

ERA UNIVERSITY
FACULTY OF ALLIED HEALTH SCIENCES & RESEARCH
BACHELOR OF SCIENCE IN MEDICAL LABORATORY
TECHNIQUES (B.SC MLT)
FRAMEWORK Fourth Semester
FOR THE ACADEMIC YEAR 2023 to 2024
Till the next change in the curriculum

Subject Code	Course Titles	Hours per week			Marks			CR
		L	Theory	Practical	Internal	External	Total	
BLT 401	Analytical Clinical Biochemistry	3	1	-	30	70	100	4
BLT 402	Applied Histopathology-1	3	1	-	30	70	100	4
BLT 403	Applied Bacteriology	3	1	-	30	70	100	4
BLT 404	Applied Haematology- I	3	1	-	30	70	100	4
BLP 401	Analytical Clinical Biochemistry - (P)	-	-	4	30	70	100	2
BLP 402	Applied Histopathology - I - (P)	-	-	4	30	70	100	2
BLP 403	Applied Bacteriology- (P)	-	-	4	30	70	100	2
BLP 404	Applied Haematology - I - (P)	-	-	4	30	70	100	2
	Guest Lecture/Tutorial/Seminar/visit to any medical research institution or reputed clinical laboratory	-	2	-	-	-	-	2
Total		12	6	16	240	560	800	26
Total Hours in Semester		550						

NOTE:

i. Abbreviations: L - Lecture, T - Tutorials and P - Practical
Considering four months per semester as working months, total contact hours per semester shall be 550 (Five hundred and fifty)

Department of Medical laboratory technique

Course Outline Effective From: 2023-24

Name of the Program	Bachelors of Science in Medical Laboratory techniques			Year/ Semester:	3rd year /IV Semester
Course Name	Analytical Clinical Biochemistry	Course Code:	BPT 401	Type: 4th semester	THEORY
Credits	L:3 T:1 P:0			Total Sessions Hours:	60
Evaluation Spread	Internal Continuous Assessment	30		End Term Exam:	70
Type of Course	<input type="radio"/> Compulsory	<input checked="" type="radio"/> Core	<input type="radio"/> Creative	<input type="radio"/> Life Skill	
Course Objectives	The students will learn basic principles/mechanisms, procedures and various types of techniques commonly performed in analytical biochemistry				
Course Outcomes (CO): <i>After the successful course completion, learners will develop following attributes:</i>					
Course Outcome (CO)	Course Outcomes (CO): students will be able to: 1. Describe and compare a range of analytical chemistry methods and explain the underlying theoretical principles; 2. Explain the broad role of analysts in quality control and assessment of experimental measurements from various application contexts; 3. Employ a variety of analytical methods to prepare, separate and characterise samples from various matrices; 4. As part of a team or individually, conduct, analyse and interpret results of a chemical analysis and effectively communicate these in written reports and other formats; 5. Work safely and competently in an analytical laboratory setting.				
CO1	Students will be able to learn spectrophotometry and colorimetry				
CO2	Students will be able to learn Photometry				
CO3	Students will be able to learn the Chromatography				
CO4	Students will be able to learn Electrophoresis				
Pedagogy	White board, Seminar, Assignment, PPT				
Internal Evaluation Mode	Continuous internal assessment and written examination				
Session Details	Topic	Hours		Mapped CO	
Unit 1	1.Introduction, Theory of spectrophotometry and colorimetry, 2.Lambert's law and Beer's law 3.Applications of colorimetry and spectrophotometry.	10		CO1	
Unit 2	1.Introduction, General principles of flame photometry 2.Limitations of flame photometry, Instrumentation 3.Applications of flame photometry 4.Atomic absorption spectroscopy- Principle & applications	10		CO2	

Unit 3	1.Paper Chromatography & Gel Chromatography: Introduction, principle, types, details for qualitative and quantitative analysis, application. 2.Thin layer chromatography: Introduction, experimental techniques, application ofTLC, limitations, High performance thin layer chromatography. 3.Column chromatography & Gas chromatography: Introduction, principle column efficiency, application of column chromatography. 4.Ion exchange chromatography: Introduction, Definition and principle, cation and anion exchangers, application.											10	C03	
Unit 4	1.Introduction, Principle, Instrumentation, Applications 2.Types of electrophoresis, Paper electrophoresis 3.Gel electrophoresis.											10	CO4	
CO-PO and PSO Mapping														
CO	PO 1	P O 2	P O 3	PO 4	PO 5	P O 6	P O 7	P O 8	PS O1	PS O2	PS O3	PS O4	PS O5	PS O6
CO1	3	3	3	3	3	3	-	-	3	3	1	3	3	3
CO2	3	3	3	3	3	3	-	-	3	3	1	3	3	3
CO3	3	3	3	3	3	3	-	-	3	3	1	3	3	3
CO4	3	3	3	3	3	3	-	-	3	3	1	3	3	3
<i>Strong contribution-3, Average contribution-2, Low contribution-1,</i>														
Suggested Readings:														
Text book/reference book Reference Books	<ol style="list-style-type: none"> 1. Practical Clinical Biochemistry by Harold Varley 2. Text book of Medical Laboratory Technology by P. B. Godker 3. Medical Laboratory Technology by Mukherjee 4. Principal of Biochemistry by M.A. Siddiqi 5. Instrumental Analysis by Chatwal Anand 6. Text book of Medical Biochemistry by Chatterjee, Shinde 7. Principal of Biochemistry by Lehninger 8. Biochemistry by Voet&Voet Biochemistry by Stryer 													
Para Text	Unit 1: Spectrophotometry and colorimetry Unit 2: Photometry Unit 3: Chromatography Unit4:Electrophoresis													
Recapitulation & Examination Pattern														
Internal Continuous Assessment:														
Component	Marks	Pattern												
Mid Semester	12	MCQ: 4 Short Answer Type Questions: 02 Long Answer Type Question: 01												
Class Test	6	MCQ: 02 Short Answer Type Questions: 01 Long Answer Type Question: 01												
Interaction in class /class participation	6													
Assignment/ Presentation	4	Hard copy/Softcopy												
Attendance	4													
Total Marks	30													

Department of Medical laboratory technique

Course Outline Effective From: 2023-24

Name of the Program	Bachelors of Science in Medical Laboratory techniques			Year/ Semester:	2 nd year/4 th sem
Course Name	Applied Histopathology-I	Course Code:	BLT 402	Type:	Theory
Credits	L:3 T:1 P:0			Total Sessions Hours:	60
Evaluation Spread	Internal Continuous Assessment:	30		End Term Exam:	70
Type of Course	<input type="radio"/> Compulsory	<input checked="" type="radio"/> Core	<input type="radio"/> Creative	<input type="radio"/> Life Skill	
Course Objectives	The students will be made aware of the methods of estimating different components of blood. Students will learn the basic concepts of staining and coagulation in the Haematology laboratory.				
Course Outcomes (CO): After the successful course completion, learners will develop following attributes:					
Course (CO)	Students will be able to collect, preserve and process blood samples. They will be able to perform efficiently routine investigations in clinical hematology laboratory. Students will also be able to carry out different immune-hematological investigations and coagulation profile tests.				
CO1	Students will be able to know the methods of estimating Hemoglobin, RBCs count and platelet count				
CO2	Students will be able to know the methods of measuring ESR, PCV, Blood smear staining, Leucocytes count				
CO3	Students will be able to know the staining techniques in the Haematology Lab				
CO4	Students will be able to know the routine examination of Fluid				
CO5	Students will be able to know the immune-hematological investigations and coagulation.				
Pedagogy	White board, Seminar, Assignment, Power point presentation, e-lecture				
Internal Evaluation Mode	Continuous internal assessment and written examination				
Session Details	Topic	Hours	Mapped CO		
Unit 1	Haemoglobinometry: Different methods to measure Haemoglobin with merits and demerits Haemocytometry: Introduction, Principle, Reagent preparation, procedure, errors involved and means to minimize errors. RBC,s & WBC,s Count Platelets & Absolute Eosinophils Count	14	CO1		
Unit 2	Principle mechanism and different methods with merit and demerits for the measuring ESR. Principle mechanism and different methods with merit and demerits for the measuring PCV. Preparation of thin and thick smears and its uses; staining of blood smears Differential leucocytes count by manual and automated method	10	CO2		
	Romanowsky Stain: Principle, composition, preparation of staining reagents and procedure of the following stains: Giemsa's stain, Leishman's stain Wright's stain, Field's stain, JSB stain. Differential leucocytes count by manual and automated method Physiological and pathological variations in leukocyte values	10	CO3		

Unit 3	<p>Semen analysis: Sample Collection, Transportation Preservation, Physical Examination, Biochemical Examination & Microscopic Examination.</p> <p>CSF analysis: Sample Collection, Transportation Preservation, Physical Examination, Biochemical Examination & Microscopic Examination.</p> <p>Pleural Fluid analysis: Sample Collection, Transportation Preservation, Physical Examination, Biochemical Examination & Microscopic Examination.</p> <p>Others Fluid analysis: Sample Collection, Transportation Preservation, Physical Examination, and Biochemical Examination & Microscopic Examination.</p>	14	C04
Unit 4	<p>Preparation of Reagents for coagulation studies: M/40 Calcium chloride, Brain Thromboplastin</p> <p>Preparation of Reagents for coagulation studies: Cephalin, Adsorbed Plasma</p> <p>Screening Tests for coagulation Studies and their significance</p>	10	CO5

CO-PO and PSO Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	3	3	2	3	3	3	1	-	3	3	-	3	3	3
CO2	3	3	2	3	3	3	1	-	3	3	-	3	3	3
CO3	3	3	2	3	3	3	1	-	3	3	-	3	3	3
CO4	3	3	2	3	3	3	1	-	3	3	-	3	3	3
CO5	3	3	2	3	3	3	1	-	3	3	-	3	3	3

Strong contribution-3, Average contribution-2, Low contribution-1,

Suggested Readings:

Text- Books/ Reference Books	<p>Textbook of Medical Laboratory Technology by Praful B. Godkar</p> <p>Medical laboratory Technology by K.L. Mukherjee Volume-I</p> <p>Practical Haematology by J.B. Dacie</p> <p>Clinical Diagnosis & Management by Laboratory methods (20th edition) by John Bernard Henry</p> <p>De Gruchy's Clinical Haematology in medical practice</p> <p>Atlas of Haematology by G.A. McDonald</p>
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Para Text	<p>Unit 1: Tools and Techniques in Hemoglobinometry estimation, Leukocyte count and Platelet count</p> <p>Unit 2: Erythrocyte sedimentation and Blood count</p> <p>Unit 3: Staining in Haematology</p> <p>Unit 4: Fluid Analysis</p>
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Recapitulation & Examination Pattern

Internal Continuous Assessment:

Component	Marks	Pattern
Mid Semester	12	MCQ: 4 Short Answer Type Questions: 02 Long Answer Type Question: 01
Class Test	6	MCQ: 02 Short Answer Type Questions: 01 Long Answer Type Question: 01
Interaction in class /class participation	6	
Assignment/ Presentation	4	Hard copy/Softcopy
Attendance	4	
Total Marks	30	

Department of Medical laboratory technique Course Outline Effective From: 2023-24

Name of the Program	Bachelors of Science in Medical Laboratory techniques			Year/ Semester:	2nd year/IV Semester
Course Name	Applied Bacteriology	Course Code:	BLT-403	Type: IV Semester	THEORY
Credits	L:3 T:1 P:0			Total Sessions Hours:	60
Evaluation Spread	Internal Continuous Assessment:	30		End Term Exam:	70
Type of Course	<input type="radio"/> Compulsory	<input checked="" type="radio"/> Core	<input type="radio"/> Creative	<input type="radio"/> Life Skill	
Course Objectives	This part will cover the laboratory strategy in the diagnosis of various infective syndromes i.e. choice of samples, collection and transportation and processing of samples for isolation of bacterial pathogens and then to put antibiotic susceptibility testing. This will also cover bacteriological examination of water, milk, food, air, I/V fluids and nosocomial infections. Further it will make the candidate familiar to epidemiology, epidemiological markers and preservation of microbes.				
Course Outcomes (CO):	<i>After the successful course completion, learners will develop following attributes:</i>				
Course Outcome (CO)	Understanding the significance of microorganisms in biogeochemical cycling of nutrients, sustainable development and bioremediation of pollutants for developing strategies of environmental conservation and remediation. To learn various methods for their isolation, detection and identification of microorganisms in food and dairy and employ in industries.				
CO1	Students will be able to learn the strategy in the diagnosis of various infective syndrome-sample collection, transportation and processing				
CO2	Students will be able to learn the antimicrobial susceptibility preparation and testing				
CO3	Students will be able to learn the Nucleic acid techniques, Automation in AST and Identification, Bacteriological examination of water, and food				
CO4	Students will be able to learn the bacteriological examination of milk and milk products				
CO5	Students will be able to learn the Sterility testing of I/V fluids and Nosocomial Infection-collection transportation and processing				
Pedagogy	PPT, Video, White board Seminar				
Internal Evaluation Mode	Continuous Internal Assessment and Written examination.				
Session Details	Topic	Hours	Mapped CO		
Unit 1	1. Laboratory strategy in the diagnosis of various infective syndromes: Samples of choice, collection, transportation and processing of samples for laboratory diagnosis of the following 1.1 complications:Septicemia and bacteremia 1.2 Upper Respiratory tract infections 1.3 Lower respiratory tract infections 1.4 Wound, skin, and deep sepsis 1.5 Urinary tract infections 1.6 Genital Tract infections 1.7 Meningitis 1.8 Gastro intestinal infections 1.9 Enteric fever 1.10 Tuberculosis (Pulmonary and Extra-pulmonary) 1.11 Pyrexia of unknown origin	14	CO1		
Unit 2	Antibiotic susceptibility testing in bacteriology: 2.1 Definition of antibiotics 2.2 Culture medium used for Antibiotic susceptibility testing 2.3 Preparation and standardization of inoculum 2.4 Control bacterial strains 2.5 Choice of antibiotics 2.6 MIC and MBC: Concepts and methods for determination 2.7 Various methods of Antibiotic susceptibility testing with special reference to Stokes and Kirby-Bauer method	14	CO2		

Unit 3	1.Basics of Nucleic acid techniques in diagnostic microbiology with special reference to Polymerase chain reaction (PCR) 2.Automation in bacterial culture detection and antimicrobial susceptibility testing: Principles and importance. 3.Bacteriological examination of water, food. 4.Introduction and importance of other bacteria considered as indicators of fecal contamination	14	CO3
Unit 4	1.Basic Concepts regarding gradation of milk,Various tests for Bacteriological examination of milk 2.Basic Concepts regarding classification of food like frozen food, canned food, raw food, cooked food etc. 3.Various tests for Bacteriological examination with special reference to food poisoning bacteria 4.Examination of Air, Significance of air bacteriology in healthcare facilities, Collection processing and reporting of an air sample	14	CO4
Unit 5	1.Collection, transportation and processing of 1/v fluids for bacterial contamination,Recording the result and interpretation 2.Nosocomial Infection: Introduction, sources and types of nosocomial infections. 3.Surveillance of hospital environment for microbial load, Role of microbiology laboratory in control of nosocomial infections 4.Epidemiological markers: Introduction, Types, Serotyping, Phage typing and Bacteriocin typing	14	CO5

CO-PO and PSO Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO 1	PSO 2	PSO3	PSO 4	PSO 5	PSO6
CO1	3	3	2	3	3	3	-	-	1	3	-	3	3	3
CO2	3	3	2	3	3	3	-	-	1	3	-	3	3	3
CO3	3	3	2	3	3	3	-	-	1	3	-	3	3	3
CO4	3	3	2	1	1	2	-	-	-	1	-	1	1	1
CO5	3	3	2	3	3	3	-	-	1	3	-	3	3	3

Strong contribution-3, Average contribution-2, Low contribution-1,

Suggested Readings:

Text- Books/ ReferenceBooks	1.Practical Medical Microbiology by Mackie & McCartney Volume 1 and 2 2.Text book of Microbiology by Ananthanarayanan 4.Medical laboratory Technology Vol. I ,II, III by Mukherjee 5.Medical Laboratory manual for tropical countries Vol II Microbiology by Monica Cheesbrough 6.Hospital Acquired Infections-Power strategies for clinical practice by Dr. V Muralidhar and SumathiMurlidhar 7.Control of Hospital infection-A practical Handbook by GajAyliffe, A.P. Fraise, A.M. Geddes, K. Mitchell Medical Microbiology by Paniker& Satish Gupte Microbiology For Medical Sciences by Bhagat Singh and Renu Singh
Para Text	Unit 1: Laboratory diagnosis of infectious diseases Unit 2: Antibiotic susceptibility testing in bacteriology: Unit 3:Nueclic acid amplification and Automation Unit4: Examination of Milk and milk products Unit 5: Sterility testing of 1/v fluids & Nosocomial Infection

Recapitulation & Examination Pattern

Internal Continuous Assessment:

Component	Marks	Pattern
Mid Semester	12	MCQ: 4 Short Answer Type Questions: 02 Long Answer Type Question: 01
Class Test	6	MCQ: 02 Short Answer Type Questions: 01 Long Answer Type Question: 01
Interaction in class /class participation	6	
Assignment/ Presentation	4	Hard copy/Softcopy
Attendance	4	
Total Marks	30	

