



Postgraduate Programme

**M.Sc. in MEDICAL LABORATORY
TECHNOLOGY**

Parul Institute of Paramedical & Health Sciences

Faculty of Medicine

Parul University

Vadodara, Gujarat, India

1. Vision of the Department

V1	To establish a develop world class self-reliant institute for imparting Medical and other Health Science education at under-graduate, post-graduate & doctoral levels of the global competence.
V2	To be a centre of excellence to sprout great researchers, technologists in health care system.

2. Mission of the Department

M1	To develop & Train quality health care personnel.
M2	To inculcate high moral, ethical & professional standards of working amongst students.
M3	To ensure skill-based learning for all Students.

3. Program Educational Objectives (PEOs):

PEOs 1	Excellence in Medical Sciences	Graduates will demonstrate advanced knowledge and technical proficiency in medical laboratory sciences, enabling them to contribute effectively to diagnostics, clinical decision-making, and public health through evidence-based laboratory practices.
PEOs 2	Professionalism & Ethical Practice	Graduates will uphold the highest standards of professionalism, integrity, and ethical conduct in all aspects of laboratory medicine, ensuring accuracy, confidentiality, and quality in healthcare delivery.
PEOs 3	Lifelong Learning & Research Contribution	Graduates will engage in lifelong learning and scholarly activities, contributing to scientific research, innovation, and continuous improvement in medical laboratory technology to address emerging challenges in healthcare.

4. Program Specific Learning Outcomes (PSLOs):

PSLOs 1	Clinical Competence & Technological Proficiency	Graduates will demonstrate advanced clinical skills and hands-on proficiency in performing and interpreting a wide range of diagnostic laboratory tests using contemporary technologies and quality control practices.
PSLOs 2	Critical Thinking & Ethical Decision-Making	Graduates will apply critical thinking and analytical reasoning in solving complex diagnostic challenges while adhering to ethical principles and regulatory standards in laboratory operations and patient care.
PSLOs 3	Leadership, Teamwork & Research	Graduates will effectively collaborate within multidisciplinary healthcare teams, exhibit leadership qualities, and integrate research methodologies to enhance

	Application	laboratory services and contribute to evidence-based healthcare practices.
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5. Program Learning Outcomes (PLOs):

PLO1	Disciplinary Knowledge	Demonstrate a thorough and integrated understanding of the principles and practices of medical laboratory science, including clinical biochemistry, hematology, microbiology, pathology, and molecular diagnostics.
PLO2	Clinical & Technical Skills	Exhibit advanced competency in performing, analyzing, and interpreting a wide range of diagnostic tests with precision, while ensuring adherence to laboratory safety and quality assurance standards.
PLO3	Critical Thinking & Problem-Solving	Apply logical reasoning, analytical thinking, and evidence-based approaches to solve complex clinical laboratory problems and contribute to patient diagnosis and treatment planning.
PLO4	Communication Skills	Communicate effectively with healthcare professionals, patients, and stakeholders using clear, concise, and appropriate oral, written, and digital communication methods in a clinical and academic setting.
PLO5	Ethics & Professionalism	Uphold ethical principles, legal guidelines, and professional conduct in laboratory practices, ensuring confidentiality, accuracy, and accountability in all aspects of patient care.
PLO6	Teamwork & Leadership	Work efficiently as a part of interdisciplinary healthcare teams, and demonstrate leadership, decision-making, and management skills in laboratory settings and professional environments.
PLO7	Digital Literacy	Utilize modern laboratory equipment, digital tools, information systems, and data analysis software to enhance diagnostic accuracy and laboratory efficiency.
PLO8	Research & Evidence-Based Practice (EBP)	Design, conduct, and critically evaluate laboratory-based research, and apply research findings to improve diagnostic methodologies and healthcare outcomes.
PLO9	Lifelong Learning & Professional Development	Engage in continuous learning and self-improvement to keep pace with advancements in medical laboratory science and contribute meaningfully to the professional

		community and public health.
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6. Credit Framework

Semester wise Credit distribution of the programme		Category wise Credit distribution of the programme	
		Category	Credit
Semester-1	24	Major Core	66
Semester-2	24		
Semester-3	24		
Semester-4	24	Clinical Postings	6
		Dissertation	24
Total Credits:	96	Total Credits:	96

7. Program Curriculum

Semester 1						
Sr. No.	Subject Code	Subject Name	Credit	Lect	Lab	Tut
1	1902000101	Research Methodology - I (T)	4	4	-	-
2	1902000102	Research Methodology - I (P)	2	-	4	-
3	1902070101	Fundamentals Of Biochemistry (T)	4	4	-	-
4	1902070102	Fundamentals Of Biochemistry (P)	2	-	4	-
5	1902070103	Hematology And Blood Banking (T)	4	4	-	-
6	1902070104	Hematology And Blood Banking (P)	2	-	4	-
7	1902070105	Fundamental Microbiology (T)	4	4	-	-
8	1902070106	Fundamental Microbiology (P)	2	-	4	-
Total			24	16	16	-
Semester 2						
Sr. No.	Subject Code	Subject Name	Credit	Lect	Lab	Tut
1	1902000201	Research Methodology - II (T)	4	4	-	-
2	1902000202	Research Methodology – II (P)	2	-	4	-
3	1902070201	Metabolic And Analytical Biochemistry (T)	4	4	-	-
4	1902070202	Metabolic And Analytical Biochemistry (P)	2	-	4	-
5	1902070203	Principles Of Coagulation Studies And Clinical Pathology(T)	4	4	-	-
6	1902070204	Principles Of Coagulation Studies And	2	-	4	-

		Clinical Pathology(P)				
7	1902070205	Immunology & Virology (T)	4	4	-	-
8	1902070206	Immunology & Virology (P)	2	-	4	
Total			24	16	16	-
Semester 3						
Sr. No.	Subject Code	Subject Name	Credit	Lect	Lab	Tut
1	1902070301	Clinical And Molecular Biochemistry (T)	4	4	-	-
2	1902070302	Clinical And Molecular Biochemistry (P)	2	-	4	-
3	1902070303	Histopathology And Cytology (T)	4	4	-	-
4	1902070304	Histopathology And Cytology (P)	2	-	4	-
5	1902070305	Parasitology & Mycology(T)	4	4	-	-
6	1902070306	Parasitology & Mycology (P)	2	-	4	-
7	1902070307	Clinical Posting	6	-	12	-
Total			24	12	24	-
Semester 4						
Sr. No.	Subject Code	Subject Name	Credit	Lect	Lab	Tut
1	1902070401	Dissertation	24	-	48	-
Total			24	-	48	-

Semester: 1	
a. Course Name:	Research Methodology- I (T)
b. Course Code:	1902000101
c. Prerequisite:	Basic knowledge of academic writing, critical thinking, reading scientific literature, formulating academic arguments, and basic tools for data representation
d. Rationale:	To equip students with essential skills to identify, design, conduct, analyze, and present research in a structured and ethical manner.

e. Course Learning Objective:	
CLOBJ 1	To remember and introduce fundamentals of research.
CLOBJ 2	To develop skills in research problem identification and design
CLOBJ 3	To understand sampling techniques and data collection methods
CLOBJ 4	To analyze and interpret research data
CLOBJ 5	To implement research plans and report findings

f. Course Outcomes:		
CLO 1	Remembering	Remember the fundamental concepts, principles, and processes of research methodology
CLO 2	Understanding	Identify, articulate, and formulate research problems based on literature review and practical observations.
CLO 3	Applying	Select and apply appropriate sampling techniques and data collection methods for different types of research studies.
CLO 4	Analyzing	Analyze, interpret, and draw inferences from research data using appropriate statistical tools.
CLO 5	Evaluating / Creating	Evaluate research findings and develop comprehensive research reports, including recommendations and implementation strategies.

g. Teaching and Examination Scheme

Teaching Scheme				Examination Scheme					Total
Lecture Hrs /Week	Tutorial Hrs/ Week	Lab Hrs /Week	Credit	Internal Marks			External Marks		
				T	CE	P	T	P	
4	-	-	4	20	20	-	60	-	100

h. Course Content

Sr.	Content	Weightage	Hours
1.	Unit 1- Epidemiology - Risk factors- hereditary, psychosocial factors, hypertension, smoking, obesity, diabetes mellitus etc. - Health promotion, disease prevention, lifestyle modification. - National health program related to cardiovascular conditions.	15%	5
2.	Unit 2- Introduction	15%	7

	• Research – definition, characteristics, purposes, kinds of research • Methods of acquiring knowledge, problem solving and scientific method. • Basic research terms • Health and social research • Concept of evidence-based practice • Ethics in research • Overview of research process		
3.	Unit 3- Review of literature • Importance, purposes, sources, criteria for selection of resources and steps in reviewing literature.	10%	7
4.	Unit 4- Research approaches and designs • Type: quantitative and qualitative • Historical, survey and experimental –characteristics, types advantages and disadvantages • Qualitative: phenomenology, grounded theory, ethnography	10%	6
5.	Unit 5- Research problem • Identification of research problem • Formulation of problem statement and research objectives • Definition of terms assumptions and delimitations • Identification of variables • Hypothesis – definition, formulation and types	10%	6
6.	Unit 6- sampling • Population and sample • Factors influencing sampling techniques. • Sample size • Probability and sampling error • Problems of sampling	10%	6
7.	Unit 7- Tools and methods of data collection • Concepts of data collection • Data sources methods/techniques quantitative and qualitative • Tools for data collection – types, characteristics and their development • Validity and reliability of tools • Procedure for data collection	10%	6
8.	Unit 8- Implementing research plan • Pilot study, review research plan (design), planning for data collection, administration of tool/interventions, collection of data	5%	6
9.	Unit 9- Analysis and interpretation of data • Plan for data analysis: quantitative and qualitative • Preparing data for computer analysis and presentation • Statistical analysis interpretation of data, conclusion and generalizations • Summary and discussion	5%	6

10.	Unit 10- Reporting and utilizing research findings: • Communication of research results; oral and written • Writing research report purposes, methods and style Vancouver, American psychological association (APA), Campbell etc. • Writing scientific articles for publication: purposes & style	10%	5
	Total teaching hours for the academic year	100%	60

i. Text Book and Reference Book:

1.	Research Methodology: A Step-by-Step Guide for Beginners By Ranjit Kumar
2.	Research Methodology: Methods and Techniques By C.R.Kothari
3.	Research Methodology By Uma Sekaran, Roger Bougie
4.	Research Design: Qualitative, Quantitative, and Mixed Methods Approaches By John W. Creswell

Semester: 1	
a. Course Name:	Research Methodology I (P)
b. Course Code:	1902000102
c. Prerequisite:	Basic knowledge of academic writing, critical thinking, reading scientific literature, formulating academic arguments, and basic tools for data representation
d. Rationale:	To equip students with essential skills to identify, design, conduct, analyze, and present research in a structured and ethical manner.

e. Course Learning Objective:	
CLOBJ 1	To review literature utilizing various sources
CLOBJ 2	To describe research methodology students will be able to define basic research terms and develop a research proposal. Conduct a research study.
CLOBJ 3	To apply research findings, utilize research findings.
CLOBJ 4	To evaluate research studies. Write scientific paper for publication.
CLOBJ 5	To develops skill in writing scientific research reports.

f. Course Outcomes:		
CLO 1	Remembering	Recall and compile relevant research articles to prepare an annotated bibliography.
CLO 2	Understanding	Explain and summarize key findings from reviewed literature to establish the context and background of a research topic.
CLO 3	Applying	Formulate research problems, objectives, and hypotheses using insights gathered from literature review.
CLO 4	Analyzing	Analyze given data sets using appropriate statistical or qualitative methods to identify patterns and relationships.
CLO 5	Evaluating / Creating	Assess the relevance and quality of reviewed literature and justify the choice of research methodology and tools.

g. Teaching and Examination Scheme

Teaching Scheme				Examination Scheme					Total
Lecture Hrs /Week	Tutorial Hrs/ Week	Lab Hrs /Week	Credit	Internal Marks			External Marks		
				T	CE	P	T	P	
-	-	4	2	-	-	40	-	60	100

h. Course Content

Sr.	Content	Weightage	Hours
1.	Annotated bibliography of research topics and articles.	15%	10
2.	Review of literatures of selected topics and reporting.	15%	10
3.	Formulation of problem statement, objectives and hypotheses.	20%	10
4.	Developing theoretical & conceptual framework.	20%	10
5.	Preparation of sample research tool.	10%	10
6.	Analysis, interpretation of given data.	20%	10
Total teaching hours for the academic year		100%	60

i. Text Book and Reference Book:

1.	Research Methodology: A Step-by-Step Guide for Beginners By Ranjit Kumar
2.	Research Methodology: Methods and Techniques By C.R.Kothari
3.	Research Methodology By Uma Sekaran, Roger Bougie
4.	Research Design: Qualitative, Quantitative, and Mixed Methods Approaches By John W. Creswell

Semester: 1	
a. Course Name:	Fundamentals of Biochemistry (T)
b. Course Code:	1902070101
c. Prerequisite:	Fundamental knowledge of biology, organic chemistry, and human physiology at undergraduate level (B.Sc. or equivalent), with exposure to basic laboratory techniques
d. Rationale:	The course "Fundamentals of Biochemistry" is designed to strengthen the molecular understanding of biological processes critical for clinical laboratory practice. Students will gain insights into the structure, function, and metabolism of biomolecules, specimen handling, and the biochemical basis of diseases. The knowledge acquired will serve as a foundation for advanced diagnostic techniques and clinical interpretation essential for healthcare and research laboratories.

e. Course Learning Objective:	
CLOBJ 1	To introduce students to basic biochemical concepts, units of measurement, and specimen handling techniques.
CLOBJ 2	To develop an understanding of the biochemical significance and structure-function relationships of macromolecules.
CLOBJ 3	To enable application of knowledge of digestion, absorption, metabolism, and their clinical relevance.
CLOBJ 4	To encourage critical analysis of nutritional biochemistry and biomolecular dysfunction in disease mechanisms.
CLOBJ 5	To develop skills in interpreting biochemical test results and correlating them with clinical conditions.

