

## ABOUT THE COURSE

Medical Laboratory Technology is fast developing along with growing population and technological advancement. It is the most sought job titles in the global Health Care System.

Medical Laboratory Technology is a broad area comprising different disciplines like Pathology, Hematology, Biochemistry, Cytology, Cytogenetics, Microbiology, Immunology, Virology, Mycology, Parasitology, Molecular biology etc.

In a country like ours, where there is fast and tremendous technological advancement and population growth, the demand and supply of trained manpower is not at par. Introduction of a Certificate Course in Medical Laboratory Technology at Higher Secondary level is a remedy to this big skill gap in the country.

Medical Laboratory Technology plays a crucial role in the diagnosis of diseases. Apart from medical diagnostics, application of Medical Laboratory Technology extends to the detection of genetic disorders, epidemiology of infectious diseases, detection of metabolic disorders and even to answer unraveled questions in forensic medicine.

The course is designed to provide multi-skilled competent personals in the field of Medical Laboratory Technology to meet the increasing demand. On completion of the course, students acquire basic skills of Medical Laboratory Technology to cater entry level jobs. The course also provides inroads for students to undergo higher education including research in disciplines of laboratory medicine.

### Job Roles

GOVT. SECTOR	PRIVATE SECTOR	SELF EMPLOYMENT
<ul style="list-style-type: none"> <li>• Laboratory Technician</li> <li>• Lab Technical Assistant</li> <li>• Laboratory Instructor</li> </ul>	<ul style="list-style-type: none"> <li>• Laboratory Technician</li> <li>• Phlebotomist</li> <li>• Lab Assistant</li> <li>• Laboratory Instructor</li> <li>• Hematology Technician</li> <li>• Blood Bank Technician</li> <li>• Clinical Pathology Technician</li> <li>• Clinical Assistant</li> </ul>	<ul style="list-style-type: none"> <li>• Laboratory Owner</li> <li>• Laboratory Technician</li> <li>• Reagent Manufacturer</li> <li>• Diagnostic distributor</li> </ul>

### Subject Approach

MLT Course is one of the best sought courses in the Vocational Higher Secondary stream of education. It comes under the group Allied Health Sciences and is the forefront runner in terms of the higher studies

options as well as employment opportunities. The curriculum of the course contains all the important subjects related to laboratory medicine like Haematology, Biochemistry, Clinical Pathology, Immunohaematology and Blood Banking, Laboratory Management, Microbiology as well as Histo-technology.

The structure of the course is designed in such a way that the first module of First Year Curriculum familiarizes the learners to the basics of Human Anatomy & Physiology and gives an idea about the important parts and features of a Diagnostic Laboratory. The topic also envisages the understanding of proper use and handling of common Laboratory Equipments and Glassware. A proper know - how about Blood, the commonest sample of any laboratory is given as part of the First module so the learner have a clear idea about the components, composition and collection of blood. The second module deals with the common Hematological investigations done in a laboratory. The practical and theoretical exposure obtained during the period makes the learners competent in the field. The second module also covers the topic Blood Banking which has attained much relevance nowadays due to the regular need for blood transfusions. The module also provides introduction to the automated machineries and techniques which can be experienced in the field visits or as part of On the Job Training (OJT).

The laboratories as well as PTCs attached to schools provide ambient atmosphere for attaining perfection in performance for the students. The curriculum of VHSE which gives prime importance to practical is further skill enhanced with the scheduled 'On the Job Training Programmes' conducted in laboratories both on the government as well as private sector. The school curriculum is further enriched with introduction of ICT enabled teaching-learning methodologies as well as activity oriented tools like survey, camps, expo etc.

### **Objectives of the course**

On completion of the course, the learners will be able to:

- acquire basic knowledge of the structure and function of human body.
- collect and handle clinical specimens properly for performing investigations.
- operate and take care of various laboratory equipment.
- perform Hematological, Pathological, Biochemical and Microbiological diagnostic procedures/techniques.
- perform routine blood bank techniques.
- perform Phlebotomy.

- act as an effective laboratory technician who demonstrates laboratory ethics and code of conduct.
- give awareness to the public about various health hazards.
- establish and run reagent manufacturing units.
- act as a distributor of diagnostic kits and reagents.
- establish and run a diagnostic laboratory.

## Syllabus in Detail

### MODULE 1

#### Anatomy, Physiology and Phlebotomy - 340 periods

Unit No.	Name of Units	Periods
1.1	<b>Basic Anatomy and Physiology</b>	<b>100</b>
1.1.1	Organisational Structure of human body <ul style="list-style-type: none"> <li>• Familiarisation of cell, Tissue, Organ and Organ system, Definition &amp; their relationship, Tissue types - Epithelial, Muscular, Connective, Nervous (Name only), Organ system (Name only)</li> <li>• Familiarisation of common terms - Anatomy, Physiology, Cytology, Histology, Pathology, Anatomical position, Anterior, Posterior, Medial, Lateral, Proximal, Distal, Central &amp; Peripheral</li> </ul>	
1.1.2	Systemic Anatomy <i>Skeletal system</i> <ul style="list-style-type: none"> <li>- Functions</li> <li>- Bones of Axial &amp; Appendicular skeleton (Name only)</li> <li>- Terms-Cartilages, joints, Osteology, Arthrology</li> </ul> <i>Circulatory System</i> <ul style="list-style-type: none"> <li>- Cardio vascular system</li> <li>- Difference between artery, vein and capillary</li> <li>- Structure of heart in brief Chambers, Valves &amp; Blood vessels (Name only)</li> <li>- Systole, Diastole &amp; Cardiac cycle</li> <li>- Measurement of BP and Pulse</li> <li>- ECG-definition and importance</li> <li>- Lymphatic system in brief</li> <li>- Familiarize Lymph</li> </ul> <i>Respiratory system</i> <ul style="list-style-type: none"> <li>- Overview (Name of Parts &amp; function)</li> <li>- Types of respiration</li> <li>- Respiratory rate (Definition &amp; Normal value)</li> <li>- Spirometry - Use</li> </ul>	

	<ul style="list-style-type: none"> <li>- Vital capacity-Definition &amp; Normal Value</li> <li>- Clinical importance of Sputum</li> <li><i>Digestive system</i></li> <li>- Overview (Name of Parts &amp; function)</li> <li>- Liver and Pancreas-Importance, Secretions (Name only) &amp; function</li> <li>- Clinical importance of Faeces</li> <li><i>Excretory system</i></li> <li>- Modes of excretion (specify names)</li> <li>- Urinary system - Parts and function</li> <li>- Formation of urine (name of steps only)</li> <li>- Normal Constituents of Urine</li> <li>- Clinical importance of Urine</li> <li><i>Nervous system</i></li> <li>- Name of Parts &amp; function-CNS &amp; PNS</li> <li>- CSF and its Clinical importance</li> <li><i>Reproductive system</i></li> <li>- Parts &amp; Function of Male reproductive system</li> <li>- Parts &amp; Function of Female reproductive system</li> <li>- Clinical importance of Seminal Fluid</li> <li><i>Endocrine system</i></li> <li>- Overview</li> <li>- Mention endocrine glands</li> <li>- Mention Hormones of clinical importance and their functions (Pituitary, Thyroid, Adrenal, Pancreas &amp; Gonads)</li> </ul>	
<b>1.2</b>	<b>Diagnostic laboratory</b>	<b>140</b>
1.2.1	<p>Introduction to Diagnostic laboratory</p> <ul style="list-style-type: none"> <li>- Significance of Medical Laboratory Technology</li> <li>- Role of Laboratory</li> <li>- Types of Laboratories</li> <li>- Sections of a Laboratory</li> </ul>	
1.2.2	<p>Common Laboratory Glass wares &amp; Lab Equipments</p> <p><i>Common Laboratory Glass wares</i></p> <ul style="list-style-type: none"> <li>- Common glass wares and its uses</li> <li>- Cleaning of glass wares</li> <li>- Preparation &amp; use of Chromic acid solution</li> </ul> <p><i>Common Laboratory Equipments</i></p> <ul style="list-style-type: none"> <li>- Use, parts, working and maintenance of Microscope, Centrifuge, Colorimeter, Chemical Balance, Micropipette &amp; Water bath</li> </ul>	

