and automated cell counting. ➤ Develop skills in performing and interpreting hematological tests accurately. ➤ Enable students to identify blood cell abnormalities through peripheral smear examination. ➤ Equip students with knowledge and techniques for specialized hematological tests. ➤ Provide hands-on experience in clinical pathology procedures and blood banking techniques. 		
Course Content			
Unit	Description	Weightage	
1	Haematology: 1.1. Microscopy 1.2. Blood Collection 1.3. Anticoagulant vacuettes 1.4. Automated cell counter 1.5. Haemoglobin Estimation 1.6. RBC count 1.7. PCV & Blood indices 1.8. ESR (Wintrobe & Westergren) 1.9. Platelet count 1.10. Total WBC count	30%	
2	Blood Banking: 2.1 Instruments 2.2. Blood Group 2.3 DU Tests	20%	
3	Clinical Pathology: 3.1. Physical examination of Urine 3.2. Chemical examination of Urine: Sugar, Protein, Ketone Bodies, Bile salt, Bile pigment, Urobilinogen, Occult Blood 3.3 Microscopic examination of Urine	30%	
4	Histopathology 4.1. Instruments 4.2. Preparation of Tissue Fixatives 4.3. Logging of Tissue Processing 4.4. Paraffin Embedding 4.5. Section Cutting	20%	

Course Outcome: At the end of the course, Students will be able to:

C01	Proficiency in accurate hematological test performance and interpretation.
C02	Effective identification and understanding of hematological abnormalities.
C03	Competence in conducting specialized hematological tests and procedures.
C04	Proficiency in blood banking techniques for clinical application.
C05	Mastery of histopathological and cytological techniques for accurate diagnosis.

Examination Scheme				
Continuous Assessment (20 marks)			External (40)	Total
Internal examinations	Projects / Assignments	Attendance	Annual examination	
10	05	05	40	60

COURSE CODE: 24MCL0105**Practical – Biochemistry**Name of the Institute: Smt. L.P. Patel Institute of Medical Laboratory TechnologyName of the Program: M.Sc. in Medical Technology (Medical Laboratory Technology)Year of the Program: Year 1

Course Code	24MCL0105	Total Credit	2
Title of Subject	Practical - Biochemistry	Total Hours/Week	2 hours (P) 1 hour (T/D)
Course Objectives	<ul style="list-style-type: none"> • Teach methods for glucose estimation, including the GOD-POD method and glucose tolerance tests. • Learn functional tests including liver function tests (bilirubin, total protein, albumin, A/G ratio, and liver enzymes), renal function tests (serum creatinine, urea, uric acid), and lipid profile analysis (cholesterol, HDL, triglycerides). • Provide training in the use of colorimetry, spectrophotometry, paper chromatography, and gel electrophoresis for biochemical analysis. 		
Course Content			
Unit	Description	Weightage	
1	1.1 Estimation of Glucose by GOD-POD method 1.2 Comparison of various methods for the estimation of glucose 1.3 Glucose Tolerance Test	30%	
2	FUNCTION TESTS 2.1 Liver function Tests: a) Estimation of Bilirubin b) Estimation of total protein, Albumin, and A/G Ratio c) Estimation of Liver enzymes: SGOT, SGPT, Alkaline phosphatase (ALP) 2.2 Renal Function Tests: a) Estimation of Serum Creatinine b) Estimation of Urea c) Estimation of Uric acid 2.3 Lipid Profile: a) Estimation of Total cholesterol b) Estimation of HDL c) Estimation of Triglyceride	40%	
3	INSTRUMENTATION 3.1 Colorimeter & Spectrophotometer 3.2 Paper Chromatography 3.3 Gel Electrophoresis	30%	

Course Outcome: At the end of the course, Students will be able to:

CO1	Accurately perform glucose estimation using the GOD-POD method and conduct glucose tolerance tests.
CO2	Demonstrate the ability to conduct and interpret functional tests, including liver function tests (bilirubin, total protein, albumin, A/G ratio, liver enzymes), renal function tests (serum creatinine, urea, uric acid), and lipid profile analysis (cholesterol, HDL, triglycerides).
CO3	Acquire proficiency in using colorimetry, spectrophotometry, paper chromatography, and gel electrophoresis for biochemical analysis.

