Maulana Abul Kalam Azad University of Technology, WB
(Formerly known as West Bengal University of Technology)
Syllabus of B.Sc. (Medical Lab Technology)
Effective from academic session 2023-24
Semester VII
Detailed Syllabus

SL. No.	Category	Course Code	Course Title	L	T	P	Credit
SEMESTER – VII (Honours)							
1	DSC-15	BMLC701	CLINICAL ENZYMOLOGY AND AUTOMATION	3	0	2	5
		BMLC791	CLINICAL ENZYMOLOGY AND AUTOMATION LAB				
2	DSC-16	BMLC702	DIAGONOSTIC HISTOPATHOLOGY	3	0	2	5
		BMLC792	Diagnostic Histopathology Lab				
3	DSC-17	BMLC703	Medical Ethics and Professionalism	3	1	0	4
4	MINOR-10		Any one from Minor Basket (Computer)	3	1	0	4
5	MINOR-11		Any one from Minor Basket (Computer)	3	1	0	4

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Course: CLINICAL ENZYMOLOGY AND AUTOMATION CLINICAL ENZYMOLOGY AND AUTOMATION LAB	
Course Code: BMLC701+BMLC791	**Semester: VII**
	Maximum Marks: 100+100
Teaching Scheme	**Examination Scheme**
Lecture: 3	End semester Exam: 70
Tutorial: 0	Attendance: 5
Practical: 2	Continuous Assessment: 25
Credit: 5	Practical/Seasonal internal continuous evaluation: 40
	Practical/Seasonal external examination: 60

SL No.	Course Objective
1.	Understand the structure, classification, and mechanisms of enzyme action..
2.	Describe factors affecting enzyme activity and enzyme kinetics.
3.	Comprehend the role and clinical significance of isoenzymes and coenzymes
4.	Learn about enzyme assays and how enzymes are measured in clinical settings.
5.	Gain knowledge about automation in clinical biochemistry laboratories and hospital lab management.

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		Course Outcomes	Mapped module/Unit
CO1		Explain the basic concepts, classification, and mechanisms of enzyme action.	1
CO2		Analyze the factors affecting enzyme activity and understand coenzymes and their roles.	2
CO3		Describe enzyme kinetics and interpret kinetic data using the Michaelis-Menten equation.	3
CO4		Evaluate the clinical significance of enzymes and isoenzymes in disease diagnosis.	4
CO5		Understand the working principles of automated clinical chemistry analyzers and hospital lab management.	5

Learning Outcome/Skills:

Upon successful completion of this course, students will be able to:

- Define enzymes and explain their classifications and mechanisms of action.
- Understand the lock and key and induced fit theories of enzyme-substrate interaction.
- Explain the concepts of activation energy and binding energy.
- Identify factors influencing enzyme activity.
- Understand coenzyme structure and function, including the roles of NAD^+, $NADP^+$, FAD, FMN, and PPP.
- Interpret enzyme kinetic data using Michaelis-Menten kinetics.
- Distinguish between different types of enzyme inhibition.
- Describe and analyze the diagnostic significance of clinically important isoenzymes.
- Use appropriate units for enzyme activity and understand serum/plasma enzyme level fluctuations.
- Perform and differentiate between kinetic and endpoint enzyme assays.
- Understand the principles and operation of clinical chemistry analyzers.
- Apply knowledge of point of care testing and manage basic hospital laboratory operations.