<b>1.3</b>	<b>Introduction to Blood &amp; Phlebotomy</b>	<b>105</b>
1.3.1	<p>Blood</p> <ul style="list-style-type: none"> <li>- Introduction - Formation of Blood</li> <li>Definition of Erythropoiesis, Leucopoiesis &amp; Thrombopoiesis</li> <li>- Composition and functions of blood</li> <li>- Plasma &amp; Formed elements</li> <li>- Plasma-composition</li> <li>- Formed elements RBC, WBC &amp; Platelets</li> <li>- Blood coagulation                             <ul style="list-style-type: none"> <li>• Definition, Name coagulation factors</li> <li>• Major steps</li> <li>• Difference between Plasma &amp; Serum</li> </ul> </li> <li>- Anticoagulants                             <ul style="list-style-type: none"> <li>• Definition, common anticoagulants, colour coding</li> </ul> </li> <li>- Preparation of EDTA Anticoagulant bottle</li> </ul>	
1.3.2	<p>Phlebotomy</p> <ul style="list-style-type: none"> <li>- Definition</li> <li>- Methods-Capillary puncture, Arterial puncture and Venous puncture</li> <li>- Sites of blood collection-capillary and venous</li> <li>- Requirement, Procedure of capillary &amp; venous blood collection</li> <li>- Precautions for blood collection</li> <li>- Complications during blood collection-hematoma, syncope, Excess bleeding</li> <li>- Pediatric blood collection</li> </ul>	
1.3.3	<p>Familiarization of Blood cells</p> <ul style="list-style-type: none"> <li>- Preparation of Thin blood smear</li> <li>- Ideal smear characteristics</li> <li>- Factors affecting smear preparation</li> <li>- Leishman's stain-staining technique</li> <li>- Blood cell types-RBC, WBC, Platelets Identifying Characters &amp; Normal range</li> <li>- Classification of White blood cells</li> <li>- Other staining methods-Fields, Giemsa, Wrights (Name only)</li> </ul>	

## Syllabus in Detail

## MODULE 2

## Haematology &amp; Blood banking techniques - 340 periods

Units	Name of Units	Periods
<b>2.1</b>	<b>Haematology</b>	<b>240</b>
2.1.1	Introduction to Haematology - Haematology-Definition - Role of haematological techniques in diagnosis	
2.1.2	Hemoglobin estimation - Introduction - Methods - Cyanmethaemoglobin estimation in detail - Clinical significance	
2.1.3	Total Cell Count - Introduction - Counting chamber - Improved Neubauer - Total Cell counts-RBC , WBC, Platelet, Absolute eosinophil Diluting fluid, procedure, calculation, normal value, clinical significance - Reticulocyte count - brief description	
2.1.4	Examination of Blood Smear - Differential Leucocyte Count Thin blood smear Preparation, staining Counting and reporting - Peripheral Smear Examination <ul style="list-style-type: none"> <li>• Abnormal RBC - size, shape, colour</li> <li>• Abnormal WBC - general characteristics of Immature cells</li> <li>• Platelets - arrangement</li> <li>• Inclusion bodies - RBC, Parasites</li> </ul>	
2.1.5	Packed cell volume - Methods - Wintrobe's method - procedure, normal value, clinical significance - Red cell indices <ul style="list-style-type: none"> <li>• MCV, MCH, MCHC,</li> <li>• Clinical Significance</li> </ul>	
2.1.6	Erythrocyte Sedimentation Rate (ESR) - Methods - Westergren's method - procedure, Normal value, clinical significance	

	<ul style="list-style-type: none"> <li>- Stages of ESR</li> <li>- Factors affecting ESR</li> <li>- Mention Automated ESR</li> </ul>	
2.1.7	<p>Test for coagulation</p> <ul style="list-style-type: none"> <li>- Introduction - relevance, enlist various coagulation tests</li> <li>- Bleeding Time -methods, clinical significance procedure, Normal value of Duke's method</li> <li>- Clotting Time-methods, clinical significance procedure, Normal value of Capillary tube method</li> <li>- Prothrombin Time - brief description</li> <li>- APTT - brief description</li> </ul>	
2.1.8	<p>Automation in Haematology</p> <ul style="list-style-type: none"> <li>- Introduction - need and advantage</li> <li>- Working principles light scatter, laser, electrical impedance</li> <li>- Parts of analyser</li> <li>- Reagents - Diluent, Lyse, Rinse</li> <li>- Methodology</li> <li>- Parameters</li> <li>- Familiarization of terms - haemogram, histogram, CBC</li> </ul>	
<b>2.2</b>	<b>Immunohaematology &amp; Blood Banking Techniques</b>	<b>100</b>
2.2.1	<p>Introduction</p> <ul style="list-style-type: none"> <li>- Immunohaematology - Definition, Historical Aspects</li> <li>- Blood group antigens &amp; Antibodies</li> <li>- Blood group system ABO &amp; Rh System in detail Other blood group systems - Name only Bombay blood group Inheritance of Blood group</li> <li>- Haemolytic disease of Newborn</li> </ul>	
2.2.2	<p>Blood Grouping techniques</p> <ul style="list-style-type: none"> <li>- Cell grouping &amp; Serum grouping</li> <li>- Slide &amp; Tube method - Procedure</li> <li>- Mention Tile method</li> </ul>	
2.2.3	<p>Blood collection for Transfusion</p> <ul style="list-style-type: none"> <li>- Transfusion-Definition, Need</li> <li>- Donor, Recipient - Definition</li> <li>- Donor screening Donor selection criteria History of Donor &amp; Medical examination</li> </ul>	

	<ul style="list-style-type: none"> <li>• Blood collection Technique-Familiarize Blood bag, Anticoagulants</li> <li>- Screening tests for Transfusion transmitted diseases</li> <li>- Storage - Blood bank refrigerator</li> <li>- Blood Components Mention components name &amp; its storage, use</li> </ul>	
2.2.4	<ul style="list-style-type: none"> <li>Compatibility Testing &amp; Issue of Blood</li> <li>- Coomb's Test- Direct &amp; Indirect</li> <li>- Cross matching Major &amp; Minor - mention 3 phases</li> <li>- Issue of Blood</li> <li>- Transfusion reactions - Name only</li> </ul>	

### Learning Outcomes

#### Module 1

On completion of the module the learner will be able to:

#### 1.1 Basic Anatomy & Physiology

- 1.1.1 Identify the basic level of organization of human body
- 1.1.2 Differentiate various medical terminologies & Anatomical terms
- 1.1.3 Identify the importance of Skeletal system and enumerate the names of different bones and the terms related
- 1.1.4 Illustrate the structure & function of CVS and to distinguish between artery, Vein, & Capillary
- 1.1.5 Collect idea about the working of heart and gain expertise in the measurement of BP and Pulse
- 1.1.6 Enumerate the significance of ECG & lymph
- 1.1.7 Explain the parts and function of Respiratory System and to differentiate types of respiration
- 1.1.8 Define Respiration rate & Vital Capacity and to describe Spirometry
- 1.1.9 Identify the Clinical importance of Sputum examination
- 1.1.10 Summarize the parts and functions of digestive system
- 1.1.11 Identify the importance of laboratory examination of faeces in GIT disorders
- 1.1.12 Recollect the parts of excretory system, parts of urinary system
- 1.1.13 Discuss about urine formation
- 1.1.14 Get awareness about normal constituents & Clinical importance of urine



- 1.1.15 Illustrate parts and functions of nervous system
- 1.1.16 Differentiate Male & Female reproductive system
- 1.1.17 Enumerate important endocrine glands and their secretions
- 1.2 Diagnostic Laboratory**
  - 1.2.1 Identify the role of Laboratory in Health Care to categorize various types & sections of laboratories
  - 1.2.2 Enumerate different types of Glass wares and to perform cleaning of Glass wares
  - 1.2.3 Practice, operation and use of common lab equipments
- 1.3 Introduction to Blood & Phlebotomy**
  - 1.3.1 Differentiate Erythropoiesis, Leucopoiesis & Thrombopoiesis
  - 1.3.2 Acquire the concept of Coagulation and to classify Anticoagulants
  - 1.3.3 Distinguish different types of Blood Collection vials
  - 1.3.4 Illustrate the sites, devices, methods and precautions and complications of blood collection and to perform phlebotomy
  - 1.3.5 Practice thin blood smear preparation and staining
  - 1.3.6 Differentiate different cell components

## Module 2

### Haematology & Blood banking techniques

#### 2.1. Haematology

On completion of the module the learner will be able to:

- 2.1.1 Summarize the role of Haematology in diagnosis
- 2.1.2 Enumerate haemoglobin estimation methods
- 2.1.3 Practice haemoglobin estimation by cyanmethaemoglobin method and evaluate its clinical significance
- 2.1.4 Identify the importance of haemocytometry and be familiar to Improved Neubauer counting chamber
- 2.1.5 Differentiate between different cell counts and evaluate their clinical significance
- 2.1.6 Practice total RBC and WBC counts
- 2.1.7 Describe Reticulocyte count
- 2.1.8 Perform Differential Leucocyte Count
- 2.1.9 Differentiate normal and abnormal blood cells, able to report normal blood picture