f. Course Outcomes:		
CLO 1	Remembering	Recall and define fundamental biochemical terms, measurement units, and specimen handling procedures.
CLO 2	Understanding	Explain the significance of macromolecules in normal and pathological physiological processes.
CLO 3	Applying	Demonstrate and apply knowledge of digestion, absorption, metabolism, and relate to clinical cases.
CLO 4	Analyzing	Analyze structure-function relationships of biomolecules and evaluate their impact on disease processes.
CLO 5	Evaluating / Creating	Assess nutritional deficiencies, biochemical disorders, and interpret biochemical test results for disease diagnosis and patient care.

g. Teaching and Examination Scheme

Teaching and Examination Scheme										
Teaching Scheme					Examination Scheme					Total
Lecture Hrs/ Week	Tutorial Hrs/ Week	Lab Hrs/ Week	Total Hrs	Credit	Internal Marks			External Marks		
					T	CE	P	T	P	
4	-	-	60	4	20	20	-	60	-	100

h. Course Content

Sr. No.	Topic	Weightage %	Hours
1	Unit 1: Introduction & General Aspects • Introduction to Clinical Biochemistry • Role of clinical biochemistry in disease diagnosis • Study of measurements units & their conversions. • Specimen collection, preservation, and transport • Anticoagulants: Types, applications, and mechanisms of action • Hazards in the laboratory	15%	8
2	Unit 2: General Biochemistry of Carbohydrates • Types, Functions, and Importance • Carbohydrate Digestion and Absorption	15%	8
3	Unit 3: General Biochemistry of Proteins • Amino Acids, Peptides, Plasma Proteins, Hemoglobin & Hemoglobinopathies • Immunoglobulins, Collagen, and Collagen-related Disorders • Protein Digestion and Absorption & Clinical Relevance	20%	12
4	Unit 4: General Biochemistry of Lipids • Classification, Functions, and Clinical Importance (TAG, Phospholipids, Cholesterol, Prostaglandins) • Cholesterol, Prostaglandins, and Fatty Acids • Lipid Digestion and Absorption & Clinical Relevance	20%	12
5	Unit 5: Nucleic Acids • Nucleobases, Nucleosides, Nucleotides, DNA, and RNAs	15%	10
6	Unit 6: Nutrition • Principles of Nutrition, Balanced Diet, BMR • Malnutrition Disorders: Kwashiorkor and Marasmus • Vitamins (Water- & Fat-soluble) and Minerals (Calcium, Iron, Trace Elements)	15%	10
	Total academic weightage/teaching hours	100	60

i. Text Book and Reference Book:

1.	Practical Clinical Biochemistry by Harold Varley
2.	Textbook of Medical Laboratory Technology by P. B. Godker
3.	Medical Laboratory Technology by Mukherjee
4.	Principal of Biochemistry by M A. Siddiqi
5.	Instrumental Analysis by Chatwal Anand

Semester: 1	
a. Course Name:	Fundamentals of Biochemistry (P)
b. Course Code:	1902070102
c. Prerequisite:	Basic understanding of biochemical principles, safe laboratory practices, and fundamental chemistry techniques at undergraduate (B.Sc.) level.
d. Rationale:	The practical course in Fundamentals of Biochemistry enables students to acquire hands-on skills in laboratory safety, specimen handling, reagent preparation, and qualitative biochemical testing. It bridges theoretical knowledge with clinical laboratory practice, empowering students to apply biochemical techniques for disease diagnosis and patient care.

e. Course Learning Objective:	
CLOBJ 1	To introduce students to laboratory safety protocols, clinical specimen collection, preservation, and transportation techniques.
CLOBJ 2	To develop practical skills in the preparation of standard solutions, molar solutions, and laboratory reagents.
CLOBJ 3	To enable students to conduct qualitative biochemical analysis of carbohydrates and proteins, and interpret the results.
CLOBJ 4	To foster understanding of urine biochemical analysis and its clinical significance in disease detection.
CLOBJ 5	To encourage critical evaluation of biochemical testing procedures and development of systematic testing approaches.

f. Course Outcomes:		
CLO 1	Remembering	Recall laboratory safety measures, specimen handling protocols, and principles of reagent preparation.
CLO 2	Understanding	Explain the principles and importance of qualitative biochemical tests for carbohydrates, proteins, and urine analysis.
CLO 3	Applying	Perform qualitative biochemical tests for carbohydrates and proteins to identify unknown samples.
CLO 4	Analyzing	Analyze normal and abnormal urine constituents and correlate findings with pathological conditions.
CLO 5	Evaluating / Creating	Assess the reliability of biochemical testing methods and create systematic protocols for biochemical analysis.

g. Teaching and Examination Scheme

Teaching and Examination Scheme										
Teaching Scheme					Examination Scheme					Total
Lecture Hrs/ Week	Tutorial Hrs/ Week	Lab Hrs/ Week	Total Hrs	Credit	Internal Marks			External Marks		
					T	CE	P	T	P	
-	-	4	60	2	-		40	-	60	100

Lect- Lecture, Lab.- Lab, Tut - Tutorial, T - Theory, P - Practical, CE - CE, T - Theory, P – Practical

h. Course Content

No.	Contents	Weightage	Hours
1	Demonstration of Laboratory Safety aspects.	10%	5
2	Demonstration and Performance of Clinical Specimen Collection, Preservation, and Transport.	10%	5
3	Demonstration and performance of Preparation of Standard & Molar Solutions and Reagents	20%	10
4	Qualitative Analysis Reactions for Carbohydrates • Identification of Unknown Carbohydrate -I • Identification of Unknown Carbohydrate -II	20%	15
5	Qualitative Analysis Reactions for Protein: • Identification of Unknown Protein -I • Identification of Unknown Protein -II	20%	15
6	Demonstration and Performance of Urine Analysis (Normal & Abnormal Constituents)	20%	10
	Total academic weightage/Practical hours	100	60

i. Text Book and Reference Book:

1.	Practical Clinical Biochemistry by Harold Varley
2.	Textbook of Medical Laboratory Technology by P. B. Godker
3.	Medical Laboratory Technology by Mukherjee
4.	Principal of Biochemistry by M A. Siddiqi
5.	Instrumental Analysis by Chatwal Anand

Semester : 1	
a. Course Name:	Hematology and Blood Banking (T)
b. Course Code:	1902070103
c. Prerequisite:	To successfully engage with this course, students are expected to have a foundational understanding of basic biological sciences, including human anatomy and physiology, cell biology, and introductory medical laboratory practices. A prior undergraduate degree in Medical Laboratory Technology (B.Sc. MLT) or an equivalent qualification with exposure to clinical laboratory procedures is essential. Familiarity with basic concepts of hematology, microbiology, and clinical biochemistry will enhance comprehension and application of advanced hematological and Immuno hematological techniques.
d. Rationale:	The course “ Hematology and Blood Banking ” is an essential component of the M.Sc. Medical Laboratory Technology curriculum, designed to develop a deep understanding of blood composition, hematological disorders, diagnostic procedures, and blood transfusion science. The course integrates theoretical knowledge with practical application, focusing on advanced testing methods, quality assurance, and safety protocols critical to clinical diagnostics. As the accurate diagnosis and monitoring of many diseases depend on laboratory testing, this course aims to equip students with the skills to perform and interpret a wide range of hematological tests, manage blood bank operations, and uphold transfusion safety. Furthermore, it lays the foundation for critical thinking in patient care, encourages adherence to ethical and professional standards, and supports the development of research skills necessary for evidence-based practice in medical laboratory science.

e. Course Learning Objective:	
CLOBJ 1	Recall and explain the fundamental principles of hematology, including blood composition, hemopoiesis, and the role of anticoagulants in laboratory testing.
CLOBJ 2	Demonstrate knowledge of routine and advanced hematological techniques, including hemoglobin estimation, cell counts, ESR, and staining methods.
CLOBJ 3	Analyze and interpret results of hematological investigations and identify hematological disorders such as various types of anemia and leukocyte abnormalities.
CLOBJ 4	Apply Immuno hematological principles in blood grouping, cross-matching, and safe transfusion practices, including identification and management of transfusion reactions.
CLOBJ 5	Demonstrate awareness and implementation of safety, quality control, and assurance measures in both hematology and blood banking laboratories.

f. Course Outcomes:		
CLO 1	Remembering	Describe the fundamental concepts of hematology, including the structure and function of blood, hemopoiesis, and the role

		of anticoagulants.
CLO 2	Understanding	Explain the principles, procedures, and clinical relevance of hematological investigations such as haemoglobinometry, ESR, and complete blood counts.
CLO 3	Applying	Perform various hematological tests and staining techniques accurately, following standard laboratory protocols.
CLO 4	Analyzing	Analyze hematological disorders and interpret diagnostic findings related to anemia, leukocyte abnormalities, and bone marrow evaluations.
CLO 5	Evaluating / Creating	Evaluate Immuno hematological procedures such as blood grouping, cross-matching, and transfusion practices, including identifying and preventing transfusion reactions.

g. Teaching and Examination Scheme

Teaching Scheme				Examination Scheme					Total
Lecture Hrs /Week	Tutorial Hrs/ Week	Lab Hrs /Week	Credit	Internal Marks			External Marks		
				T	CE	P	T	P	
4	-	-	4	20	20	-	60	-	100

h. Course Content

Sr.	Content	Weightage	Hours
1	Unit 1 : Fundamental of Hematology - Definition, Importance, Important equipment used - Laboratory organization and safety measures in Haematology Laboratory - Introduction to blood, its composition, function and normal cellular components - Anticoagulants: types, mode of action and preference of anticoagulants for different hematological studies - Collection and preservation of blood samples for various hematological investigations - Formation of cellular components of blood (Haemopoiesis: Erythropoiesis, Leucopoiesis, Thrombopoiesis) - Hemoglobin: definition, types, structure, synthesis and degradation - Morphology of normal blood cells	20%	15

2	Unit 2: Applied Hematology • Hemoglobinometry: Different methods to measure Haemoglobin with merits and demerits. • Haemocytometry: Introduction, Principle, Reagent preparation, procedure, errors involved and means to minimize errors. (RBC Count, Total leukocyte count (TLC) , Platelet Count., AbsoluteEosinophilcount • Principle mechanism and different methods with merit and demerits for the measuring ErythrocyteSedimentationRate (ESR) and its significance • Different methods with merit and demerits for packedcellvolume/Haematocritvalue • Preparation of Blood Smear Examination • Staining techniques in Haematology (Romanowsky ‘stains): Principle, composition, preparation of staining reagent • Differential leukocyte count (DLC) • Bone marrow examination • . Reticulocytes Count • Lupus Erythematosus (L.E) cell phenomenon. & Demonstration of L.E. cell by various methods Quality assurance in Haematology	20%	15
3	Unit 3: Hematological Disorders • Anemia (Introduction, Classification, Microcytic hypochromic anemia, Macrocytic anemia, Normocytic normochromic anemia) • Quantitative disorders of Leukocytes Cause and significance • Granulocytic and Monocytic Disorders, Lymphocytic Disorders, Morphologic Alterations in Neutrophils	20%	10
4	Unit 4: Blood Banking and Immunohematology • Introduction to Blood Banking • History and discovery of various blood group systems • ABO blood group system • Rh and other major blood group system • Sources of error in blood grouping and their elimination. • ABO grouping: Forward and reverse grouping. Causes of discrimination between forward and	40%	20

	- reverse grouping • Rh grouping • Compatibility test in blood transfusion • Collection of blood for cross matching from a blood bag • Major cross matching • Minor cross matching • Complications and hazards of blood transfusion • Laboratory investigations of transfusion reactions and mismatched blood transfusion. • Precautions while procurement and storage of grouping antisera • Various anticoagulants used to collect blood for transfusion purposes • Selection of donors and procedure for collection of blood from a healthy donor • Preparation of various fractions of blood for transfusion and therapeutic purposes such as: Packed red cells, washed red cells and FROZEN Red cells, Platelet Rich Plasma (PRP), Platelet concentrate and frozen platelets, Fresh plasma (FP), Fresh Frozen Plasma (FFP) and cryoprecipitate • Brief introduction of blood substitute/artificial blood • Haemopheresis: pertaining to Leucocytes, platelets and plasma Quality control in blood bank		
	Total teaching hours for the academic year	100%	60

i. Text Book and Reference Book:

1	Text book of Medical Laboratory Technology by Paraful B. Godkar
2	Medical laboratory Technology by KL Mukherjee Volume-I
3	Practical Haematology by JB Dacie
4	Clinical Diagnosis & Management by Laboratory methods (20th edition) by John Bernard Henary
5	Transfusion Science by Overfield, Hamer

Semester : 1	
a. Course Name:	Hematology & Blood Banking (P)
b. Course Code:	1902070104
c. Prerequisite:	Students entering this course should have completed a Bachelor's degree in Medical Laboratory Technology (B.Sc. MLT) or an equivalent program. They should possess foundational knowledge of hematology, basic laboratory instruments, principles of specimen collection, and general laboratory safety protocols. Prior exposure to diagnostic techniques and laboratory-based practical skills is recommended to effectively engage in hands-on hematological and immunohematological procedures.
d. Rationale:	The practical course "Hematology & Blood Banking (P)" is designed to complement and reinforce theoretical concepts through experiential learning. Accurate laboratory diagnosis is critical in clinical decision-making, and this course provides students with the necessary technical competencies to perform essential hematological and transfusion-related procedures. By engaging with real-world laboratory practices—such as blood collection, cell counting, blood grouping, cross-matching, and peripheral smear examination—students gain confidence and skill in diagnostic techniques. The course also instills the importance of laboratory safety, quality assurance, and ethical handling of biological samples. Additionally, it prepares students for roles in clinical laboratories, blood banks, research institutions, and advanced diagnostic centers, bridging the gap between theory and clinical application.

e. Course Learning Objective:	
CLOBJ 1	Identify and follow laboratory safety protocols and proper specimen collection techniques used in hematological investigations.
CLOBJ 2	Demonstrate proficiency in using hematology lab instruments such as microscopes, colorimeters, and hemocytometers.
CLOBJ 3	Perform key hematological procedures including hemoglobin estimation, total and differential cell counts, ESR, and reticulocyte count.
CLOBJ 4	Prepare and examine peripheral blood smears to identify normal and abnormal blood cells.
CLOBJ 5	Determine ABO and Rh blood groups using forward, reverse, and slide grouping methods, and perform cross-matching and compatibility testing.

f. Course Outcomes:		
CLO 1	Remembering	Recall laboratory safety protocols, specimen collection techniques, and the operation of basic hematology equipment.
CLO 2	Understanding	Explain the principles and procedures of core hematological techniques including cell counts, hemoglobin estimation, and ESR.
CLO 3	Applying	Perform hematological tests such as CBC, PCV, reticulocyte count, and peripheral smear staining with accuracy and precision.

