

**SANTOSH DEEMED TO BE UNIVERSITY**

**PRATAP VIHAR, GHAZIABAD, UP**

**MASTER OF SCIENCE IN MEDICAL LABORATORY TECHNOLOGY**

**PROPOSED GUIDELINE & SYLLABUS**

**EFFECTIVE FROM AUGUST (2021)**

**SESSION 2021-2022**

**DURATION – 2 YEARS**



**DEPARTMENT OF PATHOLOGY**

**SANTOSH MEDICAL COLLEGE HOSPITALS**

**NO.-1, AMBEDKAR ROAD, GHAZIBAD, UP.**

The Yearly Theory Examination Papers in 4 Sections containing 20 Marks of each section which should cover complete Syllabus viz:

- I. Short Notes - 4 x 5 Marks = 20 Marks
- II. Long Notes - 2 x 10 Marks = 20 Marks  
(Problem Based)
- III. Long Question - 1 x 20 Marks = 20 Marks
- IV. MCQs - 20 x 1 Mark = 20 Marks

<b>Total Theory</b>	<b>80 Marks</b>
<b>Internal Assessment</b>	<b>20 Marks</b>
<b>Viva</b>	<b>20 Marks</b>
<b>Practical Internal</b>	<b>20 Marks</b>
<b>University Practical</b>	<b>60 Marks</b>
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<b>Total</b>	<b>200 Marks</b>

Total Marks for each paper is proposed to be 200 Marks Maximum and a student shall be declared to have passed if he/she has secured more than 50 % in Theory Components including viva and 50 % in Practical components.

**SANTOSH DEEMED TO BE UNIVERSITY, GHAZIABAD, DELHI NCR**  
**PROPOSAL FOR FOLLOWING UNIQUE PATTERN FOR THE NEW COURSE INTRODUCED**

S.No	Course	Year	No. of Papers	Internal Assessment weightage / Marks (Per Paper)	University Theory Marks (Per paper)	Viva	Practical Internal	Practical University	Other Remarks
1.	B.Optom	1 <sup>st</sup>	5	20	80	20	20	60	It is proposed that each paper will be assessed for 200 Marks including internal assessment and Internal Practical
		2 <sup>nd</sup>	5	20	80	20	20	60	
		3 <sup>rd</sup>	5	20	80	20	20	60	
2.	B.Sc. Clinical Nutrition & Dietetics	1 <sup>st</sup>	5	20	80	20	20	60	
		2 <sup>nd</sup>	5	20	80	20	20	60	
		3 <sup>rd</sup>	5	20	80	20	20	60	
3.	M.Sc. Clinical Psychology	1 <sup>st</sup>	4	20	80	20	20	60	
		2 <sup>nd</sup>	4	20	80	20	20	60	

S.No	Course	Year	No. of Papers	Internal Assessment weightage / Marks (Per Paper)	University Theory Marks (Per paper)	Viva	Practical Internal	Practical University	Other Remarks
4.	M.Sc. Trauma and Critical Care	1 <sup>st</sup>	4	20	80	20	20	60	It is proposed that each paper will be assessed for 200 Marks including internal assessment and Internal Practical
		2 <sup>nd</sup>	4	20	80	20	20	60	
5.	M.Sc. Medical Imaging Technology	1 <sup>st</sup>	4	20	80	20	20	60	
		2 <sup>nd</sup>	4	20	80	20	20	60	
6.	M.H.A	1 <sup>st</sup>	4	20	80	20	20	60	
		2 <sup>nd</sup>	4	20	80	20	20	60	
7.	M.Sc. Medical Lab Technology	1 <sup>st</sup>	4	20	80	20	20	60	
		2 <sup>nd</sup>	4	20	80	20	20	60	
8.	M.S.W. Community Medicine	1 <sup>st</sup>	4	20	80	20	20	60	
		2 <sup>nd</sup>	4	20	80	20	20	60	

S.No	Course	Year	No. of Papers	Internal Assessment weightage / Marks (Per Paper)	University Theory Marks (Per paper)	Viva	Practical Internal	Practical University	Other Remarks
9.	M.Sc. Sports Medicine and Exercise Sciences	1 <sup>st</sup>	4	20	80	20	20	60	It is proposed that each paper will be assessed for 200 Marks including internal assessment and Internal Practical
		2 <sup>nd</sup>	4	20	80	20	20	60	

## CONTENTS

### Master in Medical Lab Technology (Pathology) M Sc. M.L.T. 1st YEAR

1. Human Anatomy & Physiology
2. Clinical Biochemistry
3. Clinical Pathology
4. Clinical Microbiology

#### Practical

1. Human Anatomy & Physiology
2. Clinical Biochemistry
3. Clinical Pathology
4. Clinical Microbiology

### Master in Medical Lab Technology (Pathology) M Sc. M.L.T. 2ND YEAR

1. Clinical Hematology
2. Blood Transfusion & immune hematology
3. HistoPathology and histotechniques
4. cytopathology and cytotechniques

#### Practical

1. Blood Transfusion & Immunohematology
  2. Histopathology
  3. Cytopathology
  4. hematology
- Dissertation (Pathology) & Viva

## M.Sc. (MLT) Pathology- scheme and syllabus

### M Sc. M.L.T (PATHOLOGY)

#### PAPER:- HUMAN ANATOMY & PHYSIOLOGY

#### Anatomy

##### **Syllabus:**

**UNIT-1 Introduction:** Overview of the structure organization of the human body; anatomical terminology of positions & locations, planes.

**Cell:** Cell morphology and diversity; introduction to ultra structure and function of cell organelles.

**Skeletal Muscles:** Major skeletal muscles of the head, neck, thorax, abdomen and upper and lower limbs.

**General Osteology:** General morphology of bones; structural classification of bones, development and growth of skeletal tissue and bones.

**General Astrology:** Structural and functional classification of joints; general morphology of a synovial joint and associated structures; movements made available by synovial joints.

