MAULANA ABUL KALAM AZAD UNIVERSITY OF TECHNOLOGY, WB

Syllabus of BSc in Medical Laboratory Technology
(Effective from Admission Session 2018-2019)

COURSE STRUCTURE

1ST YEAR

SEMESTER I

Sl.	Course Code	Subject	Period			Credit
			L	T	P	
1	BML - 101	Human Anatomy-I	3	-	-	3
2	BML - 102	Human Physiology-I	3	-	-	3
3	BML - 103	Biochemistry-I	3	-	-	3
4	BML – 104 (MPH 104)	Health Education & Health Communication	3	-	-	3
5	BML- 191 (BCA 191)	PC Software Lab		-	2	2
6	BML - 192	Practical: Human Anatomy-I	-	-	2	2
7	BML - 193	Practical: Human Physiology-I	-	-	2	2
8	BML - 194	Practical: Biochemistry-I	-	-	2	2
		Total				20

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SEMESTER II

Sl.	Course Code	Subject	Period			Credit
			L	T	P	
1	BML -201	Human Anatomy-II	3	-	-	3
2	BML -202	Human Physiology-II	3	-	-	3
3	BML- 203	Biochemistry-II	3	-	-	3
4	BML-204 (MHA-204)	Bio Medical Waste Management	3	1		3
5	BML -291	Human Anatomy-II	-		2	2
6	BML -292	Human Physiology-II	-		2	2
7	BML -293	Biochemistry-II	-		2	2
8	BML -294	Communication Lab	-		2	2
		Total				20

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SEMESTER III

Sl.	Course Code	Subject	Period			Credit
			L	T	P	
1	BML- 301	Pathology-I	3	-	-	3
2	BML- 302	Clinical Haematology-I	3	-	-	3
3	BML- 303	Microbiology-I	3	-	-	3
4	BML - 304	Immunology & Serology-I	2	1	-	2
5	BML- 305	Histopathology & Histotechniques -I	3	-	-	3
6	BML- 391	Clinical Haematology-I	-	-	-	2
7	BML- 392	Microbiology, Immunology & Serology - I	-	-	-	2
8	BML - 393	Histopathology & Histotechniques -I	-	-	-	2
		Total				20

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SEMESTER IV

Sl.	Course Code	Subject	Period			Credit
			L	T	P	
1	BML-401	Pathology - II	3	-	-	3
2	BML- 402	Clinical Haematology-II	3	-	-	3
3	BML- 403	Microbiology-II	3	-	-	3
4	BML- 404	Immunology & Serology-II	2	1	-	2
5	BML - 405	Histopathology & Histotechniques -II	3	-	-	3
6	BML - 491	Clinical Haematology-II	-		2	2
7	BML- 492	Microbiology,Immunology & Serology – II	-		2	2
8	BML- 494	Histopathology & Histotechniques -II	-		2	2
		Total				20

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SEMESTER V

Sl.	Course Code	Subject	Period			Credit
			L	T	P	
1	BML - 501	Immunohematology & Blood Banking	2	1	-	2
2	BML - 502	Clinical Enzymology & Automation	3	-	-	3
3	BML - 503	Parasitology & Virology	3	-	-	3
4	BML- 504	Diagnostic Cytology	3	-	-	3
5	BML – 505	Principles of Lab Management & Medical Ethics	3	-	-	3
6	BML- 591	Clinical Enzymology	-	-	2	2
7	BML- 592	Parasitology & Virology	-	-	2	2
8	BML- 593	Diagnostic Cytology	-	-	2	2
		Total				20

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SEMESTER VI

Sl.	Course Code	Subject	Period			Credit
			L	T	P	
1	BML- 601	Clinical Endocrinology & Toxicology	3	-	-	3
2	BML- 602	Advanced Diagnostic Techniques	2	1	-	2
3	BML- 603	Diagnostic Molecular Biology	3	-	-	3
4	BML- 691	Clinical Endocrinology & Toxicology	-		2	2
5	BML- 692	Advanced Diagnostic Techniques	-		2	2
6	BML- 693	Diagnostic Molecular Biology	-		2	2
7	BML - 686	Internship Project	-	-	-	6
		Total				20

Semester I

Paper: Human Anatomy-I
Code : BML-101
Contacts Hours / Week : 3L
Credits : 3
Course Contents

Unit -1 Terminology and General Plan of the Body, Body Parts and Areas, Terms of Location and Position, Body Cavities and Their Membranes, Dorsal cavity, Ventral cavity, Planes and Sections
Unit –II Cells: Structure, function and location, Prokaryotic and eukaryotic cells, Cell organelles, Cell division \Tissue, Types, Structure, Location and Function of Epithelial Tissue, Connective Tissue, Muscle Tissue, Nerve Tissue, Membranes, Glandular tissue. The Integumentary System: structure and function of The Skin, Subcutaneous Tissue
Unit-III Musculoskeletal System: Basic anatomy of important muscles and bones
Unit-IV Respiratory system: Basic anatomy of nose, larynx, trachea, bronchi and lungs
Unit – V Digestive system: basic anatomy of oesophagus, stomach, small intestine, large intestine, liver, gall bladder, pancreas

Learning Outcome:Students will develop a vocabulary of appropriate terminology to effectively communicate information related to anatomy and recognize the anatomical structures included in syllabus.

Suggested Readings:

1. Ross & Wilson,(2014),Anatomy & Physiology in health & illness,11th edition, Elsevier Publications
2. Chaurasia B D, (2016), Human Anatomy, 7th edition, CBS publishers
3. Gerard J. Tortora and Bryan H.Derrickson,(Principles of Anatomy and Physiology,14th edition,Wiley Publications

Paper: Human Physiology-I
Code: BML-102
Contacts Hours / Week : 3L
Credits : 3

Course Contents

Unit-I Cell physiology: Structure, membrane, transport across cell membrane, Active, Passive, Organization of the Body, Body Composition, Body Fluid Volumes and its measurement, Diffusion, Osmosis, Tonicity, Homeostasis
Unit-II Blood-composition, function, cellular component & their function, haemoglobin & anaemia, blood groups and coagulation Lymphatic system-Composition & function of lymph, lymphatic tissue, Immunity with the role of thymus
Unit-III Cardiovascular system-general arrange, heart, arteries, veins and capillaries, heart structure and function, cardiac cycle, heart sounds, heart rate, blood pressure, mechanism of circulation, definition of hypertension & shock
Unit-IV Respiratory system: parts of respiratory system, mechanism of respiration, pulmonary function, pulmonary circulation, lungs volume, Gas transport between lungs and tissues, Definition of hypoxia, dyspnoea, cyanosis, asphyxia and obstructive airways diseases
Unit- V Gastrointestinal physiology: Organs of GIT and their structure & function, secretion, digestion, absorption and assimilation, gastrointestinal hormones, physiology of digestion of carbohydrates, proteins & lipids, Structure & function of liver, spleen, gall bladder & pancreas, Jaundice, Cirrhosis & Pancreatitis

Learning Outcome: This subject will develop an understanding of the function of organs and organ systems in normal human body. Students will able to explain the physiological systems of body and also understand the basis of diseases.