- 2.1.10 Illustrate the importance of PCV
  - 2.1.11 Perform PCV by Wintrobe's method
  - 2.1.12 Classify different red cell indices and their clinical significance
  - 2.1.13 Enlist the clinical importance of ESR
  - 2.1.14 Perform ESR by Westergren's method
  - 2.1.15 Discuss various coagulation tests used
  - 2.1.16 Identifies explains and practice determination of Bleeding time & Clotting time
  - 2.1.17 Differentiate PT & APTT
  - 2.1.18 Enlist the need and merits of automation in haematology
  - 2.1.19 Describe the basic principle, parts, reagents, operation and reporting of results in a Haematology Analyser
  - 2.1.20 Illustrate the terms Haemogram, CBC etc.
- 2.2. Immunohaematology & Blood banking techniques**
- 2.2.1 Differentiate Blood group Antigens & Antibodies
  - 2.2.2 Classify different sub groups in ABO & Rh Blood group system
  - 2.2.3 Explain the inheritance of Blood group and HDN
  - 2.2.4 Differentiate between different grouping methods and gain expertise in various blood grouping techniques
  - 2.2.5 Enumerate the significance of transfusion
  - 2.2.6 Differentiate Donor from Recipient and Explain Blood transfusion
  - 2.2.7 Illustrate the criteria's and different phases of Donor selection
  - 2.2.8 Describe the blood collection technique
  - 2.2.9 Enumerate the tests done for transfusion transmitted diseases
  - 2.2.10 Identify the features of Blood bank refrigerator
  - 2.2.11 Gets an overview about different blood components and storage
  - 2.2.12 Illustrate the importance of Coomb's test and its types
  - 2.2.13 Differentiate the technique of Cross matching Major & Minor, and explain its phases
  - 2.2.14 Enlist transfusion reactions

## Scheme of Work

### Module - 1

#### Anatomy, Physiology and Phlebotomy

Month	Name of units	Periods
	<b>1.1 Basic Anatomy and Physiology</b>	<b>100</b>
June	1.1.1 Organisational Structure of human body	15
June/July	1.1.2 Systemic Anatomy	85
	<b>1.2 Diagnostic Laboratory</b>	<b>100</b>
July	1.2.1 Introduction to Diagnostic laboratory	30
July/August	1.2.2 Familiarisation of Common Glass wares & Laboratory Equipments	70
	<b>1.3 Introduction to Blood &amp; Phlebotomy</b>	<b>140</b>
August	1.3.1 Blood	40
September	1.3.2 Phlebotomy	40
October	1.3.3 Familiarization of Blood cells	60
<b>Module - 2</b>		
<b>Haematology and Blood Banking Techniques</b>		
	<b>2.1 Haematology</b>	<b>240</b>
November	2.1.1 Introduction to Haematology	5
November	2.1.2 Haemoglobin estimation	25
November	2.1.3 Total Cell Count	65
December	2.1.4 Examination of Blood Smear	30
December	2.1.5 Packed cell volume	25
January	2.1.6 Erythrocyte Sedimentation Rate (ESR)	30
January	2.1.7 Test for coagulation	35
January	2.1.8 Automation in Haematology	25
	<b>2.2 Immunohaematology &amp; Blood Banking</b>	<b>100</b>
Jan./Feb.	2.2.1 Introduction	15
February	2.2.2 Blood Grouping techniques	30
February	2.2.3 Blood collection for Transfusion	25
February	2.2.4 Compatibility Testing & Issue of Blood	30

## Course structure

The curriculum of MLT Course consists of 4 modules of 6 months duration.

Module 1	Anatomy, Physiology and Phlebotomy	340 periods
Module 2	Haematology and Blood Banking Techniques	340 periods
Module 3	Clinical Biochemistry, Clinical Pathology & Histo-technology	340 periods
Module 4	Diagnostic Microbiology, Laboratory Management & Automation	340 periods

### MODULE 1

Anatomy, Physiology and Phlebotomy - 340 periods

UNIT NO.	NAME OF UNITS	PERIODS
1.1	Basic Anatomy and Physiology	100
1.2	Familiarisation of a Diagnostic Laboratory	100
1.3	Introduction to Blood, Phlebotomy	140
	<b>Total Periods</b>	<b>340</b>

### MODULE 2

Haematology & Blood banking - 340 periods

UNIT NO.	NAME OF UNITS	PERIODS
2.1	Haematology	240
2.2	Immunohaematology & Blood Banking Techniques	100
	<b>Total Periods</b>	<b>340</b>

### **Class Room Activities**

- Multi-media presentation
- Group Discussion
- Interactive Discussion
- Debate
- Seminar
- Assignment
- Magazine preparation
- Album preparation
- Chart preparation
- Poster Preparation
- Role play
- Quiz
- Survey
- Collection
- Model Preparation
- Project Preparation
- Interaction with Experts
- Preparation of Handouts
- Reference of Books

### **Practical Activities**

- Demonstration
- Case study
- Hands on experience/Experiment
- Survey
- Field study
- Field visit
- Medical Camps
- Role Play
- Health Awareness Programmes
- Health Bulletin Preparation
- Socio-drama
- Vocational Exhibitions
- School PTC

## On the Job Training

OJT enables students to practice their acquired skills in real work situation and enhance their self esteem. It provides opportunity to familiarize with sophisticated equipment and recent methodologies in medical laboratory technology. A well conducted OJT ensures competence of the students among the work force. Community involvement of the OJT contributes to the social and management skills of the student. The opportunity to interact with highly qualified professionals of the field inspires the students to higher academic achievements and motivates them to attain professional excellence.

OJT can be provided at

- Govt. Medical College Laboratories, laboratories of District, Taluk Hospitals, Community Health Centers and in Public Health Laboratories
- Laboratories attached to private hospitals, blood banks and independent clinical laboratories having standard specifications.
- Laboratories of Co-operative societies, Kudumbasree units etc.

## Certification of skills in each module

- Module 1 Certificate in Phlebotomy skill.
- Module 2 Certificate in Haematology and Blood Banking skills.
- Module 3 Certificate in Clinical Biochemistry & Clinical Pathology skills.
- Module 4 Certificate in Laboratory Management & Diagnostic Microbiology skills.

## Overview of the Module 1

Curriculum for Medical Laboratory Technology course (MLT) aims to provide knowledge and skill that make the student a complete professional in the subject. The first module of the curriculum includes Basic Anatomy & Physiology, Familiarization of a Diagnostic Laboratory, Phlebotomy techniques and preliminary knowledge about blood. The duty of a clinical laboratory is to help in the process of diagnosis by the examination of various body fluids. The analysis of specimens reveals the abnormal structural and functional status of the body during diseases. Anatomy and Physiology lessons of the module helps the students to gain enough knowledge about the normal structure and function of human body, and to distinguish conditions such as normal from abnormal or health from ill health.

The role of a diagnostic laboratory in the present scenario of health care is of prime importance due to the increase in diagnostic tools and methodologies. The second unit of this module is intended to familiarise

the student with the different types and sections of a laboratory, common laboratory glasswares and lab equipments. The study of the unit gives the student, an insight about the parts and functions of a diagnostic laboratory.

Blood is the most commonly analyzed specimen in a medical laboratory. Study of phlebotomy helps the student gain knowledge and skill of blood collection. The last unit of the module concludes with a few important aspects about the composition and cellular patterns of blood and to initiate investigations in haematology.

The remarkable characteristic of the module is the timely blending of three fundamental areas of Lab Technology and triggers curiosity in a learner to explore the deeper and wider scope of the subject.