Examination Scheme				
Continuous Assessment (20 marks)			External (40)	Total
Internal examinations	Projects / Assignments	Attendance	Annual examination	
10	05	05	40	60

COURSE CODE: 24MCL0106**Practical: Microbiology**Name of the Institute: Smt. L.P. Patel Institute of Medical Laboratory TechnologyName of the Program: M.Sc. in Medical Technology (Medical Laboratory Technology)Year of the Program: Year 1

Course Code	24MCL0106	Total Credit	2
Title of Subject	Practical: Microbiology	Total Hours/Week	2 hours (P) 1 hour (T/D)
Course Objectives	<ul style="list-style-type: none"> ➤ Develop proficiency in aseptic techniques and laboratory safety practices. ➤ Master the preparation and pouring of various culture media for bacterial growth. ➤ Gain practical skills in operating autoclaves, ovens, and other sterilization equipment. ➤ Learn techniques for specimen collection, preparation, staining, and examination for microbial identification. ➤ Acquire competence in antimicrobial susceptibility testing, bacterial identification, and maintenance of bacterial cultures. 		
Course Content			
Unit	Description	Weightage	
1	<p>Bacteriology</p> <p>1.1. Aseptic practices in laboratory and safety precautions 1.2. Preparation and pouring of media – Nutrient agar, Blood agar, Mac Conkey agar, Sugars, Serum sugars, TSI, Robertsons cooked meat, Lowenstein Jensens, Sabouraud dextrose 1.3. Operation of autoclave and hot air oven, 1.4. Washing and sterilization of glassware (Plugging and packing) 1.5. Preparation of reagent – Oxidase, Kovac’s, etc. 1.6. Disposal of contaminated materials like cultures. 1.7. Quality control of media, reagents etc. 1.8. Care and maintenance of common laboratory equipment like water bath, centrifuge, refrigerators, incubators, etc. 1.9. Collection of specimens for Microbiological investigations such as Blood, Urine, Pus (Swabs), OT specimens. 1.10. Preparation of stains viz. Gram, Alberts, Ziehl Neelsen (ZN) etc. and performing of staining. 1.11. Care and operation of Microscopes viz. Light and Fluorescent microscopes. 1.12. Tests for motility: hanging drop preparation</p> <p>Tutorial/Demo</p> <ul style="list-style-type: none"> • Testing of disinfectants- phenol coefficient and “in use” tests • Collection of specimens for Microbiological investigations such as Throat swab, Rectal swab • Techniques of anaerobiosis, anaerobic jars, evacuation and filling with 	50%	

	CO ₂ and H ₂ <ul style="list-style-type: none"> • Preparation of stains viz., capsules, spores etc. and performing of staining • Care and operation of Dark Ground and Phase contrast Microscopes • Skin tests like Mantoux, Lepromin etc. 	
2	Mycology 2.1. Collection of specimens 2.2. Direct Examination of specimens by KOH, Gram, Lactophenol Cotton Blue stains. Tutorial/Demo <ul style="list-style-type: none"> • Special techniques like Wood's Lamp examination, hair baiting, hair perforation, paraffin baiting and slide culture. 	25%
3	Parasitology: 3.1. Examination of faeces for parasitic ova and cysts etc. by direct and concentration methods (Salt flotation and Formol-Ether methods) 3.2. Examination of blood for protozoa and helminths by wet mount, thin and thick stained smears 3.3. Staining Procedure: Leishman, Giemsa Tutorial/Demo <ul style="list-style-type: none"> • Collection of specimens • Preservation of parasites-mounting, fixing, staining, etc. • Serodiagnosis of parasitic infection 	25%

Course Outcome: At the end of the course, Students will be able to:

C01	Ability to maintain aseptic conditions and ensure safety in the laboratory environment.
C02	Proficiency in preparing and using culture media for bacterial growth and identification.
C03	Skill in specimen collection, processing, and microscopic examination for microbial detection and identification.
C04	Competence in performing antimicrobial susceptibility tests and interpreting results.
C05	Mastery in bacterial identification techniques and maintenance of bacterial cultures for further study and analysis.

Examination Scheme				
Continuous Assessment (20 marks)			External	Total
Internal examinations	Projects / Assignments	Attendance	Annual examination	
10	05	05	40	60

**Detailed Curriculum
Of
M.Sc. Medical Technology
(Medical Laboratory Technology)
Second Year**

COURSE CODE: 24MCL0201**Subject: Clinical Hematology, Histopathology & Cytology**Name of the Institute: Smt. L.P. Patel Institute of Medical Laboratory TechnologyName of the Program: M.Sc. in Medical Technology (Medical Laboratory Technology)Year of the Program: Year 2

