

Second Semester

Subject Code	Course Titles	Hours per week			Marks			CR
		L	T	P	Internal	External	Total	
BMLS-201	General Clinical Microbiology	4	-	-	30	70	100	4
BMLS-202	Basic Haematology	4	-	-	30	70	100	4
BMLS-203	Basic Clinical Biochemistry	4	-	-	30	70	100	4
BMLS-204	Human Anatomy and Physiology	4	-	-	30	70	100	4
BMLS-205	General Clinical Microbiology – (Practical)	-	-	4	30	70	100	2
BMLS-206	Basic Haematology – (Practical)	-	-	4	30	70	100	2
BMLS-207	Basic Clinical Biochemistry – (Practical)	-	-	4	30	70	100	2
BMLS-208	Human Anatomy and Physiology – (Practical)	-	-	4	30	70	100	2
	Guest Lecture/Tutorial/Seminar/visit to any medical research institution or reputed clinical laboratory	-	2	-	-	-	-	2
Total		16	2	16	240	560	800	26
Total Hours in Semester		544						

NOTE:

1. Abbreviations: L - Lecture, T - Tutorials and P – Practical
2. Considering four months per semester as working months, total contact hour hours per semester shall be 544 (Five hundred and forty four)

Second Semester

BMLS-201: General Medical Microbiology

Rationale: This subject gives a general insight into the history and basics of medical microbiology, imparts knowledge about equipment used in Medical Microbiology and basic procedures done in a medical microbiology laboratory i.e. microscopy, sterilization, disinfection, culture methods required to perform different microbiological tests in clinical microbiology lab and biomedical waste management.

1. Introduction to Medical Microbiology:

1.1 Definition

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- 1.2 History
- 1.3 Host - Microbe relationship
2. Safety measures in Clinical Microbiology
3. Glassware used in Clinical Microbiology Laboratory:
 - 3.1 Introduction
 - 3.2 Care and handling of glassware
 - 3.3 Cleaning of glassware
 - 3.4 Equipment used in clinical Microbiology Laboratory:
 - 3.4.1 Introduction
 - 3.4.2 Care and maintenance including calibration
4. Microscopy
 - 4.1 Introduction and history
 - 4.2 Types, principle and operation mechanism of following microscopes
 - 4.2.1 Light microscope
 - 4.2.2 DGI
 - 4.2.3 Fluorescent
 - 4.2.4 Phase contrast
 - 4.2.5 Electron microscope: Transmission/ Scanning
5. Sterilization:
 - 5.1 Definition
 - 5.2 Types and principles of sterilization methods
 - 5.2.1 Heat (dry heat, moist heat with special Reference to autoclave)
 - 5.2.2 Radiation
 - 5.2.3 Filtration
 - 5.2.4 Efficiency testing to various sterilizers
6. Antiseptics and disinfectants:
 - 6.1 Definition.
 - 6.2 Types and properties
 - 6.3 Mode of action - Uses of various disinfectants
 - 6.4 Precautions while using the disinfectants - Qualities of a good disinfectant
 - 6.5 Testing efficiency of various disinfectants
7. Biomedical waste management in a Medical Microbiology laboratory:
 - 7.1 Types of the waste generated – Segregation – Treatment – Disposal
8. General characteristics & classification of Microbes: (Bacteria & fungi)
 - 8.1 Classification of microbes with special reference to prokaryotes & eukaryotes
 - 8.2 Morphological classification of bacteria
 - 8.3 Bacterial anatomy (Bacterial cell structures)
9. Growth and Nutrition of Microbes:
 - 9.1 General nutritional & other requirements of the bacteria
 - 9.2 Classification of bacteria on the basis of their nutritional requirements
 - 9.3 Physical conditions required for growth.
 - 9.4 Normal growth cycle of bacteria (growth curve)
 - 9.5 Types of microbial cultures: Synchronous, Static, continuous culture.
10. Culture media:
 - 10.1 Introduction
 - 10.2 Classification of culture media (Example & Uses) solid media, liquid media, semisolid, Media, routine/synthetic/defined media, basal media, enriched, enrichment, Selective differential media, sugar fermentation media, transport media, preservation media and anaerobic culture media
 - 10.3 Quality control in culture media
 - 10.4 Automation in culture media preparation