### MODULE 1

#### Anatomy, Physiology and Phlebotomy - 340 periods

UNIT NO.	NAME OF UNITS	PERIODS
<b>1.1</b>	<b>Basic Anatomy and Physiology</b>	<b>100</b>
1.1.1	Organisational Structure of human body	15
1.1.2	Systemic Anatomy	85
<b>1.2</b>	<b>Diagnostic Laboratory</b>	<b>100</b>
1.2.1	Introduction to Diagnostic laboratory	30
1.2.2	Familiarisation of Common Glass wares & Laboratory Equipments	70
<b>1.3</b>	<b>Introduction to Blood &amp; Phlebotomy</b>	<b>140</b>
1.3.1	Blood	40
1.3.2	Phlebotomy	40
1.3.3	Familiarization of Blood cells	60
	<b>Total Periods</b>	<b>340</b>

Unit No. 1.1 - Basic Anatomy & Physiology

DETAILED ELEMENTS OF UNIT

Ideas/Concepts/Skill	Learning Outcomes	Suggested Activities	Assessment
<p><b>Organisational Structure of Human body</b></p> <ul style="list-style-type: none"> <li>• Familiarisation of cell, Tissue, organ and Organ system Definition &amp; their relationship</li> <li>• Tissue types (Name only)</li> <li>• Organ system (Name only)</li> <li>• Familiarization of Common terms</li> <li>• Anatomy</li> <li>• Physiology</li> <li>• Cytology</li> <li>• Histology</li> <li>• Pathology-Histopathology</li> <li>• Anatomical Position &amp; Terms (Anterior, Posterior, Medial, Lateral, Proximal, Distal, Central &amp; Peripheral)</li> </ul> <p><b>SKILLS</b></p> <ul style="list-style-type: none"> <li>• Observation</li> <li>• Composition</li> <li>• Differentiation</li> <li>• Discrimination</li> <li>• Comparison</li> </ul> <p><b>Systemic Anatomy</b></p> <ul style="list-style-type: none"> <li>• Skeletal system</li> <li>• Functions</li> <li>• Bones of Axial &amp; Appendicular skeleton (Name only)</li> <li>• Terms-Cartilages joints, Osteology, Arthrology</li> </ul>	<ul style="list-style-type: none"> <li>• Identify the basic level of organization of human body</li> <li>• Differentiate various medical terminologies &amp; Anatomical terms</li> <li>• Identify the importance of Skeletal system and familiarize the names of different bones &amp; the terms related</li> </ul>	<ul style="list-style-type: none"> <li>• Multi-media presentation</li> <li>• Brain storming</li> <li>• Model Preparation</li> <li>• Chart Preparation</li> <li>• Chart preparation</li> <li>• Poster Preparation on definitions</li> <li>• Quiz</li> <li>• Recall Previous Knowledge</li> <li>• Demonstration</li> <li>• Multi-media Presentation</li> </ul>	<ul style="list-style-type: none"> <li>• Questionnaire</li> <li>• Evaluation of Chart &amp; Models</li> <li>• Evaluation of Chart and Posters</li> <li>• Questionnaire Spotting</li> </ul>



Unit No. 1.1 - Basic Anatomy & Physiology				
DETAILED ELEMENTS OF UNIT	Ideas/Concepts/Skill	Learning Outcomes	Suggested Activities	Assessment
<ul style="list-style-type: none"> <li> <b>Circulatory System</b>                      Cardio vascular system                      Difference between artery , vein and capillary                      Structure of heart in brief                      Chambers, Valves &amp; Blood vessels (Name only)                      Systole, Diastole &amp; Cardiac cycle                      Measurement of BP and Pulse                      ECG - definition and importance                      Lymphatic system in brief                      Familiarize Lymph  <b>Respiratory system</b>                      Overview (Name of parts &amp; function)                      Types of respiration                      Normal respiration rate (Definition &amp; Normal value)                      Spirometer-use                      Vital capacity                      Definition &amp; Normal Value                      Clinical importance of Sputum  <b>Digestive system</b>                      Overview (Name of Parts &amp; function)                      Liver and Pancreas - Importance, Secretions (Name only) &amp; function                      Clinical importance of Faeces in brief                 </li> </ul>	<ul style="list-style-type: none"> <li>                     Illustrate the structure &amp; function of CVS and learn to distinguish between artery, Vein, &amp; Capillary                 </li> <li>                     Collects idea about the working of heart and gains expertise in the measurement of BP and Pulse                      Enumerates the significance of ECG &amp; lymph                 </li> <li>                     Explain the parts &amp; Function of Respiratory System and learns to differentiate types of respiration                      Define Respiration rate &amp; Vital Capacity and to familiarize Spirometer                 </li> <li>                     Identify the clinical importance of Sputum                      Summarize the parts and functions of digestive system                      Identify the importance of laboratory examination of faeces in GIT disorders                 </li> </ul>	<ul style="list-style-type: none"> <li>                     Illustration                      Demonstration                 </li> <li>                     Multi-media Presentation                      Demonstration                      Practical Work                      Multi-media Presentation                      Demonstration                      Field visit                      Multi-media Presentaion                      Brain storming                 </li> <li>                     Discussion                      Field visit                 </li> <li>                     Discussion                 </li> <li>                     Recall Previous Knowledge                      Multi-media Presentation                 </li> </ul>	<ul style="list-style-type: none"> <li>                     Participation in discussion                      Quality of work                 </li> <li>                     Performance evaluation                      Logbook entry                      Questionare participation                      Participation                 </li> <li>                     Participation in discussion                 </li> <li>                     Recording                      Quiz                 </li> </ul>	

Unit No. 1.1 - Basic Anatomy & Physiology

DETAILED ELEMENTS OF UNIT

Ideas/Concepts/Skill	Learning Outcomes	Suggested Activities	Assessment
<p><b>Excretory system</b></p> <ul style="list-style-type: none"> <li>• Modes of excretion (specify names)</li> <li>• Urinary system-Mention parts and function</li> <li>• Formation of urine (name of steps only)</li> <li>• Normal Constituents of Urine</li> <li>• Clinical importance of Urine in brief</li> </ul> <p><b>Nervous system</b></p> <ul style="list-style-type: none"> <li>• Name of Parts &amp; function- CNS &amp; PNS</li> <li>• CSF and its Clinical importance in brief</li> </ul>	<ul style="list-style-type: none"> <li>• Recollect the parts of excretory system, parts of urinary system</li> <li>• Discuss about urine formation</li> <li>• Get awareness about normal constituents &amp; Clinical importance of urine</li> </ul>	<ul style="list-style-type: none"> <li>• Recall Previous Knowledge</li> <li>• Multi-media Presentation</li> <li>• Distribution of handouts &amp; reports</li> <li>• Discussion</li> <li>• Chart preparation</li> </ul>	<ul style="list-style-type: none"> <li>• Participation in discussion</li> <li>• Conceptual understanding</li> <li>• Evaluation of chart</li> </ul>
<p><b>Reproductive system</b></p> <ul style="list-style-type: none"> <li>• Parts &amp; Function of Male Reproductive system</li> <li>• Parts &amp; Function of Female Reproductive system</li> </ul> <p><b>Endocrine system</b></p> <ul style="list-style-type: none"> <li>• Overview</li> <li>• Endocrine glands</li> <li>• Hormones of clinical importance and their functions (Pituitary, Thyroid, Adrenal, Pancreas &amp; Gonads)</li> </ul>	<ul style="list-style-type: none"> <li>• Illustrate the parts and functions of nervous system</li> <li>• Differentiate male &amp; Female reproductive system</li> <li>• Enumerate important endocrine glands and their secretions</li> </ul>	<ul style="list-style-type: none"> <li>• Recall Previous Knowledge</li> <li>• Multi-media Presentation</li> <li>• Recall Previous Knowledge</li> <li>• Multi-media Presentation</li> <li>• Discussion</li> <li>• Multi-media presentation</li> <li>• Chart preparation</li> </ul>	<ul style="list-style-type: none"> <li>• Short note</li> <li>• Participation in discussion</li> <li>• Conceptual understanding</li> <li>• Quality of charts</li> </ul>
<p><b>SKILLS</b></p> <ul style="list-style-type: none"> <li>• Observation</li> <li>• Discrimination</li> <li>• Differentiation</li> <li>• Chart Preparation</li> <li>• Comparison</li> <li>• Recording</li> <li>• Classifying</li> <li>• Performance</li> <li>• Drawing</li> </ul>			

DETAILED ELEMENTS OF UNIT		Unit 1.2 Diagnostic Laboratory	
Ideas/Concepts/Skill	Learning Outcomes	Suggested Activities	Assessment
<p><b>Introduction</b></p> <ul style="list-style-type: none"> <li>• Significance of Medical Laboratory technology</li> <li>• Types of Laboratories</li> <li>• Sections of a Laboratory</li> </ul> <p><b>SKILLS</b></p> <ul style="list-style-type: none"> <li>• Analysing</li> <li>• Comparison</li> <li>• Communication</li> <li>• Data Collection</li> </ul> <p><b>Common Laboratory glasswares &amp; Equipments</b></p> <ul style="list-style-type: none"> <li>• Glass wares &amp; its uses</li> <li>• Cleaning of Glasswares- Chromic acid solution</li> <li>• Common Laboratory Equipments- Operation, Use of Microscope Centrifuge</li> <li>• Colorimeter</li> <li>• Micropipette</li> <li>• Chemical Balance</li> <li>• Water bath</li> </ul> <p><b>SKILLS</b></p> <ul style="list-style-type: none"> <li>• Observation</li> <li>• Composition</li> <li>• Differentiation</li> <li>• Discrimination</li> <li>• Comparison</li> </ul>	<ul style="list-style-type: none"> <li>• Identify the role of Laboratory in Health care and to categorize various types and sections of laboratories</li> <li>• Enumerate different types of Glasswares and to perform cleaning of Glasswares</li> <li>• Practice operation &amp; use of common lab equipments</li> </ul>	<ul style="list-style-type: none"> <li>• Discussion</li> <li>• Field Visit</li> <li>• Role Play</li> <li>• Multi-media presentation</li> <li>• Survey</li> <li>• Discussion</li> <li>• Demonstration</li> <li>• Practical Work</li> <li>• Discussion</li> <li>• Demonstration</li> <li>• Practical Work</li> </ul>	<ul style="list-style-type: none"> <li>• Participation in discussion</li> <li>• Conceptual Understanding</li> <li>• Evaluation of Charts &amp; Assignments</li> <li>• Survey reports</li> <li>• Participation in discussion</li> <li>• Performance Evaluation</li> <li>• Participation in discussion</li> <li>• Performance Evaluation</li> </ul>