Course Code	24MCL0201	Total Credit	2
Title of Subject	Clinical Haematology, Histopathology & Cytology	Total Hours/Week	2
Course Objectives	<ul style="list-style-type: none"> ➤ Have knowledge of routine haematological tests and special red cell tests ➤ To learn about preparation of peripheral blood smears and morphology of blood cells ➤ Have knowledge on automation and quality control in haematology ➤ Have knowledge on disorders of red cells and white cells with laboratory diagnosis ➤ To learn about disorders of haemostasis with their laboratory diagnosis ➤ To learn about histopathological and cytological process in detail ➤ Have knowledge on automation and quality control in histopathology and cytology 		
COURSE CONTENT			
Unit	Description	Weightage	
1	<p>Clinical Hematology</p> <p>1.1 Routine Hematological Tests:</p> <p>1.1.1 Complete Blood Count</p> <p>1.1.2 Estimation of Hb</p> <p>1.1.3 Estimation of Erythrocyte Sedimentation Rate</p> <p>1.1.4 Packed cell volume</p> <p>1.1.5 Red Blood Cells Indices</p> <p>1.2 Peripheral Blood Smear:</p> <p>1.2.1 Indications, Types, Procedure, Staining methods, Preparation of different stains</p> <p>1.2.2 Automation in PS preparation</p> <p>1.2.3 PS Examination for red blood cells, different white blood cells; normal and abnormal morphology, platelets and parasites</p> <p>1.3 Bone Marrow Examination:</p> <p>1.3.1 Indications, Methods, Procedure, Contradictions, Complications and Evaluation, Bone Marrow Transplantation (in brief)</p> <p>1.4 Special Red Cell Tests:</p> <p>1.4.1 Sickling tests, Red cell fragility test, LE cell test, Foetal Hemoglobin Estimation and Hemoglobin electrophoresis.</p>	25%	

	<p>1.5 Automation in hematology</p> <p>1.5.1 Definition, Types of analyzers, Principles of working, Automated Blood Cells Counter, Interpretation of hemogram and histogram, Flow cytometry, Automated ESR, Automated Coagulometers, Diagnostic Molecular techniques in hematology, HPLC in the diagnosis of hemoglobinopathies,</p> <p>1.5.2 Quality control in hematology</p>	
2	<p>2.1 Disorders of Red Cells and White Cells</p> <p>2.1.1 Anemia: Definition, Classification, Clinical features and Laboratory diagnosis of Iron Deficiency Anemia, Megaloblastic Anemia, Hemolytic Anemia, Immune Hemolytic Anemia, Thalassemias and Sickle Cell Anemia in brief.</p> <p>2.1.2 Leukemia: Definition, Classification, Clinical features and Laboratory diagnosis of Acute Leukemias and Chronic Leukemias. Polycythemia vera and Multiple myeloma in brief.</p>	15%
3	<p>Disorders of Haemostasis</p> <p>3.1 Platelet disorders and Vascular Purpuras</p> <p>3.2 Disorders of coagulation- Inherited and Acquired</p> <p>3.3 Laboratory tests to detect coagulation defect</p>	10%
4	<p>Histopathology</p> <p>4.1 Tissue processing, Embedding and Blocking: Dehydration, Clearing, Impregnation, Embedding, Types of embedding medium and moulds, preparation of block, methods of tissue processing: automated & manual</p> <p>4.2 Decalcification: Definition, Methods, Decalcifying fluid, Factors affecting</p> <p>4.3 Microtomy: Definition, Types, use and troubleshooting in microtomes, Microtome knives, Methods of sharpening, Techniques of section cutting, Tissue Flotation, Section Adhesives</p> <p>4.4 Staining: Principle, preparation, Hematoxylin and Eosin stain, IHC, FISH, Special Stains</p> <p>4.5 Mounting: Aim, principle, types of mounting media, technique, Museum Techniques</p> <p>4.6 Frozen section and Cryostat: Application, construction and use</p>	25%
5	<p>Cytology</p> <p>5.1 Instruments, Techniques, Fixatives and Stains in Cytology</p> <p>5.2 Exfoliative Cytology</p> <p>5.3 Effusion Cytology</p> <p>5.4 Fine Needle Aspiration Cytology (FNAC)</p> <p>5.5 Liquid Biopsy</p>	15%
6	<p>Automation in Histopathology and Cytology</p> <p>6.1 Introduction, Benefits, Automated Instruments in Histopathology, Uses.</p> <p>6.2 Automation in Cervical Cytology & Molecular cytogenetics</p> <p>6.3 Quality control in Histopathology & Cytology</p>	10%

List of Reference Books :

1	Clinical hematology: Wintrobe's
2	Textbook of Histopathology : Laxminarayana
3	Practical hematology: Dacie & Lewis
4	Blood banking and transfusion medicine: Makroo
5	Hematology for students and practitioners: Dr. Ramnik Sood
6	Clinical Diagnosis and management by laboratory methods: John Bernard Henry (20th Edi.)

Course Outcome: At the end of the course, Students will be able to:

C01	Perform routine hematological and special red cell tests, both manually and using automated systems, and explain the clinical significance of the test results.
C02	Prepare and analyze peripheral blood smears, identify normal and abnormal cells, and explain the clinical relevance of their findings.
C03	Explain the indications and procedures for bone marrow examination, prepare bone marrow smears, and interpret the clinical significance of the findings.
C04	Perform the laboratory diagnosis of anemia and leukemia and interpret relevant test results.
C05	Describe disorders of hemostasis, perform coagulation tests, and accurately interpret the results to detect coagulation defects.
C06	Competently perform all steps in histological and cytological analysis, both manually and using automated instruments.
C07	Demonstrate a solid understanding of automation and quality control practices in histopathology and cytology.