Department of Medical laboratory technique

Course Outline Effective From: 2023-24

Name of the Program	Bachelors of Science in Medical Laboratory techniques			Year/ Semester:	2 nd year/4 th sem
Course Name	Applied Haematology-I	Course Code:	BLT404	Type:	Theory
Credits	L:3 T:1 P:0			Total Sessions Hours:	58
Evaluation Spread	Internal Continuous Assessment:	30		End Term Exam:	70
Type of Course	<input type="radio"/> Compulsory	<input checked="" type="radio"/> Core	<input type="radio"/> Creative	<input type="radio"/> Life Skill	
Course Objectives	The students will be made aware of the methods of estimating different components of blood. Students will learn the basic concepts of staining and coagulation in the Haematology laboratory.				
Course Outcomes (CO): After the successful course completion, learners will develop following attributes:					
Course Outcome(CO)	Students will be able to collect, preserve and process blood samples. They will be able to perform efficiently routine investigations in clinical hematology laboratory. Students will also be able to carry out different immune-hematological investigations and coagulation profile tests.				
CO1	Students will be able to know the methods of estimating Hemoglobin, RBCs count and platelet count				
CO2	Students will be able to know the methods of measuring ESR, PCV, Blood smear staining, Leucocytes count				
CO3	Students will be able to know the staining techniques in the Haematology Lab				
CO4	Students will be able to know the routine examination of Fluid				
CO5	Students will be able to know the immune-hematological investigations and coagulation.				
Pedagogy	White board, Seminar, Assignment, Power point presentation, e-lecture				
Internal Evaluation Mode	Continuous internal assessment and written examination				
Session Details	Topic	Hours	Mapped CO		
Unit 1	Haemoglobinometry: Different methods to measure Haemoglobin with merits and demerits Haemocytometry: Introduction, Principle, Reagent preparation, procedure, errors involved and means to minimize errors. RBC,s & WBC,s Count Platelets & Absolute Eosinophils Count	14	CO1		
Unit 2	Principle mechanism and different methods with merit and demerits for the measuring ESR. Principle mechanism and different methods with merit and demerits for the measuring PCV. Preparation of thin and thick smears and its uses; staining of blood smears Differential leucocytes count by manual and automated method	10	CO2		
Unit 3	Romanowsky Stain: Principle, composition, preparation of staining reagents and procedure of the following stains: Giemsa's stain, Leishman's stain Wright's stain, Field's stain, JSB stain. Differential leucocytes count by manual and automated method Physiological and pathological variations in leukocyte values	10	CO3		

Unit 4	<p>Semen analysis: Sample Collection, Transportation Preservation, Physical Examination, Biochemical Examination & Microscopic Examination.</p> <p>CSF analysis: Sample Collection, Transportation Preservation, Physical Examination, Biochemical Examination & Microscopic Examination.</p> <p>Pleural Fluid analysis: Sample Collection, Transportation Preservation, Physical Examination, Biochemical Examination & Microscopic Examination.</p> <p>Urine Fluid analysis: Sample Collection, Transportation Preservation, Physical Examination, and Biochemical Examination & Microscopic Examination.</p>	14	C04
Unit 5	<p>Preparation of Reagents for coagulation studies: M/40 Calcium chloride, Brain Thromboplastin</p> <p>Preparation of Reagents for coagulation studies: Cephalin, Adsorbed Plasma</p> <p>Screening Tests for coagulation Studies and their significance</p>	10	CO5

CO-PO and PSO Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	3	3	2	3	3	3	1	-	3	3	-	3	3	3
CO2	3	3	2	3	3	3	1	-	3	3	-	3	3	3
CO3	3	3	2	3	3	3	1	-	3	3	-	3	3	3
CO4	3	3	2	3	3	3	1	-	3	3	-	3	3	3
CO5	3	3	2	3	3	3	1	-	3	3	-	3	3	3

Strong contribution-3, Average contribution-2, Low contribution-1,

Suggested Readings:

Text- Books/ Reference Books	<ol style="list-style-type: none"> 1. Textbook of Medical Laboratory Technology by Praful B. Godkar 2. Medical laboratory Technology by K.L. Mukherjee Volume-I 3. Practical Haematology by J.B. Dacie 4. Clinical Diagnosis & Management by Laboratory methods (20th edition) by John Bernard Henry 5. De Gruy's Clinical Haematology in medical practice 6. Atlas of Haematology by G.A. McDonald
Para Text	<p>Unit 1: Tools and Techniques in Hemoglobinometry estimation, Leukocyte count and Platelet count</p> <p>Unit 2: Erythrocyte sedimentation and Blood count</p> <p>Unit 3: Staining in Haematology</p> <p>Unit 4: Fluid Analysis</p>

Recapitulation & Examination Pattern

Internal Continuous Assessment:

Component	Marks	Pattern
Mid Semester	12	MCQ: 4 Short Answer Type Questions: 02 Long Answer Type Question: 01
Class Test	6	MCQ: 02 Short Answer Type Questions: 01 Long Answer Type Question: 01
Interaction in class /class participation	6	
Assignment/ Presentation	4	Hard copy/Softcopy
Attendance	4	
Total Marks	30	

Department of Medical laboratory technique Course Outline Effective From: 2023-24

Name of the Program	Bachelors of Science in Medical Laboratory techniques				Year/ Semester:		2nd year /IV Semester							
Course Name	Analytical Clinical Biochemistry	Course Code:	BLP401	Type	PRACTICAL									
Credits	L:0 T:0 P:4				Total Sessions Hours:	30								
Evaluation Spread	Internal Continuous Assessment:	30			End Term Exam:	70								
Type of Course	<input type="radio"/> Compulsory		<input checked="" type="radio"/> Core		<input type="radio"/> Creative		<input type="radio"/> Life Skill							
CO1	To learn about the principle, working and maintenance of Spectrophotometer, colorimeter and flame photometer.													
CO2	To learn about the principle, working and maintenance of Paper, Gas, Thin Layer and Column Chromatography													
CO3	To learn about the principle, working and maintenance of Electrophoresis													
CO4														
Pedagogy	Hands on / Demonstration													
Internal Evaluation Mode	Continuous internal assessment and practical exam													
Session Details	Topic							Mapped CO						
UNIT 1	To demonstrate the principle, working & maintenance of spectrophotometer. To demonstrate the principle, working & maintenance of colorimeter. To demonstrate the principle, working & maintenance of flame photometer.							C01						
Unit 2	To demonstrate the principle, procedure of paper chromatography. To demonstrate the principle & procedure of Gas chromatography. To demonstrate the principle & demonstration of TLC. To demonstrate the principle & procedure of column chromatography													
Unit 3	To demonstrate the principle & and procedure of Electrophoresis.													
CO-PO and PSO Mapping														
CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	3	3	3	3	3	3	-	-	3	3	-	3	2	3
CO2	3	3	3	3	3	3	-	-	3	3	-	3	2	3
CO3	3	3	3	3	3	3	-	-	3	3	-	3	2	3
CO4	3	3	3	3	3	3	-	-	3	3	-	3	2	3
<i>Strong contribution-3, Average contribution-2, Low contribution-1,</i>														
Suggested Readings:														

Text- Books/ Reference Books	Practical Clinical Biochemistry by Harold Varley Text book of Medical Laboratory Technology by P. B. Godker Medical Laboratory Technology by Mukherjee Principal of Biochemistry by M.A. Siddiqi Instrumental Analysis by Chatwal Anand Text book of Medical Biochemistry by Chatterjee, Shinde Principal of Biochemistry by Lehninger Biochemistry by Voet&Voet Biochemistry by Stryer Principal of Biochemistry by Lehninger Principal of Biochemistry by M.A. Siddiqi	
Para Text	Unit 1: Unit 1: Spectrophotometry and colorimetry Unit 2: Photometry Unit 3: Chromatography Unit4:Electrophoresis	
Recapitulation & Examination Pattern		
Internal Continuous Assessment:		
Component	Marks	Pattern
Mid Semester	12	Exercise :0 4 Spotting: 04 File: 02 Viva: 01
Class Test	6	MCQ: 02 Short Answer Type Questions: 01 Long Answer Type Question: 01
Online Test/ Objective Test	4	MCQ: 4
Assignment/ Presentation	4	Hard copy/Softcopy
Attendance	4	
Total Marks	30	

Department of Medical laboratory technique

Course Outline Effective From: 2023-24

Name of the Program	Bachelors of Science in Medical Laboratory techniques				Year/ Semester:	2 nd year/IV semester								
Course Name	Applied Histopathology-I		Course Code:	BLP 402		Type	Practical							
Credits	L:0 T:0 P:4				Total Sessions Hours:	30								
Evaluation Spread	Internal Continuous Assessment :		30			End Term Exam:	70							
Type of Course	<input type="radio"/> Compulsory		<input checked="" type="radio"/> Core			<input type="radio"/> Creative		<input type="radio"/> Life Skill						
Course Outcomes (CO): After the successful course completion, learners will develop following attributes:														
CO1	Student will learn about the estimation of Hemoglobin by different methods.													
CO2	Student will learn about the total cell count -platelets, leukocyte and eosinophil													
CO3	Student will learn about the staining, ESR and packed cell volume measurement techniques in Haematology lab													
CO4	Student will learn about routine physical and microscopic examination of seminal fluid and CSF													
Pedagogy	Hands on / Demonstration													
Internal Evaluation mode														
Session Details	Topic										Mapped CO			
Unit	Total leukocyte count Platelets count Absolute Eosinophil count Preparation of smear and staining with Giemsa and Leishman Stain. ESR(Wintrobe and Westergren method) Packed cell volume(Macro & Micro) Routine Examination of CSF Physical and Microscopic examination of seminal fluid including sperm count Perform normal DLC										Co 1-5			
CO-PO and PSO Mapping														
CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	3	3	3	3	3	3	-	-	3	3	-	3	3	1
CO2	3	3	3	3	3	3	-	-	3	3	-	3	3	1
CO3	3	3	3	3	3	3	-	-	3	3	-	3	3	1
CO4	3	3	3	3	3	3	-	-	3	3	-	3	3	1
<i>Strong contribution-3, Average contribution-2, Low contribution-1,</i>														
Suggested Readings:														
Reference Books	Practical Haematology by J.B. Dacie													
Para Text	Unit 1: Tools and Techniques in Hemoglobinometry estimation, Leukocyte count and Platelet count Unit 2: Erythrocyte sedimentation and Blood count Unit 3: Staining in Haematology Unit 4: Fluid Analysis													
Recapitulation & Examination Pattern														
Internal Continuous Assessment:														
Component	Marks	Pattern												
Mid Semester	12	Exercise :0 4 Spotting: 04 File: 02 Viva: 02												
Class Test	6	MCQ: 02 Short Answer Type Questions: 01 Long Answer Type Question: 01												
Online Test/ Objective Test	4	MCQ: 4												
Assignment/ Presentation	4	Hard copy/Softcopy												
Attendance	4													
Total Marks	30													

Department of Medical laboratory technique

Course Outline Effective From: 2023-24

Name of the Program	Bachelors of Science in Medical Laboratory techniques			Year/ Semester:	2nd year/4th semester
Course Name	Applied Bacteriology-	Course Code:	BLP 403	Type:	Practical
Credits	L:0 T:0P:4			Total Sessions Hours:	30
Evaluation Spread	Internal Continuous Assessment:		30	End Term Exam:	70
Type of Course	<input type="radio"/> Compulsory		<input checked="" type="radio"/> Core	<input type="radio"/> Creative	<input type="radio"/> Life Skill
Course Outcomes (CO): After the successful course completion, learners will develop following attributes:					
CO1	To learn about the Laboratory strategy in the diagnosis of various clinical samples: Inoculation, isolation and identification of bacterial pathogens				
CO2	To learn about the Demonstration of automation in bacterial culture detection and antimicrobial susceptibility testing				
CO3	To learn about the bacterial examination of following articles: Water, Milk, Food and Air				
CO4	Demonstration of Sterility testing, serotyping and lyophilization methods				
Pedagogy	Hands on / Demonstration				
Internal Evaluation Mode	Continuous internal assessment and practical exam				
Session Details	Topic			Mapped CO	
Unit 1	<ol style="list-style-type: none"> 1. Inoculation of different culture media 2. Isolation of pure cultures 3. Processing of following clinical samples for culture and identification of bacterial pathogens: <ol style="list-style-type: none"> a. Blood b. Throat swab c. Sputum d. Pus e. Urine 4. Stool for Salmonella, Shigella and Vibrio cholerae 5. C.S.F. and other body fluids 			CO1	
Unit 2	Demonstration of PCR Demonstration of automation in bacterial culture detection and antimicrobial susceptibility testing Antimicrobial susceptibility testing Preparation and standardization of inoculums To demonstrate reference bacterial strains To determine MIC and MBC of known bacteria against a known antibiotic To perform antibiotic susceptibility testing of clinical isolates by using Stokes method Kirby-Bauer method			CO2	
Unit 3	Collection, transportation and processing of following articles for bacteriological examination: Water, Milk, Food and Air			CO3	

Unit 4	To demonstrate sterility testing of intravenous fluid with positive and negative controls Demonstration of serotyping and bacteriocin typing Demonstration of lyophilization and other available preservation methods ..		CO4
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CO-PO and PSO Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO 1	PSO 2	PSO3	PSO 4	PSO 5	PSO6
CO1	3	3	3	3	3	3	-	-	1	3	1	3	3	3
CO2	3	3	3	3	3	3	-	-	1	3	1	3	3	3
CO3	3	3	3	3	3	3	-	-	1	3	1	3	3	3
CO4	3	3	3	3	3	3	-	-	1	3	1	3	3	3

Strong contribution-3, Average contribution-2, Low contribution-1,

Suggested Readings:

Reference Books	1. Practical Medical Microbiology by Mackie & McCartney Volume 1 and 2
Para Text	Unit 1: Inoculation and isolation of pure cultures Unit 2: Antimicrobial susceptibility testing Unit 3: Bacteriological Examination Unit4: Sterility testing of 1/v fluids & Nosocomial Infection

Recapitulation & Examination Pattern

Internal Continuous Assessment:

Component	Marks	Pattern
Mid Semester	12	Exercise :0 4 Spotting: 04 File: 02 Viva: 02
Class Test	6	MCQ: 02 Short Answer Type Questions: 01 Long Answer Type Question: 01
Online Test/ Objective Test	4	MCQ: 4
Assignment/ Presentation	4	Hard copy/Softcopy
Attendance	4	
Total Marks	30	

Department of Medical laboratory technique

Course Outline Effective From: 2023-24

Name of the Program	Bachelors of Science in Medical Laboratory techniques			Year/ Semester:	2nd year/IV semester
Course Name	Applied Haematology-I	Course Code:	BLP 404	Type:	Practical
Credits				Total Sessions Hours:	
Evaluation Spread	Internal Continuous Assessment:			End Term Exam:	
Type of Course	<input type="radio"/> Compulsory	<input checked="" type="radio"/> Core	<input type="radio"/> Creative	<input type="radio"/> Life Skill	
Course Outcomes (CO): <i>After the successful course completion, learners will develop following attributes:</i>					
CO1	Student will learn about the estimation of Hemoglobin by different methods.				
CO2	Student will learn about the total cell count -platelets, leukocyte and eosinophil				
CO3	Student will learn about the staining, ESR and packed cell volume measurement techniques in Haematology lab				
CO4	Student will learn about routine physical and microscopic examination of seminal fluid and CSF				
Pedagogy	Hands on, demonstration				
Internal Evaluation Mode					
Session Details	Topic				MappedCO
Unit 1	1. Estimation of Haemoglobin 1.1 Sahli's method 1.2 Cyanmethaemoglobin method 1.3 Oxyhaemoglobin method				CO1
Unit 2	1. Total leukocyte count 2. Platelets count 2. Absolute Eosinophil count				CO2
Unit 3	1. Preparation of smear and staining with Giemsa and Leishman stain. 2. ESR (Wintrobe and Westergren method) 3. Packed cell volume (Macro & Micro)				CO3
Unit 4	1. Routine Examination of CSF 2. Physical and Microscopic examination of seminal fluid including sperm count 3. Perform normal DLC				CO4

CO-PO and PSO Mapping														
CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO 1	PSO 2	PSO3	PSO 4	PSO 5	PSO6
CO1	3	3	3	3	3	3	-	-	3	3	-	3	3	1
CO2	3	3	3	3	3	3	-	-	3	3	-	3	3	1
CO3	3	3	3	3	3	3	-	-	3	3	-	3	3	1
CO4	3	3	3	3	3	3	-	-	3	3	-	3	3	1
<i>Strong contribution-3, Average contribution-2, Low contribution-1,</i>														
Suggested Readings:														
Reference Books	Practical Haematology by J.B. Dacie													
Para Text	Unit 1: Estimation of Haemoglobin Unit 2: Cell count Unit 3: Staining Unit4: Fluid analysis													
Recapitulation & Examination Pattern														
Internal Continuous Assessment:														
Component	Marks	Pattern												
Mid Semester	12	MCQ: 4 Short Answer Type Questions: 02 Long Answer Type Question: 01												
Class Test	6	MCQ: 02 Short Answer Type Questions: 01 Long Answer Type Question: 01												
Online Test/ Objective Test	4	MCQ: 4												
Assignment/ Presentation	4	Hard copy/Softcopy												
Attendance	4													
Total Marks	30													

