

MAULANA ABUL KALAM AZAD UNIVERSITY OF TECHNOLOGY, WB
Syllabus of B. Sc. In Medical Lab Technology
(Effective for 2021-2022 Admission Session)
Choice Based Credit System
140 Credit (3-Year UG)

5th Semester

Subject Type	Course Name	Course Code	Credit Distribution			Credit Points	Mode of Delivery			Proposed Moocs
			Theory	Practical	Tutorial		Offline	Online	Blended	
CC 11	Immunohematology and blood banking	BML(T) 501	4	0	0	6	✓			As per MAKUT Notification
		BML 591	0	2	0					
CC 12	Parasitology and virology	BML(T) 502	4	0	0	6	✓			
		BML 592	0	2	0					
DSE 1 (Any one)	Diagonostic cytology	BML 503 (A)	4	0	0	6			✓	
		BML 593 (A)	0	2	0					
	Diagnostic Histopathology	BML503 (B)	4	0	0					
		BML593 (B)	0	2	0					
DSE 2 (Any one)	Clinical Enzymology	BML 504 (A)	4	0	0	6			✓	
		BML 594 (A)	0	2	0					
	Biochemistry & Nutrition	BML 504 (B)	4	0	0					
		BML 594 (B)	0	2	0					
Semester Credits						24				

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Paper: Immunohematology & Blood Banking

Code: BML-501/591

Credits: 4L+2P.

Course objective

Students would be able to make use of transfusion medicine, laboratory testing, quality control and apheresis techniques.

Sl	Course Outcome
1	Demonstrate the basic knowledge of Immunohematology and blood banking
2	Understand the different blood grouping system and donor selection criteria.
3	Explain the knowledge of transfusion transmissible disease and antigen antibody reaction.
4	Organise the knowledge and skill of preparation of blood components.
5	Outline the Apheresis procedure and role of different administrative bodies.
6	Examine and Evaluate to perform different activities related to transfusion medicines.

THEORY- BML (T) 501

CO	Blooms Level	Module	%age of questions
CO1	1,2,3	M1	25
CO2	1,2,3	M1,M2	20
CO3	1,2,3	M2,M3	20
CO4	1,2,3,4	M3,M4	20
CO5	1,2,3,4	M4,M5	15
			100

PRACTICAL- BML 591

CO	Blooms Level	Module	%age of questions
CO6	3,4,5	M6	100

Module-I (10 Hrs)

Basic Principles of Blood Banking; Antigen, Antibody, naturally occurring antibody, Complement, ABO & Rh blood group system, Methods of blood group determination, Forward and Reverse grouping, Slide & Tube method, Gel method.

Module-II (10 Hrs)

Other blood group system such as Lewis, MNS, Kell Duffy etc. Anticoagulants and preservative used in blood bank, Donor selection criteria, Blood collection and processing

Module-III (10 Hrs)

Transfusion transmissible infectious disease screen, Coomb's test, Cross matching, Compatibility testing, Antibody Screening & Identification, Grading of Reaction/Agglutination

Module-IV (10 Hrs)

Blood components and its preparation, preservation, storage and transportation
 Indications for different blood component transfusion, Blood transfusion reaction and its type, HDN Introduction of stem cell banking and bone marrow transplantation.

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Module-V (10 Hrs)

Apheresis, indications of hemapheresis, plasmapheresis, plateletspheresis, plasmapheresis
 Quality control of reagents, equipments, blood components used in transfusion medicine.
 Role of NACO, Indian Red Cross Society and DGHS.

MODULE—VI (PRACTICAL) (BML591) (26 Hrs)

- 1-Forward blood grouping (Tube and slide method)
- 2- Reverse blood grouping.
- 3- Rh typing.
- 4- Rh negative or D^u conformation.
- 5- Direct and indirect Coomb's test.
- 6- Major Cross matching.
- 7- Minor cross matching.
- 8- Blood donor selection.
- 9- Demonstration of blood collection procedure.
- 10- Blood group screening by finger pricking.
- 11- Demonstration of blood component separation.
- 12- Demonstration of storage of blood component.