Examination Scheme				
Continuous Assessment (30 marks)			External (70 Marks)	Total
Internal examinations	Projects / Assignments	Attendance	Annual examination	
20	05	05	70	100

COURSE CODE: 24MCL0202**SUBJECT: Clinical Pathology (Applied & Blood Banking)**Name of the Institute: Smt. L.P. Patel Institute of Medical Laboratory TechnologyName of the Program: M.Sc. in Medical Technology (Medical Laboratory Technology)Year of the Program: Year 2

Course Code	24MCL0202	Total Credit	4
Title of Subject	Clinical Pathology (applied & Blood Banking)	Total Hours/Week	4
Course Objectives	<ul style="list-style-type: none"> • Understand abnormal findings in urine, stool, and body fluids, and learn proper collection and examination techniques • Learn about advancements in clinical pathology, including fluid examinations, infertility diagnostics, pregnancy tests, and automation. • Gain knowledge of blood center operations, blood grouping techniques, and recent blood banking technologies. • Understand blood transfusion practices, donor management, and the investigation of transfusion reactions. 		
Course Content			
Unit	Description	Weightage	
1	Analysis of Urine, Stool and Body fluids 1.1 Abnormal urine and stool findings in various diseases 1.2 CSF: Collection, Preservation of sample, Physical, Chemical and Microscopic examination, Special Tests, Abnormal CSF findings in various diseases. 1.3 Pleural, Pericardial, Peritoneal and Synovial fluid: Collection of sample, Indications, Physical, Chemical and Microscopic examination with clinical correlation of abnormal findings, Special tests	30%	
2	Recent advances and Automation in Clinical Pathology 2.1 Seminal fluid examination: Indications, Methods of collection, Preservation and Transportation, Physical, Chemical and Microscopic Examination, Special Tests 2.2 Infertility: Introduction, Causes and Laboratory diagnosis of Male and Female Infertility, Assisted Reproductive Technology, Artificial Insemination, In-vitro fertilization 2.3 Pregnancy Test: Introduction of hCG, Clinical applications of tests for hCG, Laboratory tests for hCG (Bioassays, Immunologic assays) 2.4 Automation in clinical pathology, Digital Pathology, Current and future application of Artificial Intelligence in pathology 2.5 Quality control in Clinical Pathology	20%	
3	Unit 3: Blood Banking 3.1 Organization and Operation of Blood Centre: Objectives and functions of the blood centre, Organization of blood centre, Apparatus used in blood centre, its care and cleaning, Record Keeping. 3.2 Techniques of ABO and Rh blood grouping, Du test 3.3 Cross match: Types, Principle, Procedure and Application 3.4 Coomb's test: Types, Principle, Techniques and Application 3.5 Recent Advances in Blood Banking: Automation in Blood Banking,	25%	

	Gel Technology, Stem Cells Banking, Artificial Blood, Molecular typing, LIS in blood bank, Tissue banking in brief 3.6 Quality control in blood banking	
4	Unit 4: Blood Transfusion Medicine 4.1 Donor selection and deferrals 4.2 Screening of donor 4.3 Tapping of Donor, Post donation complications and management in brief 4.4 Types of blood bags and Anticoagulants used in blood bags 4.5 Storage of blood 4.6 Transfusion Transmitted Diseases and Prevention 4.7 Pre-Transfusion Testing 4.8 Blood component therapy 4.9 Apheresis, Exchange Transfusion 4.10 Blood Transfusion Reactions and investigation for the detection of BTR 4.11 Hemolytic Disease of Newborn: Types, Causes, Pathogenesis and Laboratory investigations	25%

List of Reference Books :

1	Clinical hematology: Wintrobe's
2	Textbook of Histopathology : Laxminarayana
3	Practical hematology: Dacie & Lewis
4	Blood banking and transfusion medicine: Makroo
5	Hematology for students and practitioners: Dr. Ramnik Sood
6	Clinical Diagnosis and management by laboratory methods: John Bernard Henry (20th Edi.)

Course Outcome: At the end of the course, Students will be able to:

C01	Accurately identify abnormal findings in urine, stool, and body fluids and apply proper examination techniques.
C02	Develop the understanding recent advancements in clinical pathology, including fluid analysis and automation.
C03	Proficiently operate blood centers and apply modern blood banking technologies.
C04	Effectively manage blood transfusions and address related complications.

