

# ERA UNIVERSITY

SARFARAZGANJ, HARDOI ROAD LUCKNOW (UP)-226 003

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## REVISED SYLLABUS

Faculty of Sciences

For

M.Sc. (Medical Physiology)

2023

### Administrative Office:

Dean of Faculty of Sciences

Era University, Lucknow (UP), 226003

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## DEPARTMENTAL OBJECTIVES FOR POSTGRADUATE (M.Sc) STUDENTS IN MEDICAL PHYSIOLOGY

After successful completion of training of 3 years in Physiology, the postgraduate student shall be able to:

1. Is able to demonstrate comprehensive understanding of physiology as well as that of the applied disciplines;
2. Is able to demonstrate adequate knowledge of the current developments in medical sciences as related to physiology;
3. teach undergraduates and postgraduates in physiology;
4. Is oriented to principle of research methodology and is thus able to plan and conduct research effectively;
5. Is able to plan educational programs in physiology utilizing modern methods of teaching and evaluation; and
6. Is able to organize and equipped physiology laboratories.

### Objectives

At the end of M.Sc. (Medical Physiology), the student should be able to:

- a. demonstrate comprehensive understanding of the structure, function and development of the human body as related to physiology,
- b. Demonstrate elementary understanding of the clinical applications of physiology,
- c. critically evaluate the impact of the recent information regarding physiology;
- d. Should be able to conduct lecture classes on Physiology for undergraduates;
- e. Should be able to conduct practical classes in Physiology for undergraduates;
- f. Should be able to plan and execute a research project.
- g. Develop skills as a self-directed learner, recognize continuing medical educational needs.

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19/03/23  
Department of Physiology  
Ere's Lucknow Medical College  
Lucknow-226 003, India

## **FIRST YEAR**

**Contains two semesters of 6 months each as Semester I and Semester II**

### **SEMESTER- I**

#### **Theory (MMScPHY -101)**

##### **General Physiology**

1. The Structure and Function of a Cell
2. Transport Across Cell Membranes
3. Body Water and Body Fluids
4. The Membrane Potentials

##### **Nerve Muscle Physiology**

1. Structure and Function of Nervous Tissues
2. Physiological Properties of the Nerve Fibers
3. Nerve Fiber Types and Functions
4. Degeneration and Regeneration in Peripheral Nerves
5. Neuromuscular Junction
6. Skeletal Muscle
7. Cardiac Muscle
8. Smooth Muscle

##### **Blood**

1. Composition and Functions of Blood
2. The Plasma Proteins
3. Haemoglobin
4. Erythrocyte -Red Blood Corpuscle (RBC)
5. Jaundice
6. Leucocyte- White Blood Corpuscle (WBC)
7. Platelets or Thrombocytes
8. Coagulation of Blood
9. Blood Groups
10. Lymphoid Tissues and Lymph
11. Immunity (The Immune System)

##### **The Cardio-Vascular System (CVS)**

1. Physiological Anatomy of the Heart
2. Properties of the Cardiac Muscle
3. The Cardiac Cycle
4. The Electrocardiogram (E.C.G.)
5. General Principles of the Circulation
6. Cardio-Vascular Regulatory Mechanisms

7. The Heart Rate
8. The Cardiac Output
9. The Arterial Blood Pressure
10. The Regional Circulation
11. Cardio-vascular Homeostasis in Health and Disease

### **Respiration**

1. Physiological Anatomy of Respiratory system
2. Mechanism of respiration
3. Transport of Gases
4. Regulation of Respiration
5. Hypoxia
6. Physiology of High Altitude
7. Effects of High Atmospheric Pressure
8. Pulmonary (Lung) Function Tests

### **Renal System**

1. Physiological Anatomy of the Kidney
2. Mechanism of Formation of Urine
3. Renal Clearance
4. Mechanism of Concentration and Dilution of Urine - The Counter Current System
5. Acidification of Urine
6. Regulation of Volume and Concentration of Body Fluids
7. Kidney (Renal) Function Tests
8. Physiology of Micturition

### **GIT**

1. Physiological Anatomy of Gastro-Intestinal Tract (GIT)
2. Physiology of Salivary Secretion
3. Mouth and Oesophagus
4. The Stomach
5. Pancreas
6. Liver and Gall Bladder
7. Small Intestine
8. Large Intestine (Colon)
9. Digestion and Absorption in the GIT

**Course outcome** – Alteration in homeostasis causes disease hence its understanding would help in management of disease processes. Development of understanding of general cellular function of body help to student how to function of human body at cellular level. Basic understanding of physiological processes about Nerve muscle, blood, respiratory system, cardiovascular system, renal system GIT is learnt here.

