

**Maulana Abul Kalam Azad University of Technology, West Bengal**  
(Formerly West Bengal University of Technology)  
**Syllabus for B. Sc. In Medical Lab Technology**  
(Effective for Academic Session 2018-2019)

**B.Sc. MLT- V Semester**

**Course/Paper: Immunohematology & Blood Banking**

**Paper Code: BML-501**

**Learning Objective:** The prime concern of this subject to learn about the concept of blood grouping, blood collection, infectious markers determination, compatibility testing and quality control involved in blood transfusion services.

**Unit-I**

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.

**Unit-II**

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

**Unit-III**

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

**Unit-IV**

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.

**Unit-V**

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, DGHS and blood transfusion services.

**Learning Outcome:** Students would understand the basics of transfusion medicine, laboratory testing, quality control and apheresis techniques.

**Suggested Readings:**

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

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**Course/Paper: Clinical Enzymology & Automation**  
**Paper Code: BML-502**

**Learning Objective:** This course has been formulated to impart comprehensive knowledge of enzymes and automation in Clinical Laboratory.

**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

**Unit-II**

Coenzyme: Classification, various types and function, structure of NAD<sup>+</sup>, NADP<sup>+</sup>, 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

**Unit-III**

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

**Unit-IV**

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

**Unit-V**

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

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

**Suggested Readings:**

1. D M Vasudevan, (2011), Text book of Medical Biochemistry, 6<sup>th</sup> edition Jaypee Publishers
2. M N Chatterjea & Rana Shinde, (2012), Text book of Medical Biochemistry, 8<sup>th</sup> edition, Jaypee Publications
3. Singh & Sahni, (2008), Introductory Practical Biochemistry, 2<sup>nd</sup> edition, Alpha science
4. Lehninger, (2013), Principles of Biochemistry, 6<sup>th</sup> edition, W H Freeman
5. U Satyanarayan, (2008), Essentials of Biochemistry, 2<sup>nd</sup> edition, Standard Publishers
6. Teitz, (2007), Fundamentals of Clinical Chemistry, 6<sup>th</sup> edition, Elsevier Publications
7. Bishop (2013), Clinical Chemistry, 7<sup>th</sup> edition, Wiley Publications

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**Course/Paper: Parasitology & Virology**  
**Paper Code: BML-503**

**Learning Objective:** This paper aims to learn about introduction, general characteristics, life cycle and laboratory diagnosis of various medically important parasites.

**Unit-I**

Introduction of parasites, host, zoonosis, host parasites relationship, sources of infection, mode of infection, pathogenesis, immunity in parasitic infection, lab diagnosis

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

Helminthology: Introduction and classification, Taenia solium, Taenia Saginata, Fasciola, Ascaris, Wuchereria bancrofti their morphology, life cycle, pathogenesis, clinical features and lab diagnosis.

Hookworm, Trichuris. Dracunculus their morphology, life cycle, pathogenesis, clinical features and lab diagnosis.

**Unit-II**

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

**Unit III**

Nature and Properties of Viruses

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

Isolation, purification and cultivation of viruses

Viral taxonomy: Classification and nomenclature 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

**Unit- IV**

Poxviruses, Herpesviruses, hepatitis viruses, retroviruses-HIV, Picorna viruses, 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

**Unit V**

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

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**Learning Outcome:** Students would be able to identify various viruses with latest biomedical techniques and can demonstrate the diseases associated with them.

***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. 4<sup>th</sup> 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

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**Course/Paper: Diagnostic Cytology**  
**Paper Code: BML-504**

**Learning Objective:** 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.

**Unit-I**

Cell: basic structure and function, cell organelles, cell cycle, Benign and Malignant tumors, Instruments used in cytology, preparation of buffers, stains  
Microscopy: Light, compound, phase contrast, fluorescence

**Unit- II**

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, Diff-quick, MGG, H&E, Shorr staining, significance of PAP-HPV, Destaining and restaining of slides, Cover slipping

**Unit-III**

Aspiration and exfoliative cytology, Patient preparation, Sample collection, Fixation, Processing and Staining FNAC, collection, processing of sample and staining, on site quick staining procedure

**Unit-IV**

Pap staining, Progressive & Regressive, Hormonal cytology in different age groups, Collection and processing of sputum, BAL, CSF, Pleural, peritoneal and pericardial fluid, Gynaecologic sample

**Unit-V**

Sex chromatin demonstration, Introduction of Immunocytochemistry, different markers and its applications, Automation in cytology, Liquid based preparation & automated screening device

Learning Outcome: Students would be able to perform collection, processing, staining and quality control in cytological diagnosis.