Suggested Readings:

1. Godkar.B. Praful,(2016) Textbook of MLT,3rd edition,Bhalani Publications
2. Ochei J & Kolhatkar A(2000),Medical Laboratory Science: Theory & Practice, 3rd edition,Mcgraw Hill Education
3. Mukherjee .L.K(2017), Medical Laboratory Technology,Vol.1-3,3rd edition, Tata McgrawHill
4. Sood Ramnik,(2015), Text book of Medical Laboratory Technology,2nd edition, Jaypee Publications
5. Wintrobe's Clinical Hematology,(2014),13th edition, Lippincott Williams & Wilkins
6. Principle & practice of Transfusion Medicine. Dr. R.N Makroo. Kongposh Publications.

Paper: Parasitology & Virology

Code: BML-502/592

Credits : 4L+2P.

Course objective

Students would be able to identify and infer different parasites and viruses with latest biomedical techniques.

Sl	Course Outcome
1	Acquire the knowledge of parasitology
2	Able to explain the diagnostics method in parasitology
3	Explain the nature and properties of viruses.
4	Apply the knowledge of different viral diseases.
5	Illustrate the knowledge about oncogenic viruses .
6	Experiment with different activities related to Parasitology & Virology.

THEORY- BML (T) 502

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CO	Blooms Level	Module	%age of questions
CO1	1,2	M1	25
CO2	1,2,3	M1,M2	20
CO3	1,2,3	M2,M3	23
CO4	1,2,3	M3,M4	22
CO5	2,3,4	M4,M5	10
			100

PRACTICAL- BML 592

CO	Blooms Level	Module	%age of questions
CO6	2,3,4,5	M6	100

Module-I (10 hours)

Introduction of parasites, host, zoonosis, host parasites relationship, sources of infection, mode of infection, pathogenesis, lab diagnosis.

Protozoology: Entamoeba histolytica, Malarial Parasites, Leishmania, Trypanosomes, their morphology, life cycle, pathogenesis, clinical features and lab diagnosis.

Helminthology: Morphology, life cycle, pathogenesis, clinical features and lab diagnosis

Of Taenia solium, Taenia Saginata, Ascaris, Wuchereria bancrofti, Hookworm, Trichuris Dracunculus.

Module-II (10 hours)

Diagnostic methods in Parasitology: Introduction, Examination of stool, urine, Immunological diagnosis and serology

Module- III (10 hours)

Introduction: Discovery, nature, property and definition of viruses, concept of viroids, virusoids, satellite viruses and Prions. Structure of Viruses: Capsid symmetry, enveloped and non-enveloped viruses.

Viral taxonomy: Classification of different groups of viruses,

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

Module IV (10 hours)

Brief description of Poxviruses, Herpesviruses, Hepatitis viruses, retroviruses-HIV, TORCH profile. Symptoms, mode of transmission, prophylaxis and control of Polio, Rabies, Dengue, HIV, Influenza, swine flu, Ebola, Chikungunya, Japanese Encephalitis.

Module V (10 hours)

Introduction to oncogenic viruses, 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.

Module VI-Parasitology & Virology

Code: BML- 592

Credits : 2(26 Hrs)

1. Leishman staining for malarial parasites
2. Saline wet mount for observing ova and eggs of parasites.
3. Iodine wet mount for observing ova and eggs of parasites.
4. Concentration of stool samples by floatation method
5. Zinc sulphate conc. Method for stool sample
6. Demonstration of Trichuris, Ascaris and Hookworm
7. by permanent slides.
8. Aldehyde Chopra test for Kala Azar

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9. To perform HBsAg/ Australia Ag by rapid method
10. To perform HBsAg by ELISA
11. To perform HIV Tridot method.
12. To perform HIV by ELISA
13. To perform Dengue IgG/IgM.