**Detailed Osteology and Astrology Practical:** Naming and identification of osteological features of individual human bones; Bones of Upper limbs – Clavicle, Scapula, Humerus, Radius, Ulna; Lower limbs – Femur, Hip bones, Sacrum, Tibia, Fibula, Ribs, Sternum  
Vertebral Column. Naming, identification and application of classification to the major joints of the human body; examples of variability in the human skeleton.

**UNIT-2 Cardiovascular System:** Macroscopic features, function and location of the adult and the location of major arteries and veins; macroscopic features of blood vessels including arteries, veins and capillaries; morphological features of the cellular components of blood.

**Lymphatic System:** Macroscopic features, major function and location of the lymphatic vascular structures, lymph nodes, tonsils and other mucosa-associated lymphatic tissue, spleen and thymus; microscopic anatomy of lymph nodes.

**Nervous System:** Macroscopic features and major functions of the brain brief structure, location & function of cerebrum, cerebellum & brain stem and spinal cord; morphological features and major function of the contents of the peripheral nervous system and autonomic nervous system.

4

**Respiratory System:** Macroscopic features and major functions of the nasal cavity, paranasal sinuses, pharynx, larynx, trachea, bronchi, lungs and thoracic wall including the thoracoabdominal diaphragm.

**Digestive System:** Macroscopic features and major functions of the mouth, salivary glands,

pharynx, oesophagus, stomach, small and large intestines, liver pancreas, biliary system and peritoneal cavity.

**UNIT-3 Urinary System:** Macroscopic features, major functions and location of the kidneys, ureters, urinary bladder and the urethra.

**Endocrine System:** Macroscopic features, location and basic function of the hypothalamus, pituitary gland, thyroid gland, parathyroid glands, suprarenal glands, pineal gland and organs with a minor endocrine function.

**Male Reproductive System:** Macroscopic features, Major functions and location of the scrotum, testes, epididymis, ductus deferens, inguinal canal, seminal vesicles, prostate gland, bulbourethral gland and penis.

**Female Reproductive System:** Macroscopic features, major functions and location of the ovaries, uterine tubes, uterus, vagina and external genitalia.

**Special Senses:** Macroscopic features and major functions of the contents of the orbital cavity, the eyeball, lacrimal apparatus, and external, middle and internal ear.

**UNIT-4 Upper Limb:** Relevant osteology; detailed plain radiographic anatomy of skeletally mature individuals.

**Head and Neck:** Relevant osteology of the skull and cervical vertebrae; surface anatomy, lymphatics major blood vessels and nerves of the head and neck; regional anatomy of the brain and its meninges.

**UNIT-5 Histology:** macroscopic and microscopic studies of epithelial tissue, general connective tissue, cartilaginous tissue, bone tissue, muscle tissue, nervous tissue and the integument; major functional advantages of each tissue type.

**Anatomy Practical:**

- Demonstration of bones identification and side determination upper limb-clavicle, scapula, humerus, radius, ulna, lower limb-femur, Hip bone, Tibia, Fibula, Vertebral Column, Ribs, Sternum, Sacrum
- Demonstration of heart.
- Demonstration of different parts of respiratory system and normal X-rays- lungs.
- Demonstration of the part of digestive system and normal X-rays- stomach, small intestine, large intestine, liver.
- Embalming of human cadavers for teaching purposes & social/ funeral embalming.
- Surface anatomy on cadaver.

5

- Demonstration of major vessels of the body-Aorta, subclavian, carotid, brachial, radial, ulnar, femoral, renal.
- Demonstration of bones & joints of the limb in normal X-ray.
- Demonstration of major muscles of the body-limbs, head & neck.
- Demonstration of other organs—spleen, testis, uterus.
- Histology-General epithelium, connective tissue, gland, bone, cartilage lymphoid tissue Systemic-Lung, Esophagus, Stomach, Small Intestine, Pancreas, Liver, Kidney, Pituitary Gland, Thyroid, Testis, Ovary.

**PARAMEDICAL SYLLABUS – PHYSIOLOGY (M.Sc.)**

**General Physiology:** Cell: Structure and function of a cell, Transport across the cell membrane, Passive Transport: Diffusion (Simple and Facilitated), Osmosis (Osmotic pressure, Tonicity), Active transport: Primary ( $\text{Na}^+\text{K}^+$  ATPase), Secondary, Carrier type (Uniporters, Symporters, Antiporters), Vesicular (Endocytosis and Exocytosis), Tissues: Definition and classification (Epithelial, Connective, Muscular, Nervous), Body water and body fluids: Distribution of total body water, Ionic composition of body fluids, Concept of pH and  $\text{H}^+$  concentration. The Membrane Potentials: Resting membrane potentials (Genesis & function), Action Potential

**Blood: Composition** and functions of blood, Hemoglobin (Normal values and time), Blood Cells: RBCs, WBCs, Platelets (Development, structure and functions), Coagulation of blood and bleeding disorders, Haemophilia, Purpura, Blood groups (ABO, Rh) Uses, Lymphoid tissues (types) and immunity, Immune system (Natural and Acquired), Applied: Anaemia (Types), Jaundice, Hemophilia

**Gastrointestinal Tract:** Organization of structure of GIT, Functions of digestive system, Innervation of GIT (Enteric Nervous System). Mouth (Oral Cavity): Boundaries, Tongue, Teeth, Composition and functions of saliva, Mastication (chewing), Swallowing (Deglutition) Stages. Stomach: Structure,

Functions of stomach and innervation, Composition and functions of gastric juice, Regulation of secretion of gastric juice, Gastric motility and emptying. Pancreas: Structure, Nerve supply, Composition, functions and regulation of secretion of pancreatic juice. Liver: Structure, Functions and Liver function tests Bile: Composition, functions and control of secretion. Gall Bladder: Functions of gall bladder. Small Intestine: Intestine juice, Digestion and movements. Large Intestine: Structure, movements, absorption and secretion, dietary fibers. Digestion and absorption in GIT: Digestion and absorption of carbohydrates, lipids and proteins. Food and nutrition: constituents of a normal diet, Balanced diet, Applied aspect (Deficiency diseases, Kwashiorkor, Marasmus)