Examination Scheme				
Continuous Assessment (30 marks)			External	Total
Internal examinations	Projects / Assignments	Attendance	Annual examination	
20	05	05	70	100

Course Code: 24MCL0203
Subject: Clinical Biochemistry

Name of the Institute: Smt. L.P. Patel Institute of Medical Laboratory Technology
Name of the Program: M.Sc. in Medical Technology (Medical Laboratory Technology)
Year of the Program: Year 1

Course Code	24MCL0203	Total Credit	4
Title of Subject	Clinical Biochemistry	Total Hours/Week	4
Course Objectives	<ul style="list-style-type: none"> ● Explain the metabolic pathways of carbohydrates, proteins, and lipids, including associated disorders and their clinical significance. ● Describe the synthesis and breakdown of hemoglobin and understand bilirubin metabolism to diagnose various types of jaundice. ● Explain purine metabolism and related disorders. ● Describe the functions of major organs and interpret diagnostic test results for liver, kidney, pancreas, heart, and thyroid functions. ● Understand the molecular basis of replication, transcription, DNA recombinant technology, blot techniques, and PCR. ● Describe quality control procedures, including root cause analysis and Westgard rules in biochemical testing. ● Explain the biochemical aspects of cancer, including cancer markers, and the mechanisms of free radicals and antioxidants with their clinical utility. 		
Course Content			
Unit	Description	Weightage	
1	Metabolism of Carbohydrates 1.1 Major metabolic pathways & importance: Glycolysis, TCA, HMP Shunt, Gluconeogenesis, Glycogen metabolism 1.2 Blood sugar regulation (Hormonal) 1.3 Abnormalities, Diabetes mellitus, GTT 1.4 Glycated-Hemoglobin 1.5 In born errors of amino acid metabolism 1.6 Special products formed from amino acids	12%	
2	Metabolism of Lipids 2.1 Beta oxidation, Ketogenesis, Ketosis 2.2 Lipoprotein metabolism in health and disease, Chylomicrons, VLDL, IDL, LDL and HDL 2.3 Atherosclerosis 2.4 Cholesterol metabolism 2.5 Fatty liver, Fatty acid synthesis	12%	
3	Metabolism of Proteins 3.1 Deamination, Transamination, Decarboxylation of amino acids 3.3 Formation of ammonia, Detoxification of ammonia 3.4 Urea cycle & its disorders	10%	
4	Hemoglobin 4.1 Hb Synthesis 4.2 Heme breakdown, 4.3 Jaundice, Van den bergh test 4.4 Bilirubin metabolism	12%	

5	5.1 Purine catabolism and gout. 5.2 Diagnostic & Therapeutic use of enzyme and Isoenzymes 5.3 Enzyme Kinetics	10%
6	Organ Function tests: 6.1 Liver function tests 6.2 Renal function tests 6.3 Pancreatic function tests 6.4 Thyroid function tests 6.5 Cardiac function test	12%
7	Molecular Biology 7.1 DNA replication, Transcription, Translation 7.2 Protein Targeting and folding 7.3 DNA recombinant Technology 7.4 PCR 7.5 Blot techniques 7.6 RFLP, VNTR	12%
8	Cancer: Biochemical aspects 8.1 Free radicals and antioxidants 8.2 Cancer and Cancer Markers- Biochemical Aspects	10%
9	Quality Control: 9.1 Internal & External Quality control, 9.2 Root cause of analysis (RCA) 9.3 Westgard rule	10%

List of Reference Books:

1	Textbook of Biochemistry: D.M. Vasudevan, Sree Kumari S
2	Textbook of Biochemistry: U. Satyanarayana
3	Medical clinical biochemistry: M. N. Chatterjee
4	Clinical guide to lab test : M.M. Tietz

Course Outcome: At the end of the course, Students will be able to:

C01	To critically analyze the metabolic pathways of carbohydrates, proteins, and lipids, identify associated metabolic disorders, and apply this knowledge to clinical scenarios.
C02	To diagnose jaundice and understand hemoglobin and bilirubin metabolism.
C03	To explain purine metabolism and its disorders.
C04	To interpret diagnostic tests for major organ functions.
C05	To apply molecular biology techniques in clinical labs.
C06	To implement quality control measures in biochemical testing.
C07	To evaluate cancer markers and oxidative stress in clinical settings.

Examination Scheme				
Continuous Assessment (30 marks)			External	Total
Internal examinations	Projects / Assignments	Attendance	Annual examination	
20	05	05	70	100

Course Code: 24MCL0204**Subject: Systemic & Clinical Microbiology**Name of the Institute: Smt. L.P. Patel Institute of Medical Laboratory TechnologyName of the Program: M.Sc. in Medical Technology (Medical Laboratory Technology)Year of the Program: Year 2