Unit	Total Hours	% of Questions	Bloom's Taxonomy	Remarks, if any
THEORY				
U1	10	20	1,2	NA
U2	10	20	1,2,3	NA
U3	5	20	1,2	NA
U4	10	20	1,2,3	NA
U5	10	20	1,2	NA
	45	100		

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Course Code:	BMLC701	
Course:	CLINICAL ENZYMOLOGY AND AUTOMATION	Credits: 3.0

Contents		
Chapter	**Name of the Topic**	**Hours**
Unit-I	Introduction to enzymes, Classification of Enzymes, Isoenzymes, Concept of lock and key and induced fit theory, concept of activation energy and binding energy. Factors affecting enzyme activity	12
Unit-II	Coenzyme: Classification, various types and function, structure of NAD+, NADP+, FAD and FMN, PPP. Units for measuring enzyme activity, factors affecting enzyme level in serum/ plasma. Clinical assay & its type, kinetic assay and end point assay for the enzymes	08
Unit-III	Enzyme kinetics, the Michaelis-Menten equation and its physiological significances, Enzyme Inhibition, types of inhibitors of enzyme	05
Unit-IV	Isoenzymes, their tissue distribution and clinical significance: ALT, AST, ALP, GGT, CPK, CK-MB, LDH,Troponin, Myoglobin, Amylase, Lipase, ACP	10
Unit-V	Basic Concepts of Automation, principle, working and maintenance of various clinical chemistry analyzers, point of care testing, Hospital Laboratory Management	10
	Total:	45

Course Code: BMLC 791		Course: Clinical Enzymology & Automation Lab
Credit: 2 **Hours: 60**		**Practical**
	1	To perform enzyme estimation of LFT
	2	To perform enzyme estimation of Cardiac profile
	3	Determination of Troponin I
	4	To perform enzyme estimation of Pancreatic disorder
	5	To perform estimation of ACP.
	6	Antenatal profile
	7	Estimation of bicarbonate
	8	Arterial blood gas analysis
	9	Determination of Calcium

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List of Books

Sr. No.	Name of Author	Title of the BOOK	Edition/Publication
1	D M Vasudevan, (2011)	Text book of Medical Biochemistry	6th edition Jaypee Publishers
2	M N Chatterjea & Rana Shinde,(2012),	Text book of Medical Biochemistry	8th edition,Jayppe Publications
3	Singh & Sahni,(2008)	Introductory Practical Biochemistry	2nd edition, Alpha science
4	Lehninger,(2013	Principles of Biochemistry	6th edition, W H Freeman
5	U Satyanarayan,(2008)	Essentials of Biochemistry	2nd edition, Standard Publishers
6	Teitz,(2007),	Fundamentals of Clinical Chemistry	6th edition,Elsevier Publications

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Semester VII
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Course: DIAGONOSTIC HISTOPATHOLOGY	
Course Code: BMLC702+BML792	Semester: V
Maximum Marks: 100+100	

Teaching Scheme	Examination Scheme
Lecture: 3	End semester Exam: 70
Tutorial: 0	Attendance: 5
Practical: 2	Continuous Assessment: 25
Credit:5	Practical/Seasonal internal continuous evaluation: 40
	Practical/Seasonal external examination: 60

Sl No.	Course Objective
1	Students would able to make use of tissue processing and general staining.

	Course Outcomes	Mapped module/Unit
CO 1	Build the basic knowledge of microtome and tissue section cutting.	U1
CO 2	Able to perform the different types of tissue staining.	U1,U2
CO 3	Acquire the knowledge of carbohydrate and connective tissue staining..	U1,U2,U3
CO 4	Utilize the knowledge and skill of processing of bones and nerve tissue.	U1,U2,U3,U4
CO 5	Explain the Museum techniques and working principle of different types of microscope.	U4,U5
CO 6	Able to compare different activities related to diagnostic histopathology.	U5,U6

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<u>Learning Outcome/Skills:</u>

Upon completing this course, learners will acquire comprehensive knowledge and practical skills in histological techniques, including the use and types of microtomes, microtome knives, their sharpening, and accurate section cutting along with troubleshooting common faults. They will understand the preparation and application of section adhesives and explore various staining techniques such as progressive, regressive, vital, and supravital staining, with emphasis on hematoxylin types and H&E staining. Students will gain expertise in special stains for carbohydrates (PAS, Alcian blue), glycogen, connective tissue (Trichrome, Verhoeff, Gomori, von Geison, PTAH), as well as demonstration of minerals, pigments, lipids, enzymes, and microorganisms in tissue. The course also includes processing and staining of bone marrow and bone tissue, with an introduction to neuropathology techniques like neuron and myelin staining. Learners will become proficient in museum specimen preparation, and understand the principles and applications of advanced tools such as electron microscopy, fluorescence microscopy, and immunohistochemistry in diagnostic and research settings.

