

**Scheme and Syllabus  
of  
B.Sc. Medical Laboratory Sciences  
(B.Sc. MLS)**

**Batch 2011**



By  
Department of Academics  
**Punjab Technical University**

## First Semester

Contact Hours: 35Hrs

Course Code	Course Name	Load Allocation			Marks Distribution		Total Marks	Credits
		L	T	P	Int.	Ext.		
BMLS101	Essential Biology	3	-	-	40	60	100	3
BMLS102	General Microbiology	4	-	-	40	60	100	4
BMLS103	Basic Haematology & Haematological Techniques-I	3	-	-	40	60	100	3
BMLS104	Human Anatomy & Physiology-I	4	-	-	40	60	100	3
BMLS105	Basics of Biochemistry	3	-	-	40	60	100	3
BMLS106	Essential Biology Practical	-	-	2	40	60	100	1
BMLS107	General Microbiology – Practical	-	-	4	40	60	100	2
BMLS108	Basic Haematology & Haematological Techniques-I – Practical	-	-	4	40	60	100	2
BMLS109	Human Anatomy & Physiology – Practical	-	-	4	40	60	100	2
BMLS110	Basics of Biochemistry – Practical	-	-	2	40	60	100	1
<b>Total</b>		<b>17</b>	<b>-</b>	<b>16</b>	<b>400</b>	<b>600</b>	<b>1000</b>	<b>24</b>

**Note: It is mandatory to participate in either of the following:** Guest Lecture/ Seminar/Visit to any medical research institution/ visit clinical laboratory

## Second Semester

Contact Hours: 32Hrs.

Course Code	Course Name	Load Allocation			Marks Distribution		Total Marks	Credits
		L	T	P	Int.	Ext.		
HVPE101	Foundation Course in Human Values and Professional Ethics	3	-	-	40	60	100	3
BMLS201	Systematic Bacteriology	4	-	-	40	60	100	4
BMLS202	Basic Haematology Techniques – II	3	-	-	40	60	100	3
BMLS203	Human Anatomy & Physiology – II	4	-	-	40	60	100	4
BMLS204	Biochemical Metabolism	3	-	-	40	60	100	3
BMLS205	Environmental Science	3	-	-	40	60	100	3
BMLS206	Systematic Bacteriology-Practical	-	-	4	40	60	100	2
BMLS207	Basic Haematology Techniques – II Practical	-	-	4	40	60	100	2
BMLS208	Human Anatomy & Physiology – II – Practical	-	-	2	40	60	100	1
BMLS209	Biochemical Metabolism – Practical	-	-	2	40	60	100	1
<b>Total</b>		<b>20</b>	<b>-</b>	<b>12</b>	<b>400</b>	<b>600</b>	<b>900</b>	<b>26</b>

**Note: It is mandatory to participate in either of the following:** Guest Lecture/ Seminar/Visit to any medical research institution/ visit clinical laboratory

## Third Semester

Contact Hours 31 Hrs

Course Code	Course Name	Load Allocation			Marks Distribution		Total Marks	Credits
		L	T	P	Int.	Ext.		
BTHU101	Communicative Skills	3	-	-	40	60	100	3
BMLS301	Applied Bacteriology	4	-	-	40	60	100	4
BMLS302	Applied Haematology-I	3	-	-	40	60	100	3
BMLS303	Basic Cellular Pathology	4	-	-	40	60	100	4
BMLS304	Analytical Biochemistry	3	-	-	40	60	100	3
BTHU102	Communication Skills – Practical	-	-	2	40	60	100	1
BMLS305	Applied Bacteriology – Practical	-	-	4	40	60	100	2
BMLS306	Applied Haematology-I – Practical	-	-	2	40	60	100	1
BMLS307	Basic Cellular Pathology - Practical	-	-	4	40	60	100	2
BMLS308	Analytical Biochemistry – Practical	-	-	2	40	60	100	1
<b>Total</b>		<b>17</b>	<b>-</b>	<b>14</b>	<b>400</b>	<b>600</b>	<b>1000</b>	<b>24</b>

**Note: It is mandatory to participate in either of the following:** Guest Lecture/ Seminar/Visit to any medical research institution/ visit clinical laboratory