Course Code	24MCL0204	Total Credit	4
Title of Subject	Systemic & Clinical Microbiology	Total Hours/Week	4
Course Objectives	<ul style="list-style-type: none"> ➤ To understand basic of the bacteriology, virology, clinical microbiology which is applied to tropical medicine, Recent advances in instrumentation to estimate different parameters ➤ To identify common pathogenic bacterial agents and the diseases, general and specific mechanisms of disease, epidemiology of infectious agents, transmission of infectious diseases and explain interventions employed to prevent bacterial diseases including infection control measures and vaccines ➤ To learn about common pathogenic viral agents and the diseases, epidemiology, pathogenesis and laboratory diagnosis of viral diseases, transmission and explain interventions employed to prevent viral diseases including infection control measure, vaccines and vector control government guidelines ➤ To introduce molecular biology and learn various molecular diagnostic techniques 		
Course Content			
Unit	Description	Weightage	
1	Bacteriology Morphology, Cultural Characteristics, Antigenic structures, Pathogenesis (in brief) and Laboratory Diagnosis of following bacteria: 1.1 <i>Staphylococcus, Streptococcus including Pneumococcus, Neisseria,</i> 1.2 <i>Bacillus, Corynebacterium, Clostridium,</i> 1.3 <i>Enterobacteriaceae,</i> 1.4 <i>Mycobacteria,</i> 1.5 <i>Vibrios, Campylobacter, Pseudomonas,</i> 1.6 <i>Actinomycets, Nocardia, Listeria, Haemophilus,</i> 1.7 <i>Bordetella, Brucella,</i> 1.8 <i>Spirochaetes, Chlamydiae, Rickettsiae, Mycoplasma.</i> Tutorial/Demo 1.9 <i>Lactobacillus, Micrococcus,</i> 1.10 <i>Branhamella & Moraxella,</i> 1.11 <i>Coryneform organisms other than Corynebacterium,</i> 1.12 <i>Bacteroides, Fusobacterium and Leptotrichia,</i> 1.13 <i>Aeromons, Plesiomonas, Spirillum</i> 1.14 <i>Actinobacillus,</i>	35%	

2	<p>Unit 2: Virology:</p> <p>2.1 The Nature and classification of viruses 2.2 Morphology : Virus structure and Virus replication 2.3 The genetics of viruses, The pathogenicity of viruses 2.4 Bacteriophage General properties, diseases caused, laboratory diagnosis and prevention of 2.5 Herpes viruses, 2.6 Rubella virus, 2.7 Influenza viruses, 2.8 Paramyxoviridae, 2.9 Polio, 2.10 Hepatitis viruses, 2.11 Rabies virus, 2.12 Human immunodeficiency viruses, 2.13 Oncogenic viruses</p> <p><i>Tutorial/Demo</i></p> <p>2.14 Epidemiology of viral infections 2.15 Pox viruses, 2.16 Echo and Coxsackie viruses, 2.17 Enteric viruses other than Polio virus 2.18 Rhinoviruses, 2.19 Adenoviruses and Corona viruses,</p>	35%
3	<p>Clinical Microbiology applied to Tropical Medicine and Recent advances</p> <p>3.1 Etiology and Laboratory diagnosis of Respiratory infections, Urinary tract infections, 3.2 Pyrexia of unknown origin, Meningitis, Sepsis, Septicemia, Diarrheal diseases & food poisoning. 3.3 Prevention and Control of Hospital acquired infections 3.4 Immunoprophylaxis: Types of vaccines and schedule of vaccination. 3.5 Principal and Practice of Hospital waste disposal 3.6 Recent advances in diagnostic microbiology: Automation, Nucleic acid-based detection methods. 3.7 DNA & RNA based nucleic acid detection tests 3.8 DNA & RNA extraction 3.9 Polymerase chain reaction (DNA & RNA) 3.10 CB NAAT 3.11 Gel doc & gel electrophoresis 3.12 Whole genome sequence (NGS)</p> <p><i>Tutorial/Demo</i></p> <p>3.13 Epidemiology common infectious diseases 3.14 Newer vaccines 3.15 Bio-terrorism</p>	30%

List of Reference Books:

1	Text book of microbiology: Ananthnarayana & Paniker's
2	Text book of microbiology: Chakraborty
3	Microbiology: Prescott, Harley and Klein's
4	Parasitology: K.D. Chatterjee
5	Medical Lab. manual for Tropical countries: Monica Chessbrough
6	Practical Medical Microbiology: Mackey & Mac Cartney

C01	Perform various culture methods, isolate and identify various microorganisms, maintain pure culture, perform antibiotic sensitivity tests and interpret results
C02	Explain principles and applications of diagnostic instruments
C03	Explain basic of immunoprophylaxis, types of vaccines and schedule of vaccination
C04	Perform various diagnostic tests, Use appropriate microbiology laboratory techniques, methodologies, equipments in accordance with current laboratory safety protocol.
C05	Calculate, keep record of clinical microbiology results according to standard clinical laboratory protocol
C06	Take up molecular biology challenges and efficiently work in diagnostic molecular set up

Examination Scheme				
Continuous Assessment (30 marks)			External	Total
Internal examinations	Projects / Assignments	Attendance	Annual examination	
20	05	05	70	100

Course Code: 24MCL0205
Practical: Clinical Pathology

Name of the Institute: Smt. L.P. Patel Institute of Medical Laboratory Technology
Name of the Program: M.Sc. in Medical Technology (Medical Laboratory Technology)
Year of the Program: Year 2