CLO 4	Analyzing	Analyze blood smears and laboratory results to identify hematological abnormalities such as anemia and leukemia.
CLO 5	Evaluating / Creating	Evaluate blood grouping, cross-matching procedures, and interpret compatibility testing in transfusion science.

g. Teaching and Examination Scheme

Teaching Scheme				Examination Scheme					Total
Lecture Hrs /Week	Tutorial Hrs/ Week	Lab Hrs /Week	Credit	Internal Marks			External Marks		
				T	CE	P	T	P	
-	-	4	2	-	-	40	-	60	100

h. Course Content

Sr.	Content	Weightage	Hours
1	Introduction to Hematology lab - Familiarization and working of routine Haematology Lab. Instruments. (Microscopes, Haemocytometers, Colorimeter, Spectrophotometer, Glass pipettes & Auto pipettes, Glassware, Sahli's Apparatus)& Laboratory Safety aspects.	7%	4
2	Collection of blood samples for various Lab Investigations.	7%	5
3	Identification of Normal blood cells	7%	4
4	Blood: RBC Count, Total Leucocyte Count & Platelet Count (Complete Blood Count)	7%	4
5	Hemoglobin Estimation by Cyanmethemoglobin method	7%	4
6	Peripheral Smear Examination	7%	4
7	P.C.V. (Volume of Packed Red Cell – VPRC) OR (Hematocrit), RBC Indices and Reticulocyte Count	7%	4
8	Differential Leucocyte Count	7%	5
9	E.S.R. (Erythrocyte Sedimentation Rate)	7%	4
10	Anemia	7%	4
11	Leukemia	7%	4
12	Determination of Blood Groups by slide , reverse and forward grouping method .	7%	4
13	Cross Matching and Compatibility Testing	8%	5
Total teaching hours for the academic year		100%	60

i. Text Book and Reference Book:

1	Text book of Medical Laboratory Technology by Paraful B. Godkar
2	Medical laboratory Technology by KL Mukherjee Volume-I
3	Practical Haematology by JB Dacie
4	Clinical Diagnosis & Management by Laboratory methods (20th edition) by John Bernard Henary

5	Transfusion Science by Overfield, Hamer
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Semester: 1	
a. Course Name:	Fundamentals of Microbiology(T)
b. Course Code:	1902070105
c. Prerequisite:	Students should possess a basic understanding of biological sciences, particularly cell biology, biochemistry, and general principles of human anatomy and physiology. Familiarity with basic laboratory safety and scientific terminology will facilitate easier comprehension of microbiological concepts.
d. Rationale:	The course "Fundamentals of Microbiology (T)" is structured to build a strong theoretical foundation in microbiological principles essential for clinical and diagnostic applications. It encompasses key areas such as microbial structure and function, genetics, pathogenesis, and laboratory diagnosis of infectious diseases. With the growing importance of microbiology in healthcare, pharmaceuticals, and research, it is crucial for students to gain in-depth theoretical knowledge to support practical skills. This course will prepare students to understand disease mechanisms, perform microbial investigations, and contribute effectively to clinical diagnostics and public health initiatives.

e. Course Learning Objective:	
CLOBJ 1	To Gain foundational knowledge of Microbiological principles for laboratory diagnosis.
CLOBJ 2	To Develop technical competence in Microbiological techniques and biosafety measures.
CLOBJ 3	To Interpret laboratory results in the context of disease pathogenesis and treatment.
CLOBJ 4	To Adhere to ethical and quality standards in Microbiology laboratory practices.
CLOBJ 5	To Enhance research and analytical skills in Microbial investigations.

f. Course Outcomes:		
CLO 1	Remembering	Describe the basic principles of Microbiology and Microbial cell structure.
CLO 2	Understanding	Explain microbial genetics, gene transfer mechanisms, and their role in antibiotic resistance.
CLO 3	Applying	Analyse microbial metabolism and its significance in clinical microbiology.
CLO 4	Analyzing	Understand immunological responses and their role in infectious disease management.
CLO 5	Evaluating / Creating	Apply knowledge of medical microbiology to disease diagnosis and antimicrobial treatment strategies.

g. Teaching and Examination Scheme

Teaching and Examination Scheme										
Teaching Scheme					Examination Scheme					Total
Lecture Hrs/ Week	Tutorial Hrs/ Week	Lab Hrs/ Week	Total Hrs	Credit	Internal Marks			External Marks		
					T	CE	P	T	P	
4	-	-	60	4	20	20	-	60	-	100

h. Course Content

Sr. No.	Topic	Weightage %	Hours
1	Unit 1: Introduction to Microbiology - History and Scope of Microbiology - Classification and Nomenclature of Microorganisms - Microscopy and Staining Techniques - Sterilization and Disinfection Methods - Laboratory Safety and Biosafety Levels	15 %	10
2	Unit 2: Microbial Cell Structure and Function - Prokaryotic and Eukaryotic Cell Structure - Bacterial Cell Wall and Membrane Composition - Bacterial Growth, Nutrition, and Reproduction - Endospores and Biofilms - Bacterial Growth Phases and Factors Affecting Growth - Nutritional Classification of Microorganisms	15%	10
3	Unit 3: Microbial Genetics and Molecular Biology - Structure and Function of Bacterial DNA & RNA - Plasmids, Transposons, and Gene Transfer Mechanisms (Conjugation, Transformation, Transduction) - Mutation and Antibiotic Resistance - Regulation of Gene Expression in Bacteria	20%	15
4	Unit 4: Etiology and Laboratory Diagnosis of Infectious Diseases Respiratory Infections (Bacterial, Viral,	25%	15

	Fungal, and Parasitic) • Urinary Tract Infections (UTIs) • Pyrexia of Unknown Origin (PUO) • Meningitis (Bacterial, Viral, Fungal, and Parasitic Causes) • Sepsis and Septicaemia • Diarrheal Diseases and Food Poisoning		
5	Unit 5: Bacteriology: Morphology, Cultural Characteristics, Antigenic structures, Pathogenesis (in brief) Laboratory Diagnosis of following bacteria: • Staphylococcus, Streptococcus including Pneumococcus, Neisseria • Bacillus, Corynebacterium, Clostridium, • Enterobacteriaceae • Mycobacteria, • Vibrios, Campylobacter, Pseudomonas, • Actinomycetes, Nocardia, Listeria, Haemophilus • Bordetella, Brucella • Spirochaetes, Chlamydiae, Rickettsiae, Mycoplasma. Bacterial genetics, mutation, gene transfer	25%	10
	Total academic weightage/teaching hours	100	60

i. Text Book and Reference Book:

1.	Prescott's Microbiology by Joanne Willey, Linda Sherwood, & Christopher
2.	Medical Microbiology by Murray, Rosenthal, and Pfaller
3.	Microbiology: An Introduction by Tortora, Funke, and Case
4.	Jawetz, Melnick, & Adelberg's Medical Microbiology by Carroll and Jawetz
5.	Fundamentals of Microbiology by Jeffrey Pommerville

Semester: 1	
a. Course Name:	Fundamentals of Microbiology(P)
b. Course Code:	1902070106
c. Prerequisite:	Students should have a basic understanding of biology, particularly cell structure and function, biomolecules, and general principles of infection and immunity. Familiarity with fundamental laboratory practices and safety protocols is also recommended to ensure smooth adaptation to microbiology lab work.
d. Rationale:	The course "Fundamentals of Microbiology (P)" is designed to provide students with essential practical skills and knowledge required in microbiological laboratory settings. It covers critical areas such as laboratory safety, microscopy, microbial cultivation and identification, antimicrobial susceptibility testing, and diagnostic microbiology. With increasing global challenges related to infectious diseases and antimicrobial resistance, it is vital to equip students with the technical expertise and analytical skills necessary for accurate diagnosis and effective treatment monitoring. This foundational training will prepare students for advanced studies and professional roles in clinical laboratories, research institutes, and healthcare settings.

e. Course Learning Objective:	
CLOBJ 1	To Explain and apply laboratory safety practices, biosafety principles, and maintenance procedures for laboratory equipment and microscopes.
CLOBJ 2	To Differentiate between types of microscope (light, dark field, phase contrast, fluorescence, electron microscopy) and perform basic staining techniques for microbial visualization and classification.
CLOBJ 3	To Prepare and sterilize various culture media; carry out microbial inoculation, isolation, enumeration, and perform key biochemical tests for microbial identification.
CLOBJ 4	To Conduct antimicrobial susceptibility testing using standard methods (Kirby-Bauer, MIC, E-test) and interpret the results to determine the sensitivity/resistance of microorganisms.
CLOBJ 5	To Develop critical analytical skills for troubleshooting laboratory procedures, interpreting microbiological data, and applying findings to clinical microbiology scenarios.

f. Course Outcomes:		
CLO 1	Remembering	Demonstrate understanding of basic laboratory safety protocols, biosafety levels, and proper handling and maintenance of laboratory instruments and microscopes, including advanced microscopy techniques.
CLO 2	Understanding	Prepare, sterilize, and utilize various types of culture media; apply appropriate methods for isolation, cultivation, and identification of microorganisms through staining and biochemical tests.
CLO 3	Applying	Perform antimicrobial sensitivity testing using standard manual methods (Kirby-Bauer, MIC, E-test) and interpret

		results accurately; understand the operation and evaluation of automated AST systems.
CLO 4	Analyzing	Handle clinical specimens following standard guidelines for collection, transport, and processing; diagnose common infections (respiratory, urinary, gastrointestinal) and prepare relevant culture and sensitivity reports.
CLO 5	Evaluating / Creating	Apply critical thinking and technical skills to solve problems related to microbial identification, infection diagnosis, and antimicrobial resistance patterns in clinical settings.

g. Teaching and Examination Scheme

Teaching and Examination Scheme										
Teaching Scheme					Examination Scheme					Total
Lecture Hrs/ Week	Tutorial Hrs/ Week	Lab Hrs/ Week	Total Hrs	Credit	Internal Marks			External Marks		
					T	CE	P	T	P	
4	-	-	60	4	20	20	-	60	-	100

h. Course Content

Sr. No.	Topic	Weightage %	Hours
1.	Unit- 1 Basic Laboratory Techniques and Microscopy - Laboratory hazards and safety rules - Biosafety levels (BSL I-IV) and containment - Laboratory Instrumentation and Maintenance Microscopy: - Principles and working of: - Light microscope - Dark field microscope - Phase contrast microscope - Fluorescence microscope - Electron microscopy (SEM, TEM) – basics Staining Techniques: - Simple and differential staining - Gram staining - Acid-fast staining (Ziehl-Neelsen) - Capsule staining, spore staining, flagella staining & Negative staining	15	10

2	Unit-2 Cultivation and Identification of Microorganisms Preparation of culture media - Natural, synthetic, selective, differential, enriched media Inoculation methods - streaking, spreading, pour plate, serial dilution - Anaerobic culture techniques Isolation and Biochemical tests for microbial identification (IMViC, catalase, oxidase, TSI, urease, etc.)	20	10
3	Unit-3 Antimicrobial Sensitivity Testing - Preparation of Mueller-Hinton Agar (MHA) – standard medium& Quality control of media: pH, sterility, depth. AST Methods Kirby-Bauer Disc Diffusion Method - Inoculation technique (lawn culture) - Application of antibiotic discs - Incubation (temperature, atmosphere, time) - Measurement of inhibition zones Minimum Inhibitory Concentration (MIC) Determination - Broth microdilution and macro dilution - E-test (gradient diffusion method) - Interpretation of MIC values Automated AST Systems - VITEK 2, Phoenix, MicroScan - Advantages and limitations - Interpretation and analysis	30	20
4	Unit-4 Clinical and Diagnostic Microbiology - Sample collection, transport, and processing techniques Laboratory diagnosis of: - Respiratory tract infections (throat swab, sputum) - Urinary tract infections (urine culture) - Gastrointestinal infections (stool examination) - Preparation and interpretation of culture and sensitivity reports	35	20
	Total academic weightage/teaching hours	100	60

i. Text Book and Reference Book:

1.	Prescott's Microbiology by Joanne Willey, Linda Sherwood, & Christopher Woolverton
2.	Medical Microbiology by Murray, Rosenthal, and Pfaller
3.	Microbiology: An Introduction by Tortora, Funke, and Case
4.	Jawetz, Melnick, & Adelberg's Medical Microbiology by Carroll and Jawetz
5.	Fundamentals of Microbiology by Jeffrey Pommerville

Semester : 2	
a. Course Name:	Research Methodology - II (T)
b. Course Code:	1902000201
c. Prerequisite:	Basic knowledge of academic writing, critical thinking, reading scientific literature, formulating academic arguments, and basic tools for data representation
d. Rationale:	To equip students with essential skills to identify, design, conduct, analyze, and present research in a structured and ethical manner.

e. Course Learning Objective:	
CLOBJ 1	To recall and introduce the fundamentals of biostatistics
CLOBJ 2	To demonstrate the use of statistical methods
CLOBJ 3	To illustrate the application of statistics in health sciences
CLOBJ 4	To analyze hypothesis testing and significance
CLOBJ 5	To develop data interpretation and problem-solving skills.