ERA UNIVERSITY
FACULTY OF ALLIED HEALTH SCIENCES & RESEARCH
BACHELOR OF SCIENCE IN MEDICAL LABORATORY TECHNIQUES (B.SC MLT)
FRAMEWORK Fifth Semester
FOR THE ACADEMIC YEAR 2023 to 2024
Till the next change in the curriculum

Subject Code	Course Titles	Hours per week			Marks			CR
		L	Theory	Practical	Internal	External	Total	
BLT 501	Applied Clinical Biochemistry – I	3	1	-	30	70	100	4
BLT 502	Applied Histopathology – II	3	1	-	30	70	100	4
BLT 503	Immunology & Bacterial serology	3	1	-	30	70	100	4
BLT 504	Applied Haematology- II	3	1	-	30	70	100	4
BLP 501	Applied Clinical Biochemistry- I- (P)	-	-	4	30	70	100	2
BLP 502	Applied Histopathology-11 - (P)	-	-	4	30	70	100	2
BLP 503	Immunology & Bacterial serology- (P)	-	-	4	30	70	100	2
BLP 504	Applied Haematology - II - (P)	-	-	4	30	70	100	2
	Guest Lecture/Tutorial/Seminar/visit to any medical research institution or reputed clinical laboratory	-	2	-	-	-	-	2
Total		12	6	16	240	560	800	26
Total Hours in Semester		550						

NOTE:

1. Abbreviations: L - Lecture, T - Tutorials and P - Practical
Considering four months per semester as working months, total contact hours per semester shall be 550 (Five hundred and Fifty)

Department of Medical laboratory technique
Course Outline Effective From: 2023-24

Name of the Program	Bachelors of Science in Medical Laboratory techniques			Year/ Semester:	3rd year /5th sem
Course Name	Applied Clinical Biochemistry-I	Course Code:	BLT 501	Type:	THEORY
Credits	L:3 T:1P:0			Total Sessions Hours:	50
Evaluation Spread	Internal Continuous Assessment:	30		End Term Exam:	70
Type of Course	<input type="radio"/> Compulsory	<input checked="" type="radio"/> Core	<input type="radio"/> Creative	<input type="radio"/> Life Skill	
Course Objectives	The students will be taught about Hazards & safety measures in a clinical biochemistry lab, Quality control and quality assurance, Principles of assay procedures and Estimation of various Investigations in Biochemistry Lab.				
Course Outcomes (CO): After the successful course completion, learners will develop following attributes:					
Course Outcome (CO)	Course Outcomes (CO): They will be able to Diagnosis of clinical disorders by estimating biomarker, Determine various substances including substrates, enzymes, hormones, etc and their use in diagnosis and monitoring of disease are applied, evaluate the abnormalities which commonly occur in the clinical field, review the information from each category of tests and develop a protocol for disease diagnosis				
CO1	The student will be able to learn about the Hazard & safety measures in a clinical biochemistry lab, Quality control, and quality assurance, Laboratory organization				
CO2	The student will be able to learn about the principles of assay procedures Urea uric acid, SGOT, SGPT, Bilirubin				
CO3	The student will be able to learn about the estimation and assessment of Sodium and Potassium, calcium, chloride, iodine, and phosphorus				
CO4	The student will be able to learn about the techniques used in used in clinical biochemistry lab- RIA/ELISA, Radioactivity				
CO5	The student will be able to learn about the buffer system, metabolic acidosis and alkalosis				
Pedagogy	White board, Seminar, PPT, Classroom teaching, e-Lecture, assignment				
Internal Evaluation Mode	Continuous internal assessment and written examination				
Session Details	Topic	Hours	Mapped CO		
Unit 1	1.. Hazards & safety measures in clinical Biochemistry laboratory 2. Quality control and quality assurance in a clinical biochemistry laboratory 3. Laboratory organization 4. Management and maintenance of records	10	CO1		
Unit 2	1. Principles of assay procedures, Normal range in blood, Serum, Plasma and Urine and reference values for: Glucose, Proteins 2. Urea, Uric acid 3. Bilirubin, SGOT & SGPT, ALP 4. Lipids	10	CO2		

Unit 3	1.Principles, procedures for estimation & assessment of the following including errors involved and their corrections: Sodium, Potassium 2.Chloride, Iodine 3.Calcium 4.Phosphorous and Phosphates	10	CO3
Unit 4	1.Instruments for detection of Radioactivity 2.Applications of Radioisotopes in clinical biochemistry. 3.Enzyme linked immune sorbent assay (ELISA) 4.RIA	10	CO4
Unit 5	1.Acid base balance, action of buffer system 2.Hb buffers 3.Respiratory and metabolic acidosis, respiratory and metabolic alkalosis, 4.Arterial blood gas analysis, blood gas analyzer.	10	CO5

CO-PO and PSO Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO 1	PSO 2	PSO 3	PSO4	PSO 5	PSO6
CO1	3	3	3	3	2	3	-	3	-	3	-	3	2	3
CO2	3	3	3	3	2	3	-	-	-	3	-	3	2	3
CO3	3	3	3	3	2	3	-	-	-	3	-	3	2	3
CO4	3	3	3	3	3	3	-	-	-	3	-	3	2	3
CO5	3	3	3	3	2	3	-	-	-	3	-	3	2	3

Strong contribution-3, Average contribution-2, Low contribution--1,

Suggested Readings:-

Text- Books/ Reference Books	<ol style="list-style-type: none"> 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 Chatterjee & Shinde. 6. Biochemistry by Voet & Voet 7. Biochemistry by Strye 8. Principal of Biochemistry by Lehninger
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Para Text	Unit 1: Quality control and Management Unit 2: Biochemical Assay Unit 3: Assay Procedures Unit 4: Techniques in Clinical Biochemistry Unit 5: Buffer system
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Recapitulation & Examination Pattern

Internal Continuous Assessment:

Component	Marks	Pattern
Mid Semester	12	MCQ: 4 Short Answer Type Questions: 02 Long Answer Type Question: 01
Interaction In Class	6	
Class Test	4	MCQ: 02 Short Answer Type Questions: 01 Long Answer Type Question: 01
Assignment/ Presentation	4	Hard copy/Softcopy
Attendance	4	
Total Marks	30	

Department of Medical laboratory technique

Course Outline Effective From: 2023-24

Name of the Program	Bachelors of Science in Medical Laboratory techniques			Year/ Semester:	3rd year/V semester
Course Name	Applied Histopathology -II	Course Code:	BLT 502	Type:	Theory
Credits	L:3 T:1 P:0			Total Sessions Hours:	50
Evaluation Spread	Internal Continuous Assessment:	30		End Term Exam:	
Type of Course	<input type="radio"/> Compulsory	<input checked="" type="radio"/> Core	<input type="radio"/> Creative	<input type="radio"/> Life Skill	
Course Objectives	Students will learn about various staining procedures for demonstration of different substances. The students will learn about special staining procedures, its handling & testing of various histological specimens in addition to cryostat sectioning and electron microscopic procedures.				
Course Outcomes (CO): <i>After the successful course completion, learners will develop following attributes:</i>					
Course Outcome (CO)	Justify when to use cryopreservation to preserve tissue and how a cryostat functions; apply the correct stains to enhance particular cellular and tissue structures for examination; explain the underlying principles of microtomy and be able to apply them; and determine the features of common diseases under the microscope using the systems described above.				
CO1	Students will be able to learn about various staining procedures and its application in diagnostic histopathology				
CO2	Students will be able to learn about Staining types and procedures applied for Lipids, Pigments, Amyloids, and Miscellaneous,				
CO3	Students will be able to learn about microorganisms' identification stains, demonstration of macromolecules, tissue processing in histopathology				
CO4	Students will be able to learn about Immunohistochemistry, immunocytochemistry and enzyme histochemistry.				
CO5	Students will be able to learn about Techniques used in Clinical Histopathology Laboratory				
Pedagogy	White board, PPT, Seminar, e-lecture, Classroom teaching, Assignment				
Internal Evaluation Mode	Continuous internal assessment and written exam				
Session Details	Topic			Hours	Mapped CO
Unit 1	1. Cryostat sectioning, and its applications in diagnostic histopathology. 2. Connective tissue stains and staining methods, properties, PTAH, Reticulin, verhoff 3. Masson trichrome, VenGiesson, Heidemhain's Aniline Blue Method 4. Mucin: Types, various stains and staining methods PAS, alcian blue, Mucicarmine.			10	CO1
Unit 2	1. Lipids: Types, identification with various stains and staining method {Sudan ,oil red O}. 2. Pigments: Various pigments, identification with various stains methods and staining (hemosiderin melanin). 3. Miscellaneous (calcium)Vonkossa's Stains 4. Amyloid :-Toludineblue, Metachromatic Stains.			10	CO2

Unit 3	<ol style="list-style-type: none"> 1. Identification of microorganisms using various stains. Modified Giemsa Stains, Silver Nitrate GMS. 2. Demonstration of Proteins & nucleic acids. 3. Tissue requiring special treatment i.e. eye ball, bone marrow, and muscle biopsy 4. Under calcified or unclarified bones, whole brain, and whole lungs including other large organs. 	10	CO3
Unit 4	<ol style="list-style-type: none"> 1. Immuno histochemical and immuno cytochemical staining, quality control. 2. Enzyme histochemistry: Introduction, Diagnostic applications 3. Demonstration of Phosphatases, Dehydrogenases, 4. Demonstration of Oxidases & Peroxidases 	10	CO4
Unit 5	<ol style="list-style-type: none"> 1. Neuro-pathological techniques. 2. Museum techniques. 3. Electron Microscope: working principle and its components 4. Processing, embedding and ultra-microtomy 	10	CO5

CO-PO and PSO Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO 1	PSO 2	PSO3	PSO 4	PSO 5	PSO 6
CO1	3	3	2	3	1	3	-	-	2	3	-	3	3	3
CO2	3	3	2	3	1	3	-	-	2	3	-	3	3	3
CO3	3	3	2	3	2	3	-	-	2	3	-	3	3	3
CO4	3	3	2	3	2	3	-	-	2	3	-	3	3	3
CO5	3	3	2	3	3	3	-	-	1	3	-	3	3	3

Strong contribution-3, Average contribution-2, Low contribution-1,

Suggested Readings:

Text- Books/ Reference Books	<ol style="list-style-type: none"> 1. Handbook of Histopathological Techniques by C FA Culling 2. Medical Lab technology by Lynch 3. An Introduction to Medical Lab Technology by F J Baker and Silverton 4. Bancroft's Theory and Practice of Histopathological Techniques by John D Bancroft
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Para Text	Unit 1: Cryostat staining and preservation Unit 2: Biomolecules staining methods Unit 3: Staining of Histological specimens Unit 4: Immunotechniques in Histopathology Unit 5: Tools and Techniques in Histopathology
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Recapitulation & Examination Pattern

Internal Continuous Assessment:

Component	Marks	Pattern
Mid Semester	12	MCQ: 4 Short Answer Type Questions: 02 Long Answer Type Question: 01
Class Test	4	MCQ: 02 Short Answer Type Questions: 01 Long Answer Type Question: 01
Interaction In Class	6	
Assignment/ Presentation	4	Hard copy/Softcopy
Attendance	4	
Total Marks	30	
Mid Semester	12	MCQ: 4 Short Answer Type Questions: 02 Long Answer Type Question: 01

Course Outline Effective From: 2023-24

Name of the Program	Bachelors of Science in Medical Laboratory techniques			Year/ Semester:	3rd year/V Semester
Course Name	Immunology & Bacterial Serology	Course Code:	BLT 503	Type: Fifth Semester	THEORY
Credits	L: 3 T:1 P:0			Total Sessions Hours:	52
Evaluation Spread	Internal Continuous Assessment:	30		End Term Exam:	70
Type of Course	<input type="radio"/> Compulsory	<input checked="" type="radio"/> Core	<input type="radio"/> Creative	<input type="radio"/> Life Skill	
Course Objectives	This section will cover the basic aspects of immunity, antigens, antibodies, various serological reactions, techniques and their utility in laboratory diagnosis of human diseases. It will also cover medically important fungi, infections caused by them and their laboratory diagnosis.				
Course Outcomes (CO): <i>After the successful course completion, learners will develop following attributes:</i>					
Course Outcome (CO)	The ability to understand, implement and troubleshoot the concepts related to the fields of Immunology and Serology which will enable them to analyze and develop solutions to microbiology, immunology and Serology related problems using knowledge and hands-on skills in immunodiagnostics, screening for useful Serological Investigation in relevant protocols.				
CO1	The students will learn about Immunity, its types and its mechanism				
CO2	The students will learn about, Antigen, Antibody and antigen-antibody reactions				
CO3	The students will learn about techniques used in medical microbiology-IFA, ELISA, SDS-PAGE, Weste blotting				
CO4	The students will learn about serological test-Widal, VDRL,ASO, and Complement system				
CO5	The students will learn about Immune responses, Hypersensitivity,vaccine and automation in diagnostic serology				
Pedagogy	White board, seminar, assignment, PPT				
Internal Evaluation Mode	Continuous internal assessment and written examination				
Session Details	Topic	Hours	Mapped CO		
Unit 1	1. Immunity 2. Innate 3. Acquired immunity 4. Basic concepts about their mechanisms	10	CO1		
Unit 2	1. Definition, types of antigens and determinants of antigenicity 2. Definition, types, structure and properties of immunoglobulin 3. Antigen-Antibody reactions: Definition, Classification, General features and mechanisms 4. Applications of various antigen antibody reactions	10	CO2		
Unit 3	1. Principle, procedure and applications of under mentioned in Medical Microbiology: Complement fixation test 2. Immuno- fluorescence, ELISA 3. SDS-PAGE 4. Western blotting	10	CO3		
Unit 4	1. Principle, procedure and interpretation of various serological tests: Widal, VDRL, ASO 2. CRP, Brucella tube agglutination, Rose-Waaler 3. Complement system: Definition, Basic concepts about its components 4. Complement activation pathways	10	CO4		

Unit 5	<ol style="list-style-type: none"> Immune response: Introduction, Basic concepts of Humeral and Cellular immune responses Hypersensitivity: Definition, Types of hypersensitivity reactions Basic concepts of autoimmunity and brief knowledge about autoimmune diseases Automation in diagnostic serology Vaccines: Definition, Types, Vaccination schedule Brief knowledge about Extended programme of immunization' (EPI) in India 	10	CO5
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CO-PO and PSO Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO 1	PSO 2	PSO3	PSO 4	PSO 5	PSO 6
CO1	1	3	2	2	1	2	-	-	1	2	-	3	1	3
CO2	1	3	2	2	1	2	-	-	1	3	-	3	1	3
CO3	3	3	2	3	3	3	-	-	1	3	-	3	3	3
CO4	3	3	2	3	3	3	-	-	1	3	-	3	3	3
CO5	3	3	2	3	3	3	-	-	1	3	-	3	3	3

Strong contribution-3, Average contribution-2, Low co-ntribution-1,

Suggested Readings

Text- Books/ ReferenceBooks	<ol style="list-style-type: none"> Practical Medical Microbiology by Mackie & McCartney Volume 1 and 2 Text book of Microbiology by Ananthanarayanan Medical laboratory Technology Vol. I, II, III by Mukherjee Medical Laboratory manual for tropical countries Vol II Microbiology by Monica Cheesbrough Immunology by Riot Basic & Clinical Immunology by P. Daniel Fudenberg. H. Hugh and Stites Medical Microbiology by Paniker& Satish Gupte Microbiology For Medical Sciences by Bhagat Singh and Renu Singh
Para Text	Unit 1: History and introduction to immunology: Unit 2: Antigen & Antibody Unit 3: Techniques Used in Medical Microbiology: Unit4: Serological Test & Complement System: Unit 5: Immune Response, Hypersensitivity & Vaccines:

Recapitulation & Examination Pattern

Internal Continuous Assessment:

Component	Marks	Pattern
Mid Semester	12	MCQ: 4 Short Answer Type Questions: 02 Long Answer Type Question: 01
Interaction In Class	6	
Class Test	4	MCQ: 02 Short Answer Type Questions: 01 Long Answer Type Question: 01
Assignment/ Presentation	4	Hard copy/Softcopy
Attendance	4	
Total Marks	30	



Department of Medical laboratory technique
Course Outline Effective From: 2023-24

Name of the Program	Bachelors of Science in Medical Laboratory techniques		Year/ Semester:	3 rd year/5 th sem
Course Name	Applied Haematology- II	Course Code:	BLT-504	Type: Theory
Credits	L: 3 T:1 P:0		Total Sessions Hours:	50

