SCHEME & SYLLABUS

(Choice Based Credit System)

For

BMLT

(w.e.f. Session 2017-18)

Program Code: MLT 301

DEPARTMENT OF MEDICAL LAB TECHNOLOGY

RIMT UNIVERSITY, MANDIGOBINDGARH, PUNJAB

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RIMT UNIVERSITY MANDI GOBINDGARH, PUNJAB

SECTION 1

Vision & Mission of the University

VISION

To become one of the most preferred learning places a centre of excellence to promote and nurture future leaders who would facilitate in desired change in the society

MISSION

- To impart teaching and learning through cutting edge technologies supported by the world class infrastructure

- To empower and transform young minds into capable leaders and responsible citizens of India instilled with high ethical and moral values

SECTION 2

Vision and Mission of the Department

VISION

The Department of Medical Laboratory Technology represents one of the effective methods to meet the community needs of medical specialties for supporting various research, health, and educational institutions. Besides, it aims to invest the capacities of professors and students in the theoretical and applied researches and scientific studies. It also commits itself to improve training, awareness, and health mobilizations according to new grounds consistent with recent advances.

MISSION

- To create opportunities for students to gain a foothold in the healthcare industry
- To provide sufficient didactic and technical information for the student to understand analytical processes, interpret analytical results and appreciate the clinical significance of analyses performed in a modern clinical laboratory
- To provide the students with qualities and competencies that ensure success in the field of laboratory medicine as a medical laboratory technician
- Moreover, the department has a bright, ambitious future mission to provide the best medical teaching skills, to expand horizons of scientific cooperation with the corresponding departments, and related institutions to achieve continuous and high-quality interactions.

SECTION 3

About the Program

BMLT Program is an Outcome Based Education model which is a 3 year, 6 Semester Full time Program of 134 credit hours with a Choice Based Credit System (CBCS) and Grading Evaluation System. This program comprises of foundational courses, core courses, specialization electives courses, enrichment courses and experimental learning. The suggestive curriculum takes the BMLT program to the next level in terms of implementing Outcome Based Education and to develop management professionals who are knowledgeable in their chosen domain, responsive to the environment and culture, unfailing to the communities, ethical in all doings and with a global outlook and approach.

SECTION 4

Program Educational Objectives (PEOs), Program Outcomes (POs) and Program Specific Outcomes (PSOs)

PROGRAM EDUCATION OBJECTIVES

PEO1	To create knowledge about core areas related to the field of Medical Laboratory
PEO2	Analyze, interpret and apply concepts of clinical testing for healthcare decision making
PEO3	To exhibit the knowledge of entrepreneurial qualities and explore entrepreneurial opportunities by Working effectively and professionally in teams and enabling them to evaluate investment.
PE04	To employ interpersonal communication skills in relaying laboratory test information and when interacting with patients, lab personnel and other health care professionals.

PROGRAMME OUTCOMES (POs)

PO 1	**Clinical Exposure**:- Apply knowledge and technical skills associated with medical laboratory technology for delivering quality clinical investigations support in number of Hospitals and diagnostics centers for sustainable development.
PO 2	**Technician**:- Perform routine clinical laboratory procedures within acceptable quality control parameters in hematology, biochemistry, immunohematology and microbiology. Recognize the impact of laboratory tests in a global and environmental context.
PO 3	**Social Exposure**:- Demonstrate technical skills, social behavior and professional awareness for functioning effectively as a laboratory technician.
PO 4	**Scientific Exposure**:- These are also several types of positions available, such as research labs, diagnostic Laboratories and management of a team. Apply the fundamental of research process to complete and present research study that enriches the field of physical therapy.
PO 5	**Skill Development**:- Apply problem solving technique in identifications and corrections of pre analytical, post analytical & analytical variable.
PO 6	**Leadership and Team Work -** Function as a leader / team member in diverse professional and industrial research areas. Ability to Communicate effectively by oral, written and graphical means to achieve collaborative cooperation for synergy in an organizational and across organizational boundaries.
PO 7	**Life Long Learning –** Aptitude to acquire newer knowledge and skills, assimilate and adapt them to be ready to confront uncharted environment scientifically and confidently.
PO 8	**Entrepreneurship –** A strong business sense to explore entrepreneurial opportunities and leverage managerial & leadership skills for initiating, leading & managing start-ups as well as professionalizing and growing businesses.
PO 9	**Social Responsiveness and Ethics** - Function in an ethical and professional manner without bias against any ethnicity, race, religion, caste or gender. Practice professional and ethical responsibilities with high degree of credibility, integrity and social concern.

PO 10	**Environment and Sustainability –** Exhibit understanding to assess the impact of managerial decisions and business priorities on the societal, economic and environmental aspects for sustainable development.

PROGRAMME SPECIFIC OUTCOMES (PSOs)

PSO 1	Search professional explore about the latest research corners in the field of physical medicine and rehabilitation.
PSO 2	They expertise in advance clinical intervention techniques based on evidence based practices.
PSO 3	After successful completion the students shall be proficient in making diagnosis and skills of testing procedure and techniques.
PSO 4	As a health professional the students shall have an added responsibility towards the community health issue.

SECTION 5

Curriculum / Scheme with Examination Grading Scheme

SEMESTER WISE SUMMARY OF THE PROGRAMME: BMLT

S. No.	Semester	No. of Contact Hours	Marks	Credits
1.	I	29	1000	23
2.	II	24	800	20
3	III	29	1000	23
4	IV	30	1000	25
5	V	27	900	23
6	VI	30	1000	20
	Total	**169**	**5700**	**134**

EXAMINATION GRADING SCHEME

Marks Percentage Range	Grade	Grade Point	Qualitative Meaning
80.00 - 100.00	O	10	OUTSTANDING
70.00 - 79.99	A+	9	EXCELLENT
60.00 - 69.99	A	8	VERY GOOD
55.00 - 59.99	B+	7	GOOD
50.00 - 54.99	B	6	ABOVE AVERAGE
45.00 - 49.99	C	5	AVERAGE
40.00 - 44.99	P	4	PASS
0.00 - 39.99	E	0	FAIL
	AB	0	Absent

Percentage Calculation: CGPA *10

FIRST SEMESTER

Subject		Contact Hours/Week			Credit	Evaluation Scheme (% of Total Marks)				
Code	Title	L	T	P		CWA	LWA	MTE	ETE	Total
BMLT-1101	General Microbiology	4			4	16	---	24	60	100
BMLT-1102	Basic Hematology and Hematological Techniques	4			4	16	---	24	60	100
BMLT-1103	Human Anatomy & Physiology	4			4	16	---	24	60	100
BMLT-1104	Basic Bio-chemistry	4			4	16	---	24	60	100
BMLT-1106	General Microbiology			2	1	----	40	-----	60	100
BMLT-1107	Basic Hematology and Hematological Techniques			2	1	----	40	-----	60	100
BMLT-1108	Human Anatomy & Physiology			2	1	-----	40	----	60	100
BMLT-1109	Basic Biochemistry			2	1	----	40	-----	60	100
BHUM-1101	Communication Skills	3			2	16	---	24	60	100
BHUM-1102	Communication Skills			2	1		40	-----	60	100
Total					23					**1000**

L-- Lecture T-- Tutorial P---Practical
CWA Class work Assessment
LWA Lab work Assessment
MTE Mid Term Exam

SECOND SEMESTER

Subject		Contact Hours/Week			Credit	Evaluation Scheme (% of Total Marks)				
Code	Title	L	T	P		CWA	LWA	MTE	ETE	Total
BMLT-1201	Systematic Bacteriology	4			4	16	---	24	60	100
BMLT-1202	Basic Hematology Technique	4			4	16	---	24	60	100
BMLT-1203	Human Anatomy & Physiology	4			4	16	---	24	60	100
BMLT-1204	Metabolism of Biochemistry	4			4	16	---	24	60	100
BMLT-1205	Systematic Bacteriology			2	1	----	40	-----	60	100
BMLT-1206	Basic Hematology Technique			2	1	----	40	-----	60	100
BMLT-1207	Human Anatomy & Physiology			2	1	----	40	-----	60	100
BMLT-1208	Metabolism of Biochemistry Practical			2	1	----	40	-----	60	100
Total					20					**800**

L-- Lecture T-- Tutorial P---Practical
CWA Class work Assessment
LWA Lab work Assessment
MTE Mid Term Exam

THIRD SEMESTER

Subject		Contact Hours/Week			Credit	Evaluation Scheme (% of Total Marks)				
Code	Title	L	T	P		CWA	LWA	MTE	ETE	Total
BMLT-2301	Applied Microbiology	4			4	16	---	24	60	100
BMLT-2302	Applied Hematology	4			4	16	---	24	60	100
BMLT-2303	Analytical Bio-Chemistry	4			4	16	---	24	60	100
BMLT-2304	Basic Cellular Pathology	4			4	16	---	24	60	100
BMLT-2306	Applied Microbiology			2	1	----	40	-----	60	100
BMLT-2307	Applied Hematology			2	1	----	40	-----	60	100
BMLT-2308	Analytical Bio-Chemistry			2	1	----	40	-----	60	100
BMLT-2309	Basic Cellular Pathology			2	1	----	40	-----	60	100
ELECTIVE COURSE										
BMLT-2310	Healthcare Law and Ethics	3			2	16	---	24	60	100
BMLT-2311	Healthcare Law and Ethics Practical			2	1	…….	40	……	60	100
BCOP-2301	Basic of Computer Programming	3			2	16	---	24	60	100
BCOP-2302	Basic of Computer Programming Lab			2	1	…….	40	……	60	100
Total					23					1000

L-- Lecture T-- Tutorial P---Practical
CWA Class work Assessment
LWA Lab work Assessment
MTE Mid Term Exam

FOURTH SEMESTER

Subject		Contact Hours/Week			Credit	Evaluation Scheme (% of Total Marks)				
Code	Title	L	T	P		CWA	LWA	MTE	ETE	Total
BMLT-2401	Immunology & Mycology	4			4	16	---	24	60	100
BMLT-2402	Histotechnology			2	1	----	40	-----	60	100
BMLT-2403	Applied Hematology	4			4	16	---	24	60	100
BMLT-2404	Clinical Biochemistry			2	1	----	40	-----	60	100
BMLT-2405	Blood Bank	4			4	16	---	24	60	100
BMLT-2406	Immunology & Mycology Practical			2	1	----	40	-----	60	100
BMLT-2407	Histotechnology	4			4	16	----	24	60	100
BMLT-2408	Applied Hematology Practical			2	1	----	40	-----	60	100
BMLT-2409	Clinical Biochemistry Practical	4			4	16	----	24	60	100
BMLT-2410	Blood Bank Practical			2	1	…….	40	……	60	100
Total					25					**1000**

L-- Lecture T-- Tutorial P---Practical
CWA Class work Assessment
LWA Lab work Assessment
MTE Mid Term Exam

FIFTH SEMESTER

Subject		Contact Hours/Week			Credit	Evaluation Scheme (% of Total Marks)				
Code	Title	L	T	P		CWA	LWA	MTE	ETE	Total
BMLT-3501	Medical Parasitology	4			4	16	---	24	60	100
BMLT-3502	Analytical Clinical Biochemistry	4			4	16	---	24	60	100
BMLT-3503	Cytopathology	4			4	16	---	24	60	100
BMLT-3504	Virology & Mycology	4			4	16	---	24	60	100
BMLT-3505	Environmental Science	3			3	08	---	24	60	100
BMLT-3506	Medical Parasitology			2	1	----	40	-----	60	100
BMLT-3507	Analytical Clinical Biochemistry			2	1	----	40	-----	60	100
BMLT-3508	Cytopathology			2	1	----	40	-----	60	100
BMLT-3509	Virology & Mycology Practical			2	1	----	40	-----	60	100
Total					23					**900**

L-- Lecture T-- Tutorial P---Practical
CWA Class work Assessment
LWA Lab work Assessment
MTE Mid Term Exam

SIXTH SEMESTER (INTERNSHIP)

6.1 PROJECT BASED PROFESSIONAL TRAINING-I

Subject		Contact Hours/Week			Credit	Evaluation Scheme (% of Total Marks)				
Code	Title	L	T	P		CWA	LWA	MTE	ETE	Total
BMLT-3601	Professional training		30		4		500		500	1000
Total					20					**1000**

SECTION 6

Detailed Syllabus with Course Outcomes

SYLLABUS

SEMESTER-I

SUBJECT TITLE: General Microbiology
SUBJECT CODE: BMLT-1101
SEMESTER: First
CONTACT HOURS/WEEK:

Lecture (L)	Tutorial (T)	Practical (P)	Credit (C)
4	0	0	4

Internal Assessment: 40
End Term Exam: 60
Duration of Exam; 3 Hrs

OBJECTIVE:-

- The aim of this course is to ensure that you can achieve an up-to-date level of understanding of microbiology and various microbiological techniques such as sterilization and bio-medical waste management in proper manner
- Our objective is to provide training in scientific and transferable skills through modular lecture courses, research projects, written work, seminars and supervisions.

Sr. No.	Contents	Contact Hours
UNIT-I	**Introduction to Medical Microbiology**: - Definition – History, host-microbe relationship. **Safety measures in clinical Microbiology** **Glassware used in Clinical Microbiology Laboratory:** - Introduction, care and handling of glassware and Cleaning of glassware, Precautions.	15
UNIT-II	**Equipments used in clinical Microbiology Laboratory**: - Introduction, Care and maintenance of equipments. **Microscopy, Introduction and history** - Types of microscopes (a) Light microscope (b) DGI(c) Fluorescent (d) Phase contrast (e) Electron microscope: Transmission Scanning - Principles and operational mechanisms of various types of microscopes **Sterilization**: - Definition, Types and principles of sterilization methods (a) Heat (dry heat, moist heat with special Reference to autoclave) (b) Radiation (c) Filtration - Efficiency testing to various sterilizers.	15
UNIT-III	**Antiseptics and disinfectants**: - Definition, Types and properties, Mode of action, Uses of various disinfectants - Precautions while using the disinfectants - Qualities of a good disinfectant - In-house preparation of alcoholic hand/skin disinfectants. - Testing efficiency of various disinfectants.	15

	Biomedical waste management in a Microbiology laboratory: - Types of the waste generated – Segregation – Treatment – Disposal **General characteristics & classification of Microbes: (Bacteria & fungi)** - Classification of microbes with special reference to prokaryotes & eukaryotes - Morphological classification of bacteria - Bacterial anatomy (Bacterial cell structures)	
UNIT-IV	**Growth and Nutrition of Microbes:** - General nutritional & other requirements of the bacteria - Classification of bacteria on the basis of their nutritional requirements – Physical conditions required for growth. - Normal growth cycle of bacteria (growth curve) -Types of microbial cultures: Synchronous, Static, continuous culture. **Culture media:** - Introduction - Classification of culture media (Example & Uses) solid media, liquid media, semisolid, Media, routine/synthetic/defined media, basal media, enriched , enrichment, Selective, differential media, sugar fermentation media, transport media, preservation media and anaerobic culture media. - Quality control in culture media -Automation in culture media preparation **Aerobic & anaerobic culture methods:** - Concepts - Methods Used for aerobic cultures - Methods used for anaerobic cultures	**15**

COURSE OUTCOMES: On completion of this course, the students will be able to

CO1	**BMLT-1101.1**	Study the growth and control of microbes as well as different bacteriological techniques involved in microbiology.
CO2	**BMLT-1101.2**	Understand about the different cell organelles of microorganisms and their detailed functions.
CO3	**BMLT-1101.3**	Apply the knowledge to understand the microbial physiology and to identify the microorganisms.
CO4	**BMLT-1101.4**	Analyze the microorganisms on basis of appearance and function.