f. Course Outcomes:		
CLO 1	Remembering	Recall and describe the fundamental concepts of biostatistics.
CLO 2	Understanding	Explain the key concepts in biostatistics and interpret the results.
CLO 3	Applying	Apply appropriate statistical methods to analyze and interpret healthcare data effectively.
CLO 4	Analyzing	Differentiate between various hypothesis testing methods and analyze the significance of results in medical research.
CLO 5	Evaluating / Creating	Evaluate the application and relevance of statistical methods in diverse healthcare scenarios.

g. Teaching and Examination Scheme

Teaching Scheme				Examination Scheme					Total
Lecture Hrs /Week	Tutorial Hrs/ Week	Lab Hrs /Week	Credit	Internal Marks			External Marks		
				T	CE	P	T	P	
4	-	-	4	20	20	-	60	-	100

h. Course Content

Sr.	Content	Weightage	Hours
1.	Unit 1- Introduction of statistics: - Concepts, types, significance and scope of statistics, meaning of data, sample, parameter - Type and levels of data and their measurement - Organization and presentation of data - Tabulation of data, frequency distribution - Graphical and tabular presentations.	40%	10

	Measures of central Tendency: Mean, Median, Mode.		
2.	Unit 2- Measures of variability: Range, percentiles, average deviation, quartile deviation, standard deviation.	10%	10
3.	Unit 3- Normal distribution: Probability, characteristics and application of normal probability curve; sampling error.	10%	10
4.	Unit 4- Measures of relationship: Correlation – need and meaning rank order correlation, scatter diagram method product moment correlation simple linear regression analysis and prediction	10%	10
5.	Unit 5- Significance of statistic and significance of difference between two statistics (testing hypothesis) Non parametric test – chi-square test, sign, median test, mann whitney test. Parametric test – ‘t’ test, anova, manova, ancova	10%	10
6.	Unit 6- Use of statistical methods in education: Scaling – z score, z scaling standard score and t score reliability of test scores: test-retest method, parallel forms, split half method.	10%	5
7.	Unit 7- Application of statistics in health: Ratios, rates, trends vital health statistics – birth and death rates. Measures related to fertility, morbidity and mortality	10%	5
	Total teaching hours for the academic year	100%	60

i. Text Book and Reference Book:

1	Research Methodology: A Step-by-Step Guide for Beginners By Ranjit Kumar
2	Research Methodology: Methods and Techniques By C.R.Kothari
3	Biostatistical Analysis (5th Edition) By Jerrold H. Zar
4	Biostatistics: A Foundation for Analysis in the Health Sciences By Wayne W. Daniel

Semester: 2	
a. Course Name:	Research Methodology - II (P)
b. Course Code:	1902000202
c. Prerequisite:	Basic knowledge of academic writing, critical thinking, reading scientific literature, formulating academic arguments, and basic tools for data representation
d. Rationale:	To equip students with essential skills to identify, design, conduct, analyze, and present research in a structured and ethical manner.

e. Course Learning Objective:	
CLOBJ 1	To recall fundamental concepts related to scientific writing, biostatistics, and research presentation formats including journal clubs.
CLOBJ 2	To understand the principles of scientific communication, including interpretation of data in graphical, tabular, and narrative forms.
CLOBJ 3	To apply statistical techniques and software tools for calculating descriptive and inferential statistics relevant to health data.
CLOBJ 4	To analyze scientific literature and datasets for quality, relevance, and statistical soundness during journal club presentations and practical exercises.
CLOBJ 5	To evaluate the structure and content of scientific papers and create well-structured reports or presentations based on analyzed data using appropriate visual and statistical tools.

f. Course Outcomes:		
CLO 1	Remembering	Recall key concepts and terminology related to scientific research, biostatistics, and journal club presentations.
CLO 2	Understanding	Describe the significance and appropriate use of tabular and graphical data representations.
CLO 3	Applying	Apply appropriate statistical tools to datasets and generate outputs using software like SPSS, R, or Excel.
CLO 4	Analyzing	Analyze data trends, research designs, and statistical outputs for meaningful interpretation and implications.
CLO 5	Evaluating / Creating	Evaluate the quality and validity of scientific papers and create original reports or presentations based on data analysis.

g. Teaching and Examination Scheme

Teaching Scheme				Examination Scheme					Total
Lecture Hrs /Week	Tutorial Hrs/ Week	Lab Hrs /Week	Credit	Internal Marks			External Marks		
				T	CE	P	T	P	
-	-	4	2	-	-	40	-	60	100

h. Course Content

Sr.	Content	Weightage	Hours
1.	Journal club presentation.	15%	10
2.	Writing scientific paper.	15%	10
3.	Graphic, tabular presentation of data.	20%	10

4.	Calculation of descriptive and inferential statistics.	20%	10
5.	Practice in using statistical package.	10%	10
6.	Computing vital health statistics.	20%	10
	Total teaching hours for the academic year	100%	60

i. Text Book and Reference Book:

1.	Research Methodology: A Step-by-Step Guide for Beginners By Ranjit Kumar
2.	Research Methodology: Methods and Techniques By C.R.Kothari
3.	Research Methodology By Uma Sekaran, Roger Bougie
4.	Research Design: Qualitative, Quantitative, and Mixed Methods Approaches By John W. Creswell

Semester: 2	
a. Course Name:	Metabolic and Analytical Biochemistry (T)
b. Course Code:	1902070201
c. Prerequisite:	Basic knowledge of biochemistry, specifically metabolism, enzymes, and biophysical properties of body fluids. Understanding of laboratory techniques and instrumentation used in clinical biochemistry.
d. Rationale:	The course offers a thorough understanding of the biochemical mechanisms behind metabolism and metabolic disorders. Provides practical insights into diagnosing and managing metabolic diseases, with a focus on advanced instrumentation and clinical laboratory techniques.

e. Course Learning Objective:	
CLOBJ 1	To introduce students to the basic principles and major metabolic pathways of carbohydrates, lipids, and proteins.
CLOBJ 2	To develop an understanding of the hormonal regulation of metabolic pathways and the biochemical basis of metabolic disorders.
CLOBJ 3	To apply knowledge of acid-base balance, biophysical properties of body fluids, and enzyme kinetics in clinical diagnostics.
CLOBJ 4	To enable students to interpret biochemical test results and analyze metabolic disorders.
CLOBJ 5	To develop skills in designing and implementing biochemical tests using advanced laboratory instruments.

f. Course Outcomes:		
CLO 1	Remembering	Recall the metabolic pathways of carbohydrates, lipids, and proteins, along with key regulatory mechanisms.
CLO 2	Understanding	Explain the biochemical significance of metabolic disorders such as diabetes mellitus, atherosclerosis, and amino acid metabolism disorders.
CLO 3	Applying	Demonstrate knowledge of acid-base balance, enzyme kinetics, and biophysical properties of body fluids in clinical settings.
CLO 4	Analyzing	Interpret biochemical test results related to metabolic disorders and enzyme kinetics.
CLO 5	Evaluating / Creating	Assess the role of enzymology and metabolic regulation in health and disease, and design biochemical techniques using advanced instrumentation.

g. Teaching and Examination Scheme

Teaching and Examination Scheme										
Teaching Scheme					Examination Scheme					Total
Lecture Hrs/ Week	Tutorial Hrs/ Week	Lab Hrs/ Week	Total Hrs	Credit	Internal Marks			External Marks		
					T	CE	P	T	P	
4	-	-	60	4	20	20	-	60	-	100

Lect- Lecture, Lab.- Lab, Tut - Tutorial, T - Theory, P - Practical, CE - CE, T - Theory, P – Practical

h. Course Content

Sr. No.	Topic	Weightage %	Teaching hours
1	Unit 1: Metabolism of Carbohydrates Major Metabolic Pathways & Their Importance: Glycolysis, Gluconeogenesis, Glycogenesis, Glycogenolysis, Pentose Phosphate Pathway (Hexose Monophosphate Shunt), Citric Acid Cycle (TCA/Krebs Cycle), Electron Transport Chain & Oxidative Phosphorylation Hormonal Regulation of Blood Sugar Disease & Marker: Diabetes Mellitus: HbA1c, Fasting Blood Glucose, PPBG, RBG, OGTT, Microalbuminuria) C-Peptide Hypoglycemia: Blood Glucose, Insulin Levels Galactosemia: Galactose-1-phosphate, Galactose in Blood/Urine Hereditary Fructose Intolerance: Fructose-1-phosphate, Aldolase B enzyme activity Glycogen Storage Diseases (GSDs): Blood Glucose,	20%	10

	Liver Enzymes, Muscle Enzyme Assays Lactic Acidosis: Lactate Levels, Blood pH		
2	Unit 2: Metabolism of Lipids • Beta-Oxidation, Ketogenesis, and Ketosis • Lipoprotein Metabolism in Health & Disease (Chylomicrons, VLDL, IDL, LDL, HDL) • Fatty Liver, Atherosclerosis, Cholesterol Metabolism • Fatty Acid Synthesis	20%	10
3	Unit 3: Metabolism of Proteins • Deamination, Transamination, and Decarboxylation of Amino Acids • Ammonia Formation & Detoxification, Urea Cycle Disorders • Inborn Errors of Amino Acid Metabolism and Their Clinical Implications • Special Metabolic Products Derived from Amino Acids	20%	10
4	Unit 4: Acid-Base Balance & Biophysical Properties of Body Fluids • Acid-Base Balance and Disorders • Biophysical Properties of Body Fluids • Donnan Membrane Equilibrium and Clinical Applications	10%	10
5	Unit 5: Enzymology • Definition, Characteristics, Factors Affecting Enzyme Action • Enzyme Inhibition and Isoenzymes	10%	10
6	Unit 6: Instrumentation • Automation in Clinical Biochemistry Laboratory • Colorimetry, Spectrophotometry, Chromatography, Flame Photometry, Fluorimetry, Electrophoresis • Autoanalyzer, Electrolyte Analyzer, Gas Analyzer	11%	10
	Total academic weightage/teaching hours	100	60

i. Text Book and Reference Book:

1.	Practical Clinical Biochemistry by Harold Varley
2.	Textbook of Medical Laboratory Technology by P. B. Godker
3.	Medical Laboratory Technology by Mukherjee
4.	Principal of Biochemistry by M A. Siddiqi
5.	Instrumental Analysis by Chatwal Anand

Semester: 2	
a. Course Name:	Metabolic and Analytical Biochemistry (P)
b. Course Code:	1902070202
c. Prerequisite:	Basic understanding of biochemistry concepts and laboratory safety. Familiarity with biochemical estimations and qualitative analysis techniques.
d. Rationale:	To provide hands-on training in metabolic parameter analysis and use of laboratory instruments for clinical diagnosis. To develop skills in performing biochemical tests, interpreting results, and ensuring quality control.

e. Course Learning Objective:	
CLOBJ 1	To familiarize students with biochemical estimation techniques for glucose, proteins, lipids, renal function markers, and metabolic profiling.
CLOBJ 2	To develop an understanding of laboratory data interpretation for identifying metabolic abnormalities.
CLOBJ 3	To enable students to apply quality control methods to ensure precision and accuracy in biochemical assays.
CLOBJ 4	To provide hands-on experience in operating and analyzing results from laboratory instruments like spectrophotometers, electrophoresis, chromatography systems, and pH meters.
CLOBJ 5	To train students to design standard operating procedures (SOPs) for clinical biochemical tests and correlate findings with disease diagnosis and patient care.

f. Course Outcomes:		
CLO 1	Remembering	Recall principles and methods of biochemical estimations for glucose, proteins, lipids, renal markers, and bilirubin.
CLO 2	Understanding	Explain the biochemical significance of metabolic parameters in health and disease conditions.
CLO 3	Applying	Perform biochemical assays for glucose, proteins, lipids, and renal function markers using standard laboratory techniques.
CLO 4	Analyzing	Analyze and interpret laboratory data to detect and diagnose metabolic abnormalities.
CLO 5	Evaluating / Creating	Evaluate the quality and accuracy of biochemical results through quality control practices.

g. Teaching and Examination Scheme

Teaching and Examination Scheme										
Teaching Scheme					Examination Scheme					Total
Lecture Hrs/ Week	Tutorial Hrs/ Week	Lab Hrs/ Week	Total Hrs	Credit	Internal Marks			External Marks		
					T	CE	P	T	P	
-	-	4	60	2	-	-	40	-	60	100

Lect- Lecture, Lab.- Lab, Tut - Tutorial, T - Theory, P - Practical, CE - CE, T - Theory, P – Practical

h. Course Content

Sr No	Contents	Weightage	Hours
1	Estimation of Blood/Serum Glucose by GOD POD method.	10%	6
2	Estimation of Glucose Tolerance Test (GTT)	10%	6
3	Estimation of Total Protein & A/G Ratio	10%	6
4	Estimation of Total Cholesterol, Fractions & Plasma Protein and Lipoprotein Electrophoresis	10%	6
5	Estimation of Calcium & Phosphorus	10%	6
6	Estimation of Serum Urea	10%	6
7	Estimation of Serum Creatinine	10%	6
8	Estimation of Serum Bilirubin	10%	6
9	Estimation of Serum Uric acid	10%	6
10	Demonstration of Instrumentation practicals • Spectrophotometers • Colorimeter • Gel Electrophoresis, Hb & Serum • Chromatography: TLC, HPLC, GC • pH meter	10%	6
Total academic weightage/Practical hours		100	60

i. Text Book and Reference Book:

1.	Practical Clinical Biochemistry by Harold Varley
2.	Textbook of Medical Laboratory Technology by P. B. Godker
3.	Medical Laboratory Technology by Mukherjee
4.	Principal of Biochemistry by M A. Siddiqi
5.	Instrumental Analysis by Chatwal Anand

