

**MAULANA ABUL KALAM AZAD UNIVERSITY OF TECHNOLOGY, WB**  
**Syllabus of B. Sc. In Medical Lab Technology**  
**(Effective for 2020-2021 Admission Session)**  
**Choice Based Credit System**  
**140 Credit (3-Year UG) MAKAUT Framework**  
**w.e.f 2020-21**

**3<sup>rd</sup> Semester**

Subject Type	Course Name	Course Code	Credit Distribution			Credit Points	Mode of Delivery			Proposed Moocs
			Theory	Practical	Tutorial		Offline #	Online	Blended	
CC 5	Pathology	BML(T) 301	4	0	0	6	✓			As per MAKAUT Notification
		BML 391	0	2	0					
CC 6	Haematology-I	BML(T) 302	4	0	0	6	✓			
		BML 392	0	2	0					
CC 7	Biochemistry	BML(T) 303	4	0	0	6				
		BML 393	0	2	0					
GE 3	Students will have to select from the GE Basket					6			✓	
SEC 1	Lab Management and Medical Ethics	BML 354	1	0	1	2	✓			
<b>Semester Credits</b>						<b>26</b>				

**# Only in case offline classes are not possible due to reasons like COVID Pandemic the classes will be in synchronous online mode**

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**BML 301: Pathology**

**Credits- 4L+2P**

**Course Objective:** This curriculum will provide an introductory nature and build the concepts of how human system work in altered and diseased stage under the influence of various internal and external stimuli.

Sl	Course Outcome
1	Tell the basic knowledge about the history and terminology of pathology.
2	Demonstrate the knowledge of inflammation, hypertension and other pathological condition.
3	Explain the different metabolic disorder like diabetes, protein energy malnutrition and others.
4	Infer the pathological condition of different infectious diseases.
5	Illustrate the knowledge about the cancer and related topics.
6	Apply the skill to draw the blood sample and able to perform few basic tests related to pathology.

**THEORY- BML(T) 301**

CO	Blooms Level	Module	%age of questions
CO1	1,2	M1	20
CO2	1,2	M2	24
CO3	1,2	M3	20
CO4	1,2	M4	18
CO5	1,2	M5	18
			100

**PRACTICAL- BML 391**

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

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**Module 1- 10h**

Introduction & history of pathology, Basic definitions and familiarization with the common terms used in pathology, causes and mechanisms of cell injury, reversible and irreversible injury, Introduction of hyperplasia, hypoplasia, hypertrophy, atrophy, metaplasia, necrosis and apoptosis.

**Module 2- 10h**

General features of acute and chronic inflammation, Vascular changes, cellular events, Cells and mediators of inflammation, Phagocytosis and its mechanism. Tissue Renewal and Repair, healing and fibrosis, cirrhosis, introduction of oedema, hyperaemia, congestion, haemorrhage, haemostasis, thrombosis, embolism, infarction, shock and hypertension.

**Module 3- 10h**

Protein energy malnutrition, deficiency diseases of vitamins, Role and effect of metals (Sodium, potassium, zinc, iron and calcium) and their deficiency diseases, nutritional excess and imbalances. Aetiology and pathophysiology of diabetes, arteriosclerosis, myocardial infarction, respiratory diseases (COPD), Parkinson disease.

**Module 4- 10h**

Infectious Diseases: pathogenesis & overview of modes of infections, prevention and control with suitable examples like Dengue. Routine examination of CSF, semen, sputum and stool.

**Module 5- 10h**

Cancer: Definitions, nomenclature, characteristics of benign and malignant neoplasm, metastasis, Carcinogens and cancer, concept of oncogenes, tumour suppressor genes, DNA repair genes and cancers stem cells.

**Module 6- Practical: 26 h**

1. Blood collection procedure.
2. Determination of haemoglobin by various methods.
3. Blood smear preparation.
4. Leishman Staining.
5. Total count of WBC.
6. Differential count WBC.
7. Determination of Total RBC count.
8. Determination of platelet count.

**Suggested Readings**

Harshmohan (2017), Textbook of Pathology, 7th edition, Jaypee Publications  
Robbins, (2012), Text book of Pathology, 3rd edition, Elsevier Publications

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**BML 302: Haematology –I**

**Credits- 4L+2P**

**Course Objective:** Students will learn the differential diagnosis and appropriate diagnostic evaluation of common hematologic abnormalities.

Sl	Course Outcome
1	Demonstrate knowledge about the structure of haemoglobin and other blood cells and functions.
2	Explain the morphology of RBC and their abnormalities.
3	Relate the knowledge about leucopoiesis and the ESR.
4	Explain the definition, types and lab investigations of anaemia.
5	Illustrate the knowledge about haemostatic mechanism and coagulation.
6	Make use of the skill to perform the test for different haematological investigations.

