

# **GAUHATI UNIVERSITY**



**SYLLABUS FOR**  
**BACHELOR IN MEDICAL LABORATORY TECHNICIAN**  
**AND**  
**BACHELOR IN MEDICAL LAB & MOLECULAR DIAGNOSTICS TECHNOLOGY**  
**(VOCATIONAL)**

**FYUGP STRUCTURE UNDER NEP**

**GAUHATI UNIVERSITY**

**About the Course:** The Bachelors course in Medical Laboratory Technician and Medical Lab & Molecular Diagnostics Technology (known as B. Voc. MLT/ML&DT), is a 3 years course, **currently** and will have 6 semesters. The course will have 21 papers, with 84 credits in total for the 3-year course. Each paper will have 4 credits. The first 3 semesters will have 3 papers each semester while the last 3 semesters will have 4 papers per semester.

**Objective of the Course:**

- To train competent and skillful Lab Technologists of Skills, Competence and Integrity.
- To train the students to carry out laboratory investigations accurately and provide reliable reports to facilitate proper diagnosis and prognosis of diseases.
- To be competent to undertake routine as well as special investigative procedures in various Medical Laboratory Technology.
- To develop knowledge and skill in accordance with the demand in the field of Medical Laboratory Technology.
- To enable to operate and maintain all equipment used in the Laboratory diagnosis.
- To apply bio-statistical concepts to data to draw conclusions and evaluate significance of research results.
- To enable to work as Supervisor/Trainer/Teacher in the field of Medical Laboratory Technology, as per norms.
- To create awareness on the principles underlying the organization of a Clinical Laboratory.

**Entry Criteria:** The entry criteria for B. Voc. MLT/ML & MDT are HS Science passed with Biology as one of the subjects. It is based on marks and/or interview.

**Pass:** The students of the course should pass both theory, practical and internals, individually as per University norms. There shall be both theory and practical exams at the end of each semester.

# SEMESTER I

## PAPER-I

### HUMAN ANATOMY AND PHYSIOLOGY (4 CREDITS)

**Theory: 60**

**Practical: 20**

**Internal Assessment: 20**

**Theory: 3 Credits**

**Practical: 1 Credit**

**Overview and key learning outcomes:** This paper will help the students to understand the basics and fundamentals of cells, tissues, different systems of the body including Musculo-skeletal system, GI system, Respiratory system, Cardiovascular system, Genitourinary system etc.. Further the students have to learn about the medical terminology used in human anatomy, functions of different systems of humans.

Unit	Topics	Credits & Marks
I	<b>Introduction to Human Anatomy and Physiology</b> <ul style="list-style-type: none"><li>○ Basic Anatomy and Physiology</li></ul> <b>Anatomical planes, location and terminology</b> <ul style="list-style-type: none"><li>○ Anatomical position</li><li>○ Anatomical planes</li><li>○ Important anatomical terminology</li><li>○ Different anatomical regions of the body</li></ul>	<b>1 Credit 20 marks</b>
II	<b>Cells and Tissues</b> <ul style="list-style-type: none"><li>○ Introduction, composition of cell</li><li>○ Function of cell</li><li>○ Movement through cell membrane</li><li>○ Cell cycle, cell division and control of cell division</li><li>○ Different types and various functions of tissue</li><li>○ Epithelial tissues</li><li>○ Connective tissue</li><li>○ Muscular tissues</li><li>○ Nervous tissues</li></ul>	
III	<b>Musculo-skeletal System</b> <ul style="list-style-type: none"><li>○ Introduction and basic terminology</li><li>○ Bone structure, types of bones</li><li>○ Bone development, function of bones</li><li>○ Organization of the skeleton</li><li>○ Different type of joints and cartilage</li><li>○ Structure and functions of a Skeletal Muscle, smooth muscle and cardiac muscle</li><li>○ Muscular response</li></ul>	
IV	<b>Gastro-intestinal System</b> <ul style="list-style-type: none"><li>○ Physiology &amp; anatomy of mouth, Oral cavity (lip, tongue with histology, tonsil, dentition, pharynx, salivary glands, Waldeyer's ring)</li></ul> Oesophagus, stomach, small and large intestine, liver, gallbladder, pancreas.	