**Respiratory System:** Structure and functions of respiratory system, Air Passages: Nose and nasal cavity, pharynx, larynx, tracheobronchial tree, lungs, respiratory membrane, pleura, Properties of gases: Partial Pressure, composition of dry air, Functions of respiratory system: Lung defense mechanism and pulmonary circulation. Mechanics of respiration: Mechanism of breathing (Inspiration and Expiration), Alveolar Surface Tension (Action of surfactant), Alveolar Ventilation: Dead space (Anatomical and Physiological), Diffusion capacity of lungs (Clinical Significance), Lung volumes and capacities (Static: Tidal Volume, Residual Volume, Vital Capacity, Total Lung capacity; Dynamic: FEV1, FEV2, FEV3, Minute/Pulmonary Ventilation, Maximum Voluntary Ventilation). Transport of gases: Oxygen transport [Carriage of oxygen in blood; Dissolved form & combined with hemoglobin, Carriage of oxygen in the body; In tissues (At rest and during exercise), In lungs]. Carbon-di-oxide transport [Carriage of Carbon-di-oxide in blood; In dissolved form, carbamino form (In plasma and RBCs), as bicarbonate, Carriage of Carbon-dioxide in lungs], Oxygen hemoglobin dissociation curve (Shift to right & Shift to left). Regulation of respiration: Nervous Regulation of respiration [Automatic control via Medullary and Pontine Respiratory centers, Voluntary control of respiration], Genesis of respiration (Inspiration and Expiration), Factors affecting respiration [Chemical and non-chemical stimuli], Chemical Regulation of respiration [Peripheral chemoreceptors (Carotid bodies and Aortic bodies) and Central (Medullary) chemoreceptors]. Physio clinical aspects: Dyspnea, Apnea, Hypoxia

**Cardiovascular System:** General Cardiac chambers (Valves in the heart, Heart sounds, Pacemaker tissue of the heart), Properties of Cardiac Muscle, Cardiac Cycle, Electrocardiogram (ECG), Circulation: Functions, Pressure changes in vascular system, Organization and functions of vascular system, Distribution of major vessels in the body, Lymphatic system, Regulation of cardiovascular system: Local (Basic Myogenic tone), Systemic: Chemical, Neural (Autonomic and medullary; Baroreceptors and Chemoreceptors) Heart Rate: Definition, Factors affecting HR and its control, Cardiac Output: Definition, Distribution and control, Arterial Blood Pressure: Definition, factors affecting and regulation

**Excretory System:** Anatomy and Physiology of Urinary System, Kidney: Structure, Organization and functions of Glomerulus, Glomerular membrane, Blood supply Functions of kidney: Formation of urine, Regulation of water balance, Regulation of electrolyte balance, Regulation of acid-base balance, Endocrine functions of kidney, Urinary Passages: Ureters, Urinary Bladder (Structure and function, Higher control of micturition)

**Endocrine System:** Definitions, Control (Neural and endocrine), Characteristics of hormones, Pituitary Gland: Physiological anatomy (Anterior, intermediate and posterior lobe), Anterior Pituitary – Six Hormones (GH, PRL, TSH, ACTH, LH, FSH, Growth Hormone (GH): Control and actions, Applied (Gigantism, Acromegaly, Dwarfism), Prolactin (PRL): Control and actions of PRL, Posterior Pituitary, ADH (Anti diuretic hormone): Control of ADH secretion, Actions of ADH, Applied, Oxytocin: Actions and Control of oxytocin secretion, Intermediate lobe of Pituitary, MSH (Melanocyte stimulating hormone), Thyroid Gland: Physiological anatomy, Types of hormones (T3 and T4), Regulation of thyroid secretion, Actions of thyroid hormone: Calorigenic, On carbohydrate metabolism, On lipid metabolism, On growth and development, Effect on nervous system, Applied (Goiter, Hypothyroidism, Hyperthyroidism), Parathyroid, Calcitonin and Vitamin-D: Role of calcium in metabolic processes, Distribution, Absorption and fate of calcium in the body, Hormones regulating calcium metabolism (Vitamin-D, PTH, Calcitonin), Applied (Rickets, Osteomalacia & Adult Rickets, Hyperparathyroidism), Adrenal Cortex: Physiological Anatomy of adrenal gland, Regulation of glucocorticoid secretion, Actions of glucocorticoids, Cushing's Syndrome, Mineral corticoids (Aldosterone, Actions of aldosterone, Regulation of aldosterone secretion, Addison's Disease), Sex Hormones, Adrenal Medulla: Physiological Anatomy, Actions of catecholamine's, Actions (CVS, carbohydrate metabolism, lipid metabolism, BMR, CNS, Eyes, Urinary bladder, skin), Pancreas: Physiological Anatomy, Glucagon, Insulin (Actions), Applied (Diabetes Mellitus; Causes, Signs and



symptoms), Thymus and Pineal Gland: Thymus: Functions, immunological role of thymus, Pineal gland: General features, Functions, control

**Reproductive System:** Physiology of reproduction: Sex determination and sex differentiation, Puberty: Control of onset and stages, reproductive hormones; Gonadotropin (FSH & LH), Male Reproductive System: Testis: Structure and functions, Spermatogenesis, Structure of the sperm, Seminal tract and related glands, supporting structure, seminal fluid (semen), Endocrine functions of testis (Testosterone, Control of testicular activity) Female Reproductive System, Female reproductive tract: Uterus and related structures, ovaries, ovarian hormones (Estrogen, Progesterone and Relaxin), Female Sexual Cycle: Changes in the ovaries and uterus (Menstrual cycle), Vagina and gonadotropin secretion Contraceptive measures

**Central Nervous System:** Organization and functions of nervous system Brain: Cerebral Hemisphere (Cerebrum), Basal Ganglia, Thalamus, Hypothalamus Brain stem: Midbrain, Pons, Medulla, Reticular formation, Cerebellum Spinal Cord: Structure and functions, Ascending (Sensory) tracts, Motor (Descending) tracts Cerebrospinal Fluid Peripheral Nervous system, Somatic Nervous System: Spinal nerves, Reflexes, Mono and Polysynaptic reflexes, Cranial nerves, Autonomic Nervous system (ANS): Sympathetic and Parasympathetic

