JHARKHAND
Rai University

B.Sc. in Medical Laboratory Technology (BMLT)

Batch: 2024-2027

Syllabus

Vision

To become a premier source of highly skilled and knowledgeable medical laboratory technician who can monitor the effectiveness of therapy and help healthcare professionals to diagnose diseases accurately.

Mission

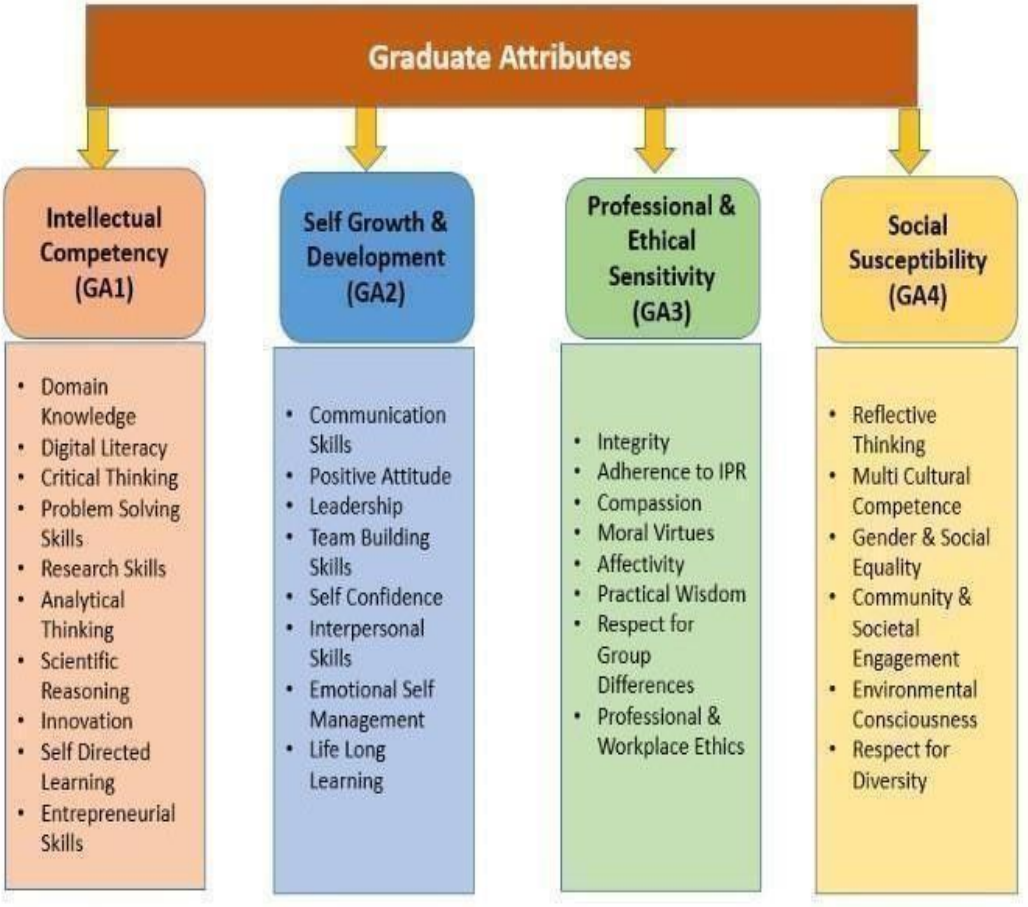
- To serve as a source of knowledgeable medical laboratory technicians with a true sprit to help the community and society.
- To provide a pool of possibilities in the healthcare industry for medical laboratory technologists from economically and socially disadvantaged families.
- To form alliances with reputable medical facilities and pathology laboratories in order to support their efforts in creating error-free diagnosis processes.

Graduate Attributes

Jharkhand Rai University is a mecca of transformative education which strongly believes in the holistic development of students. The university provides the cutting-edge of holistic learning to develop promising youngsters into leaders of tomorrow with globally relevant, future-ready and actionable intelligence. The objective of the Department is to make each student proficient in synthesizing/analyzing information and be ethical, socially responsible, and just when making decisions. JRU ensures inclusive and equitable quality education and promote lifelong learning opportunities for all.

Every graduate of the Department will be developed to possess the following attributes:

1. Intellectual Competency
2. Self-Growth & Development
3. Professional & Ethical Sensitivity
4. Social Susceptibility



Program Educational Objectives (PEO)

PEO 1. To provide thorough knowledge in various subjects of medical laboratory including theoretical and practical training for appropriate continuing education opportunities to medical laboratory professionals

PEO 2 To train recent graduates in medical laboratory science for job in hospitals and related research center

PEO 3: To provide an equal opportunity for all the graduates to become an entrepreneur through visit of various labs and clinical internship

PEO4: To gain medical laboratory knowledge and have a value-added responsibility towards the community health issues.

Program Outcome (PO)

On successfully completing the B.Sc. (MLT) program the students will be able to:

PO1: Work as technologists or technicians at clinics/hospitals/medical laboratories.

PO2: To operate in diverse laboratory environment and comprehend a wide range of laboratory techniques and protocols.

PO3: Graduates shall be capable of working in a variety of laboratory settings, handling various types of instruments and understand the various laboratory skills and procedures.

PO4: As a health professional the students shall gain medical laboratory knowledge and have a value-added responsibility towards the community health issues.

PO5: To understand and manage the prevailing health problems, focus on socio-economical process and apply suitable remedial measures.

PO6: After successful completion the students shall be capable for new start-up as per knowledge, skills and having lots of future prospects in higher and research-based studies.

Course Component of B.Sc. (MLT) program

Mapping of PEOs and POs

POs	PEOs			
	PEO 1	**PEO 2**	**PEO 3**	**PEO4**
PO 1	H	M		
PO 2	H	M		
PO 3	H	L		
PO 4				H
PO 5				H
PO 6			H	

3 Years Course		
Category	**Required Number of Credit**	**Credit Offered**
Discipline Specific Course-Core/Major	60	52
Discipline Specific Course-Core/Minor	24	26
Multidisciplinary Course	9	11
Ability Enhancement Course- Compulsory	8	5
Skill Enhancement Course- Compulsory	9	5
Common Value-Added Course	6	9
Project/ Training	4	16
Total	**120**	**124**

	Course Scheme					
	SEMESTER - I					
NSQF/National Credit Framework (NCrF) Credit level	**Code**	**Subject**	**L**	**T**	**P**	**Credits**
LEVEL-4.5	**Major Courses – Compulsory**					
	42ABMT 101	Human Anatomy & Physiology –I	4	0	0	4
	42ABMT 102	Human Anatomy & Physiology Lab.-I	0	0	2	1
	Minor Courses - Compulsory					
	42ABMT 103	Chemistry for MLT	3	0	0	3
	42ABMT 104	Laboratory Mathematics	4	0	0	4
	42ABMT 105	Chemistry for MLT Lab.	0	0	2	1
	Multidisciplinary Courses					
	42ABMT 106	Basics of Electrical & Electronics	3	0	0	3
	42ABMT 107	Basics of Electrical & Electronics Lab	0	0	2	1
	Ability Enhancement Course- Compulsory					
	42ABMT 108	Communication and Professional Skill	2	0	0	2
	Skill Enhancement Course					
	42ABMT 109	Basic Workshop I (Health care)	0	0	2	1
	Common Value-Added Course					
	42ABMT 110	Sports & Yoga/NSS/NCC/CA	0	0	2	1
						21
	SEMESTER-II					
	Major Courses – Compulsory					
	42ABMT 201	Human Anatomy & Physiology – II	3	0	0	3
	42ABMT 202	Hematology – I	3	0	0	3
	42ABMT 203	Histology	3	0	0	3
	42ABMT 204	Human Anatomy & Physiology Lab.-II	0	0	2	1
	42ABMT 205	Hematology Lab.-I	0	0	2	1
	Minor Courses - Compulsory					
	42ABMT 206	Clinical Chemistry- I	3	0	0	3
	42ABMT 207	Clinical Chemistry Lab- I	0	0	2	1
	Multidisciplinary Courses					
	42ABMT 208	Essentials of Environmental Science	1	0	0	1
	Skill Enhancement Course					
	42ABMT 209	IT SKILLS	2	0	0	2
	42ABMT 210	IT Lab.	0	0	2	1
	42ABMT 211	Basic Workshop II (Health care)	0	0	2	1
	Common Value-Added Course					
	42AVAC101	Character Building and Holistic Development of Personality-I (Spiritual and Mental Health)	2	0	0	2
						22

	SEMESTER-III					
LEVEL-5			**L**	**T**	**P**	**Credits**
	Major Courses – Compulsory					
	42ABMT 301	Biomedical Instrumentations	3	0	0	3
	42ABMT 302	Microbiology –I	3	0	0	3
	42ABMT 303	Microbiology Lab.-I	0	0	2	1
	42ABMT 304	Hematology – II	3	0	0	3
	42ABMT 305	Hematology Lab-II	0	0	2	1
	Minor Courses - Compulsory					
	42ABMT 306	Clinical Chemistry- II	3	0	0	3
	42ABMT 307	Clinical Chemistry Lab.-II	0	0	2	1
	Ability Enhancement Course- Compulsory					
	42ABMT 308	Immunology	3	0	0	3
	Common Value-Added Course					
	40BMT 104	Professional Skills	2	0	0	2
						20

	SEMESTER-IV					
LEVEL-5.5	**Major Courses - Compulsory**					
	42ABMT 401	Microbiology- II	3	0	0	3
	42ABMT 402	Digital Electronics System and Instrumentation	3	0	0	3
	42ABMT 403	Histopathology & Histotechniques	3	0	0	3
	42ABMT 404	Microbiology Lab.-II	0	0	2	1
	42ABMT 405	Digital Electronics System and Instrumentation lab	0	0	2	1
	42ABMT 406	Histopathology & Histotechniques Lab.- I	0	0	2	1
	Major Courses - Compulsory (Any One)					
	42ABMT 407	Parasitology & Cytology (Group-I)	3	0	0	3
	42ABMT 408	Immunopathology (Group-I)	3	0	0	3
	Minor Courses -Compulsory (Any One)					
	42ABMT 409	Bio-signal Acquisition System (Group-II)	3	0	0	3
	42ABMT 410	Introduction to Microprocessor (Group-II)	3	0	0	3
	Common Value-Added Course					
	42AVAC201	Character Building and Holistic Development of Personality-II (Yoga and Physical Fitness)	2	0	0	2
						20

