

# **KURUKSHETRA UNIVERSITY KURUKSHETRA**

## **Scheme of Examination and Syllabus for Under-Graduate Programme**

**Course: Bachelor of Vocation in  
Medical Laboratory Technology**

**Under Multiple Entry-Exit, Internship and  
CBCS-LOCF in accordance to NEP-2020  
w.e.f. 2023-24 (in phased manner)**

**KURUKSHETRA UNIVERSITY, KURUKSHETRA**  
**Scheme of Examination for Under-Graduate Programme**  
**Under Multiple Entry-Exit, Internship and CBCS-LOCF in accordance to NEP-2020**  
**w.e.f. 2023-24 (in phased manner),**

**Course: Bachelor of Vocation in Medical Laboratory Technology**

**(First Year)**

Remarks	Course	Paper(s)	Nomenclature of Paper	Credits	Hours/ Week	Internal marks	External Marks	Total Marks	Exam Duration	
<b>FIRST YEAR: SEMESTER-1</b>										
<b>Scheme D</b>	<b>CC-A1 4 credit</b>	B23-MLT- 101	Biochemistry I	3	3	20	50	70	3 hrs.	
			Practical	1	2	10	20	30	4 hrs.	
	<b>CC-B1 4 credit</b>	B23-MLT-102	Microbiology I	3	3	20	50	70	3 hrs.	
			Practical	1	2	10	20	30	4 hrs.	
	<b>CC-C1 4 credit</b>	B23-MLT-103	Pathology I	3	3	20	50	70	3 hrs.	
			Practical	1	2	10	20	30	4 hrs.	
	<b>CC-M1 2 credit</b>	From Available CC-M1 of 2 credits as per NEP								
	<b>MDC 1 3 Credit</b>	From Available MDC 1 of 3 credits as per NEP								
	<b>AEC-1 2 credit</b>	From Available AEC-1 of 2 credits as per NEP								
	<b>SEC-1 3 credit</b>	From Available SEC-1 of 3 credits as per NEP								
<b>VAC-1 2 credit</b>	From Available VAC-1 of 2 credits as per NEP									
<b>FIRST YEAR: SEMESTER-2</b>										
<b>Scheme D</b>	<b>CC-A2 4 credit</b>	B23- MLT-201	Biochemistry II	3	3	20	50	70	3 hrs.	
			Practical	1	2	10	20	30	4 hrs.	
	<b>CC-B2 4 credit</b>	B23-MLT-202	Microbiology II	3	3	20	50	70	3 hrs.	
			Practical	1	2	10	20	30	4 hrs.	
	<b>CC-C2 4 credit</b>	B23-MLT-203	Pathology II	3	3	20	50	70	3 hrs.	
			Practical	1	2	10	20	30	4 hrs.	
	<b>CC-M2 2 credit</b>	From Available CC-M2 of 2 credits as per NEP								
	<b>MDC 2 3 Credit</b>	From Available MDC-2 of 3 credits as per NEP								
	<b>AEC-2 2 credit</b>	From Available AEC-2 of 2 credits as per NEP								
	<b>SEC-2 3 credit</b>	From Available SEC-2 of 3 credits as per NEP								
<b>VAC-2 2 credit</b>	From Available VAC-2 of 2 credits as per NEP									
<b>Internship of 4 credits of 4-6 weeks duration after 2<sup>nd</sup> Semester</b>										

**(Second Year)**

Remarks	Course	Paper(s)	Nomenclature of Paper	Credits	Hours/Week	Internal marks	External Marks	Total Marks	Exam Duration	
<b>SECOND YEAR: SEMESTER-3</b>										
<b>Scheme D</b>	<b>CC-A3 4 credit</b>	B23- MLT-301	Biochemistry III	3	3	20	50	70	3 hrs.	
			Practical	1	2	10	20	30	4 hrs.	
	<b>CC-B3 4 credit</b>	B23-MLT-302	Microbiology III	3	3	20	50	70	3 hrs.	
			Practical	1	2	10	20	30	4 hrs.	
	<b>CC-C3 4 credit</b>	B23-MLT-303	Pathology III	3	3	20	50	70	3 hrs.	
			Practical	1	2	10	20	30	4 hrs.	
	<b>CC-M3 4 credits</b>	From Available CC-M3 of 4 credits as per NEP								
	<b>MDC 3 3 Credit</b>	From Available MDC 3 of 3 credits as per NEP								
	<b>AEC-3 2 credit</b>	From Available AEC-3 of 2 credits as per NEP								
	<b>SEC-3 3 credit</b>	From Available SEC-3 of 3 credits as per NEP								
<b>SECOND YEAR : SEMESTER-4</b>										
<b>Scheme D</b>	<b>CC-A4 4 credit</b>	B23- MLT-401	Biochemistry IV	3	3	20	50	70	3 hrs.	
			Practical	1	2	10	20	30	4 hrs.	
	<b>CC-B4 4 credit</b>	B23-MLT-402	Microbiology IV	3	3	20	50	70	3 hrs.	
			Practical	1	2	10	20	30	4 hrs.	
	<b>CC-C4 4 credit</b>	B23-MLT-403	Pathology IV	3	3	20	50	70	3 hrs.	
			Practical	1	2	10	20	30	4 hrs.	
	<b>CC-M4 (V) 4 credits</b>	From Available CC-M4(V) of 4 credits as per NEP								
	<b>AEC-4 2 credit</b>	From Available AEC-4 of 2 credits as per NEP								
	<b>VAC-3 2 credits</b>	From Available VAC-3 of 2 credits as per NEP								
	<b>Internship of 4 credits of 4-6 weeks duration after 4th Semester (if not done after second semester)</b>									