11. Aerobic & anaerobic culture methods:
 - 11.1 Concepts
 - 11.2 Methods Used for aerobic cultures
 - 11.3 Methods used for anaerobic cultures
12. Introductions to Immunology
 - 12.1 Immunity
 - 12.2 Antigens and Antibodies
13. Care & handling of laboratory animals:
 - 13.1 Introduction
 - 13.2 General care & handling
 - 13.3 Ethics & legality in use of laboratory animals

Suggested Readings

1. Practical Medical Microbiology by Mackie and McCartney
2. Text book of Microbiology by Ananthanarayan
3. Medical Microbiology by Panikar & Satish Gupte
4. Medical laboratory Technology vol. I, II, III by Mukherjee
5. District Laboratory Practice in tropical countries Vol II Microbiology by Monica Cheesbrough
6. Text book of Microbiology by Prescott

BMLS-202: Basic Haematology

Rationale: Students will be made aware of the composition of blood and methods of estimating different components of blood. Students will learn the basic concepts of Haematology & routine clinical investigations of Haematology laboratory.

1. Introduction to Haematology
 - 1.1 Definition
 - 1.2 Importance
 - 1.3 Important equipment used
2. Laboratory organization and safety measures in Haematology Laboratory
3. Introduction to blood, its composition, function and normal cellular components
4. Anticoagulants: types, mode of action and preference of anticoagulants for different hematological studies
5. Collection and preservation of blood sample for various hematological investigations
6. Formation of cellular components of blood (Haemopoiesis)
 - 6.1 Erythropoiesis
 - 6.2 Leucopoiesis
 - 6.3 Thrombopoiesis
7. Hemoglobin: definition, types, structure, synthesis and degradation
8. Morphology of normal blood cells
9. Normal Hemostasis & physiological properties of coagulation factors
10. Radioactivity: definition, half-life, physical decay and units
11. Urine analysis
12. Quality assurance in Haematology
 - 12.1 Internal and external quality control including reference preparation
 - 12.2 Routine quality assurance protocol
 - 12.3 Statistical analysis i.e. Standard deviation, Co-efficient of variation, accuracy and precision

Suggested Readings

1. Text book of Medical Laboratory Technology by Praful B. Godkar
2. Medical laboratory Technology by K.L. Mukherjee Volume-I
3. Practical Haematology by J.B. Dacie
4. Clinical Diagnosis & Management by Laboratory methods (20th edition) by John Bernard Henry
5. Atlas of Haematology (5th edition) by G.A. McDonald
6. De Gruchy's Clinical Haematology in Medical Practice

BMLS-203 Basic Clinical Biochemistry

Rationale: The main objective of the subject is to impart the knowledge of apparatus, units, equipment, and volumetric analysis in the laboratory of clinical Biochemistry.

1. Introduction to Medical lab. Technology
 - 1.1 Role of Medical lab Technologist
 - 1.2 Ethics and responsibility
 - 1.3 Safety measures
 - 1.4 First aid
2. Cleaning and care of general laboratory glass ware and equipment
 - 2.1 Steps involved in cleaning soda lime glass
 - 2.2 Steps involved in cleaning borosil glass
 - 2.3 Preparation of chromic acid solution
 - 2.4 Storage
3. Distilled water
 - 3.1 Method of preparation of distilled water
 - 3.2 Type of water distillation plants
 - 3.3 Storage of distilled water
4. Units of Measurement.
 - 4.1 S.I unit and CGS units
 - 4.2 Conversion
 - 4.3 Strength, molecular weight, equivalent weight
 - 4.4 Normality, Molarity, Molality
 - 4.5 Numerical
5. Calibration of volumetric apparatus
 - 5.1 Flask
 - 5.2 Pipettes
 - 5.3 Burettes
 - 5.4 Cylinders
6. Analytical balance
 - 6.1 Principle
 - 6.2 Working
 - 6.3 Maintenance
7. Concept of pH
 - 7.1 Definition
 - 7.2 Henderson Hassel batch equation
 - 7.3 Pka value
 - 7.4 pH indicator
 - 7.5 Methods of measurement of pH
 - 7.5.1 pH paper
 - 7.5.2 pH meter
 - 7.5.3 Principle, working, maintenance and calibration of pH meter