	SEMESTER-V					
			L	**T**	**P**	**Credits**
	Major Courses - Compulsory					
	42ABMT 501	Forensic & Medical Ethics	3	0	0	3
	42ABMT 502	Histopathology & Histotechniques Lab.- II	0	0	2	1
	42ABMT 503	Biostatistics	3	0	0	3
	Major Courses - Compulsory (Any One)					
	42ABMT 504	Techniques in Molecular Biology	3	0	0	3
	42ABMT 505	Hematology & Blood Banking (Group-I)	3	0	0	3
	Minor Courses -Compulsory					
	42ABMT 506	Bacteriology & Virology	3	0	0	3
	42ABMT 507	Bacteriology & Virology Lab	0	0	2	1
	Minor Courses -Compulsory (Any One)					
	42ABMT 508	Clinical Instrumentation (Group-II)	3	0	0	3
	42ABMT 509	Biomedical imaging Devices and Concept	3	0	0	3
	Multidisciplinary Courses					
	42ABMT 510	Laboratory Management	2	0	0	2
	Common Value-Added Course					
	42AVAC301	Character Building and Holistic Development of Personality-III (Universal Human Values and Ethics)	2	0	0	2
						21
	SEMESTER-VI					
LEVEL-5.5	42ABMT 601	Internship Project	-	-	-	16
	Multidisciplinary Courses					
	42ABMT 602	Open Elective	-	-	-	4
						20

32A	Department Code
CC	Core Course
MDC	Multidisciplinary Course
SEC	Skill Enhancement Course
AEC	Ability Enhancement Course
CCDE	Core Course Departmental Elective
VAC	Value Added Courses

Detailed Assessment Scheme

Assessment Scheme					
CIA- Continuous Internal Assessment (30 Marks)					
Assessment Parameters	**Assessment Tools**	**Marks**	**Percentage (%)**	**Bloom's Taxonomy Category**	**Bloom's Taxonomy Level LOT/HOT**
Assignment 1	Assignment consisting of minimum 5 Questions	10	33.3	Remember, Understand, Apply	LOT
Assignment 2	Assignment consisting of minimum 2 Questions	10	33.3	Analyze, Evaluate, Create	HOT
Teacher Assessment/ Class Participation					
Class Participation	Brainstorming, Discussion, Attendance, Extempore or any other activity	5	16.67		
EC&CC Activities	Extracurricular & Co Curricular activities	5	16.67		

ESE- End Semester Examination (70 Marks)			
Bloom's Taxonomy Category	**ESE Question Paper Section**	**Percentage (%)**	**Bloom's Taxonomy Level LOT/HOT**
Remember	A	30	LOT
Understand	A		
Apply	B	40	LOT/ HOT
Analyze	B		
Evaluate & create	C	30	HOT

Semester- III, IV, V & VI

SEMESTER - III

Course Scheme:

SEMESTER - III						
LEVEL - 5	**Major Courses - Compulsory**		**L**	**T**	**P**	**Credits**
	42ABMT 301	Biomedical Instrumentations	3	0	0	3
	42ABMT 302	Microbiology-I	3	0	0	3
	42ABMT 303	Microbiology Lab-I	0	0	2	1
	42ABMT 304	Haematology - II	3	0	0	3
	42ABMT 305	Haematology Lab. - II	0	0	2	1
	Minor Course - Compulsory					
	42ABMT 306	Clinical Chemistry - II	3	0	0	3
	42ABMT 307	Clinical Chemistry Lab. - II	0	0	2	1
	Ability Enhancement Course - Compulsory					
	42ABMT 308	Immunology	3	0	0	3
	Common Value – Added Course					
	40BMT 104	Professional Skills	2	0	0	2
TOTAL						**20**

Program: BMLT
Semester: III
Subject: Biomedical instrumentation
Code: 42ABMT 301

L	T	P	C
3	0	0	3

Course Outcome:
On completion of the Course, the students will be able to:

CO1: Understand the knowledge about basic structure of the Laboratory, management and the administration.

CO2: Demonstrate the laboratory instruments and glass wares; and its role.

CO3: Learn the knowledge of laboratory duties, responsibilities and illustrate the common laboratory accidents.

CO4: Learn the different types of specimen collection, laboratory records, requisition and reporting of results.

CO5: Gain the knowledge about causing factors of laboratory accidents, first aid and National Health Program.

Course Content: Biomedical instrumentation

Topics	Hours
MODULE – I: Laboratory Management and Administration	**9**
Introduction to basic terminology of the Laboratory Illustrate the principle planning of the Laboratory Study of Laboratory Administration, different part of the Medical Lab.	
MODULE – II: Laboratory Instruments and Glass wares	**9**
Principle and Operation of Cell Counters and Biochemical Analyzers, Colorimeter, Spectrophotometer, Spectrofluorometric, pH meter, Elisa reader, Glucometers, Laboratory equipment and instrument Laboratory wares and Glass wares Use and care of Laboratory Glass wares Maintenance, Cleaning and labelling of Glass wares	
MODULE – III: Laboratory responsibilities and Accidents	**9**
Duties and Responsibilities of Medical Laboratory Technician Common Laboratory Accidents Uses of Instruments **Laboratory Responsibilities and Accidents in IKS**	
MODULE – IV: Specimen Collection and Record Keeping	**9**
Various types of Specimen collection and its process Dispatch, receiving and disposal of specimen Requisition and reporting system; Laboratory records	
MODULE – V: Laboratory Accidents and Health Program	**9**
Factors causing Accident in Laboratory Demonstration of First Aid Kit Study of National Health Program	

REFERENCE BOOKS:

1. J.J. Karr & J.M. Brown, ― Introduction to Biomedical Technology, Prentice Hall
2. R. S. Khandpur ―Handbook of Biomedical Instrumentation, Tata McGraw-Hill
3. L. Crownwell ―Biomedical Instrumentation and Measurement, Prentice-Hall
4. M. Arumugham ―Biomedical Instrumentation‖, Anuradha Publications.

Program: BMLT
Semester: III
Subject: Microbiology- I
Code: 42ABMT302

L	T	P	C
3	0	0	3

Course Outcomes:
On completion of the Course, the students will be able to:

CO1: Perceive the historical development of microbiology and its key contributors (e.g., Antonie van Leeuwenhoek, Louis Pasteur, and Robert Koch).

CO2: Understand how to grow and control micro- organisms.

CO3: Understand bacterial classification, cell structure, nutrient uptake mechanisms, and growth.

CO4: Define and distinguish between terms like disease, epidemic, endemic, and pandemic, and explain their significance in public health.

CO5: Describe the morphology, cell wall composition, and internal structures of fungal cells, distinguishing them from bacterial and human cells.

Course Content: Microbiology-I

Topics	Hours
MODULE – I: Introduction to Microbiology	**9**
History, role of microbiology in health and diseases. **History of microbiology in the Bhartiya Knowledge System (BKS)** Different branches of Microbiology. Classification of microorganisms, Autotrophic and heterotrophic organisms. Difference between Eukaryotic and prokaryotic cells. Different types of bacteria including cyanobacteria, Gram positive and Gram-Negative bacteria, Archaebacterial, Actinomycetes and Rickettsia.	
MODULE – II: Growth, Control and Identification of Micro- organisms	**9**
Culture media and its different types. Principles of different types of staining, including gram staining and acid- fast staining. Anaerobic cultivation, isolation and inoculation, separation of pure cultures from mixed cultures. Principles and methods of sterilization, Physical, Chemical and Mechanical methods of sterilization. Uses and mode of action of various disinfectants and antiseptics.	
MODULE – III: Structure & physiology of bacterial cell	**9**
Bergey's system and various classifications of bacteria. Bacterial cell structure including cell wall, plasma membrane, capsule, flagella, fimbriae, Pilli, endospores, mesosome, ribosome. Genetic material: Nucleoid, plasmid, and transposable elements. Nutrition in bacteria, methods of uptake of nutrients by the cell, Active & Passive methods. Growth factors, factors affecting growth, growth curve, and mathematics of growth.	
MODULE – IV: Human pathogenic bacteria and lab diagnosis	**9**
Introduction to disease, Epidemic, Endemic, Pandemic. Bacterial infections caused by Mycobacterium like Tuberculosis, Leprosy. Air transmitted bacterial diseases: Diphtheria, Whooping cough. Intestinal infections: Enteric fever, cholera. Urinary tract infections.	
MODULE – V Human pathogenic fungi and lab diagnosis	**9**
Introduction to Fungi: structure of fungal cell. Symbiotic relationship and various fungal classes. Fungal infections including superficial dermatophyte fungal infections. Candidiasis, Nosocomial infections. Pulmonary infections, Eye and ear fungal infections.	

REFERENCE BOOKS:

1. Prescott's Microbiology Willey, Sandman and Wood, McGraw Hill
2. Microbiology Purohit, Agrobios India
3. A Textbook of Microbiology‖ Dubey & Maheshwari, S. Chand
4. Microbiology Pelczar, Chan & Kreig, McGraw Hill, 5th edition

Program: BMLT
Semester: III
Subject: Microbiology Lab. -I
Code: 42ABMT303

L	T	P	C
0	0	2	1

Course Outcomes: -

On completion of the Course, the students will be able to:

CO1: - Demonstrate proper handling, maintenance, and calibration of lab instruments.

CO2: - Demonstrate the preparation of basic liquid and solid media.

CO3: - Explain the concept of pure culture, its significance in microbiology, and the underlying principles of different isolation techniques.

CO4: - Operate laboratory equipment such as autoclaves and hot air ovens and apply appropriate parameters (time, temperature, pressure) to effectively sterilize materials.

CO5: - Explain the purpose, principles, and steps involved in preparing a uniform and effective bacterial smear for microscopic observation.

COURSE CONTENT: Microbiology Lab-I

Topics	Hours
MODULE – I: Introduction to Microbiology	**6**
1. Introduction to the use of laboratory instruments and safety precautions. A) Instruments for Inoculation and Incubation B) Instruments for Sterilization	
MODULE – II: Media preparation for Micro-organisms	**6**
1. To prepare basic liquid media (broth) for routine cultivation of bacteria. 2. Preparation of basic solid media, Agar slants and Agar deep tubes for routine cultivation of microorganism.	
MODULE – III: Growth of Micro- organisms	**6**
1. To obtain pure culture of bacteria by streak plate method. 2. To obtain pure culture of bacteria by spread plate method. 3. To obtain pure culture of bacteria by pour plate method.	
MODULE – IV: Control of Micro-organisms	**6**
1. Physical agents of control by moist heat and dry heat. 2. Mechanical agents of control UV radiation.	
MODULE – V: Identification of Bacteria	**6**
1. Preparation of bacterial smears. 2. To perform gram staining of bacteria.	

REFERENCE BOOKS:

1 Experiments in microbiology, Plant pathology and Biotechnology" K. R. Aneja, New age publication
2 Mackie and McCartney "Practical medical microbiology" Collee, Fraser, Marmion, Simmons, Elsevier publication
3 Practical Microbiology Dubey & Maheshwari, S. Chand
4 Laboratory manual in microbiology P. Gunasekaran, Newage international publishers

L	T	P	C
3	0	0	3

Program: BMLT
Semester: III
Subject: Haematology – II
Code: 42AMBT 304

Course Outcome:
On completion of the Course, the students will be able to:

CO1: Understand the various methods involve in blood collection and identifying the morphology of normal and abnormal RBCs and their causes.