**Special Senses:** The Smell: Olfactory receptors, Olfactory pathway, Physiology of olfaction, The Taste: Taste Receptors (Taste buds), Taste Pathway, Physiology of taste The Ear: Physiological Anatomy (External ear, Middle Ear, Inner ear, Cochlea), Physical Properties of sound, Mechanism of hearing, The Eye: Physiological Anatomy (Sclera, Choroid, Retina, Crystalline lens, photoreceptors), Visual Pathway, Image forming mechanism of eye, Visual Acuity, Visual reflexes, Accommodation, Defects of image forming mechanisms, Lacrimal Apparatus (Lacrimal gland, Lacrimal canaliculi, nasolacrimal duct, tears or Lacrimal fluid)

**Skin and Temperature:** Structure and function of skin, Temperature Regulation

#### **Practical**

Haemoglobinometry

- White Blood Cell count
- Red Blood Cell count
- Determination of Blood Groups
- Leishman's staining and Differential WBC count
- Determination of packed cell Volume
- Erythrocyte sedimentation rate [ESR]
- Calculation of Blood indices

- Determination of Clotting Time, Bleeding Time

## **PAPER:- CLINICAL BIOCHEMISTRY**

### **Syllabus**

1ST YEAR:

- 1) **Cell and Membrane:** Basic structure and function of the cell. Structure of the cell membrane. Functions of the cell membrane Transport through the cell membrane: active, passive, facilitated. Membrane proteins and functions.
- 2) **Chemistry of Carbohydrates:** definition, classification. Isomerism, optical isomerism, Structural presentation of monosaccharide's, The various chemical reactions of carbohydrates and their derivatives. Disaccharides and polysaccharides, Metabolism.
- 3) **Chemistry of Lipids:** definition, Classifications, properties , classifications. Fatty acids types and uses, Glycerides, Phospholipids, Glycolipids, Ecosanides, Steroids, Cholestrol, Lipoproteins, Amphipathic lipids and lipid bi layer, Metabolism.
- 4) **Chemistry of Amino acids and proteins:** definition of amino acids, Classification based on structure, requirement, metabolic fate, solubility, Physical properties of Amino acids, Chemical properties of amino acids. iso electric pH. Non standard amino acids, Metabolism. Proteins: Definition, Structure, structural classification, Functional classification. Peptide bonds an structural Motifs in protein such as A helix, B pleated sheets etc, Reactions of proteins such as denaturation, heat coagulation, salting out, reaction with acids, reactions with alkali, precipitations by heavy metals, precipitations by organic solvents, precipitation by alkaloid reagents.
- 5) **Nucleotides and nucleic acids:** Nucleotides, Purines and Pyrimidines. Sugars in nucleotides, DNA structure, Coiling and packaging of DNA, Histones, Genes and chromosomes. RNA types and structure of RNA & Metabolism.
- 6) **Vitamins:** Fat soluble and water soluble vitamins, Uses of Vitamins, Deficiency disorders.
- 7) **Nutrition:** Diet, calculation of balanced diet, disorders of protein energy malnutrition.
- 8) **Water and electrolytes,** Acid Base balance: ECF, ICF, Intra cellular and extra cellular electrolytes. Dehydration. Acidosis, alkalosis, Buffers, Means of maintaining pH.
- 9) Enzymes
- 10) Liver function test
- 11) Kidney function test
- 12) Thyroid function test
- 13) Molecular Biochemistry- DNA Replication, Transcription & Translation, Regulation of Genetic expression
- 14) Genetic Techniques; PCR, gene therapy
- 15) Hemoglobin metabolism
- 16) Hormones- Mechanism of Hormone action.

### **Practical-Clinical Biochemistry**

- Laboratory safety : Fire, chemical, radiation ,handling of biological specimens, waste
- Disposal regulations, workplace hazardous.
- Specimen collection, identification, transport, delivery and preservation.
- Patient preparation for tests.
- Anticoagulants' and preservatives
- Regulations and precautions regarding transport of biological specimens
- Preparation of high quality water
- pH determination
- Preparation of buffers and determination of pH
- Measurement of radioactivity
- Practical's related to solvent extraction, Partition coefficient, Dialysis, Concentration,
- Desalting and Ultracentrifugation.
- Calibration of equipments and laboratory wares.
- Familiarization and usage of Colorimetry, specterophotometry, fluorimetry,
- flame photometry, atomic absorption spectroscopy, nephelometry, osmometry,
- Chemiluminescence, ion selective electrodes, flowcytometry.
- Chromatography : - Paper, Thin layer, Gel filtration, Ion exchange, HPLC, GLC,

- Separation of various sugars, amino acids, lipids, drugs toxins etc. Urine amino gram.
- Electrophoresis: - Paper, Agarose gel, Cellulose acetate, PAGE, SDS-PAGE. Separation
- of serum proteins, lipoproteins, haemoglobin, globin chain and isoenzymes
- Tissue homogenization and cell disruption
- Cell fractionation methods
- Extraction of glycogen and its estimation
- Extraction of protein and its estimation
- Extraction of lipids and estimation of total lipids, glycolipid, phospholipids and cholesterol.
- Determination of saponification number and iodine number from oils
- Estimation of lactic acid and pyruvic acid
- Qualitative analysis of carbohydrate
- Detection of unknown sugars
- Qualitative analysis of proteins
- Isolation of DNA and RNA
- Estimation of DNA and RNA
- Agarose gel electrophoresis of DNA

