

**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**

**4th Semester**

Subject Type	Course Name	Course Code	Credit Distribution			Credit Points	Mode of Delivery			Proposed Moocs
			Theory	Practical	Tutorial		Offline #	Online	Blended	
CC 8	Microbiology	BML(T) 401	4	0	0	6	✓			As per MAKAUT Notification
		BML 491	0	2	0					
CC 9	Haematology- II	BML(T) 402	4	0	0	6	✓			
		BML 492	0	2	0					
CC 10	Immunology	BML(T) 403	4	0	0	6				
		BML 493	0	2	0					
GE 4	Students will have to select from the GE Basket					6			✓	
SEC 2	Histotechnique	BML 455	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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**CC8: Microbiology**

**Code- BML 401**

**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	Build the basic knowledge of microbiology.
2	Define the different equipment used in microbiology Lab.
3	Understand the mode of infection and safety measure taken in microbiology laboratory.
4	Explain the terminology used in host pathogen interaction.
5	Demonstrate the activities conducted in diagnostic microbiology.
6	Remember the character of different microorganism.
7	Utilize the knowledge and skill in diagnostic laboratory to perform different tests related to haematology.

**THEORY- BML (T) 401**

CO	Blooms Level	Module	%age of questions
CO1	1,2	M1	18
CO2	1,2	M2	15
CO3	1,2	M3	15
CO4	1,2	M4	12
CO5	1,2	M5	18
CO6	1,2	M6	22
			<b>100</b>

**PRACTICAL- BML 491**

CO	Blooms Level	Module	%age of questions
CO7	2,3	M7	100

**Module 1 9 h**

Contributions of Anton von Leeuwenhoek, Louis Pasteur, Robert Koch, Joseph Lister, Alexander Fleming, Edward Jenner. Introduction to bacterial taxonomy, Classification of Bacteria based on size, shape, arrangement, motility, flagella, spores, capsules, composition and detailed structure of Gram-positive and Gram-negative cell walls, plasma membrane, pili.

**Module 2 7h**

Basic knowledge of different types of microscope. Principle, working and use of Laminar air flow, biosafety cabinet, Centrifuge, Autoclave, hot air Oven, Incubator, Muffle Furnace, Mac-intos Field-jar etc.

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**Module 3    8 h** General safety measures used in Microbiology laboratory, Sterilization and disinfection: Various physical methods of sterilization – heat, UV radiation, ionizing radiation, filtration. Antiseptics & Disinfectants: Definition, types and properties, mode of action and use, Occurrence of lab infections, route of infections in laboratory.

**Module 4    5 h**

Host pathogen interaction: Definitions - Infection, Invasion, Pathogen, Pathogenicity, Virulence, Toxigenicity, Carriers and their types, Opportunistic infections, Nosocomial infections. Transmission of infection.

**Module 5            9h**

Specimen collection from patients, Culture medium used in microbiology, Preparation and standardization of inoculums, Antibiotic susceptibility testing in bacteriology, choice of antibiotics MIC and MBC: Concepts and methods for determination various methods of Antibiotic susceptibility testing with special reference to Stokes and Kirby-Bauer method.

**Module 6            12 h**

Description, morphology, cultural characteristics, pathogenicity, clinical features and lab diagnosis of Staphylococcus, Streptococcus, Pneumococcus, Neisseria, Mycobacterium, Clostridia, Escherichia coli, Salmonella, Shigella, Proteus, Vibrio, Pseudomonas, Spirocheates, Yersenia.

Introduction of Mycology: Definition, general properties and classification Cutaneous mycoses, Systemic mycoses, Opportunistic mycoses. Culture and laboratory test for fungus.

**Module 7- Practical: 26 h**

1. Demonstration of Microscope and its parts.
2. Demonstration of glassware used in microbiology.
3. Demonstration of autoclave and sterilization of glass wares and of media
4. Demonstration of Hot air oven and sterilization of glass wares.
5. Demonstration of Laminar airflow, biosafety cabinet and media preparation
6. Demonstration of Centrifuge.
7. Demonstration of Incubator and preservation of cultures.
8. Preparation of media.
9. Preparation of culture plates
10. To perform Gram staining.
11. To perform Indian ink staining.
12. To perform Acid fast staining (Zeihl Neelsen staining).
13. To perform Hanging drop method
14. Antibiotic sensitivity test.
15. Examination of urine.
16. Examination of sputum

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**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.