**Unit Detailing**

**Module 1 : DETAILED ELEMENTS OF UNIT Unit : 1.3 INTRODUCTION TO BLOOD & PHLEBOTOMY**

<b>Ideas/Concepts/Skill</b>	<b>Learning Outcomes</b>	<b>Suggested Activities</b>	<b>Assessment</b>
<p><b>Blood</b> Introduction - formation of Blood Erythropoiesis, Leucopoiesis, Thrombopoiesis - Definition only</p> <p>Composition of blood-Plasma, Formed elements Blood coagulation Definition, Name the coagulation factors - Major steps Difference between Plasma &amp; Serum Anticoagulants - Definition, common anticoagulants, colour coding Preparation of EDTA Anticoagulant bottle</p> <p><b>SKILLS</b> Classification Differentiation Comparison Acquisition Prediction</p>	<ul style="list-style-type: none"> <li>• Differentiate Erythropoiesis, Leucopoiesis &amp; Thrombopoiesis,</li> <li>• Acquire the concept of Components of blood, Coagulation &amp; Anticoagulants</li> <li>• Distinguish different types of Blood Collection vials</li> </ul>	<ul style="list-style-type: none"> <li>• Assignment</li> <li>• Chart preparation</li> <li>• Discussion</li> <li>• Multi-media presentation</li> <li>• Discussion</li> <li>• Seminar</li> <li>• Demonstration</li> <li>• Practical</li> </ul>	<ul style="list-style-type: none"> <li>• Participation in discussion</li> <li>• Quality of Charts &amp; Evaluation of Assignment</li> <li>• Questionnaire</li> <li>• Participation</li> <li>• Acquisition of skills</li> </ul>

**Unit Detailing**

**Module 1 : DETAILED ELEMENTS OF UNIT Unit : 1.3 INTRODUCTION TO BLOOD & PHLEBOTOMY**

<b>Ideas/Concepts/Skill</b>	<b>Learning Outcomes</b>	<b>Suggested Activities</b>	<b>Assessment</b>
<p><b>Phlebotomy</b></p> <ul style="list-style-type: none"> <li>● Definition</li> <li>● Methods - Capillary, Arterial &amp; Venous</li> <li>● Site of Collection</li> <li>● Procedure - Capillary &amp; Venous Puncture</li> <li>● Precautions during collection of Blood</li> <li>● Complications during blood collection</li> </ul> <p><b>SKILLS</b></p> <ul style="list-style-type: none"> <li>● Observation</li> <li>● Acquisition</li> <li>● Communication</li> </ul> <p><b>Familiarization of Blood cells</b></p> <ul style="list-style-type: none"> <li>● Preparation of Thin blood smear</li> <li>● Ideal blood smear characteristics</li> <li>● Factors affecting smear preparation</li> <li>● Leishman stain - staining technique,</li> <li>● Blood cell types - RBC, WBC, Platelets</li> <li>● Classification of White blood cells.</li> </ul> <p><b>SKILLS</b></p> <ul style="list-style-type: none"> <li>● Observation</li> <li>● Comparison</li> <li>● Differentiation</li> <li>● Chart Preparation</li> </ul>	<ul style="list-style-type: none"> <li>● Illustrate the sites, devises, methods precautions and complications of blood collection and to perform phlebotomy</li> </ul> <ul style="list-style-type: none"> <li>● Practice thin blood smear preparation and staining</li> <li>● Differentiate different cell components</li> </ul>	<ul style="list-style-type: none"> <li>● Demonstration</li> <li>● Practical Work</li> </ul> <ul style="list-style-type: none"> <li>● Demonstration</li> <li>● Practical</li> <li>● Demonstration</li> <li>● Chart preparation</li> </ul>	<ul style="list-style-type: none"> <li>● Performance Evaluation</li> </ul> <ul style="list-style-type: none"> <li>● Performance evaluation</li> <li>● Quality of chart given -it contain identifying characters of blood cells</li> </ul>

## Practical Activities of Module 1

- 1.1 Anatomy, Physiology & Phlebotomy
- 1.2 Basic Anatomy and Physiology
  1. Measurement of Blood Pressure and Pulse
- 1.2 Diagnostic Laboratory
  1. Familiarisation and use of Common Laboratory Glass wares
  2. Cleaning of Glass wares
  3. Preparation & Use of Chromic acid solution
  4. Use & Care of Compound Microscope
  5. Use & Care of Colorimeter
  6. Use & Care of Chemical Balance
- 1.3 Introduction to Blood & Phlebotomy
  1. Preparation of Normal saline
  2. Behaviour of RBCs in Isotonic saline, hypotonic and hypertonic saline solutions
  3. Preparation of EDTA Anticoagulant bottles
  4. Preparation of 3.8% Sodium citrate solution
  5. Capillary blood collection
  6. Venous blood collection
- 1.4 Familiarisation of Blood cells
  1. Preparation of Thin Blood smear
  2. Leishman's Staining & Familiarisation of blood Cells

### List of expected skills on completion of module 1

1. Gain precision in measurement of blood pressure and pulse.
2. Gain expertise in proper care and use of a compound microscope.
3. Acquire knowledge about handling and operation of instruments like colorimeter, centrifuge and water bath.
4. Identify and differentiate the various laboratory glass wares and how to keep them clean.
5. Attain mastery in the art of Phlebotomy.
6. Distinguish various blood cells through the study of a stained blood smear.

## Over view of module II

### HAEMATOLOGY AND BLOOD BANKING

The second module of the Curriculum comprises Haematology and immunohaematology, which are the most practice oriented branches of laboratory medicine. The haematology laboratory of a healthcare system is concerned with the diagnosis and monitoring of diseases of the blood. Lab technicians working in a haematology laboratory perform an array of blood tests that investigate the cellular elements of blood and also other constituents like haemoglobin. Morphology and physiology of blood cells are assessed in diseases through haemocytometry and Blood smear examination. Practical training in this module covers all these basic level of investigations even though by manual methods. This will provide the learner an opportunity to use state of the art technology to investigate disease, and use traditional technologies such as manual cell counts and light microscopy. Apart from the diagnosis of abnormalities like leukaemia, anaemia, coagulation disorders etc., haematological investigations help in the diagnosis of diseases of other body systems which may not be directly related to blood or bone marrow. Working as a member of a team, technician will be required to use their training to work in a variety of healthcare environments. This is achieved through the learning of basics of blood and lab management in the first module, 'Timely arranged field visits and thorough 'On the job training programme',

Blood banking, the process of collecting (donation), testing, processing, and storing blood for later use (transfusion), is a cornerstone of emergency and surgical medicine and ensures the safe use of blood and its components. The limitation to provide rigorous training in blood banking is overcome by achieving the expected skill through field visits and OJT in this special area.