**(Third Year)**

Remarks	Course	Paper(s)	Nomenclature of Paper	Credits	Hours/Week	Internal marks	External Marks	Total Marks	Exam Duration
<b>THIRD YEAR: SEMESTER-5</b>									
<b>Scheme D</b>	<b>CC-A5 4 credit</b>	B23- MLT-501	Biochemistry V	3	3	20	50	70	3 hrs.
			Practical	1	2	10	20	30	4 hrs.
	<b>CC-B5 4 credit</b>	B23-MLT-502	Microbiology V	3	3	20	50	70	3 hrs.
			Practical	1	2	10	20	30	4 hrs.
	<b>CC-C5 4 credit</b>	B23-MLT-503	Pathology V	3	3	20	50	70	3 hrs.
			Practical	1	2	10	20	30	4 hrs.
<b>CC-M5 (V) 4 credits</b>	From Available CC-M5(V) of 4 credits as per NEP								
<b>Internship 4 credits</b>	Internship#4 credit after 4th semester								
<b>THIRD YEAR : SEMESTER-6</b>									
<b>Scheme D</b>	<b>CC-A6 4 credit</b>	B23- MLT-601	Biochemistry VI	3	3	20	50	70	3 hrs.
			Practical	1	2	10	20	30	4 hrs.
	<b>CC-B6 4 credit</b>	B23-MLT-602	Microbiology VI	3	3	20	50	70	3 hrs.
			Practical	1	2	10	20	30	4 hrs.
	<b>CC-C6 4 credit</b>	B23-MLT-603	Pathology VI	3	3	20	50	70	3 hrs.
			Practical	1	2	10	20	30	4 hrs.
<b>CC-M6 4 credits</b>	From Available CC-M6 of 4 credits as per NEP								
<b>CC-M7(V) 4 credits</b>	From Available CC-M7(V) of 4 credits as per NEP								

**(Fourth Year)**

Remarks	Course	Paper(s)	Nomenclature of Paper	Credits	Hours/Week	Internal Marks	External Marks	Total Marks	Exam Duration
<b>FORTH YEAR: SEMESTER-7 (FOR HONOURS/HONOURS WITH RESEARCH IN Bachelor of Vocation in Medical Laboratory Technology)</b>									
<b>For Honours in Bachelor of Vocation in Medical Laboratory Technology /Honours with Research Bachelor of Vocation in Medical Laboratory Technology</b>	<b>CC-H1 4 credit</b>	B23-MLT-701	Hematology I	4	4	30	70	100	3 hrs.
	<b>CC-H2 4 credit</b>	B23-MLT-702	Hematology II	4	4	30	70	100	3 hrs.
	<b>CC-H3 4 credit</b>	B23-MLT-703	Hematology III	4	4	30	70	100	3 hrs.
	<b>DSE-H1 4 credit Select one Option</b>	B23-MLT-704	Microbial Pathogenesis	4	4	30	70	100	3 hrs.
		B23-MLT-705	Advances in Microbiology	4	4	30	70	100	3 hrs.
	<b>PC-H1 4 credit</b>	B23-MLT-706	Practical Based on B23-MLT-701 to 704/705	4	8	30	70	100	6 hrs.
	<b>CC-HM1 4 credit</b>	From Available Minor of 4 credits as per NEP							
<b>SEMESTER-8 (FOR HONOURS IN Bachelor of Vocation in Medical Laboratory Technology)</b>									
<b>For Honours in Bachelor of Vocation in Medical Laboratory Technology</b>	<b>CC-H4 4 credit</b>	B23-MLT-801	Hematology IV	4	4	30	70	100	3 hrs.
	<b>CC-H5 4 credit</b>	B23-MLT-802	Hematology V	4	4	30	70	100	3 hrs.
	<b>CC-H6 4 credit</b>	B23-MLT-803	Hematology VI	4	4	30	70	100	3 hrs.
	<b>DSE-H2 4 credit Select one option</b>	B23-MLT-804	Genetic Engineering	4	4	30	70	100	3 hrs.
		B23-MLT-805	Vaccine Production Technology	4	4	30	70	100	3 hrs.
	<b>PC-H2 4 credit</b>	B23-MLT-806	Practical Based on B23-MLT-801 to 804/805	4	8	30	70	100	6 hrs.
	<b>CC-HM2 4 credit</b>	From Available Minor of 4 credits as per NEP							
<b>OR SEMESTER-8 (FOR HONOURS WITH RESEARCH IN Bachelor of Vocation in Medical Laboratory Technology)</b>									
<b>For Honours with Research Bachelor of Vocation in Medical Laboratory Technology</b>	<b>CC-H4 4 credit</b>	B23-MLT-801	Hematology IV	4	4	30	70	100	3 hrs.
	<b>CC-H5 4 credit</b>	B23-MLT-802	Hematology V	4	4	30	70	100	3 hrs.
	<b>Project / Dissertation 12 credit</b>	B23-MLT-806	Project / Dissertation	8+4	-	-	-	-	-
	<b>CC-HM2 4 credit</b>	From Available Minor of 4 credits as per NEP							

**Programme Learning Outcomes (PLOs) for UG courses Bachelor of Vocation in Medical Laboratory Technology**

1. To develop critical thinking and problem solving.
2. To operate and maintain laboratory equipment, utilizing appropriate quality control and safety protocol.
3. To understand rigorous specimen handling protocols, prepare samples for analysis.
4. To make aware the students about human physiology and immunology.
5. To highlight the role of medical lab technician in the diagnosis of the disease.
6. To effect a transition of information and experiences learned in the MLT program to employment situations.