Suggested Readings:

1. Ross & Wilson,(2014),Anatomy & Physiology in health & illness,11th edition, Elsevier Publications
2. Sujit Chaudhury,(2011),Concise Medical Physiology,6th edition, NCBA
3. Sembulingam k,(2012),Essentials of Medical Physiology,6th edition, Jaypee Publications
4. Guyton and Hall,(2011) Textbook of Medical Physiology,12th Edition,Saunder/Elsevier
5. Gerard J. Tortora and Bryan H.Derrickson,(Principles of Anatomy and Physiology,14th edition,Wiley publications

Paper: Biochemistry-I
Code : BML-103
Contacts Hours / Week : 3L
Credits : 3

Course Contents

Unit-I Introduction to Clinical Biochemistry and role of Medical Lab Technologist , ethics, responsibility, safety measure and hazards in clinical biochemistry lab and first aid in laboratory accidents. Glassware's & plastic ware's used in lab, calibration of volumetric apparatus, cleaning& care and maintenance
Unit II Principle, working, care & maintenance and calibration of Weighing balance, Hotplate, Magnetic stirrer, Centrifuges, Incubator, Hot air oven, Colorimeter, Spectrophotometer, Water distillation plant, Deionizers Henderson Hassel balch equation, pH paper, pH meter, method of pH measurement,
Unit-III Preparation of solution and reagents, normal solution, molar solutions, percent solution, buffer solution, dilutions, w/v, v/v, standard solution, aqueous solutions, concepts of acid and base Units of measurement: SI unit, reference range, conversion factor, units for measurement of bio metabolite, enzymes, protein, drugs, hormones, vitamins
Unit-IV Specimen collection and processing of blood, urine & CSF, separation of serum and plasma, deproteinization of sample, Handling of specimens for testing, preservation of specimen, transport of specimen, factors affecting the clinical results, effect of storage on sample
Unit- V Physical, chemical and microscopic examination of urine, Bence Jones Proteinuria and its clinical significance, qualitative test of urine for reducing sugars, protein, ketone bodies, bile Salt, bile pigments, urobilinogen, occult blood, uric acid, urea and Creatinine, quantitative estimation of 24 hrs urine for protein and their clinical significance.

Learning Outcome: Students will know the basics of reagent preparation, instrument handling and can perform common analytical in Clinical Biochemistry.

Suggested Readings:

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

Paper: Health Education & Health Communication
Code: BML-104
Contacts Hours / Week : 3L
Credits : 3

Course Contents

Unit 1: • Health Education: Principles & Objectives, Levels of Health Education, Educational Methods, Evaluation & Practice of Health Education in India. • Health Counseling: Introduction, Theories, Process & Techniques. • Health Care Reporting, Role of NIC & Other Bodies, Research in Health Education
Unit 2: • Heath Communication: Basic Concept & Principles of Communication, Definition, Purpose, Types of Communication • Communication Process, Directions of Communication: Upward, Downward, Lateral, Factors influencing Communication, Barriers of Effective Communication, How to overcome the Barriers • Models of communication: Aristotle Model, Shannon and Weaver model, Schramm Model, Laegans Model, Fano Model, Literer's Model, Westly Maclean's Model.
Unit 3: • Mass communication & Role of Media in health education • Information Communication Technologies (ICT) in health care and awareness. (Telemedicine & e-health, community radio) • Future trends in information and communications systems :

Suggested Books:

1. Health Education – A new approach – L. Ramachandran & T. Dharmalingan
2. Health Communication in the 21st Century, By Kevin B. Wright, Lisa Sparks, H. Dan O'Hair, Blackwell publishing limited, 2013, first edition
3. Health Communication: From Theory to Practice, By Renata Schiavo, Published by Jossey Bash.
4. Health Communication, R.D. Karma Published by Mohit Publications 2008.
5. Counseling Skills for Health Care Professionals, 1st Edition, Rajinikanth AM, Jaypee Brothers, 2010.

Paper: PC Software Lab
Code: BML-191
Contacts Hours / Week : 2L
Credits : 2

- Introduction
- MS Windows(Windows '98 Second Edition)
- Desktop, creation of folders and shortcuts, features of Windows explorer
- Familiarisation and using MS packages – Word, Excel, PowerPoint, basic skills in using these tools. (Version MS-Office'2000)

Books:

1.Introduction to Computers with MS-Office, Leon, TMH
2.Personal Computer Software, EXCEL BOOKS
3.A First Course in Computers 2003, Saxena, VIKAS
4.Computer Concepts & Windows,Stoline,SPD/LABYRINTH
5.Windows'98 in easy steps,Harshad Kotecha, Wiley Dreamtech
6.Office 2000 in easy steps, Stephen Copestake, Wiley Dreamtech
7.Windows & MS-Office 2000, Krishnan, SCITECH
8.Trouble Shooting Microsoft Windows,PHI/MSP

Paper: Practical Human Anatomy-I
Code: BML-192
Contacts Hours / Week : 2L
Credits : 2

1. Demonstration of Major organs through models and permanent slides.
2. Demonstration of parts of circulatory system from models.
3. Demonstration of parts of respiratory system from models.
4. Demonstration of digestive system from models.
5. Demonstration of excretory system from models.
6. Demonstration of nervous system from models.
7. Structure of eye and ear
8. Demonstration of structural differences between skeletal, smooth and cardiac muscles.
9. Demonstration of various bones
10. Demonstration of various joints
11. Demonstration of various parts of male & female reproductive system from models

Paper: Practical Human Physiology-I
Code: BML-193
Contacts Hours / Week : 2L
Credits : 2

1. To measure pulse rate
2. To measure blood pressure
3. Demonstration of ECG
4. To perform Hemoglobin by Sahli's Method
5. To perform Hemoglobin by CMG method.
6. Haemoglobin by CMG method.
7. To perform Total RBC count.
8. To perform total leucocyte count.
9. To perform differential leucocyte count.
10. To perform PCV
11. To calculate Red cell indices.