Unit	Total Hours	% of Questions	Bloom's Taxonomy	Remarks, if any
THEORY				
U1	10	25	1	NA
U2	5	10	1, 2	NA
U3	5	10	1, 2, 3	NA
U4	10	25	1, 2, 3	NA
U5	10	20	1, 2, 3	NA
U6	5	10	1,2,3	NA
	45	100%		

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Course Code:	BMLC702	
Course:	**DIAGONOSTIC HISTOPATHOLOGY**	Credits: 3.0

Contents		
Chapter	**Name of the Topic**	**Hours**
Unit-I	Microtome, its type and working, various type of microtome, Microtome knives, its type and knife sharpening, Section cutting, fault and remedies, Section adhesive.	10
Unit-II	Progressive, regressive, vital, supravital staining, types of hematoxylin, Haematoxylin and eosin staining, use of control sections in tissue staining, mounting and mounting media, advantages & disadvantages.	5
Unit-III	Staining of carbohydrates: preparation of Schiff reagent, PAS staining, Alcian blue, staining of glycogen. Connective tissue & its staining: Trichrome staining, verhoeff stain, Gomori's method, von Geison stain, PTAH stain.	5
Unit-IV	Demonstration of minerals and pigments in tissue sample, Demonstration and identification of lipids, Demonstration of enzymes, diagnostic application a n d Demonstration of microorganism on tissue specimens.	10
Unit-V	Processing and staining of bone marrow sample. Fixation, Processing and section cutting of bones, Techniques in neuropathology: Neurons staining, Myelin, Neuropathology lab specimen Handling.	10
Unit-VI	Museum techniques Electron microscopy: Principle and working, of tissue. Fluorescence Microscope: Principleand working. Immunohistochemistry: principle, types, applications	5
	Total:	45

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Course Code: BMLC792	Course: Diagonostic Histopathology Lab
Credit: 2 Hours: 60	List of practical
1	Demonstration of glass wares and equipment used in histopathology lab.
2	To prepare alcohol of different concentration.
3	To prepare formalin from stock solution.
4	To sharp knife by honing and stropping.
5	Grossing of tissue
6	To perform tissue processing by manual method
7	To perform section cutting of paraffin embedded tissue
8	To fix the smear on glass slide.
9	To perform hematoxylin and eosin staining

List of Books

Sl. No.	Name of Author	Title of the Book	Edition & Publisher
1	Bancroft's	Bancroft's Theory and Practice of Histological Techniques	7th Edition, Elsevier Publications
2	Harshmohan (2017)	Textbook of Pathology	7th edition, Jaypee Publications
3	Godkar.B. Praful,(2016)	Textbook of MLT	3rd edition,Bhalani Publications
4	C F A Culling,(1974)	Handbook of Histopathological and Histochemical Techniques: Including Museum Techniques,	3rd edition, Butterworths Publishers

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Course: Medical Ethics and Professionalism	
Course Code: BMLC703	**Semester: VII**
Maximum Marks: 100	
Teaching Scheme	**Examination Scheme**
Theory: 3	End semester Exam: 70
Tutorial: 1	Attendance: 5
Practical: 0	Continuous Assessment: 25
Credit: 4	Practical/Seasonal internal continuous evaluation: 0
	Practical/Seasonal external examination: 0

Sl. No.	Course Objective
1	Understand the principles and frameworks of medical ethics and professionalism in laboratory practice
2	Apply ethical reasoning and decision-making in diagnostic and clinical contexts.
3	Demonstrate professional behavior, accountability, and respect in patient and workplace interactions.
4	Recognize the legal and regulatory obligations of medical laboratory professionals.
5	Develop effective communication, empathy, and leadership skills necessary for ethical practice.