***Suggested Readings:***

1. Bibbo, (1997), Comprehensive Cytopathology, 2<sup>nd</sup> edition, Saunders Publishers
2. Koss's Diagnostic Cytology, Vol.1 & 2, (2006), 5<sup>th</sup> edition, Lippincott

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**Course/Paper: Principles of Laboratory Management & Medical Ethics**  
**Paper Code: BML-505**

**Learning Outcome:** The students will be made aware of the basic ethics, good lab practices including awareness/ safety in a clinical lab.

**Unit-I**

Ethical Principles and standards for a clinical laboratory professional duty to the patient, duty to colleagues and other professionals, Good Laboratory Practice (GLP), Introduction to Basics of GLP and Accreditation, Aims of GLP and Accreditation, Advantages of Accreditation, Brief knowledge about National and International Agencies for clinical laboratory accreditation

**Unit-II**

Awareness/Safety in a clinical laboratory, General safety precautions.  
HIV: pre- and post-exposure guidelines, Hepatitis B & C: pre- and post-exposure guidelines, Drug Resistant Tuberculosis  
Patient management for clinical samples collection, transportation and preservation, Sample accountability, Purpose of accountability, Methods of accountability

**Unit-III**

Sample analysis: Introduction, factors affecting sample analysis, reporting results, basic format of a test report, reported reference range, clinical alerts, abnormal results, results from referral laboratories, release of examination results, alteration in reports

**Unit-IV**

Quality Management system: Introduction, Quality assurance, Quality control system, Internal and External quality control, quality control chart  
Biomedical  
Introduction and importance of calibration and Validation of Clinical Laboratory instrument  
Ethics in Medical laboratory Practice, Ethics in relation to Pre-Examination procedures, Examination procedures, reporting of results, preserving medical records  
Procurement of equipment and Inventory Control,

**Unit-V**

Audit in a Medical Laboratory, Introduction and Importance, NABL & CAP, Responsibility, Planning, Horizontal, Vertical and Test audit, Frequency of audit, Documentation

**Learning Outcome:** 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.

**Suggested readings:**

1. Teitz,(2007),Fundamentals of Clinical Chemistry,6<sup>th</sup> edition, Elsevier Publications
2. Bishop(2013),Clinical Chemistry,7<sup>th</sup> edition, Wiley Publications
3. Henry's Clinical Diagnosis and Management by Laboratory Methods,(2011),22<sup>nd</sup> edition, Elsevier

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**Practical Syllabus**

**BML-591 (Clinical Enzymology)**

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
10. Creatinine and urea clearance test

**BML- 592 (Practical Parasitology & Virology)**

1. Leishman staining for malarial parasites
2. Demonstration of permanent slide of Trichuris, Ascaris and Hookworm
3. Saline wet mount for observing ova and eggs of parasites.
4. Iodine wet mount for observing ova and eggs of parasites.
5. Concentration of stool samples by floatation method
6. Zinc sulphate conc. Method for stool sample
7. Demonstration of various parasites by permanent slides.
8. Concentration of stool sample by sedimentation method
9. Serological diagnosis of Leishmania
10. Aldehyde Chopra test for Kala Azar
11. To perform HBsAg/ Australia Ag by rapid method
12. To perform HBsAg by ELISA
13. To perform HIV Tridot method.
14. To perform HIV by ELISA
15. To perform Dengue IgG/IgM
16. To perform TORCH profile
17. Demonstration of PCR HBV
18. Demonstration of PCR HIV Viral load

**BML-593 (Practical Diagnostic Cytology)**

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