Paper: Practical Biochemistry-I
Code: BML-194
Contacts Hours / Week : 2L
Credits : 2

1. To study general laboratory safety rules.
2. To demonstrate glasswares,apparatus and plasticwares used in laboratory.
3. Collection of blood sample
4. To separate serum and plasma.
5. Preparation of different percentage solutions
6. Preparation of normal and molar solutions.(0.1 N NaOH, 0.2N HCl,0.1 M H_2SO_4)
7. Demonstration of photocolorimeter
8. Demonstration of spectrophotometer
9. Demonstration of pH meter
10. Deproteinization of blood sample

Semester II

Paper: Human Anatomy-II
Code: BML-201
Contacts Hours / Week : 3L
Credits : 3

Unit-I Cardiovascular system: Basic anatomy of heart and important blood vessels Brief introduction about Lymphatic System
Unit –II The Nervous System: Basic anatomy of brain and spinal cord, meninges and cerebrospinal fluid, Cranial Nerves
Unit-III Endocrine System: Brief anatomy of Pituitary, Thyroid, Parathyroid, Pancreas, Adrenal
Unit-IV Special Senses: Basic anatomy of eye, ear and nose
Unit-V Genitourinary system: Basic anatomy of kidney and associated organs, male reproductive organs, female reproductive organs

Learning Outcome: This curriculum can stimulate the students to understand the basic anatomy of included system and the resultant unified organization thereupon.

Suggested Readings:

1. Ross & Wilson,(2014),Anatomy & Physiology in health & illness,11th edition,Elsevier Publications
2. Chaurasia B D, (2016), Human Anatomy, 7th edition,CBS publishers
3. Gerard J. Tortora and Bryan H.Derrickson,(Principles of Anatomy and Physiology,14th edition,Wiley publications

Paper: Human Physiology-II
Code: BML-202
Contacts Hours / Week : 3L
Credits : 3

Unit- I Organs of Excretory System: Kidneys, Nephron, Mechanism of Excretion, Urine formation (Glomerular filtration and Tubular reabsorption), Electrolytes: their balances and imbalances Introduction of acidosis and alkalosis
Unit-II Muscle nerve physiology, types of muscles, their gross structural and functional difference with reference to properties
Unit-III Nervous system- general organization of CNS, function of important structure and spinal cord, neuron, nerve impulse, type of nerves according to function, Autonomic nervous system- organization & function Special senses-general organization & functions
Unit- IV Endocrine System: Brief introduction about endocrine glands and their secretion, common endocrinological disorder such as diabetes mellitus, hyper & hypothyroidism, dwarfism, gigantism, tetany
Unit-V Reproductive System: male & female reproductive organs, sex hormones, secondary sexual characteristics, puberty, spermatogenesis, oogenesis, menstrual cycle, pregnancy, menopause, contraceptive measures.

Learning Outcome: Students will able to understand functioning of various systems included in syllabus as well as diseases mentioned.

Suggested Readings:

1. Ross & Wilson,(2014),Anatomy & Physiology in health & illness,11th edition,Elsevier Publications
2. Sujit Chaudhury,(2011),Concise Medical Physiology,6th edition, NCBA
3. Sembulingam k,(2012),Essentials of Medical Physiology,6th edition, Jaypee Publications
4. Guyton and Hall,(2011) Textbook of Medical Physiology,12th Edition,Saunder/Elsevier
5. Gerard J. Tortora and Bryan H.Derrickson,(Principles of Anatomy and Physiology,14th edition,Wiley publications

Paper: Biochemistry–II
Code: BML-203
Contacts Hours / Week : 3L
Credits : 3

Unit-I Carbohydrates: Classification, function, importance, structure, digestion & absorption. Proteins: Classification, function, importance, structure, digestion & absorption.
Unit-II Amino acids: Classification, Structure, Properties and Biological functions. Lipids: Classification of lipids, Classification of fatty acids, Saturated & Unsaturated fatty acids, their biological functions, digestion and absorption, introduction of lipoproteins
Unit-III Enzymes : Definition, Classification of enzyme, Cofactor & Coenzymes, Concept of active sites and general mode of action of enzymes, units for measuring enzyme activity, factor affecting enzyme activity, factor responsible for abnormal enzyme secretion
Unit-IV Nucleic acids: Structure, Function and types of DNA and RNA, Nucleotides, Nucleosides, Nitrogen bases, purines and pyrimidines and role of Nucleic acid.
Unit-V Vitamins: classification, function and disease associated with vitamins. Minerals and ions: Requirement, function and biological importance of Calcium, Iron, Iodine, Zinc, Phosphorus, Copper, Sodium and Potassium

Learning Outcome: Students will understand the chemistry, function, and biological importance of carbohydrates, proteins, lipids, nucleic acids, enzymes, vitamins and minerals.

Suggested Readings:

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

Paper: Bio-Medical Waste Management
Code: BML-204
Contacts Hours / Week : 3L+1 T
Credits : 3

Unit 1: Present Scenario Bio-medical waste – Concepts and Perceptions, Waste Generation, Segregation , Disposal
Unit 2: Planning and Objectives of BMW Management, Survey, Policies and Perspectives of BMW Management
Unit 3: Record Keeping, Management of Bio-medical Waste, Technologies for Treatment for BMW, Criteria for selecting appropriate Medical Waste Technologies
Unit 4: Training, Occupational Safety and Health Issues
Unit 5: Legal Aspects and Environment Concern, Implementation of Action Plan, Approaches to Common Regional facility

Reference Books:

1. The Book of Hospital Waste Management: Dr. D.B. Acharya & Dr. Meeta Singh (Minerva Press, New Delhi)
2. Hospital Waste Management & its Monitoring: Madhuri Sharma (Jaypee Brothers, Medical Publishers (P) Ltd. New Delhi)

Paper:Practical Human Anatomy II
Code:BML -291
Contacts Hours / Week : 2P
Credits : 2

[As per Theory BML – 201]

Paper:Practical Human Physiology-II
Code:BML-292
Contacts Hours / Week : 2P
Credits : 2

1. To perform total platelet count.
2. To perform bleeding time.
3. To perform clotting time.
4. To study about CSF examination.
5. To study about intrauterine contraceptive devices.
6. To demonstrate microscopic structure of bones withpermanent slides.
7. To demonstrate microscopic structure of muscles with permanentslides.