8. Volumetric analysis
 - 8.1 Normal and molar solutions
 - 8.2 Standard solutions
 - 8.3 Preparation of reagents
 - 8.4 Storage of chemicals
9. Osmosis
 - 9.1 Definition
 - 9.2 Types of osmosis
 - 9.3 Factors affecting osmotic pressure
 - 9.4 Vant Hoff's equation
 - 9.5 Applications of osmosis
 - 9.6 Dialysis

Suggested Readings

1. Text book of Medical Laboratory Technology by P. B. Godker
2. Medical Laboratory Technology by K.L. Mukherjee volume III
3. Practical Clinical Biochemistry by Harold Varley
4. Principal of Biochemistry by M. A. Siddiqi
5. Instrumental Analysis by Chatwal Anand
6. Text book of Medical Biochemistry by Chatterjee, Shinde
7. Principal of Biochemistry by Lehninger
8. Biochemistry by Voet&Voet
9. Biochemistry by Stryer

BMLS-204: Human Anatomy and Physiology

Rationale: Students will be able to learn the terminology of the subject and basic knowledge of cells, tissues, blood and to understand anatomy and physiology of human body. This subject will develop an understanding of the structure and function of organs and organ systems in normal human body.

1. Introduction to human Anatomy and Physiology
2. Cell and cell organelles
 - 2.1 Structure and classification
 - 2.2 Function
 - 2.3 Cell division (Mitosis and Meiosis)
3. Tissues
 - 3.1 Definition
 - 3.2 Classification with structure and Functions
 - 3.2.1 Epithelial tissues
 - 3.2.2 Connective tissues
 - 3.2.3 Muscular tissues
 - 3.2.4 Nervous tissue
4. Blood
 - 4.1 Composition
 - 4.2 Function of blood
5. Muscular skeletal system
 - 5.1 Introduction
 - 5.2 Classification
 - 5.3 Structure and function of skeletal system, muscles and joints
 - 5.4 Various movements of body

6. Respiratory system
 - 6.1 Introduction
 - 6.2 Structure
 - 6.3 Function
 - 6.4 Mechanism of breathing and respiration
 - 6.5 Various terms involved in respiratory System
 - 6.5.1 Vital capacity
 - 6.5.2 Total Volume
 - 6.5.3 Reserve volume
 - 6.5.4 Total lung capacity
7. Cardiovascular system
 - 7.1 Anatomy and physiology of heart
 - 7.2 Blood circulation
 - 7.3 Arteries and veins
 - 7.4 Conductive system of heart
 - 7.5 Cardiac cycle
 - 7.6 Introduction to ECG
8. Lymphatic system
 - 8.1 Introduction
 - 8.2 Structure and function
 - 8.2.1 Lymph nodes
 - 8.2.2 Spleen
 - 8.2.3 Thymus gland, Tonsils
9. Structure and function of sense organ
 - 9.1 Eye
 - 9.2 Ear
 - 9.3 Nose
 - 9.4 Tongue
10. Body fluids and their significance: Important terms, types of body fluid, total body water, avenues by which water leaves and enters body, general principles for fluid balance, cardinal principle, How body fluids maintain Homeostasis, Electrolytes & ions Function of electrolytes, How electrolyte imbalance leads to fluid imbalance
11. Digestive system: Organization; accessory organs; structure & function (Mouth, Tongue, Teeth, Esophagus, Pharynx, Stomach, Intestine, Rectum, Anus); Digestive glands; physiology of digestion of carbohydrates, lipids & proteins
12. Liver: structure and function
13. Urinarysystem:Mainparts,Structure&functionofkidney,structureof nephron, physiology of excretion & urine formation,urine,additional excretory organs
14. Genital system: Structure of male and female reproductive system, Gametogenesis in male & female, menstrual cycle. Placenta and extra embryonic membranes.
15. Nervous system: Parts, function & structure; brain, spinal cord, spinal & cranial nerves; all & none principle, role of neurotransmitters in transmission of nerve impulse
16. Endocrine system: Endocrine & exocrine glands, their location, structure & functions