CO2: Explain the physiological meaning, reference ranges, and diagnostic relevance of Mean Corpuscular Volume, Mean Corpuscular Hemoglobin, and Mean Corpuscular Hemoglobin Concentration.

CO3: Describe and perform the sickle cell preparation test, including slide preparation, staining, and microscopic identification of sickled red blood cells.

CO4: Explain the mechanism of coagulation, including vascular, platelet, and coagulation factor involvement, leading to clot formation.

CO5: Describe the genetic basis, inheritance patterns, and clinical manifestations of Hemophilia and polycythemia with their causes

Course Content: Haematology – II

Topics	Hours
MODULE – I: Blood Collection and Abnormal Red blood cells	**9**
Introduction to Blood Collection Methods of whole blood collection, collection process and procedure Study of morphology of different variations of Abnormal RBCs	
MODULE – II: Red Cell Indices, Eosinophil and Reticulocyte count	**9**
Calculation of different red cell indices – MCV, MCH & MCHC Various method of estimation of Eosinophil Count and its significance Estimation of Reticulocyte count	
MODULE – III: Bone Marrow and Sickel Cell	**9**
Introduction to Bone Marrow and Sickel Cell Laboratory findings and estimation of Sickel cell preparation Various method involves in collection of Bone Marrow Preparation of Bone Marrow smear and clinical significance	
MODULE – IV: Blood Coagulation and Haemorrhagic disorder	**9**
Blood Coagulation, Blood Coagulation Factors Mechanism of Blood Coagulation Haemorrhagic disorder- Bleeding time, Clotting time, Prothrombin time, clot retraction, Purpura	
MODULE – V: Anaemia, Leukaemia, Haemophilia and Polycythaemia	**9**
Physiological variation of Haemophilia and Polycythaemia Causes and classification of Anaemia Causes and classification of Leukaemia	

REFERENCE BOOKS:

1. Haematology for Medical Technologists, Charles F. Seiverd, Fifth Edition. Lea & Febiger, Philadelphia
2. An introduction to Medical Laboratory Technology, Baker et al., Seventh Edition, A Hodder Arnold Publication.
3. Technical Haematology, Arthur Simmons, Third Edition, Lippincott Company.
4. Pathology Practical Book, Harsh Mohan, Fifth revised edition, Jaypee Brothers

Program: BMLT
Semester: III
Subject: Haematology Lab. – II
Code: 42AMBT 305

L	T	P	C
0	0	2	1

Course Outcome:
On completion of the Course, the students will be able to:

CO1: Describe and demonstrate capillary and venous blood collection techniques, including site selection, equipment use**,** and infection control measures.

CO2: Calculate Red Cell Indices and estimate the procedure of Eosinophil and Reticulocyte count.

CO3: Explain the genetic basis, clinical features**,** and morphological characteristics of red blood cells in sickle cell anemia.

CO4: Understand mechanism and procedure of blood coagulation and Haemorrhagic disorder.

CO5: Understand Concept and significance of Anemia and Leukemia.

Course Content: Haematology Lab. – II

Topics	Hours
MODULE – I: Concept of Blood collection and slide preparation	**6**
Determination of various method of Blood collection Preparation of whole blood smear. Standardization of instruments and glassware for adaptation for Sample collection. Experiment based on study of morphology of abnormal red cell and their identification.	
MODULE – II: Estimation of Eosinophil and Reticulocyte Count	**6**
Determination of MCH, MCV and MCHC Calculation of Red Cell Indices by Hb, PCV and Red cell count Estimation of Absolute Eosinophil Count Estimation of Reticulocyte Count	
MODULE – III: Preparation of Sickel Cell and Bone marrow smear	**6**
Determination of Sickel cell smear Determination of Bone marrow smear Preparation of sickle cell smear	
MODULE – IV: Haemorrhagic disorder and Blood coagulation	**6**
Determination of bleeding time by various methods Determination of clotting time by various methods	
MODULE – V: Diagnosis of Anaemia and Leukaemia	**6**
Identification of various types of Anaemia Identification of various types of Leukaemia	

REFERENCE BOOKS:

1. Haematology for Medical Technologists, Charles F. Seiverd, Fifth Edition. Lea & Febiger, Philadelphia
2. An introduction to Medical Laboratory Technology, Baker et al., Seventh Edition, A Hodder Arnold Publication.
3. Technical Haematology, Arthur Simmons, Third Edition, Lippincott Company.
4. Pathology Practical Book, Harsh Mohan, Fifth revised edition, Jaypee Brothers

Program: BMLT
Semester: III
Subject: Clinical Chemistry-II
Code: 42ABMT306

L	T	P	C
3	0	0	3

Course Outcomes: -
On completion of the Course, the students will be able to:

CO1: - Understand about 'Diabetes', their types, various methods involve to diagnose Diabetes and their clinical significance.

CO2: - Understand 'Liver Function Test', types of investigation involve, methods to diagnose with their clinical significance.

CO3: -: Illustrate and discuss about 'Renal Function Test', method involves to diagnose different types of tests and their clinical significance.

CO4: - Discuss the 'Cardiac Function Test', types of investigation involve, methods to diagnose with their clinical significance.

CO5: - Illustrate and understand about different types of Electrolytes and Enzymes, various methods involve to diagnose the level and their clinical significance.

Course Content: Clinical Chemistry – II

Topics	Hours
MODULE – I: Diabetes and Diabetic Profile Test	**9**
Introduction to Diabetes, Type of Diabetes, diagnosis of Diabetes Different method involves to diagnose diabetes and their clinical significance Glucose Tolerance Test with graphical presentation	
MODULE – II: Liver Function Test	**9**
Introduction to Liver, types of tests involve Various method involves in different types of tests in LFT Clinical significance in different types of tests	
MODULE – III: Kidney Function Test	**9**
Introduction to Kidney, types of tests involve Various method involves in different types of tests in KFT Clinical significance in different types of tests	
MODULE – IV: Cardiac Function Test	**9**
Introduction to Heart, types of tests involve Various method involves in different types of tests in CFT Clinical significance in different types of tests	
MODULE – V: Electrolytes and Enzymatic Assay Test	**9**
Illustrate different type of Electrolytes and Enzymes Method involves to diagnose the level of electrolytes and enzymes Study the clinical significance in diagnosis the level of electrolytes and enzymes	

REFERENCE BOOKS:

1. Clinical Biochemistry, Nanda Maheshwari, Jaypee Brothers
2. Textbook of Clinical Biochemistry, Ramnik Sood, CBS Publisher
3. Practical Clinical Biochemistry, Ranjana Chawla, Jaypee Brothers

Program: BMLT
Semester: III
Subject: Clinical Chemistry Lab. – II
Code: 42AMBT 307

L	T	P	C
0	0	2	1

Course Outcome:
On completion of the Course, the students will be able to:

CO 1: Analyze the various type of diabetes, procedure to detect diabetes with different methods.

CO 2: Illustrate various types of tests involves in Liver Function Test.

CO 3: Understand the various types of tests related to Kidney function.

CO 4: Illustrate various types of tests involves in Cardiac Function Test.

CO 5: Understand Concept and significance test of Electrolytes and enzymes.

Course Content: Clinical Chemistry Lab. – II

Topics	Hours
MODULE – I: Diabetic Profile Test	**6**
Determination of Blood glucose Test by Folin-Wu method Determination of Blood glucose Test by GOD – POD method Glucose Tolerance Test (GTT)	
MODULE – II: Liver Function Test	**6**
Determination of Serum Bilirubin Test Principal and procedure of SGPT test Principal and procedure of SGOT test Principal and procedure of Serum protein test Principal and procedure of Alkaline phosphatase test	
MODULE – III: Renal (Kidney) Function Test	**6**
Determination of Serum Urea Test Determination of Uric Acid Test Determination of Serum Creatinine Test	
MODULE – IV: Cardiac Function Test	**6**
Determination of Serum total cholesterol Determination of Serum HDL Cholesterol Determination of Serum triglyceride test Determination of LDL and VLDL	
MODULE – V: Electrolytes and Enzyme assay test	**6**
Determination of Serum Sodium, Serum Potassium, Serum Chloride Determination of Serum Phosphorus, Serum Calcium Determination of Serum Amylase, Serum Lipase and LDH Test	

REFERENCE BOOKS:

1. Clinical Biochemistry, Nanda Maheshwari, Jaypee Brothers
2. Textbook of Clinical Biochemistry, Ramnik Sood, CBS Publisher
3. Practical Clinical Biochemistry, Ranjana Chawla, Jaypee Brothers

Program: BMLT
Semester: III
Subject: Immunology
Code: 42ABMT 308

L	T	P	C
3	0	0	3

Course Outcome:
On completion of the Course, the students will be able to:

CO1: Understand about immunology and immune system, types of immunity and measurement of immunity.

CO2: Explain about Antibodies and Antigens, types of antigen and antibodies, antigenic determinant.

CO3: Illustrate the Antigen and Antibody reaction, types of antigens and antibody reaction and their measurement.

CO4: Understand about the Complement, structure and function of the Immune system.

CO5: Define sensitization and allergy, explain their immunological basis, and understand the body'**s** immune overreaction to allergens.