Evaluation Spread	Internal Continuous Assessment:	30	End Term Exam:	70
Type of Course	<input type="radio"/> Compulsory	<input checked="" type="radio"/> Core	<input type="radio"/> Creative	<input type="radio"/> Life Skill
Course Objectives	The students will be made aware of the safety precautions in Haematology, basic concepts of Automation, quantitative assay of coagulation factors, Karyo typing etc. and will learn about concepts such as safety precautions, quality assurance, biomedical waste management and automation in haematology. It will also cover bone marrow examination, red cell anomalies, disorder of leucocytes, LE. cell phenomenon.			
Course Outcomes (CO): After the successful course completion, learners will develop following attributes:				
Course Outcome (CO)	They will be able to perform efficiently routine investigations in clinical hematology laboratory. Students will also be able to carry out different immune-haematological investigations and coagulation profile tests. They will be able to handle automated instruments.			
CO1	The students will be able to learn the automation in Haematology			
CO2	The students will be able to learn the Bone marrow examination, processing and staining of biopsy specimens			
CO3	The students will be able to learn the red cell anomalies MCV, MCH, MCHC and RDW			
CO4	The students will be able to learn the L.E cell phenomenon and factors deficiency			
CO5	The students will be able to learn cytochemical staining used in Haematology-PAS, SBB,NAP and MPO			
Pedagogy	White board, PPT, Classroom Teaching, Seminar, e.t.c			
Internal Evaluation Mode	Continuous internal assessment and written examination			
Session Details	Topic	Hours	Mapped CO	
Unit 1	Safety precautions in Haematology Principle of automated blood cell counter; Uses, care, maintenance and calibration of automated blood cell counter Automatic ESR analyzer, urine analyzer Coagulometer	10	CO1	
Unit 2	1. Composition and functions, Aspiration of bone marrow (Adults and children) 2. Processing of aspirated bone marrow (Preparation & staining of smear) 3. Brief knowledge about examination of aspirated bone marrow (differential cell counts and cellular ratios) 4. Processing and staining of trephine biopsy specimens	10	CO2	
Unit 3	1. Red cell anomalies 2. Morphological changes such as variation in size shape & staining character. 3. MCV, MCH, MCHC & RDW 4. Reticulocytes: Definition, different methods to count, Absolute reticulocyte count	10	CO3	
Unit 4	1. Lupus Erythematosus (LE) cell phenomenon: Definition of LE. cell. 2. Demonstration of LE. cell by various methods& Clinical significance. 3. Quantitative assay of coagulation factors : Principle, Procedure 4. Screening of inhibitors	10	CO4	

UNIT 5	<ol style="list-style-type: none"> 1. Karyotyping: Chromosomal studies in hematological disorders (PBLC and Bone marrow) 2. Cyto-chemical staining: Principles, method and significance 3. PAS, SBB, NAP& MPO 4. Biomedical waste management in Haematology laboratory (Other than Radioactive material) 	10	CO5
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CO-PO and PSO Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO 1	PSO 2	PSO3	PSO 4	PSO 5	PSO 6
CO1	3	3	2	3	3	3	-	-	2	3	-	3	3	3
CO2	3	3	2	2	3	3	-	-	2	3	-	3	3	3
CO3	3	3	2	3	3	3	-	-	2	3	-	3	3	3
CO4	3	3	2	3	3	3	-	-	2	3	-	3	3	3
CO5	3	3	2	3	3	3	-	-	2	3	-	3	3	3

Strong contribution-3, Average contribution-2, Low contribution-1,

Suggested Readings:

Text- Books/ Reference Books	<ol style="list-style-type: none"> 1. Text book of Medical Laboratory Technology by Paraful B. Godkar 2. Medical laboratory Technology by KL Mukherjee Volume-I 3. Practical Haematology by JB Dacie 4. Clinical Diagnosis & Management by Laboratory methods (20th edition) by John Bernard Henary 5. Atlas of Haematology (5th edition) by G.A. McDonald 6. De Gruchy's clinical Haematology in medical practice
Para Text	Unit 1: Automation in Haematology: Unit 2: Bone Marrow Examination Unit 3: Red Cells Indices: Unit4: LE Cells & Factors Deficiency Unit 5: Cytochemical Stains Used in Haematology:

Recapitulation & Examination Pattern

Internal Continuous Assessment:

Component	Marks	Pattern
Mid Semester	12	MCQ: 4 Short Answer Type Questions: 02 Long Answer Type Question: 01
Interaction In Class	6	
Class Test	4	MCQ: 02 Short Answer Type Questions: 01 Long Answer Type Question: 01
Assignment/ Presentation	4	Hard copy/Softcopy
Attendance	4	
Total Marks	30	



Department of Medical laboratory technique Course Outline Effective From: 2023-24

Name of the Program	Bachelors of Science in Medical Laboratory techniques			Year/ Semester:	3 rd year/5 th sem
Course Name	Applied Clinical Biochemistry	Course Code:	BLP-501	Type:	Practical
Credits	L:0 P:0 T:4			Total Sessions Hours:	30
Evaluation Spread	Internal Continuous Assessment:	30		End Term Exam:	70

Type of Course	<input type="radio"/> Compulsory	<input checked="" type="radio"/> Core	<input type="radio"/> Creative	<input type="radio"/> Life Skill
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Course Outcomes (CO): After the successful course completion, learners will develop following attributes:

CO1 Students will learn about the assay procedures and estimation of various investigation from clinical samples in the clinical biochemistry lab. Urea, Protein, Glucose, uric acid Cholesterol and serum bilirubin

Pedagogy Hands on/Demonstration

Internal Evaluation Mode Continuous internal assessment and written examination

Session Details	Topic	MappedCO
Unit 1	Estimation of Glucose in Urine and in Blood. Estimation of Protein in Urine and Blood. Estimation of Urea in blood. Estimation of uric acid in blood. Estimation of serum Bilirubin Estimation of Total Cholesterol in blood. Estimation of HDL Cholesterol. Estimation of LDL Cholesterol. Estimation of TG Estimation of Creatinine in Blood Estimation of serum calcium, Inorganic phosphate To measure electrolytes Sodium, Potassium & Chloride.	CO1

CO-PO and PSO Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO 1	PSO 2	PSO3	PSO 4	PSO 5	PSO 6
CO1	3	3	3	3	3	3	3	1	2	3	-	3	3	3

Strong contribution-3, Average contribution-2, Low contribution-1,

Suggested Readings:

Text- Books 1. Practical Clinical Biochemistry by Harold Varley.

Para Text Unit 1: Staining Methods in Clinical Biochemistry

Recapitulation & Examination Pattern

Internal Continuous Assessment:

Component	Marks	Pattern
Mid Semester	12	Spotting: 4 Exercise: 04 Viva :02 File:02
Class Test	6	MCQ: 02 Short Answer Type Questions: 01 Long Answer Type Question: 01
Online Test/ Objective Test	4	MCQ: 4
Assignment/ Presentation	4	Hard copy/Softcopy
Attendance	4	
Total Marks	30	



Department of Medical laboratory technique
Course Outline Effective From: 2023-24

Name of the Program	Bachelors of Science in Medical Laboratory techniques			Year/ Semester:	3rd year/V Semester
Course Name	Applied Histopathology	Course Code:	BLP-502	Type:	Practical
Credits	L:0 T:0 P:4			Total Sessions Hours:	30
Evaluation Spread	Internal Continuous Assessment:	30		End Term Exam:	70
Type of Course	C Compulsory	C Core	C Creative	C Life Skill	

Course Outcomes (CO): After the successful course completion, learners will develop following attributes:

CO1	Students will learn about the staining procedure and preparation of various reagents required in histopathology lab.	
Pedagogy	Hands on/Demonstration	
Internal Evaluation Mode	Continuous internal assessment and written examination	
Session Details	Topic	MappedCO
Unit 1	<ol style="list-style-type: none"> 1. To cut frozen section and stain for Haematoxylin and Eosin, Metachromatic stain Toluidine blue and Oil Red 'O' staining for the demonstration of fat 1. To prepare Schiff's reagent in the lab and do Periodic Acid Schiff's (PAS) stain on a Paraffin section 2. To stain a paraffin section for the demonstration of smooth muscle by Van Gieson's Stain 3. To perform Masson's trichrome stain on a paraffin section for the demonstration of collagen fiber, muscle fiber and other cell elements. 4. To stain the paraffin section for the demonstration of the elastic fibers (EVG). 5. To stain Decalcified paraffin embedded section for the presence of calcium salts (Von Kossa's method). 6. To stain a paraffin section for the following Mucicarmine, Alcian blue. 7. To stain a paraffin section for the demonstration of iron (Perl's stain) 8. To demonstrate the presence of bacteria and fungi in paraffin embedded sections using The following staining procedures: <ol style="list-style-type: none"> a. Gram's staining b. AFB staining (Ziehl Neelson's staining) for M. tuberculosis and leprae c. Grocott's stain for fungi d. Schmorl's reaction for reducing substances (melanin) e. To stain for nucleic acid (DNA and RNA) f. Feulgen Staining g. Methyl Green-Pyronin Staining h. Enzymatic methods 	CO1

CO-PO and PSO Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO 1	PSO 2	PSO3	PSO 4	PSO 5	PSO 6
CO1	3	3	3	3	3	3	-	-	3	3	-	3	3	3

Strong contribution-3, Average contribution-2, Low contribution-1,

Suggested Readings:

Text- Books	Bancroft's Theory and Practice of Histopathological Techniques by John D Bancroft
Para Text	Unit 1: Staining techniques in Histopathology

Recapitulation & Examination Pattern

Internal Continuous Assessment:

Component	Marks	Pattern
Mid Semester	12	Spotting: 4 Exercise: 04 Viva :02 File:02
Class Test	6	MCQ: 02 Short Answer Type Questions: 01 Long Answer Type Question: 01
Online Test/ Objective Test	4	MCQ: 4
Assignment/ Presentation	4	Hard copy/Softcopy
Attendance	4	
Total Marks	30	

Department of Medical laboratory technique

Course Outline Effective From: 2023-24

Name of the Program	Bachelors of Science in Medical Laboratory techniques			Year/ Semester:	3rd year/5th sem
CourseName	Immunology & Bacterial Serology-	Course Code:	BLP 503	Type:	Practical
Credits	L:0 T:0 P:4			Total Sessions Hours:	30
EvaluationSpread	Internal Continuous Assessment:	30		End Term Exam:	70
Type ofCourse	<input type="radio"/> Compulsory	<input checked="" type="radio"/> Core	<input type="radio"/> Creative	<input type="radio"/> Life Skill	

Course Outcomes (CO): After the successful course completion, learners will develop following attributes:

CO1	Students will learn about the techniques used in the testing of blood sample
CO2	Students will learn about the preparation of phosphate buffer used in bacteriology lab
CO3	Students will learn about different serological techniques used in clinical microbiology lab
CO4	Students will learn about different Immunotechniques

Pedagogy Hands on/Demonstration

Internal Evaluation Mode Continuous internal assessment and written examination

SessionDetails	Topic	MappedCO
Unit 1	1. Collection of blood sample by vein puncture, separation and preservation of serum 2. Performing Haemolysin titration for Rose-Waaler test	O1
Unit 2	1. Preparation of Phosphate buffers, Verinol buffer, ASO buffer, Richardson's buffer, Buffers of different pH and Molarity, Tris buffer 2. Standardization of cell concentration by Spectrophotometer	CO2
Unit 3	Performance of Serological tests i.e. Widal, Brucella Tube Agglutination, VDRL (including Antigen Preparation), ASO (Anti-Streptolysin =O')C-Reactive Protein (Latex agglutination) Rheumatoid factor (RF) Latex agglutination	CO3
Unit 4	1. Demonstration of antigen/antibody determination by Immune fluorescence (IF) 2. Immunodiffusion, precipitation in Agarose gel (Ouchterlony)CCIEP, ELISA, SOS - PAGE and Western blotting	CO4

CO-PO and PSO Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO 1	PSO 2	PSO3	PSO 4	PSO 5	PSO6
CO1	3	3	3	3	3	3	-	-	3	3	-	3	3	3
CO2	3	3	3	3	3	3	-	-	3	3	-	3	3	3

CO3	3	3	3	3	3	3	-	-	3	3	-	3	3	3
CO4	3	3	3	3	3	3	-	-	3	3	-	3	3	3

Strong contribution-3, Average contribution-2, Low contribution-1,

Suggested Readings:

Text- Books	Practical Medical Microbiology by Mackie & McCartney Volume 1 and 2
Para Text	Unit 1: Blood sample collection Unit 2: Buffer system Unit 3: Antigen-Antibody serological test Unit4: Immunotechniques

Recapitulation & Examination Pattern

Internal Continuous Assessment:

Component	Marks	Pattern
Mid Semester	12	Spotting: 4 Exercise: 04 Viva :02 File:02
Class Test	6	MCQ: 02 Short Answer Type Questions: 01 Long Answer Type Question: 01
Online Test/ Objective Test	4	MCQ: 4
Assignment/ Presentation	4	Hard copy/Softcopy
Attendance	4	
Total Marks	30	

Department of Medical laboratory technique
Course Outline Effective From: 2023-24

Name of the Program	Bachelors of Science in Medical Laboratory techniques			Year/ Semester:	3rd year/5th sem
Course Name	Applied Haematology-II-	Course Code:	BLP-504	Type:	Practical
Credits	L: 0 T:0 P: 4			Total Sessions Hours:	30
Evaluation Spread	Internal Continuous Assessment:	30		End Term Exam:	70
Type of Course	<input type="radio"/> Compulsory	<input checked="" type="radio"/> Core	<input type="radio"/> Creative	<input type="radio"/> Life Skill	

Course Outcomes (CO): *After the successful course completion, learners will develop following attributes:*

CO1	Students will learn about the morphological evaluation of blood cells in the Haematology lab
CO2	Students will learn about the quantitative assay of coagulation factors.
CO3	Students will learn about the red cell anomalies, karyotyping and disorders of leucocytes

Pedagogy Hands on/Demonstration

Internal Evaluation Mode Continuous internal assessment and written examination

Session Details	Topic	MappedCO
Unit 1	Review the morphology of Normal and abnormal RBCs Review the morphology of normal and immature WBCs Calculating INR and determining the ISi of thromboplastin Quantitative Factor assays: Factor VIII Factor IX Factor VII Factor X Factor V Quantification of inhibitors (Bethesda method) APLA : Lupus Anticoagulant (LA) Anti-cardiolipin antibodies (ACA) Perform Euglobulin clot lysis test (ELT) Urea clot solubility test for factor XIII.	CO1

CO-PO and PSO Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO 1	PSO 2	PSO3	PSO4	PSO5	PSO6
CO1	3	3	3	3	3	3	-	-	3	3	-	3	3	3
CO2	3	3	3	3	3	3	-	-	3	3	-	3	3	3
CO3	3	3	3	3	3	3	-	-	3	3	-	3	3	3
CO4	3	3	3	3	3	3	-	-	3	3	-	3	3	3

Strong contribution-3, Average contribution-2, Low contribution-1,

Suggested Readings:

Text- Books	Practical Haematology by JB Dacie
Para Text	Unit 1: Microscopic examination of blood cells Unit 2: Coagulation factor study Unit 3: Leucocytes disorders test

Recapitulation & Examination Pattern

Internal Continuous Assessment:

Component	Marks	Pattern
Mid Semester	12	Spotting: 4 Exercise: 04 Viva :02 File:02
Class Test	6	MCQ: 02 Short Answer Type Questions: 01 Long Answer Type Question: 01
Online Test/ Objective Test	4	MCQ: 4
Assignment/ Presentation	4	Hard copy/Softcopy
Attendance	4	
Total Marks	30	

ERA UNIVERSITY
FACULTY OF ALLIED HEALTH SCIENCES & RESEARCH
BACHELOR OF SCIENCE IN MEDICAL LABORATORY TECHNIQUES (B.SC MLT)
FRAMEWORK Sixth Semester
FOR THE ACADEMIC YEAR 2023 to 2024
Till the next change in the curriculum

Subject Code	Course Titles	Hours per week			Marks			CR
		L	Theory	Practical	Internal	External	Total	
BLT-601	Applied Clinical Biochemistry- II	3	1	-	30	70	100	4
BLT-602	Advanced Hematology	3	1	-	30	70	100	4
BLT-603	Medical Parasitology & Entomology	3	1	-	30	70	100	4
BLT-604	Cytopathology	3	1		30	70	100	4
BLP-601	Applied Clinical Biochemistry- II-- (P)	-	-	4	30	70	100	2
BLP-602	Advanced Haematology - (P)	-	-	4	30	70	100	2
BLP-603	Medical Parasitology & Entomology -(P)	-	-	4	30	70	100	2
BLP-604	Cytopathology - (P)	-	-	4	30	70	100	2
	Guest Lecture/Tutorial/Seminar/visit to any medical research institution or reputed clinical Laboratory	-	2	-	-	-	-	2
Total		12	6	16	240	560	800	26
Total Hours in Semester		550						

NOTE:

i. **Abbreviations:** L - Lecture, T - Tutorials and P - Practical

Considering four months per semester as working months, total contact hours per semester shall be 550 (Five hundred and fifty)