**PAPER:- CLINICAL PATHOLOGY**

- ☒ Examination of Urine - Routine and Special tests
- ☒ Examination of Stool - Routine and Special tests
- ☒ Examination of Sputum - Routine and Special tests
- ☒ Semen examination - Routine and Special tests
- ☒ Examination of CSF - Routine and Special tests
- ☒ Examination of various body fluids-Pleural Fluid, Pericardial Fluid, Synovial Fluid, Ascetic Fluid
- ☒ Various methods of detecting HCG levels
- ☒ Structure and molecular organization of Chromosomes
- ☒ Identification of human chromosomes
- ☒ Karyotyping
  - Direct chromosome preparation of Bone Marrow cells
  - Culture techniques
- ☒ Banding techniques
- ☒ Sex Chromatin bodies
- ☒ Autoradiography of human chromosomes
- ☒ Chromosome Identification by image analysis and Quantitative cytochemistry
- ☒ Clinical Manifestations of chromosome disorders
- ☒ Anemia and other disorders of Erythropoiesis
- ☒ Disorders of Leucopoiesis
- ☒ Homeostasis & its investigations
- ☒ Investigations of Thrombotic tendency
- ☒ Laboratory control of Anticoagulant , Thrombotic and platelet therapy
- ☒ Collection and handling of Blood
- ☒ All Routine and special Hematological Investigations
- ☒ Blood and Bone Marrow preparations
- ☒ Leucoproliferative disorders with special references to Leukemia
- ☒ Automation in Hematology
- ☒ Cytochemistry of Leukemic cells
- ☒ Amniocentesis
- ☒ Bone marrow transplantation
- ☒ Application of different Microscopes
- ☒ Preparations of various Reagents and Stains used in Hematology
- ☒ Immunophenotyping
- ☒ Flowcytometry
- ☒ Molecular techniques in Hematology

## **Practical Clinical Pathology**

- Examination of Urine - Routine and Special tests
- Examination of Stool - Routine and Special tests
- Examination of Sputum - Routine and Special tests
- Semen examination - Routine and Special tests
- Examination of CSF - Routine and Special tests
- Examination of various body fluids-Pleural Fluid, Pericardial Fluid, Synovial Fluid, Ascetic Fluid
- Various methods of detecting HCG levels
- Structure and molecular organization of Chromosomes
- Identification of human chromosomes
- Karyotyping
- Direct chromosome preparation of Bone Marrow cells
- Culture techniques
- Banding techniques
- Sex Chromatin bodies
- Autoradiography of human chromosomes
- Chromosome Identification by image analysis and Quantitative cytochemistry
- Clinical Manifestations of chromosome disorders
- Organization of Histology Laboratory

## **PAPER:- CLINICAL MICROBIOLOGY**

### **CLINICAL MICROBIOLOGY**

#### **THEORY**

#### **UNIT I**

#### **GENERAL MICROBIOLOGY**

1. History and Pioneers in microbiology
2. Microscopy
3. Morphology of bacteria and other microorganism
4. Nomenclature and classification of microbes
5. Growth and nutrition of bacteria
6. Sterilization and disinfection
7. Bacterial toxins
8. Bacterial genetics
9. Antibacterial substances used in the treatment of infection and drug resistance in bacteria
10. Bacterial ecology-Normal flora of human body, Hospital environment, Air, Water and Milk

#### **UNIT II**

#### **IMMUNOLOGY**

1. Normal immune system
2. Innate immunity and acquired immunity
3. Antigens
4. Immunoglobulin
5. Complement
6. Antigen-Antibody reactions
7. Cell mediated immunity & humoral immunity
8. Hypersensitivity
9. Immunodeficiency
10. Auto-immunity

#### **UNIT III**

#### **SYSTEMIC BACTERIOLOGY**

1. Isolation, description and identification of bacteria
2. Staphylococcus and Micrococcus
3. Streptococcus
4. Neisseria
5. Corynebacterium
6. Bacillus:The Aerobic spore bearing bacilli

7. Clostridium: The anaerobic spore bearing bacilli
8. Enterobacteriaceae
- 12
9. Vibrios and Campylobacter
10. Haemophilus and Bordetella
11. Brucella
12. Mycobacteria
13. Actinomyces and Nocardia
14. Pseudomonas
15. Spirochaetes
16. Chlamydiae
17. Rickettsiae
18. Mycoplasma & Ureaplasma

#### **UNIT IV**

##### **VIROLOGY**

1. Classification of viruses
2. Morphology, Virus structure
3. Viral replication
4. Pathogenicity of viruses
5. Bacteriophages
6. Pox viruses
7. Herpes viruses
8. Arboviruses
9. Orthomyxovirus
10. paramyxoviruses
11. Enteroviruses: Polio & other enteric viruses
12. Hepatitis viruses
13. Rabies viruses
14. Human immunodeficiency viruses

#### **UNIT V**

##### **PARASITOLOGY**

1. Protozoan parasites of medical importance  
Entamoeba, Giardia, Trichomonas, Leishmania, Trypanosoma, Plasmodium, Toxoplasma, Pneumocystis Carinii
2. Helminths: All those medically important helminths belonging to Cestodes, Trematodes and Nematodes  
Cestodes: Diphylobothrium, Taenia, Echinococcus, Hymenolepis,  
Nematodes: Trichuris, Trichinella, Strongyloides, Ancylostoma, Ascaris, Enterobius, Filarial worms, Dracunculus medinensis, etc.

13

#### **UNIT VI**

##### **MYCOLOGY**

1. The morphology and reproduction in fungi
2. Classification of fungi
3. Opportunistic fungi
4. Superficial mycotic infections
5. Fungi causing subcutaneous mycoses
6. Fungi causing systemic infections
7. Laboratory diagnosis of fungal infections

#### **UNIT VII**

##### **CLINICAL MICRO BIOLOGY**

1. Laboratory diagnosis of Meningitis, Lower respiratory tract infection, Upper respiratory infection, Genital tract infection.
2. Gastroenteritis
3. Blood stream infection
4. Hospital acquired infection and Biomedical waste management

##### **Practical**

## **SKILLS TO ACQUIRE**

### **BACTERIOLOGY**

1. Aseptic practice in Lab and safety precautions
2. Washing and Sterilization of glasswares
3. Care and operation of microscopes viz. Dark ground, Phase contrast and Fluorescent microscope,(Electron microscope).
4. Operation and maintenance of Autoclave, Hot air oven, Distillation plants, Filters like Sietz and Membrane and sterility test and Testing of disinfectant-Phenol coefficient test and its uses.
5. Care and maintenance of common laboratory equipments
6. Collection of specimens for Microbiological investigations
7. Preparations of stains viz. Grams, Alberts, Capsules, Spores, Ziehl Neelsons,etc and performing of staining
8. Preparation and pouring of media- Nutrient agar, Blood agar, Mac Conkey agar, Sugars, Kligler iron agar, Robertson's cooked meat, Lowenstein Jensen, Sabouraud's
9. Preparation of reagents-Oxidase, Kovac, etc
10. Identification of bacteria of medical importance upto species level(except Anaerobes which could be upto generic level)
11. Preparation of antibiotics discs: performance of Kirby Bauer, Stokes, etc
12. Disposal of contaminated materials
13. Quality control of media, reagents, etc.
14. Techniques for Anaerobiosis