Course Content: Immunology

Topics	Hours
MODULE – I: Introduction to Immunity and their types	**9**
Introduction to immunity and immune system **Comprehensive introduction to Immunity and the Immune System in IKS** Illustrate the types of Immunity, immune cells Study the measurement of Immunity, Organ related to immune system	
MODULE – II: Antigen and Antibodies	**9**
Introduction to Antigen and Antibodies Types of Antigen and Antibodies, Monoclonal antibody, Polyclonal Illustration of determines Antigenicity and specificity of Antigen, Hybridoma technology	
MODULE – III: Antigen Antibody Reaction	**9**
Introduction and General features of Antigen Antibody reaction Measure of Antigen and Antibody Types of Antigen Antibody reactions, ELISA, RIA, Flowcytometry, blotting techniques. Complement fixation test	
MODULE – IV: Complement, Structure and function of Immune system	**9**
Definition, Complement functions, MHC Class and its types, Interleukins and Interferon and its types B-cell activation and T-cell activation Classical and Alternative Pathway Biological effects of Complement Deficiencies of the complement system	
MODULE – V: Hypersensitivity	**9**
Definition and introduction to Sensitization and Allergy, Autoimmunity Classification of Hypersensitivity Schwartzman Reaction	

REFERENCE BOOKS:

1. An introduction to Medical Laboratory Technology, Baker et al., Seventh Edition, A Hodder, Arnold Publication
2. Microbiology Theory for MLT, Namita Jaggi, Jaypee

SEMESTER - IV

Course Scheme:

SEMESTER - IV						
LEVEL – 5.5	**Major Courses - Compulsory**		**L**	**T**	**P**	**Credits**
	42ABMT 401	Microbiology - II	3	0	0	3
	42ABMT 402	Digital Electronics System and Instrumentation	3	0	0	3
	42ABMT 403	Histopathology & Histotechniques	3	0	0	3
	42ABMT 404	Microbiology Lab. - II	0	0	2	1
	42ABMT 405	Digital Electronics System and Instrumentation Lab	0	0	2	1
	42ABMT 406	Histopathology & Histotechniques Lab.	0	0	2	1
	Major Courses – Compulsory (Any One)					
	42ABMT 407	Parasitology and Cytology (Group-I)	3	0	0	3
	42ABMT408	Immunopathology (Group-I)	3	0	0	3
	Minor Courses – Compulsory (Any One)					
	42ABMT 409	Bio-signal Acquisition System (Group-II)	3	0	0	3
	42ABMT410	Introduction to Microprocessor (Group-II)	3	0	0	3
	Common Value – Added Course					
	42AVAC 201	Character Building and Holistic Development of Personality – II (Yoga and Physical Fitness)	2	0	0	2
Total						**20**

Program: BMLT
Semester: IV
Subject: Microbiology-II
Code: 42ABMT401

Course Outcomes: -
On completion of the Course, the students will be able to:

CO1: -Understand the mode of action and general characteristics of chemotherapeutic agents and drugs.

CO2: - Define prophylactic agents, explain their importance in infection control, and describe how they contribute to public health and immunity.

CO3: - Explain the role of microorganisms in food and their implications for health

CO4: -Develop expertise in fermentation technology, mastering fermenter structure, production methods, and preservation.

CO5: -Gain a comprehensive understanding of algae and parasites, enabling them to assess their ecological roles

COURSE CONTENT: Microbiology-II

TOPICS	HOURS
MODULE-I:- Chemotherapeutic agents: Antibiotics	**9**
Chemotherapeutic agents. Antibiotics, general characteristics Antibacterial antibiotics: mode of action of various antibiotics including Penicillin, Ampicillin, Cephalosporin, Bacitracin, Vancomycin, Streptomycin. Antifungal drugs. Antiviral drugs	
MODULE-II:- Prophylactic agents: Vaccines	**9**
Prophylactic agents, Antigenic preparation. Vaccines and their different types. Killed and live attenuated vaccines. Subunit vaccines: DNA, mRNA, Viral vector vaccines. Advantage & Disadvantage of vaccines.	
MODULE-III:- Microbiological studies of Air, Food & Water	**9**
Introduction, methods of purification and testing of laboratory air. Microbiology of food: Microorganism found in food, Primary sources of food poisoning, mycotoxins in food stuffs and various preventive measures. Biological characteristics of water, BOD and COD. Sewage and its treatment including primary, secondary, and tertiary treatment, disinfection of water.	
MODULE-IV:- Microbiology in Fermentation Technology	**9**
Introduction to Fermentation Technology, Structure of Fermenter, different types of Fermentation. General methods of production of alcohol: Ethanol. General methods of production of organic acids: Acetic acid, Citric acid General methods of production of antibiotics: Penicillin, Streptomycin, and Tetracycline Preservation of Industrial microbes and Lyophilization	
MODULE-V:- Algae & Parasites	**9**
Introduction to Algae: structure of Algal cell. Symbiotic relationship and various algae classes. Economic benefits of algae. Introduction of parasites: Different class's pf Parasites. A brief introduction to parasitic diseases and their lab diagnosis	

REFERENCE BOOKS:

1. Prescott's Microbiology, Willey, Sandman and Wood, Mc Graw Hill, 12th edition.
2. Microbiology, Purohit, Agrobios India.
3. A Textbook of Microbiology, Dubey & Maheshwari, S. Chand

Program: BMLT
Semester: IV
Subject: Digital Electronics system and Instrumentation
Code: 42ABMT402

Course Outcomes: -
On completion of the Course, the students will be able to:

CO1: Develop the essential skills for understanding the digital circuits.

CO2: Define logic algebra, explain the postulates and theorems of Boolean algebra, and apply them to simplify logical expressions.

CO3: Exemplify the elements of Instruments and measurement system and interpret the performance characteristics of the measurement.

CO4: Demonstrate the working of digital instruments using the block diagram approach.

CO5: Organize sensors and switches for the measurement of given physical variables.

COURSE CONTENT: Digital Electronics system and Instrumentation

TOPICS	HOURS
MODULE-I:- BOOLEAN ALGEBRA AND LOGIC GATES	**9**
Features of logic algebra, postulates of Boolean algebra, Theorems of Boolean algebra, Boolean functions. Basic logic gates: AND, OR and NOT gates, Universal gates: NAND & NOR gates, Special gates: EX-OR & EX- NOR gates, their block diagrams and truth tables. Logic diagrams from Boolean expressions, Positive, Negative and mixed logic. Implementation of gates using NAND and NOR gates.	
MODULE-II:- MINIMIZATION TECHNIQUES	**9**
Representation of switching function: Sum of Product Form, Product of Sum Form, Standard SOP and POS Form. Converting Expression in Standard SOP or POS Forms, Min. terms and Max Terms. Simplification of Boolean Expression, Algebraic Simplification 1.4 Karnaugh Map, Plotting of K-map, Grouping Cells for Simplification, Simplification of SOP and POS Expression. Don't Care Condition, K-map up to 4 variables, and Simplification of logic functions with K-map.	
MODULE-III:- Basics of Instrumentation System	**9**
Measurement and Measurement Systems. Elements of Generalized Measurement System. Range of Span, Reproducibility and Drift, Hysteresis, Accuracy and Precision, Linearity, Sensitivity. Threshold, Dead Time, Dead Zone, Resolution.	
MODULE-IV:- Digital Instruments	**9**
Advantage of Digital Instruments over Analog Instruments. Role of Digital to Analog Converter (D/A), Analog to Digital Converter (A/D) Data Acquisition System. Block Diagram Approach of Basic Digital Instrument Block Diagram of Digital Multimeter.	
MODULE-V:- Sensors and Switches	**9**
Classification of Sensors Resistive, Capacitive and Inductive Transducer Biomedical sensors, Smart sensors Proximity switches, Photoelectric switches. Limit switches	

REFERENCE BOOKS: -

1. J.J. Karr & J.M. Brown, ―Introduction to Biomedical Technology, Prentice Hall
2. R. S. Khandpur, ―Handbook of Biomedical Instrumentation‖, Tata McGraw-Hill
3. L. Crownwell, ―Biomedical Instrumentation and Measurement‖, Prentice-Hall
4. Digital Design (T) M. Morris Mano, 4th Edition, Prentice Hall of India Pvt. Ltd., 2008.
5. Digital Electronics (Circuits, Systems & Ics) (R) by S. N. Ali, Galgotia, 2003.

Program: BMLT
Semester: IV
Subject: Histopathology & Histotechniques
Code: 42ABMT403

L	T	P	C
3	0	0	3

Course Outcomes: -
On completion of the Course, the students will be able to:

CO1: - Penetrate the theoretical prospects of cytology, about cell growth, cell injury, aging, inflammation, and wounds to cell death.

CO2: - Understand the basics of histopathology and their techniques including; tissue preparation, fixation, dehydration, clearing, embedding, routine & special staining and microscopy.

CO3: - Perceive the applications of microtome and their types, applications of microscope and electron microscopy in histopathological studies.

CO4: - Understand the essentiality of decalcification, method of decalcification and their advantage and disadvantages.

CO5: - Know the applications of biopsy, method of biopsy including their advantages for pathological studies.

COURSE CONTENT: - Histopathology & Histotechniques

TOPICS	HOURS
MODULE-I:- Cytology	
Introduction of cell growth. Cell injury, cell adaptations, intracellular accumulations, cell aging and cell death. Acute and chronic inflammation. Fibrosis and related term. Wound healing, methods and related aspects.	9
MODULE-II:- Histopathology and their techniques	
Introduction to histopathology and their techniques. Tissue preparation and processing. Steps of histopathological techniques include; fixation, dehydration, clearing, embedding. Routine & special staining of tissues. Interpretation by using microscopy.	9
MODULE-III:- Application of sectioning in histopathology and their observation	
Applications of microtome and their various types. Introduction and role of cryotomy. Application of microscope and their types. Application of electron microscope and its working principal. Role of above microscope for histopathological and other related studies.	9
MODULE-IV:- Decalcification and other process for bone	
Introduction of decalcifications. Essential preliminary process for bone decalcifications. Methods of decalcification and their types with advantages and disadvantages. Factors affecting rate of decalcification. Methods of determining optimum decalcification or end point	9
MODULE-V:- Biopsy	
Introduction of biopsy. Applications and limitations of biopsy. Method of biopsy and their types including their advantages and disadvantages. Benefits and risk of biopsy. Complications and side effects of biopsy.	9

REFERENCE BOOK: -

1. Pathology Practical Book Harsh Mohan; Jaypee Brothers Medical Publishers (P) Ltd., 2nd Edition,
2. Histology (A text book & Atlas) Wilkins, 5th Edition, 2006 Michael H. Ross, Wojciech Pawlina; Lippincott Williams
3. Bancroft's Theory and practice of Histopathological Techniques Kim S Suvarna, Christopher Layton, John D. Bancroft; Elsevier Health Sciences, 7th Edition,
4. Techniques in Histopathology and Cytopathology Sadhana Vishwakarma; Jaypee Brothers Medical Publishers, 1st Edition, 2017
5. Textbook of Histology Leslie P. Gartner; Elsevier,

Program: BMLT
Semester: IV
Subject: Microbiology Lab-II
Code: 42ABMT404

L	T	P	C
0	0	2	1

Course Outcomes: -
On completion of the Course, the students will be able to:

CO1: - Demonstrate proficiency in isolating microorganisms from different sources and preparing pure cultures of bacteria, essential skills for microbiological research and applications.

CO2: Achieve mastery in differential staining techniques, including Gram staining and acid-fast staining, enabling accurate differentiation and classification of bacteria based on their cell wall.

CO3: - Acquire competence in identifying fungi using staining methods and studying fungal morphology through scotch tape preparations, enhancing their ability to recognize and classify fungal species.

CO4: - Understand how various factors such as pH, temperature, and salt concentration affect microbial growth, providing insights into microbial behavior in different environmental conditions.

CO5: - Able to evaluate the effectiveness of antiseptic agents using standardized methods, enabling them to assess the suitability of different antiseptics for microbial inhibition in clinical and laboratory.