Name of the Program	Bachelors of Science in Medical Laboratory techniques			Year/ Semester:	3rd year /6th sem
Course Name	Applied clinical Biochemistry -II	Course Code:	BLT-601	Type: 6th semester	THEORY
Credits	L:3 T:1 P:0			Total Sessions Hours:	60
Evaluation Spread	Internal Continuous Assessment:	30		End Term Exam:	70
Type of Course	<input type="radio"/> Compulsory	<input checked="" type="radio"/> Core	<input type="radio"/> Creative	<input type="radio"/> Life Skill	
Course Objectives	The students will learn how to analyze various clinical patients sample for estimation of different components which are the cause of the disease or are the diagnostic/prognostic markers.				
Course Outcome (CO)	Course Outcomes (CO): Students will know basics and procedure of different parameters used to assess organ function. The students will learn to perform assay of clinically important enzyme: serum alkaline phosphatase, serum creatine phosphokinase and serum acid phosphatase.				
CO1	The students will learn about the automation in clinical biochemistry				
CO2	The students will learn about the gastric analysis and Qualitative test				
CO3	The students will learn about the Organ profile test				
CO4	The students will learn about the enzyme test in clinical biochemistry				
Pedagogy	Seminar, PPT, White board, Assignment				
Internal Evaluation Mode	Continuous Internal Assessment and Written examination				
Session Details	Topic	Hours	Mapped CO		
Unit 1	1.Automation in clinical biochemistry 2.Method of estimation and assessment for: Glucosetolerance test 3.Method of estimation and assessment for: Insulin tolerance test 4.Method of estimation and assessment for: Xylose excretion test.	12	CO1		
Unit 2	Gastric analysis. Clearance test for renal function. Qualitative test for: Urobilinogens, Barbiturates Ketosteroids	12	CO2		
Unit 3	Lipid Profile Test 1. Renal Function Test 2. Thyroid Function Test 3. Liver Function Test & Cardiac Function Test	12	CO3		

Unit 4	1.Enzymes: Principles, Clinical significance and Procedures for estimation: Acid phosphatase, Alkaline phosphatase 2.Lactate dehydrogenase 3.Aspartate transaminase 4.Alanine transaminase & Creatine phosphokinase	12	CO4
Unit 5	1.Qualitative analysis of Renal calculi. 2.Chemical examination of Cerebrospinal fluid. 3.Chemical examination of Ascitic fluidn & Pleural Fluid. 4.Brief knowledge about rapid techniques in clinical biochemistry	12	CO5

CO-PO and PSO Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO 1	PSO 2	PSO 3	PSO4	PSO 5	PSO6
CO1	3	3	3	3	1	3	-	-	2	3	-	3	2	3
CO2	3	3	3	3	1	3	-	-	2	3	-	3	2	3
CO3	3	3	3	3	1	3	-	-	2	3	-	3	2	3
CO4	3	3	3	3	2	3	-	-	2	3	-	3	2	3
CO5	3	3	3	3	2	3	-	-	2	3	-	3	2	3

Strong contribution-3, Average contribution-2, Low contribution-1,

Suggested Readings:

Text- Books/ Reference Books	<ol style="list-style-type: none"> 1. Text book of Medical Laboratory Technology by P.B. Godkar.. 2. Practical Clinical Biochemistry by Harold Varley. 3. Text book of Medical Biochemistry by Chaterjee&Shinde. 4. Principal of Biochemistry by Lehninger 5. Biochemistry by Voet&Voet 6. Biochemistry by Stryer 7. Medical Laboratory Science, Theory & Practical by A. Kolhatkar. 8. Biochemistry, U. Satyanarayan& U. Chakrapani.
Para Text	Unit 1: Automation in clinical biochemistry: Unit 2: Gastric analysis & Qualitative Test: Unit 3: Organ Profile Test: Unit4: Enzymes: Unit5: Body Cavity Fluid:

Recapitulation & Examination Pattern

Internal Continuous Assessment:

Component	Marks	Pattern
Mid Semester	12	MCQ: 4 Short Answer Type Questions: 02 Long Answer Type Question: 01
Class Test	4	MCQ: 02 Short Answer Type Questions: 01 Long Answer Type Question: 01
Interaction In Class	6	
Assignment/ Presentation	4	Hard copy/Softcopy
Attendance	4	
Total Marks	30	

Name of the Program	Bachelors of Science in Medical Laboratory techniques			Year/ Semester:	3rd year/6th sem
Course Name	Advanced Haematology	Course Code:	BLT-602	Type:	THEORY
Credits	L:3 T:1 P:0			Total Sessions Hours:	60
Evaluation Spread	Internal Continuous Assessment:	30		End Term Exam:	70
Type of Course	<input type="radio"/> Compulsory	<input checked="" type="radio"/> Core	<input type="radio"/> Creative	<input type="radio"/> Life Skill	
Course Objectives	The students will be made aware of different anemia, Leukemia, chromosomal studies, bleeding disorders and radiation hazards.				
Course Outcomes (CO): <i>After the successful course completion, learners will develop following attributes:</i>					
Course Outcome (CO)	<p>Students will able to Differentiate and categorize the normal and abnormal morphology of the different cell types in the blood and bone marrow</p> <ul style="list-style-type: none"> Analyze and compare the basic pathology related to these different abnormalities in the red and white blood cells Apply the basic knowledge in hematology for future professional training (e.g. Clinical Laboratory Scientist training program) Interpret the clinical and laboratory information to understand and classify different types of anemia. 				
CO1	To learn about the Anemia - Definition, Causes, Blood morphology abnormalities and Diagnosis				
CO2	To learn about the Anemia- Definition, Causes, Blood morphology abnormalities and Special test				
CO3	To learn about the Leukemia – Definition Morphology and				
CO4	To learn about the bleeding disorders				
CO5	To learn about the Radioisotopes measurement used in blood and plasma volume determination				
Pedagogy	Seminar, PPT, White board, Assignment				
Internal Evaluation Mode	Continuous Internal Assessment and Written examination				
Session Details	Topic			Hours	Mapped CO
Unit 1	Definition , causes, changes in blood morphology due to the following anaemias and special tests- Iron deficiency anemia Megaloblastic anaemia, Aplastic anaemia Sideroblastic anaemia			12	CO1
Unit 2	Definition , causes, changes in blood morphology due to the following anaemias and special tests <ol style="list-style-type: none"> Sickle cell anaemia, Autoimmune hemolytic anaemia, Hereditary spherocytosis, G6PD deficiency anaemia Thalassemia Sickling test, Osmotic fragility test, Schilling test, Serum Iron, Iron binding capacity. 			12	CO2

Unit 3	<ol style="list-style-type: none"> 1. Definitions, morphology, identification of various abnormal cells in common Leukemia's 2. Acute Leukemia: AML, ALL 3. Chronic Leukemia: AML, CLL 4. Plasma cell myeloma. 	12	CO3
Unit 4	<ol style="list-style-type: none"> 1. Hemophilia A, B & Von-Willebrand disease 2. DIC, 3. Platelet disorder (Qualitative and quantitative) 4. Laboratory approach for investigating thrombosis. 	12	CO4
Unit 5	<ol style="list-style-type: none"> 2. Using radioisotopes measurement of: Blood volume 3. Determination of Red cell volume and Plasma volume 4. Red cell life span, Platelet life span 5. Radiation hazards and its prevention, Disposal of radioactive material 	12	CO5

CO-PO and PSO Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO 1	PSO 2	PSO3	PSO 4	PSO 5	PSO 6
CO1	2	3	3	3	3	2	1	--	3	3	3	3	3	3
CO2	2	3	3	3	3	2	1	-	3	3	3	3	3	3
CO3	2	3	3	3	3	2	1	-	3	3	3	3	3	3
CO4	2	3	3	3	3	2	1	-	3	3	3	3	3	3
CO5	2	3	3	3	3	2	1	-	3	3	3	3	3	3

Strong contribution-3, Average contribution-2, Low contribution-1,

Suggested Readings:

Text- Books	<ol style="list-style-type: none"> 1. Text book of Medical Laboratory Technology by Paraful B. Godkar 2. Medical laboratory Technology by KL Mukherjee Volume-I 3. Practical Haematology by JB Dacie 4. Atlas of Haematology {5th edition) by G.A. McDonald 5. De Gruchy's clinical Haematology in medical practice 6. Postgraduate Haematology by Hoffbrand
Reference Books	<ol style="list-style-type: none"> 1. Clinical Diagnosis & Management by Laboratory methods {20th edition) by John Bernard Henry
Para Text	Unit 1: Anaemias-I: Unit 2: Anaemias-II: Unit 3: Leukemia: Unit4: Bleeding Disorders Unit 5: Radioisotopes Measurement:

Recapitulation & Examination Pattern

Internal Continuous Assessment:

Component	Marks	Pattern
Mid Semester	12	MCQ: 4 Short Answer Type Questions: 02 Long Answer Type Question: 01
Class Test	4	MCQ: 02 Short Answer Type Questions: 01 Long Answer Type Question: 01
Interaction in Class	6	
Assignment/ Presentation	4	Hard copy/Softcopy
Attendance	4	
Total Marks	30	

Name of the Program	Bachelors of Science in Medical Laboratory techniques			Year/ Semester:	3 rd year/VI Semester
Course Name	Medical Parasitology & Entomology	Course Code:	BLT-603	Type: Sixth Semester	THEORY
Credits	L:3 T:1 P:0			Total Sessions Hours:	60
Evaluation Spread	Internal Continuous Assessment:	30		End Term Exam:	70
Type of Course	<input type="radio"/> Compulsory	<input checked="" type="radio"/> Core	<input type="radio"/> Creative	<input type="radio"/> Life Skill	
Course Objectives	The student will be taught about introduction, general characteristics, life cycle and laboratory diagnosis of various medically important parasites.				
Course Outcomes (CO): <i>After the successful course completion, learners will develop following attributes:</i>					
Course Outcome (CO)	<p>Upon successful completion, students will have the knowledge and skills to: On satisfying the requirements of this course, students will have the knowledge and skills to:</p> <ol style="list-style-type: none"> 1. Identify, describe and contrast unicellular parasites and parasitic worm 2. Prepare and observe live parasitic specimens and test students' own seropositivity for a particular parasitic infection 3. Report on observations of biological specimens such as parasites 4. Appraise the impacts of parasitic diseases on human societies 5. Assemble a presentation on a current topic in parasitology (literature research, selection of relevant sources of information, evaluation of the information/data, formulation of the research's results) 				
CO1	Student will know about introduction, general characteristics, laboratory diagnosis of medical parasitology and protozoal parasites				
CO2	Student will know about general characteristics, transmission and laboratory diagnosis of Helminthic parasites				
CO3	Student will know about general characteristics, transmission and laboratory diagnosis of Helminthic parasites				
CO4	Student will know about Laboratory diagnosis of parasites from different specimens-Stool and Blood				
CO5	Student will know about Laboratory diagnosis of Malarial parasites, hydrated cyst and cysticercosis				
Pedagogy	Seminar, PPT, White board, Assignment				
Internal Evaluation Mode	Continuous Internal assessment and written examination				
Session Details	Topic	Hours	Mapped CO		
Unit 1	<ol style="list-style-type: none"> 1. Introduction to Medical Parasitology with respect to terms used in Parasitology. 2. Protozoology/ Protozoal parasites: General characteristics of protozoa. 3. Geographical distribution, Habitat, Morphology, life cycle, Mode of infection and laboratory diagnosis of Entamoeba sp. 4. Geographical distribution, Habitat, Morphology, life cycle, Mode of infection and laboratory diagnosis of Intestinal and vaginal flagellates i.e. Giardia, Trichomonas sp. 5. Geographical distribution, Habitat, Morphology, life cycle, Mode of infection and laboratory diagnosis of blood and tissue flagellates i.e. Plasmodium and Toxoplasma sp. 	12	CO1		
Unit 2	<ol style="list-style-type: none"> 1. General characteristics of Cestodes, Trematodes and Nematodes 2. Geographical distribution, Habitat, Morphology, life cycle, Mode of infection 	12	CO2		

	and laboratory diagnosis of: Taeniasolium and saginata 3. Echinococcusgranulosus, Hymenolepis nana 4. Chistosoma haematobium and mansoni		
Unit 3	1. Geographical distribution, Habitat, Morphology, life cycle, Mode of infection and laboratory diagnosis of : Fasciola hepatica and buski 2. Trichuristrichura, Trichinellaspiales 3. Strongyloidesstercoralis, Ancylostomaduodenale, Enterobiusvermicularis 4. Ascarislumbricoideis, Wuchereriabancrofti, Dracunculusmedinensis	12	CO3
Unit 4	1. Examination of Stool for parasites For intestinal protozoa! infections: Collection of stool samples, Preparation of material for unstained and stained preparations, Staining methods i.e. Iodine staining and permanent staining 2. For Helminthic infections: Concentration techniques i.e. Flotation and sedimentation techniques, Egg counting techniques 3. Examination of blood for parasites: Preparation of thin and thick blood film, Leishman staining of thick and thin smear: Field's stain, JSB stain	12	C04
Unit 5	1. Morphology, life cycle and lab-diagnosis of Malarial parasite with special reference to P.vivax and P. falciparum 2. Examination of blood film for Malarial parasite and Microfilariae 3. Laboratory diagnosis of hydrated cyst and cysticercosis 4. Concentration techniques for demonstration of Ova and Cysts (Principles and applications)	12	CO5

CO-PO and PSO Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO 1	PSO 2	PSO3	PSO 4	PSO 5	PSO 6
CO1	3	3	3	3	2	3	-	-	2	3	-	3	2	2
CO2	3	3	3	3	2	3	-	-	2	3	-	3	2	2
CO3	3	3	3	3	2	3	-	-	2	3	-	3	2	2
CO4	3	3	3	3	3	3	-	-	2	3	-	3	3	3
CO5	3	3	3	3	3	3	-	-	2	3	-	3	3	3

Strong contribution-3, Average contribution-2, Low contribution-1,

Suggested Readings:

Text-Books/reference book	1. Parasitology in relation to Clinical Medicine by K D Chatterjee 2. Medical Entomology by A.K. Hati, Pub. Allied Book Agency 3. Medical Parasitology by D.R. Arora 4. Clinical Parasitology by Paul Chester Beaver 5. Microbiology For Medical Sciences by Bhagat Singh and Renu Singh
Para Text	Unit 1: Introduction to Medical Parasitology & Protozoology: Unit 2: Helminthology/ Helminthic parasites-I: Unit 3: Helminthology/ Helminthic parasites-II: Unit4: Diagnostic Procedure-I: Unit 5: Diagnostic Procedure-II:

Recapitulation & Examination Pattern

Internal Continuous Assessment:

Component	Marks	Pattern
Mid Semester	12	MCQ: 4 Short Answer Type Questions: 02 Long Answer Type Question: 01
Class Test	4	MCQ: 02 Short Answer Type Questions: 01 Long Answer Type Question: 01
Interaction In Class	6	
Assignment/ Presentation	4	Hard copy/Softcopy
Attendance	4	
Total Marks	30	

Name of the Program	Bachelors of Science in Medical Laboratory techniques			Year/ Semester:	3 rd year/6 th semester
Course Name	Cytopathology	Course Code:	BLT-604	Type:	Theory
Credits	L:3 T:1 P:0			Total Sessions Hours:	58
Evaluation Spread	Internal Continuous Assessment:	30		End Term Exam:	70
Type of Course	<input type="radio"/> Compulsory	<input checked="" type="radio"/> Core	<input type="radio"/> Creative	<input type="radio"/> Life Skill	
Course Objectives	The students will learn about various staining procedures for demonstration of different substances & various cytological investigations. This will include special staining procedures & handling & testing of various cytological specimens.				
Course Outcomes (CO): After the successful course completion, learners will develop following attributes:					
Course Outcome (CO)	Identifies various specimens and processing techniques employed in cytology Students will able to collect and proceed various Specimens in different sections of Cytopathology lab. The will able to used Automation in Cytopathology				
CO1	To learn about the definition, branches, equipment and sample preparation in Cytopathology lab				
CO2	To learn about the sample fixation and block preparation in diagnostic cytopathology				
CO3	To learn about the enzyme cytochemistry and Fluid cytology: sample preparation, smearing and staining.				
CO4	To learn about the automation in cytology and staining procedure				
CO5	To learn about the special staining used in Cytopathology				
Pedagogy	Seminar, PPT, White board, Assignment				
Internal Evaluation Mode	Continuous Internal Assessment and Written examination				
Session Details	Topic	Hours	Mapped CO		
Unit 1	<ol style="list-style-type: none"> Introduction, Definition, Branches of Cytopathology. Aspiration cytology- Principles, indications and utility of the technique with special emphasis on role of cytotechnician in FNAC clinics Equipments used in FNAC clinics. Exfoliative Cytology- Principles, indications and utility of the technique, Sampl collection, labelling, preparation, processing of cervical, endometrial, respiratory tract, gastrointestinal tract and urinary tract sample, Smear preparation. 	12	CO1		
Unit 2	<ol style="list-style-type: none"> Fixatives and fixations: - types, uses, merits, demerits. Cell Block preparation. .Cryostat sectioning, its applications in diagnostic cytopathology Vital staining for Sex Chromatin 	12	CO2		
Unit 3	<ol style="list-style-type: none"> Enzyme Cytochemistry: Diagnostic applications Demonstration of Phosphatases, Dehydrogenases, Oxidases & Peroxidases Fluid Cytology:- Sample Collection, Assessment of smearing and staining Urine, CSE, Body Fluids (Pleural, Pericardial, Ascitic) 	12	CO3		