## **Practical (MMScPHY – 102)**

### **Haematology Lab**

1. Collection of Blood, Microscope
2. Preparation and Staining of Blood Smear
3. Identification of cell
4. Differential WBC Count
5. Arneth's Count
6. Haemocytometer
7. Total WBC Count of Blood
8. Total RBC Count of Blood
9. Haemoglobin Estimation
10. Blood Groups
11. Platelet Count
12. Bleeding and Coagulation Time+
13. ESR & PCV (Demonstration)
14. Osmotic effects on RBC (Demonstration)

**Course outcome** - At the end of Semester student will be able to perform, analysis and report on experiments.

## **SEMESTER- II**

### **Theory (MMScPHY – 201)**

#### **Endocrine**

1. General Principles of Endocrinology
2. The Pituitary Gland
3. The Thyroid Gland
4. The Parathyroids, Calcitonin and Vitamin D
5. The Adrenal Cortex
6. The Adrenal Medulla
7. The Pancreas

#### **The Reproductive System**

1. Physiology of Reproduction
2. Male Reproductive System
3. Female Reproductive System
4. Physiology of Coitus
5. Contraceptive Measures
6. Physiology of Pregnancy
7. Physiology of Foetus and Newborn

#### **CNS**

1. Organization of the Nervous System
2. The Synapse
3. Sensory Receptors
4. Reflexes
5. The Sensory System
6. The Motor Areas and Descending Tracts
7. The Autonomic Nervous System
8. Spinal Cord Lesions
9. The Vestibular Apparatus (Labyrinth)
10. Control of Body Movement and Posture
11. The Reticular Formation
12. The Cerebellum
13. The Thalamus
14. The Electroencephalogram and Sleep
15. The Basal Ganglia
16. The Hypothalamus
17. The Cerebral Hemisphere (Cerebrum)
18. The Limbic System: Emotion and Motivation
19. Higher functions of the Nervous System
20. Chemical transmission in the Nervous System

## **The Special Senses**

1. The Smell
2. The Taste
3. The Ear
4. The Eye

## **Growth, development and Genetics**

### **Integumentary system**

### **Peripheral Nervous system**

### **Autonomic Nervous system**

**Course outcome** – Physiological system base knowledge helps in system based design of therapy. Basic knowledge of the physiological processes about Endocrine, Reproductive, Growth, development and Genetics, PNS, ANS, CNS & special senses is learnt here.

## **Practical (MMScPHY – 202)**

### **Human Lab**

1. Body Mass Index, Pulse and general physical examination
2. Examination of Respiratory System
3. Lung Volumes and Capacities
4. Effect of Deglutition, Coughing, Sneezing, Hyperventilation and Breath Holding on Respiration
5. Cardio vascular System Examination
6. Determination of Blood Pressure, Effect of posture on BP
7. Effect of Exercise on Blood Pressure Pulse Rate and Respiratory Rate
8. Recording of Electrocardiogram
9. II Cranial Nerve (Optic Nerve)
10. Examination of III, IV, VI & VIII Cranial Nerve
11. Examination of I, V, VII, IX, X, XI and XII Cranial Nerves
12. Examination of Motor Nervous System
13. Clinical Examination of Reflexes
14. Clinical Examination of Sensory Nervous System

**Course outcome** - At the end of Semester student will able to perform, analysis and report on experiments.

## Second Year

Comprise of two semester, i.e Semester III and Semester IV and in each semester, the candidate shall attain two papers and as such the candidate shall total 4 papers in second year.

### SEMESTOR –III

#### Paper-One (MMScPHY - 301)

##### General Physiology

#### **1. The Structure and Function of a Cell**

Introduction, Homeostatic Regulation, The Structure and Function of a Cell, Junctional Complexes, Cell Junctions, Apoptosis-programmed cell death

#### **2. Transport Across Cell Membranes**

Passive Transport Processes,(A) Diffusion: simple, facilitated (B) Osmosis: osmotic pressure, tonicity, Active transport processes,(A) Primary (**Na<sup>+</sup>-K<sup>+</sup>** pump) (B) Secondary (C) Carrier type (uniporters, symporters, antiporters),(D) Vesicular transport processes: endocytosis (phagocytosis), pinocytosis, exocytosis, Intercellular communication: chemical messengers

#### **3. Body Water and Body Fluids**

Introduction, Distribution of total body water (TBW), Measurement of body fluid volumes. Ionic composition of body fluids, Units for measuring concentration of solutes,(A) Moles (B) Equivalentents, (D) Concept of pH and **H<sup>+</sup>** concentration

#### **4. The Membrane Potentials**

Introduction: Ionic composition of body fluids, Gibbs-Donnan membrane equilibrium, Resting membrane potential, Genesis, equilibrium potential; variation in membrane potential. Action potential, Definition; Origin; phases; ionic basis; properties; electrotonic potentials (graded potentials), extracellular (surface) recording - biphasic and monophasic; injury (demarcation) potential.