SUGGESTED READINGS:

1.Medical Laboratories Management- Cost effective methods by Sangeeta Sharma, RachnaAgarwal, Sujata Chaturvedi and Rajiv Thakur,

2. An Introduction to Medical Lab Technology by Godkar (Latest Edition), Diagnosticmicrobiology by Koss Volume –I,
3. An introduction to Medical Lab Technology by Paniker(Latest Edition), 4.Introduction to Medical Lab Technology by Godkar (Latest Edition), 5.Diagnostic microbiology by Koss Volume –I,
6.An introduction to Medical Lab Technology by Paniker(Latest Edition)

SUBJECT TITLE: Basic Hematology and Hematological Techniques
SUBJECT CODE: BMLT-1102
SEMESTER: First
CONTACT HOURS/WEEK:

Lecture (L)	Tutorial (T)	Practical (P)	Credit (C)
4	0	0	4

Internal Assessment: 40
End Term Exam: 60
Duration of Exam; 3 Hrs

OBJECTIVE:-

- The aim of this course is to ensure that you can achieve an up-to-date level of understanding of hematology and hematological techniques for the identification of various cells in proper manner
- Our objective is to provide training in scientific and transferable skills through modular lecture courses, research projects, written work, seminars and supervisions.

Sr. No.	Contents	Contact Hours
UNIT-I	**Introduction to Hematology (a)** Definition **(b)** Importance **(c)** Important equipment used. Laboratory organization and safety measures in hematology Laboratory Introduction to blood, its composition**,** Function and normal cellular components	**15**
UNIT-II	**Formation of cellular components** of blood (a) Erythropoiesis **(b)** Leucopoiesis **(c)** Thrombopoiesis **Collection and preservation** of blood sample for various hematological investigations. . Preparation of blood Films Types. Methods of preparation (Thick and thin smear/film)	**15**
UNIT-III	**Staining techniques in Hematology (Romanowsky's stains**) Principle, composition, preparation of staining reagents and procedure of the following 1. Giemsa stain 2. Leishman stain 3. Wright's stain 4. Field's stain **Definition, principles & procedure, Normal values, Clinical significance Of following** **(a)**Haemoglobinometry **(b)** Total leucocytes count (TLC) **(c)** Differential leucocytes count (DLC) **(d)** Erythrocyte sedimentation rate(ESR) **(e)** Packed cell volume/Hematocrit value **(F)** Red cell Indices(RCI)	**15**

UNIT-IV	**Abosolute Eosinophil Count** **Reticulocyte Count** **Platelet Count**	**15**

COURSE OUTCOMES: On completion of this course, the students will be able to

CO1	**BMLT -1102.1**	Learn about the blood
CO2	**BMLT -1102.2**	Understand the composition of blood and different types with its function
CO3	**BMLT -1102.3**	Estimate the ways to know the different components of blood
CO4	**BMLT -1102.4**	Analyze different blood cells

SUGGESTED READINGS:

1. An Introduction to Medical Lab Technology by Godkar (Latest Edition)
2. Diagnostic microbiology by Koss Volume –I,
3. An introduction to Medical Lab Technology by Paniker(Latest Edition)

SUBJECT TITLE: Human Anatomy & Physiology
SUBJECT CODE: BMLT-1103
SEMESTER: First
CONTACT HOURS/WEEK:

Lecture (L)	Tutorial (T)	Practical (P)	Credit (C)
4	0	0	4

Internal Assessment: 40
End Term Exam: 60
Duration of Exam; 3 Hrs

Objective:-

- The aim of this course is to ensure that you can achieve an up-to-date level of understanding of various system's of human body in proper manner
- Our objective is to provide training in scientific and transferable skills through modular lecture courses, research projects, written work, seminars and supervisions.

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Sr. No.	Contents	Contact Hours
UNIT-I	**Introduction to human Anatomy and Physiology.** **Cell and cell organelles.** **(a)** Structure and classification **(b)** Function **(c)** Cell division (Mitosis and Meiosis) **3. Tissues** (a) Definition (b) Classification with structure and Functions of followings **(i)**Epithelial tissues **(ii)** Connective tissues **(iii)** Muscular tissues **(iv)** Nervous tissue	**15**
UNIT-II	**Blood** Composition of blood**,** Function of blood **Muscular skeletal system** (a) Introduction (b) Classification (c) Structure and function of skeletal system, muscles and joints (d) Various movements of body	**15**
UNIT-III	**Respiratory system** (a) Introduction (b) Structure (c) Function (d) Mechanism of breathing and respiration (e) various terms involved in respiratory System: (i) Vital capacity, (ii) Total Volume (iii) Reserve volume (iv)Total lung capacity. **Cardiovascular systems.** **(a)** Anatomy and physiology of heart (b) Blood circulation. (c)	**15**

	Arteries and veins. (d) Conductive system of heart. (e) Cardiac cycle. (f) Introduction to ECG.	
UNIT-IV	**Lymphatic system.** (a) Introduction. (b) Structure and function (i) Lymph nodes. (ii) Spleen. (iii)Thymus gland, Tonsils **Structure and function of sense organs: (a)** Eye. **(b)** Ear. **(c)** Nose. **(d)** Tongue	**15**

COURSE OUTCOMES: On completion of this course, the students will be able to

CO1	**BMLT -1103.1**	Learn the basic terminology of subject
CO2	**BMLT -1103.2**	Understand about different cells, tissues and blood
CO3	**BMLT -1103.3**	Know about anatomy and physiology of human body
CO4	**BMLT -1103.4**	Develop understanding of structure and function of different organ systems

SUGGESTED READINGS:

i. An Introduction to Medical Lab Technology by Godkar (Latest Edition)
ii. Diagnostic microbiology by Koss Volume –I
iii. An introduction to Medical Lab Technology by Paniker(Latest Edition)
iv. Anatomy by N.Murgesh (New Edition)

SUBJECT TITLE: Basic Bio-Chemistry
SUBJECT CODE: BMLT-1104
SEMESTER: First
CONTACT HOURS/WEEK:

Lecture (L)	Tutorial (T)	Practical (P)	Credit (C)
4	0	0	4

Internal Assessment: 40
End Term Exam: 60
Duration of Exam; 3 Hrs

Objective:--

- The aim of this course is to ensure that you can achieve an up-to-date level of understanding of Bio-Chemistry and Basic parameters such as distillation, ph, cleaning of glassware and SI units in proper manner
- Our objective is to provide training in scientific and transferable skills through modular lecture courses, research projects, written work, seminars and supervisions.

Sr. No.	Contents	Contact Hours
UNIT-I	**Introduction to Medical lab Technology**. Role of medical lab Technologist. Ethics and responsibility Safety measures First aid. **Cleaning and care of general laboratory glass ware and equipments.** Steps involved in cleaning soda lime glass Steps involved in cleaning borosil glass. Preparation of chromic acid solution and storage	**15**
UNIT-II	**Distilled water**. Method of preparation of distilled water & their storage Type of water distillation plants. **Units of Measurement**. S.I unit and CGS units Conversion Strength, molecular weight, equivalent weight Normality, molarity, molality	**15**
UNIT-III	**Calibration of volumetric apparatus:-** flask, pipette, burettes, and cylinders. **Analytical balance:** Principle, Working, Maintenance **Volumetric Analysis** Normal and molar solutions Standard solutions Preparation of reagents	**15**

	Storage of chemical	
UNIT-IV	**Concept of pH:-** Definition, Henderson Hasse batch equation, Pka value, pH indicator. Methods of measurement of pH (i) pH paper (ii) pH meter (iii) Principle, working, maintenance and calibration of pH meter **Osmosis**: definition, types of osmosis, factors affecting osmotic pressure, Vant Hoffs equation and application of Osmosis.	**15**

COURSE OUTCOMES: On completion of this course, the students will be able to

CO1	**BMLT -1104.1**	Learn about the different Glassware used in lab
CO2	**BMLT -1104.2**	Understand the different Apparatus , units, equipments
CO3	**BMLT -1104.3**	Know about different volumetric analysis
CO4	**BMLT -1104.4**	Calibration of glassware

SUGGESTED READINGS:

1. An Introduction to Medical Lab Technology by Godkar (Latest Edition)
2. Diagnostic microbiology by Koss Volume –I,
3. An introduction to Medical Lab Technology by Paniker(Latest Edition),

SUBJECT TITLE: General Microbiology
SUBJECT CODE: BMLT-1106
SEMESTER: First
CONTACT HOURS/WEEK:

Lecture (L)	Tutorial (T)	Practical (P)	Credit (C)
0	0	2	1

Internal Assessment: 40
End Term Exam: 60
Duration of Exam; 3 Hrs

PRACTICALS

1. To demonstrate safe code of practice for a Microbiology laboratory
2. To prepare cleaning agents & to study the technique for cleaning & sterilization of glassware.
3. To demonstrate the working & handling of Compound microscope.
4. To demonstrate the method of sterilization by autoclave.
5. To demonstrate the method of sterilization by hot air oven.
6. To demonstrate the method of sterilization of media/solution by filtration.
7. To prepare working dilution of commonly used disinfectants.
8. To demonstrate the different morphological types of bacteria.
9. To demonstrate aerobic culture
10. To demonstrate anaerobic culture.
11. Visit to animal house & demonstrate about care of laboratory animals.

COURSE OUTCOMES: On completion of this course, the students will be able to

CO1	**BMLT -1106.1**	Know the Different Microbiological Instruments and chemicals used in laboratory
CO2	**BMLT -1106.2**	Understand the working of various instruments
CO3	**BMLT -1106.3**	Preparation of different culture media
CO4	**BMLT -1106.4**	Identification of different microbes

SUGGESTED READINGS:

1. An Introduction to Medical Lab Technology by Godkar
2. Diagnostic microbiology by Koss Volume –I,

SUBJECT TITLE: Basic Hematology and Hematological Techniques
SUBJECT CODE: BMLT-1107
SEMESTER: First
CONTACT HOURS/WEEK:

Lecture (L)	Tutorial (T)	Practical (P)	Credit (C)
0	0	4	2

Internal Assessment: 40
End Term Exam: 60
Duration of Exam; 3 hrs

PRACTICALS

1. Demonstration of Equipments used in clinical hematology (a) Microscope **(b)** Blood Cell counter (DLC) **(c)** Sahli's apparatus **(d)** Calorimeter

2. Hb Estimation:-

(a) Sahli's method **(b)** Cyanmethahaemoglobin method **(c)** Oxyhaemoglobin method

3. Total leukocyte count

4. Preparation of smear and staining with Giemsa and Leishman stain.

5. Differential leucocytes count

6. Platelets count

7. Reticulocyte count

8. Absolute Eosinophil count

9. Calculation of Red cell indices (RCI)

10. ESR (Wintrobe and Westergren method)

11. Packed cell volume:

11.1 By macro method

11.2 By micro method

COURSE OUTCOMES: On completion of this course, the students will be able to

CO1	**BMLT -1107.1**	Know the various hematological lab instruments
CO2	**BMLT -1107.2**	Practice to Collect blood
CO3	**BMLT -1107.3**	Preparation of different anticoagulants and chemicals
CO4	**BMLT -1107.4**	Identification of different blood cells

SUBJECT TITLE: HUMAN ANATOMY & PHUSIOLOGY
SUBJECT CODE: BMLT-1108
SEMESTER: First
CONTACT HOURS/WEEK:

Lecture (L)	Tutorial (T)	Practical (P)	Credit (C)
0	0	2	1

Internal Assessment: 40
End Term Exam: 60
Duration of Exam; 3 Hr

PRACTICALS

1. Demonstration of various parts of body
2. Demonstration of tissues of body
3. Demonstration of parts of digestive system
4. Demonstration of parts of respiratory system
5. Demonstration of parts of skin
6. Demonstration of parts of excretory system
7. Demonstration of various parts of circulatory system(Demonstration from models)
8. Examination of blood film for various blood cells from stained slides
9. Blood Pressure estimation
10. Demonstration of various parts of nervous system (brain and spinal cord)(Model)
11. Structure of eye and ear (demonstration from models)
12. Demonstration of reflex action
13. Demonstration of structural differences between skeletal, smooth and cardiac muscles(permanent mounts)
14. Demonstration of various bones and joints
15. Demonstration of various parts of reproductive system (Male and female from modelsand charts)

Note: Demonstrations can be done with the help of models, charts and histological slides

COURSE OUTCOMES: On completion of this course, the students will be able to

CO1	**BMLT -1108.1**	Learn the basic terminology of subject
CO2	**BMLT -1108.2**	Understand about different cells, tissues and blood
CO3	**BMLT -1108.3**	Know about anatomy and physiology of human body
CO4	**BMLT -1108.4**	Develop understanding of structure and function of different organ systems

SUBJECT TITLE: Basic Bio-Chemistry
SUBJECT CODE: BMLT-1109
SEMESTER: First
CONTACT HOURS/WEEK:

Lecture (L)	Tutorial (T)	Practical (P)	Credit (C)
0	0	2	1

Internal Assessment: 40
End Term Exam: 60
Duration of Exam; 3 Hrs

PRACTICALS

1. Cleaning of glass and plastic ware.
2. Preparation of distilled water
3. Principle, working and maintenance of pH meter.
4. To prepare 0.1 N NaoH solution
5. To prepare 0.2 N NaoH solution
6. To prepare 0.1 molar H_2SO_4
7. To prepare 0.2 Molar Sodium Carbonate solution
8. Demonstration of osmosis and dialysis.

COURSE OUTCOMES: On completion of this course, the students will be able to

CO1	**BMLT -1109.1**	Know about various glassware including volumetric and non volumetric
CO2	**BMLT -1109.2**	Understand about different cleaning agents and how to clean glasswares
CO3	**BMLT -1109.3**	Learn about the molar solution concept
CO4	**BMLT -1109.4**	Apply the molar solution concept for preparation of different concentrations of solution

SUBJECT TITLE: COMMUNICATION SKILLS
SUBJECT CODE: BHUM-1101
SEMESTER:-I
CONTACT HOURS/WEEK:

LECTURE(L)	TUTORIAL(T)	PRACTICAL (P)	CREDIT(C)
3	0	2	2

Internal Assessment: 40
End Term Exam : 60
Duration of Exam: 3Hrs

Objective and Outcomes of Course:
Language is the most common used medium of self expression in all spheres of human life- personal, social and professional. A student must have a fair knowledge of English language and skills to communicate effectively to handle the future jobs in industry. The objective of this subject is to enable the diploma holders to acquire proficiency, both in spoken (oral) and written language. At the end of the subject, the student will be able to develop comprehension skills, improve vocabulary, use proper grammar, acquire writing skills, correspond with others and enhance skills in spoken English.