## Fourth Semester

Contact Hours 31 Hrs

Course Code	Course Name	Load Allocation			Marks Distribution		Total Marks	Credits
		L	T	P	Int.	Ext.		
BMLS401	Fundamentals of Computers	2	-	-	40	60	100	2
BMLS402	Immunology & Mycology	4	-	-	40	60	100	4
BMLS403	Applied Haematology-II	3	-	-	40	60	100	3
BMLS404	Histotechnology-I	4	-	-	40	60	100	4
BMLS405	Clinical Biochemistry-I	4	-	-	40	60	100	4
BMLS406	Fundamentals of Computers – Practical	-	-	2	40	60	100	1
BMLS407	Immunology & Mycology – Practical	-	-	4	40	60	100	2
BMLS408	Applied Haematology-II – Practical	-	-	4	40	60	100	2
BMLS409	Histotechnology-I - Practical	-	-	4	40	60	100	2
BMLS410	Clinical Biochemistry-I – Practical	-	-	2	40	60	100	1
<b>Total</b>		<b>17</b>	<b>-</b>	<b>16</b>	<b>400</b>	<b>600</b>	<b>1000</b>	<b>25</b>

**Note: It is mandatory to participate in either of the following:** Guest Lecture/ Seminar/Visit to any medical research institution/ visit clinical laboratory

## Fifth Semester

Contact Hours: 33Hrs

Course Code	Course Name	Load Allocation			Marks Distribution		Total Marks	Credits
		L	T	P	Int.	Ext.		
<b>BMLS501</b>	Essential Biology for Medical Laboratory Sciences	3	-	-	40	60	100	<b>3</b>
<b>BMLS502</b>	General Microbiology	4	-	-	40	60	100	<b>4</b>
<b>BMLS503</b>	Basic Haematology & Haematological Techniques-I	3	-	-	40	60	100	<b>3</b>
<b>BMLS504</b>	Human Anatomy & Physiology-I	4	-	-	40	60	100	<b>3</b>
<b>BMLS505</b>	Basics of Biochemistry	3	-	-	40	60	100	<b>3</b>
<b>BMLS506</b>	Essential Biology for Medical Laboratory Sciences	-	-	2	40	60	100	<b>1</b>
<b>BMLS507</b>	General Microbiology – Practical	-	-	4	40	60	100	<b>2</b>
<b>BMLS508</b>	Basic Haematology & Haematological Techniques-I – Practical	-	-	4	40	60	100	<b>2</b>
<b>BMLS509</b>	Human Anatomy & Physiology – Practical	-	-	4	40	60	100	<b>2</b>
<b>BMLS510</b>	Basics of Biochemistry - Practical	-	-	2	40	60	100	<b>1</b>
<b>Total</b>		<b>17</b>	<b>-</b>	<b>16</b>	<b>400</b>	<b>600</b>	<b>1000</b>	<b>24</b>

## Sixth Semester

Course Code	Course Name	Load Allocation	Marks Distribution	Total Marks
<b>BMLS601</b>	Professional Training	<b>Four Months</b>		
	<b>i.</b> Thesis			250 Marks
	<b>ii.</b> Viva Voce			150 Marks
	<b>iii.</b> Attendance			100 Marks
<b>Total</b>			<b>500 Marks</b>	

For evaluation of professional training, out of 700 marks, 200 will be awarded by the healthcare industry where the candidate has taken training. After taking 4 months training from healthcare industry the candidate shall report back to parent institute where he/she will submit his/her project report and will attend the institute for rest of the semester period. Then at the end of the semester he/she will appear for the practical examinations in the presence of Internal & External Examiners.

**BMLS-101 Essential Biology****PART-A****1. Introduction**

Biology & Its Branches; Scientific methods in Biology; Scope of biology and career options in Medical Laboratory Sciences; Characters of living organisms (elementary idea of metabolism, transfer of energy at molecular level, open and closed systems, homeostasis, growth and reproduction, adaptation, survival, death). Origin and Evolution of life - Theories of Evolution; Evidence of Evolution; Sources of Variations (mutation, recombination, genetic drift, migration, natural selection); Concept of species; Speciation and Isolation (geographical and reproductive); Origin of species.

**2. Ecology and Environment**

Atmosphere; Hydrosphere; Lithosphere; Abiotic and Biotic components of Ecosystem; Biogeochemical cycles of Carbon, Nitrogen and Oxygen; Food Chain and Food web.

**3. Diversity of Life**

Diversity of living organisms, Systematics; Need, history and types of classification (artificial, natural, polygenetic); biosystematics; binomial nomenclature; Two kingdom system, Five kingdom System, their merits and demerits, status of bacteria and virus; Morphology of animals - salient features of pathogenic microbes, protozoan, helminthes and insects structure and function of tissues - epithelial, connective, muscular and nervous.