Unit 4	1. Liquid based cytology: Principles and preparation 2. Cyto centrifuge, molecular cytology 3. Immune-cytochemistry 4. MGG & PAP Stainig	12	CO41
Unit 5	1. PAS 2. Alcian Blue 3. Mucicarmin 4. Giemsa, Sudan.	10	CO5

CO-PO and PSO Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO 1	PSO 2	PSO3	PSO 4	PSO 5	PSO 6
CO1	3	3	3	3	2	3	-	-	2	3	-	3	3	3
CO2	3	3	3	3	2	3	-	-	2	3	-	3	3	3
CO3	3	3	3	3	2	3	-	-	2	3	-	3	3	3
CO4	3	3	3	3	2	3	-	-	2	3	-	3	3	3
CO5	3	3	3	3	2	3	-	-	2	3	-	3	3	3

Strong contribution-3, Average contribution-2, Low contribution-1,

Suggested Readings:

Text- Books/ Reference Books	1. Handbook of Histopathological Techniques by C FA Culling 2. Medical Lab technology by Lynch 3. An Introduction to Medical Lab Technology by F J Baker and Silverton 4. Bancroft's Theory and Practice of Histopathological Techniques by John D Bancroft 5. Diagnostic Cytology by Koss Volume -II
Para Text	Unit 1: Introduction: Unit 2: Diagnostic Cytopathology: Unit 3: Enzyme Cytochemistry & Fluid Cytology: Unit4: Automation in Cytology & Staining: Unit: 5Special Stains Used in Cytopathology:

Recapitulation & Examination Pattern

Internal Continuous Assessment:

Component	Marks	Pattern
Mid Semester	12	MCQ: 4 Short Answer Type Questions: 02 Long Answer Type Question: 01
Class Test	6	MCQ: 02 Short Answer Type Questions: 01 Long Answer Type Question: 01
Interaction In Class	6	
Assignment/ Presentation	4	Hard copy/Softcopy
Attendance	4	
Total Marks	30	
Mid Semester	12	MCQ: 4 Short Answer Type Questions: 02 Long Answer Type Question: 01

Course Outline Effective From: 2023-24

Name of the Program	Bachelors of Science in Medical Laboratory techniques			Year/ Semester:	3rd year/6th sem
Course Name	Applied Clinical Biochemistry-II-	Course Code:	BLP601	Type:	Practical
Credits	L:0 T:0 P:4			Total Sessions Hours:	30
Evaluation Spread	Internal Continuous Assessment:	30		End Term Exam:	70
Type of Course	<input type="radio"/> Compulsory	<input checked="" type="radio"/> Core	<input type="radio"/> Creative	<input type="radio"/> Life Skill	

Course Outcomes (CO): After the successful course completion, learners will develop following attributes:

CO1	The students will learn about the estimation and assessment of glucose tolerance and insulin tolerance from various clinical patients' sample	
CO2	The students will learn about the estimation of uric acid, Creatinine clearance, and Urea clearance test	
CO3	The students will learn about the estimation of Serum acid phosphatase, Alkaline phosphatase Lactate dehydrogenase and T3, T4 and TSH	
Pedagogy	Hands on/Demonstration	
Internal Evaluation Mode	Continuous internal assessment and written examination	
Session Details	Topic	MappedCO
Unit 1	1. Estimation of Glucose tolerance test (GTT). 2. Estimation of Insulin tolerance test (ITT).	CO1
Unit 2	1. Determination of Uric acid in Urine. 2. Determination of Creatinine clearance. 3. Determination of Urea clearance.	CO2
Unit3	1. Determination of Serum acid phosphatase. 2. Determination of Serum Alkaline phosphatase. 3. Determination of Serum Lactate dehydrogenase. 4. Determination of T3, T4 and TSH	CO3

CO-PO and PSO Mapping

CO	PO 1	PO 2	PO 3	PO4	PO5	PO 6	PO 7	PO 8	PS O1	PS O2	PSO 3	PSO 4	PS O5	PS O6
CO1	3	3	3	3	3	3	-	-	2	3	1	3	3	3
CO2	3	3	3	3	3	3	-	-	2	3	1	3	3	3
CO3	3	3	3	3	3	3	-	-	2	3	1	3	3	3

Strong contribution-3, Average contribution-2, Low contribution-1,

Suggested Readings:

Reference /Text- Books	1.Practical Clinical Biochemistry by Harold Varley.
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Recapitulation & Examination Pattern

Internal Continuous Assessment:

Component	Marks	Pattern
Mid Semester	12	Spotting: 4 Exercise: 04 Viva :02 File:021
Class Test	6	MCQ: 02 Short Answer Type Questions: 01 Long Answer Type Question: 01
Online Test/ Objective Test	4	MCQ: 4
Assignment/ Presentation	4	Hard copy/Softcopy
Attendance	4	
Total Marks	30	

Name of the Program	Bachelors of Science in Medical Laboratory techniques			Year/ Semester:	3rd year/6th sem
Course Name	Advanced Haematology-	Course Code:	BLP 602	Type:	PRACTICAL
Credits	L:0 T:0 P:4			Total Sessions Hours:	30
Evaluation Spread	Internal Continuous Assessment:	30		End Term Exam:	70
Type of Course	<input type="radio"/> Compulsory	<input checked="" type="radio"/> Core	<input type="radio"/> Creative	<input type="radio"/> Life Skill	

Course Outcomes (CO): *After the successful course completion, learners will develop the following attributes:*

CO1	The students will learn about the Interpretation of histogram of automated blood cell counter, estimation of serum iron, and screening of enzyme deficiency
CO2	The students will learn about the estimation of hemoglobin in the blood sample by different methods
CO3	The students will learn about the screening methods for bleeding disorder detection

Pedagogy Hands on/Demonstration

Internal Evaluation Mode Continuous internal assessment and written examination

Session Details	Topic	MappedCO
Unit 1	<ol style="list-style-type: none"> Study and interpretation of Histogram of Automated Blood cell counter To estimate serum iron and total iron binding capacity. Screening tests for enzymes deficiency: Pyruvate Kinase, G6PD 	CO1
Unit 2	<ol style="list-style-type: none"> To estimate Hb-F, Hb-A2 in a given blood sample. To estimate plasma and urine Hemoglobin in the given specimens. To demonstrate the presence of Hb-S by Sickling and Solubility tests. Perform Hb electrophoresis (alkaline) 	C02
Unit 3	<ol style="list-style-type: none"> Perform osmotic red cell fragility. Detection of Fibrin degradation products (FDPs) To perform various platelet function tests such as whole blood clot retraction test, prothrombin consumption index (PCI) Platelet adhesion, aggregation and PF3 availability test. <p>Peripheral Blood Lymphocyte Culture for chromosome studies in Leukemia</p>	C03

CO-PO and PSO Mapping

CO	PO 1	PO 2	PO 3	PO4	PO5	PO 6	PO 7	PO 8	PS O1	PS O2	PSO 3	PS O4	PS O5	PS O6
CO1	3	3	3	3	3	3	-	-	1	3	-	3	3	3
CO2	3	3	3	3	3	3	-	-	1	3	-	3	3	3
CO3	3	3	3	3	3	3	-	-	1	3	-	3	3	3

Suggested Readings:

Text- Books	Practical Haematology by JB Dacie
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Recapitulation & Examination Pattern**Internal Continuous Assessment:**

Component	Marks	Pattern
Mid Semester	12	Spotting: 4 Exercise: 04 Viva :02 File:021
Class Test	6	MCQ: 02 Short Answer Type Questions: 01 Long Answer Type Question: 01
Online Test/ Objective Test	4	MCQ: 4
Assignment/ Presentation	4	Hard copy/Softcopy
Attendance	4	
Total Marks	30	

Name of the Program	Bachelors of Science in Medical Laboratory techniques			Year/ Semester:	3rd year/ 6th sem
Course Name	Medical Parasitology & Entomology-	Course Code:	BLP-603	Type:	Practical
Credits	L:0 T:0 P:4			Total Sessions Hours:	30
Evaluation Spread	Internal Continuous Assessment:	30		End Term Exam:	70
Type of Course	<input type="radio"/> Compulsory	<input checked="" type="radio"/> Core	<input type="radio"/> Creative	<input type="radio"/> Life Skill	
Course Outcomes (CO): <i>After the successful course completion, learners will develop following attributes:</i>					
CO1	The students will learn about the routine stool examination for detection of intestinal parasites with different methods				
CO2	The students will learn about the routine identification of adult worms by using models and slides				
CO3	The students will learn about the routine identification of malarial parasites, preparation, staining and examination.				
Pedagogy	Hands on/Demonstration				
Internal Evaluation Mode	Continuous internal assessment and written examination				
Session Details	Topic				MappedCO
Unit 1	<p>A. Routine stool examination for detection of intestinal parasites with concentration methods:</p> <ol style="list-style-type: none"> 1. Saline preparation 2. Iodine preparation 3. Floatation method 4. Centrifugation method 5. Formal ether method 6. Zinc sulphate method <p>B. Identification of adult worms from models/slides:</p> <ol style="list-style-type: none"> 1. Tapeworm 2. Tapeworm segments 3. Ascaris (Round worm) 4. Hookworms <p>C. Pinworms</p> <ol style="list-style-type: none"> 1. Malarial parasite: 2. Preparation of thin and thick smears 3. Staining of smears 4. Examination of smears for malarial parasites (P. vivax and P. falciparum) 				CO1- CO3

X

CO-PO and PSO Mapping

CO	PO 1	PO 2	PO 3	PO4	PO5	PO 6	PO 7	PO 8	PS O1	PS O2	PSO 3	PS O4	PS O5	PSO 6
CO1	3	3	3	2	3	3	-	-	1	3	-	3	3	3
CO2	3	3	3	2	3	3	-	-	1	3	-	3	3	3
CO3	3	3	3	2	3	3	-	-	1	3	-	3	3	3

Strong contribution-3, Average contribution-2, Low contribution-1,

Suggested Readings:

Text- Books 1Clinical Parasitology by Paul Chester Beaver

Recapitulation & Examination Pattern**Internal Continuous Assessment:**

Component	Marks	Pattern
Mid Semester	12	Spotting: 4 Exercise: 04 Viva :02 File:02
Class Test	6	MCQ: 02 Short Answer Type Questions: 01 Long Answer Type Question: 01
Online Test/ Objective Test	4	MCQ: 4
Assignment/ Presentation	4	Hard copy/Softcopy
Attendance	4	
Total Marks	30	

Name of the Program	Bachelors of Science in Medical Laboratory techniques			Year/ Semester:	3rd year/6th sem
Course Name	Cytopathology	Course Code:	BLP-604	Type:	Practical
Credits	L:0 T:0 P:4			Total Sessions Hours:	30
Evaluation Spread	Internal Continuous Assessment:	30		End Term Exam:	70
Type of Course	<input type="radio"/> Compulsory	<input checked="" type="radio"/> Core	<input type="radio"/> Creative	<input type="radio"/> Life Skill	

Course Outcomes (CO): After the successful course completion, learners will develop the following attributes:

CO1	The students will learn about different staining techniques used in the cytopathology Lab
CO2	The students will learn about section cutting of Gynaec tissue and processing of CSF sample and body fluids by cytospin
CO3	The students will learn about various stains used in Cytology lab
Pedagogy	Hands on/Demonstration
Internal Evaluation Mode	Continuous internal assessment and written examination
Session Details	Topic
Unit 1	1. To perform Papnicolaou's stain on cervical smear 2. To perform Guard's staining for demonstration sex chromatin (Barr bodies on a buccal smear) 3. To perform Shorr's staining for Hormonal assessment
Unit 2	1. To cut frozen sections of Gynaec tissue 2. To perform CSF sample and body fluids by cytospin
Unit 3	1. Should know the various stains used in Cytology lab:11 May Grunwald Giemsa, H&E, PAS, Grocott's.
	MappedCO
	CO1
	CO2
	CO3

CO-PO and PSO Mapping

CO	PO 1	PO 2	PO 3	PO4	PO5	PO 6	PO 7	PO 8	PS O1	PS O2	PSO 3	PS O4	PS O5	PSO 6
CO1	3	3	3	3	3	3	-	-	2	3	-	3	3	3
CO2	3	3	3	3	3	3	-	-	2	3	-	3	3	3
CO3	3	3	3	3	3	3	-	-	2	3	-	3	3	3

Strong contribution-3, Average contribution-2, Low contribution-1,

Suggested Readings:

Text- Books 1.Diagnostic Cytology by Koss Volume -II

Para Text	Unit 1: Diagnostic Cytopathology Unit 2: Fluid Cytology Methods Unit 3: Special staining in Cytopathology
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Recapitulation & Examination Pattern

Internal Continuous Assessment:

Component	Marks	Pattern
Mid Semester	12	Spotting: 4 Exercise: 04 Viva :02 File:021
Class Test	6	MCQ: 02 Short Answer Type Questions: 01 Long Answer Type Question: 01
Online Test/ Objective Test	4	MCQ: 4
Assignment/ Presentation	4	Hard copy/Softcopy
Attendance	4	
Total Marks	30	

ERA UNIVERSITY
FACULTY OF ALLIED HEALTH SCIENCES & RESEARCH
BACHELOR OF SCIENCE IN MEDICAL LABORATORY TECHNIQUES (B.SC MLT)
FRAMEWORK Seventh Semester
FOR THE ACADEMIC YEAR 2023 to 2024
Till the next change in the curriculum

COURSE CODE	Course Titles	Hours per week			Marks			C R
		L	Theory	Practical	Internal	External	Total	
BLT 701	Immunopathology & Molecular Biology	3	1	-	30	70	100	4
BLT 702	Blood Banking & Genetics	3	1	-	30	70	100	4
BLT 703	Medical Virology & Mycology	3	1	-	30	70	100	4
BLT 704	Research methodology and Biostatistics	3	1	-	30	70	100	4
BLT 705	Principles of Laboratory Management	3	1	-	30	70	100	4
BLP 701	Immunopathology & Molecular Biology - (P)	-	-	4	30	70	100	2
BLP 702	Blood Banking & Genetics- (P)	-	-	4	30	70	100	2
BLP 703	Medical Mycology and Virology - (P)	-	-	4	30	70	100	2
	Guest Lecture/Tutorial/Seminar/visit to any medical research institution or reputed clinical laboratory	-	2	-	-	-	-	2
Total		15	7	12	240	560	800	26
Total Hours in Semester		550						

NOTE:

i. **Abbreviations:** L - Lecture, T - Tutorials and P - Practical

Considering four months per semester as working months, total contact hours per semester shall be 550 (Five hundred and fifty)

Name of the Program	Bachelors of Science in Medical Laboratory techniques		Year/ Semester:	4 th year/ 7 th sem
Course Name	Immunopathology and Molecular Biology	Course Code:	BLT701	Type: THEORY
Credits	L:3 T:1 P:0		Total Sessions Hours:	60
Evaluation Spread	Internal Continuous Assessment:	30	End Term Exam:	70
Type of Course	<input type="radio"/> Compulsory	<input checked="" type="radio"/> Core	<input type="radio"/> Creative	<input type="radio"/> Life Skill
Course Objectives	The students will learn how to analyze various clinical patients' samples, for estimation of different components which are the cause of the immune disease or are the diagnostic/prognostic markers. This subject gives information about various clinically important cells of immune system, lymphoid organs, antigen, antibody, Ag-Ab. reactions, transplant immunology etc. & automation techniques. Molecular biology concerns the molecular basis of biological activity between biomolecules in the various systems of a cell, including the interactions between DNA, RNA and proteins and their biosynthesis, as well as the regulation of these interactions. A basic introduction of molecular biology and its techniques like PCR, RTPCR etc. will also be rendered to sensitize students to take up future molecular biology challenges.			
Course Outcomes (CO): <i>After the successful course completion, learners will develop following attributes:</i>				
Course Outcome (CO)	<ul style="list-style-type: none"> • Demonstrate the basic knowledge of immunological processes at a cellular and molecular level • Define central immunological principles and concepts • Outline, compare and contrast the key mechanisms and cellular players of innate and adaptive immunity and how they relate • Elucidate the genetic basis for immunological diversity and the generation of adaptive immune responses • Understand and explain the basis of immunological tolerance, autoimmunity and transplantation • Exhibit a knowledge base in genetics, cell and molecular biology, and anatomy and physiology • Demonstrate the knowledge of common and advanced laboratory practices in cell and molecular biology 			
CO1	Student will learn about the Immune system, , Types of Immunity, Immune response, cells and organs of the immune system			
CO2	Student will learn about Structure, Function and Classes of Antigen Antibody			
CO3	Students will learn about Hypersensitivity, HLA typing, and Immune tolerance			
CO4	Students will learn about molecular biology techniques and their application in Medical diagnostics			
CO5	Students will learn about replication, damage and repair of DNA molecule			
Pedagogy	White Board, Computer Lab, Projector etc.			
Internal Evaluation Mode	Online as well as Offline Mode.			
Session details	Topic	Hours	Mapped CO	
Unit 1	1. Historical background, general concepts of the immune system, 2. innate and adaptive immunity; active and passive immunity 3. Primary and secondary immune response. 4. Cells and Organs of the immune system, Lymphoid organs of the Immune system, MHC I & II	12 Hrs	CO1	
Unit 2	1. Antigens and haptens : Properties ,foreignness, molecular size, heterogeneity. 2. Antibodies: Historical perspective of antibody structure; structure, function and properties of the antibodies 3. different classes, subclasses and biological activities of antibodies; concepts of antibody diversity, isotype, allotype, 4. Introduction of hybridoma technology, monoclonal antibodies, polyclonal antibody	12 Hrs	CO2	
Unit 3	1. HLA Typing & Cross matching 2. Transplant Immunology. 3. Hypersensitivity: Definition, Types, Mechanisms, Autoimmunity 4. Immune tolerance : Basic concepts.	12 Hrs	CO3	
Unit 4	1. Introduction to Molecular Biology 2. Relationship of Mol. Biology with other Science. 3. Molecular Biology Techniques: Principle, Reagents used, procedure and applications in Medical diagnostics. 4. Polymerase Chain Reaction and its advanced versions, Gel electrophoresis, Western blot.	12 Hrs	CO4	