Paper:Practical Biochemistry-II
Code:BML-293
Contacts Hours / Week : 2P
Credits : 2

1. To identify carbohydrates in given solution by various methods.
2. To determine protein by Biuret method.
3. To perform protein test by various methods.
4. Physical examination of urine
5. Urine sugar determination by Benedict's metod.
6. Protein by heat and acetic method
7. Bile salt, Bile pigments and Urobilinogen determination
8. Determination of Ketone bodies
9. Determination of various parameters of urine by uristik method.
10. Preparation of hemolysate

Paper:Communication Lab
Code:BML-294
Contacts Hours / Week : 2P
Credits : 2

1. Introduction: Meaning of Communication; Role of Communication in Business; Basic elements of the Communication process, level of Communication, forms, models and media of Communications, Verbal and non-verbal Communication-functions and types. Barriers to effective Communication.
2. Grammar: Subject verb agreement, tense, voice, improvement of sentences, rearrangement of sentences. Vocabulary: usage, synonyms, antonyms.
3. Comprehension
4. Forms of Writing: The Essay, The Précis, The Report, The Proposal, The C.V. and Job
5. Application letter. The Presentation.
6. Role Playing
7. Group Discussion

Semester III

Paper: Pathology - I
Code: BML-301
Contacts Hours / Week : 3L
Credits : 3

Unit I 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
Unit II General features of acute and chronic inflammation: Vascular changes, cellular events, Cells and mediators of inflammation, Phagocytosisand its mechanism
Unit III Tissue Renewal and Repair, healing and fibrosis, cirrhosis, introduction of oedema, hyperaemia, congestion, haemorrhage, haemostasis, thrombosis, embolism, infarction, shock and hypertension.
Unit IV Protein energy malnutrition, deficiency diseases of vitamins and minerals, nutritional excess and imbalances. Role and effect of metals (Zinc, Iron and Calcium) and their deficiency diseases, Aetiology and pathophysiology of diabetes, arteriosclerosis, myocardial infarction, respiratory diseases (COPD), Parkinson disease Infectious Diseases: pathogenesis & overview of modes of infections, prevention and control with suitable examples like Typhoid, Dengue
Unit V 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.

Learning Outcome: 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 to the students.

Suggested Readings:

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

Paper: Clinical Haematology-I
Course Code: BML-302
Contacts Hours / Week : 3L
Credits : 3

Unit –I RBCs, formation, morphology, cytoskeleton, anisocytosis, poikilocytosis, metabolism, role of 2, 3- BPG and oxygen dissociation curve. Anaemia and its classification, Morphological and etiological, pathogenesis, laboratory investigations and management, Iron deficiency anaemia, metabolism of iron, pathogenesis, laboratory investigations and management, principle and procedure of special test Megaloblastic anaemia, pernicious anaemia, pathogenesis, laboratory investigations
Unit-II Haemoglobin, its synthesis and types, normal and abnormal hemoglobins, extravasccular and intravascular hemolysis. Haemolytic anaemia, pathogenesis and laboratory investigations, principle and procedure of special test, G-6-PD
Unit –III Leukopoiesis , Stages of Leukocyte Maturation, Features of Cell Identification, leucocytosis and leucocytopenia , neutrophilia , eosinophilia, basophilia, monocytosis, lymphocytosis, neutropenia, lymphopenia, causes and significance, toxic granulation, Morphological alterations in neutrophil, effect of HIV on blood cell parameter
Unit-IV Overview of hemostasis and coagulation, Stages of platelets development, Primary and Secondary hemostasis, Role of platelets, Role of coagulation factors, Coagulation inhibitorysystem, Fibrinolysis
Unit-V General blood picture, estimation of iron, TIBC, Transferrin, Ferritin, Plasma haemoglobin,Vit.B12, Folic acid, FIGLU test, Schiling test, Parietal cell antibodies,G-6-PD, Osmotic fragility test, Heinz bodies, Perls Prussian staining, Platelet count, Platelet aggregation test, PT, INR APTT, Mixing experiments in PT and APTT, Thrombin time.

Learning Outcome: Students will learn the differential diagnosis and appropriate diagnostic evaluation of common hematologic abnormalities.

Suggested Readings:

1. Mukherjee .L.K(2017), Medical Laboratory Technology,Vol.1-3,3rd edition, Tata Mcgraw Hill
2. Sood Ramnik,(2015), Text book of Medical Laboratory Technology,2nd edition, JaypeePublications
3. Wintrobe's Clinical Haematology,(2014),13th edition, Lippincott Williams & Wilkins
4. De Gruchy's Clinical Haematology in Medical Practice,(2012),Sixth edition, Wiley Publications
5. Dacie & Lewis Practical Haematology, (2011),11th edition, Elsevier Publications

Paper: Microbiology-I
Code: BML-303
Contacts Hours / Week : 3L
Credits : 3

Unit-I Development of microbiology as a discipline, Contributions of Anton von Leeuwenhoek, Louis Pasteur, Robert Koch, Joseph Lister, Alexander Fleming, Edward Jenner Introduction to bacterial taxonomy, Classification of Bacteria, Morphology based on size, shape, arrangement, motility, flagella, spores, capsules, cell wall, plasma membrane, pili, ribosomes.
Unit-II Microscopy: Study of compound microscope – magnification, numerical aperture, resolution and components of microscope. Dark ground illumination, care of microscope and common difficulties micrometry. Bright Field Microscope, Dark Field Microscope, Phase Contrast Microscope, Fluorescence Microscope, Transmission Electron Microscope, Scanning Electron Microscope
Unit-III Cell size, shape and arrangement, cell-wall, composition and detailed structure of Gram-positive and Gram-negative cell walls, Cell Membrane: Structure, function and chemical composition of bacterial cell membranes. Cytoplasm: Ribosome, mesosomes, inclusion bodies, nucleoid, chromosome and plasmids, Endospore: Structure, formation
Unit-IV General safety measures used in Microbiology laboratory, Sterilization and disinfection: Various physical methods of sterilization – heat, UV radiation, ionizing radiation, filtration, characters affecting sterilization, auto clave control and sterilization indicators. Biomedical waste management in a Medical Microbiology laboratory: Types of the waste generated, Segregation, Treatment, Disposal
Unit-V Antiseptics & Disinfectants: Definition, types and properties, mode of action, use, qualities of good disinfectants. Chemical disinfectants – phenol and its compounds, alcohol, halogen, heavy metals and quaternary ammonium compounds, aldehyde, gaseous compound. use and abuse of disinfectants. precautions while using the disinfectants.