**MODULE 2****Haematology & Blood banking techniques - 340 periods**

<b>UNIT NO.</b>	<b>NAME OF UNITS</b>	<b>PERIODS</b>
<b>2.1</b>	<b>Haematology</b>	<b>240</b>
2.1.1	Introduction to Haematology	5
2.1.2	Hemoglobin estimation	25
2.1.3	Total Cell Count	65
2.1.4	Examination of Blood Smear	30
2.1.5	Packed cell volume	25
2.1.6	Erythrocyte Sedimentation Rate (ESR)	30
2.1.7	Test for coagulation	35
2.1.8	Automation in Haematology	25
<b>2.2</b>	<b>Immunohaematology &amp; Blood Banking</b>	<b>100</b>
2.2.1	Introduction	15
2.2.2	Blood Grouping techniques	30
2.2.2	Blood collection for Transfusion	25
2.2.3	Compatibility Testing & Issue of Blood	30
	<b>Total Periods</b>	<b>340</b>



Module 2 : Haematology & Blood banking techniques Unit 2.1: HAEMATOLOGY

Ideas/Concepts/Skill	Learning Outcomes	Suggested Activities	Assessment
<p><b>Introduction to Haematology</b></p> <ul style="list-style-type: none"> <li>• Haematology - Definition</li> <li>• Role of haematological techniques in diagnosis</li> </ul> <p><b>Hemoglobin estimation</b></p> <ul style="list-style-type: none"> <li>• Introduction</li> <li>• Methods</li> <li>• Cyanmethaemoglobin estimation in detail</li> <li>• Clinical significance</li> </ul> <p><b>SKILLS:</b></p> <ul style="list-style-type: none"> <li>• Observation</li> <li>• Performance</li> <li>• Comparison</li> <li>• Reporting</li> </ul> <p><b>Total Cell Counts</b></p> <ul style="list-style-type: none"> <li>• Introduction</li> <li>• Counting chamber - Improved Neubauer</li> <li>• Total Cell counts-RBC , WBC, Platelet, Abs.eosinophil</li> <li>• Diluting fluid, Procedure, calculation, normal value, clinical significance</li> <li>• Reticulocyte count- brief description</li> </ul> <p><b>SKILLS:</b></p> <ul style="list-style-type: none"> <li>• Observation</li> <li>• Performance</li> <li>• Identification</li> <li>• Reporting</li> <li>• Chart Preparation</li> </ul>	<ul style="list-style-type: none"> <li>• Summarise the role of Haematology in diagnosis</li> <li>• Enumerate different haemoglobin estimation methods</li> <li>• Practice haemoglobin estimation by cyan methaemoglobin method and evaluate its clinical significance</li> <li>• Identify the importance of haemocytometry and familiarize Improved Neubauer counting chamber</li> <li>• Differentiate between different cell counts and evaluate their clinical significance</li> <li>• Practice total RBC and WBC counts</li> <li>• Describe Reticulocyte count</li> </ul>	<ul style="list-style-type: none"> <li>• Discussion</li> <li>• Chart preparation</li> <li>• Practicals</li> <li>• Organising Camps</li> <li>• Discussion</li> <li>• Demonstration</li> <li>• Chart preparation</li> <li>• Assignment</li> <li>• Practical</li> <li>• Multi-media presentation</li> </ul>	<ul style="list-style-type: none"> <li>• Participation in discussion</li> <li>• Performance evaluation</li> <li>• Participation</li> <li>• Questionnaire</li> <li>• Performance evaluation</li> </ul>

Ideas/Concepts/Skill	Learning Outcomes	Suggested Activities	Assessment
<p><b>Examination of Blood Smear</b></p> <ul style="list-style-type: none"> <li>Differential Leucocyte Count</li> <li>Thin blood smear preparation, staining, Counting and reporting</li> <li>Peripheral Smear Examination               <ul style="list-style-type: none"> <li>Abnormal RBC- size, shape, clour</li> <li>Abnormal WBC - general characteristics of Immature cells</li> <li>Platelets- arrangement</li> <li>Inclusion bodies - RBC, Parasites</li> </ul> </li> </ul> <p><b>SKILLS:</b></p> <ul style="list-style-type: none"> <li>Discrimination</li> <li>Differentiation</li> <li>Reporting</li> </ul> <p><b>Packed cell volume</b></p> <ul style="list-style-type: none"> <li>Methods</li> <li>Wintrobe's method</li> <li>- procedure, Normal value, clinical significance</li> <li>Red cell indices               <ul style="list-style-type: none"> <li>MCV, MCH, MCHC,</li> <li>Clinical Significance</li> </ul> </li> </ul> <p><b>SKILLS:</b></p> <ul style="list-style-type: none"> <li>Observation</li> <li>Experimentation</li> <li>Comparison</li> <li>Reporting</li> </ul> <p><b>Erythrocyte Sedimentation Rate (ESR)</b></p> <ul style="list-style-type: none"> <li>Methods</li> <li>Stages of ESR</li> <li>Factors affecting ESR</li> <li>Westergren's method</li> <li>- procedure, Normal value, clinical significance</li> </ul> <p><b>SKILLS:</b></p> <ul style="list-style-type: none"> <li>Analysing</li> <li>Observation</li> <li>Differentiation</li> <li>Reporting</li> </ul>	<ul style="list-style-type: none"> <li>Perform Differential Leucocyte count</li> <li>Differentiate normal And abnormal blood cells, able to report normal blood picture</li> </ul> <ul style="list-style-type: none"> <li>Illustrate the importance of PCV</li> <li>Perform PCV by Wintrobe's method</li> <li>Differentiate different red cell indices and explain their clinical significance</li> </ul> <ul style="list-style-type: none"> <li>Enlist the clinical importance of ESR</li> <li>Perform ESR by Westergren's method</li> </ul>	<ul style="list-style-type: none"> <li>Practical</li> <li>Demonstration</li> <li>Multi-media presentation</li> </ul> <ul style="list-style-type: none"> <li>Practical</li> <li>Assignment</li> </ul> <ul style="list-style-type: none"> <li>Assignment</li> <li>Practicals</li> </ul>	<ul style="list-style-type: none"> <li>Performance evaluation</li> <li>Participation</li> <li>Performance evaluation</li> </ul> <ul style="list-style-type: none"> <li>Performance evaluation</li> </ul>

Ideas/Concepts/Skill	Learning Outcomes	Suggested Activities	Assessment
<p><b>Test for coagulation</b></p> <ul style="list-style-type: none"> <li>• Introduction - relevance, enlist various coagulation tests</li> <li>• Bleeding Time - methods, clinical significance - procedure, Normal value of Duke's method</li> <li>• Clotting Time-methods, clinical significance</li> <li>• procedure, Normal value of Capillary tube method</li> <li>• Prothrombin Time-brief description</li> <li>• APTT-brief description</li> </ul> <p><b>SKILLS:</b></p> <ul style="list-style-type: none"> <li>• Acquisition</li> <li>• Comparison</li> <li>• Observation</li> <li>• Prediction</li> </ul> <p><b>Automation in Haematology</b></p> <ul style="list-style-type: none"> <li>• Introduction-need and advantage</li> <li>• Working principle</li> <li>• Light scatter, laser, electrical impedance</li> <li>• Parts of a Haematology analyser</li> <li>• Reagents - Diluent, Lyse, Rinse</li> <li>• Methodology</li> <li>• Parameters</li> <li>• Familiarization of terms - haemogram, histogram, CBC</li> </ul> <p><b>SKILLS:</b></p> <ul style="list-style-type: none"> <li>• Observation</li> <li>• Understanding</li> <li>• Comparison</li> <li>• Differentiation</li> <li>• Reporting</li> </ul>	<ul style="list-style-type: none"> <li>• Discuss various coagulation tests used</li> <li>• Identifies and explains determination of Bleeding time &amp; Clotting time</li> <li>• Differentiate PT &amp; APTT</li> </ul> <ul style="list-style-type: none"> <li>• Enlist the need and merits of automation in haematology</li> <li>• Describe basic principle, parts, reagents, operation and reporting of results in a Haematology Analyser.</li> <li>• Illustrate the terms CBC, Haemogram</li> </ul>	<ul style="list-style-type: none"> <li>• Discussion</li> <li>• Recalling previous Knowledge</li> <li>• Practical</li> <li>• Multi-media Presentation</li> <li>• Field visit</li> </ul> <ul style="list-style-type: none"> <li>• Field visit</li> <li>• Multi-media presentation</li> </ul>	<ul style="list-style-type: none"> <li>• Performance evaluation</li> <li>• Participation in discussion</li> <li>• Performance evaluation</li> </ul> <ul style="list-style-type: none"> <li>• Report evaluation</li> </ul>