**CC-A1**

<b>Session: 2023-24</b>			
<b>Part A - Introduction</b>			
Subject	Bachelor of Vocation in Medical Laboratory Technology		
Semester	I		
Name of the Course	Biochemistry – 1		
Course Code	B23-MLT-101		
Course Type:	CC		
Level of the course (As per Annexure-I)	<b>100-199</b>		
Pre-requisite for the course (if any)	---		
Course Learning Outcomes(CLO):	After completing this course, the learner will be able to: 1. Demonstrate the knowledge of structure, function and inter-relationship of bio molecules. 2. Understand the integration of various aspects of metabolism and their regulatory pathways. 3. Know about the apparatus and reagents used in analytical and diagnostic section of biochemistry. 4. Teach about the concept of quality control.		
CLO5 is based on practical component	5*. Gain knowledge of handling of sophisticated instruments for performing various tests.		
Credits	Theory	Practical	Total
	03	01	04
Contact Hours	03	02	05
<b>Max. Marks: 100</b> <b>Internal Assessment Marks: 30 (Theory 20 + Practical 10)</b> <b>End Term Exam Marks: 70 (Theory 50 + Practical 20)</b>		<b>Exam duration:</b> <b>Theory: 3 Hours</b> <b>Practical: 4 hours</b>	
<b>Part B- Contents of the Course</b>			
<b><u>Instructions for Paper- Setter:</u></b> Nine questions will be set in all. Question No.1 comprising of objective/short answer type questions from the entire syllabus, will be compulsory. The remaining eight questions will be set taking two questions from each unit. The candidates will be required to attempt Q.No.1 & four others selecting one question from each unit. All questions carry equal marks.			
Unit	Topics		Contact Hours

I	Introduction to Medical Lab Technology, Role of Medical Laboratory technologists-ethics, responsibility, safety measures and hazards in clinical biochemistry, first aid (accidents). Units of measurements, S.I. Units, measurement of volume, various volumetric apparatus (cylinders, flasks, pipettes), calibration of volumetric apparatus.	3 hours/ week
II	Cleaning and caring of general laboratory glassware and equipment, preparation and storage of distilled water, preparation of reagents and standard solutions, storage of chemicals and reagents, use of analytical balance, dry and moist heat radiation, filtration, autoclaving and chemical disinfection for sterilization.	
III	Introduction, aim and scope of Biochemistry. Elementary knowledge of inorganic chemistry :- atomic weight, molecular weight, equivalent weight, acid, bases. Elementary knowledge of organic chemistry : (a) Organic compounds (b) Aliphatic and aromatic compounds (c) Alcohols, Aldehydes, Ketones, Amines, Esters, Phenol etc.	
IV	Viscosity - principles and applications; sedimentation - principles and applications; Radio-isotopes and their use in Biochemistry, mole, molar, molal and normal solutions, pH measurement, buffer solutions, percent solutions, osmosis, dialysis, surface tension.	
V*	<p style="text-align: center;"><b>PRACTICAL</b></p> <ol style="list-style-type: none"> <li>1. Organization of clinical laboratories <ol style="list-style-type: none"> <li>(a) Organizational Structure</li> <li>(b) Functional Components</li> </ol> </li> <li>2. Study of laboratory ethics and responsibility of its workers.</li> <li>3. Biohazards and Safety precautions.</li> <li>4. First aid-knowledge of first aid procedures.</li> <li>5. The calibration of volumetric apparatus</li> <li>6. Study of cleaning and sterilization of glassware &amp; equipments.</li> <li>7. Preparation of normal, molar, molal and percent solutions.</li> <li>8. Preparation of buffer solutions and determination of their pH.</li> <li>9. The determination of pH using indicators.</li> <li>10. The detection of changes in the confirmation of bovine serum albumin by viscosity measurements.</li> <li>11. The effect of pH on the conformation of bovine serum albumin.</li> <li>12. To study the phenomenon of osmosis.</li> <li>13. To study the phenomenon of dialysis.</li> </ol>	2 hours / week
<b>Suggested Evaluation Methods</b>		

<p style="text-align: center;"><b>Internal Assessment:</b></p> <p>➤ <b>Theory</b></p> <ul style="list-style-type: none"> <li>• Class Participation: 5</li> <li>• Seminar/presentation/assignment/quiz/class test etc.: 5</li> <li>• Mid-Term Exam: 10</li> </ul> <p>➤ <b>Practicum</b></p> <ul style="list-style-type: none"> <li>• Class Participation: NA</li> <li>• Seminar/Demonstration/Viva-voce/Lab records etc.: 10</li> <li>• Mid-Term Exam: NA</li> </ul>	<p style="text-align: center;"><b>End Term Examination:</b></p> <p style="text-align: center;"><b>Theory: 50</b> (Written exam)</p> <p style="text-align: center;"><b>Practical: 20</b> (Seminar/Demonstration/Viva-voce/Lab records etc)</p>
<b>Part C-Learning Resources</b>	
<p><b>Recommended Books/e-resources/LMS:</b></p> <ol style="list-style-type: none"> <li>1. Medical Laboratory Technology (Volume 3): Procedure Manual for Routine Diagnostic, Kanai Mukharjee</li> <li>2. Essentials of Biochemistry, Second Edition, Dr.( Prof) Satyanarayana</li> <li>3. Essentials of Biochemistry, 2nd Edition, Dr. PankajaNaik</li> <li>4. Principles and Techniques of Biochemistry and Molecular Biology, 5Th Edition, Wilson &amp; Walker</li> </ol>	

