GAUHATI UNIVERSITY



# SYLLABUS FOR

MEDICAL LABORATORY TECHNICIAN & MOLECULAR DIAGNOSTICS

# FYUGP STRUCTURE UNDER NEP GAUHATI UNIVERSITY

**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 GI system, Respiratory system, cardiovascular system, urinary system, reproductive system endocrine system etc. Further the students have to learn about the medical terminology used in human anatomy, functions of different systems of humans.

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| **Unit** | **Topics** | **Credits**  **& Marks** |
| **I** | **Introduction to Human Anatomy and Physiology**   * Anatomy and Physiology * Characteristic of Life * Maintenance of Life * Levels of organism | **1 Credit** |
| **II** | **Cells**   * Introduction, composition of cell * Movement through cell membrane * Cell cycle, cell division and control of cell division   **Tissue**   * Introduction. different types and various functions * Epithelial tissues * Connective tissue * Muscular tissues * Nervous tissues |
| **III** | **Anatomical planes, location and terminology**   * Anatomical position * Anatomical planes * Important anatomical terminology * Different anatomical regions of the body |
| **IV** | **Skeletal System**   * Introduction * Bone structure * Bone development, function of bones * Organization of the skeleton * Different type of joints and cartilage |
| **V** | **Muscular System**   * Introduction * Structure of a Skeletal Muscle * Action of skeletal Muscle * Muscular response * Smooth muscles * Cardiac muscles * Skeletal muscle actions |

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| **VI** | **Gastro-intestinal System**   * Physiology & anatomy of mouth, Oral cavity (lip, tongue (with histology), tonsil, dentition, pharynx, salivary glands, Waldeyer’s ring) Oesophagus, stomach, small and large intestine, liver, gallbladder,   pancreas. | **1**  **Credit** |
| **VII** | **Respiratory System**   * Parts of Respiratory System, nose, nasal cavity, larynx, trachea, lungs, bronchopulmonary segments, names of paranasal air sinuses, Physiology of respiration, control of respiration |
| **VIII** | **Cardiovascular System and Lymphatic System**   * Anatomy of physiology of heart, Heart size, location, chambers, exterior & 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. * Blood pressure and pulse Peripheral pulse * Inferior vena cava, portal vein, portosystemic anastomosis, Great saphenous vein, Dural venous sinuses, * Lymphatic system – Cistern chyli & thoracic duct, histology of lymphatic tissue, Names of regional lymphatics, axillary and inguinal lymph nodes in brief |
| **IX** | **Urinary System**   * Anatomy of Kidney, Ureter, Urinary bladder, male and female urethra. * Histology of Kidney, ureter and urinary bladder. * Formation of Urine * Micturition |
| **X** | **Nervous System**   * Basic structure and function * General function of the Nervous system * Nervous tissue * Cell membrane potential * The synapse * Processing impulses * Classification of Neurons and Nerve fibers   **Nerve Pathways, Division of the N.S.**   * Introduction, meninges, ventricles and CSF * Central Nervous system - Brian and its parts, Spinal cord * Peripheral Nervous System - Spinal Nerves, Cranial nerves & autonomic Nervous System | **1**  **Credit** |
| **XI** | **Reproductive System**   * Parts of male reproductive system, testis, vas deferens, epididymis, prostate. Spermatogenesis: Parts of female reproductive system – uterus, fallopian tubes, ovary, mammary glands – gross. Oogenesis, Ovulation,   Menstrual cycle. |
| **XII** | * **Endocrine System**   Name of all endocrine glands, detail on pituitary gland, thyroid gland, parathyroid gland, suprarenal gland – (gross and histology). |

**Practical: (1 Credit)**

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| **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:**

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| **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 | Animal Physiology | A.K Berry | Emkey |
| 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 apparatus.

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| **Unit** | **Topics** | **Credits &**  **Marks** |
| **I** | **Introduction to Biomolecules Carbohydrates & Lipids:**   * 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. * Lipids: Introduction, classification of lipids, Important saturated & unsaturated fatty acids. Properties & functions. Derived lipids: Phospholipids, glycolipids, Waxes, Biological role of cholesterol.   **Amino acid and Proteins:**   * Introduction, classification, optical isomerism, Optical properties, Acid – Base properties. Peptide bond formation and properties. Composition and primary, secondary and tertiary structures of proteins.   **Nucleic acids:**   * Structures of purine and pyrimidine bases, nucleosides, nucleotides, RNA and DNA (differences), helical structure of DNA (Watson & Crick   model), Types of RNA- mRNA, rRNA & tRNA | **2**  **Credit (20 Marks)** |
| **II** | **Instruments (theory and demonstration) Diagrams to be drawn**.   * Use, care and maintenance of water bath, water distillation plant, refrigerators, cold box and deep freezer * Centrifuges: Principle, Svedberg unit, centrifugal force. * Different types of centrifuges: Use, care and maintenance of a centrifuge. * Laboratory balances use, care and maintenance of manual balances and electrical balances. * Colorimeter and spectrophotometer, principle and different parts of colorimeter. Cuvettes, significance of cuvettes in colorimeter, cuvette   for visible and UV range. | **1**  **Credit (20 Marks)** |
| **III** | **Standard solutions**   * Technique for preparations of standard solutions. Significance of volumetric flasks in preparing standard solutions. * Preparations of standard solutions of deliquescent compounds (cacl2, Potassium carbonate, sodium hydroxide etc.) |  |