V	<p><b>Respiratory System</b></p> <ul style="list-style-type: none"> <li>○ Parts of Respiratory System, nose, nasal cavity, larynx, trachea, lungs, bronchopulmonary segments, names of paranasal air sinuses, Physiology of respiration, control of respiration</li> </ul>	<p><b>1 Credit</b> <b>20 marks</b></p>
VI	<p><b>Cardiovascular System and Lymphatic System</b></p> <ul style="list-style-type: none"> <li>○ Anatomy and physiology of heart, Heart size, location, chambers, exterior &amp; interior, blood supply to the heart, Systemic and pulmonary circulation, Branches of aorta, common carotid artery, axillary artery, brachial artery, superficial palmar arch, femoral artery, internal iliac artery.</li> <li>○ Blood pressure and peripheral pulse</li> <li>○ Inferior vena cava, portal vein, portosystemic anastomosis, Great saphenous vein, Dural venous sinuses,</li> <li>○ Lymphatic system – Cisterna chyli &amp; thoracic duct, histology of lymphatic tissue, Names of regional lymphatics, axillary and inguinal lymph nodes in brief</li> </ul>	
VII	<p><b>Genito-urinary System</b></p> <ul style="list-style-type: none"> <li>○ Anatomy of Kidney, Ureter, Urinary bladder, male and female urethra.</li> <li>○ Histology of Kidney, ureter and urinary bladder.</li> <li>○ Formation of Urine</li> <li>○ Micturition</li> <li>○ Parts of male reproductive system, testis, vas deferens, epididymis, prostate. Spermatogenesis.</li> <li>○ Parts of female reproductive system – uterus, fallopian tubes, ovary, mammary glands – gross.</li> <li>○ Oogenesis, Ovulation, Menstrual cycle.</li> </ul>	<p><b>1 Credit</b> <b>20 Marks</b></p>
VIII	<p><b>Nervous System</b></p> <ul style="list-style-type: none"> <li>○ Basic structure and function</li> <li>○ General function of the Nervous system</li> <li>○ Nervous tissue</li> <li>○ Cell membrane potential</li> <li>○ The synapse</li> <li>○ Processing impulses</li> <li>○ Classification of Neurons and Nerve fibers</li> </ul> <p><b>Basics of sensory, Somatic and Enteric nervous system.</b></p> <ul style="list-style-type: none"> <li>○ Introduction, meninges, ventricles and CSF</li> <li>○ Central Nervous system - Brain and its parts, Spinal cord</li> <li>○ Peripheral Nervous System - Spinal Nerves, Cranial nerves &amp; autonomic Nervous System</li> </ul>	
IX	<p><b>Endocrine System</b></p> <ul style="list-style-type: none"> <li>○ Name of all endocrine glands</li> </ul> <p>Detail on (gross and histology).</p> <ul style="list-style-type: none"> <li>○ Pituitary gland</li> <li>○ Thyroid gland</li> <li>○ Parathyroid gland</li> <li>○ Adrenal gland</li> </ul>	

Sl. No.	Experiments
I	Histology of types of epithelium, Histology of serous, mucous & mixed salivary gland.
II	Demonstration of parts of the respiratory system.
III	Demonstration of heart and vessels in body, Histology of lymph node, spleen, tonsil & thymus, Normal chest radiography showing heart shadows.
IV	Demonstration of reflections
V	Histology of three types of cartilages.
VI	Demonstration of parts of urinary systems.
VII	Demonstration of the glands.
VIII	Demonstration of blood pressure with sphygmomanometer, demonstration of peripheral pulse

#### Reference Books:

Sl. No.	Title	Authors	Publisher
1	Ross and Wilson Anatomy and Physiology in Health and Illness	Anne Waugh Allison Grant	Elsevier
2	Textbook of Medical Physiology	Guyton	Jaypee
3	BD Chaurasia's Human Anatomy	BD Chaurasia's	CBS Publishers
4	Understanding Medical Physiology	L. Bijlani	Jaypee
5	Principles of Anatomy and Physiology	Gerard J. Tortora Bryan Derrickson	Wiley

## PAPER-II

### INTRODUCTION TO BIOMOLECULES, INSTRUMENTATION AND REAGENTS (4 CREDITS)

Theory: 60

Practical: 20

Internal Assessment: 20

Theory: 3 Credits

Practical: 1 Credit

**Overview and key learning outcomes:** This paper will assist students in learning fundamental principles of macromolecular function and structure. Additionally, able to identify various laboratory glassware, plastic ware, and instruments, as well as care and maintenance of laboratory equipment and Biomedical waste management.