Semester : 2	
a. Course Name:	Principle of Coagulation Studies and Clinical Pathology (T)
b. Course Code:	1902070203
c. Prerequisite:	The course <i>Principle of Coagulation Studies and Clinical Pathology</i> is designed to equip postgraduate students in Medical Laboratory Technology with a deep understanding of coagulation mechanisms, related disorders, and the clinical evaluation of body fluids. Coagulation disorders are critical components in the diagnosis and management of hematological and systemic diseases. Accurate interpretation of coagulation profiles and pathological fluid analyses is essential in modern diagnostics and patient care. This course ensures that students acquire both theoretical knowledge and practical skills necessary to perform, interpret, and standardize coagulation and clinical pathology tests. It also supports the development of competencies required in laboratory quality assurance, clinical decision-making, and the formulation of SOPs for coagulation-related procedures, thus preparing students for advanced roles in clinical laboratories, hospitals, and diagnostic centers.
d. Rationale:	Students enrolling in this course should have completed undergraduate-level courses in the following areas: • Basic Human Physiology and Biochemistry: Understanding of hemostasis, blood components, and metabolic pathways. • Hematology: Prior knowledge of blood cells, their functions, and common blood disorders. • Laboratory Instrumentation and Techniques: Familiarity with basic lab equipment and standard operating procedures. • Pathology: Introductory understanding of disease mechanisms and diagnostic methods. These foundational subjects will help students grasp complex concepts in coagulation studies and fluid analysis and apply them effectively in clinical laboratory settings.

e. Course Learning Objective:	
CLOBJ 1	Recall the physiological mechanisms of Hemostasis and functions of coagulation factors.
CLOBJ 2	Explain the types and causes of coagulation disorders, including bleeding and thrombotic conditions.
CLOBJ 3	Apply appropriate laboratory techniques to perform coagulation and body fluid tests.
CLOBJ 4	Analyze the results of coagulation studies and correlate them with clinical conditions.
CLOBJ 5	Evaluate diagnostic outcomes of body fluid analysis in various disease conditions.

f. Course Outcomes:		
CLO 1	Remembering	Describe the fundamental principles of coagulation,

		hemostasis, and clinical pathology.
CLO 2	Understanding	Explain the pathophysiology of bleeding and thrombotic disorders and associated diagnostic procedures.
CLO 3	Applying	Perform standard coagulation and clinical pathology tests accurately in a laboratory setting.
CLO 4	Analyzing	Analyze laboratory test results and identify abnormalities in coagulation profiles and body fluids.
CLO 5	Evaluating / Creating	Evaluate the significance of test results in relation to patient symptoms and disease progression.

g. Teaching and Examination Scheme

Teaching Scheme				Examination Scheme					Total
Lecture Hrs /Week	Tutorial Hrs/ Week	Lab Hrs /Week	Credit	Internal Marks			External Marks		
				T	CE	P	T	P	
4	-	-	4	20	20	-	60	-	100

h. Course Content

Sr.	Content	Weightage	Hours
1	Unit 1: Introduction to Coagulation Studies - Mechanism of Hemostasis & physiological properties of coagulation factors, - Radioactivity: definition, half-life, physical decay and units.	20%	15
2	Unit 2: Disorders related to Coagulation - Bleeding disorders - Introduction Causes of bleeding disorders - Vascular defect - Platelet defect - Factor deficiency - Inhibitors - Hyper fibrinolysis - Types of bleeding disorders - Inherited bleeding disorders - Acquired bleeding disorders - Thrombosis - Introduction - Causes of thrombosis - Monitoring of Anticoagulants - Oral anticoagulants by INR Heparin	20%	15

3	Unit 3: Diagnostic Parameters for coagulation studies • Perform BT, CT, Hess test, PT and APTT • Quantitative assay of coagulation factors • Principle, Procedure, Screening of inhibitors • Inhibitors against coagulation factors • APLA (antiphospholipid antibodies) • Calculating INR and determining the ISI of thromboplastin • Quantitative Factor assays: Factor VIII Factor IX Factor VII Factor X Factor V • Euglobulin Clot lysis test Urea clot solubility test for factor XIII	30%	15
4	Unit 4: Clinical Pathology Examination of Various Body Fluids • Urine • Stool • CSF • Seminal • Synovial	30%	15
	Total teaching hours for the academic year	100%	60

i. Text Book and Reference Book:

1	Text book of Medical Laboratory Technology by P.B. Godkar.
2	Medical Laboratory Science, Theory & Practical by A. Kolhatkar
3	Clinical Diagnosis & Management by Laboratory methods (20th edition) by John Bernard Henary
4	Atlas of Haematology (5th edition) by G.A.
5	De Gruchy's clinical Haematology in medical practice

Semester : 2	
a. Course Name:	Principle of Coagulation Studies and Clinical Pathology (P)
b. Course Code:	1902070204
c. Prerequisite:	To enroll in this course, students should have prior knowledge and skills in the following areas: • Basic Hematology and Coagulation Physiology: Understanding of blood components, coagulation pathways, and hemostasis. • Clinical Biochemistry and Pathology: Familiarity with disease mechanisms and laboratory correlation. • Laboratory Techniques: Proficiency in using pipettes, centrifuges, and microscopes; familiarity with lab safety and basic test procedures. • Analytical Thinking: Ability to follow test protocols, record observations, and interpret clinical results. These foundational competencies are essential for effectively performing and understanding the practical applications of coagulation studies and clinical pathology.
d. Rationale:	The practical course “<i>Principle of Coagulation Studies and Clinical Pathology (P)</i>” is vital for developing hands-on expertise in diagnostic procedures that assess the hemostatic system. Understanding and evaluating coagulation parameters such as platelet count, bleeding time, clotting time, and factor assays are crucial for diagnosing bleeding and thrombotic disorders. This course bridges theoretical concepts with laboratory practice, emphasizing real-time interpretation of results and their clinical significance. By engaging in practical demonstrations and testing, students build competence in performing and analyzing essential coagulation tests, ensuring readiness for roles in diagnostic laboratories, transfusion centers, and hospital pathology departments. The course also strengthens critical thinking by encouraging the formulation of protocols and evaluating test outcomes in varied clinical contexts.

e. Course Learning Objective:	
CLOBJ 1	Recall the basic principles of hemostasis and the mechanisms involved in blood coagulation.
CLOBJ 2	Understand the clinical importance of platelet count, bleeding time, and clotting time in diagnostics.
CLOBJ 3	Apply laboratory techniques to perform platelet count, BT, CT, PTT, APTT, and Thrombin Time.
CLOBJ 4	Analyze and interpret results of routine and advanced coagulation tests.
CLOBJ 5	Evaluate the accuracy and clinical relevance of screening tests in coagulation disorders.

f. Course Outcomes:		
CLO 1	Remembering	Recall the principles of hemostasis and coagulation mechanisms.

CLO 2	Understanding	Explain the significance of coagulation tests in diagnosing platelet and bleeding disorders.
CLO 3	Applying	Perform platelet count, bleeding time, and clotting time using standard laboratory techniques.
CLO 4	Analyzing	Analyze test results such as PTT, APTT, and Thrombin Time to identify abnormalities.
CLO 5	Evaluating / Creating	Evaluate the effectiveness of screening tests in identifying coagulation disorders.

g. Teaching and Examination Scheme

Teaching Scheme				Examination Scheme					Total
Lecture Hrs /Week	Tutorial Hrs/ Week	Lab Hrs /Week	Credit	Internal Marks			External Marks		
				T	CE	P	T	P	
-	-	4	2	-	-	40	-	60	100

h. Course Content

Sr.	Content	Weightage	Hours
1	Introduction to Normal Hemostasis and Mechanism of coagulation.	11%	7
2	Performance of Platelet count by Hemocytometer, Autoanalyzer and their clinical significance with platelet disorders.	12%	7
3	Performance of Bleeding time & Clotting time	11%	6
4	Partial thromboplastin time	11%	6
5	Activated Thromboplastin time	11%	6
6	Thrombin Time	11%	6
7	Screening Tests for coagulation Studies and their significance	11%	6
8	Demonstration and Calculating INR and determining the ISI of thromboplastin	11%	6
9	Quantitative Factor assays Factor VIII Factor IX Factor VII Factor X Factor V	11%	10
	Total teaching hours for the academic year	100%	60

i. Text Book and Reference Book:

1	Text book of Medical Laboratory Technology by P.B. Godkar.
2	Medical Laboratory Science, Theory & Practical by A. Kolhatkar.
3	Clinical Diagnosis & Management by Laboratory methods (20th edition) by John Bernard Henary
4	Atlas of Haematology (5th edition) by G.A.

5	De Gruchy's clinical Haematology in medical practice
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Semester: 2	
a. Course Name:	Immunology & Virology (T)
b. Course Code:	1902070205
c. Prerequisite:	Students should have a fundamental understanding of basic biology, especially cell biology, microbiology, and human physiology. Prior knowledge of microbial structures, mechanisms of infection, and basic laboratory safety principles will facilitate better comprehension of immunological and virological concepts.
d. Rationale:	The course "Immunology & Virology (T)" is designed to introduce students to the essential principles governing immune responses and viral infections. With the rising significance of immunology in disease prevention, diagnosis, treatment, and vaccine development, and the increasing global burden of emerging viral diseases, it is critical for students to develop a strong theoretical background. This course equips students with the necessary knowledge to understand immune mechanisms, hypersensitivity, autoimmune disorders, viral structure, replication, pathogenesis, and diagnostic virology. It prepares students for advanced study, clinical practice, research, and careers in healthcare and biomedical sciences

e. Course Learning Objective:	
CLOBJ 1	To Apply fundamental immunology and virology concepts in healthcare and laboratory settings.
CLOBJ 2	To Explain immune responses, antigen-antibody interactions, and disease pathogenesis.
CLOBJ 3	To Analyze hypersensitivity, autoimmunity, and immunological disorders
CLOBJ 4	To Utilize immunological and virological concepts for disease prevention and treatment.
CLOBJ 5	To Evaluate emerging viral infections and advancements in immunotherapy

f. Course Outcomes:		
CLO 1	Remembering	Explain the fundamentals of immunology, including immune system components and mechanisms.
CLO 2	Understanding	Describe hypersensitivity reactions, autoimmune diseases, and their pathophysiology.
CLO 3	Applying	Understand immunotechnology applications, including vaccine development and monoclonal antibodies.
CLO 4	Analyzing	Explain the classification, replication, and pathogenesis of viruses.
CLO 5	Evaluating / Creating	Analyze viral diseases, diagnostic techniques, and antiviral therapies

g. Teaching and Examination Scheme

Teaching and Examination Scheme										
Teaching Scheme					Examination Scheme					Total
Lecture Hrs/ Week	Tutorial Hrs/ Week	Lab Hrs/ Week	Total Hrs	Credit	Internal Marks			External Marks		
					T	CE	P	T	P	
4	-	-	60	4	20	20	-	60	-	100

h. Course Content

Sr. No.	Topic	Weightage %	Hours
1	Unit 1: Introduction to Immunology - Overview of the Immune System - Cells and Organs of the Immune System - Antigens and Antibodies - Immunological Memory and Tolerance	20	10
2	Unit 2: Components of Immunity - Components of Innate Immunity - Mechanisms of Adaptive Immunity (Humoral and Cell-Mediated) - Cytokines and Their Role in Immune Regulation - Complement System and its Activation Pathways	20	10
3	Unit 3: General Virology and Viral Pathogenesis - Classification and Structure of Viruses - Viral Replication Mechanisms - Host-Virus Interactions - The genetics of viruses, The pathogenicity of viruses	15	10
4	Unit 4: Clinical Virology and Emerging Viral Diseases - Bacteriophage, - Diseases caused, lab diagnosis and prevention of; -Herpes viruses, -Rubella virus, -Influenza viruses, -Paramyxoviridae -Polio, -Hepatitis viruses -Rabies virus, -Human immunodeficiency viruses -Oncogenic virus	30	15
5	Unit 5: Hypersensitivity and Autoimmune Disorders - Types of Hypersensitivity Reactions - Mechanisms of Autoimmune Diseases - Organ-Specific and Systemic Autoimmune	15	15

	Disorders • Immunosuppressive Therapies		
	Total academic weightage/teaching hours	100	60

i. Text Book and Reference Book:

1.	Kuby Immunology by Owen, Punt, and Stranford
2.	Cellular and Molecular Immunology by Abbas, Lichtman, and Pillai
3.	Fields Virology by Knipe and Howley
4.	Medical Virology by White and Fenner
5.	Essential Immunology by Roitt and Delves

Semester: 2	
a. Course Name:	Immunology & Virology(P)
b. Course Code:	1902070206
c. Prerequisite:	Students should have basic knowledge of microbiology, human biology, and laboratory safety procedures. Familiarity with fundamental biological processes, including infection mechanisms and immune responses, is recommended to successfully perform and interpret immunological and virological laboratory tests.
d. Rationale:	The course "Immunology & Virology (P)" is designed to equip students with essential hands-on skills in immunological and virological diagnostics. With the growing importance of rapid and accurate detection of immune disorders and viral infections in clinical practice, students must gain proficiency in both traditional and advanced laboratory techniques such as ELISA, Western blotting, PCR, and rapid antigen testing. This course bridges theoretical knowledge with practical expertise, preparing students for professional roles in diagnostic laboratories, research institutes, and healthcare settings, where precision and biosafety are critical.

e. Course Learning Objective:	
CLOBJ 1	To Develop hands-on expertise in immunological and virological laboratory techniques.
CLOBJ 2	To Apply diagnostic tools for immune disorders and viral infections.
CLOBJ 3	To Perform serological and molecular techniques for disease identification.
CLOBJ 4	To Demonstrate critical thinking in virology and immunology diagnostics.
CLOBJ 5	To Utilize modern immunological and virological research tools in diagnostics and therapeutics.

f. Course Outcomes:		
CLO 1	Remembering	Explain the basic principles of immunology and virology.
CLO 2	Understanding	Perform fundamental immunological tests such as ELISA and Widal test.
CLO 3	Applying	Conduct antigen-antibody interaction experiments and analyze results
CLO 4	Analyzing	Analyze clinical samples using serological and molecular diagnostic methods.
CLO 5	Evaluating / Creating	Demonstrate proficiency in advanced immunological and virological laboratory techniques.