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	Course Outcomes	Mapped module/Unit
CO 1	Explain the fundamental principles of medical ethics.	U1
CO 2	Understand teamwork and cooperation within healthcare settings.	U1,U2
CO 3	Apply safety and quality assurance standards ethically.	U1,U2,U3
CO 4	Apply ethical reasoning in resolving real-world professional conflicts.	U1,U2,U3,U4
CO 5	Commit to continuous professional development and ethical leadership.	U4,U5

Learning Outcome/Skills:

By the end of this course, students will understand the fundamental principles and theories of medical ethics and their application in laboratory practice. They will demonstrate professionalism, integrity, and accountability while maintaining ethical relationships with patients, clinicians, and colleagues. Students will gain knowledge of legal and regulatory frameworks, including consent, confidentiality, and quality standards. They will be able to identify and address ethical issues in laboratory work and research, upholding integrity and responsibility in scientific practice. Additionally, they will develop effective communication skills, empathy, and leadership qualities essential for professional growth and lifelong learning in the field of medical laboratory technology.

Unit	Total Hours	% of Questions	Bloom's Taxonomy	Remarks, if any
THEORY				
U1	10	10	1,2	NA
U2	10	20	1,2	NA
U3	12	20	1,2,3	NA
U4	14	30	1,2,3	NA
U5	12	20	1,2,3	NA
	60	100%		

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Course Code:	BMLC703	
Course:	Medical Ethics and Professionalism	Credits: 4.0

Contents		
Chapter	**Name of the Topic**	**Hours**
Unit-I	Foundations of Medical Ethics: Definition, scope, and importance of medical ethics Historical perspectives: Hippocratic Oath, Nuremberg Code, Declaration of Helsinki Principles of biomedical ethics — autonomy, beneficence, non-maleficence, justice Ethical theories (deontology, utilitarianism, virtue ethics) Role of ethics in laboratory practice	10
Unit-II	Professionalism in Medical Laboratory Practice: Meaning and characteristics of professionalism Professional behavior, attitude, and integrity Ethical relationships: patient–technologist, clinician–technologist, and peer interactions Teamwork, discipline, and inter professional collaboration Professional accountability and responsibilities	10
Unit-III	Legal and Regulatory Frameworks: Legal responsibilities of medical laboratory professionals Consent, confidentiality, and data protection (HIPAA/local equivalents) Negligence and malpractice in laboratory testing Laboratory quality control, accreditation (NABL), and standard operating procedures Roles of regulatory councils, hospital ethics committees, and national bodies	12
Unit-IV	Ethical Issues in Laboratory Practice and Research: Ethical dilemmas in diagnostic and research laboratories Handling of human samples, genetic testing, and patient confidentiality Reporting critical results and dealing with errors Research ethics, plagiarism, and publication integrity Conflict of interest and whistleblowing	14
Unit-V	Communication, Empathy, and Professional Development: Effective communication with patients and healthcare teams Empathy, compassion, and patient-centered care Managing stress, ethical conflicts, and workplace challenges Continuing education, lifelong learning, and leadership in medical technology Case studies and role plays on ethics and professionalism	12
	Total:	**60**

List of Books

Sl. No.	Name of Author	Title of the Book	Edition & Publisher
1	C.E. Harris, M.S. Pritchard & M.J. Rabins	Engineering Ethics: Concepts and Cases	6th Edition, Cengage Learning, 2018
2	B.M. Chatterjee	Medical Ethics – A Practical Guide for Medical Professionals	3rd Edition, Jaypee Brothers Medical Publishers, 2020
3	R. Barry & L. G. Engelhardt	Bioethics Reader: Editors' Selections	2nd Edition, Routledge, 2019