# **Nerve Muscle Physiology**

## **1. Structure and Function of Nervous Tissues**

Structure and function of the neuron, Myelinated and unmyelinated nerves; myelinogenesis Glial cell (neuroglia); Neurotrophins: Nerve growth factor; Metabolism in the nerve fibers, Heat production in the nerve fibers.

## **2. Physiological Properties of the Nerve Fibers**

Excitability, All or none law, Refractory period, Accommodation, Conductivity, Orthodromic and antidromic conduction

## **3. Nerve Fiber Types and Functions**

General; Classification; Properties of mixed nerves: (Compound action potential)

## **4. Degeneration and Regeneration in Peripheral Nerves**

Introduction: causes and grading of injury; Degeneration and regeneration changes; Complications

## **5. Neuromuscular Junction**

Definition, Structure, Synthesis of events at NMJ, Miniature and Giant end plate potential, Clinical importance, Applied: Myasthenia gravis, Lambert Eaton Syndrome

## **6. Skeletal Muscle**

Introduction, Structure, muscle protein, Contractile response, Excitation contraction coupling, Steps in muscular contraction and relaxation with molecular basis, Mode of contraction: Isometric and isotonic, motor unit, Energy source for muscular contraction

## **7. Cardiac Muscle**

Structure, Properties (Morphological Electrical, Mechanical, Metabolic)

## **8. Smooth Muscle**

General features: single unit and multiunit smooth muscles, Properties of visceral smooth muscle (electrical, mechanical-plasticity) Nerve supply, excitatory junctional potential, Denervation hypersensitivity, Effect of various agents on membrane potential of intestinal smooth muscle.

**Course Outcome** – Deviation of normal cellular physiology causes disease manifestation hence the key principle of physiology help in understanding interconnection between different component within a particular system or across system. Basic understanding of physiological process about General Physiology, Nerve muscle Physiology is learnt here.

**Blood**

**1. Composition and Functions of Blood**

Composition of Blood, Functions of Blood, Serum

**2. The Plasma Proteins**

Origin of plasma proteins, Forms of plasma proteins and their functions, Relation of diet to plasma proteins (Whipple's experiment), Variations in plasma protein concentration, Functions of plasma proteins

**3. Haemoglobin**

Structure, Some important definitions: Oxyhaemoglobin; carbamino-haemoglobin, Normal values reduced haemoglobin; carboxyhaemoglobin; methaemoglobin, Functions of haemoglobin Disadvantages of 'free' haemoglobin, Synthesis of haemoglobin, Catabolism of haemoglobin, Varieties of haemoglobin: HbA; HbF-thalassaemia; HbS

**4. Erythrocyte -Red Blood Corpuscle (RBC)**

General structure, Variations in size, shape and structure of RBC, Haemopoiesis: Theories of haemopoiesis; Interleukins (ILs); Colony stimulating factors (CSFs), Erythropoiesis: Stages; Regulation, Anaemias: Grading, Classification: Pernicious anaemia; Folic acid deficiency anaemia; Iron deficiency anaemia; Congenital spherocytosis

**5. Jaundice**

Chemistry of bilirubin formation, Fate of bilirubin, Types of jaundice and their characteristic features (Hemolytic; Hepatic; Obstructive), Physiological Jaundice: Jaundice of newborn, Phototherapy

**6. Leucocyte- White Blood Corpuscle (WBC)**

General: Total leucocyte count; Leucopenia; Leucocytosis; Leukaemia, Structure, functions and variations, Physiology of phagocytic mechanism, Leucopoiesis: Stages; Regulation; Senile leucocytes

**7. Platelets or Thrombocytes**

Structure; Count and variations; Thrombopoiesis; Functions

**8. Coagulation of Blood**

Definition, Mechanism, Physiology of clotting mechanism, Anti-coagulant mechanism: Fibrinolytic system, Anti-coagulants: Natural; Synthetic, Haemorrhagic (bleeding) disorders, hemophilia, purpura.