Suggested Readings:

1. Ananthanarayan R. and Paniker C.K.J. (2009) Textbook of Microbiology. 8th edition, University Press Publication
2. Brooks G.F., Carroll K.C., Butel J.S., Morse S.A. and Mietzner, T.A. (2013)
3. Adelberg's Medical Microbiology. 26th edition. McGraw Hill Publication
4. Goering R., Dockrell H., Zuckerman M. and Wakelin D. (2007) Mims' Medical Microbiology. 4th edition. Elsevier
5. Willey JM, Sherwood LM, and Woolverton CJ. (2013) Prescott, Harley and Klein's Microbiology. 9th edition. McGraw Hill Higher Education
6. Ananthanarayan R. and Paniker C.K.J. (2009) Textbook of Microbiology. 8th edition, University Press Publication
7. Adelberg's Medical Microbiology. 26th edition. McGraw Hill Publication

DSE 1-Diagnostic Cytology

Credits: 4L+2P.

Course objective

Students would be able to take part in collection, processing, staining and quality control in cytological diagnosis.

Sl	Course Outcome
1	Build knowledge about the basic structure of cells.
2	Apply the knowledge of the cell fixation, blocking and staining.
3	Demonstrate the FNAC and staining procedure.
4	Explain the process of different cytological fluid sample.
5	Illustrate the knowledge of modern cytological technique.
6	Able to experiment with different activities of diagnostic cytology.

THEORY- BML 503 (A)

CO	Blooms Level	Module	%age of questions
CO1	1,2	M1	18
CO2	1,2,3	M2	20
CO3	2,3	M3	20
CO4	2,3,4	M4	20
CO5	2,3,4	M5	22
			100

PRACTICAL- BML 593 (A)

CO	Blooms Level	Module	%age of questions
CO6	2,3,4,5	M6	100

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Module I (10 hours) Cell: basic structure and function, cell organelles, cell cycle, Benign and Malignant tumors, Instruments used in cytology, preparation of buffers, stains.
Module II (10 hours) Instruments and equipments used in cytology Fixation and Fixatives used in cytology, Adhesive and mounting media, Cell block and cytospin technique, Staining such as PAP, H&E, significance of PAP-HPV, Destaining and restaining of slides, Cover slipping
Module III (10 hours) Aspiration and exfoliative cytology, Patient preparation, Sample collection, Fixation, Processing and Staining. FNAC, collection, processing of sample and staining, on site quick staining procedure.
Module IV (10 hours) Hormonal cytology in different age groups, Collection and processing of sputum, BAL, CSF, Pleural, peritoneal and pericardial fluid, Gynaecologic sample
Module V (10 hours) Sex chromatin demonstration, Introduction of Immunocytochemistry, different markers and its applications, Automation in cytology, Liquid based preparation & automated screening device.

Module VI -Practical Diagnostic Cytology (26 hrs)

Credits : 2

1. Preparation of various cytological fixatives
2. Preparation of various stains used in cytology
3. Preparation of smear
4. To perform PAP staining
5. To perform Giemsa staining on fluid sample
6. To prepare cell suspension
7. Processing of various fluid samples

Suggested Readings:

Bibbo, (1997), Comprehensive Cytopathology, 2nd edition, Saunders Publishers
Koss's Diagnostic Cytology, Vol.1 & 2, (2006), 5th edition, Lippincott Godkar. B. Praful, (2016) Textbook of MLT, 3rd edition, Bhalani Publications
Ochei J & Kolhatkar A (2000), Medical Laboratory Science: Theory & Practice, 3rd edition, McGraw Hill Education
Mukherjee .L.K (2017), Medical Laboratory Technology, Vol.1-3, 3rd edition, Tata McGraw Hill
Sood Ramnik, (2015), Text book of Medical Laboratory Technology, 2nd edition, Jaypee Publications.