Learning Outcome: This course make the students to know handling of instruments and sterilization techniques.

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. Goldsby RA, Kindt TJ, Osborne BA. (2007). Kuby's Immunology. 6th edition W.H. Freeman and Company, New York.

Paper: Immunology & Serology -I
Code: BML-304
Contacts Hours / Week : 2L+1T
Credits : 2

Unit-I Historical background, general concepts of the immune system, innate and adaptive immunity; active and passive immunity; primary and secondary immune response. Cell and organs of immune system, Phagocytosis
Unit-II Antigens and haptens : Properties ,foreignness, molecular size, heterogeneity, B and T cell epitopes; T dependent and T independent antigens. Antibodies: Historical perspective of antibody structure; structure, function and properties of the antibodies; different classes, subclasses and biological activities of antibodies; concepts of antibody diversity, isotype, allotype, Introduction of hybridoma technology, monoclonal antibodies, polyclonal antibody
Unit-III Mechanism of humoral and cell mediated immune response. Introduction of Major Histocompatibility Complex, organization of MHC and inheritance in humans; Antigen presenting cells, antigen processing and presentation Complement system and complement fixation test.
Unit-IV Laboratory tests for demonstration of antigen – antibody reaction such as agglutination, precipitation, ELISA, RIA, Immunofluorescence,
Unit-V Rheumatological diseases, etiology and pathogenesis and lab investigations

Learning Outcome: The students will learn scientific approaches/techniques that are used to investigate various diseases.

Suggested 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. 6th edition W.H. Freeman and Company, New York.
4. Murphy K, Travers P, Walport M. (2008). Janeway's Immunobiology. 7th 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.

Paper: Histopathology & Histotechniques-I
Code: BML-305
Contacts Hours / Week : 3L
Credits : 3

Unit-I Introduction of histopathology, cytology & histotechniques, laboratory organization, care & maintenance of equipments used in histotechnology lab ,Safety measures in histotechnology lab Reception, Recording, Labelling and transportation of tissue specimens,Basic concepts of fixation and various types of fixative used in histopathology and cytopathology
Unit-II Tissue and its types, Location and function,Grossing of tissues, whole mount, sections, smears, tissue processing and its steps, manual and automated method, components & principle of automatic tissue processor Decalcification, decalcification methods, types of decalcifying fluid, Processing of bones and teeth, Embedding media, its type and properties
Unit-III Microtome, its type and working, various type of microtome,Microtome knives, its type and knife sharpening,Section cutting, fault and remedies,Section adhesive
Unit-IV 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, accelerators, accentuators, metachromasia, metachromatic dyes
Unit- V 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, refractive index

Learning Outcome: Students would able to carry out tissue processing and general 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

Paper: Practical Clinical Haematology-I
Code:BML-391
Contacts Hours / Week : 2P
Credits : 2

1. Determination of haemoglobin by various methods.
2. Determination of Total RBC count.
3. Determination of PCV
4. Determination of red cell indices
5. Demonstration of hypochromic microcytic slide.
6. General blood picture
7. Determination of G-6-PD
8. Differential Leucocute Count.
9. Absolute leucocyte count
10. Demonstration of toxic granulation of neutrophil
11. To perform PT and Calculate INR
12. To perform APTT
13. To perform sickling test
14. Determination of Plasma Hemoglobin
15. To perform reticulocyte count.

Paper: Microbiology, Immunology & Serology - I
Code:BML- 392
Contacts Hours / Week : 2P
Credits : 2

1. Demonstration of Microscope and its parts
2. Demonstration of glassware used in microbiology.
3. Demonstration of autoclave and sterilization of glass wares.
4. Demonstration of Hot air oven and sterilization of glass wares.
5. To perform Gram staining
6. To perform Acid fast staining (Zeihl Neelsen staining)
7. To perform Indian ink staining
8. To perform Hanging drop method
9. Demonstration of capsule
10. Staining of bacterial spores
11. To demonstrate agglutination reaction.
12. To perform RA test
13. To perform WIDAL test
14. To perform RPR test.
15. To perform CRP test.
16.

Paper: Histopathology & Histotechniques-I
Code:BML-393
Contacts Hours / Week : 2P
Credits : 2

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.

10. Mounting and preservation of slide.

Semester IV

Paper: Pathology-II
Code: BML-401
Contacts Hours / Week : 3L
Credits : 3

Unit- I Hemoglobin, structure ,function and types , Hemoglobinometry , Haemoglobin estimation by various methods, advantages and disadvantages, physiological and pathological variations on blood parameters, 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. Physiological and pathologicalchanges in values Erythrocyte sedimentation rate, manual and automated method, factor affecting ESR, packed cell volume, red cell indices (MCV, MCH, MCHC), Physiological and pathological variations in value
Unit-II Complete blood count, determination by automated method and significance of each parameter, Reticulocyte count, routine examination of CSF, semen, sputum and stool.
Unit –III Mechanism of coagulation, coagulation factors, Bleeding time, clotting time, platelet count, protamine sulphate test, clot retraction test
Unit-IV Introduction to immuno hematology and blood banking technology, antigen, antibody, complements,ABO & Rh blood group system, method of determination, other blood group system, Donor selection, blood collection, anticoagulants, additive systems, blood bags, its labelling , storage and transportation
Unit- V Uses, care & maintenance and calibration of Coulter counter, coagulometer, automatic ESR analyzer, urine analyzer, point of care testing. Pre and Post analytical variables, automation in hematology

Learning Outcome: Students can perform the various type of tests involved in hematology, immunohematology, coagulation profile and can handle automated instruments.