## **9. Blood Groups**

Classical 'ABO' blood groups: Determination, Inheritance and hemolytic diseases  
Uses: Blood transfusion, investigation - a case of paternity dispute Blood banking or Blood storage

## **10. Lymphoid Tissues and Lymph**

Lymphoid Tissues, Tissue macrophage system; Lymphocytes Plasma cells, Functions of Spleen, Lymph

## **11. Immunity (The Immune System)**

Introduction, Classification, Natural immune System (the complement system; C-reactive protein; interferons; NK cells), Acquired (immunoglobulins; cytokines), Regulation of immune response, Immunological tolerance: Recognition of self; Auto-immunization, Tissue Transplant (Graft)

## **The Cardio-Vascular System (CVS)**

### **1. Physiological Anatomy of the Heart**

Cardiac Chambers: General; Valves in the heart; Heart sounds, Pacemaker tissue of the heart.

### **2. Properties of the Cardiac Muscle**

Morphological, Electrical, Mechanical; and Metabolic Properties.

### **3. The Cardiac Cycle**

Definition, Events JVP, Record ECG changes, Heart Sounds

### **4. The Electrocardiogram (E.C.G.)**

Normal ECG, Electrocardiography, Cardiac Vector (Cardiac axis), Abnormal ECG, Heart block; Extrasystoles; Arrhythmias; WIPW Syndrome, Myocardial Infarction (MI); Effect due to changes in ionic composition of blood

### **5. General Principles of the Circulation**

Introduction, Functions, Pressure changes in the vascular system, Organisation and Functions of the Vascular System, Dynamics of Blood Flow; Biophysical consideration.

## **6. Cardio-Vascular Regulatory Mechanisms**

Local :Basal Myogenic Tone (BMT), Role of endothelial cells (Nitric oxide, endothelins) Systemic: (a) Chemical (b)Neural:Autonomic and Medullary (VMC and CVC) - Baroreceptors and Chemoreceptors Cortico-hypothalamic descending pathways

## **7. The Heart Rate**

Factors Affecting Heart Rate and its Control.

## **8. The Cardiac Output**

Definition, Distribution, Control (Heterometric & Homometric ) . Methods of measurement

## **9. The Arterial Blood Pressure**

Definition, Factors affecting, Determinants of arterial BP, Regulation of arterial BP

## **10.The Regional Circulation**

Capillary, Coronary, Cerebral Circulation including cerebrospinal fluid ( CSF), Cutaneous (Skin), Muscle, Splanchnic (intestinal and hepatic), and Pulmonary Circulation

## **11.Cardio-vascular Homeostasis in Health and Disease**

Regulation of blood volume, Compensations for gravitational effects, Shock and syncope, Heart failure, High BP (hypertension)

**Course Outcome** – Physiological System based knowledge help in therapy based on system organization. Basic understanding of Physiological processes of blood & cardiovascular system. Most of the pathological investigation is blood based.

## **Practical (MMScPHY - 303)**

### **Human Lab**

1. Body Mass Index, Pulse and general physical examination
2. Examination of Respiratory System
3. Lung Volumes and Capacities
4. Effect of Deglutition, Coughing, Sneezing, Hyperventilation and Breath Holding on Respiration
5. Cardio vascular System Examination
6. Determination of Blood Pressure, Effect of posture on BP
7. Effect of Exercise on Blood Pressure Pulse Rate and Respiratory Rate
8. Recording of Electrocardiogram
9. II Cranial Nerve (Optic Nerve)
10. Examination of III, IV, VI & VIII Cranial Nerve
11. Examination of I, V, VII, IX, X, XI and XII Cranial Nerves
12. Examination of Motor Nervous System
13. Clinical Examination of Reflexes
14. Clinical Examination of Sensory Nervous System

### **Amphibian/ Experimental Lab Experiments**

1. An Introduction to the Amphibian (Frog) Experiments and study of Apparatus
2. Gastrocnemius Muscle and Sciatic Nerve Preparation of Frog
3. Recording of Simple Muscle of Twitch (Effect of a single stimulus)
4. Effect of changing the strength of stimulus on Skeletal Muscle contraction
5. Effect of Temperature on Muscle Contraction
6. Determination of Conduction Velocity of the Sciatic Nerve
7. Effect of two Successive stimuli on Skeletal Muscle Contraction
8. Genesis of Tetanus (Effect of many Successive Stimuli)
9. Phenomenon of Fatigue and its site (Effect of Continued stimulation)
10. Effect of load and Length on Muscle Contraction (Free- and After- loading)
11. Recording of Normal Cardiogram
12. Effect of Temperature on Frog's Heart
13. Properties of Cardiac Muscle
14. Effect of Stimulation of Vagus nerve and white crescentic line (WCL) on the cardiogram
15. Effect of Adrenalin, Acetylcholine, and Atroline on Heart
16. Effect of Stimulation of Vagosympathetic Trunk and Crescent, Vagal Escape, Effect of Nicotine and Atropine

**Course outcome** - At the end of Semester student will able to perform, analysis and report on experiments and observation in Physiology.