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DSE 1: Diagnostic Histopathology
Credits : 4L+2P.

Course objective

Students would be able to make use of tissue processing and general staining.

Sl	Course Outcome
1	Build the basic knowledge of microtome and tissue section cutting.
2	Able to perform the different types of tissue staining.
3	Acquire the knowledge of carbohydrate and connective tissue staining.
4	Utilize the knowledge and skill of processing of bones and nerve tissue.
5	Explain the Museum techniques and working principle of different types of microscope.
6	Able to compare different activities related to diagnostic histopathology.

THEORY- BML 503 (B)

CO	Blooms Level	Module	%age of questions
CO1	1,2,3	M1	20
CO2	1,2,3	M2	20
CO3	2,3,4	M3	20
CO4	2,3,4	M4	20
CO5	2,3,4	M5	20
			100

PRACTICAL- BML 593 (B)

CO	Blooms Level	Module	%age of questions
CO6	3,4,5,6	M6	100

<p>Module-I(10 Hrs) Microtome, its type and working, various type of microtome, Microtome knives, its type and knife sharpening, Section cutting, fault and remedies, Section adhesive.</p>
<p>Module-II(10 Hrs) 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.</p>
<p>Module-III(10 Hrs) Staining of carbohydrates: preparation of Schiff reagent, PAS staining, Alcianblue, staining of glycogen. Connective tissue & its staining: Trichrome staining, verhoeff stain, Gomori's method, von Geison stain, PTAH stain.</p>
<p>Module-IV(10 Hrs) Demonstration of minerals and pigments in tissue sample, Demonstration and identification of lipids, Demonstration of enzymes, diagnostic application and Demonstration of microorganism on tissue specimens. Processing and staining of bone marrow sample. Fixation, Processing and section cutting of bones, Techniques</p>

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in neuropathology: Neurons staining, Myelin, Neuropathology lab specimen Handling.

Module-V(10 Hrs)

Museum techniques

Electron microscopy: Principle and working, of tissue. Fluorescence Microscope: Principle and working.

Immunohistochemistry: principle, types, applications.

Module VI- Histopathology

Credits :2 (26 hrs.)

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.

Suggested Readings:

1. 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

DSE 2-Clinical Enzymology & Automation

Code: BML-504 (A)/594A

Credits: 4L+2P.

Course objective

Students would be able to compare contemporary methods and practical approaches that are used in the clinical laboratories for the investigation of the diseased state as well as outline the application of automation in laboratory.

Sl	Course Outcome
1	Develop idea about the enzyme and isoenzyme.
2	Make use of knowledge about co-enzymes.
3	Demonstrate about the Michaelis-Menten equation and its physiological significances.
4	Explain about the clinical significance of cardiac, Liver, and pancreatic enzymes in diagnosis.
5	Apply knowledge about automation in clinical laboratory and maintenance of equipments.

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6	Able to assess different activities of diagnostic laboratories.
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THEORY- BML 504(A)

CO	Blooms Level	Module	%age of questions
CO1	1,2,3	M1	22
CO2	1,2,3	M1,M2	20
CO3	2,3,4	M2,M3	20
CO4	2,3,4	M3,M4	20
CO5	2,3,4	M4,M5	18
			100

PRACTICAL- BML 594(A)

CO	Blooms Level	Module	%age of questions
CO6	3,4,5	M5,M6	100

Module I (10 Hours)

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

Module II (10 Hours)

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

Module III (10 Hours)

Enzyme kinetics, the Michaelis-Menten equation and its physiological significances, Enzyme Inhibition, types of inhibitors of enzyme

Module IV (10 Hours)

Isoenzymes, their tissue distribution and clinical significance: ALT, AST, ALP, GGT, CPK, CK-MB, LDH, Troponin, Myoglobin, Amylase, Lipase, ACP

Module –V (10 Hours)

Basic Concepts of Automation, principle, working and maintenance of various clinical chemistry analyzers, point of care testing, Hospital Laboratory Management