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SL. No.	Category	Course Code	Course Title	L	T	P	Credit
**SEMESTER – VII (Honours with research)**
1	DSC-15	BSMC701	CLINICAL ENZYMOLOGY AND AUTOMATION	3	0	2	5
		BSMC791	CLINICAL ENZYMOLOGY AND AUTOMATION LAB				
2	DSC-16	BSMC702	DIAGONOSTIC HISTOPATHOLOGY	3	0	2	5
		BSMC792	Diagnostic Histopathology Lab				
3	DSC-17	BSMCR703	Research Methodology	3	1	0	4
4	MINOR-10		Any one from Minor Basket (Computer)	3	1	0	4
5	MINOR-11		Any one from Minor Basket (Computer)	3	1	0	4

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Course: CLINICAL ENZYMOLOGY AND AUTOMATION CLINICAL ENZYMOLOGY AND AUTOMATION LAB	
Course Code: BMLC701+BMLC791	Semester: VII
	Maximum Marks: 100+100

Teaching Scheme	Examination Scheme
Lecture: 3	End semester Exam: 70
Tutorial: 0	Attendance: 5
Practical: 2	Continuous Assessment: 25
Credit: 5	Practical/Seasonal internal continuous evaluation: 40
	Practical/Seasonal external examination: 60

SL No.	Course Objective
1.	Understand the structure, classification, and mechanisms of enzyme action..
2.	Describe factors affecting enzyme activity and enzyme kinetics.
3.	Comprehend the role and clinical significance of isoenzymes and coenzymes
4.	Learn about enzyme assays and how enzymes are measured in clinical settings.
5.	Gain knowledge about automation in clinical biochemistry laboratories and hospital lab management.

	Course Outcomes	Mapped module/Unit
CO1	Explain the basic concepts, classification, and mechanisms of enzyme action.	1
CO2	Analyze the factors affecting enzyme activity and understand coenzymes and their roles.	2
CO3	Describe enzyme kinetics and interpret kinetic data using the Michaelis-Menten equation.	3
CO4	Evaluate the clinical significance of enzymes and isoenzymes in disease diagnosis.	4
CO5	Understand the working principles of automated clinical chemistry analyzers and hospital lab management.	5

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Learning Outcome/Skills:

Upon successful completion of this course, students will be able to:

- Define enzymes and explain their classifications and mechanisms of action.
- Understand the lock and key and induced fit theories of enzyme-substrate interaction.
- Explain the concepts of activation energy and binding energy.
- Identify factors influencing enzyme activity.
- Understand coenzyme structure and function, including the roles of NAD^+, $NADP^+$, FAD, FMN, and PPP.
- Interpret enzyme kinetic data using Michaelis-Menten kinetics.
- Distinguish between different types of enzyme inhibition.
- Describe and analyze the diagnostic significance of clinically important isoenzymes.
- Use appropriate units for enzyme activity and understand serum/plasma enzyme level fluctuations.
- Perform and differentiate between kinetic and endpoint enzyme assays.
- Understand the principles and operation of clinical chemistry analyzers.
- Apply knowledge of point of care testing and manage basic hospital laboratory operations.

Unit	Total Hours	% of Questions	Bloom's Taxonomy	Remarks, if any
THEORY				
U1	10	20	1,2	NA
U2	10	20	1,2,3	NA
U3	5	20	1,2	NA
U4	10	20	1,2,3	NA
U5	10	20	1,2	NA
	45	100		

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Course Code:	BMLC701	
Course:	CLINICAL ENZYMOLOGY AND AUTOMATION	Credits: 3.0