<b>PLO CLO Mapping of B23-MLT-101</b>						
	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6
CLO1	1.5	1.0	1.0	1.5	0.5	0
CLO2	1.5	1.0	1.0	2.0	1.0	0
CLO3	2.0	2.0	2.0	1.5	1.5	0
CLO4	2.0	2.0	2.0	0	1.0	0
CLO5	2.0	2.0	0.5	0	0	0

**CC-B1**

<b>Session: 2023-24</b>			
<b>Part A - Introduction</b>			
Subject	Bachelor of Vocation in Medical Laboratory Technology		
Semester	I		
Name of the Course	Microbiology – 1		
Course Code	B23-MLT-102		
Course Type:	CC		
Level of the course (As per Annexure-I)	<b>100-199</b>		
Pre-requisite for the course (if any)	---		
Course Outcomes(CLO):	Learning	After completing this course, the learner will be able to: 1. To know the basics of microbiology and knowledge about the contributions of microbiologists. 2. Identify the microorganisms and the disease process as well as aseptic and sterile techniques. 3. Impart general insight into the history, bacterial genetics and serology. 4. Provide knowledge about the equipment used in microbiology and safety precautions.  5*. Handle the instruments and know about the sterilization techniques.	
CLO5 is based on practical component			
Credits	Theory	Practical	Total
	03	01	04
Contact Hours	03	02	05
<b>Max. Marks: 100</b> <b>Internal Assessment Marks: 30 (Theory 20 + Practical 10)</b> <b>End Term Exam Marks: 70 (Theory 50 + Practical 20)</b>		<b>Exam duration:</b> <b>Theory: 3 Hours</b> <b>Practical: 4 hours</b>	
<b>Part B- Contents of the Course</b>			
<b><u>Instructions for Paper- Setter:</u></b> Nine questions will be set in all. Question No.1 comprising of objective/short answer type questions from the entire syllabus, will be compulsory. The remaining eight questions will be set taking two questions from each unit. The candidates will be required to attempt Q.No.1 & four others selecting one question from each unit. All questions carry equal marks.			

Unit	Topics	Contact Hours
I	<p><b>Basic principles and usage of Instruments:</b>            General Instruments : Distillation plant, Centrifuge machine, Analytical Balance, Hotplate, Magnetic Stirrer, Water Bath, Automatic dispenser and diluters, Deionizer.            Microbiological Instruments : pH-meter, Autoclave, Incubator, Hot air oven, Laminar Air flow, Colony counter, Muffle furnace, Refrigerator, Inoculator, Mc Intosh and Flides anaerobic jar.</p>	3 hours / week
II	<p><b>Microscopy and Micrometry:</b>            Microscopy: Study of compound microscope-magnification, numerical aperture, resolution and components of microscope. Dark ground illumination, care of microscope and common difficulties. Study of phase contrast, interference, fluorescent, polarising and electron microscope. Calibration of ocular micrometer and measurement of microorganisms.</p>	
III	<p><b>Microbiology &amp; Medicine:</b> Introduction to Medical Microbiology, Discovery of microorganisms. Contribution of Robert Koch, Antonie Van Leeuwenhoek, Louis Pasteur, Bordet, Paul Ehrlich, Alexander Flemming, Elie Metchnikoff, Needham, Tyndall Janssen, Joseph Lister, Karl Landsteiner etc. Scope &amp; relevance and safety measures of Medical Microbiology. Role of medical microbiology in identification and management of various infectious diseases.</p>	
IV	<p><b>Sterilization and Disinfection :</b> Definition, mode of action and uses of various physical methods of sterilization - heat, UV radiation, ionizing radiation, character affecting sterilization, autoclave control and sterilization indicators. Chemical disinfectants - phenol and its compounds, alcohol, halogen, heavy metals and quaternary ammonium compounds, aldehyde, gaseous compounds. Use and abuse of disinfectants. Disinfectants, antiseptics, chemotherapeutic agents, chemotherapeutic index, development of chemotherapy, antibiotics and effect of antibiotics on protein and nucleic acid synthesis and cytoplasmic membrane. Future development of chemotherapy.</p>	
V*	<p style="text-align: center;"><b>PRACTICALS</b></p> <ol style="list-style-type: none"> <li>1. Role of Microbiology Laboratory</li> <li>2. Basic rules for specimen collection and handling, transportation of specimen and safety regulations.</li> <li>3. Laboratory Procedures in Microbiology :             <ol style="list-style-type: none"> <li>(a) Disinfection and sterilization</li> <li>(b) Laboratory culture</li> </ol> </li> <li>4. Study of Principle and Working of :             <ol style="list-style-type: none"> <li>(a) Microscopes (all types)</li> <li>(b) Distillation apparatus</li> <li>(c) Centrifuge</li> <li>(d) Balance</li> <li>(e) De-ionizer</li> <li>(f) pH meter</li> <li>(g) Autoclave</li> <li>(h) Incubator</li> <li>(i) Oven</li> </ol> </li> </ol>	2 hours/ week

	(j) Colony Counter (k) Muffle Furnace (l) Refrigerator	
<b>Suggested Evaluation Methods</b>		
<p style="text-align: center;"><b>Internal Assessment:</b></p> <p>➤ <b>Theory</b></p> <ul style="list-style-type: none"> <li>• Class Participation: 5</li> <li>• Seminar/presentation/assignment/quiz/class test etc.: 5</li> <li>• Mid-Term Exam: 10</li> </ul> <p>➤ <b>Practicum</b></p> <ul style="list-style-type: none"> <li>• Class Participation: NA</li> <li>• Seminar/Demonstration/Viva-voce/Lab records etc.: 10</li> <li>• Mid-Term Exam: NA</li> </ul>		<p><b>End Term Examination:</b></p> <p><b>Theory: 50</b> (Written exam)</p> <p><b>Practical: 20</b> (Seminar/Demonstration/Viva-voce/Lab records etc)</p>
<b>Part C-Learning Resources</b>		
<b>Recommended Books/e-resources/LMS:</b>		
<ol style="list-style-type: none"> <li>1. Text Book of Microbiology for Nursing Students, AnantNarayan Panikar</li> <li>2. Text Book of Ophthalmology, Khurana</li> <li>3. Text Book of Microbiology, Baveja.</li> </ol>		