Module VI-Practical Clinical Enzymology (26 hours)

Credits : 2

1.To perform enzyme estimation of LFT

1. To perform enzyme estimation of Cardiac profile
2. Determination of Troponin I
3. To perform enzyme estimation of Pancreatic disorder
4. To perform estimation of ACP.
5. Antenatal profile
6. Estimation of bicarbonate
7. Arterial blood gas analysis
8. Determination of Calcium
9. Creatinine and urea clearance test

Suggested Readings:

2. D M Vasudevan, (2011), Text book of Medical Biochemistry, 6th edition Jaypee

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Publishers

3. M N Chatterjea & Rana Shinde,(2012),Text book of Medical Biochemistry,8th edition,Jaypee Publications
4. Singh & Sahni,(2008),Introductory Practical Biochemistry,2nd edition, Alpha science
5. Lehninger,(2013),Principles of Biochemistry,6th edition, W H Freeman
6. U Satyanarayan,(2008), Essentials of Biochemistry,2nd edition, Standard Publishers
7. Teitz,(2007),Fundamentals of Clinical Chemistry,6th edition,Elsevier Publications
8. Bishop(2013),Clinical Chemistry,7th edition, WileyPublications.

DSE 2-BIOCHEMISTRY& NUTRITION

Credits- 4L+2P

Course Objective: This course prepares the students with handling of instruments and sterilization techniques.Students shall be able to identify and differentiate bacteria and fungus in biological samples.

Sl	Course Outcome
1	Ability to understand the concept of solutions,PH and cell structure.
2	Able to understand the Metabolismo f Carbohydrate and related disorder.
3	Explain the properties of protein and vitamins.
4	Demonstrate the different metabolic activities .
5	Illustrate the different hormonal activities.
6	Apply the knowledge to perform test of different biochemical components.

THEORY- BML 504 (B)

CO	Blooms Level	Module	%age of questions
CO1	1,2,3	M1	20
CO2	1,2,3	M1,M2	20
CO3	1,2,3	M2,M3	20
CO4	2,3,4	M3,M4	20
CO5	2,3,4	M4,M5	20
			100

PRACTICAL- BML 594 (B)

CO	Blooms Level	Module	%age of questions
CO6	3,4,5	M6	100

Module 1 10 h

Concepts of PH and buffers, Acid-base equilibrium, osmotic pressure and its physiological applications.

Morphology, Structure and functions of cell, cell membrane, Nucleus, Chromatin, mitochondria,

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Module 2 10h

Metabolism of Carbohydrate, Lipid, Protein, Mineral: Glycolysis, TCA Cycle, Glycogenesis, Glycogenolysis, Gluconeogenesis, maintenance of Blood glucose, Inter conversion of different sugars. Metabolism of cholesterol, Ketone bodies, Athero- sclerosis and obesity

Module 3 10 h

proteins properties and reactions of proteins. Classification, Fat-soluble vitamins A, D, E, K Water soluble vitamins-B Complex and Vitamin C. Daily requirement physiological functions and disease of vitamin deficiency.

Module 4 (10 h)

Transmethylation, Demethylation, Fate of Ammonia Urea synthesis and synthesis of creatinine, inborn errors of metabolisms. Iron, Calcium, Phosphorous, Trace elements.

Module 5(10h)

General characteristics and Mechanism of Hormone actions, Insulin, Glucose, Thyroid and Para-Thyroid hormones. Cortical sex hormones. Stokes and Kirby-Bauer method.

Module 6 26 h

1. Identification of carbohydrates (Qualitative Tests)
2. Identification of proteins (Qualitative Tests)
3. Estimation of serum lipase
4. Estimation of serum amylase.
5. Creatinine clearance test.
6. Estimation of total protein in urine.
7. Estimation of glucose in urine by Benedict's methods
8. Urine analysis – normal & abnormal constituents of urine.
9. Blood glucose estimation.