Suggested readings:

1. Anatomy & Physiology- Ross and Wilson
2. Anatomy and Physiology: Understanding the Human Body by Clark
3. Anatomy and Physiology for nurses by Evelyn Pearce
4. Anatomy and Physiology for nurses by Sears
5. Anatomy and Physiology for nurses by Pearson
6. Anatomy and Physiology by N Murgesh

BMLS-205: General Medical Microbiology – Practical

1. To demonstrate safe code of practice for a Microbiology laboratory
2. To prepare cleaning agents & to study the technique for cleaning & sterilization of glassware.
3. To demonstrate the working & handling of Compound microscope.
4. To demonstrate the method of sterilization by autoclave including its efficacy testing.
5. To demonstrate the method of sterilization by hot air oven including its efficacy testing.
6. To demonstrate the method of sterilization of media/solution by filtration.
7. Demonstration of Antiseptics, Spirit, Cetrimide& Povidone-Iodine.
8. To demonstrate the use of disinfectants.
9. Demonstrate the precaution while using disinfectants.
10. To prepare working dilution of commonly used disinfectants.
11. In-use test
12. Rideal-walker phenol co-efficient test.
13. Kelsey-Sykes test
14. To demonstrate the different morphological types of bacteria
15. Preparation of one culture media from each type
16. To demonstrate aerobic culture
17. To demonstrate anaerobic culture
18. Visit to animal house & demonstrate about care of laboratory animals

BMLS-206 Basic Haematology – Practical

1. Preparation of various anticoagulants :
 - 1.1 EDTA
 - 1.2 Sodium Citrate,
 - 1.3 Oxalate with Fluoride
2. Collection of blood sample for various Lab Investigations
3. Familiarization and working of routine Haematology Lab. Instruments
 - 3.1 Microscopes
 - 3.2 Haemocytometers
 - 3.3 Colorimeter
 - 3.4 Spectrophotometer
 - 3.5 Glass pipettes & Auto pipettes
 - 3.6 Glassware
 - 3.7 Sahli's Apparatus
4. Identification of Normal blood cells
5. Urine Analysis:
 - 5.1 Routine biochemistry of Urine for:
 - 5.1.1 pH
 - 5.1.2 Specific Gravity
 - 5.1.3 Glucose
 - 5.1.4 Ketones
 - 5.1.5 Bilirubin
 - 5.1.6 Albumin
 - 5.2 Microscopic Examination of Urine

BMLS-207: Basic Clinical Biochemistry – Practical

1. Cleaning of the laboratory glass ware (Volumetric and non-volumetric)
2. Preparation of distilled water

3. Principle, working and maintenance of pH meter.
4. To prepare 0.1 N NaOH solution.
5. To prepare 0.2N HCl solution.
6. To prepare 0.1 molar H₂SO₄
7. To prepare 0.2 Molar Sodium carbonate solution.
8. Demonstration of osmosis and dialysis.

BMLS-208: Human Anatomy & Physiology – Practical

1. Demonstration of various parts of body
2. Demonstration of tissues of body
3. Demonstration of parts of digestive system
4. Demonstration of parts of respiratory system
5. Demonstration of parts of skin
6. Demonstration of parts of excretory system
7. Demonstration of various parts of circulatory system (Demonstration from models)
8. Examination of blood film for various blood cells from stained slides
9. Blood pressure estimation
10. Demonstration of various parts of nervous system (brain and spinal cord)(Model)
11. Structure of eye and ear (demonstration from models)
12. Demonstration of reflex action
13. Demonstration of structural differences between skeletal, smooth and cardiac muscles (permanent mounts)
14. Demonstration of various bones and joints
15. Demonstration of various parts of reproductive system (Male and female from models and charts)
16. To study circulatory system from charts and transverse section (TS) of artery and vein from permanent slides.
17. To study digestive system from charts and TS of liver, spleen and pancreas from permanent slides.
18. Study of Urinary system (charts)
19. Study of Genital system (male & female) from charts and TS of testis and ovary from permanent slides.
20. To study nervous system (From models / charts)
21. To study various body fluids.

Note: Demonstrations can be done with the help of models, charts and histological slides