COURSE CONTENT: Microbiology Lab-II

TOPICS	HOURS
MODULE-I:- Isolation & Preparation of Pure cultures	**6**
Isolation of micro-organism from various sources like Air, water, and soil. Preparation of pure culture of various gram positive and gram- negative bacteria.	
MODULE-II:- Differential staining	**6**
To differentiate gram positive and gram-negative bacteria by Gram staining. To differentiate bacteria by Acid fast staining.	
MODULE-III:- Identification of Fungus	**6**
Identification of unknown fungus by lacto phenol cotton blue staining methods. Scotchta preparation for studying morphology of fungi.	
MODULE-IV:- Effect of various factors on microbial growth	**6**
Effect of different PH on microbial growth. Effect of different incubation temperature on microbial growth. Effect of different salt concentration on microbial growth.	
MODULE-V:- Antiseptic studies	**6**
Evaluation of Alcohol effectiveness as an antiseptic. Evaluation of antiseptic by Filter paper disc method. To perform phenol-coefficient test (Rideal Walker test).	

REFERENCE BOOK: -

1. "Experiments in microbiology, Plant pathology and Biotechnology" K. R. Aneja, Newage publication
2. Mackie and McCartney "Practical medical microbiology" Collee, Fraser, Marmion, Simmons, Elsevier publication
3. Practical Microbiology Dubey & Maheshwari, S. Chand

Program: BMLT
Semester: IV
Subject: Digital Electronics system and Instrumentation Lab
Code: 42ABMT405

L	T	P	C
0	0	2	1

Course Outcomes: -
On completion of the Course, the students will be able to:

CO1: - Understand the pin layouts & use of basic and universal gates using ICs.

CO2: - Demonstrate and implement code converters using logic gates.

CO3: - Attribute the basics of CRO and Function Generator with the demonstration of their Front Panel Controls.

CO4: - Check measurements performed using Function Generator, CRO, and Digital Multimeter.

CO5: - Check measurements performed by Analog to Digital Converter and Digital to Analog Converter.

COURSE CONTENT: Digital Electronics system and Instrumentation Lab

TOPICS	HOURS
MODULE-I:- Boolean Algebra and Logic Gates	6
Verification of basic Logic gates. Verification of Universal logic gates and realization of basic gates	
MODULE-II:- Minimization Techniques	6
Design and implementation of BCD to excess-3 code and vice versa code converters using logic gates. Design and implementation of Binary to Gray and vice versa code converters using logic gates.	
MODULE-III:- Basics of CRO and Function Generator	6
To study the front panel control of CRO. To study the front panel control of the function generator	
MODULE-IV:- Measurements performed through CRO and Digital Multimeter	6
Voltage and Frequency Measurement using CRO To study the applications of the Digital Multimeter	
MODULE-V:- Interfacing of Real-world signal with Digital Instruments	6
To study and observe the output of a 4-bit digital-to-analog converter. To study and observe the output of an 8-bit analog-to-digital converter.	

REFERENCE BOOKS: -

1. J.J. Karr & J.M. Brown, ―Introduction to Biomedical Technology, Prentice Hall
2. R. S. Khandpur, ―Handbook of Biomedical Instrumentation‖ Tata McGraw-Hill
3. L. Crownwell, ―Biomedical Instrumentation and Measurement‖, Prentice-Hall
4. Digital Design (T) M. Morris Mano, 4th Edition, Prentice Hall of India Pvt. Ltd., 2008.
5. Digital Electronics (Circuits, Systems & Ics) (R) by S. N. Ali, Galgotia, 2003.

Program: BMLT
Semester: IV
Subject: Histopathology & Histotechniques Lab-I
Code: 42ABMT406

Course Outcomes: -
On completion of the Course, the students will be able to:

CO1: - Provide comprehensive knowledge of various techniques involved in Histological studies.

CO2: - Detailed study of various Animal tissues at microscopic level.

CO3: - Overall idea of Working principle & application of various instruments used in Lab.

CO4: - Knowledge of use of Chemicals (Fixatives) and Staining agents.

CO5: - Use various microscopes (Light &Electron) & interpretation of various slides of stained animal & human tissues.

COURSE CONTENT: Histopathology & Histotechniques Lab-I

TOPICS	**HOURS**
MODULE-I:-	**6**
Basic Principles in Histology -Tissue Processing	
MODULE-II:-	**6**
Study of various types of Microscopes (Light, Electron)	
MODULE-III:-	**6**
To perform Haematoxylin & Eosin stain	
MODULE-IV:-	**6**
Morphological study of cells and tissues of specimen to be examined	
MODULE-V:-	**6**
Interpretation of Histological slides	

REFERENCE BOOKS: -

1. Histology Practical Manual Balakrishna, Edition -IV, 2019, Jaypee Brothers
2. Medical Laboratory Technology KL Mukherjee, Edition- II,2017, Mc Graw Hill
3. Anatomy & Physiology Ross & Williams, Edition –XIV, 2022, Elsevier Health Sciences

Program: BMLT
Semester: IV
Subject: Parasitology & Cytology
Code: 42ABMT407

Course Outcomes: -
On completion of the Course, the students will be able to:

CO1: - Understand parasite classification and characteristics, focusing on protozoa and helminths, forming a strong foundation in parasitology for accurate diagnosis and treatment.

CO2: Identifying and managing protozoal infections, including morphology, life cycles, symptoms, and laboratory diagnosis.

CO3: - Develop expertise in diagnosing and treating malaria, covering Plasmodium species identification, morphology, life cycles, and treatment.

CO4: - Acquire competence in identifying and treating nematode and cestode infections, including morphology, life cycles, symptoms, and laboratory diagnosis.

CO5: - Demonstrate proficiency in cytology techniques such as exfoliative cytology, FNAC, imprint cytology, and hormonal marker assessment, enabling accurate detection,

COURSE CONTENT: Parasitology & Cytology

TOPICS	HOURS
MODULE-I:- Introduction to Parasites	**9**
Definition and classification of Parasites. General characteristics, classification of protozoa. Different types of medically important Protozoa. General characteristics, classification of Aschelminths. General characteristics, classification of Platyhelminthes.	
MODULE-II:- Protozoa	**9**
Morphology, life cycle, symptoms, pathogenicity: Entamoeba histolytica, Giardia lamblia, Leishmania, Trypanosoma Laboratory diagnosis and treatment of Intestinal & Blood and Tissue protozoa.	
MODULE-III:- Malaria	**9**
Morphology & lifecycle of Plasmodium, symptoms. Symptoms, pathogenicity, different types of Schizogony. Lab diagnosis, culture techniques. Identification of different plasmodium species. Treatment of malaria, different types of malaria.	
MODULE-IV:- Nematodes and Cestodes	**9**
Morphology, life cycle, symptoms, pathogenicity, Lab diagnosis: Ascaris lumbricoides, Enterobius vermicularis, Strongyloides stercoralis, Taenia spp. & Cysticercosis, D. latum	
MODULE-V:- Cyto-diagnostic studies	**9**
Introduction to Cyto-diagnostic cytology, Basis of detection of malignant and pre-malignant lesions, Different types of cytology: Exfoliative cytology, Fine needle aspiration cytology (FNAC), Applications of PAP smear.	

REFERENCE BOOKS: -

1. Prescott's Microbiology Willey, Sandman and Wood, Mc Graw Hill,
2. Textbook of Pathology Harsh Mohan, Jaypee brothers,
3. A Textbook of Microbiology Dubey & Maheshwari, S. Chand
4. Medical Parasitology T. K. Dey, New central book agency

Program: BMLT
Semester: IV
Subject: Immunopathology
Code: 42ABMT408

Course Outcomes: -
On completion of the Course, the students will be able to:

CO1: - Perceive the basics of immunopathology, immunology, immunity, immunization, immune system, vaccines, allergy, hypersensitivity, infections, autoimmune.

CO2: - Understand the basics of blood, composition and its functions, theoretical aspects of blood, its types, abnormalities, blood coagulation, and its mechanism and blood grouping.

CO3: - Penetrate the method of blood collections, storage, and blood related products, blood transfusion, essential conditions of transfusion and its precautions.

CO4: - Understand the serology and antenatal care, essential nutritional supplement during pregnancy, prenatal and postnatal care for mother and newborn baby.

CO5: - Know the process of kidney transplantation, sign and symptoms of kidney failure, methods of kidney transplantations, chances of complication and rejections.

COURSE CONTENT: Immunopathology

TOPICS	HOURS
MODULE-I:- Immunology	**9**
Introduction of Immunopathology, immunology, immunity, immunization, immune system. Role of vaccine, vaccination and related terms. Allergy; its sign & symptoms, hypersensitivity, infections and their precautions. Autoimmune disease, prevention and their cure. Immunological disease and their chances of contaminations.	
MODULE-II:- An overview on the theory of blood groups	**9**
Introduction of blood, composition and its functions. Theoretical aspects of blood, its types and their importance. Abnormalities and diseases associated with blood. Blood coagulation, anticoagulants and its mechanism. Importance of ABO and Rhesus blood grouping systems, its significance and other types of blood groups.	
MODULE-III:- The method of blood collection and blood transfusion	**9**
Standard method of blood collections. Blood storage, blood related products and chances of complications. Blood transfusion, essential condition of transfusion and its precautions. Immediate adverse effects of blood transfusion. Immunological aspects and complications of blood transfusion.	
MODULE-IV:- Antenatal care and haemolytic disease of the new born	**9**
Introduction of serology and antenatal care. Essential nutritional supplement need to be advice during pregnancy. The prenatal and postnatal care for mother and newborn baby. Introduction of Hemolytic disease of the newborn. Etiology and pathogenesis of hemolytic disease of the newborn.	
MODULE-V:- Kidney transplant	**9**
Introduction to kidney transplantation. Sign and symptoms of kidney failure. Best possible methods of kidney transplantations, chances of complication and rejections. Criteria of donor selections and factors that affect kidney transplant. Importance of tissue typing, cross matching, ABO compatibility during kidney transplant.	

REFERENCE BOOKS: -

1. Samter's Immunologic disease, K. Frank Austen, Michael M. Frank, John P. Atkinson, Harvey Cantor; Lippincott Williams and Wilkins;
2. Handbook of human Immunology, Marry S. Leffell, Albert D. Dannenberg, Noel R. Rose; CRC press, Boca Raton, Florida
3. Indian Pharmacopoeia (IP) Govt. of India, Ministry of health & family welfare; Indian Pharmacopoeia commission

Program: BMLT
Semester: IV
Subject: Bio- signal Acquisition System
Code: 42ABMT409

Course Outcomes: -
On completion of the Course, the students will be able to:

CO1: -Understand the working with the biomedical equipment.

CO2: - Explain the fundamentals of the types of biomedical sensors and transducers for biomedical data acquisition.