**THEORY- BML (T) 302**

CO	Blooms Level	Module	%age of questions
CO1	1,2	M1	26
CO2	1,2	M2	18
CO3	1,2	M3	15
CO4	1,2	M4	20
CO5	1,2	M5	21
			100

**PRACTICAL- BML 392**

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

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**Module I- 10h**

Haemoglobin: Structure, function, types, normal and abnormal haemoglobins. Estimation of haemoglobin by various methods with advantages and disadvantages. Hemocytometry: visual and electronic method, Neubauer counting chamber, RBC count, WBC count, Platelets count, absolute eosinophil count. Principle, procedure, calculation, significance, precautions involved during counting. Absolute count of various WBCs. Estimation of  $G-6-PD$ .

**Module 2- 10h**

RBCs: formation, morphology, cytoskeleton, anisocytosis, poikilocytosis, metabolism, role of 2, 3- DPG and oxygen dissociation curve. Packed cell volume, red cell indices (MCV, MCH, MCHC), physiological and pathological variations in value, reticulocyte count.

**Module 3- 10h**

ESR: physiological and pathological changes in values Erythrocyte sedimentation rate, manual and automated method, factor-affecting ESR.

Extravascular and intravascular haemolysis.

Leukopoiesis: Stages of Leukocyte Maturation, Features of Cell Identification

**Module 4- 10h**

Anaemia and its classification: Morphological and etiological, pathogenesis, laboratory investigations. Iron deficiency anaemia: pathogenesis, laboratory investigations. Megaloblastic anaemia, pernicious anaemia and Haemolytic anaemia: pathogenesis, laboratory investigations.

**Module 5- 10h**

Overview of haemostasis and coagulation, Stages of platelets development, Primary and Secondary haemostasis, Role of platelets, coagulation inhibitory system, Fibrinolysis. Complete blood count, determination by automated method and significance of each parameter, Reticulocyte count Mechanism of coagulation, coagulation factors, Bleeding time, clotting time, platelet count, protamine sulphate test, clot retraction test.

**Module 6: Practical 26h**

1. Determination of Total RBC count.
2. Determination of PCV

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3. Determination of red cell indices
4. Demonstration of hypochromic microcytic slide.
5. Determination of bleeding time and clotting time.
6. General blood picture
7. Determination of G-6-PD
8. Differential Leucocyte Count.
9. Total leucocyte count
10. Demonstration of toxic granulation of neutrophil
11. Estimation of ESR.
12. To perform reticulocyte count

**Text Books:**

1. Sood Ramnik,(2015), Text book of Medical Laboratory Technology,2nd edition, Jaypee Publications.
2. Mukherjee K. L. (2017), Medical Laboratory Technology, Vol.1-3,3rd edition, Tata Mcgraw Hill

**Suggested Readings:**

1. Wintrobe's Clinical Haematology, (2014), 13th edition, Lippincott Williams & Wilkins
2. De Gruchy's Clinical Haematology in Medical Practice, (2012),Sixth edition, Wiley Publications
3. Dacie & Lewis Practical Haematology, (2011), 11th edition, Elsevier Publications

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**BML 303: Biochemistry**

**Credits- 4L+2P**

**Course Objective:** The syllabus of biochemistry introduces the students about the basic knowledge and functions different biomolecules like carbohydrates, amino acids, proteins, enzymes, lipids, nucleic acids, vitamins and minerals. Students will know the basics of reagent preparation, instruments handling and can perform common analytical test.

Sl	Course Outcome
1	Demonstrate about different types carbohydrates, which we are taking as meal for generation of energy by metabolic pathways and understand the disease related to carbohydrates.
2	Illustrate the structure, properties and significance of amino acids and proteins, and the catalytic activity of enzymes.
3	Explain the lipid with its function and related disease.
4	Understand about the nucleic acids present in human body.
5	Demonstrate about functions of the vitamin, minerals and its deficiency disease.
6	Apply the knowledge and skill in diagnostic laboratory to perform biochemical test.

**THEORY- BML (T) 303**

CO	Blooms Level	Module	%age of questions
CO1	1,2	M1	20
CO2	1,2	M2	30
CO3	1,2	M3	15
CO4	1,2	M4	15
CO5	1,2	M5	20
			100

**PRACTICAL- BML 393**

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

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**Module 1- Carbohydrates: 10h**

Classification, biomedical importance & properties.

Brief outline of metabolism: Glycogenesis, Glycogenolysis, Gluconeogenesis, Glycolysis, Citric acid cycle, HMP shunt, Regulation of blood glucose concentration, Diabetes Mellitus, Glycosuria, Glucose Tolerance Test.