<b>PLO CLO Mapping of B23-MLT-102</b>						
	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6
CLO1	0.2	0.2	0	0.5	0.5	0
CLO2	1.5	0	1.0	1.0	1.5	0.5
CLO3	0.4	0.2	0.5	1.5	0.5	0.5
CLO4	1.0	0.2	0.5	0	1.0	1.5
CLO5	1.5	2.0	2.0	0	1.5	1.5

**CC-C1**

<b>Session: 2023-24</b>			
<b>Part A - Introduction</b>			
Subject	Bachelor of Vocation in Medical Laboratory Technology		
Semester	I		
Name of the Course	Pathology – 1		
Course Code	B23-MLT-103		
Course Type:	CC		
Level of the course (As per Annexure-I)	<b>100-199</b>		
Pre-requisite for the course (if any)	---		
Course Learning Outcomes(CLO):	After completing this course, the learner will be able to:		
CLO5 is based on practical component	<ol style="list-style-type: none"><li>1. Learn about histopathology, classification of tissues and their functions.</li><li>2. Impart awareness about recording of specimens and maintaining records.</li><li>3. Gain knowledge about the morphology and anatomy of human body.</li><li>4. Use of various equipments for histology.</li></ol> <hr/> <p>5*. Study of laboratory organization related to histology and cytology.</p>		
Credits	Theory	Practical	Total
	03	01	04
Contact Hours	03	02	05
<b>Max. Marks: 100</b> <b>Internal Assessment Marks: 30 (Theory 20 + Practical 10)</b> <b>End Term Exam Marks: 70 (Theory 50 + Practical 20)</b>		<b>Exam duration:</b> <b>Theory: 3 Hours</b> <b>Practical: 4 hours</b>	
<b>Part B- Contents of the Course</b>			
<b><u>Instructions for Paper- Setter:</u></b> Nine questions will be set in all. Question No.1 comprising of objective/short answer type questions from the entire syllabus, will be compulsory. The remaining eight questions will be set taking two questions from each unit. The candidates will be required to attempt Q.No.1 & four others selecting one question from each unit. All questions carry equal marks.			
Unit	Topics		Contact Hours

I	Introduction to histopathology and laboratory organization, Introduction to anatomical terms and organization of human body. Tissues - Definitions, types, classification, location and functions.  Management and planning, receiving and recording of specimens, indexing, maintaining records, knowledge of maintenance and use of various equipments	3 hours/ week
II	<b>Study of:</b> Skeletal system, bones, joints and muscles. Respiratory system. Cardiovascular system. Alimentary system mechanism and physiology of digestion and absorption.	
III	<b>Study of:</b> <b>Liver</b> structure and function. Urinary system. Male genital system. Female genital system.	
IV	<b>Study of:</b> Nervous system. Spleen, lymph node and R.E. system. Endocrine glands and their functions.	
V*	<b>PRACTICALS</b>  <ul style="list-style-type: none"> <li>• Study of laboratory organization related to histology and cytology - basic terminologies and specimen handling.</li> <li>• Use and care of equipments, laboratory supplies and management.</li> <li>• Study of tissues.</li> <li>• Study of all the systems with the help of model/charts.</li> <li>• Study of bones.</li> </ul>	2 hours/ week
<b>Suggested Evaluation Methods</b>		
<p style="text-align: center;"><b>Internal Assessment:</b></p> <p>➤ <b>Theory</b></p> <ul style="list-style-type: none"> <li>• Class Participation: 5</li> <li>• Seminar/presentation/assignment/quiz/class test etc.: 5</li> <li>• Mid-Term Exam: 10</li> </ul> <p>➤ <b>Practicum</b></p> <ul style="list-style-type: none"> <li>• Class Participation: NA</li> <li>• Seminar/Demonstration/Viva-voce/Lab records etc.: 10</li> <li>• Mid-Term Exam: NA</li> </ul>		<p style="text-align: center;"><b>End Term Examination:</b></p> <p style="text-align: center;"><b>Theory: 50</b> (Written exam) <b>Practical: 20</b> (Seminar/Demonstration/Viva-voce/Lab records etc)</p>
<b>Part C-Learning Resources</b>		
<b>Recommended Books/e-resources/LMS:</b>		
<ol style="list-style-type: none"> <li>1. Textbook of Medical Laboratory Technology, Volume 1, 3<sup>rd</sup> Edition by Praful Ghodkar</li> <li>2. Textbook of Medical Laboratory Technology, Volume 2, 3<sup>rd</sup> Edition by Praful Ghodkar</li> <li>3. Medical Laboratory Technology (Volume 1): Procedure Manual for Routine Diagnostic, Kanai Mukharjee</li> </ol>		

4. Medical Laboratory Technology (Volume 2): Procedure Manual for Routine Diagnostic, Kanai Mukharjee
5. Medical Laboratory Technology (Volume 3): Procedure Manual for Routine Diagnostic, Kanai Mukharjee

**PLO CLO Mapping of B23-MLT-103**

	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6
CLO1	0	1.0	1.0	1.5	1.0	0.5
CLO2	1.0	1.0	3.0	0.3	1.5	0.5
CLO3	0.5	1.5	1.0	1.5	1.5	1.5
CLO4	1.0	2.0	1.0	0	1.5	1.5
CLO5	1.5	2.5	1.5	0	1.5	1.5