g. Teaching and Examination Scheme

Teaching and Examination Scheme										
Teaching Scheme					Examination Scheme					Total
Lecture Hrs/ Week	Tutorial Hrs/ Week	Lab Hrs/ Week	Total Hrs	Credit	Internal Marks			External Marks		
					T	CE	P	T	P	
4	-	-	60	4	20	20	-	60	-	100

h. Course Content

Sr. No.	Topic	Weightage %	Hours
1	Unit-1 Immunological Techniques - Preparation of reagents (buffers, antigens, antisera) - ELISA Technique: - Direct ELISA - Indirect ELISA - Sandwich ELISA (for antigen detection) - Immunofluorescence Technique: - Direct and Indirect methods on slides - Western Blotting: - Protein transfer and detection by antibodies - Rapid Immunochromatographic Tests (ICT): - COVID-19 rapid antibody test - Dengue NS1 antigen test - Agglutination-Based Rapid Tests - Latex agglutination test for CRP/RF	15	10
2	Unit-2 Antigen-Antibody Reactions - Precipitation Techniques: - Single Radial Immunodiffusion (Mancini method) - Double Immunodiffusion (Ouchterlony)	15	10

	method) • Agglutination Reactions: ◦ Widal test for Typhoid diagnosis ◦ Slide agglutination for Salmonella or Staphylococcus typing ◦ Blood grouping (ABO and Rh typing) • Complement Fixation Test (basic demonstration) • Immunoelectrophoresis (antigen-antibody diffusion combined with electrophoresis)		
3	Unit-3 Virological Techniques • Sample Collection for Viral Diagnostics: ◦ Nasopharyngeal swab collection ◦ Blood (serum/plasma) sample handling ◦ Stool samples for enteroviruses • Viral Culture Techniques (Demonstration or Visit-Based): ◦ Cell line maintenance (Vero cells, HeLa cells - demo) ◦ Cytopathic effect observation (demo images/videos if live unavailable) • Hemagglutination (HA) and Hemagglutination Inhibition (HI) Assay • Rapid Antigen Detection Tests (RADTs): ◦ Influenza antigen detection ◦ Rotavirus antigen in stool samples	20	15
4	Unit-4 Polymerase Chain Reaction (PCR) for Viral Detection. • DNA/RNA extraction from clinical samples ◦ Manual extraction (phenol-chloroform) ◦ Spin column method (demo if kits are used) • Reverse Transcription PCR (RT-PCR) (if RNA viruses like SARS-CoV-2 are targeted) • Conventional PCR Setup: ◦ Master mix preparation ◦ Primer design basics (demo only) ◦ Amplification of viral genes (e.g.,	25	15

	CMV, HPV, HBV) • Gel Electrophoresis: ◦ Running and interpreting PCR products • Real-Time PCR (qPCR) (Demo or Visit if available): ◦ Threshold cycle (Ct) interpretation ◦ Viral load estimation basics		
5	Unit-5 Clinical Sample Analysis in Virology & Immunology • Processing of clinical specimens: ◦ Nasal/throat swab in Viral Transport Medium (VTM) ◦ Urine/stool samples • ELISA for Viral Serology: ◦ HIV, HBsAg, HCV antibody detection • Interpretation of Laboratory Test Results: ◦ Positive and Negative controls in immunological assays ◦ Reporting format for serological and virological findings • Correlation with clinical symptoms • Biosafety precautions in handling infectious samples (PPE, Biosafety cabinets)	25	10
	Total academic weightage/teaching hours	100	60

i. Text Book and Reference Book:

1.	Kuby Immunology by Owen, Punt, Stranford
2.	Janeway's Immunobiology by Murphy & Weaver
3.	Essential Immunology by Roitt & Delves
4.	Medical Virology by D.E. White & Fenner
5.	Principles of Virology by Flint et al.

Semester: 3	
a. Course Name:	Clinical and Molecular Biochemistry (T)
b. Course Code:	1902070301
c. Prerequisite:	Basic understanding of human biochemistry, metabolism, molecular biology, and clinical laboratory principles.
d. Rationale:	This course builds a strong theoretical foundation in clinical biochemistry and molecular biology, preparing students for accurate disease diagnosis, laboratory management, and research applications.

e. Course Learning Objective:	
CLOBJ 1	To explain biochemical processes related to hemoglobin, heme metabolism, and purine degradation.
CLOBJ 2	To describe the diagnostic significance of clinical enzymes and biomarkers.
CLOBJ 3	To interpret various organ function tests and understand laboratory quality control measures.
CLOBJ 4	To illustrate molecular biology mechanisms and diagnostic techniques like PCR and blotting.
CLOBJ 5	To evaluate biochemical markers and clinical reporting procedures in emergency settings.

f. Course Outcomes:		
CLO 1	Remembering	Recall hemoglobin synthesis, bilirubin metabolism, and purine catabolism.
CLO 2	Understanding	Explain the diagnostic value of enzymes, biomarkers, and biochemical pathways.
CLO 3	Applying	Perform interpretation of organ function tests and quality control programs.
CLO 4	Analyzing	Analyze molecular biology techniques for clinical diagnostics.
CLO 5	Evaluating / Creating	Assess the importance of biochemical markers in disease management and emergencies.

g. Teaching and Examination Scheme

Teaching and Examination Scheme										
Teaching Scheme					Examination Scheme					Total
Lecture Hrs/ Week	Tutorial Hrs/ Week	Lab Hrs/ Week	Total Hrs	Credit	Internal Marks			External Marks		
					T	CE	P	T	P	
4	-	-	60	4	20	20	-	60	-	100

Lect- Lecture, Lab.- Lab, Tut - Tutorial, T - Theory, P - Practical, CE - CE, T - Theory, P – Practical

h. Course Content

Sr. No.	Topic	Weightage %	Teaching hours
1	Unit 1: Hemoglobin & Heme Metabolism • Hemoglobin Synthesis • Heme Breakdown and Jaundice • Bilirubin Metabolism, Van den Bergh Test	20%	10
2	Unit 2: Purine Metabolism & Diagnostic Enzymes • Purine Catabolism & Gout • Diagnostic Use of Enzymes and Isoenzymes	20%	5
3	Unit 3: Organ Function Tests & Quality Control • Liver, Renal, Pancreatic, Thyroid, and Cardiac Function Tests • Internal & External Quality Control Programs	20%	15
4	Unit 4: Molecular Biology • DNA Replication, Transcription, and Translation • Protein Targeting & Folding • DNA Recombinant Technology, Gene Therapy • PCR, Blot Techniques (Southern, Western, Northern), RFLP, VNTR	15%	15
5	Unit 5: Clinical Biochemistry & Disease Biomarkers • Free Radicals & Antioxidants • Biochemical Aspects of Cancer & Cancer Markers • Cardiac Enzymes, Lipid Profile, Iron Profile • Hormonal Assays (Thyroid, FSH, LH, Prolactin, Cortisol, Testosterone, etc.) • Blood Gas Analysis & Serum Electrolytes • Clinical Reporting in Emergency Cases	25%	15
	Total teaching hours for the academic year	100	60

i. Text Book and Reference Book:

1.	Practical Clinical Biochemistry by Harold Varley
2.	Textbook of Medical Laboratory Technology by P. B. Godker
3.	Medical Laboratory Technology by Mukherjee
4.	Principal of Biochemistry by M A. Siddiqi
5.	Instrumental Analysis by Chatwal Anand

Semester: 3	
a. Course Name:	Metabolic and Analytical Biochemistry (P)
b. Course Code:	1902070302
c. Prerequisite:	Basic knowledge of clinical biochemistry techniques, fundamental understanding of metabolism, molecular biology principles, and familiarity with laboratory instrumentation.
d. Rationale:	This course provides practical skills in biochemical and molecular diagnostics, enabling students to perform clinical assays, understand disease markers, and apply quality control measures essential for accurate laboratory reporting.

e. Course Learning Objective:	
CLOBJ 1	To introduce key biochemical assays related to iron profile, glycated hemoglobin, and organ function tests.
CLOBJ 2	To develop competency in advanced biochemical techniques like ELISA, chemiluminescence, and spectrophotometry.
CLOBJ 3	To enable students to perform molecular diagnostic techniques such as PCR, blotting, and nucleic acid extraction.
CLOBJ 4	To train students in interpreting biochemical and molecular test results for clinical relevance.
CLOBJ 5	To instill knowledge of laboratory quality control and troubleshooting errors in biochemical testing.

f. Course Outcomes:		
CLO 1	Remembering	Recall principles and procedures of key biochemical assays.
CLO 2	Understanding	Explain the clinical relevance of biochemical and molecular markers in diagnosis.
CLO 3	Applying	Perform routine and advanced biochemical and molecular diagnostic tests.
CLO 4	Analyzing	Interpret and compare results from biochemical and molecular diagnostic techniques.
CLO 5	Evaluating / Creating	Evaluate laboratory results using quality control standards and troubleshoot errors.

g. Teaching and Examination Scheme

Teaching and Examination Scheme										
Teaching Scheme					Examination Scheme					Total
Lecture Hrs/ Week	Tutorial Hrs/ Week	Lab Hrs/ Week	Total Hrs	Credit	Internal Marks			External Marks		
					T	CE	P	T	P	
-	-	4	60	2	-	-	40	-	60	100

Lect- Lecture, Lab.- Lab, Tut - Tutorial, T - Theory, P - Practical, CE - CE, T - Theory, P – Practical

h. Course Content

No.	Contents	Weightage %	Hours
1.	Estimation of Iron Profile: Serum Iron Measurement (Spectrophotometry), Total Iron Binding Capacity (TIBC), Ferritin Estimation.	10%	7
2.	Estimation of Glycated Hemoglobin.	10%	5
3.	Estimation of Organ Function Test: • Liver Function Test • Thyroid Function Test • Cardiac Function test • Renal Function test • Pancreatic function test • Lipid Profile	20%	13
4.	Estimation of Arterial Blood Gas (ABG) Analysis	5%	2
5.	Estimation of Serum Electrolyte (Na ⁺ , Ca ⁺ , K ⁺)	5%	2
6.	Demonstration of Advanced biochemical Testing • ELISA • Chemiluminescence Technique • Radioimmunoassay • Spectrophotometry	20%	8
7.	Demonstration & Performance of Molecular Techniques: • Phenol-Chloroform for DNA, TRIzol/Guanidinium for RNA, Silica Column-Based DNA/RNA Extraction Kits • Blot Techniques (Western, Southern, Northern) • Demonstration & Performance of PCR • Electrophoresis	20%	13
8.	Quality Control & Assurance in Biochemistry lab	10%	10
	Total academic weightage/Practical hours	100	60

i. Text Book and Reference Book:

1.	Practical Clinical Biochemistry by Harold Varley
2.	Textbook of Medical Laboratory Technology by P. B. Godker
3.	Medical Laboratory Technology by Mukherjee
4.	Principal of Biochemistry by M A. Siddiqi
5.	Instrumental Analysis by Chatwal Anand

Semester : 3	
a. Course Name:	Histopathology and Cytopathology (T)
b. Course Code:	1902070303
c. Prerequisite:	Students enrolling in this course are expected to have: • Fundamental knowledge of human anatomy and physiology. • Basic understanding of pathological processes and microbiology. • Prior exposure to general laboratory practices and biosafety. • Familiarity with essential concepts in medical laboratory technology, ideally covered in the first and second semesters of the M.Sc. MLT program.
d. Rationale:	Histopathology and cytopathology are critical branches of diagnostic pathology, offering detailed insights into tissue and cellular abnormalities. This course is designed to provide M.Sc. Medical Laboratory Technology students with theoretical and practical knowledge essential for the identification of diseases at the cellular and tissue levels. The rationale includes: • Enabling accurate diagnostic evaluation of diseases through microscopic analysis of tissues and cells. • Equipping students with hands-on skills in tissue processing, staining, and cytological techniques including FNAC and fluid cytology. • Preparing students to contribute effectively in clinical laboratories, pathology labs, and research settings by understanding the technological advancements in automation and immune-cytochemistry. • Fostering analytical skills to differentiate normal from pathological samples, thereby playing a key role in disease detection and prognosis.

e. Course Learning Objective:	
CLOBJ 1	Define and recall the fundamental principles of histology and cytology, including disease manifestations at the tissue and cellular levels.
CLOBJ 2	Explain the procedures and principles involved in tissue processing, fixation, sectioning, and staining techniques used in histopathological examinations
CLOBJ 3	Demonstrate technical competence in handling histotechnology equipment, preparing tissue samples, and executing standard laboratory protocols.
CLOBJ 4	Analyze histological and cytological slides to distinguish between normal and pathological changes across different organ systems.
CLOBJ 5	Evaluate laboratory results and correlate cytological/histological findings with clinical conditions for accurate diagnosis and prognosis.

f. Course Outcomes:		
CLO 1	Remembering	Define and recall the core concepts of histopathology and cytopathology, including key terminologies, tissue structures, and cellular abnormalities.
CLO 2	Understanding	Explain the principles and methodologies of tissue processing,

		fixation, embedding, section cutting, and staining in histopathology.
CLO 3	Applying	Demonstrate standard laboratory procedures in histotechnology and cytotechnology, including use of stains, fixatives, and sectioning equipment.
CLO 4	Analyzing	Differentiate between normal and pathological tissue and cell samples using microscopic techniques.
CLO 5	Evaluating / Creating	Critically evaluate histopathological and cytological reports for diagnostic accuracy and clinical relevance.