**CC 9: Haematology II**

**Code- BML 402**

**Credits- 4L+2P**

**Course Objective:** Students will be able to perform the differential diagnosis and appropriate diagnostic evaluation of common hematologic abnormalities.

Sl	Course Outcome
1	Understand the basic principle related to coagulation study and general blood picture.
2	Explain the pathogenesis, clinical features and lab investigations of aplastic and sideroblastic anaemia.
3	Demonstrate the pathogenesis, clinical features and lab investigations of sickle cell anaemia and thalassemia.
4	Built knowledge about the aetiology, classification, clinical features and laboratory investigations of Leukemia.
5	Able to illustrate the disorder related to blood coagulation, special attention to coagulation factor deficiency.
6	Apply the knowledge and skill in diagnostic laboratory to perform different tests related to haematology.

**THEORY- BML (T) 402**

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

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**PRACTICAL- BML 492**

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

**Module 1** 10 h

General blood picture estimation of iron, TIBC, Transferrin, Ferritin, Plasma haemoglobin, Vit.B12, Folic acid, Heinz bodies, Platelet count, Platelet aggregation test, PT, INR, APTT, Thrombin time. Role of coagulation factors.

**Module 2** 9 h

Aplastic anaemia, Anaemia of chronic disorders, Sideroblastic anaemia: aetiology, pathogenesis, clinical features, laboratory investigations. Bone marrow examination, composition & functions, aspiration techniques, processing and staining.

**Module 3** 10h

Sickle cell anaemia, sickle cell trait, aetiology, pathogenesis, clinical features, and laboratory investigations, Sickling test, Thalassaemia, classification, aetiology, pathogenesis, clinical features, laboratory Investigations.

**Module 4** 10 h

Leukemia and its classification, WHO and FAB classification, AML, ALL, CML, CLL, its aetiology, clinical features, laboratory investigations. Cytochemistry involved in diagnosis of various types of leukemia.

**Module 5** 11 h

Qualitative and quantitative disorders of platelets, disorders of secondary hemostasis, hemophilia and its lab diagnosis, Von- Willebrand disease, Disseminated intravascular coagulation, thrombosis, Disorder of fibrinogen, test for bleeding & coagulation disorders, correction studies for factor deficiency, quantitative factor assay, LE cells, its demonstration and significance.

**Module 6- Practical:** 26h

1. To perform sickling test.
2. To perform Heinz bodies.
3. To perform LAP scoring.
4. To determine total platelet count.
5. To perform PT.
6. To perform APTT.
7. To perform thrombin time.
8. To perform D-dimer test.
9. To determine fibrinogen conc.
10. Haemoglobin electrophoresis.

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**CC 10: Immunology**

**Code- BML 403**

**Credits- 4L+2P**

**Course Objective:** Prepare the students with the basic knowledge of immune system, its functions and its related disease. Students will able to carry out differential diagnosis of immune disease by the help of serological techniques.

Sl	Course Outcome
1	Illustrate the basic concept of immune cells, immune organs, antigens, haptens and immunogens.
2	Demonstrate different types of antibody and its structures and immune response.
3	Explain about the histocompatibility complex and its role in transplantation immunology.
4	Acquire knowledge on immunological disorder and its related diseases.
5	Understand about the immunization and its functions to protect from immune disease.
6	Apply the knowledge and skill in diagnostic laboratory to perform serological tests.

**THEORY- BML (T) 403**

CO	Blooms Level	Module	%age of questions
CO1	1,2	M1	17
CO2	1,2	M2	20
CO3	1,2	M3	21
CO4	1,2	M4	30
CO5	1,2	M5	12
			<b>100</b>

**PRACTICAL- BML 493**

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

**Module 1- 8h**

Historical background, general concepts of the immune system, innate and adaptive immunity, Cell and organs of immune system, Phagocytosis. Antigens, Immunogen, haptens: Properties, foreignness, molecular size, heterogeneity, B and T cell epitopes, T dependent and T independent antigens.