CC-A2

<b>Session: 2023-24</b>			
<b>Part A – Introduction</b>			
Subject	Bachelor of Vocation in Medical Laboratory Technology		
Semester	II		
Name of the Course	Biochemistry – II		
Course Code	B23-MLT-201		
Course Type:	CC		
Level of the course (As per Annexure-I)	<b>100-199</b>		
Pre-requisite for the course (if any)	---		
Course Learning Outcomes(CLO):	After completing this course, the learner will be able to: Provide a good theoretical and practical education in understanding importance of water. Understand the organization of a clinical laboratory including lab information system, autoanalyzers in laboratory for qualitative analysis. Introduce various body fluids with their biochemical composition and regulatory mechanism in blood pH. To provide knowledge about various body fluids with their importance in diagnosis of different diseases.		
CLO5 is based on practical component	* Provide skills for accurate results as well as calibrate different laboratory instruments.		
Credits	Theory	Practical	Total
	03	01	04
Contact Hours	03	02	05
<b>Max. Marks: 100</b> <b>Internal Assessment Marks: 30 (Theory 20 + Practical 10)</b> <b>End Term Exam Marks: 70 (Theory 50 + Practical 20)</b>		<b>Exam duration:</b> <b>Theory: 3 Hours</b> <b>Practical: 4 hours</b>	
<b>Part B- Contents of the Course</b>			
<b><u>Instructions for Paper- Setter:</u></b> Nine questions will be set in all. Question No.1 comprising of objective/short answer type questions from the entire syllabus, will be compulsory. The remaining eight questions will be set taking two questions from each unit. The candidates will be required to attempt Q.No.1 & four others selecting one question from each unit. All questions carry equal marks.			

Unit	Topics	Contact Hours
I	<b>Water</b> : Structure of water, solvents, properties of water, importance of water : <b>Carbohydrates</b> : Structure, classification and their functions in biological system.	3 hours/ week
II	<b>Lipids</b> : General structure of fatty acids and classification of lipids. <b>Amino acids</b> : Common structural features, physical and chemical properties, separation of amino acids and essential amino acids. <b>Proteins</b> : Classification, structural organization and functions of proteins.	
III	<b>Enzymes</b> : Definition, classification of enzymes, concept of active sites, general mode of action of enzymes, mechanism of enzyme activity, Coenzymes. A brief account of <b>Vitamins</b> .	
IV	<b>Nucleic acids</b> : Structure, function and types of DNA and RNA, Nucleotides, Nucleosides, Nitrogen bases and role of Nucleic acids. <b>Porphyrins</b> : A brief account of Porphyrins.	
V*	<p style="text-align: center;"><b>PRACTICALS</b></p> <ul style="list-style-type: none"> <li>• To study the phenomenon of imbibition of water.</li> <li>• To study the phenomenon of diffusion of water.</li> <li>• To study the phenomenon of plasmolysis and deplasmolysis.</li> <li>• To determine the osmotic pressure of cell sap by plasmolytic method.</li> <li>• To study the qualitative analysis of carbohydrates.</li> <li>• To study the qualitative analysis of proteins.</li> <li>• To study the qualitative analysis of fats &amp; oils.</li> <li>• To study the structure of DNA and RNA from model/charts.</li> <li>• To study the effects of temperature, pH and substrate concentration on enzyme activity.</li> </ul>	2 hours/ week
<b>Suggested Evaluation Methods</b>		
<p style="text-align: center;"><b>Internal Assessment:</b></p> <p>➤ <b>Theory</b></p> <ul style="list-style-type: none"> <li>• Class Participation: 5</li> <li>• Seminar/presentation/assignment/quiz/class test etc.: 5</li> <li>• Mid-Term Exam: 10</li> </ul> <p>➤ <b>Practicum</b></p> <ul style="list-style-type: none"> <li>• Class Participation: NA</li> <li>• Seminar/Demonstration/Viva-voce/Lab records etc.: 10</li> <li>• Mid-Term Exam: NA</li> </ul>		<p style="text-align: center;"><b>End Term Examination:</b></p> <p style="text-align: center;"><b>Theory: 50</b> (Written exam)  <b>Practical: 20</b> (Seminar/Demonstration/Viva-voce/Lab records etc)</p>
<b>Part C-Learning Resources</b>		

**Recommended Books/e-resources/LMS:**

6. Essentials of Biochemistry, Second Edition, Dr.( Prof) Satyanarayana
7. Essentials of Biochemistry, 2<sup>nd</sup> Edition, Dr. PankajaNaik
8. Principles and Techniques of Biochemistry and Molecular Biology, 5<sup>Th</sup> Edition, Wilson & Walker
9. **An Introduction to Chemistry, 8<sup>th</sup> Edition by Mark Bishop**
10. Clinical Chemistry made easy, 1<sup>st</sup>Edition by Hughes Tietz  
Fundamentals of Clinical Chemistry, 7<sup>th</sup> Edition by Carl Burtis

**PLO CLO Mapping of B23-MLT-201**

	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6
CLO1	1.5	1.0	0.5	2.0	1.0	1.5
CLO2	1.5	2.0	2.0	0.5	2.0	2.0
CLO3	1.5	1.0	1.0	0.6	2.0	2.0
CLO4	2.0	1.0	2.0	0.3	2.7	2.0
CLO5	2.5	2.0	1.0	0.2	2.0	2.5