### **IMMUNOLOGY**

1. Collection and preservation of serum.
2. Performance of common serological test
3. Immuno electrophoresis
4. ELISA
5. CD4
6. Skin test - Montoux test

### **MYCOLOGY**

1. Collection and processing of clinical specimens for fungi.
2. Special techniques like Wood lamp examination, hair baiting techniques, slide cultures.
3. Stoke cultures maintenance

### **PARASITOLOGY**

1. Examination of faeces for ova and cysts: Direct and Concentration method.
2. Egg counting techniques.
3. Examination of peripheral blood, Urine, CSF, and other fluids for parasites.
4. Permanent staining technique for parasites.

### **VIROLOGY**

1. Preparation and identification of CPE in various tissue cultures.
2. Serological test for viral infections
3. Handling of experiment animals and collection of various samples for evidence of viral infections in animals.

1. Laboratory diagnosis of AIDS
2. Laboratory diagnosis of Hepatitis
3. Laboratory diagnosis of Dengue
4. Safety measures

### **PAPER:- CLINICAL HEMATOLOGY**

1. Red Blood Cells :
  - a. Normal morphology count
  - b. Isolation from whole blood & count
  - c. Effect on count & morphology of physiochemical parameters & the diseased state
  - d. Red cell anomalies & their relevance w.r.t. normal & diseased state
2. Blood Transfusion :
  - a. Pre-requisitement & the complication of mis-matched transfusion.
  - b. Methods of blood matching

### 3. White blood cells & platelets;-

- a. Morphology count & methods of isolation
- b. Effect on count & morphology of cell by the physiochemical parameters, diseased. State & the relevance of condition of the diseases

18

#### 1. Anaemia's :

- a. Definition (in general) & courses
- b. Types of anemia & their classification
- c. Physiochemical, characteristic features & etiology of a plastic anemia, hemolytic, megaloblastic
- d. Clinical features & diagnosis

#### 5. Leukaemia

- a. Definition (in general) & their etiology
- b. Classification of leukaemia
- c. FAB classification
- d. Etiologies, physiochemical features of different type of leukaemias with reference to clinical states
- e. Diagnosis of different types of leukaemias

#### 6. Coagulation studies;

- a. General pathway (intrinsic & extrinsic)
- b. Properties (physiochemical) mode of action of coagulation factors
- c. Platelet studies, platelet function tests (for different Coagulation factors) > Effect of promoters & inhibitors at different steps in coagulation, their solution & mode of action.
- d. Diseases associated with coagulation disorders, their etiology & characteristics features.

#### 7. Red Cell mass studies'

- a. Chemical method & radioactive methods
  - b. Red Cell function studies
- ☒ Anaemia and other disorders of Erythropoiesis
  - ☒ Disorders of Leucopoiesis
  - ☒ Haemostasis & its investigations
  - ☒ Investigations of Thrombotic tendency
  - ☒ Laboratory control of Anticoagulant , Thrombotic and platelet therapy
  - ☒ Collection and handling of Blood
  - ☒ All Routine and special Haematological Investigations
  - ☒ Blood and Bone Marrow preparations
  - ☒ Leucoproliferative disorders with special references to Leukaemias
  - ☒ Automation in Haematology
  - ☒ Cytochemistry of Leukaemic cells
  - ☒ Amniocentesis
  - ☒ Bone marrow transplantation
  - ☒ Application of different Microscopes
  - ☒ Preparations of various Reagents and Stains used in Haematology
  - ☒ Immunophenotyping

19

#### ☒ Flowcytometry

#### ☒ Molecular techniques in Haematology

#### **Practical- Clinical Hematology**

- Haemopoiesis
- Anaemia and other disorders of Erythropoiesis
- Disorders of Leucopoiesis
- Haemostasis & its investigations
- Investigations of Thrombotic tendency
- Laboratory control of Anticoagulant , Thrombotic and platelet therapy
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- Immunophenotyping
- Flowcytometry
- Molecular techniques in Haematology

### **PAPER :- Blood Transfusions & IMMUNOHEMATOLOGY**

**Unit I** Reception, labeling and recording of laboratory investigations

Cleaning of glassware, pipettes, E.S.R. tubes and counting chambers

Preparation of capillary pipette, distilled water, reagents, buffers

**Unit II** Collection of blood, preparation of blood smear, staining of blood and bone marrow smears.

**Unit III** Measurement of hemoglobin, counting of leucocytes, erythrocytes, platelets and reticulocytes.

Recognition of blood cells in peripheral blood smears

**Unit IV** Determination of haematocrite and E.S.R., preparation of haemolysate and determination of alkali resistant

hemoglobin, paper electrophoresis of hemoglobin.

Test for sickle celling, bleeding time, coagulation time, prothrombin time, and kaolin cephalin clotting time.

**Unit V** Abo blood grouping and Rh typing

Performance of direct and indirect coombs test, red cell agglutination test (screening Paul bunnell test).

**Unit VI** Preparation for the demonstration of L.E. Cell phenomenon.

**Unit VII** Blood donor selection & screening

Blood collection and preservation, principle of clearing and preparing transfusion bottle and tubing sets – preparation and composition of anticoagulant – preservative solutions.

**Unit VIII** Transfusion reaction and their investigations

### **Immunoematology**

1 Blood & blood group antigens: General characteristics of ABO, Lewis, Rh, Mn & Xg antigens.

Leucocyte & platelet & is antigens. Blood transfusion, Erythroblastosis fetalis.