Contents of Syllabus:

Sr.No	Contents	Content Hours
UNIT-I	**Communication:** Introduction, Meaning, Definition, Process of communication, Essentials of Communication.	**12**
UNIT-II	**Facts of Literature** Comprehension exercises on the following selective readings. • **Story Section :** The Selfish Gaint (Oscar Wilde), The Stick (Surinder Singh), Homecoming(R.N.Tagore) • **Prose Section:** My Struggle for an Education • **Poetry Section :** Daffodils (William Wordworth), Stopping by Woods on a Snowy Evening (Robert Frost), Ozymandias(P.B. Shelley)	**14**
UNIT-III	**Writing Skills:**	**10**

	Letter Writing and Essay Writing	
UNIT-IV	**Vocabulary and Grammar:** Parts of Speech, Tenses, Prefixes and Suffixed, One Word Substitution, Antonyms	**12**

COURSE OUTCOMES: On completion of this course, the students will be able to

CO1	**BHUM-1101.1**	Understand and evaluate key theoretical approaches used in the medical lab field .
CO2	**BHUM-1101.2**	Able to find, use, and evaluate primary academic writing associated with the communication discipline
CO3	**BHUM-1101.3**	Able to communicate effectively orally and in writing
CO4	**BHUM-1101.4**	To develop analytical, management and interpersonal skills, together with the technical knowledge of the work in the medical lab.

PRESCRIBED BOOK

The Text Book on **" English and Communication Skills, Book-I** (Abhishek Publication)by Kuldip Jaidka et.al. Developed by NITTR, Chandigarh is recommended to be used for teaching and setting- up the question papers.

SUBJECT TITLE: COMMUNICATION SKILLS
SUBJECT CODE: BHUM- 1102
SEMESTER:-I
CONTACT HOURS/WEEK:

Internal Assessment: 60
End Term Exam : 40
Duration of Exam: 3Hrs

Contents of Syllabus:

The following activities to be conducted in Comm.Skills Lab.

Contents of Syllabus:

Sr.No	Contents	Content Hours
1	Introducing Oneself	**20**
2	How to locate information in an Encyclopedia	
3	How to Look up words in a Dictionary	
4	Greetings for Different Occasions	
5	Tongue Twister	
6	Reading aloud newspaper headlines	
7	Spelling Rules	
8	Situational Concversation	
9	Paragraph Writing	
10	Basic Table Manners	

COURSE OUTCOMES: On completion of this course, the students will be able to

CO1	**BHUM-1102.1**	Understand and evaluate key theoretical approaches used in the medical lab field .
CO2	**BHUM-1102.2**	Able to find, use, and evaluate primary academic writing associated with the communication discipline
CO3	**BHUM-1102.3**	Able to communicate effectively orally and in writing
CO4	**BHUM-1102.4**	To develop analytical, management and interpersonal skills, together with the technical knowledge of the work in the medical lab.

RECOMMENDED BOOKS

1 English and Communication Skills, Boks-I by Kuldip Jaidka, Alwainder Dhillon and Parmod Kumar Singla, Prescribed by NITTTS, Chandigarh Published by Abshishek Publication, 57-59, Sector- 17, Chandigarh

SEMESTER-II

SUBJECT TITLE: Systematic Bacteriology
SUBJECT CODE: BMLT-1201
SEMESTER: II
CONTACT HOURS/WEEK:

Lecture (L)	Tutorial (T)	Practical (P)	Credit (C)
4	0	0	4

Internal Assessment: 40
End Term Exam: 60
Duration of Exam; 3 Hrs

OBJECTIVE:

- The aim of this course is to ensure that you can achieve an up-to-date level of understanding of various bacteria, various staining methods and biochemical testing and in proper manner
- Our objective is to provide training in scientific and transferable skills through modular lecture courses, research projects, written work, seminars and supervisions.

Sr. No.	Contents	Contact Hours
UNIT-I	**Introduction to Bacteriology** **a.** morphology of bacteria **b.** bacteria growth curve **c.** types of culture media **Staining techniques in bacteriology** **a.** Significance of staining in bacteriology **b.** Principle, procedure, results & interpretation of the following staining techniques -Gram stain - Ziehl-Neelsen Staining -Other Staining	**15**
UNIT-II	**Principle, procedures and result & interpretation of the following biochemical test for identification of different bacteria.** **a.** Catalase **b.** Coagulase **c.** Indole **d.** Methyl Red	**15**
UNIT-III	**Sterilization and disinfection**:- a. Physical agents b. Chemical agents c. Biomedical waste	**15**
UNIT-IV	**Various characteristics (morphological, cultural and**	**15**

	biochemical), pathogenesity and laboratory diagnosis of the following bacteria: **a.** Staphylococcus **b.** Streptococcus **c.** Pneumococcus **d.** Neisseria gonorhoeae and Neisseria meningitis **e.** Enterobacteriaceae: Escherichia coli, Klebsiella, salmonella and shigella **f.** Vibro **g.** Mycobateria(Tuberculosis and leprae) **h.** Pseudomonas	

COURSE OUTCOMES: On completion of this course, the students will be able to

CO1	**BMLT -1201.1**	Students will have great knowledge about morphological changes in erythrocytes and leukocytes.
CO2	**BMLT -1201.2**	Identification of Different variants
CO3	**BMLT -1201.3**	Learners will be able to perform various Staining tests.
CO4	**BMLT -1201.4**	Ability to develop knowledge related to different microorganisms.

SUGGESTED READINGS:

1. An Introduction to Medical Lab Technology by Godkar (Latest Edition)
2. Diagnostic microbiology by Koss Volume –I
3. An introduction to Medical Lab Technology by Paniker(Latest Edition),

SUBJECT TITLE: Basic Hematological Techniques
SUBJECT CODE: BMLT-1202
SEMESTER: SECOND
CONTACT HOURS/WEEK:

Lecture (L)	Tutorial (T)	Practical (P)	Credit (C)
4	0	0	4

Internal Assessment: 40
End Term Exam: 60
Duration of Exam; 3 Hrs

Objective:-

- The aim of this course is to ensure that you can achieve an up-to-date level of understanding of Basic of Hematological and various testing procedures related hemoglobin and coagulation disorders in proper manner
- Our objective is to provide training in scientific and transferable skills through modular lecture courses, research projects, written work, seminars and supervisions.

Sr. No.	Contents	Contact Hours
UNIT-I	**Haemoglobin pigments and their measurement.** **Abnormal haemoglobins, their identification and estimation.** Introduction about haemoglobin S Introduction about thalassaemia	15
UNIT-II	**Normal haemostatic mechanism and theory' of blood coagulation.** **Physiological Properties of various coagulation factors.**	15
UNIT-III	**Classification of coagulation factors.** Introduction about intrinsic system. Introduction about extrinsic system. introductions about fibrinolysis mechanism. **Preparation and standardization of coagulation reagents such as** tissue, Thromboplastin, Cephalin, Thrombin M/40 CacI2 and Kaolin Solution.	15
UNIT-IV	**Screening coagulation tests such as** screening test for bleeding time	15

	screening test for clotting time screening test prothrombin time screening test for partial thromboplastin test. screening test for hess test.	

COURSE OUTCOMES: On completion of this course, the students will be able to

CO1	**BMLT -1202.1**	Learn about the blood
CO2	**BMLT -1202.2**	Understand the composition of blood and different types with its function
CO3	**BMLT -1202.3**	Understanding the different hematological techniques in proper manner
CO4	**BMLT -1202.4**	Analyze different blood cells using various techniques

SUGGESTED READINGS:

1. An Introduction to Medical Lab Technology by Godkar (Latest Edition)
2. Diagnostic microbiology by Koss Volume -I
3. An introduction to Medical Lab Technology by Paniker(Latest Edition)

SUBJECT TITLE: Human Anatomy & Physiology
SUBJECT CODE: BMLT-1203
SEMESTER: II
CONTACT HOURS/WEEK:

Lecture (L)	Tutorial (T)	Practical (P)	Credit (C)
4	0	0	4

Internal Assessment: 40
End Term Exam: 60

Objective:-

- The aim of this course is to ensure that you can achieve an up-to-date level of understanding of various organs and systems of human body in proper manner
- Our objective is to provide training in scientific and transferable skills through modular lecture courses, research projects, written work, seminars and supervisions.

Sr. No.	Contents	Contact Hours
UNIT-I	**Metabolism, Diet and Vitamins**:, Introduction, Carbohydrate metabolism, Basal metabolism, Protein metabolism, Fat metabolism, Water metabolism, Salt metabolism, Vitamins with introduction and classification **Cardiovascular System:** Organization, accessory organs, structure & function of heart, location of heart. Blood circulation, Cardiac cycle, Heart sounds, Disorders of blood vessels, Disorders of Heart	15
UNIT-II	**Blood Pressure**: Introduction, Factor affecting blood pressure, Measurement of blood pressure and Disorders of Blood pressure. **Urinary system:** Organs, Structure, Position, function of kidney, Formation of urine, Composition of urine and Diseases of Urinary system.	15
UNIT-III	**Genital system**: Structure of male and female reproductive system, Gametogenesis in male and female. Menstrual cycle, Process of Fertilization **Nervous system**: Organs, function & structure, brain, spinal cord, spinal &cranial nerves, role of neurotransmitters in transmission of nerve impulse.	15
UNIT-IV	**Spleen**, **Thymus:** Structure & function of spleen & Thymus gland. Tonsils - Structure function, General information about lymphatic system **Endocrine system:** Endocrine & exocrine glands, their location, structure functions	15

COURSE OUTCOMES: On completion of this course, the students will be able to

CO1	**BMLT -1203.1**	Learn the basic terminology of subject
CO2	**BMLT -1203.2**	Understand about different cells, tissues and blood
CO3	**BMLT -1203.3**	Know about anatomy and physiology of human body
CO4	**BMLT -1203.4**	Develop understanding of structure and function of different organ systems

SUGGESTED READINGS:

1. An Introduction to Medical Lab Technology by Godkar (Latest Edition)
2. Diagnostic microbiology by Koss Volume —I
3. An introduction to Medical Lab Technology by Paniker(latest Edition)

SUBJECT TITLE: Metabolism of Bio-Chemistry
SUBJECT CODE: BMLT-1204
SEMESTER: II
CONTACT HOURS/WEEK:

Lecture (L)	Tutorial (T)	Practical (P)	Credit (C)
4	0	0	4

Internal Assessment: 40
End Term Exam: 60
Duration of Exam; 3 Hrs

Objective and outcome of course:

- The aim of this course is to ensure that you can achieve an up-to-date level of understanding of various metabolism such as carbohydrates, lipids, protein and nucleic acid in proper manner
- Our objective is to provide training in scientific and transferable skills through modular lecture courses, research projects, written work, seminars and supervisions.

Sr. No.	Contents	Contact Hours
UNIT-I	**Introduction to Cell:** - Cell Organelles & their functions. Separation & purification of Biomolecules. **Carbohydrate Metabolism** Introduction & Importance Classification Digestion and Absorption Metabolism:- Glycolysis, Citric acid cycle, Gluconeogenesis, Glycogenolysis, Glycogenesis Disorders of carbohydrate metabolism	15
UNIT-II	**Protein Metabolism** Introduction & Importance Molecular structure of protein Classification of Proteins Important properties of proteins. Synthesis of proteins Digestion & absorption of Proteins Metabolism: -Urea Cycle Disorders of proteins metabolism	15
UNIT-III	**Lipids** Introduction Classification Properties of fats Breakdown of fatty acids digestion and absorption of fatty acids Fatty acid biosynthesis & fatty acid oxidation **Nucleic acid**	15

	Introduction Functions of Nucleic acids Functions of energy carriers	
UNIT-IV	**6. Enzymes** Introductions & Importance Classifications & Properties of enzymes Mechanism of enzyme action Factors affecting enzyme action Enzyme kinetics & enzyme inhibiters Clinical Enzymology	**15**

COURSE OUTCOMES: On completion of this course, the students will be able to

CO1	**BMLT -1204.1**	Study the different biomolecules
CO2	**BMLT -1204.2**	Understand the metabolism of different biomolecules
CO3	**BMLT -1204.3**	They study the influence and role of structure in reactivity of biomolecules
CO4	**BMLT -1204.4**	Develop critical thinking about the functioning of biomolecules.

SUGGESTED READINGS:

1.Medical Laboratories Management- Cost effective methods by Sangeeta Sharma, RachnaAgarwal, Sujata Chaturvedi and Rajiv Thakur,
2. An Introduction to Medical Lab Technology by Godkar (Latest Edition), Diagnosticmicrobiology by Koss Volume –I,
3. An introduction to Medical Lab Technology by Paniker(Latest Edition),4.Introduction to Medical Lab Technology by Godkar (Latest Edition), 5.Diagnostic microbiology by Koss Volume –I,
6.An introduction to Medical Lab Technology by Paniker(Latest Edition)

SUBJECT TITLE: Systematic Bacteriology
SUBJECT CODE: BMLT-1205
SEMESTER: Second
CONTACT HOURS/WEEK:

Lecture (L)	Tutorial (T)	Practical (P)	Credit (C)
0	0	2	1

Internal Assessment: 40
End Term Exam: 60
Duration of Exam; 3 Hrs

Systematic bacteriology

Practical

1. Introduction of sterilization with their agents
2. Introduction of bio-chemical tests
   a. Coagulase
   b. Indole
   c. Metyl red test
   d. Introduction of Gram's stain
3. Various characteristics (morphological, cultural and biochemical), pathogenesity and laboratory diagnosis of the following bacteria:
   a. Staphylococcus
   b. Streptococcus
   c. Pneumococcus
   d. Neisseria gonorhoeae and Neisseria meningitis
   e. Enterobacteriaceae: Escherichia coli, Klebsiella, salmonella and shigella
   f. Vibro
   g. Mycobateria(Tuberculosis and leprae)
   h. Pseudomonas

COURSE OUTCOMES: On completion of this course, the students will be able to

CO1	**BMLT -1206.1**	Students will have great knowledge about morphological changes in erythrocytes and leukocytes.
CO2	**BMLT -1206.2**	Identification of Different variants

CO3	**BMLT -1206.3**	Learners will be able to perform various Staining tests.
CO4	**BMLT -1206.4**	Ability to develop knowledge related to different microorganisms.