**CC-B2**

<b>Session: 2023-24</b>			
<b>Part A - Introduction</b>			
Subject	Bachelor of Vocation in Medical Laboratory Technology		
Semester	II		
Name of the Course	Microbiology – II		
Course Code	B23-MLT-202		
Course Type:	CC		
Level of the course (As per Annexure-I)	<b>100-199</b>		
Pre-requisite for the course (if any)	---		
Course Learning Outcomes(CLO):	After completing this course, the learner will be able to: Know the occurrence, spread and control of bacterial infections. Provide information about bacterial culture procedures, staining procedures and bio-chemical tests for identification of bacteria. Know the occurrence, spread and control of mycological infections, culture methods required to perform microbiological tests. To learn general characters, life cycle and laboratory diagnosis of various medically important parasites.		
CLO5 is based on practical component	* To train the students with knowledge of medically significant isolates in mycology, parasitology, isolation methods and treatments.		
Credits	Theory	Practical	Total
	03	01	04
Contact Hours	03	02	05
<b>Max. Marks: 100</b> <b>Internal Assessment Marks: 30 (Theory 20 + Practical 10)</b> <b>End Term Exam Marks: 70 (Theory 50 + Practical 20)</b>		<b>Exam duration:</b> <b>Theory: 3 Hours</b> <b>Practical: 4 hours</b>	
<b>Part B- Contents of the Course</b>			
<b><u>Instructions for Paper- Setter:</u></b> Nine questions will be set in all. Question No.1 comprising of objective/short answer type questions from the entire syllabus, will be compulsory. The remaining eight questions will be set taking two questions from each unit. The candidates will be required to attempt Q.No.1 & four others selecting one question from each unit. All questions carry equal marks.			

Unit	Topics	Contact Hours
I	<p><b>Cultural Media</b> : Liquid and solid media, container for media distribution of media in tubes, bottles and petridishes. Common ingredients of cultural media, synthetic media, peptone water, nutrient agar and broth, chocolate and blood agar, malt extract and broth, milk agar etc.</p> <p>Special media for <i>Neisseria</i>, <i>Corynebacterium</i>, <i>Mycobacterium</i> &amp; <i>Enterobacteriaceae</i> group.</p>	3 hours/ week
II	<p><b>Cultivation of bacteria</b> : Instruments used, inoculation hood, laminar flow, culture procedure, incubation (aerobic and anaerobic). Isolation of pure culture and its preservation. Blood culture. Introduction and uses of culture, classification of cultures, antimicrobial sensitivity, anaerobic cultivation techniques.</p> <p><b>Pure culture</b> : Maintenance and preservation of pure cultures. Collection, transport processing and storage of clinical sample for microbiological analysis.</p>	
III	<p>Anatomy of bacterial cell, intercellular components and their functions, bacterial reproduction, morphological study of bacteria and its appendages - flagella, fimbriae, pili, capsule, spore and cysts.</p> <p><b>Classification and identification of bacteria</b> : Biological groups, morphological and biological classification, DNA composition as a basis of classification system of identification - morphology, staining reactions, cultural characters, biochemical reactions, antigenic characters and Medical importance.</p>	
IV	<p>Typical growth curve, various phases of growth physiology of bacteria-catabolism and anabolism. Nutrition of microbes and physical conditions required for growth.</p> <p>Effect of carbon, nitrogen, growth factors, vitamins, temperature, pH, osmotic pressure, oxygen and carbon dioxide on microbial growth.</p>	
V*	<p style="text-align: center;"><b>PRACTICALS</b></p> <ol style="list-style-type: none"> <li>1. Principle, construction and working of : Microscope, Laminar Air Flow</li> <li>2. Study of bacterial cell morphology</li> <li>3. Isolation of pure cultures and preservation.</li> <li>4. Demonstration of staining procedures for Gram staining, endospore and capsules.</li> <li>5. Classification and identification of bacteria with respect to Gram Staining.</li> <li>6. Study of growth curve in Bacteria and yeast</li> <li>7. Preparation of culture media and technique of aseptic transfers.</li> <li>8. Study of composition and preparation of stains.</li> </ol>	2 hours/ week

<b>Suggested Evaluation Methods</b>	
<p style="text-align: center;"><b>Internal Assessment:</b></p> <p>➤ <b>Theory</b></p> <ul style="list-style-type: none"> <li>• Class Participation: 5</li> <li>• Seminar/presentation/assignment/quiz/class test etc.: 5</li> <li>• Mid-Term Exam: 10</li> </ul> <p>➤ <b>Practicum</b></p> <ul style="list-style-type: none"> <li>• Class Participation: NA</li> <li>• Seminar/Demonstration/Viva-voce/Lab records etc.: 10</li> <li>• Mid-Term Exam: NA</li> </ul>	<p><b>End Term Examination:</b></p> <p><b>Theory: 50</b> (Written exam)</p> <p><b>Practical: 20</b> (Seminar/Demonstration/Viva-voce/Lab records etc)</p>
<b>Part C-Learning Resources</b>	
<p><b>Recommended Books/e-resources/LMS:</b></p> <ol style="list-style-type: none"> <li>1. Microbiology for Nursing and Allied Sciences. Dr. Arora 2<sup>nd</sup> Edition</li> <li>2. Textbook of Microbiology for Nurses Anantnarayan 1<sup>st</sup> Edition</li> <li>3. Practical and Applied Microbiology Anuradha De 4<sup>th</sup> Edition</li> <li>4. Text Book of Microbiology Anantnarayan 10<sup>th</sup> Edition</li> <li>5. TextBook of Microbiology and Parasitology PrafulGodkar 1<sup>st</sup> Edition</li> <li>6. Medical Parasitology C. P. Baweja 3<sup>rd</sup> Edition</li> </ol>	