Contents		
Chapter	**Name of the Topic**	**Hours**
Unit-I	Introduction to enzymes, Classification of Enzymes, Isoenzymes, Concept of lock and key and induced fit theory, concept of activation energy and binding energy. Factors affecting enzyme activity	12
Unit-II	Coenzyme: Classification, various types and function, structure of NAD+, NADP+, FAD and FMN, PPP. Units for measuring enzyme activity, factors affecting enzyme level in serum/ plasma. Clinical assay & its type, kinetic assay and end point assay for the enzymes	08
Unit-III	Enzyme kinetics, the Michaelis-Menten equation and its physiological significances, Enzyme Inhibition, types of inhibitors of enzyme	5
Unit-IV	Isoenzymes, their tissue distribution and clinical significance: ALT, AST, ALP, GGT, CPK, CK-MB, LDH,Troponin, Myoglobin, Amylase, Lipase, ACP	10
Unit-V	Basic Concepts of Automation, principle, working and maintenance of various clinical chemistry analyzers, point of care testing, Hospital Laboratory Management	10
	Total:	45

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Course Code: BML 791	Course: Clinical Enzymology & Automation Lab	
Credit: 2 **Hours: 60**	**Practical**	
1	To perform enzyme estimation of LFT	
2	To perform enzyme estimation of Cardiac profile	
3	Determination of Troponin I	
4	To perform enzyme estimation of Pancreatic disorder	
5	To perform estimation of ACP.	
6	Antenatal profile	
7	Estimation of bicarbonate	
8	Arterial blood gas analysis	
9	Determination of Calcium	

List of Books

Sr. No.	Name of Author	Title of the BOOK	Edition/Publication
1	D M Vasudevan, (2011)	Text book of Medical Biochemistry	6th edition Jaypee Publishers
2	M N Chatterjea & Rana Shinde,(2012),	Text book of Medical Biochemistry	8th edition,Jayppe Publications
3	Singh & Sahni,(2008)	Introductory Practical Biochemistry	2nd edition, Alpha science
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Course: DIAGONOSTIC HISTOPATHOLOGY	
Course Code: BMLC702+BMLC792	**Semester: V**
Maximum Marks: 100+100	

Teaching Scheme	Examination Scheme
Lecture: 3	End semester Exam: 70
Tutorial: 0	Attendance: 5
Practical: 2	Continuous Assessment: 25
Credit:5	Practical/Seasonal internal continuous evaluation: 40
	Practical/Seasonal external examination: 60

Sl No.	Course Objective	
1	Students would able to make use of tissue processing and general staining.	

	Course Outcomes	Mapped module/Unit
CO 1	Build the basic knowledge of microtome and tissue section cutting.	U1
CO 2	Able to perform the different types of tissue staining.	U1,U2
CO 3	Acquire the knowledge of carbohydrate and connective tissue staining..	U1,U2,U3
CO 4	Utilize the knowledge and skill of processing of bones and nerve tissue.	U1,U2,U3,U4
CO 5	Explain the Museum techniques and working principle of different types of microscope.	U4,U5
CO 6	Able to compare different activities related to diagnostic histopathology.	U5,U6

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Learning Outcome/Skills:

Upon completing this course, learners will acquire comprehensive knowledge and practical skills in histological techniques, including the use and types of microtomes, microtome knives, their sharpening, and accurate section cutting along with troubleshooting common faults. They will understand the preparation and application of section adhesives and explore various staining techniques such as progressive, regressive, vital, and supravital staining, with emphasis on hematoxylin types and H&E staining. Students will gain expertise in special stains for carbohydrates (PAS, Alcian blue), glycogen, connective tissue (Trichrome, Verhoeff, Gomori, von Geison, PTAH), as well as demonstration of minerals, pigments, lipids, enzymes, and microorganisms in tissue. The course also includes processing and staining of bone marrow and bone tissue, with an introduction to neuropathology techniques like neuron and myelin staining. Learners will become proficient in museum specimen preparation, and understand the principles and applications of advanced tools such as electron microscopy, fluorescence microscopy, and immunohistochemistry in diagnostic and research settings.