SUBJECT TITLE: Basic Hematology Techniques
SUBJECT CODE: BMLT-1206
SEMESTER: Second
CONTACT HOURS/WEEK:

Lecture (L)	Tutorial (T)	Practical (P)	Credit (C)
0	0	2	1

Internal Assessment: 40
End Term Exam: 60
Duration of Exam; 3 Hrs

Basic Haematology Techniques
Practical

1. To Measure the levels of methaemoglobin, Carboxy and sulphaemoglobin.
2. To determine platelets count of the given sample using phase contrast microscope
3. To determine PT, PTI, INR and APTT of the given sample
4. To prepare the following in laboratory

   Brain Thromoplastic, Cephalin, Thrombin, M/40 $cacl_2$ and Kaolin solution

COURSE OUTCOMES: On completion of this course, the students will be able to

CO1	**BMLT -1207.1**	Know the various haematological lab instruments
CO2	**BMLT -1207.2**	Practice to Collect blood
CO3	**BMLT -1207.3**	Preparation of different smears, films
CO4	**BMLT -1207.4**	Identification of different blood cells using various techniques

SUBJECT TITLE: HUMAN ANATOMY & PHUSIOLOGY
SUBJECT CODE: BMLT-1207
SEMESTER: Second
CONTACT HOURS/WEEK:

Lecture (L)	Tutorial (T)	Practical (P)	Credit (C)
0	0	2	1

Internal Assessment: 40
End Term Exam: 60
Duration of Exam; 3 Hr

PRACTICALS

1. Demonstration of various parts of body
2. Demonstration of tissues of body
3. Demonstration of Cardiovascular System
4. Demonstration of parts of respiratory system
5. Demonstration of parts of excretory system
6. Demonstration of various parts of circulatory system(Demonstration from models)
7. Examination of blood film for various blood cells from stained slides
8. Blood Pressure estimation
9. Demonstration of various parts of nervous system (brain and spinal cord)(Model)
10. Structure of eye and ear (demonstration from models)
11. Demonstration of various parts of reproductive system (Male and female from modelsand charts)

Note: Demonstrations can be done with the help of models, charts and histological slides

COURSE OUTCOMES: On completion of this course, the students will be able to

CO1	**BMLT -1208.1**	Learn the basic terminology of subject
CO2	**BMLT -1208.2**	Understand about different cells, tissues and blood
CO3	**BMLT -1208.3**	Know about anatomy and physiology of human body
CO4	**BMLT -1208.4**	Develop understanding of structure and function of different organ systems

SUBJECT TITLE: Metabolism of Bio-Chemistry
SUBJECT CODE: BMLT-1208
SEMESTER: II
CONTACT HOURS/WEEK:

Lecture (L)	Tutorial (T)	Practical (P)	Credit (C)
0	0	4	2

Internal Assessment: 40
End Term Exam: 60
Duration of Exam; 3 Hrs

Metabolism in Biochemistry

Practical

1. To determine the presence of carbohydrates by Molish test.
2. To determine the presence of reducing sugar by fehling solution.
3. To determine the presence of reducing sugar by benedicts method.
4. To determine starch by Iodine test.
5. Determination of glucose in serum & plasma
6. To Determination of glucose by Folin and Wu method
7. Determination of urea in serum, plasma, urine
8. Determination of creatinine in serum, plasma, urine
9. Determination of serum albumine
10. Determination of cholesterol in serum or plasma

COURSE OUTCOMES: On completion of this course, the students will be able to

CO1	**BMLT -1209.1**	Study the different biomolecules
CO2	**BMLT -1209.2**	Preparation of different chemicals
CO3	**BMLT -1209.3**	Presence of different biomolecules with different test
CO4	**BMLT -1209.4**	Identification of biomolecules

SEMESTER-III

SUBJECT TITLE: Applied Microbiology
SUBJECT CODE: BMLT-2301
SEMESTER: Third
CONTACT HOURS/WEEK:

Lecture (L)	Tutorial (T)	Practical (P)	Credit (C)
4	0	0	4

Internal Assessment: 40
End Term Exam: 60
Duration of Exam; 3 Hrs

Objective:-

- The aim of this course is to ensure that you can achieve an up-to-date level of understanding of various bacterial infections and their antibiotic sensitivity, hospital infection in proper manner
- Our objective is to provide training in scientific and transferable skills through modular lecture courses, research projects, written work, seminars and supervisions.

Sr. No.	Contents	Contact Hours
UNIT-I	**Laboratory strategy in the diagnosis of various Infective syndromes : Samples of choice, Collection, transportation and processing of samples for laboratory diagnosis of the following complications**: **a.** Septicemia and bacteraemia **b.** Upper Respiratory tract infections **c.** Lower Respiratory tract infections **d.** Wound, skin, and deep sepsis **e.** Urinary tract infections **f.** Genital Tract infections **g.** Meningitis **h.** Gastro intestinal infections **i.** Enteric fever **j.** Tuberculosis (Pulmonary and Extra-pulmonary)	**15**
UNIT-II	**Antibiotic susceptibility testing in bacteriology** **a.** Definition of antibiotics **b.** Culture medium used for Antibiotic susceptibility testing **c.** Preparation and standardization of inoculum **d.** Control bacterial strains **e.** Choice of antibiotics **f.** MIC and MBC: Concepts and methods for determination **g.** Various methods of Antibiotic susceptibility testing with special reference to Stokes method and Kirby-Bauer method	**15**

	i.Tests for production of **β-lactamase**	
UNIT-III	**Bacteriological examination of water, milk, food and air** **3.1 Examination of water** **a.** Collection and transportation of water sample **b.** Presumptive coliform count **c.** Eijkman test **d.** Counts of faecal Streptococci **e.** Counts of Clostridium perfringens f. Membrane filtration tests **g.** Interpretation of results **Examination of Milk and milk products** a. Basic Concepts regarding gradation of milk b. Various tests for Bacteriological examination **Examination of food articles** a. Basic Concepts regarding classification of food like frozen food, canned food, raw food, cooked food etc. b.Various tests for Bacteriological examination with special reference to food poisoning bacteria **Examination of Air** a. Significance of air bacteriology b. Settle plate method c.Types of air sampling instruments d. Collection processing and reporting of an air sample	**15**
UNIT-IV	**Sterility testing of I /v fluids** a. collection, transportation and processing of I/V fluid for bacterial contamination b. recording the result and interpretation **Nosocomial Infection :** a) Introduction, sources and types of nosocomial infections. b) Bacteriological surveillance of hospital environment. c) Role of microbiology laboratory in control of nosocomial infections **Epidemiological markers**: a. Serotyping, b. Phage typing and c. Bacteriocine typing.	**15**

	Preservation methods for microbes a. Basic concepts of preservation of microbes b. Why do we need to preserve bacteria? c. Principle and procedures of various preservation methods with special Reference to lyophilization.	

COURSE OUTCOMES: On completion of this course, the students will be able to

CO1	**BMLT -2301.1**	Learners will be able to make Laboratory strategies in the diagnosis of various systemic bacterial infection.
CO2	**BMLT -2301.2**	Study about Antibiotic susceptibility testing in bacteriology with various methods
CO3	**BMLT -2301.3**	Study about bacteriological examination of water, milk, food and air with various diagnostic methods and with special reference to different bacteria.
CO4	**BMLT -2301.4**	Learners will have knowledge about source and types of Nosocomial infection, epidemiological markers and preservation methods for various microbes.

SUGGESTED READINGS:

i. An Introduction to Medical Lab Technology by Godkar (Latest Edition)
ii. Diagnostic microbiology by Koss Volume –I,
iii. An introduction to Medical Lab Technology by Paniker(Latest Edition)
iv. Microbiology by D.R. Arora, Panikar, Anathnaryan

SUBJECT TITLE: Applied Hematology
SUBJECT CODE: BMLT-2302
SEMESTER: III
CONTACT HOURS/WEEK:

Lecture (L)	Tutorial (T)	Practical (P)	Credit (C)
4	0	0	4

Internal Assessment: 40
End Term Exam: 60

Objective:-

- The aim of this course is to ensure that you can achieve an up-to-date level of understanding of hematological disorders, routine hematological test of various body fluids in proper manner
- Our objective is to provide training in scientific and transferable skills through modular lecture courses, research projects, written work, seminars and supervisions.

Sr. No.	Contents	Contact Hours
UNIT-I	**Quality assurance in haematology.** Internal and external quality control including reference preparation Routine quality assurance protocol **Basic concepts of automation in haemotology** **Bone marrow examination** Composition and functions Aspiration of bone marrow (Adults and children) Processing of aspirated bone marrow (Preparation staining of smear Brief knowledge about examination of aspirated bone marrow (differential cell counts and cellular ratios) processing and staining of trephine biopsy specimens	**15**
UNIT-II	**Red cell anomalies** Morphological changes such as variation in size shape & staining character **Disorders of leucocytes** Abnormal morphology e shift, left & variation in counting. **L.E.cell phenomenon.** Definition of L.E.cell. Demonstration of L.E.cell by various methods Clinical significance.	**15**
UNIT-III	**Safety precautions in haematology** Physiological variations in Hb, PCV, TLC and Platelets, Investigations of a case suffering from bleeding disorders, Quantitative assay of coagulation factors Principle, Procedure	**15**
UNIT-IV	Routine examination of urine	**15**

	Routine examination of seminal fluid Routine examination of CSF and other body fluids i.e. pleural, peritoneal and synovial fluid etc. Biomedical waste management in haematology laboratory	

COURSE OUTCOMES: On completion of this course, the students will be able to

CO1	**BMLT -2302.1**	Students will have great knowledge about morphological changes in erythrocytes and leukocytes.
CO2	**BMLT -2302.2**	Identification of variants in HB, TLC, PCV and platelets and automation hematology
CO3	**BMLT -2302.3**	Learners will be able to perform various coagulation tests related to haemostasis and fibrinolysis.
CO4	**BMLT -2302.4**	Ability to take blood sample and Can perform test for the identification of anemias.

SUGGESTED READINGS:

1. An Introduction to Medical Lab Technology by Godkar (Latest Edition)
2. Diagnostic microbiology by Koss Volume -I
3. An introduction to Medical Lab Technology by Paniker(Latest Edition)

SUBJECT TITLE: Analytical Bio-Chemistry
SUBJECT CODE: BMLT-2303
SEMESTER: III
CONTACT HOURS/WEEK:

Lecture (L)	Tutorial (T)	Practical (P)	Credit (C)
4	0	0	4

Internal Assessment: 40
End Term Exam: 60
Duration of Exam; 3 Hrs

Objective:-

- The aim of this course is to ensure that you can achieve an up-to-date level of understanding of analytical techniques used in biochemistry in proper manner.
- Our objective is to provide training in scientific and transferable skills through modular lecture courses, research projects, written work, seminars and supervisions.

Sr. No.	Contents	Contact Hours
UNIT-I	**Spectrophotometry and colorimetry** Introduction Theory of spectrophotometry and colorimetry Lambert`s law and Beer`s law Applications of colorimetry and Spectrophotometry **Photometry** Introduction General principles of Flame photometry Limitations of flame photometry Instrumentation Applications of flame photometry	**15**
UNIT-II	**Chromatography** Introduction, definition, types of chromatography with principle & procedure and results **Paper Chromatography** : Introduction, principle, types ,details for qualitative and quantitative analysis, application **Thin layer chromatography:** Introduction, experimental techniques, applicatio of TLC, limitations, High performance thin layer chromatography **Column chromatography**: Introduction, principle column efficiency, application of column chromatography **Gas chromatography**: Introduction principle, instrumentation, application **Adsorption chromatography** : Introduction, adsorbents, procedure, limitation, Application	**15**

	Ion exchange chromatography: Introduction principle, instrumentation, application and cation &anion exchangers. **Gel Chromatography**: Introduction Principle and method, application and advantages	
UNIT-III	**Electrophoresis**: Introduction, principle, Instrumentation, paper and gel electrophoresis and their application	**15**
UNIT-IV	**Atomic Absorption spectroscopy** Introduction Principle Differences and advantages between atomic absorption spectroscopy and flame emission spectroscopy Disadvantages Instrumentation Applications	**15**

COURSE OUTCOMES: On completion of this course, the students will be able to

CO1	**BMLT -2303.1**	Learner will gain knowledge about various instruments used for the analysis of different bio-molecules.
CO2	**BMLT -2303.2**	By using spectrophotometer, colorimeter and photometric techniques students will be able to perform different test.
CO3	**BMLT -2303.3**	Study distinct Chromatography techniques, their uses and methodology.
CO4	**BMLT -2303.4**	Students will be able to use electrophoretic techniques and spectroscopic techniques.

SUGGESTED READINGS:

1. An Introduction to Medical Lab Technology by Godkar (Latest Edition)
2. Diagnostic microbiology by Koss Volume -I
3. An introduction to Medical Lab Technology by Paniker(Latest Edition)

SUBJECT TITLE: Basic Cellular Pathology
SUBJECT CODE: BMLT-2304

SEMESTER: III
CONTACT HOURS/WEEK:

Lecture (L)	Tutorial (T)	Practical (P)	Credit (C)
4	0	0	4

Internal Assessment: 40
End Term Exam: 60
Duration of Exam; 3 Hrs

Objective:-

- The aim of this course is to ensure that you can achieve an up-to-date level of understanding of cellular pathology and pathological techniques in proper manner
- Our objective is to provide training in scientific and transferable skills through modular lecture courses, research projects, written work, seminars and supervisions.

CONTENTS OF SYALLBUS:

S.NO.	CONTENTS	CONTACT HOURS
UNIT-I	**Alimentary System: -** Diseases of mouth, Diseases of Oesophagus-Oesophageal varices. **Digestive System:-** Gastritis, Peptic ulceration, Appendicitis microbial diseases, food poisoning, hernia, Intestinal abstrictions & malabsorbtion. **Accessory Digestive glands: - Salivary glands-** mumps, **liver –** hepatitis, liver failure and cirrhosis. **Pancreas-** pancreatitis. **Gall Bladder-** Gall stones, jaundice and cardiovascular diseases.	15
UNIT-II	**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.	15
UNIT-III	**Urinary System: -** Glomerulonephritis, Nephrotic syndrome, Renal failure, Renal calculi, Urinary obstruction, Urinary tract infection **Reproductive system:-** Sexually transmitted diseases, Pelvic inflammatory disease, disorder of cuvix(CIN), Disease of ovaries, ectopic pregnancy, prostatitis, Infertility	15

UNIT-IV	**Nervous System: -** Neuronal damage, ICP, Cerebral Infarction, headinjury, Alzheimer's disease, dementia. **Endocrine System:-** Pituitary:- Hyper & Hypo secretions Thyroid: - Goiter Adrenal: - Cushing Syndrome, Addison DiseasePancreas: - Diabetes **Sense Organs:-** Ear:- OtitisEye: - Cataract	15

COURSE OUTCOMES: On completion of this course, the students will be able to

CO1	**BMLT -2304.1**	Students will have basic knowledge about various systems and organs of human body.
CO2	**BMLT -2304.2**	They will know about various causes and sign symptoms of different diseases.
CO3	**BMLT -2304.3**	Learners will have understanding about medical terminology used for diseases.
CO4	**BMLT -2304.4**	They have command on diseases of alimentary, digestive, respiratory, urinary reproductive, nervous and endocrine system.