Course Code	24MCL0205	Total Credit	2
Title of Subject	Practical: Clinical Pathology	Total Hours/Week	2 hours (P) 1 hour (T/D)
Course Objectives	<ul style="list-style-type: none"> ➤ Familiarize students with fundamental hematological techniques, including blood collection and automated cell counting. ➤ Develop skills in performing and interpreting hematological tests accurately. ➤ Enable students to identify blood cell abnormalities through peripheral smear examination. ➤ Equip students with knowledge and techniques for specialized hematological tests. ➤ Provide hands-on experience in clinical pathology procedures and blood banking techniques. 		
Course Content			
Unit	Description	Weightage	
1	Pathology: Students should be able to perform: Haematology: 1.1. Differential WBC count 1.2. Peripheral smear examination – I 1.3. Peripheral smear examination – II 1.4. Reticulocyte count 1.5. Sickling tests 1.6. Hb Electrophoresis 1.7. Bone marrow examination 1.8. Fetal Hb Estimation 1.9. Absolute eosinophil count 1.10. Osmotic fragility tests 1.11 PT 1.12 APTT 1.13 D-Dimer test 1.14 AEC	30%	
2	Blood Banking: 2.1 CM Tests 2.2. DCT 2.3. ICT 2.4. Anti-D Titre 2.5. Anti ABO titre	30%	

3	Clinical Pathology: 3.1. Semen Examination R & M 3.2. CSF Examination R & M	10%
4	Histopathology & Cytology 4.1. H & E Stain 4.2. PAP stain 4.3. Mounting 4.4. Special Stains (Demo) 4.5. Frozen Section (Demo)	30%

Course Outcome: At the end of the course, Students will be able to:

C01	Proficiency in accurate hematological test performance and interpretation.
C02	Effective identification and understanding of hematological abnormalities.
C03	Competence in conducting specialized hematological tests and procedures.
C04	Proficiency in blood banking techniques for clinical application.
C05	Mastery of histopathological and cytological techniques for accurate diagnosis.

Examination Scheme				
Continuous Assessment (30 marks)			External	Total
Internal examinations	Projects / Assignments	Attendance	Annual examination	
20	05	05	70	100

COURSE CODE: 24MCL0206
PRACTICAL: Clinical Biochemistry

Name of the Institute: Smt. L.P. Patel Institute of Medical Laboratory Technology
 Name of the Program: M.Sc. in Medical Technology (Medical Laboratory Technology)
 Year of the Program: Year 2

Course Code	24MCL0206	Total Credit	2
Title of Subject	Practical: Clinical Biochemistry	Total Hours/Week	2 hours (P) 1 hour (T/D)
Course Objectives	<ul style="list-style-type: none"> ➤ Develop proficiency in solution preparation and analysis. ➤ Understand protein analysis and electrophoresis techniques. ➤ Acquire skills in conducting various biochemical body profile tests. ➤ Familiarize with advanced analytical instruments and organ function testing. 		
Course Content			
Unit	Description	Weightage	
1	Basic Molecular Techniques: 1.1 DNA/RNA Isolation: <ul style="list-style-type: none"> ● Principles and protocols for DNA and RNA extraction from different biological samples. ● Quantification and purity assessment using spectrophotometry (A260/A280 ratio). ● Agarose gel electrophoresis for the assessment of extracted nucleic acids. 1.2 Polymerase Chain Reaction (PCR): <ul style="list-style-type: none"> ● Introduction to PCR: Principle, components, and types (conventional, real-time, etc.). ● Hands-on training in setting up and running a PCR reaction. ● Analysis of PCR products using gel electrophoresis. ● Troubleshooting common PCR issues. 	30%	
2	Basic Electrophoretic Techniques: 2.1 Agarose Gel Electrophoresis: <ul style="list-style-type: none"> ● Preparation and casting of agarose gels. ● Loading and running samples. ● Visualization and interpretation of bands under UV light. ● Use of DNA ladders for molecular weight determination. 	30%	
3	Chromatography Techniques: 3.1 Paper Chromatography: <ul style="list-style-type: none"> ● Principles and techniques of paper chromatography. ● Separation of amino acids and carbohydrates. ● Identification of compounds based on R_f values. 	20%	
4	Advanced Molecular Techniques: Only Tutorial & Demonstration 4.1 Real-Time PCR (qPCR): <ul style="list-style-type: none"> ● Introduction to quantitative PCR and its clinical applications. ● Setting up qPCR reactions and analyzing amplification curves. ● Interpretation of C_t values and quantification of nucleic acids. 	20%	

	4.2 DNA Sequencing (Introduction): <ul style="list-style-type: none"> ● Basic principles of DNA sequencing (Sanger and Next-Generation Sequencing). ● Sample preparation and loading for sequencing reactions. ● Overview of sequence data analysis. 	
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Course Outcome: At the end of the course, Students will be able to:

C01	Gain hands-on experience with molecular and biochemical techniques.
C02	Be proficient in DNA/RNA isolation, PCR, and electrophoretic techniques.
C03	Separate and analyze the amino acids and carbohydrates by paper chromatography
C04	Acquire the ability to interpret and troubleshoot experiments in molecular biology and biochemistry.
CO5	Demonstrate the basic understanding of advanced molecular techniques

Examination Scheme				
Continuous Assessment (30 marks)			External	Total
Internal examinations	Projects / Assignments	Attendance	Annual examination	
20	05	05	70	100

COURSE CODE: 24MCL0207
PRACTICAL: Microbiology

Name of the Institute: Smt. L.P. Patel Institute of Medical Laboratory Technology
Name of the Program: M.Sc. in Medical Technology (Medical Laboratory Technology)
Year of the Program: Year 2

Course Code	24MCL0207	Total Credit	2
Title of Subject	Practical: Microbiology	Total Hours/Week	2 hours (P) 1 hour (T/D)
Course Objectives	<ul style="list-style-type: none"> ➤ Develop proficiency in aseptic techniques and laboratory safety practices. ➤ Master the preparation and pouring of various culture media for bacterial growth. ➤ Gain practical skills in operating autoclaves, ovens, and other sterilization equipment. ➤ Learn techniques for specimen collection, preparation, staining, and examination for microbial identification. ➤ Acquire competence in antimicrobial susceptibility testing, bacterial identification, and maintenance of bacterial cultures. 		
Course Content			
Unit	Description	Weightage	
1	<p>Bacteriology</p> <p>1.1 Preparation and pouring of media – Nutrient agar, Blood agar, Mac Conkey agar, Sugars, Serum sugars, TSI, Robertsons cooked meat, Sabouraud dextrose</p> <p>1.2. Operation of autoclave, hot air oven, distillation plant, filters like Sietz and membrane and sterility tests.</p> <p>1.3. Washing and sterilization of glassware (Plugging and packing)</p> <p>1.4. Disposal of contaminated materials like cultures.</p> <p>1.5. Quality control of media, reagents etc.</p> <p>1.6. Performance of antimicrobial susceptibility testing e.g. Kirby-Bauer, Estimation of Minimal Inhibitory/Bactericidal concentrations by tube/plate dilution methods.</p> <p>1.7. Collection of specimens for Microbiological investigations such as Blood, Urine, Pus (Swabs), OT specimens.</p> <p>1.8. Identification of Bacteria of Medical Importance up to species level</p> <p>1.9. Preparation of stains viz. Gram staining and performing of staining.</p> <p>1.10. Quantitative analysis of urine by pour plate method and semi-quantitative analysis by standard loop test for finding significant bacteriuria.</p> <p>1.11.Plating of clinical specimens on media for isolation, purification, identification and quantitation purposes.</p> <p>1.12. Methods for the preservation of bacteria, Maintenance of stock cultures.</p> <p>1.13. Tests for motility: hanging drop preparation</p>	50%	

2	<p>Immunology</p> <p>2.1. Collection of blood by venipuncture, separation of serum and preservation of serum for short and long periods.</p> <p>2.2. Performance of serological tests viz. Widal, VDRL/RPR</p> <p>2.3. Enzyme linked immunosorbant assay: HIV, HBsAg, HCV</p> <p>2.4. Latex agglutination tests : RA, CRP,</p> <p>2.5. Rapid tests (Immunochromatography or Flow through type) HIV.</p> <p>Demonstration:</p> <ul style="list-style-type: none"> • Performance of serological tests viz. Brucella tube agglutination, Weil-Felix, cold agglutination, indirect haemagglutination, Paul-Bunnell, Rose-Waaler, IFA. • Immunodiffusion in gels (Ouchterlony), counter immunoelectrophoresis. • Staphylococcal co-agglutination tests. 	25%
3	<p>Mycology</p> <p>3.1. Collection of specimens</p> <p>3.2. Isolation and identification of common laboratory contaminants, dermatophytes and others of medical importance (Yeasts, dematiaceous fungi)</p> <p>3.3. Maintenance of stock culture.</p> <p>Demonstration:</p> <ul style="list-style-type: none"> • Special techniques like Wood's Lamp examination, hair baiting, hair perforation, paraffin baiting and slide culture. 	25%

Course Outcome: At the end of the course, Students will be able to:

C01	Ability to maintain aseptic conditions and ensure safety in the laboratory environment.
C02	Proficiency in preparing and using culture media for bacterial growth and identification.
C03	Skill in specimen collection, processing, and microscopic examination for microbial detection and identification.
C04	Competence in performing antimicrobial susceptibility tests and interpreting results.
C05	Mastery in bacterial identification techniques and maintenance of bacterial cultures for further study and analysis.

Examination Scheme				
Continuous Assessment (30 marks)			External	Total
Internal examinations	Projects / Assignments	Attendance	Annual examination	
20	05	05	70	100