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| **IV** | **Laboratory Apparatus and Preparation of solutions**   * Pipettes – different types (Graduated, volumetric, Pasteur, automatic etc.), calibration of glass pipettes, Burettes, beakers, Petri dishes, depression plates. * Flasks – different types, volumetric, round bottomed, conical etc. * Significance of borosilicate glass; care and cleaning of glassware, different cleaning solutions of glass. * Preparation of Molar, Normal, and Percentage solutions. * Preparation of different dilutions | **1**  **Credit (20 Marks)** |

**Practical (1 Credit)**

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| **Sl. No.** | **Experiments** |
| **1** | Identification of different laboratory glasswares (Pipettes, Funnels, Measuring cylinders, Test tubes, Centrifuge tubes, test tube draining rack Tripod stand, wire gauze, Bunsen burner etc) |
| **2** | Cleaning and maintenance of glassware. |
| **3** | Study of instruments and appliances (Centrifuge, Weighing balance, colorimeter etc.) |
| **4** | Study of weighing various types of chemicals, liquids, hygroscopic substances |
| **5** | Preparation of discard solutions. |
| **6** | Calculation and preparation of Percentage solution, Molar solution. Normality solution**.** |
| **7** | Estimation of blood glucose (Fasting, Random and Postprandial) |

**Reference Books:**

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| --- | --- | --- | --- |
| **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 |

**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 equipments, 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.

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| **Unit** | **Topics** | **Credits &**  **Marks** |
| **I** | **Introduction to pathology**   * Evolution of pathology * Different branches of pathology   **Cell injury**   * Etiology of Cell injury * Pathogenesis of cell injury * Reversible and irreversible cell injury * Cellular adaptations (Atrophy, Hypertrophy, hyperplasia, metaplasia, dysplasia etc) | **1 Credit** |
| **II** | **Inflammation**   * Definition, causes and types * Acute inflammation and chronic inflammation * Cells involved in inflammation * General features of chronic inflammation * Systemic effects of chronic inflammation |
| **III** | **Basic Hematology**   * Hematopoiesis - Erythropoiesis, Leukopoiesis and Thrombopoiesis * Blood and its composition (Structure and functions of red blood cells, white blood cells, platelets and related pathologic conditions)   **Anaemia**   * Introduction and classifications (Morphological and etiological), effects of anemia on body. * Haematocrit * Red cell indices (MCV, MCH, MCHC, RDW)   **Collection of blood sample**   * Collection of blood sample (capillary, venous and arterial blood) * Different equipment used for blood sample collection * Interpretation of test request form * Correct method of preparation of an appropriate site for obtaining blood samples * Different types of vacutainer and order of blood draw | **1**  **Credit** |
| **IV** | **Introduction to Laboratory**   * Types of laboratory * Laboratory set up * Physical aspect of laboratory |

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|  | * Basic laboratory set up * Medico-logical aspects of clinical practice |  |
| **V** | **Introduction to Immuno-hematology**   * History of blood group * Biochemistry and genetics of ABO and RH blood Group individuals * Different blood group systems. * Methods of blood grouping (ABO and Rh) * Universal donor and recipient concepts | **1**  **Credit** |
| **VI** | **Personnel Hygiene**   * To develop understanding of the concept of Healthy Living * To develop understanding & procedures of Hand Hygiene * To be equipped with Techniques of Use of PPE |
| **VII** | **Safety & First Aid**   * To develop understanding and precautions to ensure Patient’s Safety * To develop basic understanding and precautions to ensure sample preservation while transporting. * Describe common emergency conditions and what to do in medical emergencies. * Describe basics of first aid. * To develop understanding and precautions to ensure safety * Different types of Laboratory Hazards * Accidents in the laboratory |

**Practical: (1 Credit)**

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| **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) |
| 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:**

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| --- | --- | --- | --- |
| **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** |