SUGGESTED READINGS:

1.Medical Laboratories Management- Cost effective methods by Sangeeta Sharma, Rachna Agarwal, Sujata Chaturvedi and Rajiv Thakur,
2. An Introduction to Medical Lab Technology by Godkar (Latest Edition), Diagnostic microbiology by Koss Volume –I,
3.An introduction to Medical Lab Technology by Paniker(Latest Edition),
4.Introduction to Medical Lab Technology by Godkar (Latest Edition),
5.Diagnostic microbiology by Koss Volume –I,
6.An introduction to Medical Lab Technology by Paniker(Latest Edition)

SUBJECT TITLE: Applied Microbiology
SUBJECT CODE: BMLT-2306
SEMESTER: Third
CONTACT HOURS/WEEK:

Lecture (L)	Tutorial (T)	Practical (P)	Credit (C)
0	0	2	1

Internal Assessment: 40
End Term Exam: 60
Duration of Exam; 3 Hrs

Applied Microbiology Practical

1. Inoculation of different culture media

2. Isolation of pure cultures

3. Processing of following clinical samples for culture and identification of pathogens:

- Blood
- Throat swab
- Sputum
- Pus
- Urine
- Stool for Salmonella, Shigella and Vibrio cholerae
- C.S.F. and other body fluids

4. Antimicrobial susceptibility testing

a. Introduction and terms used

b. Preparation and standardization of inoculum

c. To demonstrate reference bacterial strains

d. Choice of antibiotics

5. Collection, transportation and processing of :

a. water,

b. milk ,

6. To demonstrate sterility testing of intravenous fluid with positive and negative Controls

COURSE OUTCOMES: On completion of this course, the students will be able to

CO1	**BMLT -2306.1**	Students will be able to Inoculate different samples on culture media and identification of pure culture.
CO2	**BMLT -2306.2**	Laboratory strategies in the diagnosis of various systemic bacterial infection.
CO3	**BMLT -2306.3**	Learners can perform Antibiotic susceptibility testing in bacteriology with various methods
CO4	**BMLT -2306.4**	Study about bacteriological examination of water, milk, food and air with various diagnostic methods and with special reference to different bacteria.

SUBJECT TITLE: Applied Hematology
SUBJECT CODE: BMLT-2307
SEMESTER: III
CONTACT HOURS/WEEK:

Lecture (L)	Tutorial (T)	Practical (P)	Credit (C)
0	0	2	1

Internal Assessment:40
End Term Exam; 60
Duration of Exam; 3 Hrs

Applied Haematology Practical

1.To prepare a bone marrow smear and stain by Leishman's, May Grunwald Giesma and Perl's stain.

2. To process a bone marrow trephine biopsy cut sections and stain with H &E, Reticulin stain and PAS staining**.**

3. To identify morphologically the

a. Immature Erythroid series cells.

b. Immature Myeloid and other WBC series cells.

4. To study the RBCs abnormal morphological forms.

a. Variation in size, shape & Staining character

b. Red cell inclusion.

5. To collect blood & test it for the presence of L.E.cell from a suspected DLE patient.

6. Preparation of various additive reagents used in mixing experiments a Correction studies / mixing experiments to pin point the defect in case of prolonged

a. PT

b. APTT

c. Thrombin time

7. Macroscopic, Microscopic and chemical examination of urine.

8. Cytological examination of CSF and other body fluids.

9. Macroscopic, Microscopic examination (including sperm count) of seminal fluid.

COURSE OUTCOMES: On completion of this course, the students will be able to

CO1	**BMLT -2307.1**	Learners will be able to perform various tests for the identification of red cell abnormalities.
CO2	**BMLT -2307.2**	Learners will be able to perform various tests for the identification of leukocyte abnormalities.
CO3	**BMLT -2307.3**	Students will have knowledge about various tests for the identification of coagulation disorders.
CO4	**BMLT -2307.4**	Students can collect blood sample and can perform various test for the identification of anemia's.

SUBJECT TITLE: Analytical Bio-Chemistry practical
SUBJECT CODE: BMLT-2308
SEMESTER: Third
CONTACT HOURS/WEEK:

Lecture (L)	Tutorial (T)	Practical (P)	Credit (C)
0	0	3	2

Internal Assessment: 40
End Term Exam: 60
Duration of Exam; 3 Hrs

Analytical Biochemistry Lab.
(PRACTICAL)

1. To demonstrate the principle, working & maintenance of spectrophotometer.
2. To demonstrate the principle, working & maintenance of colorimeter.
3. To demonstrate the principle, working & maintenance of flame photometer.
4. To demonstrate the principle, procedure of paper chromatography.
5. To demonstrate the principle & demonstration of TLC.
6. To demonstrate the principle & procedure of column chromatography.
7. To demonstrate the principle & procedure of Electrophoresis.

COURSE OUTCOMES: On completion of this course, the students will be able to

CO1	**BMLT -2308.1**	Learner will gain knowledge about various instruments used for the analysis of different bio-molecules.
CO2	**BMLT -2308.2**	By using spectrophotometer, colorimeter and photometric techniques students will be able to perform different test.
CO3	**BMLT -2308.3**	Study distinct Chromatography techniques, their uses and methodology.
CO4	**BMLT -2308.4**	Students will be able to use electrophoretic techniques and spectroscopic techniques.

SUBJECT TITLE: Basic Cellular Pathology
SUBJECT CODE: BMLT-2309
SEMESTER: III
CONTACT HOURS/WEEK:

Lecture (L)	Tutorial (T)	Practical (P)	Credit (C)
0	0	2	1

Internal Assessment:40
End Term Exam; 60
Duration of Exam; 3 Hrs

PRACTICAL

1. Examination of Urine - Routine and Special tests
2. Examination of Stool- Routine and Special tests
3. Examination of Sputum -Routine and Special tests
4. Semen examination -Routine and Special tests
5. Examination of CSF Routine and Special tests
6. Examination of various body fluids-Pleural Fluid, Pericardial Fluid, Synovial Fluid, Ascetic Fluid
7. Various methods of detecting HCG

COURSE OUTCOMES: On completion of this course, the students will be able to

CO1	**BMLT -2309.1**	Students will have basic knowledge about various systems and organs of human body.
CO2	**BMLT -2309.2**	They will know about various causes and sign symptoms of different diseases.
CO3	**BMLT -2309.3**	Students will able to perform different test responsible for different diseases.
CO4	**BMLT -2309.4**	They have command on diseases of alimentary, digestive, respiratory, urinary reproductive, nervous and endocrine system.

SUBJECT TITLE: Healthcare Law and Ethics
SUBJECT CODE: BMLT-2310
SEMESTER: Second
CONTACT HOURS/WEEK:

Lecture (L)	Tutorial (T)	Practical (P)	Credit (C)
2	0	0	2

Internal Assessment: 40
End Term Exam: 60
Duration of Exam; 3 Hrs

OBJECTIVE:-

- The aim of this course is to ensure that you can achieve an up-to-date level of understanding of microbiology and various microbiological techniques such as sterilization and bio-medical waste management in proper manner
- Our objective is to provide training in scientific and transferable skills through modular lecture courses, research projects, written work, seminars and supervisions.

Sr. No.	Contents	Contact Hours
UNIT-I	**Introduction to Medical Law, Ethics and Bioethics** – Medical Law, Ethics, Bioethics, Ethics Committees and Quality Assurance Programs and Medical Etiquette. **The Legal System** – Sources of Law, Classification of Law, the Court System and Trial Process	15
UNIT-II	**Importance of the Legal System for the Physician and the Healthcare Professional** – Medical Practice Acts, Licensure, Standards of Care, Confidentiality, Statute of Limitations, Good Samaritan Law, Respondent Superior and Risk Management. **The Physician-Patient Relationship** – Physician's Rights and Responsibilities, Patient's Rights, Rights of Minors, Patient's Responsibilities and the Role of the Healthcare Consumer	15
UNIT-III	**Public Duties of the Physician and the Healthcare Professional** – Public Health Records and Vital Statistics, Controlled Substances Act and Regulations, Protection for the Employee and the Environment. **Workplace Law and Ethics** – Professionalism in the Workplace, Discrimination in the Workplace, Privacy, Cultural and Religious Considerations, Effective Hiring Practices	15
UNIT-IV	**Ethical and Bioethical Issues in Medicine** – history, Standards and Behavior, Code of Ethics, Bioethical Issues, Human Genome Project, Genetic Engineering, Healthcare Reform. **Ethical Issues Relating to Life** – Fetal Development, Assisted or Artificial Conception, Contraception, Sterilization, Abortion, Genetic Counseling and Testing, Wrongful Life Suits.	15

COURSE OUTCOMES: On completion of this course, the students will be able to

CO1	**BMLT-1101.1**	To learn different laws and ethical issues related to healthcare
CO2	**BMLT-1101.2**	To understanding particular rules, statutes, case law, hypothetical's and examination of case studies.
CO3	**BMLT-1101.3**	To provide the student with an understanding of how to identify medical/legal ethical issues and how to respond appropriately in the workplace environment
CO4	**BMLT-1101.4**	To analyze and apply the Law of Ethics to the responsibilities and duties of the Healthcare Professional. Students will also exam ethical codes

Suggested readings:

1. Medical Law and Ethics by Bonnie F Fremgen

2. Medical Law and Ethics by Herring

3. Medical Laboratories Management- Cost effective methods by Sangeeta Sharma, Rachna Agarwal, Sujata Chaturvedi and Rajiv Thakur

SUBJECT TITLE: Healthcare Law and Ethics
SUBJECT CODE: BMLT-2311
SEMESTER: Second
CONTACT HOURS/WEEK:

Lecture (L)	Tutorial (T)	Practical (P)	Credit (C)
0	0	2	1

Internal Assessment: 40
End Term Exam: 60
Duration of Exam; 3 Hrs

PRACTICAL

1. The community orientation and clinical visit will include visit to the entire chain of healthcare delivery system -Sub centre, PHC, CHC, SDH, DH and Medical College, private hospitals, dispensaries and clinics.
2. Visit to working Microbiology, Haematology, Biochemistry and Histopathology laboratories
3. The student will also be briefed regarding governance at village level including interaction and group discussion with village panchayat and front line health workers.
4. Clinical visit to their respective professional department within the hospital.
5. Evidence-based infection control principles and practices [such as Sterilization, Disinfection, Effective hand hygiene and use of Personal Protective Equipment (PPE)],
6. Prevention & control of common healthcare associated infections

COURSE OUTCOMES: On completion of this course, the students will be able to

CO1	**BMLT-1101.1**	To learn different laws and ethical issues related to healthcare
CO2	**BMLT-1101.2**	To understanding particular rules, statutes, case law, hypothetical's and examination of case studies.
CO3	**BMLT-1101.3**	To provide the student with an understanding of how to identify medical/legal ethical issues and how to respond appropriately in the workplace environment
CO4	**BMLT-1101.4**	To analyze and apply the Law of Ethics to the responsibilities and duties of the Healthcare Professional. Students will also exam ethical codes

SUBJECT TITLE: Basic of Computer Programming
SUBJECT CODE: BCOP-2301
SEMESTER: III
CONTACT HOURS/WEEK: 3

Lecture (L)	Tutorial (T)	Practical (P)	Credit (C)
3	0	0	3

Internal Assessment:40
End Term Exam; 60
Duration of Exam; 3 Hrs

Objective:-

- The aim of this course is to ensure that you can achieve an up-to-date level of understanding of basic computers.
- Our objective is to provide training in scientific and transferable skills through modular lecture courses, research projects, written work, seminars and supervisions.

S.NO.	CONTENTS	CONTAC THOURS
UNIT-I	Introduction to computer: Introduction, characteristics of computer, block diagram of computer, generations of computer, computer languages. Input output devices: Input devices(keyboard, point and draw devices, data scanning devices, digitizer, electronic card reader, voice recognition devices, vision-input devices), output devices(monitors, pointers, plotters, screen image projector, voice responsesystems). Processor and memory: The Central Processing Unit (CPU), main memory.	15
UNIT-II	Storage Devices: Sequential and direct access devices, magnetic tape, magnetic disk, optical disk, mass storage devices. Introduction of windows: History, features, desktop, taskbar, icons on the desktop, operation with folder, creating shortcuts, operation with windows (opening, closing, moving, resizing, minimizing and maximizing, etc.). Introduction to MS-Word: introduction, components of a word window, creating, opening and inserting files,	15

	editing a document file, page setting and formatting the text, saving the document, spell checking, printing the document file, creating and editing oftable, mail merge.	
UNIT-III	Introduction to Excel: introduction, about worksheet, entering information, saving workbooks and formatting, printing the worksheet, creating graphs. Introduction to power-point: introduction, creating and manipulating presentation, views, formatting and enhancing text, slide with graphs. Introduction of Operating System: introduction, operating system concepts, types of operating system	15
UNIT-IV	Computer networks: introduction, types of network (LAN, MAN, WAN, Internet, Intranet), network topologies (star, ring, bus, mesh, tree, hybrid), components of network. Internet and its Applications: definition, brief history, basic services (E-Mail, File Transfer Protocol, telnet, the World Wide Web (WWW)), www browsers, use of the internet. Application of Computers in clinical settings.	15

COURSE OUTCOMES: On completion of this course, the students will be able to

CO1	**BCOP -2301.1**	Students will have knowledge about the basic hardware system of computer and laptop.
CO2	**BCOP -2301.2**	Learners will able to use Microsoft office
CO3	**BCOP -2301.3**	They will be able to install and use various software's
CO4	**BCOP -2301.4**	Learners will be able to get clerical and data entry jobs.

Suggested Readings:

1. Information technology by Anshuman Sharma (Lakhanpal Publisher)
2. Computer Fundamentals (Concepts. Systems and applications) by P. K. Sinha (University of Tokyo, Japan) BPB Publications

SUBJECT TITLE: Basic of Computer Programming
SUBJECT CODE: BCOP-2302
SEMESTER: III
CONTACT HOURS/WEEK: 3

Lecture (L)	Tutorial (T)	Practical (P)	Credit (C)
3	0	0	3

Internal Assessment:40
End Term Exam; 60
Duration of Exam; 3 Hrs

Objective:-

- The aim of this course is to ensure that you can achieve an up-to-date level of understanding of basic computers.
- Our objective is to provide training in scientific and transferable skills through modular lecture courses, research projects, written work, seminars and supervisions.

Practical

1. Demonstration of basic hardware of the computers and laptops
2. Learning to use MS office: MS word, MS PowerPoint, MS Excel
3. To install different software
4. Data entry efficiency

COURSE OUTCOMES: On completion of this course, the students will be able to

CO1	**BCOP -2302.1**	Students will have knowledge about the basic hardware system of computer and laptop.
CO2	**BCOP -2302.2**	Learners will able to use Microsoft office
CO3	**BCOP -2302.3**	They will be able to install and use various software's.
CO4	**BCOP -2302.4**	Learners will be able to get clerical and data entry jobs

SEMESTER-IV

SUBJECT TITLE: Immunology and Mycology
SUBJECT CODE: BMLT-2401
SEMESTER: IV
CONTACT HOURS/WEEK:

Lecture (L)	Tutorial (T)	Practical (P)	Credit (C)
4	0	0	4

Internal Assessment: 40
End Term Exam: 60
Duration of Exam; 3 Hrs

Objective:-

- The aim of this course is to ensure that you can achieve an up-to-date level of understanding of Immunology, immunological test, immunity and identification of fungus in with various tests.
- Our objective is to provide training in scientific and transferable skills through modular lecture courses, research projects, written work, seminars and supervisions.