CO3: -Understand Fundamentals of bio-signals and their pattern analysis.

CO4: -Understand the fundamentals of the concept and design of biomedical equipment.

CO5: -Gain a comprehensive understanding of algae and parasites, enabling them to assess their ecological roles, economic importance, and health impacts.

COURSE CONTENT: Bio- signal Acquisition System

TOPICS	HOURS
MODULE-I:- Signal and Noises	**9**
Generation of resting and action potential, polarization and depolarization, rhythmicity of cardiac potential, Types of bio-signals and its sources	
MODULE-II:- Transducers	**9**
Biomedical Sensors and electrodes, Transducers for biomedical application, Recording problems and its remedy	
MODULE-III:- Signal Conditioning	**9**
Different types of biomedical amplifiers and their principles of operation. Application of filters in conditioning of bio-signals	
MODULE-IV:- Telemetry System	**9**
Radio telemetry system, Portable telemetry system, Land-line telemetry system, ECG and other physiological telemetry system	
MODULE-V:- Different types of Bio-recorders and Medical Display System	**9**
Types of XY chart recorder and principle of operation, different types of cameras used for image recording systems, functional numerical display, central monitoring console	

REFERENCE BOOKS: -
1. J.J. Karr & J.M. Brown, ―Introduction to Biomedical Technology, Prentice Hall
2. R. S. Khandpur, ―Handbook of Biomedical Instrumentation, Tata McGraw-Hill
3. L. Crown well, ―Biomedical Instrumentation and Measurement, Prentice-Hall

Program: BMLT
Semester: IV
Subject: Introduction to Microprocessor
Code: 42ABMT410

L	T	P	C
3	0	0	3

Course Outcomes: -
On completion of the Course, the students will be able to:

CO1: -Interpret and recognize the architecture and characteristics of 8085 and 8086.

CO2: - Understand the implement assembly level programs.

CO3: -Explain the Recognize and demonstrate various types interrupts.

CO4: -Comprehend the principles of interfacing and the functioning of programmable peripheral devices.

CO5: -Explain the functions of microprocessor in biomedical applications.

COURSE CONTENT: Introduction to Microprocessor

TOPICS	HOURS
MODULE-I:- Introduction to 8085 & 8086	**9**
The 8085 and 8086 architectures, Memory, I/O Devices, Logic devices for interfacing, Memory-Interfacing, Addressing modes, Instructions, programming techniques.	
MODULE-II:- 8085 and 8086 INSTRUCTIONS	**9**
Looping, Counting and Indexing, Data Transfer and, Arithmetic instructions, Counters and Time Displays, Stacks & subroutines, Conditional call and return instructions.	
MODULE-III:- Interrupts	**9**
The 8085 and 8086 Interrupt, Vectored interrupts, Additional I/O concepts and processes, Serial I/O & data communication.	
MODULE-IV:- General purpose programmable peripheral devices	**9**
8255 Programmable peripheral interface, Interfacing keyboard and Seven Segment display, The 8254 programmable Interval timer, The 8259 programmable Interrupt controller, 8257 DMA controller.	
MODULE-V:- Biomedical Applications of Microprocessors:	**9**
Applications in Computed Radiography, Applications in Computed Tomography, Applications in ECG, Applications in EEG, Applications in EMG and Applications in Patient Monitoring Systems.	

REFERENCE BOOKS: -

1. Microprocessor & Application Ramesh C Gaonkar, Penram International Publishing, 6th ed, 2013
2. Microprocessors and Interfacing, Programming and Hardware Doughlas V.Hall, McGraw Hill Inc.,
3. Microcomputer Systems: The 8086 / 8088 Family -Architecture, Programming and Design Yu-Cheng Liu, Glenn A.Gibson, PHI,
4. Microprocessor & Microcontroller B Ram, Dhanpat Rai Publication

SEMESTER-V

Course Scheme

SEMESTER - V						
LEVEL – 5.5	**Major Courses - Compulsory**		**L**	**T**	**P**	**Credits**
	42ABMT 501	Forensic & Medical Ethics	3	0	0	3
	42ABMT 502	Histopathology & Histotechniques Lab-II	0	0	2	1
	42ABMT 503	Biostatistics	3	0	0	3
	Major Courses-Compulsory (Any One)					
	42ABMT 504	Techniques in Molecular Biology	3	0	0	3
	42ABMT 505	Hematology & Blood Banking (Group-I)	3	0	0	3
	Minor Course – Compulsory					
	42ABMT 506	Bacteriology & Virology	3	0	0	3
	42ABMT507	Bacteriology & Virology Lab	0	0	2	1
	Minor Course – Compulsory (Any One)					
	42ABMT 508	Clinical Instrumentation (Group-II)	3	0	0	3
	42ABMT509	Biomedical imaging Devices and Concept	3	0	0	3
	Multidisciplinary Courses					
	42ABMT510	Laboratory Management	2	0	0	2
	Common Value – Added Course					
	42AVAC 301	Character Building and Holistic Development of Personality – II (Yoga and Physical Fitness)	2	0	0	2
Total						**21**

Program: BMLT
Semester: V
Subject: Forensic & Medical Ethics
Code: 42ABMT501

L	T	P	C
3	0	0	3

Course Outcomes: -
On completion of the Course, the students will be able to:

CO1: - Perceive the basics of forensic sciences, legal and ethics, Basic principles of medical ethics, jurisprudence, laws of India.

CO2: - Know and understand the setup of forensic science laboratory and its applications, Investigation and examination of biological fluids and other materials by using different method.

CO3: - Understand the role and adverse effects of drug, drug abuse, and functions of legal and illegal drugs in forensics, role and effects of Drug resistance.

CO4: - Penetrate the poison, food poisoning, reasons, sign and symptoms, introduction of mushrooms and characteristics of poisonous mushrooms.

CO5: - Understand the medico-legal aspects of Medical Termination of Pregnancy Act, procedure of legal abortion, consent and protocol.

COURSE CONTENT: Forensic & Medical Ethics

TOPICS	HOURS
MODULE-I:- Legal and ethical aspects of Forensic & medical ethics and related terms	
Introduction of forensic sciences, legal and ethics. Basic principles of medical ethics and its type. Introduction to jurisprudence, scope and its significance. Introduction of laws of India; criminal laws, civil laws, types of inquest and offences. Objective of autopsy, types of autopsies, legally defined manner of death, initial examination and record.	**9**
MODULE-II:- Setup of Forensic Science laboratory and examination of biological fluids	
Introduction and setup of forensic science laboratory and its applications. Investigation and examination of biological fluids, traces evidences and other materials by using different methods. Principle and applications of chromatography. Introduction, applications and its type of electrophoresis. Introduction, classifications and applications of Spectrophotometry.	**9**
MODULE-III:- Introduction to drug, drug abuse and dependence	
Introduction of drug and drug abuse. Function of legal and illegal drugs in forensics. Role and effects of Drug resistance, physical dependence, tolerance and related terms. Drug addiction, habituation, sign, symptoms and its solutions. Drug dependence, its prevention and management.	**9**
MODULE-IV:- Food Poison and different types of poisoning	
Introduction of poison, food poisoning, sign and symptoms. Main reason for outbreak of food poisoning. Introduction of mushrooms, types, nutritional values and characteristics of poisonou mushrooms. Poisoning from vegetables, soybeans, bacteria and other forms of substances and their complications. Precaution, prevention and management of food poisoning.	**9**
MODULE-V:- Medico-legal Aspects of Medical Termination of Pregnancy Act, protocol, record and policy	
Objective of medico-legal aspects of Medical Termination of Pregnancy Act (MTP). Procedure of legal abortion, consent and protocol. Medical termination, registered medical practitioner, confidential record and monitor quality of services. Condition not possible to perform termination of pregnancy and violation. Regulatory body, application and approval of place for terminations, cancellation and medical insurance policy.	**9**

REFERENCE BOOKS:

1. Handbook of Forensic Medicine and Toxicology (Medical Jurisprudence), P.V. Chadha, Jaypee Brothers Medical Publishers.
2. Textbook of Medical Ethics, Erich H. Loewy, Springer Netherlands.
3. Textbook of Forensic Medicine & Toxicology: Principles & Practice, Krishan Vij, Elsevier India.

Program: BMLT

Semester: V

Subject: Histopathology & Histotechniques Lab-II

Code: 42ABMT502

L	T	P	C
0	0	2	1

Course Outcomes: -

On completion of the Course, the students will be able to:

CO1: - Provide the comprehensive knowledge of Histotechniques involved in Histological studies.

CO2: - Understand the various steps of Histotechniques, solvents applying in the various types of tissues specimen.

CO3: - Overall idea with working principle, handling & application of various apparatus and instruments used in the Lab.

CO4: - Study and use of various types of chemicals, staining agents with their advantages and disadvantages.

CO5: - Use different types of microscopes and also performed interpretation of stained tissues specimen

COURSE CONTENT: Histopathology & Histotechniques Lab-II

TOPICS	HOURS
MODULE-I:-	**6**
Advance knowledge in Histology, histopathology and Histotechniques - Tissue Processing and preparations	
MODULE-II:-	**6**
Study the various types of Instruments, glassware, fixative agents and chemicals	
MODULE-III:-	**6**
To improve the knowledge of various types of sophisticated microscope (Simple and advances) and microtome (manual and semi- automated) Haematoxylin & Eosin stain	
MODULE-IV:-	**6**
Anatomical and morphological study of cells and tissues specimen and effects of chemical an staining agents	
MODULE-V:-	**6**
Advance Interpretation of prepared Histological slides with the standard with different types of tissues specimen	

REFERENCE BOOKS:

1. Pathology Practical Book, Harsh Mohan; Jaypee Brothers Medical Publishers (P) Ltd.
2. Bancroft's Theory and practice of Histopathological Techniques, Kim S Suvarna, Christopher Layton, John D. Bancroft; Elsevier Health Sciences.
3. Histology Practical Manual, Balakrishna, Jaypee Brothers.

Program: BMLT
Semester: V
Subject: Biostatistics
Code: 42ABMT503

L	T	P	C
3	0	0	3

Course Outcomes: -
On completion of the Course, the students will be able to:

CO1: - Understand statistical concepts and their relevance in biological and medical research.

CO2: - Apply descriptive and inferential statistics to real-world datasets.

CO3: - Design valid health research studies using appropriate sampling and statistical techniques.

CO4: - Analyze and interpret biological data using statistical software.

CO5: - Critically evaluate published research from a statistical perspective.