Unit	Topics	Credits & Marks
I	<p><b>Introduction to Biomolecules</b></p> <p><b>Carbohydrates &amp; Lipids:</b></p> <ul style="list-style-type: none"><li>○ Carbohydrates: Introduction, classification into mono, oligo and polysaccharides. Classification of monosaccharides, based on no. of C-atoms. Functional groups- aldoses and ketoses. Biochemical reactions of monosaccharide, Isomerism of Carbohydrates.</li><li>○ Lipids: Introduction, classification of lipids, Important saturated &amp; unsaturated fatty acids. Properties &amp; functions. Derived lipids: Phospholipids, glycolipids, Waxes, Biological role of cholesterol.</li></ul> <p><b>Amino acid and Proteins:</b></p> <ul style="list-style-type: none"><li>○ Introduction, classification, optical isomerism, Optical properties, Acid – Base properties. Peptide bond formation and properties. Composition and primary, secondary and tertiary structures of proteins.</li></ul> <p><b>Nucleic acids:</b></p> <ul style="list-style-type: none"><li>○ Structures of purine and pyrimidine bases, nucleosides, nucleotides, RNA and DNA (differences), helical structure of DNA (Watson &amp; Crick model), Types of RNA- mRNA, rRNA &amp; tRNA</li></ul>	1 Credit (20 Marks)
II	<p><b>Instruments (theory and demonstration) Diagrams to be drawn.</b></p> <ul style="list-style-type: none"><li>○ Use, care and maintenance of water bath, water distillation plant, refrigerators, cold box and deep freezer</li><li>○ Centrifuges: Principle, Svedberg unit, centrifugal force.</li><li>○ Different types of centrifuges: Use, care and maintenance of a centrifuge.</li><li>○ Laboratory balances use, care and maintenance of manual balances and electrical balances.</li><li>○ Colorimeter and spectrophotometer, principle and different parts of colorimeter. Cuvettes, significance of cuvettes in colorimeter, cuvette</li></ul>	1 Credit (20 Marks)

	for visible and UV range.	
<b>III</b>	<p><b>Standard solutions</b></p> <ul style="list-style-type: none"> <li>○ Technique for preparations of standard solutions. Significance of volumetric flasks in preparing standard solutions.</li> <li>○ Preparations of standard solutions of deliquescent compounds (CaCl<sub>2</sub>, Potassium carbonate, sodium hydroxide etc.)</li> </ul>	<b>1 Credit (20 Marks)</b>
<b>IV</b>	<p><b>Laboratory Apparatus and Preparation of solutions</b></p> <ul style="list-style-type: none"> <li>○ Pipettes – different types (Graduated, volumetric, Pasteur, automatic etc.), calibration of glass pipettes, Burettes, beakers, Petri dishes, depression plates.</li> <li>○ Flasks – different types, volumetric, round bottomed, conical etc.</li> <li>○ Significance of borosilicate glass; care and cleaning of glassware, different cleaning solutions of glass.</li> <li>○ Preparation of Molar, Normal, and Percentage solutions.</li> <li>○ Preparation of different dilutions</li> </ul>	
<b>V</b>	<p><b>Bio Medical Waste Management</b></p> <ul style="list-style-type: none"> <li>○ To gain understanding of importance of proper and safe disposal of bio-medical waste &amp; treatment.</li> <li>○ To gain understanding of categories of biomedical waste.</li> <li>○ To learn about disposal of bio-medical waste colour coding, types of containers, transportation of waste, etc.</li> <li>○ To gain broad understanding of standards for bio-medical waste disposal</li> <li>○ To gain broad understanding of means of biomedical waste treatment.</li> </ul>	

### Practical Biochemistry (1 Credit)

Sl. No.	Experiments
I	Identification of different laboratory glasswares (Pipettes, Funnels, Measuring cylinders, Test tubes, Centrifuge tubes, test tube draining rack Tripod stand, wire gauze, Bunsen burner etc)
II	Cleaning and maintenance of glassware.
III	Demonstration of instruments and appliances (Centrifuge, Weighing balance, colorimeter etc.)
IV	Demonstration of weighing various types of chemicals, liquids, hygroscopic substances
V	Preparation of discard solutions.
VI	Calculation and preparation of Percentage solution, Molar solution. Normality solution.
VII	Estimation of blood glucose (Fasting, Random and Postprandial)

### Reference Books:

Sl. No.	Title	Authors	Publisher

1	Textbook of biochemistry for medical students	D M Vasudevan	Jaypee
2	Fundamentals of biochemistry	J L Jain	S Chand
3	Biochemistry	D Voet, J Voet	Wiley
4	Medical Laboratory Technology Methods & interpretation	Ramnik Sood	Jaypee
5	Textbook of Medical Lab Technology	Praful B. Godkar, Darshan P. Godkar	Bhalani
6	Biochemistry	U. Satyanarayana C. Chakrapani	Elsevier

**PAPER-III**

**INTRODUCTION TO PATHOLOGY (4 CREDITS)**

**Theory: 60**

**Practical: 20**

**Internal Assessment: 20**

**Theory: 3 Credits**

**Practical: 1 Credit**

**Overview and key learning outcomes:** In this paper the students have to know about various blood collection equipment, different types of blood sample collections, need to know about color coded vacutainers, anticoagulants, further the students has to know basics about blood and other samples with suitable collections and various tests. The students have to learn about various laboratory hazards, safety and first-aid and personal hygiene.