Suggested Readings:

1. Godkar.B. Praful,(2016) Textbook of MLT,3rd edition,Bhalani Publications
2. Singh Tejinder,(2014),Atlas & Textbook of Haematology,3rd edition,Avichal Publications
3. Ochei J & Kolhatkar A(2000),Medical Laboratory Science: Theory & Practice, 3rd edition,Mcgraw HillEducation
4. Mukherjee .L.K(2017), Medical Laboratory Technology,Vol.1-3,3rd edition, Tata Mcgraw Hill
5. Sood Ramnik,(2015), Text book of Medical Laboratory Technology,2nd edition, JaypeePublications

Paper: Clinical Haematology-II
Code: BML-402
Contacts Hours / Week : 3L
Credits : 3

Unit- I Aplastic anaemia, Anaemia of chronic disorders, Sideroblastic anaemia, Haemolytic Anaemia, etiology, pathogenesis, clinical features, laboratory investigations, Bone marrow examination, composition & functions, aspiration techniques, processing and staining
Unit-II Hemoglobinopathies, qualitative and quantitative Sickle cell anaemia, sickle cell trait,etiology, pathogenesis, clinical features, and laboratory investigations,Disease management and prognosis, Sickling test Thalassaemia, classification, etiology, pathogenesis, clinical features, laboratory investigations, haemoglobin electrophoresis
Unit-III Leukemia and its classification, WHO and FAB classification, AML, ALL, CML, CLL, its etiology, clinical features, laboratory investigations Cytochemistry involved in diagnosis of various types of leukemia.
Unit-IV Qualitative and quantitative disorders of platelets, hypercoaguable test, 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
Unit- V LE cells, its demonstration and significance, lupus anticoagulants, Blood parasites, Malaria, Trypanosomes, Filariasis, Leishmania

Learning Outcome: This course made the students competent enough to perform various laboratory test related to acute and chronic haematological disorders.

Suggested Readings:

1. Wintrobe's Clinical Hematology,(2014),13th edition, Lippincott Williams & Wilkins
2. De Gruchy's Clinical Haematology in Medical Practice,(2012),Sixth edition, Wiley Publications
3. Dacie & Lewis Practical hematology, (2011),11th edition, Elsevier Publications
4. R N Makroo, (2009),Compendium of Trasfusion medicine,2nd edition, Career Publications

Paper:Microbiology-II
Code: BML-403
Contacts Hours / Week : 3L
Credits : 3

Unit-I Lab organization, management, recording of results and quality control in Medical Microbiology Lab. Safety measures in Microbiology Laboratory, Occurrence of lab infections, route of infections in laboratory, safety measures precaution in use of pathogens in teaching.
Unit-II Host pathogen interaction: Definitions - Infection, Invasion, Pathogen, Pathogenicity, Virulence, Toxigenicity, Carriers and their types, Opportunistic infections, Nosocomial infections. Transmission of infection
Unit-III Principle, working, use, care & maintenance of Laminar air flow, Centrifuge, Autoclave, hot air Oven, Incubator, Colony Counter, Muffle Furnace, Mac-intos Field-jar etc. Sterility testing of I/v fluids, Collection, transportation and processing of I/v fluids for bacterial contamination, Recording the result and interpretation
Unit-IV Hospital acquired infection, Specimen collection from patients, clinics and hospitals, Specimen collection for epidemiological investigations, role of microbiology laboratory in control of nosocomial infection Antimicrobial agents and Antibiotics: Introduction, mechanism of action, classification and uses, Antibiotic susceptibility testing in bacteriology, Culture medium used for Antibiotic susceptibility testing, Preparation and standardization of inoculums, Control bacterial strains, Description, morphology, cultural characteristics, pathogenecity, cultural characteristics, clinical features and lab diagnosis of Staphylococcus, Streptococcus, Pneumococcus, Neisseria, Bordetella, Choice of antibiotics MIC and MBC: Concepts and methods for determinationVarious methods of Antibiotic susceptibility testing with special reference to Stokes and Kirby-Bauer method
Unit-V Description, morphology, cultural characteristics, pathogenecity, cultural characteristics, clinical features and lab diagnosis of Clostridia, Escherichia coli, Salmonella,Shigella, Proteus, Vibrio, Pseudomonas, Spirocheates, Chlamydia, Actinomyces, Rickettsia,Yersenia, Brucella, Description, morphology, cultural characteristics, pathogenecity, cultural characteristics, clinical features and lab diagnosis of Vibrio, Pseudomonas, Spirocheates, Chlamydia, Actinomyces, Rickettsia,Yersenia, Brucella, Introduction of Mycology: Definition, general properties and classification Cutaneous mycoses, Systemic mycoses, Opportunisticmycoses Culture and laboratory test for fungus

Learning Outcome: Students would be able to identify and differentiate bacteria and fungus in biological samples.

Suggested Readings

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

Paper: Immunology & Serology-II
Code: BML-404
Contacts Hours / Week : 2L+1T
Credits : 2

Unit- I Western blotting, Immunodiffusion, Immunoelectrophoresis, Hypersensitivity and its types Introduction to Allergy and its laboratory test
Unit-II Introduction of transplant immunology, graft rejection, tissue typing for kidney and bone marrow transplant, Laboratory test for transplant
Unit –III Autoimmune disorders, pathogenesis, organ specific and systemic autoimmune disorders and its markers such parietal cell antibody, anti sperm antibody, lupus anticoagulants, anti mitochondrial antibody, ANA, ds DNA, HLA-B27, ASMA, anti CCP
Unit-IV Immunological disorders: primary and secondary immunodeficiency, SCID, AIDS, Tumour, types of tumours, Various Tumour Markers, their significance and method of estimation.
Unit-V Vaccines, classification and applications, Active and passive immunization, Immunoprophylaxis schedule in neonates, children and in pregnancy

.Learning Outcome: Students will able to carry out differential diagnosis of disease by the help of serological techniques.

Suggested 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. 6th edition W.H. Freemanand Company, New York.
4. Murphy K, Travers P, Walport M. (2008). Janeway's Immunobiology. 7th 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.