**Unit Detailing**

**Module 2 : Haematology & Blood banking techniques**

**Unit 2.2 IMMUNO HAEMATOLOGY & BLOOD BANKING**

Ideas/Concepts/Skill	Learning Outcomes	Suggested Activities	Assessment
<p><b>Introduction</b></p> <ul style="list-style-type: none"> <li>Immunohaematology - Definition, Historical Aspects</li> <li>Blood group antigens &amp; Antibodies</li> <li>Blood group system</li> <li>ABO &amp; Rh System in detail</li> <li>Other blood group systems anem only</li> <li>Bombay blood group</li> <li>Inheritance of Blood group</li> <li>Haemolytic disease of Newborn</li> </ul> <p><b>Blood Grouping techniques</b></p> <ul style="list-style-type: none"> <li>Cell grouping &amp; Serum grouping</li> <li>Slide &amp; Tube method - Procedure</li> <li>Mention Tile method</li> </ul> <p><b>Blood collection for Transfusion</b></p> <ul style="list-style-type: none"> <li>Transfusion-Definition,Need</li> <li>Donor, Recipient-Definition</li> <li>Donor screening</li> <li>Donor selection criteria</li> <li>History of Donor &amp; Medical examination</li> <li>Blood collection Technique-</li> <li>Blood bag, Anticoagulants</li> <li>Screening tests for Transfusion transmitted diseases</li> <li>Storage - Blood bank refrigerator</li> <li>Blood Components</li> <li>Mention components name &amp; its storage, use</li> </ul> <p><b>Compatibility Testing &amp; Issue of Blood</b></p> <ul style="list-style-type: none"> <li>Coomb's Test - Direct &amp; Indirect</li> <li>Cross matching</li> <li>Major &amp; Minor- mention 3 phases</li> <li>Issue of Blood</li> <li>Transfusion reactions (Name only)</li> </ul>	<ul style="list-style-type: none"> <li>Recognize immune haematological concepts and differentiate Blood group antigens &amp; Antibodies</li> <li>Classify different sub groups in ABO &amp; Rh Blood group system</li> <li>Explain the inheritance of Blood group and HDN</li> </ul> <ul style="list-style-type: none"> <li>Differentiate between different grouping methods and gain expertise in various blood grouping techniques</li> <li>Enumerate the significance of transfusion</li> <li>Collect concepts about Donor, Recipient and Blood transfusion</li> <li>Illustrate the criteria's and different phases of Donor selection</li> <li>Describe blood collection technique</li> <li>Enumerate tests done for transfusion transmitted diseases</li> <li>Identify the features of Blood bank refrigerator</li> <li>Enlist different blood components and their storage</li> </ul> <ul style="list-style-type: none"> <li>Illustrate the importance of Coombs test and its types</li> <li>Differentiate the technique of Major &amp; Minor Cross matching and explain its phases</li> <li>Enlist transfusion reactions</li> </ul>	<ul style="list-style-type: none"> <li>Multi-media presentation</li> <li>Chart preparation</li> <li>Discussion</li> </ul> <ul style="list-style-type: none"> <li>Demonstration</li> <li>Practical</li> <li>Organizing &amp; Participating in the blood group camps</li> <li>Brain storming</li> <li>Field visit</li> <li>Demonstration</li> <li>Field visit</li> <li>Field visit</li> <li>Field visit</li> <li>Field visit</li> </ul>	<ul style="list-style-type: none"> <li>Quality of charts</li> <li>Questionnaire</li> </ul> <ul style="list-style-type: none"> <li>Performance evaluation</li> <li>Participation in the camp</li> </ul> <ul style="list-style-type: none"> <li>Report evaluation</li> <li>Report evaluation</li> <li>Report evaluation</li> <li>Report evaluation</li> <li>Report evaluation</li> </ul> <ul style="list-style-type: none"> <li>Report evaluation</li> </ul>

## List of Practical Activities of MODULE 2

### Haematology & Blood banking techniques

#### 2.1 Haematology

1. Estimation of Haemoglobin by Cyanmethaemoglobin method
2. Familiarisation of Counting Chamber
3. Preparation of Tuerk's Fluid
4. Total W.B.C count
5. Total R.B.C count
6. Platelet count
7. Differential Leucocyte Count
8. Peripheral smear examination-Demonstration of Abnormal blood cells & Reporting of Normal blood smear
9. Packed cell Volume-Wintrobe's method
10. Erythrocyte Sedimentation Rate-Westergren's method
11. Bleeding Time method-Duke's method
12. Clotting Time method-Capillary tube method

#### 2.2 Immunohaematology & Blood banking

1. ABO Grouping-Slide method
2. ABO Grouping-Tube method
3. Compatibility testing

List of expected skills on completion of module 2.

The learner is expected to achieve the following skills at the end of module 2.

1. Gain expertise in performing various haematological investigations
2. Be Familiar with haematology analysers and examine the advantages of automation in haematology
3. Gain expertise in performing blood grouping techniques by different methodologies
4. Be Familiar with the procedures, investigations and working of a blood bank from blood grouping till the issuing of blood

### List of Tools, Equipment and materials

#### Module 1

- |                  |       |
|------------------|-------|
| 1. BP Apparatus  | 5 no. |
| 2. Stethoscope   | 5 no. |
| 3. Laptop        | 1 no  |
| 4. LCD Projector | 1 no. |

5. Models and Chart of organ systems of human body
6. Chart showing phlebotomy sites 1 no.
7. Multi-media presentations
8. Permanent slides of cell, tissues
9. Laboratory glassware
 

Test tube	Conical Flask
Standard Flask	Measuring Cylinder
Pipettes	Beaker
Funnel	Centrifuge tube
Reagent Bottle	Dropper bottle
Wash bottle	Glass rod
Watch glass	
10. Chemical balance 1 no.
11. Medical Microscope 12 nos.
12. Cedar wood Oil 250 ml
13. Centrifuge 1 no
14. Micropipette (fixed 1000 micro litre) 1no.
15. Micropipette (Variable 100-1000 micro litre) 1no.
16. Micropipette (Variable 5-50 micro litre) 1no.
17. Water bath 1no.
18. Needle Destroyer 1no.
19. Photoelectric Colorimeter 2 no.
20. Cuvette 6 no.
21. Bunsen Burner 6 Nos.
22. Rubber teets 1 dozen
23. Vacutainer tubes (With different anticoagulants) 1/2 dozen
24. Disposable Gloves 1 box
25. Lancet (1 x 200) 1 box
26. Disposable Syringe and needle (5ml) (1 x 100) 1box
27. Cotton 1 Roll
28. Tourniquet 6 nos.
29. Glass slides 5 packets
30. Microscopic coverglass 5 packets
31. Spreader slide ½ dozen
32. Spirit 500 ml
33. EDTA powder 500 gm

34.	Leishman stain (1X250 ml)	2 bottle
35.	Potassium Dichromate	500 gm
36.	Con. Sulphuric Acid	500ml
37.	Distilled Water	5 litre
38.	Sodium Chloride	500 gm
39.	Tri Sodium Citrate	500 gm

### Module 2

1.	Drabkins Solution with Hb Standard	1000 ml
2.	Improved Neubauer Counting chamber	6 nos.
3.	Counting chamber Cover Glass	1 Packet
4.	RBC diluting fluid	125ml
5.	Methylene Blue	125ml
6.	Glacial Acetic acid	500ml
7.	Distilled Water	5 Litres
8.	Eosinophil diluting fluid	125ml
9.	Platelet Diluting fluid	125ml
10.	Wintrobe's tube	12 Nos.
11.	Pasteur pipette	1 Packet
12.	Westergren's pipette	12 Nos.
13.	Westergren's stand	5 Nos.
14.	Capillary tube	4 Packet
15.	Filter paper no.10	6 Packet
16.	Antisera A,B & D	1 x 10ml each
17.	White Porcelain Tile	1 No.
18.	Blood bag- Single, Double & Triple bags	1 No.
19.	Coomb's Serum	2ml
20.	Chart showing Abnormal blood cell	1 No.
21.	Chart showing blood Group interpretation	1 no.

### Reference books

#### Module 1

1. Ross and Wilson Anatomy and Physiology in health and illness by Kathleen J W Wilson- Churchill Livingstone
2. Sear's Anatomy and Physiology for Nurses by RS Winwood, J L Smith-ELBS
3. Human Physiology by C Chatterjee

4. Review of Medical Physiology by William F Ganong
5. Text book of Physiology by SharadaSubramanyam & Dr. K Madhavankutty
6. Text book of Medical Laboratory Technology By Praful B Godkar
7. Medical Laboratory Technology by Kanai L Mukharjee
8. Clinical Diagnosis and Management by laboratory methods Henry Bernard J Sanford T & Davidson
9. Practical Haematology by Dacies and Lewis

## Module 2

1. Text book of Medical Laboratory Technology By Praful B Godkar
2. Medical Laboratory Technology by Kanai L Mukharjee
3. Clinical Dignosis and Lab Management by Henry Bernard J Sanford T & Davidson
4. Practical Haematology by Dacies and Lewis
5. Principles and Practice of transfusion Medicine by Dr. R N Makroo
6. Text book of Medical Laboratory Technology By Praful B Godkar
7. Medical Laboratory Science, Theory and Practical by J Ochei & Kolhatkar
8. Text book of Laboratory Medicine, by V H Talib
9. Hand book of Laboratory Technology by Scott

## Detailed Unit Analysis

### Overview of the Unit

Anatomy and physiology has prime importance in the curriculum of medical sciences. The first unit of the first module for MLT curriculum is dedicated to Basic Anatomy & Physiology and offer learning the structure and function of human body, but not in a much detailed way. Knowledge about the normal structure and function help the student to differentiate diseased condition from healthy state. Human Anatomy and physiology being a much vast and deeper subject, is difficult to be dealt in a basic programme like VHSE. Hence this unit is designed in such a way that both the subjects are exposed to the student with less room for detailed discussions. In this combined topic, necessary weightage has been ensured in relevant areas

The unit mainly discusses two aspects. The first part deals with the role of anatomy and physiology in laboratory technology and familiarization of common anatomical terms. This is expected to provide a new insight about the subject and awareness, how this knowledge will be beneficial in their profession.