Unit 5	<ol style="list-style-type: none"> 1. Chemical composition of DNA, DNA replication. 2. DNA damage and repair. 3. Regulation of prokaryotic and eukaryotic gene expression 4. Cell Cycle. 	12 Hrs	CO5
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CO-PO and PSO Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	3	2	2	1	1	3	-	-	1	1	-	2	1	2
CO2	3	2	2	1	1	3	-	-	1	1	-	2	1	2
CO3	3	2	2	2	1	3	-	-	3	3	-	3	2	3
CO4	3	3	3	3	3	3	-	-	3	3	-	3	2	3
CO5	3	2	2	2	1	3	-	-	2	3	-	2	2	3

Strong contribution-3, Average contribution-2, Low contribution-1,

Suggested Readings:

Text- Books/ Reference Books	<ul style="list-style-type: none"> • Immunology by Ivan Roitt, Jonathaan Brostoff and David Male • Immunology by Kuby • Basic & Clinical Immunology by P. Daniel Fudenberg. H. Hugh and Stites • Elements of Biotechnology by PK Gupta • Advanced Molecular Biology by R Twyman • Principal of Biochemistry by Lehninger • Medical Immunology by Daniel P Stites • Watson Molecular Biology of Gene
Para Text	<p>Unit 1: History & Introduction Unit 2: Antigen & Antibody Unit 3: HLA & Hypersensitivity Unit4: Molecular Biology Unit4: Molecular Biology</p>

Recapitulation & Examination Pattern

Internal Continuous Assessment:

Component	Marks	Pattern
Mid Semester	12	MCQ: 4 Short Answer Type Questions: 02 Long Answer Type Question: 01
Interaction in class /class participation	06	
Class test	4	
Assignment/ Presentation/ project	4	Hard copy/Softcopy
Attendance	4	
Total Marks	30	

Department of Medical laboratory technique

Course Outline Effective From: 2023-24

Name of the Program	Bachelors of Science in Medical Laboratory techniques		Year/ Semester:	4 th year/7 th semester	
Course Name	Blood Banking and Genetics	Course Code:	BLT-702	Type:	THEORY
Credits	Blood banking & molecular biology		Total Sessions Hours:	60	
Evaluation Spread	Internal Continuous Assessment:	30	End Term Exam:	70	
Type of Course	<input type="radio"/> Compulsory	<input checked="" type="radio"/> Core	<input type="radio"/> Creative	<input type="radio"/> Life Skill	
Course Objectives	Blood banking will make students learn about blood grouping & blood, Transfusion. The students will learn about the concept of blood grouping, compatibility testing in blood transfusion & screening of donated blood for various Infection Diseases. Genetics will make students learn about Fundamentals of Heredity. The students will learn about the concept of inheritance in various genetic diseases.				
Course Outcomes (CO): After the successful course completion, learners will develop following attributes:					
Course Outcome(CO)	<ul style="list-style-type: none"> Apply advanced blood bank and blood transfusion knowledge to make appropriate and effective on-the-job professional decisions. Perform and interpret commonly utilized procedures in the blood bank laboratory. Recognize normal and abnormal test results and correlate these data with appropriate pathologic conditions to accurately advise health care providers. Adapt immunohematology laboratory techniques and procedures when errors and discrepancies in results are obtained to effect resolution in a professional and timely manner. 				
CO1	Student will learn about History and Discovery of Blood group, Various methods used in blood banking and their interpretation.				
CO2	Students will learn about tools and techniques used in blood banking and genetics				
CO3	Student will know about Blood components, Preparation and management.				
CO4	Student will know about Blood Transfusion Reactions, Types, Laboratory investigation compatibility test and transfusion transmissible diseases.				
CO5	Student will know about Genetics-principles, Chromosomes and molecular genetics				
Pedagogy	White Board, Computer Lab, Projector etc.				
Internal Evaluation Mode	Online as well as Offline Mode.				
Session Details	Topic	Hours		Mapped CO	
Unit 1	<ol style="list-style-type: none"> History and discovery of blood group system ABO and Rhesus blood group system Cell and serum grouping Various methods, interpretation of results. 	12 Hrs		CO1	
Unit 2	<ol style="list-style-type: none"> Discrepancies in blood grouping and resolving problems Variants of D antigen and weak D typing. Compatibility testing:- definition, indication methods. Coombs test:- Direct, indirect, principle, procedure, interpretation, applications. 	12 Hrs		CO2	
Unit 3	<ol style="list-style-type: none"> Blood component: Preparation, labeling, storage, cell separator Preparation of packed cells and various fractions of blood for transfusion purposes. Preparation of PRP,FP,FFP and Cryoprecipitate Total quality management, documentation record keeping. 	12 Hrs		CO3	
Unit 4	<ol style="list-style-type: none"> Transfusion reactions: Definitions, classification & Causes Laboratory investigation of transfusion reactions and mismatched, transfusion reactions. Compatibility tests in blood transfusion, complications and hazard of blood transfusion. Transfusion transmissible diseases, screening methods (Sample collection, processing, handling and disposal). 	12 Hrs		CO4	

UNIT 5	Continuity of life-heredity, variation Mendel's laws of inheritance, Chromosomal basis of inheritance; other patterns of inheritance Incomplete dominance, multi parallelism, quantitative inheritance. Chromosomes-Bacterial cell and eukaryotic cell; parallelism between genes and chromosomes; genome, linkage and crossing over; gene mapping; recombination. Molecular genetics: DNA as a genetic material- its structure and replication; structure of RNA and its role in protein synthesis, Vectors, plasmids, Human Genetics, Microbial genetics.	12 Hrs	CO5
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CO-PO and PSO Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	3	3	3	3	2	3	2	1	1	3	-	3	2	3
CO2	3	3	3	3	2	3	2	1	1	3	-	3	2	3
CO3	3	3	3	3	2	3	2	3	1	3	-	3	2	3
CO4	3	3	3	3	2	3	2	1	1	3	-	3	2	3
CO5	3	3	3	3	2	3	2	1	1	3	-	3	2	3

Strong contribution-3, Average contribution-2, Low contribution-1,

Suggested Readings:

Text- Books/ ReferenceBooks	<ol style="list-style-type: none"> 1. Practical Haematology by J.B. Dacie 2. Transfusion Science by Overfield, Hamer 3. Medical Laboratory Technology by K.L. Mukherjee Volume-I 4. Mollison's Blood Transfusion in Clinical Medicine, 12th Edition by Harvey G. Klein 5. Genes by Benjamin Lewin 6. Genetics by B.D. Singh 7. Instant Notes on Genetics by PC Winter, GI Hickey and HL Fletcher 8. Principals of Genetics by Gardner
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Para Text	Unit 1: History & Discovery of Blood Group Unit 2: Techniques Unit 3: Blood Components Unit4: Transfusion Reactions Unit 5: Genetics
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Recapitulation & Examination Pattern

Internal Continuous Assessment:

Component	Marks	Pattern
Mid Semester	12	MCQ: 4 Short Answer Type Questions: 02 Long Answer Type Question: 01
Interaction in class /class participation	06	
Class test	4	
Assignment/ Presentation/ project	4	Hard copy/Softcopy
Attendance	4	
Total Marks	30	

Department of Medical laboratory technique
Course Outline Effective From: 2023-24

Name of the Program	Bachelors of Science in Medical Laboratory techniques		Year/ Semester:	4 th year / 7 th sem Semester
Course Name	Medical Virology and Mycology	Course Code:	BLT 703	Type: THEORY
Credits	L-3,T-1,P-O		Total Sessions Hours:	60
Evaluation Spread	Internal Continuous Assessment:	30	End Term Exam:	70
Type of Course	<input type="radio"/> Compulsory	<input checked="" type="radio"/> Core	<input type="radio"/> Creative	<input type="radio"/> Life Skill
Course Objectives	The student will be taught about introduction, general characteristics, life cycle and laboratory diagnosis of various medically important Viruses & Fungi.			
Course Outcomes (CO): After the successful course completion, learners will develop following attributes:				
Course Outcome(CO)	Students will able to Explain viruses, fungi including their classification, morphology, and laboratory diagnosis and prevention measures, Perform laboratory investigations for the diagnosis of infectious diseases caused by viruses, fungi, Discuss various viral fungal diseases of human.			
CO1	To learn about the Medical Virology- Introduction, Morphology, Laboratory diagnosis and staining techniques.			
CO2	To learn about the Viral culture, Transmission, Multiplication and virus -host interaction			
CO3	To learn about the Viruses: Classification, Types, Diseases, Prevention and Control			
CO4	To learn about the Medical Mycology-Introduction, Classification and general characteristics of medically important fungi. Students will be able to learn about the tools and techniques used in Laboratory diagnosis of medically important fungi.			
CO5	To learn about the Morphology, Diseases and Lab Diagnosis of yeasts and moulds.			
Pedagogy	White Board, Computer Lab, Projector etc.			
Internal Evaluation Mode	Online as well as Offline Mode.			
Session Details	Topic	Hours	Mappe dCO	
Unit 1	<ol style="list-style-type: none"> Introduction to medical virology, Introduction to medically important viruses. Structure and Classification of viruses Collection, transportation and storage of sample for viral diagnosis. Staining techniques used in Virology 	12	CO1	
Unit 2	<ol style="list-style-type: none"> Processing of samples for viral culture (Egg inoculation and tissue culture). Modes of viral transmission: Persistent, non-persistent, vertical and horizontal Viral multiplication and replication strategies: Interaction of viruses with cellular receptors and entry of viruses. Assembly, maturation and release of virions. 	12	CO2	
Unit 3	<ol style="list-style-type: none"> Poxviruses, Herpesviruses, hepaptitis viruses, retroviruses-HIV, Picornaviruses, rhabdoviruses Orthomyxoviruses and paramyxoviruses, TORCH profile, Symptoms, mode of transmission, prophylaxis and control of Polio, Herpes, Hepatitis, Rabies, Dengue, HIV Influenza with brief description of swine flu, Ebola, Chikungunya, Japanese Encephalitis. Introduction to oncogenic viruses, Types of oncogenic DNA and RNA viruses, concepts of oncogenes and proto-oncogenes Prevention & control of viral diseases, antiviral compounds and their mode of action, interferon and their mode of action, General principles of viral vaccination 	12	CO3	
Unit 4	<ol style="list-style-type: none"> Introduction to Medical Mycology Basic concepts about superficial and deep Mycoses Taxonomy and classification and general characteristics of various medically important fungi Normal fungal flora. Techniques used for isolation and identification of medically important fungi. Direct microscopy in Medical mycology laboratory, Processing of clinical samples for diagnosis of fungal infections i.e. Skin, nail, hair, pus, sputum, CSF and other body fluids. 	12	CO4	

Unit 5	<ol style="list-style-type: none"> Morphology, Diseases & lab diagnosis of: Candida, Dermatophytes, Mycetoma (Eumycetoma & Actinomycetoma), Cryptococcus, Histoplasmosis Opportunistic Fungi, Blastomyces, coccidioidosis, Nocardia. Methods for identification of yeasts and moulds, Dimorphism in fungi, Antifungal susceptibility tests. Preservation of fungal cultures, Routine myco-serological tests and skin tests. 	12	CO5
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CO-PO and PSO Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	3	3	3	3	2	3	1	-	1	3	1	3	3	1
CO2	3	3	3	3	2	3	1	-	1	3	1	3	3	1
CO3	3	3	3	3	2	3	1	-	1	3	1	3	3	1
CO4	3	3	3	3	2	3	1	-	1	3	1	3	3	1
CO5	3	3	3	3	2	3	1	-	1	3	1	3	3	1

Strong contribution-3, Average contribution-2, Low contribution-1,

Suggested Readings:

Text- Books/ Reference Books	<ol style="list-style-type: none"> Text book of Microbiology by Ananthanarayanan Medical laboratory Technology Vol. I, II, III by Mukherjee Medical Laboratory manual for tropical countries Vol. II Microbiology by Monica Cheesbrough Microbiology For Medical Sciences by Bhagat Singh and Renu Singh Medical Mycology by Dr. Jagdish Chander Medical Microbiology by Panikar & Satish Gupta
Para Text	Unit 1: Introduction to Virology: Unit 2: Virus Culture: Unit 3: Details of Viruses: Unit 4: Introduction to Mycology: Unit 5: Details of Fungi:

Recapitulation & Examination Pattern

Internal Continuous Assessment:

Component	Marks	Pattern
Mid Semester	12	MCQ: 4 Short Answer Type Questions: 02 Long Answer Type Question: 01
Interaction in class /class participation	06	
Class test	4	
Assignment/ Presentation/ project	4	Hard copy/Softcopy
Attendance	4	
Total Marks	30	

Name of the Program	Bachelors of Science in Medical Laboratory techniques		Year/ Semester:	4 th year/ 7 th semester
CourseName	Research Methodology and Biostatistics	CourseCode:	BLT-704	Type: THEORY
Credits	L:3 T:1 P:0		Total Sessions Hours:	40
EvaluationSpread	Internal Continuous Assessment:	30	End Term Exam:	70
Type ofCourse	<input type="radio"/> Compulsory	<input checked="" type="radio"/> Core	<input type="radio"/> Creative	<input type="radio"/> Life Skill
Course Objectives	The objective of this module is to help the students understand the basic principles of research and methods applied to draw inferences from the research findings. The students will also be made aware of the need of biostatistics and understanding of data, sampling methods, in addition to being given information about the relation between data and variables			
Course Outcomes (CO): After the successful course completion, learners will develop following attributes:				
Course Outcome(CO)	Students will realize the significance of Research Methodology and statistics for their career progression. Students will be able to formulate the statistical analysis and Data processing by different methods.			
CO1	Students will be able to learn about the research methodology and basic concepts of Biostatistics			
CO2	Students will be able to learn about the tools and techniques used in the sampling and collection of different types of data and their sampling			
CO3	Students will be able to learn about the Biostatistics, its use and the relationship between data and variables			
CO4	Students will be able to learn about the Data processing and its interpretation by calculating standard deviation, standard errors, coefficient of variation and chi-square test			
CO5	Students will be able to learn about constructing and summarizing data and to evaluate the statistical analysis			
Pedagogy	Seminar, PPT, White board, e-Lecture, Classroom teaching			
Internal Evaluation Mode	Continuous internal assessment and written examination			
SessionDetails	Topic	Hours	Mapped CO	
Unit 1	1. Ethical Principles and standards for a clinical laboratory professional duty to the patient, duty to colleagues and other professionals 2. Good Laboratory Practice {GLP}, Introduction to Basics of GLP and Accreditation 3. Aims of GLP and Accreditation, Advantages of Accreditation 4. Brief knowledge about National and International Agencies for clinical laboratory accreditation	08	CO1	
Unit 2	1. Awareness/ Safety in a clinical laboratory, General safety precautions. 2. HIV: pre- and post-exposure guidelines, Hepatitis B & C: pre- and post-exposure guidelines; 3. Drug Resistant Tuberculosis Patient management for clinical samples collection, transportation and preservation. 4. Sample accountability, Purpose of accountability, Methods of accountability	08	CO2	
Unit 3	1. Sample analysis: Introduction, factors affecting sample analysis. 2. Reporting results, basic format of a test report, reported reference range. 3. Clinical alerts, abnormal results, results from referral laboratories. 4. Release of examination results, alteration in reports	08	CO3	

Unit 4	<ol style="list-style-type: none"> 1. Quality Management system: Introduction, Quality assurance, Quality control system. 2. Internal and External quality control, quality control chart and importance of calibration and Validation of Clinical Laboratory instrument. 3. Ethics in Medical laboratory Practice, Ethics in relation to Pre Examination procedures, Examination procedures, reporting of results, preserving medical records 4. Procurement of equipment and Inventory Control. 	08	CO4
UNIT 5	<ol style="list-style-type: none"> 1. Audit in a Medical Laboratory. 2. Introduction and Importance, NABL & CAP. 3. Responsibility, Planning, Horizontal, Vertical and Test audit. 4. Frequency of audit, Documentation 	08	CO5

CO-PO and PSO Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO 1	PSO 2	PSO3	PSO 4	PSO 5	PSO6
CO1	3	3	3	1	1	3	-	3	3	3	3	3	2	3
CO2	3	3	2	1	1	3	-	3	3	3	-	3	3	3
CO3	3	3	3	1	1	3	-	3	3	3	-	3	3	3
CO4	3	3	3	1	1	3	-	3	3	3	-	3	3	3
CO5	3	3	3	1	1	3	-	3	3	3	-	3	3	3