g. Teaching and Examination Scheme

Teaching Scheme				Examination Scheme					Total
Lecture Hrs /Week	Tutorial Hrs/ Week	Lab Hrs /Week	Credit	Internal Marks			External Marks		
				T	CE	P	T	P	
4	-	-	4	20	20	-	60	-	100

h. Course Content

Sr.	Content	Weightage	Hours
1	Unit 1: FUNDAMENTAL OF HISTOLOGY - Alimentary System: Diseases of mouth, Diseases of Esophagus- Esophageal varices. - Digestive System: Gastritis, Peptic ulceration, Appendicitis microbial diseases, food poisoning, hernia, Intestinal obstructions & mal absorption. - Accessory Digestive glands: Salivary glands- mumps - Liver – hepatitis, liver failure, cirrhosis. - Pancreas- pancreatitis. - Gall Bladder- Gall stones, jaundice and cardiovascular diseases. - Circulatory System: Diseases of Blood vessels- Atheroma, Arteriosclerosis, heart block. - Disorders of Blood Pressure-Hyper & Hypotension. - Respiratory System: Upper respiratory tract infection, Bronchi, Asthma, Pneumonia, Lung abscess, Tuberculosis, Lung Collapse. - Urinary System: Glomerulonephritis, Nephrotic syndrome, renal failure, renal calculi, Urinary obstruction, Urinary tract infection. - Reproductive system: Sexually transmitted diseases, Pelvic inflammatory disease, disorder of	30%	20

	cervix (CIN), Disease of ovaries, ectopic pregnancy, prostatitis, Infertility • Nervous System: Neuronal damage, ICP, Cerebral Infarction, head injury, Alzheimer 's disease, dementia. • Endocrine System: • Pituitary: Hyper & Hypo secretions • Thyroid: Goiter • Adrenal: Cushing Syndrome, Addison Disease • Pancreas: Diabetes Sense Organs: Ear: Otitis Eye: Cataract		
2	Unit 2: Histotechnology • Introduction, Care, and maintenance of laboratory equipment used in histotechnology. • Safety measures in a histopathology laboratory • Basic concepts about routine methods of examination of tissues • Collection and transportation of specimens for histological examination • Basic concepts of fixation Various types of fixatives used in a routine histopathology laboratory. Simple fixatives Compound fixatives Special fixatives for demonstration of various tissue elements • Decalcification Criteria of a good decalcification agent, Technique of decalcification followed with selection of tissue, fixation, and decalcification, neutralization of acid and thorough washing. Various types of decalcifying fluids: Organic & Inorganic Acid, chelating agents, Use of Ion-exchange resins and Electrophoretic decalcification and treatment of hard tissues which are not calcified. • Tissue Processing • Components & principles of various types of automatic tissue Processors Embedding: Definition Various types of embedding media • Section Cutting Introduction regarding equipment used for sectioning Microtome Knives	40%	20

	Sharpening of Microtome Knives, Honing, Stopping, various types of microtomes and their applications - Freezing Microtome and various types of Cryostats. Faults in paraffin section cutting with reason and remedy, spreading the sections and attachment, or mounting of sections to glass slides. - Staining, Impregnation and Mountains Theory of Staining, Classifications of Dyes, Principles of Dye Chemistry Stains and Dyes and their uses. - Types of Stains, Chemical Staining Action, Mordants and Accentuators, Metachromasia Use of Controls in Staining Procedures Preparation of Stains, solvents, aniline water, and buffers etc.		
3	Unit 3: Cytopathology - Enzyme Cytochemistry: Diagnostic applications Demonstration of Phosphatases, Dehydrogenases, Oxidases & Peroxidases Vital staining for Sex Chromatin - Aspiration cytology: Principle Indications & utility of the technique with special emphasis on role of cytotechnologist in FNAC clinics Exfoliative cytology (Papanicolaou technique for the staining of cervical smears) Cervical cytology - Fluid Cytology Urine CSF Body Fluids (Pleural, Pericardial, Ascitic) Automation in cytology Liquid based cytology: Principles and preparation, Cytoentrifuge, molecular cytology, Cell Block and Immune-cytochemistry	30%	20
	Total teaching hours for the academic year	100%	60

i. Text Book and Reference Book:

1	Handbook of Histopathological Techniques by C F A Culling
2	Medical Lab technology by Lynch
3	An Introduction to Medical Lab Technology by F J Baker and Silverton
4	Bancroft 's Theory and Practice of Histopathological Techniques by John D Bancroft

5	Diagnostic Cytology by Koss Volume -II
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Semester : 3	
a. Course Name:	Histology and Cytology (P)
b. Course Code:	1902070304
c. Prerequisite:	To successfully undertake this course, students should have prior learning and skills in: • Basic Anatomy and Physiology: To understand the structure and function of human tissues and organs. • General Pathology: To recognize normal vs. pathological tissue changes. • Biochemistry and Cell Biology: For understanding the molecular basis of cellular function and degeneration. • Laboratory Techniques: Familiarity with basic laboratory instruments, safety procedures, and microscopy. • Histology (Theory): Previous exposure to tissue types and staining principles is strongly recommended. These prerequisites ensure students are well-prepared to comprehend and apply histological and cytological techniques accurately in a laboratory setting.
d. Rationale:	The practical course <i>Histopathology and Cytology (P)</i> is fundamental in training students to process, stain, and analyze human tissue samples for diagnostic purposes. Histopathological techniques are crucial in identifying structural abnormalities and cellular changes associated with various diseases, particularly cancers and chronic conditions. This course integrates foundational techniques such as tissue fixation, embedding, sectioning, and staining—including both routine and special stains. Students will gain hands-on experience with modern tools such as cryostats and immunohistochemistry protocols, preparing them for work in diagnostic laboratories, research institutions, and hospitals. The emphasis on slide preparation, interpretation, and quality assessment ensures that graduates meet the current demands for precision in clinical pathology and cytodiagnosis.

e. Course Learning Objective:	
CLOBJ 1	Recall the fundamental principles of histopathology and cytology, including tissue types and staining basics.
CLOBJ 2	Explain the importance and application of various staining methods in identifying tissue characteristics.
CLOBJ 3	Demonstrate tissue processing techniques including fixation, embedding, sectioning, and staining.
CLOBJ 4	Analyze stained tissue slides to distinguish between normal and pathological structures under a microscope.
CLOBJ 5	Evaluate the quality of histopathological and cytological preparations and suggest improvements.

f. Course Outcomes:		
CLO 1	Remembering	Recall the principles and techniques of tissue fixation,

		processing, staining, and sectioning.
CLO 2	Understanding	Explain the relevance of various histopathological and cytological stains in diagnosing disease conditions.
CLO 3	Applying	Apply tissue preparation techniques including embedding, microtomy, and staining in a laboratory setting.
CLO 4	Analyzing	Analyze stained tissue sections to differentiate between normal and pathological histological features.
CLO 5	Evaluating / Creating	Evaluate the accuracy, precision, and quality of histological slide preparations.

g. Teaching and Examination Scheme

Teaching Scheme				Examination Scheme					Total
Lecture Hrs /Week	Tutorial Hrs/ Week	Lab Hrs /Week	Credit	Internal Marks			External Marks		
				T	CE	P	T	P	
-	-	4	2	-	-	40	-	60	100

h. Course Content

Sr.	Content	Weightage	Hours
1	To study squamous cells from cheek cells (Buccal mucosa)	7%	4
2	To study stained slide preparation from organs of digestive system	7%	4
3	Study of stained slides of liver, pancreas, gall bladder	7%	4
4	Study of various types of microscopes and draw diagrams in practical notebook.	7%	4
5	To study stained slide preparation from organs of circulatory system	7%	4
6	To study stained slide preparation from organs of Respiratory system.	7%	4
7	To study stained slide preparation from organs of Nervous system.	7%	4
8	To study stained slide preparation from organs of Urinary system.	7%	4
9	To study stained slide preparation from organs of Endocrine system	7%	4
10	Demonstration and Performance of Tissue grossing, Processing , Embedding, section cutting.	7%	6
11	Demonstration and Performance of Routine histopathological stain.	7%	4
12	Demonstration and Performance of Special Stain	7%	
13	To study Immunohistochemistry from tissue sample	7%	4
14	Demonstration of preparation of Frozen Section or Cryostat	7%	4

15	Demonstration of FNAC	2%	2
	Total teaching hours for the academic year	100%	60

i. Text Book and Reference Book:

1	Handbook of Histopathological Techniques by C F A Culling
2	Medical Lab technology by Lynch
3	An Introduction to Medical Lab Technology by F J Baker and Silverton
4	Bancroft 's Theory and Practice of Histopathological Techniques by John D Bancroft
5	Diagnostic Cytology by Koss Volume -II

Semester: 3	
a. Course Name:	Parasitology & Mycology(T)
b. Course Code:	1902070305
c. Prerequisite:	Students should have a basic understanding of Microbiology, human anatomy and physiology, and infectious disease processes. Prior exposure to fundamental biological concepts and laboratory safety practices will assist students in effectively grasping the topics of Parasitology and Mycology.
d. Rationale:	The course "Parasitology & Mycology (T)" is designed to introduce students to the significant roles of fungi and parasites in human disease. With an increasing prevalence of parasitic and fungal infections worldwide, and the emergence of new pathogens, there is a critical need for healthcare and laboratory professionals to accurately diagnose, understand, and manage these diseases. This course provides a thorough grounding in the morphology, classification, life cycles, pathogenesis, and laboratory identification of medically important fungi and parasites. It also focuses on epidemiology, control strategies, and treatment approaches, preparing students for clinical practice, public health work, and research careers.

e. Course Learning Objective:	
CLOBJ 1	To Demonstrate knowledge of medical mycology and parasitology in disease diagnosis.
CLOBJ 2	To Explain the morphology, classification, and life cycles of clinically relevant fungi and parasites.
CLOBJ 3	To Apply laboratory techniques for isolation and identification of fungi and parasites.
CLOBJ 4	To Evaluate the clinical impact of fungal and parasitic infections and their control measures.
CLOBJ 5	To Utilize epidemiological principles to design strategies for disease prevention.

f. Course Outcomes:		
CLO 1	Remembering	Explain the fundamentals of parasitology and mycology, including classification and life cycles.
CLO 2	Understanding	Describe the pathogenesis and clinical manifestations of parasitic and fungal infections.
CLO 3	Applying	Understand diagnostic approaches for parasitology and mycology.
CLO 4	Analyzing	Analyze epidemiology and control strategies for parasitic and fungal infections.
CLO 5	Evaluating / Creating	Apply knowledge to disease diagnosis and treatment strategies.

g. Teaching and Examination Scheme

Teaching and Examination Scheme										
Teaching Scheme					Examination Scheme					Total
Lecture Hrs/ Week	Tutorial Hrs/ Week	Lab Hrs/ Week	Total Hrs	Credit	Internal Marks			External Marks		
					T	CE	P	T	P	
4	-	-	60	4	20	20	-	60	-	100

h. Course Content

Sr. No.	Topic	Weightage %	Hours
1	Unit 1: Introduction to Parasitology Definition, classification, host-parasite relationships, transmission, sample collection, and biosafety	15	10
2	Unit 2 : Protozoa: - Intestinal & Urogenital Protozoa: Entamoeba histolytica, Giardia lamblia, Cryptosporidium spp., Trichomonas vaginalis - Blood & Tissue Protozoa: Plasmodium spp., Leishmania spp., Trypanosoma spp., Toxoplasma gondii	20	15
3	Unit 3 : Helminths: - Nematodes (Roundworms) – Intestinal & Tissue: Ascaris lumbricoides, Hookworms (Ancylostoma, Necator), Trichuris trichiura, Strongyloides stercoralis, Filariasis (Wuchereria bancrofti, Brugia malayi) - Trematodes (Flukes) & Cestodes (Tapeworms): Schistosoma spp., Fasciola hepatica, Clonorchis sinensis, Paragonimus westermani, Taenia spp., Echinococcus spp.	20	15
4	Unit 4: Fundamentals of medical mycology Systemic & Opportunistic Mycoses: Histoplasmosis, Blastomycosis, Coccidioidomycosis, Aspergillosis, Cryptococcosis, Mucormycosis, Pneumocystis jirovecii infection Superficial & Cutaneous Mycoses: Dermatophytosis (Tinea infections), Candidiasis Subcutaneous & Deep Mycoses: Sporotrichosis, Chromoblastomycosis, Mycetoma	15	10
5	Unit 5: Epidemiology, Prevention & Treatment	30	10

	of Parasitic and Fungal Diseases – Disease burden, transmission, vaccination, antifungal & antiparasitic drugs, public health measures.		
	Total academic weightage/teaching hours	100	60

i. Text Book and Reference Book:

1.	Medical Parasitology by Markell and Voge
2.	Foundations of Parasitology by Schmidt and Roberts
3.	Medical Mycology by Rippon
4.	Atlas of Clinical Fungi by De Hoog et al.
5.	Parasitology: A Conceptual Approach by Robert Desowitz

Semester: 3	
a. Course Name:	Parasitology & Mycology (P)
b. Course Code:	1902070306
c. Prerequisite:	Students should have a fundamental understanding of microbiology, including basic knowledge of microorganisms, infectious diseases, and laboratory safety procedures. Familiarity with microscopic techniques and general biological laboratory practices is recommended for successful execution of parasitological and mycological diagnostic methods.
d. Rationale:	The course "Parasitology & Mycology (P)" aims to equip students with essential practical skills for the diagnosis and study of parasitic and fungal infections. Given the rising global impact of parasitic and fungal diseases, accurate laboratory identification and analysis are critical for effective patient care and public health management. Through hands-on training in microscopic examination, culture techniques, staining methods, molecular diagnostics, and serological assays, students develop proficiency in clinical sample handling and diagnostic interpretation. This course prepares students for advanced clinical laboratory work, research opportunities, and healthcare roles focused on infectious disease diagnosis and management.

e. Course Learning Objective:	
CLOBJ 1	To Apply fundamental parasitology and mycology concepts in laboratory and clinical settings.
CLOBJ 2	To Demonstrate an understanding of parasitic and fungal infections, including their mechanisms and effects.
CLOBJ 3	To Analyze clinical samples using advanced parasitological and mycological techniques.
CLOBJ 4	To Utilize diagnostic tools and techniques for accurate detection of parasitic and fungal diseases.
CLOBJ 5	To Develop skills in handling, culturing, and identifying pathogenic parasites and fungi.

f. Course Outcomes:		
CLO 1	Remembering	Perform microscopic identification of parasites and fungi.
CLO 2	Understanding	Conduct culture and staining techniques for mycological diagnosis.
CLO 3	Applying	Apply molecular and biochemical techniques for identifying parasitic and fungal infections.
CLO 4	Analyzing	Analyze clinical samples and interpret serological test results.
CLO 5	Evaluating / Creating	Demonstrate laboratory proficiency in parasitology and mycology experiments.