<b>PLO CLO Mapping of B23-MLT-202</b>						
	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6
CLO1	1.5	1.0	1.0	0.5	2.0	1.4
CLO2	1.4	2.4	2.6	0.2	2.1	2.7
CLO3	1.5	2.5	2.2	0.2	2.3	2.6
CLO4	0.5	1.5	2.4	0.8	2.8	2.7
CLO5	1.5	2.5	2.3	0.3	2.7	2.7

CC-C3

<b>Session: 2023-24</b>			
<b>Part A - Introduction</b>			
Subject	Bachelor of Vocation in Medical Laboratory Technology		
Semester	II		
Name of the Course	Pathology – II		
Course Code	B23-MLT-203		
Course Type:	CC		
Level of the course (As per Annexure-I)	<b>100-199</b>		
Pre-requisite for the course (if any)	---		
Course Learning Outcomes(CLO):	After completing this course, the learner will be able to: Provide knowledge about general principles, recording and labeling of histology specimens. Gain knowledge about various fixatives for tissue embedding. Enable the students to know about the working of microtome. Learn about the methods of collection of museum specimens, preparation and their storage.		
CLO5 is based on practical component	* Prepare microtomy slides of various organs.		
Credits	Theory	Practical	Total
	03	01	04
Contact Hours	03	02	05
<b>Max. Marks: 100</b> <b>Internal Assessment Marks: 30 (Theory 20 + Practical 10)</b> <b>End Term Exam Marks: 70 (Theory 50 + Practical 20)</b>		<b>Exam duration:</b> <b>Theory: 3 Hours</b> <b>Practical: 4 hours</b>	
<b>Part B- Contents of the Course</b>			
<b><u>Instructions for Paper- Setter:</u></b> Nine questions will be set in all. Question No.1 comprising of objective/short answer type questions from the entire syllabus, will be compulsory. The remaining eight questions will be set taking two questions from each unit. The candidates will be required to attempt Q.No.1 & four others selecting one question from each unit. All questions carry equal marks.			
Unit	Topics		Contact Hours

I	<p><b>Introduction to Histopathology :</b>  General Principle, Reception, recording and labelling of histology specimens.</p> <p>Fixation and various fixatives - Mode of action and indication preparation.</p> <p>Processing of histological tissues for paraffin-embedding.  Embedding and embedding media, Vacuum embedding.</p>	3 hours/ week
II	<p><b>Equipment used in Histopathology :</b></p> <ol style="list-style-type: none"> <li>(1) Tissue Processor</li> <li>(2) Microtome - various types, their working principle and maintenance.</li> <li>(3) Microtome knives and knife-sharpening.</li> <li>(4) Automatic slide strainer</li> <li>(5) Freezing microtome</li> <li>(6) Cryostat</li> </ol> <p>Section cutting, cutting faults and remedies.  Decalcification - Methods, advantages and disadvantages, various types - their mechanisms of action.</p>	
III	<p><b>Major techniques used in Histopathology ;</b></p> <p>Routine staining procedures, mounting and mounting media.  Dye chemistry, theory and practice of staining.  Solvent mordents, accelerators and accentuators.  Use of controls in various staining procedures.</p>	
IV	<p>Preparation of Haematoxylin and Eosine  Methods of preparation, staining technique for rapid diagnosis  Histo-chemical staining  Cyto-chemical staining</p> <p>Collection of Museum specimens  Preparation and storage, methods of mounting</p>	
V*	<p style="text-align: center;"><b>PRACTICALS</b></p> <ul style="list-style-type: none"> <li>• Histological study of all the systems.</li> <li>• Preparation of stains.</li> <li>• Microtomy.</li> </ul>	2 hours/ week
<b>Suggested Evaluation Methods</b>		

<p style="text-align: center;"><b>Internal Assessment:</b></p> <p>➤ <b>Theory</b></p> <ul style="list-style-type: none"> <li>• Class Participation: 5</li> <li>• Seminar/presentation/assignment/quiz/class test etc.: 5</li> <li>• Mid-Term Exam: 10</li> </ul> <p>➤ <b>Practicum</b></p> <ul style="list-style-type: none"> <li>• Class Participation: NA</li> <li>• Seminar/Demonstration/Viva-voce/Lab records etc.: 10</li> <li>• Mid-Term Exam: NA</li> </ul>	<p><b>End Term Examination:</b></p> <p><b>Theory: 50</b> (Written exam)</p> <p><b>Practical: 20</b> (Seminar/Demonstration/Viva-voce/Lab records etc)</p>
<b>Part C-Learning Resources</b>	
<b>Recommended Books/e-resources/LMS:</b>	
<p>11. Textbook of Medical Laboratory Technology, Volume 1, 3<sup>rd</sup> Edition by Praful Ghodkar</p> <p>12. Textbook of Medical Laboratory Technology, Volume 2, 3<sup>rd</sup> Edition by Praful Ghodkar</p> <p>13. Medical Laboratory Technology (Volume 1): Procedure Manual for Routine Diagnostic, Kanai Mukharjee</p> <p>14. Medical Laboratory Technology (Volume 2): Procedure Manual for Routine Diagnostic, Kanai Mukharjee</p> <p>15. Medical Laboratory Technology (Volume 3): Procedure Manual for Routine Diagnostic, Kanai Mukharjee</p>	

<b>PLO CLO Mapping</b>						
	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6
CLO1	1.0	1.7	2.3	0	2.0	2.2
CLO2	1.2	2.0	2.6	0	1.0	2.0
CLO3	1.4	2.4	2.2	0	1.0	2.0
CLO4	1.4	2.5	0.5	0	1.0	1.5
CLO5	1.2	2.4	2.6	0	1.0	3