Unit	Total Hours	% of Questions	Bloom's Taxonomy	Remarks, if any
THEORY				
U1	10	25	1	NA
U2	5	10	1, 2	NA
U3	5	10	1, 2, 3	NA
U4	10	25	1, 2, 3	NA
U5	10	20	1, 2, 3	NA
U6	5	10	1,2,3	NA
	45	100%		

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Course Code:	BMLC702	
Course:	**DIAGONOSTIC HISTOPATHOLOGY**	**Credits: 3.0**

Contents		
Chapter	**Name of the Topic**	**Hours**
Unit-I	Microtome, its type and working, various type of microtome, Microtome knives, its type and knife sharpening, Section cutting, fault and remedies, Section adhesive.	10
Unit-II	Progressive, regressive, vital, supravital staining, types of hematoxylin, Haematoxylin and eosin staining, use of control sections in tissue staining, mounting and mounting media, advantages & disadvantages.	5
Unit-III	Staining of carbohydrates: preparation of Schiff reagent, PAS staining, Alcian blue, staining of glycogen. Connective tissue & its staining: Trichrome staining, verhoeff stain, Gomori's method, von Geison stain, PTAH stain.	5
Unit-IV	Demonstration of minerals and pigments in tissue sample, Demonstration and identification of lipids, Demonstration of enzymes, diagnostic application a n d Demonstration of microorganism on tissue specimens.	10
Unit-V	Processing and staining of bone marrow sample. Fixation, Processing and section cutting of bones, Techniques in neuropathology: Neurons staining, Myelin, Neuropathology lab specimen Handling.	10
Unit-VI	Museum techniques Electron microscopy: Principle and working, of tissue. Fluorescence Microscope: Principleand working. Immunohistochemistry: principle, types, applications	5
	Total:	45

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Course Code: BMLC792	Course: Diagonostic Histopathology
Credit: 2 Hours: 60	**List of practical**
1	Demonstration of glass wares and equipment used in histopathology lab.
2	To prepare alcohol of different concentration.
3	To prepare formalin from stock solution.
4	To sharp knife by honing and stropping.
5	Grossing of tissue
6	To perform tissue processing by manual method
7	To perform section cutting of paraffin embedded tissue
8	To fix the smear on glass slide.
9	To perform hematoxylin and eosin staining

List of Books

Sl. No.	Name of Author	Title of the Book	Edition & Publisher
1	Bancroft's	Bancroft's Theory and Practice of Histological Techniques	7th Edition, Elsevier Publications
2	Harshmohan (2017)	Textbook of Pathology	7th edition, Jaypee Publications
3	Godkar.B. Praful,(2016)	Textbook of MLT	3rd edition,Bhalani Publications
4	C F A Culling,(1974)	Handbook of Histopathological and Histochemical Techniques: Including Museum Techniques,	3rd edition, Butterworths Publishers

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Course: Research Methodology	
Course Code: BMLCR703	**Semester: VII**
Maximum Marks: 100	
Teaching Scheme	**Examination Scheme**
Theory: 3	End semester Exam: 70
Tutorial: 1	Attendance: 5
Practical: 0	Continuous Assessment: 25
Credit: 4	Practical/Seasonal internal continuous evaluation: 0
	Practical/Seasonal external examination: 0

Sl. No.	Course Objective
1	Identify research problems and formulate hypotheses.
2	Design and conduct research studies using appropriate sampling, data collection, and analysis methods.
3	Interpret results, write clear reports, and present their findings.
4	Understand the ethical principles of research and avoid common pitfalls in publication.