Paper: Histopathology & Histotechniques-II
Code: BML-405
Contacts Hours / Week : 3L
Credits : 3

Unit-I Staining of carbohydrates: preparation of Schiff reagent, PAS staining, Alcian blue, staining of glycogen, Amyloid, other staining method Connective tissue & its staining: Trichrome staining, verhoeff stain, Weigert Resorcin stain, Gordon's and Sweet stain, Gomori's method, von Geison stain, PTAH stain
Unit-II Demonstration of minerals and pigments in tissue sample, Demonstration and identification of lipids, Demonstration of enzymes, diagnostic application and the demonstration of phosphatases, dehydrogenases, oxidases and peroxidases, Demonstration of microorganism on tissue specimens, Bacteria, AFB, Actinomyces, spirochetes, fungi
Unit-III Demonstration of nucleic acids, Processing and staining of bone marrow sample. Fixation, Processing and section cutting of bones, eye ball, Techniques in neuropathology: Neurons staining, Myelin, Neuropathology lab specimen handling
Unit-IV Demonstration of sex chromatin, Museum techniques Electron microscopy: Principle and working, fixation, processing and staining of tissue Fluorescence Microscope: Principle and working
Unit- V Immunohistochemistry: principle, types, applications, antigen retrieval, APAAP, PAP Staining, Quality control in histopathology

Learning Outcome: Students would be able to perform various staining techniques and understand principle and application of various techniques.

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

Paper: Clinical Haematology-II

Code:BML-491

Contacts Hours / Week : 2P

Credits : 2

1. Staining of bone marrow
2. To perform sickling test.
3. To determine fetal haemoglobin
4. To perform Heinz bodies
5. Demonstration of leukemic slides
6. To perform LAP scoring
7. To determine total platelet count
8. To perform PT
9. To perform APTT
10. To perform thrombin time.
11. To perform D-dimer test.
12. To determine fibrinogen conc.
13. General blood Picture
14. To demonstrate malarial slide
15. Haemoglobin electrophoresis
16. Demonstration of hemoparasites like trypanosomes , Filaria, Malaria

Paper: Fundamentals of Microbiology, Immunology & Serology-II

Code:BML-492

Contacts Hours / Week : 2P

Credits : 2

1. Demonstration of Autoclave and sterilization of media
2. Demonstration of Laminar air flow and media preparation
3. Preparation of culture plates
4. Demonstration of Centrifuge.
5. Demonstration of hot air Oven and sterilization of glassware's
6. Demonstration of Incubator and preservation of cultures
7. Preparation of media
8. Antibiotic sensitivity test.
9. Microscopic examination of urine
10. Examination of urine
11. Examination of sputum
12. To perform HIV Tridot test.
13. To perform radial immunodiffusion test.
14. To perform immunoprecipitation method.
15. To perfrom HBsAg rapid test.
16. To perform ASO test
17. To perform ELISA test.
18. To perform TB IgG & IgM test
19. To perform Dengue IgG & IgM test
20. To perform typhidot test.
21. Introduction of Allergy panel
22. Montoux test

Paper: Histopathology & Histotechniques -II
Code:BML-494
Contacts Hours / Week : 2P
Credits : 2

1. Grossing of tissue
2. To perform tissue processing by manual method.
3. To perform section cutting of paraffin embedded tissue.
4. To fix the smear on glass slide.
5. To perform hematoxylin and eosin staining.
6. To perform PAS staining.
7. To perform AFB staining.

Paper: Immunohematology & Blood Banking
Code: BML-501
Contacts Hours / Week : 3L
Credits : 3

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 ofreagents, 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,3rd edition,Bhalani Publications
2. Ochei J & Kolhatkar A(2000),Medical Laboratory Science: Theory & Practice, 3rd edition,Mcgraw HillEducation
3. Mukherjee .L.K(2017), Medical Laboratory Technology,Vol.1-3,3rd edition, Tata Mcgraw Hill
4. Sood Ramnik,(2015), Text book of Medical Laboratory Technology,2nd edition, JaypeePublications
5. Wintrobe's Clinical Hematology,(2014),13th edition, Lippincott Williams & Wilkins

Paper: Clinical Enzymology & Automation
Code: BML-502
Contacts Hours / Week : 3L
Credits : 3

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+, 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
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,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
7. Bishop(2013),Clinical Chemistry,7th edition, Wiley Publications

Paper: Parasitology & Virology
Code: BML-503
Contacts Hours / Week : 3L
Credits : 3

Unit-I

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

Protozoalogy: 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, hepaptitis viruses, retroviruses-HIV, Picorna viruses, rhabdoviruses, orthomyxoviruses and paramyxo viruses, 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. 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

Paper: Diagnostic Cytology
Code: BML-504
Contacts Hours / Week : 3L
Credits : 3

Unit-I Cell: basic structure and function, cell organelles, cell cycle, Benign and Malignant tumors, Instruments used in cytology, preparation of buffers, stainsMicroscopy: 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,2nd edition, Saunders Publishers
2. Koss's Diagnostic Cytology,Vol.1 & 2,(2006),5th edition, Lippincott

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

Contacts Hours / Week : 3L
Credits : 3

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,6th edition, Elsevier Publications
2. Bishop(2013),Clinical Chemistry,7th edition, Wiley Publications
3. Henry's Clinical Diagnosis and Management by Laboratory Methods,(2011),22nd edition, Elsevier

Paper: Practical Clinical Enzymology
Code: BML-591
Contacts Hours / Week : 2P
Credits : 2

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

Paper: Practical Parasitology & Virology
Code: BML- 592
Contacts Hours / Week : 2P
Credits : 2

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 byfloatation 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

Paper: Practical Diagnostic Cytology
Code: BML-593
Contacts Hours / Week : 2P
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

Semester VI

Paper: Clinical Endocrinology & Toxicology
Code: BML-601
Contacts Hours / Week : 3L
Credits : 3

Unit-I Hormones, Classification of hormones, organs of endocrine system their secretion and function, regulation of hormone secretion, Mechanism of action
Unit-II Thyroid function test: Thyroid hormones, biological function, hypothyroidism, hyperthyroidism, Determination of T_3, T_4, TSH, FT_3, FT_4, TBG, Disorder associated with thyroid dysfunction.
Unit-III Infertility profile: LH, FSH, TSH, Estrogen, Progesterone, Total Testosterone, Free testosterone, DHEA-S, 17- Ketosteroids, Prolactin, their estimation and clinical significance, reference range, hypo and hyper secretion, Triple Test
Unit-IV Growth hormone, ACTH, Aldosterone, Cortisol their estimation and clinical significance, reference range, hypo and hyper secretion
Unit-V Introduction of Toxicology, Alcohol poisoning, Lead poisoning, Zinc poisoning, Mercury poisoning drugs abuse, screening procedure for drug screening, Spot tests, hair and urine test, Immunoassay for drugs.