**Module 2- 11h**

Antibodies: Historical perspective of antibody structure; structure, function and properties of the antibodies; different classes, subclasses and biological activities of antibodies; isotype, allotype, monoclonal antibodies and polyclonal antibody, active and passive immunity; primary and secondary immune response.

Laboratory tests for demonstration of antigen – antibody reaction such as agglutination, precipitation.

**Module 3- 11 h**

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Introduction of Major Histocompatibility Complex, organization of MHC and inheritance in humans; Antigen presenting cells, antigen processing and presentation. Mechanism of humoral and cell mediated immune response.

Introduction of transplant immunology, graft rejection, tissue typing for transplant, Laboratory test for transplant.

**Module 4- 14h**

Hypersensitivity and its types Introduction to Allergy and its laboratory test.

Autoimmune disorders, pathogenesis, organ specific and systemic autoimmune disorders and its markers such parietal cell antibody, anti sperm antibody, lupus anticoagulants, HLA-B27, anti CCP

Immunological disorders: primary and secondary immunodeficiency, SCID, AIDS, Tumour, types of tumours, Various Tumour Markers, their significance and method of estimation.

**Module 5- 6h**

Vaccines, classification and applications, Active and passive immunization, Immunoprophylaxis schedule in neonates, children and in pregnancy.

**Module 6- Practical: 26h**

1. To demonstrate agglutination reaction.
2. To perform RA test.
3. To perform WIDAL test.
4. To perform CRP test.
5. To perform HIV Tridot test.
6. To perform HBsAg rapid test.
7. To perform ASO test.
8. To perform TB IgG & IgM test.
9. To perform Dengue IgG & IgM test.
10. To perform RPR test.
11. Montoux test

**Suggesting Readings**

1. Abbas AK, Lichtman AH, Pillai S. (2007). Cellular and Molecular Immunology. 6th edition Saunders Publication, Philadelphia.
2. Delves P, Martin S, Burton D, Roitt IM. (2006). Roitt's Essential Immunology. 11th edition Wiley- Blackwell Scientific Publication, Oxford.
3. Goldsby RA, Kindt TJ, Osborne BA. (2007). Kuby's Immunology. 6<sup>th</sup> edition W.H. Freeman and Company, New York.
4. Murphy K, Travers P, Walport M. (2008). Janeway's Immunobiology. 7<sup>th</sup> edition Garland Science Publishers, New York.
5. Peakman M, and Vergani D. (2009). Basic and Clinical Immunology. 2nd edition Churchill Livingstone Publishers, Edinberg.
6. Richard C and Geiffrey S. (2009). Immunology. 6th edition. Wiley Blackwell Publication.

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**SEC 2: Histotechnique**

**Code- BML 455**

**Credits- 1L+1T**

**Course Objective:** Students would be able to carry out tissue processing and general staining.

Sl	Course Outcome
1	Understand the basic knowledge of histotechnique.
2	Demonstrate the tissue processing and microtome and its use
3	Able to explain the process of frozen tissue section in emergency and routine tissue staining.

CO	Blooms Level	Module	%age of questions
CO1	1,2	M1	24
CO2	1,2	M2	38
CO3	1,2	M3	38
			<b>100</b>

**Module 1: 8h**

Introduction of histopathology, cytology & histotechniques, care & maintenance of equipments used in histotechnology lab, safety measures in histotechnology lab. Recording, Labelling and transportation of tissue specimens, Basic concepts of fixation and various types of fixative used in histopathology and cytopathology.

**Module 2: 10 h**

Tissue and its types, Location and function, Grossing of tissues, sections, smears, tissue processing and its steps, manual and automated method. Decalcification, decalcification methods, types of decalcifying fluid, Processing of bones and teeth, Embedding media, its type and properties. Microtome, its type, Microtome knives, its type and knife sharpening, Section cutting, fault and remedies.

**Module 3: 10 h**

Cryostat, frozen sections of fresh, fixed and unfixed tissue, freeze drying, rapid frozen sections and staining for emergency diagnosis Dye chemistry, Stains and dyes, natural dye, acidic dye, basic dye, neutral dyes, fluorescence dye, mordant. Supravital staining, types of hematoxylin, Haematoxylin and eosin staining, counter staining, mounting and mounting media, advantages & disadvantages.

**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