	Course Outcomes	Mapped module/Unit
CO 1	Understand the definition, objectives, and importance of research, including its types and ethical considerations.	U1
CO 2	Identify research problems, conduct literature reviews, and plan appropriate research designs including hypothesis formulation and sampling methods.	U1,U2
CO 3	Collect, classify, and analyze research data using appropriate tools and statistical methods.	U1,U2,U3
CO 4	Interpret research results and develop comprehensive research reports, dissertations, and scientific articles.	U1,U2,U3,U4
CO 5	Understand research applications in medical laboratory practices and the importance of quality assurance and funding.	U4,U5

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Learning Outcome/Skills:

By the end of this course, students will be able to understand the fundamental concepts of research, including its definition, objectives, and various types such as basic, applied, clinical, descriptive, and analytical research. They will develop the ability to identify relevant research problems within the field of medical laboratory technology and conduct thorough literature reviews to support their studies. Students will learn how to design effective research studies, formulate hypotheses, and distinguish between different types of variables. They will acquire practical skills in selecting appropriate sampling techniques, determining sample size, and collecting both qualitative and quantitative data through methods such as surveys, questionnaires, and laboratory records. Additionally, they will gain foundational knowledge in biostatistics, including measures like mean, median, mode, and standard deviation, and learn to use tools such as Excel and SPSS for basic data analysis. The course will also enhance their ability to interpret results, write structured research reports and abstracts, and apply referencing styles like APA and Vancouver. Emphasis will be placed on research ethics, including the importance of avoiding plagiarism and maintaining integrity. Furthermore, students will explore the application of research in laboratory practices, including pathology, microbiology, biochemistry, and quality assurance. Finally, they will gain insight into the process of scientific publication, including journal selection, the peer-review process, and common reasons for manuscript rejection, preparing them for future contributions to academic and professional research.

Unit	Total Hours	% of Questions	Bloom's Taxonomy	Remarks, if any
THEORY				
U1	10	10	1,2	NA
U2	10	20	1,2	NA
U3	12	20	1,2,3	NA
U4	14	30	1,2,3	NA
U5	12	20	1,2,3	NA
	60	100%		

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Course Code:	BMLCR703	
Course:	Research Methodology	Credits: 4.0

Contents

Chapter	Name of the Topic	Hours
Unit-I	Introduction to Research and its Importance. Definition and objectives of research. Types of research: Basic, Applied, Clinical, Descriptive, Analytical. Research in Medical Laboratory Technology. Identifying research problems. Review of literature and its significance. Research ethics and plagiarism	10
Unit-II	Research Design and Planning. Elements of a research design. Formulation of hypothesis. Variables: Independent, Dependent, Confounding. Sampling techniques: Probability and Non-probability. Inclusion and exclusion criteria. Sample size determination. Pilot studies	10
Unit-III	Data Collection and Analysis. Types of data: Primary vs Secondary, Qualitative vs Quantitative. Data collection methods: Surveys, Questionnaires, Observations, Lab data. Tools and instruments used in data collection. Introduction to biostatistics: Mean, Median, Mode, Standard deviation. Data presentation: Tables, Charts, Graphs. Use of Excel/SPSS for data entry and basic analysis	12
Unit-IV	Interpretation and Report Writing. Interpretation of results. Discussion and conclusion. Limitations of the study. Referencing styles: Vancouver, APA. Structure of research reports, dissertations, and articles. Writing abstracts and proposals	14
Unit-V	Research in Laboratory Practice and Publication. Clinical case study-based research. Research applications in pathology, microbiology, and biochemistry. Quality assurance and control as research. ICMR and other funding agencies. Steps in publication: Selection of journals, peer-review process. Common reasons for manuscript rejection	12
	Total:	60

List of Books

Sl. No.	Name of Author	Title of the Book	Edition & Publisher
1	C.R. Kothari, Gaurav Garg	Research Methodology: Methods and Techniques	4th Edition, New Age International Publishers
2	John W. Creswell	Research Design: Qualitative, Quantitative, and Mixed Methods Approaches	5th Edition, Sage Publications
3	Donald Ary, Lucy Cheser Jacobs	Introduction to Research in Education	9th Edition, Cengage Learning