COURSE CONTENT: Biostatistics

TOPICS	HOURS
MODULE-I:- Introduction to Biostatistics, Data Presentation & Measures of Central Tendency	
Definition and scope of biostatistics. Role in public health and biomedical research. Types and sources of data. Scales of measurement: nominal, ordinal, interval, ratio. Tabulation of data. Graphical methods: bar charts, histograms, pie charts, line graphs, box plots. Mean, median, and mode. Uses and limitations.	**9**
MODULE-II:- Measures of Dispersion, Probability Concepts & Probability Distributions	
Range, interquartile range, variance, standard deviation. Coefficient of variation. Understanding variability in health data. Basics of probability. Rules of probability (addition, multiplication). Conditional probability. Discrete: Binomial and Poisson distributions. Continuous: Normal distribution.	**9**
MODULE-III:- Sampling Techniques, Study Designs in Biostatistics & Hypothesis Testing Basics	
Sampling vs population. Random, stratified, cluster, and systematic sampling. Sampling bias and errors. Cross-sectional, case-control, cohort, and experimental designs. Sample size estimation (intro). Null and alternative hypothesis. Type I and II errors. P-values, significance levels. Confidence intervals.	**9**
MODULE-IV:- Correlation and Regression, Introduction to Survival Analysis & Use of Statistical Software	
Pearson and Spearman correlation. Simple linear regression: interpretation and assumptions. Introduction to multiple regression. Concepts of censoring. Life tables and Kaplan-Meier curves. Log-rank test. Data entry and cleaning. Coding variables. Running analyses in SPSS/R. Graphical representation and exporting results.	**9**
MODULE-V:- Critical Appraisal and Report Writing	
Interpreting statistical sections in journal articles Common statistical errors in publications Writing the statistical analysis section of a report	**9**

REFERENCE BOOKS:

1. Biostatistics: A Foundation for Analysis in the Health Sciences – Wayne W. Daniel
2. Intuitive Biostatistics – Harvey Motulsky
3. Practical Statistics for Medical Research – Douglas G. Altman
4. Rosner, B. – Fundamentals of Biostatistics

Program: BMLT
Semester: V
Subject: Techniques in Molecular Biology
Code: 42ABMT504

L	T	P	C
3	0	0	3

Course Outcomes: -
On completion of the Course, the students will be able to:

CO1: - Understand the principles behind core molecular biology techniques.

CO2: - Perform essential molecular biology experiments.

CO3: - Analyze and interpret experimental data in research and clinical settings.

CO4: - Design and troubleshoot molecular biology workflows.

CO5: - Understand the ethical and safety implications in molecular research.

COURSE CONTENT: Techniques in Molecular Biology

TOPICS	HOURS
MODULE-I:- Introduction to Molecular Biology, Nucleic Acid Extraction & Quantification and Quality Analysis of Nucleic Acids	
History and scope. Overview of molecular techniques and their applications in diagnostics, forensics, and research. Isolation of DNA and RNA from cells/tissues. Principles of lysis, separation, and purification. Use of organic extraction vs. column-based methods. Spectrophotometry. Fluorimeter. Gel electrophoresis.	**9**
MODULE-II:- Polymerase Chain Reaction (PCR), Variants of PCR & Electrophoresis and Blotting Techniques	
Principle and components. Optimization of PCR: annealing temp, cycle number. Applications of conventional PCR. Reverse Transcriptase PCR (RT-PCR). Real-Time PCR (qPCR): SYBR Green, TaqMan probes. Multiplex PCR, Hot-start PCR, Nested PCR. Agarose and polyacrylamide gels. Southern blot (DNA), Northern blot (RNA), Western blot (Protein). Transfer methods and detection systems (chemiluminescence, colorimetric).	**9**
MODULE-III:- Cloning and Recombinant DNA Technology, Plasmid DNA Isolation and Verification	
Restriction enzymes, ligation, and cloning vectors, Competent cells and transformation (chemical/electroporation). Alkaline lysis method. Restriction digestion and gel verification.	**9**
MODULE-IV:- Protein Expression and Purification, CRISPR and Genome Editing Tools & Molecular Diagnostics Techniques	
Prokaryotic and eukaryotic expression systems (E. coli, yeast, mammalian). Affinity chromatography. Protein quantification. Basics of CRISPR-Cas9 mechanism. Applications in functional genomics, therapy, diagnostics. ELISA. DNA microarrays. LAMP (Loop-mediated isothermal amplification). Applications in pathogen detection and mutation screening.	**9**
MODULE-V:- Bioinformatics in Molecular Biology & Recent Advances & Project Presentations	
Sequence databases (NCBI, EMBL). Synthetic biology. Molecular barcoding. Single-cell genomics. Student presentations of mini-projects.	**9**

REFERENCE BOOKS:

1. Molecular Biology of the Gene – Watson, et al.
2. Molecular Cloning: A Laboratory Manual – Sambrook & Russell
3. Principles and Techniques of Biochemistry and Molecular Biology – Wilson & Walker
4. Gene Cloning and DNA Analysis – T.A. Brown

Program: BMLT
Semester: V
Subject: Hematology & Blood Banking
Code: 42ABMT505

L	T	P	C
3	0	0	3

Course Outcomes: -
On completion of the Course, the students will be able to:

CO1: - Understand various types of anemia and leukemia and investigation required to identify them.

CO2: - Conversant with various laboratory techniques to assess bleeding disorders.

CO3: - Proficient with different laboratory investigation for diagnosis of disseminated intravascular coagulation.

CO4: - Understand applications of cytogenetic techniques.

CO5: - Acquainted with various methods applied in blood banking system.

COURSE CONTENT: Hematology & Blood Banking

TOPICS	HOURS
MODULE-I:- Anemia and Leukemia	**9**
Definition and classification of anemia, Laboratory investigation procedures of megaloblastic anemia and iron deficiency anemia (IDA). Definition and classification of leukemia, Laboratory investigation procedures of Leukemia.	
MODULE-II:- Laboratory Techniques of assessing bleeding disorders	**9**
Platelet functions and their interpretations, Various methods of bleeding time determinations Various methods of bleeding time determinations, Prothrombin time (PT) determination Activated Partial Thromboplastin Time (APTT) determination.	
MODULE-III:- Disseminated Intravascular Coagulation (DIC) and Fibrinolysis	**9**
Etiology of DIC, Mechanism of DIC, Laboratory investigation of disseminated intravascular coagulation, Mechanism of fibrinolysis: Tests for fibrinolysis.	
MODULE-IV:- Cytogenetic Studies	**9**
Definition of Cytogenetics, Techniques available for cytogenetic studies Applications of cytogenetic studies	
MODULE-V:- Blood Bank	**9**
Introduction, Blood Grouping and Rh typing , Cross matching & Compatibility testing.	

REFERENCE BOOKS:

1. An introduction to medical laboratory technology, Baker et al., Seventh Edition, A Hodder Arnold Publication.
2. Blood coagulation and homeostasis, Thomson J, Churchill Livingstone.

Program: BMLT
Semester: V
Subject: Bacteriology & Virology
Code: 42ABMT506

L	T	P	C
3	0	0	3

Course Outcomes: -
On completion of the Course, the students will be able to:

CO1: - Understand the gram positive and negative cocci.

CO2: - Understand the gram positive and negative bacilli.

CO3: - Familiar with the general properties of viruses.

CO4: - Know about common viral disease, infection, and diagnosis.

CO5: - Understand the emerging viral infection,

COURSE CONTENT: Bacteriology & Virology

TOPICS	HOURS
MODULE-I:- Gram positive cocci & Gram negative cocci –	9
staphylococci , streptococci & Neisseria	
MODULE-II:- Gram positive bacilli & Gram negative bacilli	9
Corynebacterium, Mycobacterium, Actinomy Listeria, Bacillus, Clostridia. Enterobacteriaceae, Pseudomonas Alcaligenes, Vibrio, Aeromonas, Plesiomonas, Campylobacter, Bacteroides, Fusobacterium, Brucella, Haemophilus, Bordetella, Pasteurella, Francisella, Spirochaetes, Chlamydia, Rickettsia, Mycoplasma, L forms, etc.	
MODULE-III:- General properties of viruses	9
Structure, replication, growth Classification, identification. Bacteriophage – Phage typing.	
MODULE-IV: - Common viral disease – mode of infection, spread. Laboratory Diagnosis	9
Polio, Influenza, Para influenza, Mumps, Measles, Rubella, Respiratory syncitial, Rhino, Rota, Hepatitis, arbo viruses prevalent in India (Dengue, West Nile, Japanese Encephalitis, KFD), Chicken pox, Adeno, Papova, Herpes, HIV, Cytomegalo viruses, etc. 3	
MODULE-V:- Emerging viral infections:	9
SARS, MERS CoV, Zika, Crimean Congo hemorrhagic Fever, Nipah, Influenza viruses etc.	

REFERENCE BOOKS: -

1. Text Book of Parasitology by K.D. Chatterjee, Chatterjee Medical Publishers, Calcutta.
2. Parasitic diseases in man by Richard Knight English Language Book Society (ELBS)
3. Medical Microbiology by R. Cruick shanketal, vol.I ELBS 4. Text book of Medical Parasitology by S.C. Parija

Program: BMLT

Semester: V

Subject: Bacteriology & Virology Lab

Code: 42ABMT507

L	T	P	C
0	0	2	1

Course Outcomes: -

On completion of the Course, the students will be able to:

CO1: - Perceive the principles of specimen collection & describe and perform key laboratory.

CO2: - Demonstrate proper methods for collection and processing and perform microbiological testing of food, water, and milk.

CO3: - Understand and apply proper methods for the collection of biological specimens in various field and lab settings.

CO4: - Understand the principles and protocols involved in preparing and initiating tissue cultures from plant or animal cells and evaluate test sensitivity, specificity.

CO5: - Identify the appropriate collection methods and containers based on the suspected fungal pathogen and site of infection

COURSE CONTENT: Bacteriology & Virology Lab

TOPICS	HOURS
MODULE-I:-	**6**
Collection and transportation of clinical specimens. Procedures and tests required in the laboratory diagnosis of the infections caused by the pathogenic bacteria listed above.	
MODULE-II:-	**6**
Examination of urine, stool, etc. for isolation and identification of pathogenic bacteria. Bacteriology of food, water, milk	
MODULE-III:-	**6**
Collection, transportation and preservation of specimens. Preparation of glassware and media for tissue culture.	
MODULE-IV:-	**6**
Preparation and maintenance of tissue culture. Serological tests in virology. Antigen detection by various techniques.	
MODULE-V:-	**6**
Collection of specimens for fungal examination. Direct KOH examination. Isolation and identification of fungi from clinical specimens.	

REFERENCE BOOKS: -

1. Text Book of Parasitology by K.D. Chatterjee, Chatterjee Medical Publishers, Calcutta.
2. Parasitic diseases in man by Richard Knight English Language Book Society (ELBS

Program: BMLT
Semester: V
Subject: Clinical Instrumentation
Code: 42ABMT508

L	T	P	C
3	0	0	3

Course Outcomes: -

On completion of the Course, the students will be able to:

CO1: - Understand the general physiology for man-machine interaction in medical environment.