2 Molecular structure of hemoglobin. Genetic significance of Hemoglobin, structural variation, chemical & biochemical characteristics of Hemoglobin biosynthesis.

### **1. Blood Grouping**

- Introduction
- Human Blood Group system
- ABO Subgroups
- Red Cell Antigen
- Natural Antibodies
- Rh. System
- Rh. Antigens & Rh Antibodies
- Hemolytic Diseases of New born & Prevention
- Principle of Blood grouping, antigen-antibody reaction.
- Agglutination, Haemagglutination, Condition required for antigen antibody reaction
- Blood grouping techniques-Cell grouping, Serum grouping
- Method for ABO grouping Slide & Tube Method Cell grouping Serum grouping Rh grouping by slide & tube method
- Difficulties in ABO grouping
- Rouleaux formation how it interferes with Blood grouping
- Auto agglutinins.
- Antiserum used in ABO test procedures, Anti-A, Anti-B, Anti-AB Antiserum
- Inheritance of the Blood groups;
- Control A & B Cells preparation Auto Control
- Medical applications of Blood groups

### **2. Blood Transfusion**



- Principal & Practice of blood Transfusion
- Blood Transfusion service at District Level
- Guide lines for the use of Blood Appropriate use of Blood Quality Assurance
- Antilogous Blood Transfusion practices.
- Objectives of Quality Assurance in Blood Transfusion services, Standard operating procedures for usage, donation & storage of blood screening of donor compatibility testing, safety procurement of supplies.

### **3. Blood Donation**

- Introduction
- Blood donor requirements
- Criteria for selection & rejection
- Medical history & personal details
- Self-exclusion
- Health checks before donating blood
- Screening for TTI

### **4. Blood Collection**

- Blood collections packs
- Anticoagulants
- Taking & giving sets in Blood transfusion
- Techniques of collecting blood from a doctor
- Instructions given to the donor after blood donation
- Adverse donor reaction

### **5. Testing Donor Blood**

- Screening donor's blood for infectious agents –HIV, HCV, HBV, Trepanoma palladium, Plasmodium HTLV.
- Bacterially contaminated Blood

### **6. Blood Donor Records**

- Blood donation record book
- Recording results.
- Blood donor card

### **7. Storage & Transport**

- Storage of blood
- Changes in blood after storage
- Gas refrigerator
- Lay out of a blood bank ref refrigerator
- Transportation

### **8. Maintenance of Blood Bank Records**

- Blood bank temperature sheet
- Blood bank stock sheet
- Blood transfusion request form.

### **9. Compatibility Testing**

- Purpose
- Single tube compatibility techniques using AHG reagent
- Emergency compatibility testing
- Difficulties in cross matching
- Labeling & Issuing cross-matched blood

### **10. Blood Components**

- Collection of blood components of fractional transfusion
- Platelets packed Red Cell Platelet rich Plasma, Platelets concentrate
- Preparation of concentrated (packed) Red Cells
- Techniques of preparation.

### **11. Blood Transfusion Reaction**

- Investigation of a Transfusion reaction
- Hemolytic transfusion reaction
- Actions to take when transfusion reaction occurs.

### **Practical Blood Transfusion**

- **Blood Bank Administration**

a) Record Keeping

26

b) Computerization in blood transfusion services.

c) Blood grouping ABO

d) PH typing various techniques.

• **Cross Matching**

a) Tube test

b) Slide Test

c) DU Test

d) Sub Grouping Test

• **Coomb's Test**

a) Direct comb's test

b) Indirect comb's test

• Compatibility testing for blood transfusion cross matching test.

a) 5% cell suspension and 10% cell suspensions.

b) HIV and AIDS demonstration

• Haemopoiesis

• Anaemia and other disorders of Erythropoiesis

• Disorders of Leucopoiesis

• Haemostasis & its investigations

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• Application of different Microscopes

• Preparations of various Reagents and Stains used in Haematology

• Immunophenotyping

• Flowcytometry

• Molecular techniques in Haematology

**PRACTICAL**

1. Basic Hematological Techniques, Characteristic of good technician, Preparation of specimen collection material, Lab. Request from, Basic steps for drawing a blood specimen by vein puncture.

Complication of vein puncture, Patient after care, Specimen rejectin criteria for blood specimen,

Hemolytic of blood, Blood collection by skin puncture (Capillary Blood), Arterial puncture,

Deciding specimen types and selection of , Anticoagulant-EDTA, Citrate, Oxalate, Heparin,

sodium fluoride., Separation of serum, Separation of plasma, Changes in blood on keeping,

Maintenance of specimen identification, Transport of the specimen, Effect of storage on Blood

Cell Morphology,

1. Universal precautions.

2. Basic requirements for hematology laboratory

3. Glassware's for Hematology

4. Equipments for Hematology

5. Anticoagulant vial preparation

6. Complete Blood Counts

7. Determination of Hemoglobin

8. TRBC Count by Hemocytometers

9. TLC by Hemocytometer

10. Differential Leukocyte count

11. Determination of Platelet Count.

12. Determination of ESR by win robes

13. Determination of ESR by Wintergreen's Method

14. Determination of PCV by Wintrobe's
15. Erythrocyte Indices-MCV, MCH MCHC
16. Reticulocyte Count
17. Absolute Eosinophil Count
18. Morphology of Red Blood Cells
19. Blood grouping & Cross Matching
20. Reserves grouping
21. Antiglobulin test
22. Rh. Typing
23. Donor Blood Connection Techniques
24. Laboratory in Good Criteria for Safe Blood Collection, Quality control in Blood Banks. Risk assessment for AIDS and Serum hepatitis.
24. Basic knowledge of disease transmissible disease example HIV, Serum hepatitis B and C, VDRL, and Malaria

**Paper:- Histopathology**

**Introduction to Histology**, the cell, cell Organelles, nucleus, cell division, tissues, fresh & fixed tissues.

Different types of Embedding Viz. Wax, Resin, and Cryostat etc. Basic Cytology

**Theory of Histopathology** Reception of specimens, Histopathology of Tumor cell, Histopathology of Liver Kidney Adrenal Ovary Testis.