S.NO.	CONTENTS	CONTACTHOURS
UNIT-I	**History and introduction to immunology** **Immunity** Introduction, types Innate and acquired immunity including basic concepts about their mechanisms. **Definition, types of antigens and Determinants of antigenicity**	15
UNIT-II	**Definition, types, structure and properties of immunoglobulins** **Antigen-Antibody reactions** Definition, Classification , general features and mechanisms and applications of various antigen antibody reactions **Principle, procedure and applications** of Complement fixation test, Immunofluorescence, ELISA, CCIEP, and RIA, SDS-PAGE and western blotting in medical microbiology	15
UNIT-III	**Principle, procedure and interpretation of various serological tests** i.e. Widal,VDRL, ASO, CRP, Brucella tube agglutination and Rose-Waaler	15

	Raising of high titre antisera in laboratory animals and its standardization. **Complement system**: Definition and Basic concepts about its components and complement activation pathways	
UNIT-IV	**Immune response** : Introduction & Basic concepts of humoral and cellular immune responses **Hypersensitivity**: Definition and Types of hypersensitivity reactions, Basic concepts of autoimmunity and brief knowledge about autoimmune Diseases **Vaccines:** Definition, Types, Vaccination schedule and Brief knowledge about vaccination	15

COURSE OUTCOMES: On completion of this course, the students will be able to

CO1	**BMLT -2401.1**	Study the history, introduction and types of antigens and immunoglobulins
CO2	**BMLT -2401.2**	Understand about the different types immune response, basic concepts of Humoral and cellular immune response
CO3	**BMLT -2401.3**	Apply the knowledge to understand the types ,vaccination and brief knowledge about vaccination
CO4	**BMLT -2401.4**	Analyze the Principles, Procedures and interpretation of various serological tests

SUGGESTED READINGS:

1. An Introduction to Medical Lab Technology by Godkar (Latest Edition)
2. Diagnostic microbiology by Koss Volume –I
3. An introduction to Medical Lab Technology by Paniker(Latest Edition)

SUBJECT TITLE: Histotechnology
SUBJECT CODE: BMLT-2402
SEMESTER: Fourth
CONTACT HOURS/WEEK:

Lecture (L)	Tutorial (T)	Practical (P)	Credit (C)
4	0	0	4

Internal Assessment: 40
End Term Exam: 60
Duration of Exam; 3 Hrs

Objective:-

- The aim of this course is to ensure that you can achieve an up-to-date level of understanding of histotechnological techniques such as fixation, decalcification processing, sectioning and staining of tissues in proper manner
- Our objective is to provide training in scientific and transferable skills through modular lecture courses, research projects, written work, seminars and supervisions.

S.NO.	CONTENTS	CONTACT HOURS
UNIT-I	**Introduction to histotechnology**. 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**	15
UNIT-II	**Basic concept of fixation** Various types of fixatives used in routine histopathology laboratory for demonstration of various tissue elements Simple fixative, Compound fixative,Special fixative **Decalcification** Criteria of a good decalcification agent, Technique of decalcification followed with selection of tissue, fixation, decalcification, neutralization of acid and thorough washing, Various types of decalcifying fluids: Organic & Inorganic Acid, chelating agents, Use of Ion- exchange resigns and	15

	Electrophoretic decalcification and treatment of hard tissues which are not calcified.	
UNIT-III	**Processing of various tissues for histological examination** **a. Embedding** **i.** Definition **ii.** Various types of embedding media **iii.** Procedure followed by Dehydration, Clearing, Infiltration and Routine timing schedule for manual or automatic tissue processing. **iv.** Components & principles of various types of automatic tissue processors **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 glass slide.	15
UNIT-IV	**General staining procedure in histology.** Theory of staining, classification of dyes, principles of dye chemistry Stains and dyes and their uses, Types of stains, chemical staining action, Mordants, and accentuators, Metachromacy Use and control of staining procedures Preparation of stains, solvents, aniline water and buffers etc. Commonly used moutants in histotechnology lab General staining procedure in paraffin infiltrated and embedding tissue.	15

	Nuclear stains and cytoplasmic stains Equipment and procedure for manual staining and automatic staining technique Mounting of cover slips, labeling, cataloguing the slides	

Course Outcomes:

After taking the course, students will be able to:

CO1	**BMLT -2402.1**	Study the basic histotechnological Procedures as well as to get aware of the recent trends in Histotechnology
CO2	**BMLT -2402.2**	Understand about the different types of fixatives Examination of Tissues used in routine Histopathology Laboratory.
CO3	**BMLT -2402.3**	Apply the knowledge to understand the various types of Microtomes ,section cutting equipments and various types of equipments used in histopathology Lab.
CO4	**BMLT -2402.4**	Analyze the various types of Procedures used in dehydration, clearing,infiltration and Principles and components used in manual and automatic tissue processors.

SUGGESTED READINGS:

1. An Introduction to Medical Lab Technology by Godkar (Latest Edition),
2. Diagnostic microbiology by Koss Volume –I,
3. An introduction to Medical Lab Technology by Paniker(Latest Edition),

SUBJECT TITLE: Applied Hematology
SUBJECT CODE: BMLT-2403
SEMESTER: Fourth
CONTACT HOURS/WEEK:

Lecture (L)	Tutorial (T)	Practical (P)	Credit (C)
4	0	0	4

Internal Assessment: 40
End Term Exam: 60
Duration of Exam; 3 Hrs

Objective:-

- The aim of this course is to ensure that you can achieve an up-to-date level of understanding about various blood related disorders such as anemia, leukemia, coagulation disorders and their diagnosis in proper manner
- Our objective is to provide training in scientific and transferable skills through modular lecture courses, research projects, written work, seminars and supervisions.

S.NO.	CONTENTS	CONTACT HOURS
UNIT-I	**ANAEMIA** Definition and classification of anaemias. Introduction of Iron deficiency anaemia Laboratory diagnosis of iron deficiency anaemia	15
UNIT-II	Introduction of megaloblastic anaemia Laboratory diagnosis of megaloblastic anaemia Introduction of haemolytic anaemia Laboratory diagnosis of haemolytic anaemia	15
UNIT-III	**LEUKAEMIA** Definition, classification and laboratory diagnosis of leukaemias Definition and laboratory diagnosis of Leukamoid reactions Cytochemical stainings, procedure and their significance in various haemopoietic disorders. Chromosomal studies in haematology and their significance	15

UNIT-IV	**COAGULATION DISORDERS** Mechanism of normal fibrinolysis and lab diagnosis of hyperfibrinolysis Mechanism and lab diagnosis of disseminated intravascular coagulation (DIC). Lab diagnosis of Haemophilia and Von willebrand disease. Laboratory diagnosis of idiopathic thrombocytopenic purpura (ITP). Platelets function test and their interpretation.	15

Course Outcomes:

After taking the course, students will be able to:

CO1	**BMLT -2403.1**	Study the Introduction, classification and Laboratory diagnosis of various types of anaemias.
CO2	**BMLT -2403.2**	Understand about the different types Blood coagulation tests like haemophilia, Von willebrand syndromeDiffuse intravascular coagulation(DIC)Idiopathic thrombocytopenic purpura (ITP)And other miscellaneous disorders
CO3	**BMLT -2403.3**	Apply the knowledge to understand the Bone marrow Aspiration ,its clinical significance and staining procedures.
CO4	**BMLT -2403.4**	Analyze the various staining procedures of Polycythemia Erythrocyte and leucocyte cytochemistry Diagnostic radioisotopes in haematology.

SUGGESTED READINGS:

1. An Introduction to Medical Lab Technology by Godkar (Latest Edition),
2. Diagnostic microbiology by Koss Volume –I,
3. An introduction to Medical Lab Technology by Paniker(Latest Edition), by Paniker(Latest Edition)

SUBJECT TITLE: Clinical Bio-Chemistry
SUBJECT CODE: BMLT-2404
SEMESTER: IV
CONTACT HOURS/WEEK:

Lecture (L)	Tutorial (T)	Practical (P)	Credit (C)
4	0	0	4

Internal Assessment: 40
End Term Exam: 60
Duration of Exam; 3 Hrs

Objective:-

- The aim of this course is to ensure that you can achieve an up-to-date level of understanding of hematology and hematological techniques in proper manner
- Our objective is to provide training in scientific and transferable skills through modular lecture courses, research projects, written work, seminars and supervisions.

S.NO.	CONTENTS	CONTACT HOURS
UNIT-I	Hazards & safety measures in clinical Biochemistry laboratory. Quality control and quality assurance in a clinical biochemistry laboratory. Laboratory organization, management and maintenance of records. Normal range of blood, serum, plasma, and urine, and reference values	15
UNIT-II	Principles, procedures, results and interpretation of following: a. Glucose b. Proteins c. Urea d. Uric acid e. Creatinine f. Bilirubin g. Lipids	15
UNIT-III	Introduction, Principles, procedures , clinical significance, Precautions, normal range, result/interpretation of following: - a. Sodium b. Potassium c. Chloride d. Iodine e. Calcium	15

	f. Phosphorous and Phosohates	
UNIT-IV	Instruments for detection of Radioactivity. Uses of radioisotopes in clinical biochemistry. Radioisotopes techniques	15

After taking the course, students will be able to:

CO1	**BMLT -2404.1**	Study the basic biochemical analytical procedures as well as to get aware of the recent trends in clinical biochemistry Laboratory.
CO2	**BMLT -2404.2**	Understand about the Laboratory management and biochemical techniques.
CO3	**BMLT -2404.3**	Apply the knowledge to understand the Introduction, Principles, procedures , clinical significance, Precautions, normal range, result/interpretation of Sodium, Potassium and Chloride, Iodine.Calcium, Phosphorous and Phosohates tests.
CO4	**BMLT -2404.4**	Analyze the Knowledge ofHazards & safety measures in clinical Biochemistry laboratory organization, management and maintenance of records.

SUGGESTED READINGS:

1. An Introduction to Medical Lab Technology by Godkar (Latest Edition),
2. Diagnostic microbiology by Koss Volume –I,
3. An introduction to Medical Lab Technology by Paniker(Latest Edition),

SUBJECT TITLE: Blood Bank
SUBJECT CODE: BMLT-2405
SEMESTER: IV
CONTACT HOURS/WEEK:

Lecture (L)	Tutorial (T)	Practical (P)	Credit (C)
4	0	0	4

Internal Assessment: 40
End Term Exam: 60
Duration of Exam; 3 Hrs

Objective:

- The aim of this course is to ensure that you can achieve an up-to-date level of understanding of hematology and hematological techniques in proper manner
- Our objective is to provide training in scientific and transferable skills through modular lecture courses, research projects, written work, seminars and supervisions.

S.NO.	CONTENTS	CONTACT HOURS
UNIT-I	**Historical introduction to Transfusion medicine (blood banking)** **Development of ABO antigen in red cells** **Glassware used in Blood Banking** Types of glassware and cleaning agents used Cleaning of new and used glassware/plastic ware **Anticoagulants used in blood bank** Types and composition of various anticoagulants Advantages and disadvantages of various anticoagulant	15
UNIT-II	**Screening of blood donors for following** MP VDRL HIV HbsAg HCV **Antigen and Antibody**	15

	Introductin, Definition of antigen and antibody Classification of antigens and antibodies. **ABO Blood Group System** Antigens and antibodies involved Principle and procedure of ABO blood grouping Various other sub groups A1,A2,A1B,A2B	
UNIT-III	**The Rh Blood Group System** Antigen and antibody involved Principle and procedure of Rh grouping Variant of D antigen (Du) **Coombs Test** Direct coombs test (principle, procedure, importance and application) Indirect coombs test (principle, procedure, importance and application) **Cross Matching** Types of cross matching Various methods and their procedures	15
UNIT-IV	**Blood Collection and storage** Screening of blood donor and characteristics of ideal blood donor. Blood collection procedure Transportation and storage **Various blood components (Packed cells, Fresh frozen plasma, Cryoprecipitate, PRP(Platelet rich plasma)** Preparation Preservation **Blood Transfusion reactions**	15

Course Outcomes:

After taking the course, students will be able to:

CO1	**BMLT -2405.1**	Study the introduction and development of ABO antigens and antibodies
CO2	**BMLT -2405.2**	Understand about the different types of anticoagulants used in Blood banking and various types of methods and Procedures used in Cross matching.
CO3	**BMLT -2405.3**	Apply the knowledge to understand the various types of Blood group systems like ABO Blood group systems and RH blood group systems.
CO4	**BMLT -2405.4**	Analyze the Principle, Procedures and important applications used in Direct and indirect coombs tests.

Suggested reading:

1. An Introduction to Medical Lab Technology by Godkar (Latest Edition),
2. Diagnostic microbiology by Koss Volume –I,
3. An introduction to Medical Lab Technology by Paniker(Latest Edition),

SUBJECT TITLE: Immunology & Mycology
SUBJECT CODE: BMLT-2406
SEMESTER: Fourth
CONTACT HOURS/WEEK:

Lecture (L)	Tutorial (T)	Practical (P)	Credit (C)
0	0	2	1

Internal Assessment: 40
End Term Exam: 60
Duration of Exam; 3 Hrs.

PRACTICAL

1. Collection of blood sample by veinpuncture, separation and preservation of serum
2. Raising haemolysin in Rabbit and performing its titration for Rosewaaler
3. Preparation of Phosphate buffers, Vernol buffer, ASO buffer, Richardsons buffer, Buffers of different pH and molarity, tris buffer, Standardization of cell concentration by spectrophotometer
4. Performance of Serological tests *i.e.*

a. Widal,

b. Brucella Tube Agglutination,

c. VDRL (including Antigen Preparation),

d. ASO (Antistreptolysin 'O')

e. C-Reactive Protein (Latex agglutination)

f. Rheumatoid factor (RF) Latex agglutination

5. Demonstration of antigen / antibody determination by Immunoflourescence, Immunodiffusion, precipitation in agarose gel(ouchterlony), CCIEP, ELISA, SDSPAGE and western blotting.
6. To prepare culture media used routinely in mycology
7. To perform all the staining techniques for identification of fungi as mentioned in theory syllabus.
8. To identify given yeast culture (By performing various identification techniques studied in theory.
9. To identify given mould culture (By performing various identification techniques studied in theory.

Course Outcomes:

After taking the course, students will be able to:

CO1	**BMLT -2406.1**	Study the basic Immunology and serology Procedures as well as to get aware of the recent trends in the immunology and serology lab.
CO2	**BMLT -2406.2**	Understand the routine staining procedures like Widal, CRP, ASO and RA factor tests.
CO3	**BMLT -2406.3**	Understand the basic requirements of the Immunology and serological specimens their collection and processing of specimens
CO4	**BMLT -2406.4**	Understand the proper use and handling of common laboratory equipments and Glasswares.

SUBJECT TITLE: Histotechnology practical
SUBJECT CODE: BMLT-2407
SEMESTER: Fourth
CONTACT HOURS/WEEK:

Lecture	Tutorial	Practical	Credit
0	0	2	1

Internal Assessment: 40
End Term Exam: 60
Duration of Exam; 3 Hrs.