Learning Outcome: After the exposure of the current paper students would be able to detect hormones and toxic substances in blood samples and also understand the basis of endocrine disorders.

Suggested readings:

1. Teitz,(2007),Fundamentals of Clinical Chemistry,6th edition,Elsevier Publications
2. Bishop(2013),Clinical Chemistry,7th edition, Wiley Publications
3. Henry's Clinical Diagnosis and Management by Laboratory Methods,(2011),22nd edition, Elsevier
4. D M Vasudevan, (2011),Text book of Medical Biochemistry,6th edition Jaypee Publishers
5. M N Chatterjea & Rana Shinde,(2012),Text book of Medical Biochemistry,8th edition,Jayppe Publications
6. Singh & Sahni,(2008),Introductory Practical Biochemistry,2nd edition, Alpha science
7. Lehninger,(2013),Principles of Biochemistry,6th edition, W H Freeman

Paper:Advanced Diagnostic Techniques
Paper Code: BML-602
Contacts Hours / Week : 2L+1T
Credits : 2

Unit-I Chromatography, its principle, types and applications. Paper Chromatography, Thin layer chromatography, HPLC, Gas liquid chromatography, Ion exchange chromatography and their application in diagnosis.
Unit-II Basic Principle of electrophoresis, Paper electrophoresis, Gel electrophoresis, PAGE, SDS-PAGE, Agarose gel electrophoresis, buffer systems in electrophoresis. Electrophoresis of proteins and nucleic acids, haemoglobin, immunoglobulin's, isoenzymes Applications of electrophoresis in clinical diagnosis.
Unit-III Centrifugation, fixed angle and swinging bucket rotors , RCF and sedimentation coefficient, differential centrifugation, density gradient centrifugation andUltracentrifugation.
Unit-IV Radioisotopes, Radioactivity, instruments for radioactivity measurement, applications of radioisotopes in clinical biochemistry
Unit-V Immunoassay: ELISA, RIA, FIA, FACS and their applications in clinical diagnosis.

Learning Outcome: After the exposure of the current paper students would find themselves equipped with a full package of skill development in order to work in an advance diagnostic setting.

Suggested Readings:

1. Teitz,(2007),Fundamentals of Clinical Chemistry,6th edition, Elsevier Publications
2. Henry's Clinical Diagnosis and Management by Laboratory Methods,(2011),22nd edition, Elsevier
3. Singh & Sahni,(2008),Introductory Practical Biochemistry,2nd edition, Alpha science
4. Lehninger,(2013),Principles of Biochemistry,6th edition, W H Freeman
5. Wilson & Walker, Practical Biochemistry,2nd edition

Paper: Diagnostic Molecular Biology
Code: BML-603
Contacts Hours / Week : 3L
Credits : 3

Unit-I Nucleic Acids, DNA, RNA, composition, structure, types, denaturation and renaturation of DNA, chemistry of DNA synthesis, general principles of replication, enzyme involved in DNA replication – DNA polymerases, DNA ligase, primase, telomerase and other accessory proteins.
Unit II Basic transcription apparatus, Initiation, elongation and termination of transcription, Eukaryotic Transcription of mRNA, tRNA and rRNA, types of RNA polymerases, transcription factors Introduction of translation
Unit-III Nucleic acid amplification testing, PCR, Principle, Types, applications, Thermal cycler, RT PCR, reverse transcriptase PCR, Nested PCR
Unit-IV Blotting techniques, southern blotting and Western blotting Introduction to chromosomes, its structure and disorder, Karyotyping, Chromosomal studies in hematological disorders (PBLC and Bone marrow), FISH
Unit-V Radioisotopes and its application in measurement of blood volume, determination of red cell volume and plasma volume, red cell life span, platelet life span, radiation hazards and its prevention disposal of radioactive material Introduction and applications of Flow cytometry, Stem cell banking, Prenatal Diagnosis

Learning Outcome: Students will also be rendered to take up future molecular biology challenges and efficiently work in diagnostic molecular setup.

Suggested Readings:

1. Teitz,(2007),Fundamentals of Clinical Chemistry,6th edition,Elsevier Publications
2. Henry's Clinical Diagnosis and Management by Laboratory Methods,(2011),22nd edition, Elsevier
3. Singh & Sahni,(2008),Introductory Practical Biochemistry,2nd edition, Alpha science
4. Lehninger,(2013),Principles of Biochemistry,6th edition, W H Freeman

Paper: Practical Clinical Endocrinology & Toxicology
Code: BML-691
Contacts Hours / Week : 2P
Credits : 2

1. To determine T_3 conc. in serum sample.
2. To determine T_4 conc. in serum sample.
3. To determine TSH conc. in serum sample.
4. To determine LH conc. in serum sample.
5. To determine FSH conc. in serum sample.
6. To determine Prolactin conc. in serum sample.
7. To determine TSH conc. in serum sample.
8. To perform TRIPLE test.
9. Demonstration of male and female infertility test.
10. Beta HCG

Paper: Practical Advanced Diagnostic Techniques
Code: BML-692
Contacts Hours / Week : 2P
Credits : 2

1. To perform separation of amino acids by paper chromatography
2. To perform separation of amino acids by thin layer chromatography
3. To perform separation of DNA by Agarose gel electrophoresis.
4. Separation of protein by PAGE
5. Separation of protein by paper electrophoresis
6. Separation of haemoglobin

Paper: Practical Diagnostic Molecular Biology
Code: BML-693
Contacts Hours / Week : 2P
Credits : 2

1. Isolation of DNA
2. Separation of DNA by Agarose gel electrophoresis
3. Demonstration of thermal cycler and PCR.
4. HIV test by Western Blotting
5. To perform karyotyping
6. Demonstration of PCR HLA B-27
7. Demonstration of PCR HIV
8. Demonstration of PCR MTB

Paper: Hospital Internship and Project
Code: BML-686
Credits : 6

Students shall be deputed to various labs of Pathology department wherein they shall undergo practical training of handling patients, collection and processing of blood, urine, sputum stool and body fluids samples.

Identification of patient's particulars based on CR number, Lab Number and transfer of samples from collection centres to different labs. Process of performing various tests in different labs. Each student is required to maintain a logbook of the various posting.

Student's performance shall be evaluated on continuous basis by the faculty posted in various sections. The faculty shall submit the assessment records of each student posted in his/her section on monthly basis to the HOD. Marks will be awardedout of 100.