**4. Cell and Cell Division**

Cell as a basic unit of life - discovery of cell, cell theory, cell as a self-contained unit; prokaryotic and eukaryotic cell; cell division; unicellular

and multicellular organisms; Ultrastructure of prokaryotic and eukaryotic cell - cell wall, cell membrane - unit membrane concept (Fluid-Mosaic model); membrane transport; cellular movement (exocytosis, endocytosis); cell organelles and their functions- nucleus, mitochondria, plastids, endoplasmic reticulum, Golgi complex, lysosomes, microtubules, centriole, vacuole, cytoskeleton, cilia and flagella, ribosomes. Molecules of cell; inorganic and organic materials - water, salt, mineral ions, carbohydrates, lipids, amino acids, proteins, nucleotides, nucleic acids (DNA and RNA); Enzymes (Properties, chemical nature and mechanism of action); vitamins, hormones and steroids.

## 5. Genetics

Continuity of life - heredity, variation; Mendel's laws of inheritance, chromosomal basis of inheritance; other patterns of inheritance - incomplete dominance, multiple allelism, quantitative inheritance. Chromosomes - bacterial cell and eukaryotic cell; parallelism between genes and chromosomes; genome, linkage and crossing over; gene mapping; recombination; DNA as a genetic material - its structure and replication; Central dogma; structure of RNA, types of RNA

## BMLS 102 General Microbiology

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

### PART – A

#### 1. Introduction to Medical Microbiology:

- Definition - History - Host-Microbe relationship.

#### 2. Safety measures in clinical Microbiology

#### 3. Glassware used in Clinical Microbiology Laboratory:

- Introduction - Care and handling of glassware - Cleaning of glassware

#### 4. Equipments used in clinical Microbiology Laboratory:

- Introduction - Care and maintenance

#### 5. Microscopy

- Introduction and history

- Types of microscopes

(a) Light microscope

(b) DGI

(c) Fluorescent

(d) Phase contrast

(e) Electron microscope:

Transmission Scanning

- Principles and operational mechanisms of various types of microscopes

#### 6. Sterilization:

- Definition

- Types and principles of sterilization methods

- Heat (dry heat, moist heat with special Reference to autoclave)

- Radiation
- Filtration
- Efficiency testing to various sterilizers

### **7. Antiseptics and disinfectants:**

- Definition- Types and properties - Mode of action - Uses of various disinfectants
- Precautions while using the disinfectants - Qualities of a good disinfectant.
- Testing efficiency of various disinfectants

## **PART-B**

### **8. Biomedical waste management in a Microbiology laboratory:**

- Types of the waste generated – Segregation – Treatment – Disposal

### **9. General characteristics & classification of Microbes : (Bacteria & fungi)**

- Classification of microbes with special reference to Prokaryotes & Eukaryotes
- Morphological classification of bacteria
- Bacterial anatomy (Bacterial cell structures)

### **10. Growth and Nutrition of Microbes :**

- General nutritional & other requirements of the bacteria
- Classification of bacteria on the basis of their nutritional requirements
- Physical conditions required for growth.
- Normal growth cycle of bacteria (growth curve)
- Types of microbial cultures: Synchronous, Static, continuous culture.

### **11. Culture media:**

- Introduction
- 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.
- Quality control in culture media

-Automation in culture media preparation

## **12. Aerobic & anaerobic culture methods:**

- Concepts
- Methods Used for aerobic cultures
- Methods used for anaerobic cultures.

## **13. Introductions to Immunology**

- Immunity
- Antigens and Antibodies

## **14. Care & handling of laboratory animals:**

- Introduction
- General care & handling
- Ethics & legality in use of laboratory animals

### **Suggested Readings/ Books:**

1. Text book of Microbiology by Ananthanereyan
2. Medical Microbiology by Paniker & Satish Gupte
3. Medical laboratory Technology vol.I ,II, III by Mukherjee
4. Medical Laboratory manual for tropical countries Vol II Microbiology by Monia Cheesbrough
5. Text book of Microbiology by Prescott
6. Practical Medical Microbiology by Mackie & MacCartney Volume 1 and 2
7. Immunology by Kuby

## **BMLS 103 Basic Haematology & Haematological Techniques-I**

**Objective/s:** The students will be made aware of the composition of blood and methods of estimating different components of blood. Students will be able to know the basic concepts of Haematology & routine clinical investigations of Haematology laboratory.

### **PART-A**

#### **1. Introduction to Haematology**

(a) Definition (b) Importance (c) Important equipment used.