HISTOTECHNOLOGY
Practical

1. Demonstration of instruments used for dissection
2. Use of antiseptics, disinfectant and insecticides in tissue processing laboratory
3. Reception and labeling of histological specimens
4. Preparation of various fixatives

a.10% Neutral formalin

b. Formal saline

c. Formal acetic acid

5. To perform embedding and casting of block
6. To process a bone for decalcification
7. To prepare 70% alcohol form absolute alcohol.

Course Outcomes:

After taking the course, students will be able to:

CO1	**BMLT -2407.1**	Study the various equipments used in histopatholgy Laboratory
CO2	**BMLT -2407.2**	Understand the routine working, care and maintance of Microtomes.
CO3	**BMLT -2407.3**	Understand the basic procedures of the Honing and stropping techniques,different types of specimen used in Histotechnological specimens and collection and precessing of Histotechnological specimens.
CO4	**BMLT -2407.4**	Understand the proper use and handling of common laboratory equipments used in histotechnology laboratory.

SUBJECT TITLE: Applied Hematology
SUBJECT CODE: BMLT-2408
SEMESTER: Fourth
CONTACT HOURS/WEEK:

Lecture (L)	Tutorial (T)	Practical (P)	Credit (C)
0	0	2	1

Internal Assessment: 40
End Term Exam: 60
Duration of Exam; 3 Hrs.

Applied Haematology
Practicals

1. To estimate serum iron and total iron binding capacity.
2. To detect whether the given specimen is G6PD deficient or normal.
3. To estimate Hb-F in a given blood sample.
4. To estimate plasma and urine Haemoglobin in the given specimens.
5. To demonstrate the presence of Hb-S by sickling and solubility tests.
6. To test the given blood sample for its osmotic red cell fragility.
7. Cytochemical staining on the given smears such as PAS, SBB, MPO, LAP and Perl's reaction.
8. Estimation of Fibrinogen, Fibrin degradation products (FDPs) and Euglobulin clot lysis test (ELT)
9. Urea clot solubility test for factor XIII.
10. To perform various platelet function tests such as whole blood clot retraction test, prothrombin consumption index (PCI) Platelet adhesion, aggregation and PF3 availability test

Course Outcomes:

After taking the course, students will be able to:

CO1	**BMLT -2408.1**	Study the various equipments used in haematology Laboratory.
CO2	**BMLT -2408.2**	Understand the Various lab diagnostic tests used for different types of anemias.
CO3	**BMLT -2408.3**	Understand the basic procedures of the Bone Marrow aspiration.
CO4	**BMLT -2408.4**	Understand the proper use and handling of common laboratory equipments used in haematology Laboratory

SUBJECT TITLE: Clinical Biochemistry Practical
SUBJECT CODE: BMLT-2409
SEMESTER: Fourth
CONTACT HOURS/WEEK:

Lecture (L)	Tutorial (T)	Practical (P)	Credit (C)
0	0	2	1

Internal Assessment: 40
End Term Exam: 60

1. Estimation of Glucose in Blood.
2. Estimation of Protein in Blood.
3. Estimation of Urea in blood.
4. Estimation of uric acid in blood.
5. Estimation of serum bilirubin
6. Estimation of Total Cholestrol in blood.
7. Estimation of HDL Cholestrol.
9. Estimation of TG
10. Estimation of Creatinine in Blood
11. Estimation of serum calcium
12. To measure electrolytes Sodium, Potassium & Chloride.

Course Outcomes:

After taking the course, students will be able to:

CO1	**BMLT -2409.1**	Study the basic biochemical analytical procedures as well as to get aware of the recent trends in clinical biochemistry
CO2	**BMLT -2409.2**	Understand the routine biochemical investigations like blood sugar, renal function tests, Liver function tests
CO3	**BMLT -2409.3**	Understanding the basic requirements for the biochemical investigations including different biological specimens, their collection and processing of biochemical estimations and have brief knowledge of preparation of solutions and different types of assays
CO4	**BMLT -2409.4**	Understanding of proper use and handling of common Laboratory Equipment and Glassware in biochemistry lab

SUBJECT TITLE: Blood Bank
SUBJECT CODE: BMLT-2410
SEMESTER: IV
CONTACT HOURS/WEEK:

Lecture (L)	Tutorial (T)	Practical (P)	Credit (C)
0	0	2	1

Duration of Exam; 3 Hrs

LIST OF PRACTICALS

1. Washing and sterilization of glass ware
2. Performing ABO blood grouping by following method:
    - Direct
    - Tube Test
    - Indirect (reverse)
    - Subgroup
3. Performing-Rh grouping by following techniques:
    - Slide
    - Tube technique
4. Performance of Coombs Test
    - Direct
    - Indirect
5. Cross Matching (compatibility testing)
    - Major
    - Minor
6. Preparation of anticoagulants
    - ACD (Acid Citrate Dextros
    - CPD (Citrate Phosphate Dextrose)
    - CPDA (Citrate Phosphate Dextrose Analine

Course Outcomes:

After taking the course, students will be able to:

CO1	**BMLT -2410.1**	Study the basic sterilization and glasswares used in Blood banking
CO2	**BMLT -2410.2**	Analyze the performing the major cross matching and minor matching tests.
CO3	**BMLT -2410.3**	Understand the proper handling of common Laboratory Procedures in direct and indirect ABO blood grouping systems.
CO4	**BMLT -2410.4**	Apply the knowledge to understand about preparation of various anticoagulants like ACD, CPD and CPDA.

SEMESTER-V

SUBJECT TITLE: Medical Parasitology
SUBJECT CODE: BMLT-3501
SEMESTER: V
CONTACT HOURS/WEEK:

Lecture (L)	Tutorial (T)	Practical (P)	Credit (C)
4	0	0	4

Internal Assessment: 40
End Term Exam: 60
Duration of Exam; 3 Hrs

Objective:-

- The aim of this course is to ensure that you can achieve an up-to-date level of understanding about the morphological structure, life cycle and lab diagnosis of various parasites and their identification techniques in proper manner

- Our objective is to provide training in scientific and transferable skills through modular lecture courses, research projects, written work, seminars and supervisions.

S.NO.	CONTENTS	CONTACT HOURS
UNIT-I	**Introduction to medical parasitology with respect to terms used in Parasitology.** **Protozoology/ Protozoal parasites:** General characteristics of protozoa. Geographical distribution, Habitat, Morphology, life cycle, Mode of infection and laboratory diagnosis of Entamoeba Geographical distribution, Habitat, Morphology, life cycle, Mode of infection and laboratory diagnosis of blood and tissue flagellates i.e. Plasmodium and Toxoplasma sp.	15
UNIT-II	**Helminthology/ Helminthic parasites:** General characteristics of Cestodes, Trematodes and Nematodes Geographical distribution, Habitat, Morphology, life cycle, Mode of infection and laboratory diagnosis of : Taeniasolium and saginata Echinococcus granulos	15

UNIT-III	**Diagnostic procedures:** Examination of Stool for parasites For intestinal protozoal infections General rules for microscopic examination of stool samples Collection of stool samples Preparation of material for unstained and stained preparations Staining methods i.e. Iodine staining and permanent staining Examination of blood for parasites Preparation of thin and thick blood film Leishman's staining Examination of thick and thin smear Field's stain JSB stain **Examination of blood film for Malaria parasite and Microfilariae** Collection, Transport, processing and preservation of samples for routine parasitological investigations.	15
UNIT-IV	Morphology, life cycle and lab-diagnosis of Giardia and Entamoeba Morphology, life cycle and lab-diagnosis of Roundworms and Hookworms Morphology, life cycle and lab-diagnosis of Malaria parasite with special reference to P.vivax and P. falciparum Laboratory diagnosis of hydrated cyst and cysticercosis. Concentration techniques for demonstration of Ova and Cysts (Principles, Procedure and applications)	15

Course Outcomes:

After taking the course, students will be able to:

CO1	**BMLT -3501.1**	Study the growth and control of Parasites as well as different Parasitological techniques involved in Parasitology.
CO2	**BMLT -3501.2**	Understand about the different cell organelles of Parasites and their detailed functions
CO3	**BMLT -3501.3**	Apply the knowledge to understand the Parasite's physiology and to identify the Parasites.
CO4	**BMLT -3501.4**	Analyze the Parasites on basis of appearance and function

Suggested readings:

1. Text book of Parasitology by NC Dey
2. Text book of Parasitology by Chaterjee
3. Medical parasitology by RL Ichhpujani and Rajesh Bhatia
4. Text book of Microbiology by Ananthanereyan
5. Medical Microbiology by Paniker& Satish Gupte
6. Text book of Microbiology by DR arora

SUBJECT TITLE: Analytical Clinical Bio-Chemistry
SUBJECT CODE: BMLT-3502
SEMESTER: V
CONTACT HOURS/WEEK:

Lecture (L)	Tutorial (T)	Practical (P)	Credit (C)
4	0	0	4

Internal Assessment: 40
End Term Exam: 60
Duration of Exam; 3 Hrs

Objective:-

- The aim of this course is to ensure that you can achieve an up-to-date level of understanding of various tests such as gastric analysis, enzymatic analysis and body fluid estimation in proper manner
- Our objective is to provide training in scientific and transferable skills through modular lecture courses, research projects, written work, seminars and supervisions.

S.NO.	CONTENTS	CONTACT HOURS
UNIT-I	**Automation in clinical biochemistry** **Method of estimation and assessment for:** Glucose tolerance test Insulin tolerance test Xylose excretion test.	15
UNIT-II	**Gastric analysis.** **Clearance test for renal function.** **Qualitative test for:** Urobilinogens Barbiturates T3, T4 and TSH Ketosteroids	15
UNIT-III	**Enzymes:** Principle, procedure and Clinical significance for the estimation of following enzymes Acid phosphatase	15

	Alkaline phosphatase Lactate dehydrogenase Aspartate transaminase Alanine transaminase Creatine phosphokinase	
UNIT-IV	**Qualitative analysis of Renal calculi.** **Chemical examination of Cerebrospinal fluid.** **Brief knowledge about rapid techniques in clinical biochemistry**	15

Course Outcomes:

After taking the course, students will be able to:

CO1	**BMLT -3502.1**	Study the basic biochemical analytical procedures as well as to get aware of the recent trends in clinical biochemistry.
CO2	**BMLT -3502.2**	Understand about the Laboratory Management and Biochemical techniques skills.
CO3	**BMLT -3502.3**	Apply the knowledge to understand the the diagnosis of diseases,prognosis and treatment
CO4	**BMLT -3502.4**	Understand the need, advantages and recent advances of automation in a Clinical biochemistry laboratory

Suggested readings

1. Text book of Medical Laboratory Technology by P.B. Godkar.
2. Medical Laboratory Science, Theory & Practical by A. Kolhatkar.
3. Practical Clinical Biochemistry by Harold Varley.
4. Biochemistry, U. Satyanarayan& U. Chakrapani.
5. Text book of Medical Biochemistry by Chaterjee&Shinde.
6. Principal of Biochemistry by Lehninger
7. Biochemistry by Voet&Voet
8. Biochemistry by Stryer

SUBJECT TITLE: Cytopathology
SUBJECT CODE: BMLT-3503
SEMESTER: V
CONTACT HOURS/WEEK:4

Lecture (L)	Tutorial (T)	Practical (P)	Credit (C)
4	0	0	4

Internal Assessment: 40
End Term Exam: 60
Duration of Exam; 3 Hrs

Objective:-

- The aim of this course is to ensure that you can achieve an up-to-date level of understanding about various staining procedures for demonstration of different substances & various cytological investigations. This will include special staining procedures & handling testing of various cytological specimens
- Our objective is to provide training in scientific and transferable skills through modular lecture courses, research projects, written work, seminars and supervisions.

S.NO.	CONTENTS	CONTACT HOURS
UNIT-I	**Cryostat sectioning, its applications in diagnostic cytopathology.** **Enzyme Cytochemistry:** Diagnostic applications Demonstration of Phosphates, Dehydrogenases, Oxidases & Peroxidases **Vital staining for Sex Chromatin**	15
UNIT-II	**Aspiration cytology:** Principle Indications & utility of the technique with special emphasis on the role of cytotechnologist in FNAC clinics	15
UNIT-III	Exfoliative cytology (Papanicolaou technique for the staining of	15

	cervical smears) Cervical cytology Fluid cytology Urine CSF Body fluids (Pleural, Pericardial, Ascitic)	
UNIT-IV	**Automation in cytology** **Liquid based cytology: Principles, and preparation, Cytocentrifuge, molecular cytology, Cell block and Immune-cytochemistry**	15

Course Outcomes:

After taking the course, students will be able to:

CO1	**BMLT -3503.1**	Study the basic Histotechnology & Cytopathology analytical procedures as well as to get aware of the recent trends in Histotechnology & Cytopathology.
CO2	**BMLT -3503.2**	Understand about the Laboratory Management and Histotechnology & Cytopathology techniques skills
CO3	**BMLT -3503.3**	Apply the knowledge to understand the the diagnosis of diseases,prognosis and treatment.
CO4	**BMLT -3503.4**	Understand the need, advantages and recent advances of automation in a Histotechnology & Cytopathology laboratory

Suggested readings:

1. Medical laboratory Technology by KL Mukherjee Volume-III
2. An Introduction to Medical Lab Technology by Godkar (Latest Edition),
3. Diagnostic microbiology by Koss Volume –I,
1. An introduction to Medical Lab Technology by Paniker(Latest Edition),

SUBJECT TITLE: VIROLOGY AND MYCOLOGY
SUBJECT CODE: BMLT-3504
SEMESTER: V
CONTACT HOURS/WEEK:

Lecture (L)	Tutorial (T)	Practical (P)	Credit (C)
4	0	0	4

Internal Assessment: 40
End Term Exam: 60
Duration of Exam; 3 Hrs

Objective and outcome of course:

- The aim of this course is to ensure that you can achieve an up-to-date level of understanding ofVirology and mycology and realatedtechniques in proper manner
- Our objective is to provide training in scientific and transferable skills through modular lecturecourses, research projects, written work, seminars and supervisions.