**Module 2- Amino acids, Proteins and enzymes: 17h**

Amino acid: Amino acid-definition, classification, function, properties.

Protein and metabolic pathways: Protein-definition, classification and function. Primary, secondary, tertiary, quaternary structures of protein, Non-protein nitrogen, Nitrogen balance, Transamination and deamination, Uric acid formation, Urea cycle.

Enzymes: Definition, Cofactor & Coenzymes, Concept of active sites and general mode of action of enzymes, factor affecting enzyme activity, units of enzyme.

**Module 3- Lipids: 9h**

Classification of lipids, Biomedical importance, Classification of fatty acids, Essential fatty acids, Ketone body formation, Fatty liver, Ketosis, Cholesterol & its clinical significance, Lipoproteins in the blood composition & their functions in brief.

**Module 4-Nucleic acids: 6h**

Nitrogen bases, Nucleosides, Nucleotides, Structure, function and types of DNA and RNA, Role of Nucleic acid.

**Module 5- Vitamins and Minerals: 8h**

Vitamins: classification, function and disease associated with vitamins.

Minerals: Requirement, function and biological importance of Calcium, Iron, Iodine, Zinc, Phosphorus, Copper, Sodium and Potassium.

**Module 6- Practical: 26h**

1. Demonstration of glass and plastic apparatus and equipment (Colorimeter, spectrophotometer, Water distillation plant, pH meter) used in the Biochemistry Lab.
2. Handling and cleaning of the apparatus and equipment.
3. Preparation of different percentage, normal, molar solutions.
4. Preparation of solution by dilution.
5. Preparation of different buffers used in pathological laboratory and determine their PH.
6. Determination of glucose in a sample by both qualitatively (Benedict's method) and quantitatively.



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7. Determine of total protein and albumin (quantitative estimation)
8. Determination of Ketone bodies, Bile salt, Bile pigments and urobilinogen in given sample.
9. Determination of cholesterol and triglyceride.
10. Determination of urea in blood.
11. Determination of creatinine in blood.
12. Determination of uric acid.

**Text Books:**

1. M Adhya & B Singha, (2018), Biochemistry (General and Ocular).
2. D M Vasudevan, (2011), Textbook of Medical Biochemistry, 6th edition Jaypee Publishers.
3. M N Chatterjea & Rana Shinde, (2012), Textbook of Medical Biochemistry, 8th edition, Jaypee Publishers.
4. D M Vasudevan & S K Das, Practical text Book of Biochemistry for medical Students, second edition, Jaypee Brothers Medical Publishers (P) Ltd
5. G Hegyi, J Kardos, M Kovács, A M Csizmadia, L Nyitray, G Pal, L Radnai, A Remenyi & I Venekei, (2013), National Development Agency.

**Suggested Readings:**

1. R K Murray, D K Granner, P A Mayes, V W Rodwell, 31<sup>st</sup> edition, Harper's Illustrated Biochemistry, MC Graw Hill Education (LANGE).
2. Nelson & Cox, 4th Edition, Lehninger principles of Biochemistry
3. J Berg J Tymoczko & L Stryer, 7<sup>th</sup> Edition, Biochemistry, W. H. Freeman and Company, New York
4. Voet & Voet, 4<sup>th</sup> edition, Biochemistry, John Wiley & Sons, Inc.

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**BML 354: Lab management and Medical Ethics**

**Credits- 1L +1T**

**Course Objective:** 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.

Sl	Course Outcome
1	Develop the knowledge about the basic laboratory ethics and laboratory accreditation procedure.
2	Apply the knowledge about the biomedical safety measure in laboratory practice.
3	Build the laboratory data collection and reporting system.
4	Utilize the quality control system in the diagnostic laboratory.
5	Develop the audit procedure related to laboratory accreditation and documentation.

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

**Credits: 2**

**Module I: 5h**

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.

**Module 2: 5h**

Awareness/Safety in a clinical laboratory, General safety precautions. HIV: pre- and post-exposure guidelines, Hepatitis B & C: pre- and post-exposure guidelines.

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**Module 3:** 5h

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

**Module 4:** 6h

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. Examination procedures, reporting of results, preserving medical records Procurement of equipment and Inventory Control.

**Module 5:** 5h

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

**Text Books:**

Henry's Clinical Diagnosis and Management by Laboratory Methods, (2011), 22<sup>nd</sup> edition, Elsevier

**Suggested Readings:**

1. Teitz, (2007), Fundamentals of Clinical Chemistry, 6th edition, Elsevier Publications
2. Bishop (2013), Clinical Chemistry, 7th edition, Wiley Publications