CO2: - Fundamentals of the types of biomedical sensors and transducers for biomedical data acquisition.

CO3: - Fundamentals of bio signals and their pattern analysis.

CO4: - Understand the fundamentals of the concept and design of biomedical equipment.

CO5: - Analyze the electrical hazards associated with medical equipment so that the safety equipment can be devised or suggested.

COURSE CONTENT: Clinical Instrumentation

TOPICS	HOURS
MODULE-I:- Clinical Cardiology	9
Electrocardiography, patient preparation for ECG recording, Electrode placement of electrodes, distinguishing the artifacts in ECG recording and their removal, stress testing; interpretation of ECG signals for clinical diagnosis; defibrillator and cardiac pacing	
MODULE-II:- Clinical Electroencephalography	9
EEG, Different type of` Machine and their electrical characteristics placement of electrodes, different artifacts in EEG and their removal, Montages for EEG, types of conducting paste for recording and their preparation, effects of different climatic conditions on recording of EEG, interpretation of EEG signals for clinical diagnosis	
MODULE-III:- Clinical Electromyography	9
EMG, single unit and compound myography, types of electrodes and important signal characteristics of EMG; Nerve and muscle conduction: MNCV, SNCV, F wave, H reflex, blink reflex, VEP, BAER, SSEP test	
MODULE-IV:- Clinical Therapeutic and Intensive-care	9
Instruments Electro-shock therapy instrumentation, Polygraph, Bio feed-back Instrument, Lie detector instrument; Central monitoring system for intensive care unit, different types of diathermy, physiotherapy and surgical diathermy and their different electrodes for cutting and coagulation	
MODULE-V:- Special Clinical Devices and System	9
Devices applied in auditory, ophthalmic and dental clinics; Types of ambulances and their accessories; Types of hazards in a hospital and their mitigation	

REFERENCE BOOKS:

1. Praveen J. Kumar and Michaell Clark, ―Clinical Medicine‖, ELBS.
2. Operating Manual of Neuro perfect, Medicaid Systems
3. Operating Manuals of ECG machine, TMT machine, Bio feedbacks machine, Diathermies machine.

Program: BMLT
Semester: V
Subject: Biomedical Imaging Devices and Concept
Code: 42ABMT509

L	T	P	C
3	0	0	3

Course Outcomes: -
On completion of the Course, the students will be able to:

CO1: -Understand the general physics in imaging systems.

CO2: - Learn and understand the instrumentation of different image acquisition systems.

CO3: -Process and analyze the anatomical and physiological images.

CO4: - Analyze the radiation hazards and its prevention.

CO5: - Understand the safety and precaution.

COURSE CONTENT: Biomedical Imaging Devices and Concept

TOPICS	**HOURS**
MODULE-I:- X-ray Techniques	**9**
X-ray Generation and Interaction with Matter, Concept of Dose Selection, Parameters Affecting the Quality of Image, X-ray Tube and Machine, CT-Scan and Generations, Contrast Media Application in X-ray Imaging. Dark Room and Film Processing	
MODULE-II:- Ultrasound	**9**
Interaction with Matter, Different Modes of Operation, Construction of Ultrasonic Transducer, Ultrasonic Probes and their Selection, Gel, Knobology Course	
MODULE-III:- Magnetic Resonance Imaging	**9**
Concept of MRI, Type of Magnets, Charging of Liquid Helium and Charging of Magnet, Radio Frequency Interference and its Prevention, Installation of MRI, Patient Preparation and Selection of Coil, Contrast Application and its Hazard Management	
MODULE-IV:- :Nuclear Medicinal Techniques	**9**
Radioisotope, Radiopharmaceuticals, Scintillation, Gamma Camera, SPECT, PET, Clinical Applications	
MODULE-V:- Safety and Precaution	**9**
Radiation Dose, Personal Dosimetry Techniques, Radiation Detectors and Counters	

REFERENCE BOOKS:

1. X-ray Diagnosis and Imaging by L.C. Gupta, Abhitabh Gupta; JAPEE Brothers Medical Publisher (P) Ltd., Delhi.
2. Ultrasound Physics & Instrumentation, Davind Hykes, Wayne R. Hedrick, Dale E. Starchman, Churchill Livingstone, N.Y.
3. Hand Book for X-ray Technician by Palmer, W.H.O. Publication.
4. Radiological Procedure by Chapman, Elsevier.
5. Handbook for Technicians: Darkroom Procedure by Palmar, W.H.O. Publication

Program: BMLT
Semester: V
Subject: Laboratory Management
Code: 42ABMT510

L	T	P	C
2	0	0	2

Course Outcomes: -
On completion of the Course, the students will be able to:

CO1: - Proficient in material management for providing the accurate results.

CO2: - Comprehensive procedures of purchasing.

CO3: - Understand the principles of inventory control.

CO4: - Proficient to stores materials and records.

CO5: - Comprehensive knowledge of materials handling systems, equipment and safety issues.

COURSE CONTENT: Laboratory Management

TOPICS	HOURS
MODULE-I:- Concept of Material Management	**6**
Importance, objective and Significance of material management, Scope of materials management, Classification of material management, Materials control.	
MODULE-II:- Purchasing	**6**
Basic ideas of purchasing, purchasing vs procurement, Objective and principles of purchasing, Purchasing function and Purchase procedure.	
MODULE-III:- Inventory Control	**6**
Basic principles of inventory control, Fixation of stock level, Concept of EOQ, Inventory control through ABC analysis	
MODULE-IV:- Store Management	**6**
An overview of Stores management, location – different types of stores – methods of storing – safety and security of materials – stores equipment – materials handling equipment, Stores system and procedures. Store records.	
MODULE-V:- Materials Handling	**6**
Principles of Materials handling system, Materials handling equipment's, Safety Issues	

REFERENCE BOOKS:

1. Materials management in Integrated Approach, P. Gopal krishna & M. Sunderasan, PHI Learning Pvt. Ltd.
2. Purchasing and Materials Management, Donald W. Dobler, Lamar Lee Jr, David N. Burt McGraw Hill.
3. Materials Management Inventory Control and Logistics, AK Dutta, Prentice Hall of India.

SEMESTER - VI

Course scheme

SEMESTER VI						
LEVEL-5.5	42ABMT601	Internship Project				16
	Multidisciplinary Courses					
	42ABMT602	Open Elective				4
	Total					**20**

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RUBRIC FOR INTERNSHIP / CLINICAL POSTING

Program: Bachelor in Medical Laboratory Technology (BMLT)
Duration: 6 months
Clinical Settings: Pathology Labs, Hospitals, Blood Banks, Diagnostic Centers
Total Marks: As per institutional policy.

PURPOSE OF THE RUBRIC:
The rubric serves as a standardized tool to **evaluate and document students' clinical competence, professional behavior, communication, and ethical practice** in real-world diagnostic laboratory settings. It supports:

- **Fair and transparent assessment**
- **Outcome-based learning**
- **Continuous improvement**

OBJECTIVE:
To assess a student's ability to apply theoretical knowledge in practical settings, operate laboratory instruments, follow safety norms, and exhibit professional behavior.

EVALUATION CRITERIA AND RUBRIC:

S. No.	Criteria	Weight (%)	Excellent (4)	Good (3)	Satisfactory (2)	Needs Improvement (1)
1	**Technical Proficiency**	25%	Performs all lab tests (e.g., haematology, biochemistry, microbiology) independently with accuracy.	Performs most tests correctly; needs minor guidance.	Can perform tests with supervision; occasional errors.	Struggles with basic procedures or frequent errors.
2	**Sample Handling & Processing**	15%	Handles specimens (blood, urine, sputum, etc.) with full aseptic technique and proper labelling.	Mostly follows safety and handling protocols.	Some lapses in aseptic technique or sample management.	Mishandles samples or compromises safety.
3	**Equipment Operation & Maintenance**	10%	Operates analyzers, microscopes, centrifuges confidently; calibrates and maintains equipment.	Uses equipment correctly with minor assistance.	Occasional misuse or lack of equipment care.	Lacks understanding of lab equipment or misuse observed.
4	**Report Preparation & Accuracy**	10%	Prepares accurate, well-formatted lab reports with appropriate interpretation of results.	Reports mostly correct with minor errors.	Frequent errors or incomplete entries in reports.	Reports lack clarity or contain major inaccuracies.
5	**Infection Control & Biosafety**	10%	Consistently follows biosafety levels, waste disposal rules, and universal precautions.	Follows biosafety norms with minor errors.	Needs reminders; occasional breaches.	Disregards biosafety protocols; unsafe practices.
6	**Professional Conduct & Ethics**	10%	Always professional, responsible, respectful, and follows lab protocols.	Usually professional; minor lapses.	Sometimes unprofessional or careless.	Frequently unprofessional or unethical.
7	**Communication Skills**	5%	Communicates clearly with lab staff, clinicians, and patients; writes legible and organized notes.	Communicates well with occasional hesitation.	Needs improvement in expression or technical language.	Poor communication or documentation.
8	**Teamwork and Collaboration**	5%	Actively collaborates with lab staff; assists others when needed.	Participates in teamwork with minor issues.	Sometimes isolates self or avoids shared tasks.	Disruptive or uncooperative behaviour.
9	**Punctuality and Attendance**	5%	95–100% attendance and always on time.	85–94% attendance; mostly punctual.	75–84% attendance or occasional delays.	<75% attendance or frequent absences.
10	**Supervisor Feedback**	5%	Highly rated by supervisor for skills and attitude.	Generally rated positively; good engagement.	Mixed feedback; needs improvement.	Negative or unsatisfactory feedback.

EVALUATION METHOD:

- **Internal Faculty + Clinical Supervisor Jointly Assess**
- Proof collected via:
  - **Logbook/Record book**
  - **Daily Reports**
  - **Viva Voce**
  - **Practical Demonstrations**
  - **Supervisor Evaluation Sheet**

SCORING GUIDE:

Each criterion is rated on a **4 - point scale**:

- **4 – Excellent**
- **3 – Good**
- **2 – Satisfactory**
- **1 – Needs Improvement**

Final Score = ∑ (Score × Weight %) across all criteria.

LEARNING OUTCOMES ASSESSED (MAPPED TO PLOS):

Outcome Domain	Mapped to
Clinical Competence	PLO 1, 2, 3
Safety and Ethics	PLO 4, 6
Reporting & Accuracy	PLO 5, 7
Teamwork & Communication	PLO 8, 9
Lifelong Learning Readiness	PLO 10

BENEFITS OF USING RUBRIC:

- Promotes **objective, consistent evaluation**.
- Helps **identify gaps** in skills for remediation.
- Encourages **self-reflection** and **feedback-based improvement**.