#### **2. Laboratory organization and safety measures in Haematology Laboratory**

#### **3. Introduction to blood, its composition, function and normal cellular components.**

#### **4. Formation of cellular components of blood.**

(a) Erythropoiesis (b) Leucopoiesis (c) Thrombopoiesis

#### **5. Collection and preservation of blood sample for various haematological investigations.**

### **PART-B**

#### **6. Definition, principles & procedure, Normal values, Clinical significance, errors involved, means to minimize errors for the following**

- Haemoglobinometry
- Total leucocytes count (TLC)
- Differential leucocytes count (DLC)
- Erythrocyte Sedimentation Rate (ESR)
- Packed cell volume/ Haematocrit value.
- Red cell Indices (RCI)
- Absolute Eosinophil count
- Reticulocyte count
- Platelet Count.

- 7. Preparation of blood Films:** Types. Methods of preparation (Thick and thin smear/film)
- 8. Staining techniques in Haematology (Romanowsky's stains) :** Principle, composition, preparation of staining reagents and procedure of the following
- Giemsa stain
  - Leishman stain
  - Wright's stain
  - Field's stain
  - JSB stain.

**Suggested Readings/ Books:**

1. Text book of Medical Laboratory Technology by Paraful B. Godkar
2. Medical laboratory Technology by KL Mukherjee Volume-I
3. Haematology for students Practitioners by Ramnik Sood
4. Hand book of Medical Laboratory Technology(IIInd edition) by V.H. Talib
5. Haematology (International edition)Emmanuel C.Besa Harwal Publisher
6. Practical Haematology by JB Dacie
7. Practical Haematology(8<sup>th</sup> edition) by Sir John
8. Clinical Haematology by Christopher A. Ludlam
9. Clinical Diagnosis &Management by Laboratory methods(20<sup>th</sup> edition) by John Bernard Henary
10. Medical Laboratory Technology Methods & Interpretation(5<sup>th</sup> edition) by Ramnik Sood
11. Atlas of haematology(5<sup>th</sup> edition)by G.A. McDonald
12. A Manual of Laboratory & Diagnostic Tests(6<sup>th</sup> edition)by Frances Fischbach
13. Haematology (Pathophysiological basis for clinical practice) by Stephen M. Robinson

## **BMLS 104 Human Anatomy and Physiology - I**

**Objective/s:** 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.

### **PART-A**

#### **1. Introduction to human Anatomy and Physiology.**

#### **2. Cell and cell organelles.**

- Structure and classification
- Function
- Cell division (Mitosis and Meiosis)

#### **3. Tissues**

- Definition
- Classification with structure and Functions of following:
  - Epithelial tissues
  - Connective tissues
  - Muscular tissues
  - Nervous tissue

#### **4. Blood:** Composition and function of blood

#### **5. Muscular skeletal system**

- Introduction
- Classification
- Structure and function of skeletal system, muscles and joints.
- Various movements of body.

#### **6. Respiratory system**

- Introduction
- Structure
- Function
- Mechanism of breathing and respiration

- Various terms involved in respiratory System.
  - Vital capacity.
  - Total Volume.
  - Reserve volume.
  - Total lung capacity.

## **PART-B**

### **7. Cardiovascular system.**

- Anatomy and physiology of heart
- Blood circulation.
- Arteries and veins.
- Conductive system of heart.
- Cardiac cycle.
- Introduction to ECG.

### **8. Lymphatic system.**

- Introduction.
- Structure and function of:
  - Lymph nodes.
  - Spleen.
  - thymus gland,
  - Tonsils

### **9. Structure and function of sense organs.**

- Eye.
- Ear.
- Nose.
- Tongue.

#### **Suggested Readings/ Books:**

1. Anatomy & Physiology- Ross and Wilson\
2. Anatomy and Physiology: Understanding the Human Body by Clark
3. Human Anatomy for nurses by Pearce

## **BMLS 105 Basics of Biochemistry**

**Objective/s:** The main objective of the subject is to impart the knowledge of apparatus, units, equipments, volumetric analysis in the laboratory of clinical Biochemistry.

### **PART-A**

#### **1. Introduction to Medical lab Technology.**

- Role of Medical Lab Technologists
- Ethics and responsibility
- Safety measures
- First aid.

#### **2. Cleaning and care of general laboratory glass ware and equipments.**

- Steps involved in cleaning soda lime glass
- Steps involved in cleaning “Borosil” glass
- Preparation of chromic acid solution.
- Storage.