<b>Unit</b>	<b>Topics</b>	<b>Credits &amp; Marks</b>
<b>I</b>	<p><b>Introduction to pathology</b></p> <ul style="list-style-type: none"> <li>○ Evolution of pathology</li> <li>○ Different branches of pathology</li> </ul> <p><b>Cell injury</b></p> <ul style="list-style-type: none"> <li>○ Etiology of Cell injury</li> <li>○ Pathogenesis of cell injury</li> <li>○ Reversible and irreversible cell injury</li> <li>○ Cellular adaptations (Atrophy, Hypertrophy, hyperplasia, metaplasia, dysplasia etc)</li> </ul>	<b>1 Credit 20 marks</b>
<b>II</b>	<p><b>Inflammation</b></p> <ul style="list-style-type: none"> <li>○ Definition, causes and types</li> <li>○ Acute inflammation and chronic inflammation</li> <li>○ Cells involved in inflammation</li> <li>○ General features of chronic inflammation</li> <li>○ Systemic effects of chronic inflammation</li> </ul>	



III	<p><b>Basic Hematology</b></p> <ul style="list-style-type: none"> <li>○ Hematopoiesis - Erythropoiesis, Leukopoiesis and Thrombopoiesis</li> <li>○ Blood and its composition (Structure and functions of red blood cells, white blood cells, platelets and related pathologic conditions)</li> </ul> <p><b>Anaemia</b></p> <ul style="list-style-type: none"> <li>○ Introduction and classifications (Morphological and etiological), effects of anemia on body.</li> <li>○ Haematocrit</li> <li>○ Red cell indices (MCV, MCH, MCHC, RDW)</li> </ul> <p><b>Methods and types of various sample collection</b></p> <ul style="list-style-type: none"> <li>○ Collection of blood (Capillary, venous and arterial blood)</li> <li>○ Anticoagulants</li> <li>○ Interpretation of test request form</li> <li>○ Different types of vacutainers and order of blood draw</li> <li>○ Collection of CSF &amp; other body cavity fluids</li> <li>○ Urine collection &amp; use of preservatives</li> </ul>	1 Credit 20marks
IV	<p><b>Introduction to Laboratory</b></p> <ul style="list-style-type: none"> <li>○ Types of laboratories</li> <li>○ Laboratory set up</li> <li>○ Physical aspect of laboratory</li> <li>○ Medico-logical aspects of clinical practice</li> </ul>	
V	<p><b>Introduction to Immuno-hematology</b></p> <ul style="list-style-type: none"> <li>○ History of blood group</li> <li>○ Biochemistry and genetics of ABO and RH blood Group individuals</li> <li>○ Different blood group systems</li> <li>○ Methods of blood grouping (ABO and Rh)</li> <li>○ Universal donor and recipient concepts</li> </ul>	
VI	<p><b>Personnel Hygiene</b></p> <ul style="list-style-type: none"> <li>○ To develop understanding of the concept of Healthy Living</li> <li>○ To develop understanding &amp; procedures of Hand Hygiene</li> <li>○ To be equipped with Techniques of Use of PPE</li> </ul>	1 Credit 20 marks
VII	<p><b>Safety &amp; First Aid</b></p> <ul style="list-style-type: none"> <li>○ To develop understanding and precautions to ensure Patient's Safety</li> <li>○ To develop basic understanding and precautions to ensure sample preservation while transporting</li> <li>○ Describe common emergency conditions and what to do in medical emergencies</li> <li>○ Describe basics of first aid</li> <li>○ Different types of Laboratory Hazards</li> <li>○ Accidents in the laboratory</li> </ul>	

**Practical Pathology: (1 Credit)**

Sl. No.	Experiments
I	Collection of Blood sample (capillary blood and Venous blood) using correct techniques (Vacutainer and syringe based blood collection)

II	Haemoglobin Estimation (Sahli's method and Cyanmethemoglobin method)
III	Haematocrit (PCV)
IV	Erythrocyte Sedimentation Rate (ESR)(Wintrobe's and Westergren's method)
V	Preparation of peripheral blood film and stain with Romanowsky stain.
VI	Blood grouping and Rh typing (Slide method and tube method)
VII	Serum typing or reverse blood typing

**Reference Books:**

Sl. No.	Title	Authors	Publisher
1	Textbook of Pathology	Harsh Mohan	Jaypee
2	Clinical Pathology hematology & Blood Banking	Nanda Maheswari	Jaypee
3	Essentials of Clinical Pathology	Shirish M Kawthalkar	Jaypee
4	Practical Pathology	Harsh Mohan	Jaypee
5	Textbook of Medical Laboratory Technology	Darshan P. Godkar, Praful B. Godkar	Bhalani Publishing House