**Fixation of tissue**, different kind of fixatives, simple fixative, compound fixative, formaldehyde, mercuric chloride, osmium, Picric acid, alcohols, other acids, formalin, buffered formalin, osmic acid, Zenker's soln, Heidenhain's iron-haematoxylin soln, cytological fixatives, nuclear fixatives, fixation of smear etc., decalcification, method of decalcification, assessment of decalcification, soln for decalcification.

**Processing of tissue**, dehydration, impregnation in the wax, manual and automatic tissue processor, gelatin embedding, celloidin embedding, double embedding, cytological fixatives, preparation of different smears, vaginal, sputum, membrane.

**Microtome, instrument**, principle, use in section cutting, parts and working of commonly used microtome, different kinds of microtome, rotary, base sledge, sliding, low temperature microtome, cryostat, microtome knives, honing and stropping knives.

**Section cutting o paraffin sections**, section preparation from frozen sections, fixing of tissue to slide, preparation of celloidin section and fixation. Staining techniques, natural dyes, synthetic dyes, basic and acidic dyes, haematoxylin staining, Pap, flicker & Conn, methanamine silver nitrate, Ziehl-Neelsen's stain, propylene glycol sudan technique, Papanicolaou, Harn's alum, Haematoxylin, acridine orange technique.

**Unit I:** Handling of fresh histological specimen (tissues) cryo/frozen sections of fresh and fixed tissues freeze drying Lipids identification and demonstration Micro organisms in tissues various staining technique for their demonstration and identification Nucleic acids DNA and RNA special stains and procedures Cytoplasm constituents and their demonstration Cervical cytology basis of detection of malignant and premalignant lesions Hermeral assessment with cytologic techniques and sex chromatin and pregnancy tests Cells and organs of immune system Immunoglobulin's antibodies and humoral immune response Allergy Rheumatological diseases and investigations.

**Unit II Method of preparing stains**

Method of preparing stains & Fixatives. Theory of Tissue processing and embedding, Theory of H & E staining.

**Unit III Use Microtome Tissues section**

Introduction, cutting Embedding and preparation of blocks Fixation of Tissue with DPX mount Theory of frozen section preparation.

**Unit IV Preparation of smear**

Preparation of smear for Fine needle aspiration cytology Pap's smear theory and identification of cells in a normal vaginal smear.

**Unit V Stool examination**

Normal abnormal constituent.

Normal and abnormal constituent of Urine, Normal and abnormal constituent of amniotic fluid Normal and abnormal constituent of Semen analysis.

### **Equipment used in histopathology, their merits and demerits and care to be taken:**

- a. Tissue processor
  - b. Microtome
  - c. Knife sharpener
  - d. Automatic slide strainer
  - e. Knives
  - f. Freezing microtome cryostat
  - g. Hot plate
  - h. Water bath
4. Decalcification-method, advantage and disadvantage of each method.
5. Frozen section and Cryostat techniques, staining and mounting technique morbid anatomy
6. Tissue processing-fixation Dehydrate, clearing impregnation in paraffin. Making of paraffin block and section cutting errors in section cutting and there correction.
7. Preparation of different types special stains. Histo-chemical and Cyto-chemical techniques Immune Cytochemical staining.

### **Practical**

- Organisation of Histology Laboratory
- Histological equipments
- Reception and recording of tissue specimen
- Tissue processing and Microtomy including frozen
- Theory of staining
- Preparation and quality control of all routine and special stains used in istopathology
- All staining techniques and their interpretation
- Immunohistochemistry
- Molecular markers of malignant neoplasms
- Molecular techniques
- Immunofluorescent techniques
- Enzyme histochemistry
- Museum techniques
- Autopsy Techniques
- Automation in Histological Techniques
- Histopathology, Reception of specimens, Histopathology of Tumor cell
- Histopathology of Liver, Kidney, Adrenal, Ovary, Testies
- Method of preparing stains & Fixatives.
- Use of Microtome, Tissue section cutting
- Embedding and preparation of blocks
- Fixation of Tissue with DPX mount
- Reception and recording of tissue specimen
- Tissue processing and Microtomy including frozen
- Theory of staining
- Preparation and quality control of all routine and special stains used in Histopathology
- All staining techniques and their interpretation
- Immunohistochemistry
- Molecular markers of malignant neoplasms
- Molecular techniques
- Immunofluorescent techniques
- Enzyme histochemistry
- Museum techniques
- Autopsy Techniques
- Automation in Histological Techniques

### **Paper:- CYTOLOGY**

#### **Cytology**

Handling of fresh histological specimen (tissues) cryo/frozen sections of fresh and fixed tissues, freeze drying Lipids identification and demonstration Micro-organisms in tissues-various staining

technique for their demonstration and identification  
Nucleic acids, DNA and RNA special stains and procedures  
Cytoplasmic constituents and their demonstration.

Cervical cytology-basis of detection of malignant and premalignant lesions.

Humoral assessment with cytologic techniques and sex chromatin and pregnancy test.

Cells and organs of immune system  
Immunoglobulins, antibodies and humoral immune response

Allergy  
Rheumatologic diseases and investigations.

Tissues requiring special treatment i.e. eye ball  
Bone marrow biopsy under calcified bones.

Neuropathology techniques  
Enzyme histochemistry demonstrations of phosphatases dehydrogenases oxidases and peroxidases etc.

Electron microscope working principles components and allied techniques for electron microscopy  
ultra-microtomy  
Museum techniques  
Aspiration cytology principles indications and utility of the techniques with special emphasis on role of cytotechnician in FNAC clinics  
Infection and immune system  
Cancer Immunology

Tissue typing for kidney transplant

### **Practical cytology**

- Morphology and Physiology of cell
- Cytology of
  - Female genital Tract
  - Urinary Tract
  - Gastrointestinal Tract
  - Respiratory Tract
  - Effusions
  - Miscellaneous Fluids
- Collection, Preservation, Fixation and Processing of various Cytological Specimen
- Preparation and Quality control of various stains and reagents used in cytology
- All routine and special Staining techniques in cytology
- FNAC
- Immunocytochemistry
- Automation in Cytology

### **Dissertation**

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☒ **Viva- voce: -**