Strong contribution-3, Average contribution-2, Low contribution-1,

Suggested Readings:

Text- Books/ ReferenceBooks	<ol style="list-style-type: none"> 1. Methods in biostatistics for medical students by B.K.Mahajan 2. RPG Biostatistics by HimanshuTyagi 3. Statistical Methods by S.P. Gupta
Para Text	Unit 1: Introduction Unit 2: Data collection methods Unit 3: Biostatistics: DATA distribution Unit4: Methods in Biostatistics Unit 5: Statistical analysis

Recapitulation & Examination Pattern

Internal Continuous Assessment:

Component	Marks	Pattern
Mid Semester	12	MCQ: 4 Short Answer Type Questions: 02 Long Answer Type Question: 01
Interaction in class /class participation	06	
Class test	4	
Assignment/ Presentation/ project	4	Hard copy/Softcopy
Attendance	4	
Total Marks	30	

Department of Medical laboratory technique

Course Outline Effective From: 2023-24

Name of the Program	Bachelors of Science in Medical Laboratory techniques		Year/ Semester:	4 th year/7 th semester
CourseName	Principles of Laboratory Management	CourseCode:	BLT-705	Type: Theory
Credits	L:3 T:1 P: 0		Total Sessions Hours:	48
EvaluationSpread	Internal Continuous Assessment:	30	End Term Exam:	70
Type ofCourse	<input type="radio"/> Compulsory	<input checked="" type="radio"/> Core	<input type="radio"/> Creative	<input type="radio"/> Life Skill
Course Objectives	The objective of this module is to help the students will be made aware of the basic ethics, good lab practices including awareness/ safety in a clinical lab & aware various Accrediting body.			
Course Outcomes (CO): After the successful course completion, learners will develop following attributes:				
Course Outcome (CO)	Students would be competent enough to understand sample accountability, quality management system, biomedical waste management, calibration and validation of clinical laboratory instruments, Laboratory Information system (LIS), Hospital Information system (HIS) and financial management.			
CO1	Students will be able to lean about the Laboratory ethics, Good Laboratory Practices and Accreditation in a clinical laboratory			
CO2	Students will be able to lean about sample management and pre-and post-exposure guideline for HIV & Hep B, C			
CO3	Students will be able to lean about clinical sample analysis factors and release of examination results			
CO4	Students will be able to lean about quality management principles and medical laboratory ethics			
CO5	Students will be able to lean about Audit: Introduction and importance of NABL			
Pedagogy	Seminar, Assignment, whiteboard, PPT			
Internal Evaluation Mode	Continuous internal assessment and written examination			
SessionDetails	Topic	Hours	MappedCO	
Unit 1	<ol style="list-style-type: none"> 1. Ethical Principles and standards for a clinical laboratory professional duty to the patient, duty to colleagues and other professionals 2. Good Laboratory Practice {GLP}, Introduction to Basics of GLP and Accreditation 3. Aims of GLP and Accreditation, Advantages of Accreditation 4. Brief knowledge about National and International Agencies for clinical laboratory accreditation 	10	CO1	
Unit 2	<ol style="list-style-type: none"> 1. Awareness/ Safety in a clinical laboratory, General safety precautions. 2. HIV: pre- and post-exposure guidelines, Hepatitis B & C: pre- and post-exposure guidelines; 3. Drug Resistant Tuberculosis Patient management for clinical samples collection, transportation and preservation. 4. Sample accountability, Purpose of accountability, Methods of accountability 	10	CO2	
Unit 3	<ol style="list-style-type: none"> 1. Sample analysis: Introduction, factors affecting sample analysis. 2. Reporting results, basic format of a test report, reported reference range. 3. Clinical alerts, abnormal results, results from referral laboratories. 4. Release of examination results, alteration in reports 	10	CO3	

Unit 4	<ol style="list-style-type: none"> 1. Quality Management system: Introduction, Quality assurance, Quality control system. 2. Internal and External quality control, quality control chart and importance of calibration and Validation of Clinical Laboratory instrument. 3. Ethics in Medical laboratory Practice, Ethics in relation to PreExamination procedures, Examination procedures, reporting of results, preserving medical records 4. Procurement of equipment and Inventory Control. 	10	CO4
Unit 5	<ol style="list-style-type: none"> 1. Audit in a Medical Laboratory. 2. Introduction and Importance, NABL & CAP. 3. Responsibility, Planning, Horizontal, Vertical and Test audit. 4. Frequency of audit, Documentation 	08	CO5

CO-PO and PSO Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO 1	PSO 2	PSO3	PSO 4	PSO 5	PSO6
CO1	3	3	3	3	3	3	1	1	3	3	1	3	2	3
CO2	3	3	3	3	3	3	1	1	3	3	1	3	2	3
CO3	3	3	3	3	3	3	1	1	3	3	1	3	2	3
CO4	3	3	3	3	3	3	1	1	3	3	1	3	2	3
CO5	3	3	3	3	3	3	1	1	3	3	1	3	2	3

Strong contribution-3, Average contribution-2, Low contribution-1,

Suggested Readings:

Text- Books	<ol style="list-style-type: none"> 1. Teitz,(2007),Fundamentals of Clinical Chemistry,6th edition, ElsevierPublications 2. Bishop(2013},Clinical Chemistry,7th edition, WileyPublications 3. Henry's Clinical Diagnosis and Management by LaboratoryMethods,(2011),22ndedition, Elsevier
Para Text	Unit 1: Introduction Unit 2: Patient safety and sample management Unit 3: Sample analysis and reporting Unit4: Laboratory quality management Unit 5: Laboratory Audit

Recapitulation & Examination Pattern

Internal Continuous Assessment:

Component	Marks	Pattern
Mid Semester	12	MCQ: 4 Short Answer Type Questions: 02 Long Answer Type Question: 01
Interaction in class /class participation	06	MCQ: 4 Short Answer Type Questions: 02 Long Answer Type Question: 01
Class test	4	
Assignment/ Presentation/ project	4	Hard copy/Softcopy
Attendance	4	
Total Marks	30	

Department of Medical laboratory technique

Course Outline Effective From: 2023-24

Name of the Program	Bachelors of Science in Medical Laboratory techniques			Year/ Semester:	4 th year/ 7 th sem
Course Name	Immunopathology & Molecular Biology-	Course Code:	BLP-701	Type:	Practical
Credits	L-0,P-0,P-4			Total Sessions Hours:	30
Evaluation Spread	Internal Continuous Assessment:	30		End Term Exam:	70
Type of Course	<input type="radio"/> Compulsory	<input checked="" type="radio"/> Core	<input type="radio"/> Creative	<input type="radio"/> Life Skill	

Course Outcomes (CO): After the successful course completion, learners will develop following attributes:

CO1 Student will be able to learn about techniques used in the immunopathology laboratory to isolate PBMC, T&B Cell separation, ANA, ANCA, Agglutination Reactions

CO2 Student will be able to learn about Molecular biology techniques used in diagnostic laboratory

Pedagogy White Board, Computer Lab, Projector etc.

Internal Evaluation Mode Online as well as Offline Mode

Session Details	Topic	Mapped CO
Unit 1	Peripheral blood mononuclear cell (PBMC) isolation by gradient centrifugation T and B cell separation immunofluorescence Anti- Nuclear Antibody (ANA) Anti- Neutrophil Cytoplasmic Antibody (ANCA) AIDS Immunology and Pathogenesis (AIP) Thyroid Microsomal antigen (TMA)- Agglutination reactions <	CO1
Unit 2	Electrophoresis Gel diffusion Nephelometry HLA Typing Serology & Cross match Molecular Typing Nitro blue Tetrazolium Chloride Test (NBT) FACS for CD4 and CD8 ELISA for lab. diagnosis of AIDS Polymerase Chain Reaction and its advanced versions Gel electrophoresis Western blotting Isolation of DNA and RNA Estimation of DNA and RNA Determination of molecular weight and quantification of DNA using agarose gel electrophoresis	CO2

CO-PO and PSO Mapping

CO	PO								PSO					
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO 1	PSO 2	PSO3	PSO 4	PSO 5	PSO 6
CO1	3	3	3	3	3	3	-	-	3	3	-	3	3	3
CO2	3	3	3	3	3	3	-	-	3	3	-	3	3	3

Strong contribution-3, Average contribution-2, Low contribution-1,

Suggested Readings:

Text- Books

1. Watson Molecular Biology of Gene
2. Advanced Molecular Biology by R Twyman
3. Basic & Clinical Immunology by P. Daniel Fudenberg. H. Hugh and Stites

Para Text

Unit 1: Immunotechniques
Unit 2: Molecular Biology Techniques

Recapitulation & Examination Pattern**Internal Continuous Assessment:**

Component	Marks	Pattern
Mid Semester	12	Exercise :0 4 Spotting: 04 File: 02 Viva: 01
Class Test	6	MCQ: 02 Short Answer Type Questions: 01 Long Answer Type Question: 01
Online Test/ Objective Test	4	MCQ: 4
Assignment/ Presentation	4	Hard copy/Softcopy
Attendance	4	
Total Marks	30	

**Department of Medical laboratory technique
Course Outline Effective From: 2023-24**

Name of the Program	Bachelors of Science in Medical Laboratory techniques			Year/ Semester:	4th year/ 7th sem
Course Name	Blood Banking & Genetics-	Course Code:	BLP-702	Type:	Practical
Credits	L:0 T:0 P:1			Total Sessions Hours:	60
Evaluation Spread	Internal Continuous Assessment:	30		End Term Exam:	70
Type of Course	<input type="radio"/> Compulsory	<input checked="" type="radio"/> Core	<input type="radio"/> Creative	<input type="radio"/> Life Skill	

Course Outcomes (CO): *After the successful course completion, learners will develop following attributes:*

CO1	To learn about the preparation of reagents, collection and preservation of blood, blood screening, cross matching, and fraction of blood preparation in a blood banking laboratory
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Pedagogy	Hands-on/demonstration
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Internal Evaluation Mode	Online as well as Offline Mode.
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Session Details	Topic	MappedCO
Unit 1	<ul style="list-style-type: none"> To prepare Acid Citrate Dextrose (ACD) and Citrate Phosphate Dextrose (CPD) Solutions Screening of blood donor: physical examination including medical history of the donor Collection and preservation of blood for transfusion purpose Screening of blood for Malaria, Microfilaria, HBs Ag, Syphilis and HIV To determine the ABO & Rh grouping 5.1 Direct or preliminary grouping 	CO1

- Indirect or proof grouping
- Rh grouping and determination of Du in case of Rh negative
- To perform Direct and Indirect Coomb's test
- To perform cross matching
- Major cross matching
- Minor cross matching
- Preparation of various fractions of blood.

CO-PO and PSO Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO 1	PSO 2	PSO3	PSO 4	PSO 5	PSO6
CO1	3	3	3	3	3	3	-	-	3	3	-	3	3	3

Strong contribution-3, Average contribution-2, Low contribution-1,

Suggested Readings:

- Text- Books**
1. Practical Haematology by J.B. Dacie
 2. Mollison's Blood Transfusion in Clinical Medicine, 12th Edition by Harvey G. Klein

Para Text Unit 1: Blood sample collection, screening, Transfusion, Cross matching and Fractions

Recapitulation & Examination Pattern

Internal Continuous Assessment:

Component	Marks	Pattern
Mid Semester	12	Exercise :0 4 Spotting: 04 File: 02 Viva: 01
Class Test	6	MCQ: 02 Short Answer Type Questions: 01 Long Answer Type Question: 01
Online Test/ Objective Test	4	MCQ: 4
Assignment/ Presentation	4	Hard copy/Softcopy
Attendance	4	
Total Marks	30	

Department of Medical laboratory technique Course Outline Effective From: 2023-24

Name of the Program	Bachelors of Science in Medical Laboratory techniques			Year/ Semester:	4 th year/7 th semester
Course Name	Medical Virology and Mycology	Course Code:	BLP-703	Type:	Practical
Credits	L:0 T:0 P: 4			Total Sessions Hours:	60
Evaluation Spread	Internal Continuous Assessment:	30		End Term Exam:	70
Type of Course	<input type="radio"/> Compulsory	<input checked="" type="radio"/> Core	<input type="radio"/> Creative	<input type="radio"/> Life Skill	
Course Outcomes (CO): After the successful course completion, learners will develop following attributes:					
CO1	To learn about the preparation of culture media, stains and reagents required in a medical mycology laboratory				
CO2	To learn about the identification of yeast and mould by different identification techniques				
CO3	To learn about the laboratory diagnosis of fungal infections from Skin, Nail, Hair, Body fluids and Secretions				
CO4	To learn about the Virus structure and different stains used in medical virology and mycology lab.				
Pedagogy	White Board, Computer Lab, Projector etc.				
Internal Evaluation Mode	Online as well as Offline Mode.				
Session Details	Topic				MappedCO

Unit 1	To prepare culture media used routinely in mycology To perform KOH preparation, Gram stain, Potassium Hydroxide - Calcofluor White method, India Ink preparation, Modified Kinyoun Acid Fast Stain for Nocardia, LCB preparation.	CO1
Unit 2	<ol style="list-style-type: none"> To identify given yeast culture by performing various identification techniques studied in theory. To identify given mould culture by performing various identification techniques studied in theory. To demonstrate dimorphism in fungi 	CO2
Unit 3	To collect and process clinical samples for laboratory diagnosis of fungal infections i.e. <ol style="list-style-type: none"> Skin Nail Hair Body fluids and secretions 	CO3
	<ol style="list-style-type: none"> To demonstrate structure of viruses and their multiplication from charts etc. To perform Giemsa stain, Seller's stain, immunofluorescent staining procedures for diagnosis of viral infections Demonstration of fertilized hen egg Demonstration of various inoculation routes in fertilized hen egg 	CO4

CO-PO and PSO Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO 1	PSO 2	PSO3	PSO 4	PSO 5	PSO 6
CO1	3	3	3	3	3	3	-	-	3	3	-	3	3	3
CO2	3	3	3	3	3	3	-	-	3	3	-	3	3	3
CO3	3	3	3	3	3	3	-	-	3	3	-	3	3	3
CO4	3	3	3	3	3	3	-	-	3	3	-	3	3	3

Strong contribution-3, Average contribution-2, Low contribution-1,

Suggested Readings:

Text- Books	<ol style="list-style-type: none"> Practical Medical Microbiology by Mackie & Maccartney Volume 1 and 2 Medical Laboratory manual for tropical countries Vol. II Microbiology by Monica Cheesbrough
Para Text	Unit 1: Staining in Mycology Unit 2: Fungus identification Unit 3: Sample collection: Nail, Hair, Skin, Body Fluids Unit 4: Virus staining

Recapitulation & Examination Pattern

Internal Continuous Assessment:

Component	Marks	Pattern
Mid Semester	12	Exercise :0 4 Spotting: 04 File: 02 Viva: 01
Class Test	6	MCQ: 02 Short Answer Type Questions: 01 Long Answer Type Question: 01
Online Test/ Objective Test	4	MCQ: 4

Assignment/ Presentation	4	Hard copy/Softcopy
Attendance	4	
Total Marks	30	

Eighth Semester

(Six months Internship)

Internship:

There shall be six months of internship after the completion of Seventh Semester for candidates declared to have passed the examination in all the subjects.

No candidate shall be awarded degree certificate without successfully completing six months (180days) of internship. The internship shall be rotatory and cover clinical branches concerned with BMLS viz:-

S.No.	Labs	Days
1.	Cytology & Collection center	30 Days
2.	Hematology	30 Days
3.	Biochemistry & Biotechnology	30 Day
4	Microbiology & Serology	30 Day
5	Histopathology	30 Days
6	Blood Banking	30 Days

Other Details

Rotatory internship Compulsorily to be Completed From the Organization's Hospital (Only Under special circumstances/ on Compassionate ground the Internship may be permitted from the Hospital Outside the campus) or Medical College approved by the University. Every candidate after passing all the subjects of every semester will compulsorily undergo rotatory internship to the satisfaction of the college Authorities and University concerned for a period of six months so as to be eligible for the award of the degree of Bachelors in Medical Laboratory Science (BMLS) and registration.

The University shall issue a provisional degree of Bachelors in Medical Laboratory Science (BMLS) on passing the final examination and after the completion of internship on demand by the candidate.

The internee shall be entrusted with laboratory responsibilities under direct supervision of Senior Medical Officer/Technician. They shall not be working independently.

Internee will not issue any certified copy of investigation reports or other related documents under their signature.

Assessment of Internship:

The Internee shall maintain the record of work, which is to be verified and certified by the senior medical officer/Technician under whom he /she works. Apart from scrutiny of record of work, assessment and evaluation of training shall be undertaken by an objective approach using situation tests in knowledge, skills and attitude during at the end of training. Based on the record of work and date of evaluation, The Director/Principal shall issue certificate for satisfactory completion of training following which the university shall award the degree of Bachelors of Science in Medical Laboratory techniques (**B.Sc MLT**).

Internship Log Book

Signed and completed Internship log book is compulsory to submit in the department/college to obtain internship completion and course completion letter/certificates.