g. Teaching and Examination Scheme

Teaching and Examination Scheme										
Teaching Scheme					Examination Scheme					Total
Lecture Hrs/ Week	Tutorial Hrs/ Week	Lab Hrs/ Week	Total Hrs	Credit	Internal Marks			External Marks		
					T	CE	P	T	P	
4	-	-	60	2	-	-	40	-	60	100

h. Course Content

Sr. No.	Topic	Weightage %	Hours
1	Unit-1 Parasitological Techniques - Collection of stool, blood, urine, and tissue samples for parasitology - Direct Wet Mount Preparation (saline and iodine mounts) - Concentration Techniques: - Sedimentation methods (Formol-ether concentration) - Flotation methods (Salt/Sugar flotation) - Microscopic Examination: - Detection of ova, cysts, trophozoites, and larvae - Blood Parasite Detection: - Thick and thin blood smear preparation and staining (Giemsa, Field's stain) - Detection of malaria, filarial parasites under microscope	15	10
2	Unit-2 Culturing and Staining Methods □ Culture of <i>Entamoeba histolytica</i> - Harada-Mori filter paper strip culture for larvae - Culture methods for <i>Leishmania</i> (NNN medium) Fungal Culture Techniques: - Inoculation on Sabouraud Dextrose Agar (SDA) - Slide culture technique for mold identification Staining Methods: - Lactophenol Cotton Blue (LPCB) mount for fungal elements	15	10

	- KOH mount for fungal hyphae detection - Gram staining for yeast detection (e.g., <i>Candida</i>)		
3	Unit- 3 Biochemical and Molecular Identification - Biochemical Tests: - Carbohydrate assimilation tests for yeasts (<i>Candida albicans</i> vs. <i>Candida tropicalis</i>) - Germ tube test for <i>Candida albicans</i> - Molecular Methods (basic demo/intro if kits used): - DNA extraction from fungal and parasite samples - Basics of agarose gel electrophoresis - Identification of fungal species using ITS PCR (Internal Transcribed Spacer region PCR) - Interpretation of fungal biochemical test results - Parasitological species differentiation based on biochemical markers (e.g., isoenzyme patterns - basic concept)	20	15
4	Unit-4 Molecular and Serological Methods for Parasitology and Mycology Conventional PCR: - Setup for amplification of fungal DNA (e.g., <i>Aspergillus</i> detection) - PCR for detection of parasitic DNA (e.g., <i>Plasmodium falciparum</i>) Real-Time PCR (demo or visit if possible): - Overview of Ct values interpretation Serological Techniques: - ELISA for parasitic infections (e.g., Toxoplasma IgG/IgM ELISA) - Latex agglutination test for <i>Cryptococcus</i> antigen detection Immunodiffusion Tests: - For fungal infections like Histoplasmosis	25	10
	Total academic weightage/teaching hours	100	60

i. Text Book and Reference Book:

1.	Medical Parasitology by Markell and Voge
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2.	Foundations of Parasitology by Schmidt and Roberts
3.	Medical Mycology by Rippon
4.	Atlas of Clinical Fungi by De Hoog et al.
5.	Parasitology: A Conceptual Approach by Robert Desowitz

Semester : 3	
a. Course Name:	Clinical Posting
b. Course Code:	192070307
c. Prerequisite:	Students must have completed foundational courses in: • Human Anatomy and Physiology • Basic Biochemistry • Basic Hematology and Microbiology • Fundamentals of Medical Laboratory Techniques These subjects provide the necessary understanding of body systems, biological sample handling, and essential lab safety and technical knowledge required to benefit from the hands-on clinical posting experience.
d. Rationale:	The Clinical Posting course is designed to bridge the gap between theoretical learning and practical application in real-time clinical laboratory settings. It provides students with essential exposure to professional lab environments where they observe, learn, and perform diagnostic procedures under supervision. The course aims to develop competence in routine laboratory testing, enhance interpretative skills for laboratory results, and ensure adherence to quality control protocols. By integrating hands-on experience with critical thinking, this course prepares students for responsible roles as skilled medical laboratory technologists, capable of contributing effectively to patient diagnosis and care.

e. Course Learning Objective:	
CLOBJ 1	Recall and describe fundamental laboratory techniques and principles used in hematology, clinical biochemistry, microbiology, histopathology, and blood banking.
CLOBJ 2	Explain the procedures, reagents, instruments, and clinical relevance of various diagnostic tests performed in the medical laboratory setting.
CLOBJ 3	Demonstrate correct techniques for specimen collection, preparation, and analysis across different diagnostic disciplines under supervision in a clinical setting.
CLOBJ 4	Interpret laboratory test results and identify potential sources of errors or variations in procedures through quality control measures.
CLOBJ 5	Evaluate the suitability of testing methods in given clinical scenarios and apply problem-solving skills to handle laboratory discrepancies, while adhering to ethical and safety standards.

f. Course Outcomes:		
CLO 1	Remembering	Demonstrate the ability to perform routine hematological, biochemical, microbiological, histopathological, and blood banking procedures under supervision.
CLO 2	Understanding	Accurately collect, label, and process various clinical specimens following standard protocols and safety guidelines
CLO 3	Applying	Apply theoretical knowledge to interpret basic laboratory results and recognize normal versus abnormal findings.

CLO 4	Analyzing	Utilize appropriate quality control measures and understand the significance of internal and external quality assurance in laboratory practice.
CLO 5	Evaluating / Creating	Exhibit professional behavior, ethical responsibility, and communication skills essential for functioning effectively in clinical laboratory environments.

g. Teaching and Examination Scheme

Teaching Scheme				Examination Scheme					Total
Lecture Hrs /Week	Tutorial Hrs/ Week	Lab Hrs /Week	Credit	Internal Marks			External Marks		
				T	CE	P	T	P	
-	-	12	6	-	-	40	-	60	100

h. Course Content

Sr.	Content	Weightage	Hours
1	Basic Principles of tests performed in healthcare settings which require collection of blood samples. Test Requisition Forms (TRF) a. Types of TRF b. Significance of recording details on Laboratory TRF c. Important aspects of the TRF d. Filling accurate information in the right location in the TRF e. Interpreting the TRF details. Blood collection systems – a. Open b. Closed c Vacuum extraction systems. Collection and preservation of blood sample for various hematological investigation Urine analysis Quality assurance in Haematology Internal and external quality control including reference preparation. Routine quality assurance protocol Statistical analysis i.e. Standard deviation, Co-efficient of variation, accuracy and precision Determination of Glucose in serum & plasma Estimates of blood Glucose by Folin& Wu method Determination of Urea in serum, plasma & urine. Determination of Creatinine in serum or plasma Determination of serum Albumin Determination of Cholesterol in serum or plasma	20%	45
2	Bacterial culture, Instruments used to seed culture media.	20%	45

	Culture procedures – seeding a plate Staining techniques in bacteriology Significance of staining in bacteriology Principle, Reagent preparation, procedures, and interpretation of the following Simple staining Negative staining Gram stain Albert's stain Neisser 's stain Ziehl –Neelsen staining. Capsule staining Flagella staining Spore staining Fontana stain for spirochetes Antibiotic susceptibility testing in bacteriology Definition of antibiotics Culture medium used for Antibiotic susceptibility testing Preparation and standardization of inoculum Control bacterial strains Choice of antibiotics MIC and MBC: Concepts and methods for determination Various methods of Antibiotic susceptibility testing with special reference to Stokes and Kirby-Bauer method		
3	Blood Banking • Introduction to Blood Banking • History and discovery of various blood group systems • ABO blood group system • Rh and other major blood group system • Sources of error in blood grouping and their elimination. • ABO grouping: Forward and reverse grouping. Causes of discrimination between forward and reverse grouping • Rh grouping Compatibility test in blood transfusion • Collection of blood for cross matching from a blood bag • Major cross matching • Minor cross matching • Use of enzymes in blood bank specially Papain • Complications and hazards of blood transfusion • Laboratory investigations of transfusion reactions and mismatched blood transfusion. • Precautions while procurement and storage of grouping antisera • Various anticoagulants used to collect blood for transfusion purposes • Selection of donor and procedure for collection of blood	20%	30

	from a healthy donor - Preparation of various fractions of blood for transfusion and therapeutic purposes such as: Packed red cells, washed red cells and FROZEN Red cells Platelet Rich Plasma (PRP), Platelet concentrate and frozen platelets. Fresh plasma (FP), Fresh Frozen Plasma (FFP) and cryoprecipitate - Brief introduction of blood substitute/artificial blood - Haemophiles: pertaining to Leucocytes, platelets and plasma. Quality control in blood bank		
4	Collection and transportation of specimens for histological examination Basic concepts of fixation Various types of fixatives used in a routine histopathology laboratory Simple fixatives Compound fixatives Special fixatives for demonstration of various tissue elements Decalcification Criteria of a good decalcification agent Technique of decalcification followed with selection of tissue, fixation, and decalcification, neutralization of acid and thorough washing. Various types of decalcifying fluids: Organic & Inorganic Acid, chelating agents, Use of Ion-exchange resins and Electrophoretic decalcification and treatment of hard tissues which are not calcified Processing of various tissues for histological examination Procedure followed by Dehydration, Clearing, Infiltration and routine timing schedule for manual or automatic tissue processing. Components & principles of various types of automatic tissue Processors Embedding: Definition Various types of embedding media Section Cutting Introduction regarding equipment used for sectioning Microtome Knives, Sharpening of Microtome Knives, Honing, Stropping, various types of microtome and their applications Freezing Microtome and various types of Cryostats. Faults in paraffin section cutting with reason and remedy, spreading the sections and attachment or mounting of sections to	40%	60

	glass slides. Staining, Impregnation and Mountants Types of Stains, Chemical Staining Action, Mordants and Accentuators, Metachromasia Use of Controls in Staining Procedures		
	Total teaching hours for the academic year	100%	180

i. Text Book and Reference Book:

1	Text book of Medical Laboratory Technology by Paraful B. Godkar
2	Medical laboratory Technology by KL Mukherjee Volume-I
3	Practical Haematology by JB Dacie
4	Clinical Diagnosis & Management by Laboratory methods (20th edition) by John Bernard Henary
5	Transfusion Science by Overfield, Hamer

Semester: 4	
a. Course Name:	Dissertation
b. Course Code:	1902070401
c. Prerequisite:	The dissertation work requires students to have a foundational understanding of research methodologies, domain-specific theories, and analytical or experimental techniques relevant to their field.
d. Rationale:	It aims to foster innovation through the discovery of new knowledge or the advancement of existing techniques. It encourages analytical or experimental inquiry with a focus on solving real-world problems. The research should demonstrate societal relevance and academic value, while equipping students with the capacity for sustained, independent research in future academic or professional pursuits.

e. Course Learning Objective:	
CLOBJ 1	To equip students with the ability to identify, define, and articulate a research problem through systematic literature review and theoretical understanding.
CLOBJ 2	To enable students to design and implement appropriate research methodologies to investigate the defined problem.
CLOBJ 3	To promote collaboration with hospitals and research organizations for data collection, experimentation, or fieldwork, ensuring relevance and application of research.
CLOBJ 4	To train students in data analysis, interpretation, and synthesis of results, demonstrating critical thinking and problem-solving skills.
CLOBJ 5	To develop the ability to prepare a structured dissertation report and present findings through professional written and oral communication, complying with academic standards.

f. Course Outcomes:		
CLO 1	Remembering	Recall fundamental concepts of research methodology, ethical guidelines, and academic writing standards required for dissertation work.
CLO 2	Understanding	Develop the ability to identify, define, and articulate a clear research problem using relevant literature.
CLO 3	Applying	Apply and evaluate suitable research design and methodology for conducting systematic investigation.
CLO 4	Analyzing	Analyze results and draw conclusions based on critical evaluation of data.
CLO 5	Evaluating / Creating	Communicate research outcomes through structured reporting and oral defense and create manuscript for publications.

g. Teaching and Examination Scheme

Teaching Scheme				Examination Scheme					Total
Lecture Hrs /Week	Tutorial Hrs/ Week	Lab Hrs /Week	Credit	Internal Marks			External Marks		
				T	CE	P	T	P	
0	0	48	24	-	100	-	-	100	200

h. Guidelines

Sr.	Content
1.	Title & Supervision: • Titles may be proposed by students, supervisors, or industries. • Final allocation is based on merit and approved by the Head of Department. • One or two supervisors (internal and/or external) will guide the student; interdisciplinary topics require at least one internal supervisor from the core discipline.
2.	Industry Collaboration: • Industry/R&D-based projects are encouraged. • Students must work 5 days/week in the industry and report weekly to the department. • Completion certificate and acknowledgment of industry contribution are mandatory.
3.	Submission Requirements: • Spiral-bound reports for each internal review stage. • Final submission: 4 hardbound copies and one soft copy (PDF on CD), duly signed by the supervisor(s) and department heads.
4.	Evaluation: • Internal Reviews: Title Clearance (20), Progress Review-I (40), Progress Review-II (40) • Final Evaluation: Viva (50), Thesis & Publication (50) • Total Marks: Internal – 60, External – 140 (Total: 200) • Evaluated by internal review panel and external examiner using standard rubrics
5.	Note: Title changes must be requested before or during Progress Review-I with valid justification and departmental approval.

i. Text Book and Reference Book:

1	<i>Research Methodology: Methods and Techniques</i> by C.R. Kothari and Gaurav Garg, New Age International Publishers, 4th Edition.
2	<i>Practical Research: Planning and Design</i> by Paul D. Leedy and Jeanne Ellis Ormrod, Pearson, 12th Edition.
3	<i>Scientific Writing and Communication: Papers, Proposals, and Presentations</i> by Angelika H. Hofmann, Oxford University Press, 3rd Edition.
4	<i>Biostatistics: A Foundation for Analysis in the Health Sciences</i> by Wayne W. Daniel and Chad L. Cross, Wiley, 11th Edition
5	<i>Bioinformatics: Sequence and Genome Analysis</i> by David W. Mount, Cold Spring Harbor Laboratory Press, 2nd Edition.