#### **3. Distilled water.**

- Method of preparation of distilled water
- Type of water distillation plants
- Storage of distilled water

#### **4. Units of Measurement.**

- S.I unit and CGS units
- Conversion Strength, molecular weight, equivalent weight
- Normality, Molarity, Molality
- Numerical

#### **5. Calibration of volumetric apparatus**

- Flask
- Pipettes
- Burettes
- Cylinders

## PART-B

### 6. Analytical balance

- Principle
- Working
- Maintenance

### 7. Concept of pH

- Definition
- Henderson Hasselbatch equation
- Pka value
- pH indicator
- Methods of measurement of pH
  - pH paper
  - pH meter
  - Principle, working, maintenance and calibration of pH meter

### 8. Volumetric analysis

- Normal and molar solutions
- Standard solutions
- Preparation of reagents
- Storage of chemicals

### 9. Osmosis

- Definition
- Types of osmosis
- Factors affecting osmotic pressure
- Vant Hoff's equation
- Applications of osmosis
- Dialysis

#### Suggested Readings/ Books:

1. Text book of Medical Laboratory Technology by P. B. Godker
2. Medical Laboratory Technology by KL 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 Chaterjee Shinde
7. Principal of Biochemistry by Lehninger
8. Biochemistry by Voet & Voet
9. Biochemistry by Stryer

**BMLS 106 Essential Biology Practical**

1. Study of evolution through charts and models
2. Study of Mendel's law of inheritance through charts.
3. Study of Mitosis and Meiosis through animal cells (Grasshopper)
4. Study of mitochondria and Nucleus by staining with a Janus Green and Methylene Blue respectively.
5. Study of osmosis and diffusion.
6. Study of permanent slides of Pathogenic Protozoans like *Entamoeba*, *Plasmodium*, *Trypanosoma*, *Leishmania*, *Giardia*, and Pathogenic Helminthes like *Fasciola*, *Ancylostoma*, *Trichinella*, *Oxyuris*, *Wuchereria*
7. Study of specimens of *Anopheles*, *Culex*, *Aedes*, *Stenocephalide*, *Pediculus*, *Musca* and the reasons for identification.
8. Study of Epithelial, Muscle, Nerve and mammalian blood cells through permanent or temporary cells.

## BMLS 107 General Microbiology Practical

**Objective/s:** Students are able to classify, identify, use of instruments, sterilization, cultural requirements and to perform different microbiological tests in clinical microbiology lab.

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 study the working & handling of Compound microscope.
4. To study the method of sterilization by autoclave.
5. To study the method of sterilization by hot air oven.
6. To study 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. To demonstrate the different morphological types of bacteria.
14. Preparation of one culture media from each type.
15. To demonstrate aerobic culture
16. To demonstrate anaerobic culture.
17. Visit to animal house & demonstrate about care of laboratory animals.

**BMLS 108 Basic Haematology and Haematological Techniques-I Practical**

**Objective/s:** Students will be able to know the basic concepts of Haematology & routine clinical investigations of Haematology lab.

**1. Demonstration of Equipments used in clinical Haematology.**

- (a) Microscope
- (b) Blood Cell counter (DLC)
- (c) Sahli's apparatus
- (d) Calorimeter

**2. Hb Estimation**

- (a) Sahli's method
- (b) Cyanmethaemoglobin method
- (c) Oxyhaemoglobin method

**3. Total leukocyte count****4. Preparation of smear and staining with Giemsa and Leishman stain.****5. Differential leucocytes count****6. Platelets count****7. Reticulocyte count****8. Absolute Eosinophil count****9. Calculation of Red cell indices (RCI)****10. ESR (Winrobe and Weslergren method)****11. Packed cell volume (Macro & Micro)**

## **BMLS 109 Human Anatomy and Physiology Practical**

**Objective/s:** 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.

1. Demonstration of human cell from slides/charts.
2. Demonstration of cell division i.e. mitosis and Meiosis from permanent mounted slides.
3. **Demonstration of various tissues from permanent slides.**
  - (i) Epithelial tissue
  - (ii) Connective tissue.
  - (iii) (iii) Muscular tissue
  - (iv) Nervous tissue
4. Demonstration of individual bone.
5. Demonstration of respiratory system from chart.
6. Pear expiratory flow rate( PEFr)
7. Demonstration of cardiovascular system form chart.
8. Electro cardio gram (ECG)
9. Demonstration of eye, nose, ear and tongue from model and charts.
10. To study and count spleenocytes from mammalian spleen

**BMLS-110 Basics of Biochemistry Practical**

**Objective/s:** The main objective of the subject is to impart the knowledge of apparatus, units, equipments, volumetric analysis in the laboratory of clinical biochemistry

1. Cleaning of the laboratory glass ware.
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 H<sub>2</sub>SO<sub>4</sub>
7. To prepare 0.2 Molar Sodium carbonate solution.
8. Demonstration of osmosis and dialysis.