During the second part all major body systems are discussed briefly. The knowledge gained earlier by the students about human body will definitely make the learning much easier and interesting. More over the curiosity of learners about human body, Its numerous functions and systems, maintain the interest of a student till the completion of unit.

### List of Expected Skills

- Observation
- Drawing
- Performance
- Discrimination
- Differentiation
- Management
- Understanding
- Identification
- Analysing

## Module 1 Unit 1.1 Basic anatomy & Physiology

### 1.1.1. Chapter 1 Organizational set up of Human body

#### Concept 1

Familiarization of Cell, Tissue, Organ & Organ system

#### *Activity Suggested:*

Discussion & Multi-media presentation

Mentor initiates a general discussion after showing a video clipping

Preparation of Chart/Poster/Models

#### *Points to be discussed:*

Terms - cell, tissue, organ

Names of various systems of the body

#### *Consolidation:*

The fundamental unit of life is cell

Organizational set up of living body

#### Concept 2

Familiarization of Common terms

Anatomical Position & Anatomical Terms

#### *Activity Suggested:*

Poster preparation, Chart preparation

Discussion about the different branches of sciences, deals with the study of human body and their relevance

*Points to be discussed:*

What is Anatomy, Physiology, Cytology, Histology, Pathology-Histopathology

Common terms used to locate the position of different organs in the human body with respect to anatomical position such as anterior, posterior, medial, lateral, proximal, distal, superior, inferior.

*Consolidation:*

Understand the different terms used to study the structure of human body.

Identifies the location of different organs using terms with respect to anatomical position.

**Chapter 2 Systemic Anatomy****Concept 1****Skeletal System***Activity Suggested:*

Recall the previous knowledge & Demonstration using models  
Discussion about Skeletal system by demonstration of a model of human skeleton

*Points to be discussed:*

System Overview-General function, Familiarization of bones, Osteology, Cartilage & Joints- Arthrology

*Consolidation:*

Different bones of the human body which provide a structural frame work and helps in movement.

Study of bone-Osteology

Study of Joints-Arthrology

**Concept 2****Cardiovascular system***Activity Suggested:*

Illustration & Practical work

Discussion with illustration of Diagram of Heart, demonstrates the technique of Blood pressure measurement technique

*Points to be discussed:*

System overview, Function

Difference between artery, vein and capillary

Cardiac cycle

Measurement of Blood Pressure & Pulse

ECG-definition and importance

Discuss about Lymph

*Consolidation:*

Cardio-vascular system consists of central pumping organ Heart and numerous blood vessels to circulate the blood through various parts of the body.

Understand the importance of ECG and know about lymph

*Assigned activity:*

Measurement of Blood Pressure & Pulse

### Concept 3

Respiratory system

*Activity Suggested:*

Brain storming & Multimedia presentation

Mentor started a brain storming session with students about the structure functions of Respiratory system and conclude with a video clipping

*Points to be discussed:*

Parts of Respiratory system

What is Respiration and its types

What do you mean by Respiratory rate & Vital capacity

Importance of spirometer

Clinical importance of Sputum

*Consolidation:*

Mention Respiratory system parts includes nose, pharynx, larynx, trachea, bronchi & lungs

Respiration - Inspiration & Expiration

Know Respiratory rate, Vital capacity & spirometer

Importance of Lab examination of sputum in respiratory disorders

### Concept 4

Digestive system

*Activity Suggested:*

Recall previous knowledge & Multimedia presentation

*Points to be discussed:*

Overview, Name of the parts, Mouth, Pharynx, Oesophagus, Stomach, Small intestine, Function of Liver and Pancreas

### Clinical importance of faeces examination

*Consolidation:*

- Parts & function of digestive system
- To know about secretions & functions of Liver & Pancreas
- Clinical importance of faecal examination in GIT disorders

### Concept 4

Excretory system

*Activity Suggested:*

Recall previous knowledge & Multi-media presentation

*Points to be discussed:*

- Overview
- Modes of excretion,
- Urinary system - parts and function
- Steps of urine formation
- Normal constituents of urine and its clinical importance

*Consolidation:*

- Different channels of excretion
- Urinary system consists of Kidney, Ureter, Urinary Bladder & Urethra
- Normal constituents of urine
- Clinical importance of urine in screening of kidney disorders

### Concept 4

Nervous system

*Activity Suggested:*

Recall previous knowledge & Multi-media presentation

*Points to be discussed:*

- Overview
- Name parts of system - CNS & PNS
- To know about importance & function of CSF

*Consolidation:*

- Nervous system co-ordinates all life activities
- Parts of nervous system
- Function and Clinical importance of CSF

**Concept 4**

Reproductive system

*Activity Suggested:*

Recall previous knowledge & Multi-media presentation

*Points to be discussed:*

Overview

Mention parts of Male Reproductive system

Mention parts of Female Reproductive system

*Consolidation:*

The male reproductive system consists of Testis and accessory organs

Students gather knowledge about various parts of female reproductive system

**Concept 4**

Endocrine system

*Activity Suggested:*

Discussion & Chart preparation

*Points to be discussed:*

Overview

Mention important endocrine glands such as Pituitary, Thyroid, Parathyroid, Adrenal, Pancreas and Gonads

What are hormones?

Mention major Hormones and their functions

*Consolidation:*

Students get awareness about the position of endocrine glands such as Pituitary, Thyroid,

Parathyroid, Adrenal, Pancreas and Gonads

Important Hormones and action

*Assigned work: Chart preparation***Repository of CE possibilities**

Assessment in education is the process by which knowledge, skill attitude and belief is documented. Most popular way of assessment in the current scenario is conducting examinations, even though pitfalls lay in. Establishing pre determined criteria are inevitable to reaching the desired goals in assessing students. This help the teacher to know which student have in fact achieved the learning intention.

## Process assessment

Process assessment is another form of product assessment. Different methods of assessment provide the means of ensuring that students are able to demonstrate the range of their abilities in different contexts. Performance Assessment and Personal Communication are one of the commonest strategies employed for this. Each category has its own advantages in assessing different learning outcomes. For example, a selected response assessment task such as a series of multiple-choice questions, is able to assess mastery in all areas of knowledge but does not observe reasoning. Participation in discussion and other class room activities, performance in practicals, answering during interviews are some of the ways to assess individuals. Preparation, Performance and data evaluation in project works can especially account for the performance dimension.

## Portfolio assessment

A portfolio is a collection of student work with a common theme or purpose. Portfolios are often described as a more authentic means of assessment than the traditional classroom test. Rather than showing that the learner knows what has been taught, the portfolio demonstrates that the student can do what has been taught. Different methods of assessment are useful for different purposes. Portfolio assessment is most appropriate when learning can be best demonstrated through a product. Prepared charts, documented reports, albums, magazines and the effort and participation in these will be some of the criteria.

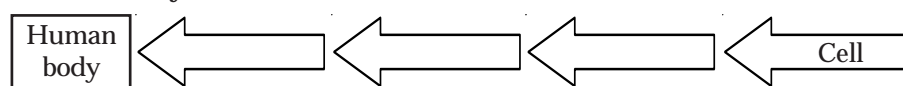
## Unit assessment

Unit assessment is achieved by conducting academic quiz, multiple choice/open book exams, personal interviews, unit tests etc.

## TE Questions

### Organisational structure of Human body

- Complete the given chart showing organisational structure of human body



- Arrange properly

Anatomy	Study of functions of the body
Physiology	Study of Tissues
Cytology	Study of structure of body
Histology	Study of diseases
Pathology	Study of Cells

3. Arrange the different organs in the descending order of their position
  - a) Eyes
  - b) Heart
  - c) Brain
  - d) Knee
  - e) Navel
  - f) Toe
  - g) Thumb
  - h) Thigh
4. Largest bone in the body is \_\_\_\_\_.
5. Find the Odd one out
  - a) Anterior, Lateral, Medial,
  - b) Ovary, Fallopian tube, Vas deferens, Uterus
6. Your teacher asked your group to conduct a seminar on BP Measurement.  
Prepare a draft paper showing the requirement, procedure and normal value of the same.