S.NO.	CONTENTS	CONTACTHOURS
UNIT-I	**Introduction to medical mycology-** 1. Moulds, yeasts, and dimorphic fungi 2. Reproduction in fungi 3. Classes offungi 4. Asexual sporulation 5. Classification of fungal infection (mycoses). **Taxonomy and classification and general characteristics of variousmedically important fungi (superficial and systemic). Laboratory techniques in mycology, identification of fungal isolates byspecial techniques.** **Fungal infections** 1. Superficial mycoses 2. Subcutaneous mycoses 3. Systemic mycoses 4. Opportunistic mycoses	15
UNIT-II	**Introduction of virology, general properties of virus** **Structure of viruses, susceptibility to physical and chemical agents,replication of viruses, viral vaccines, bacteriophage**	

UNIT -III	**Classification of viruses-:** 1.viriods 2.prions **DNA VIRUSES(morphology,pathogenicity,lab diagnosis)**	15
	poxviridae,herpesviridae,adenoviridae,papoviridae,hepadnaviridae, parvoviridae RNA VIRUSES Orthomyxoviridae,paramyxoviridae,rhabdoviridae,filoviridae,picornaviridae, caliciviridae, togaviridae, flaviviridae, coronaviridae, arenaviridae, retroviridae, other miscellaneous viruses	
UNIT - IV	**Virus isolation** Culture techniques-chick embryos, laboratory animals, cell culture(primary cell culture, diploid cell culture, continuous cell culture lines), growth media Detection of virus growth in cell culture 1.cytopathic effects, 2.haemadsorption, 3.interference, 4.transformation, 5.fluorescent antibody testing,6.immunoperoxidase, 7.detection of enzymes, 8.electron microscopy	

Course Outcomes:

After taking the course, students will be able to:

CO1	**BMLT -3504.1**	Study the basic virology and mycology analytical procedures as well as to get aware of the recent trends in parasitology.
CO2	**BMLT -3504.2**	Understand about the Laboratory Management and parasitology techniques skills
CO3	**BMLT -3504.3**	Apply the knowledge to understand the the diagnosis of diseases, prognosis and treatment.
CO4	**BMLT -3504.4**	Understanding of proper use and handling of common Laboratory Equipment and Glassware in parasitology lab

Suggested reading:

1.Medical Laboratories Management- Cost effective methods by Sangeeta Sharma, Rachna Agarwal, Sujata Chaturvedi and Rajiv Thakur,

2. An Introduction to Medical Lab Technology by Godkar (Latest Edition), Diagnostic microbiology by Koss Volume –I,

3.An introduction to Medical Lab Technology by Paniker(Latest Edition),

4.Introduction to Medical Lab Technology by Godkar (Latest Edition),

5.Diagnostic microbiology by Koss Volume –I,

6.An introduction to Medical Lab Technology by Paniker(Latest Edition)

SUBJECT TITLE: Environmental science
SUBJECT CODE: BMLT-3505
SEMESTER: V
CONTACT HOURS/WEEK:3

Tutorial	Practical	Credit
3	0	3

Internal Assessment: 40
End Term Exam: 60
Duration of Exam: 3 Hrs

Objective:-

- The aim of this course is to ensure that you can achieve an up to date level of knowledge of environment in general, Natural resources, ecosystems, environment pollution, and social issues related to environment, Human population and the environment and understanding the hospital environment.
- Our objective is to provide training in scientific and transferable skills through modular lecture courses, research projects, written work, seminars and supervisions.

S.NO.	CONTENTS	CONTACTHOURS
UNIT-I	**Introduction:** Definition and scope and importance of multidisciplinary nature of environment. Need for public awareness. **Natural Resources:** Natural Resources and associated problems, use and over exploitation, case studies of forest resources and water resources **Ecosystems:** Concept of Ecosystem, Structure, interrelationship, producers, consumers and decomposers, ecological pyramids biodiversity and importance. Hotspots of biodiversity	15
UNIT-II	**Pollution**: definition, Causes, effects and control measures of air pollution, Water pollution, Soil pollution, Marine pollution, Noise pollution, Thermal pollution, Nuclear hazards Solid waste management: Causes, effects and control measure of urban and industrial wastes. Role of an individual in prevention of pollution. Pollution case studies. Social blemishes and the Environment From Unsustainable to Sustainable development, Urban problems related to energy, Water conservation, rain water harvesting, water shed management Resettlement and rehabilitation	15

	of people; its pros and concerns. Case studies, Environmental ethics: Issues and possible solutions. Climate change, global warming, acid rain, ozone layer depletion, nuclear accidents and holocaust. Case studies, Wasteland reclamation. Consumerism and waste products, Environment Protection Act, Air (Prevention and Control of Pollution) Act. Water (Prevention and control of pollution) Act. Wildlife Protection Act, Forest Conservation Act, Issues involved in enforcement of environmental legislation Public awareness. Human Population and the Environment, Population growth, variation among nations. Population explosion–Family Welfare Programme. Environment and human health, Human Rights, Value Education, HIV/AIDS. Women and child Welfare. Role of Information Technology in Environment and human health. Case studies.	
UNIT -III	**Understanding the Hospital Environment** **Understanding the environment in the following clinical laboratories:** Microbiology Biochemistry Histopathology Haematology	15
UNIT -IV	**Clinical laboratory hazards to the environment from the following and means to prevent:** Infectious material Toxic Chemicals Radioactive Material Other miscellaneous wastes	15

Course Outcomes:

After taking the course, students will be able to:

CO1	**BMLT -3505.1**	Study the intellectual and methodological tools to understand and address the crucial current environmental issues.
CO2	**BMLT -3505.2**	Understand and create environmental ethics and raise people's awareness of the importance of environmental protection and biodiversity
CO3	**BMLT -3505.3**	Apply the knowledge to understand the the impact of individuals, society on significant environmental issues.
CO4	**BMLT -3505.4**	Understanding of proper use of skills and analytical tools needed to face the environmental issues

Suggested readings

1. Aggarwal KC 2001 Environment biology, Nidhi publ, Ltd, Bikaner
2. Jadhav H & Bhosale VM 1995 Environment Protection and laws. Himalya Pub house, Delhi 284.
3. Rao MN, Datta AK 1987 Waste water treatment, oxford & IBH Publ. Co.Pvt.Ltd 345p
4. Daniel D Chiras 2010. Environmental science,Ist Ind edition,Jones and bartlet India pvt ltd.,4262, Ansar road, Daryaganj, New delhi
5. Principle of environment science by Cunninghan WP
6. Essential of environment science by Joseph
7. Environmental pollution control engineering by Rao CS

SUBJECT TITLE: Medical Parasitology
SUBJECT CODE: BMLT-3506
SEMESTER: V
CONTACT HOURS/WEEK:

Lecture	Tutorial	Practical	Credit
0	0	2	1

Internal Assessment: 40
End term; 60
Duration of Exam 3 Hrs

Medical Parasitology
Practical

1. **Routine stool examination for detection of intestinal parasites with concentration methods:**

1.1 Saline preparation

1.2 Iodine preparation

1.3 Floatation method

1.4 Centrifugation method

1.5 Formal ether method

1.6 Zinc sulfate method

2. **Identification of adult adult worms from models/slides:**

2.1 Tape worm

2.2 Tapeworm segments

2.3 Ascaris

2.4 Hookworms

2.5 Pinworms

3. Malarial parasites:

3.1 Preparation of thin and thick smears

3.2 Staining of smears

3.3 Examination of smears for malarial parasites (P.vivax and P.falciparum)

Course Outcomes:

After taking the course, students will be able to:

CO1	**BMLT -3506.1**	Study the basic virology and mycology analytical procedures as well as to get aware of the recent trends in parasitology.
CO2	**BMLT -3506.2**	Understand about the Laboratory Management of parasitology techniques skills
CO3	**BMLT -3506.3**	Apply the knowledge to understand the the diagnosis of diseases, prognosis and treatment.
CO4	**BMLT -3506.4**	Understanding of proper use and handling of common Laboratory Equipment and Glassware in parasitology lab

SUBJECT TITLE: Analytical Clinical Bio-Chemistry
SUBJECT CODE: BMLT-3507
SEMESTER: V
CONTACT HOURS/WEEKS:4

Lecture	Tutorial	Practical	Credit
0	0	2	1

Internal Assessment : 40
End term:60
Duration of Exam: 3 Hrs

BMLT-3506: Applied Clinical Bio-Chemistry-II-Practical

1. Estimation of Glucose tolerance test (GTT).

2. Estimation of Insulin Tolerance Test (ITT).

3. Determination of Uric acid in Urine.

4. Determination of Creatinine Clearance

5. Determination of Urea Clearance

6. Determination of Serum acid phosphate.

7. Determination of Serum Alkaline phosphatase.

8. Determination of Serum Lactate Dehydrogenase.

9. Determination of T3, T4 and TSH.

Course Outcomes:

After taking the course, students will be able to:

CO1	**BMLT -3507.1**	Study the basic biochemical analytical procedures as well as to get aware of the recent trends in clinical biochemistry.
CO2	**BMLT -3507.2**	Understand the routine biochemical investigations like blood sugar, renal function tests, Liver function tests
CO3	**BMLT -3507.3**	Understanding the basic requirements for the biochemical investigations including different biological specimens, their collection and processing of biochemical estimations and have brief knowledge of preparation of solutions and different types of assays
CO4	**BMLT -3507.4**	Understanding of proper use and handling of common Laboratory Equipment and Glassware in biochemistry lab

Suggested Reading

1. An introduction to Medical Laboratory Technology by FJ Baker and Silverton
2. Bancroft theory and practice of Histopathological techniques by John D Bancroft
3. Diagnostic cytology by Koss volume-II

SUBJECT TITLE: Cytopathology
SUBJECT CODE: BMLT-3508
SEMESTER: V
CONTACT HOURS/WEEK:

Lecture	Tutorial	Practical	Credit
0	0	2	1

Internal Assessment : 40
End term;60
Duration of Exam; 3 Hrs

BMLT-3508: Histotechnology & Cytopathology – Practical

1. To perform the staining procedure for the identification of reticulin fibers.
2. To perform the staining procedure for the identification of carbohydrates.
3. To perform the staining procedure for the identification of lipids.
4. To perform the staining procedure for the identification of micro-organisms.
5. To perform the staining procedure for the identification of enzymes.
6. 6 To perform PAP stain for cervical smear.
8. To perform staining for demonstration sex chromatin (Barr bodies on a buccal smear)
9. To perform Shorr's staining for Hormonal assessment
10. To prepare the fixative and mounting medium that is used in museum.

Course Outcomes:

After taking the course, students will be able to:

CO1	**BMLT -3508.1**	Study the basic Histotechnology & Cytopathology analytical procedures as well as to get aware of the recent trends in Histotechnology & Cytopathology Lab.
CO2	**BMLT -3508.2**	Understand the routine staining procedure like identification of carbohydrates lipids, enzymes, micro-organisms.
CO3	**BMLT -3508.3**	Understanding the basic requirements for the Histotechnological & Cytopathological investigations including different biological specimens, their collection and processing of Histotechnological & Cytopathological estimations and have brief knowledge of preparation of solutions and different types of assays
CO4	**BMLT -3508.4**	Understanding of proper use and handling of common Laboratory Equipment and Glassware used in Histotechnology & Cytopathology lab

SUBJECT TITLE: VIROLOGY AND MYCOLOGY practical

SUBJECT CODE: BMLT-3509

SEMESTER: V

CONTACT HOURS/WEEK: 4

Lecture (L)	Tutorial (T)	Practical (P)	Credit (C)
0	0	2	1

Duration of Exam; 3 Hrs

1. To perform for the test the KOH preparation diagnosis of fungal infection.
2. To perform the India ink preparation for the detection of fungal infection.
3. To perform the lactophenol cotton blue stain for the detection of fungal infection.
4. To prepare the SDA media
5. Cultivation of fungal sample on the SDA media.
6. To demonstrate the technique for the cultivation of virus in the chick embryo.
7. To demonstrate the technique used for the cultivation of virus by cell culture method.

Course Outcomes:

After taking the course, students will be able to:

CO1	**BMLT -3509.1**	Study the basic Histotechnology & Cytopathology analytical procedures as well as to get aware of the recent trends in Histotechnology & Cytopathology Lab.
CO2	**BMLT -3509.2**	Understand the routine staining procedure like identification of carbohydrates lipids, enzymes, micro-organisms.
CO3	**BMLT -3509.3**	Understanding the basic requirements for the Histotechnological & Cytopathological investigations including different biological specimens, their collection and processing of Histotechnological & Cytopathological estimations and have brief knowledge of preparation of solutions and different types of assays
CO4	**BMLT -3509.4**	Understanding of proper use and handling of common Laboratory Equipment and Glassware used in Histotechnology & Cytopathology lab

SEMESTER-VI

BACHELOR IN MEDICAL LABORATORY TECHNOLOGY (BMLT)
SIXTH SEMESTER (INTERNSHIP)

6.1 PROJECT BASED PROFESSIONAL TRAINING-I

OBJECTIVE

The objective of providing professional training is to:

I. Create confidence in the students to work in world of work by developing practical skills pertaining to laboratory management and diagnostic skills in the field of clinical haematology, transfusion medicine blood banking, clinical biochemistry, clinical microbiology, histopathology and cytology and ensuring laboratory safety and quality assurance.

2.Create necessary awareness regarding use of various types of diagnostic equipment particularly sophisticated ones which are used in the field of medical laboratory technology.

3.Develop appreciation regarding size and scale of operations, environment and other related aspects she value of team work, interpersonal relations and professional ethics in the field of medical laboratory technology.

4.Develop necessary traits for starting small clinical laboratories as per requirements.

	Subject	Contact Hours/Week			Credit	Evaluation Scheme (% of Total Marks)					Exam Duration (Hours)
Code	Title	L	T	P		CWA	LWA	MTE	ETE	TOTAL	
BMLT-3601	Clinical Hematology		30		4		100		100	200	
BMLT-3602	Clinical Microbiology		30		4		100		100	200	
BMLT-3603	Clinical Bio-Chemistry		30		4		100		100	200	
BMLT-3604	Blood Bank & Transfusion Medicine		30		4		100		100	200	
BMLT-3605	Histotechnology & Cytology		30		4		100		100	200	
	Total				20					1000	

SELECTION OF TRAINING PLACES

The institute offering B.Sc. programme in Medical Laboratory Technology should establish contact/rapport by personal visit to following types of organizations:
I. Medical Colleges/Research institutions
2. Civil Hospitals at District Headquarters having well equipped laboratory

BACHELOR IN MEDICAL LABORATORY TECHNOLOGY (BMLT) SIXTH SEMESTER (INTERNSHIP)

3. Hospitals in private sector
4. Well established clinical laboratories being run by a qualified person.

Course Outcomes:

After taking the course, students will be able to:

CO1	**BMLT -3601.1**	Study about the various biological laboratory tests principles and procedures
CO2	**BMLT -3601.2**	How to report the diagnosis test and how to relate these reports with diseases process
CO3	**BMLT -3601.3**	Do further education to upgrade their knowledge and to be in professional competence
CO4	**BMLT -3601.4**	Learn about the laboratory safety, infections borne from body fluids, hazardous chemical, universal precaution to protect society and lab workers along with patients from infection and how to dispose biomedical waste

METHODOLOGY OF ORGANIZING PROFESSIONAL TRAINING

Each concerned teacher will be responsible for a group of students in respective specialty to plan, supervise and monitor the progress when placed in different organizations Co Practical training. For this purpose, necessary recurring expenditure for making payment of TA/DA to the faculty of institute and the experts may be worked out by respective Institutes, keeping in view, number of visits and the distances involved in such travelling. The concerned teacher will have to continuously interact with training centers to monitor the progress of the students

GENERAL GUIDELINES

(i) The students are expected to prepare practical record book as per given list of the Experiments. Besides, they can also add other experiments as well.
(ii) External examiner along with internal faculty should evaluate the student's Performance through viva voice/spotting/performance and synopsis.