**SEMESTOR- IV**  
**MMScPHY04**

**Paper-One (MMScPHY0 - 401)**

**Respiration**

**1. Physiological Anatomy of Respiratory system**

Passage of air, Tracheo-bronchial tree, Properties of gases: partial pressure, composition of air, Non-respiratory functions of respiratory system

**2. Mechanism of respiration**

Mechanism of breathing, Pressure changes during ventilation; Lung volumes and capacities; Alveolar surface tension; Pressure-volume relationship; Work done during breathing: Airway resistance; Alveolar ventilation: dead space, V/P ratio, diffusion capacity of lung.

**3. Transport of Gases**

Oxygen transport: oxygen haemoglobin dissociation curve; Carbondioxide transport.

**4. Regulation of Respiration**

Nervous regulation of respiration, Respiratory centres, Genesis of respiration; Chemical regulation of respiration: chemoreceptors (peripheral and central), Physio-clinical aspects: Dyspnoea; Breath holding; Asphyxia; Drowning; Periodic breathing.

**5. Hypoxia**

Definition, Types: (Hypoxic, Anaemic, Stagnant, Histotoxic), Effects of hypoxia: O<sub>2</sub> therapy; Cyanosis

**6. Physiology of High Altitude**

Effects during rapid and slow ascent: pulmonary oedema; motion sickness; Acclimatization

**7. Effects of High Atmospheric Pressure**

Caisson's disease; Nitrogen narcosis; High pressure nervous syndrome, Air embolism

**8. Pulmonary (Lung) Function Tests**

## **Renal System**

### **1. Physiological Anatomy of the Kidney**

Kidney Structure: ; Nephron; organization and function of glomerulus; Types of Nephrons Juxtaglomerular Apparatus, Kidney functions, Blood Supply of the Kidney Renal Blood Vessels; Peculiarities of Renal Circulation.

### **2. Mechanism of Formation of Urine**

Glomerular Filtration; GFR; Glomerular filtration versus systemic filtration; Filtration Fraction, Reabsorption and secretion in renal tubules of glucose;  $\text{Na}^+$ ;  $\text{K}^+$ ,  $\text{HCO}_3^-$ ,  $\text{H}^+$ , Cl and water

### **3. Renal Clearance**

Introduction; Significance Applications as a measure of GFR, tubular secretory capacity RPF, RBF osmotic' and 'free-water' clearances, excretion of waste products, Uremia; Dialysis therapy

### **4. Mechanism of Concentration and Dilution of Urine - The Counter Current System**

Counter Current System , Counter Current Multipliers and Exchangers, Role of Urea, Diuresis-Water versus osmotic Diuretics

### **5. Acidification of Urine**

Renal Regulation of Acid-Base Balance: Buffer Systems in the Kidneys; titratable Acidity; excretion of  $\text{H}^+$

### **6. Regulation of Volume and Concentration of Body Fluids**

Regulatory Mechanisms: Defence of tonicity, volume and  $\text{H}^+$  Concentration

Applied: dehydration, overhydration, Acidosis and Alkalosis; Anion Gap

### **7. Kidney (Renal) Function Tests**

Urine and blood examination, Renal clearance tests: for glomerular and tubular functions, Miscellaneous tests.

### **8. Physiology of Micturition**

Definition; Physiological anatomy, Nerve supply and Postural activity of the urinary ladder, The micturition reflex, Mechanism of voluntary micturition and its reflex control, Applied aspects: Deafferentation; denervation

**Course Outcome** – It help in understanding of basic physiology of Respiration and Renal system and different human disease related to above system

**Paper two (MMScPHY - 402)**

**GIT**

- 1. Physiological Anatomy of Gastro-Intestinal Tract (GIT)**  
Introduction; Organisation of structure of GIT: Innervation; Structure of small and large intestine.
- 2. Physiology of Salivary Secretion**  
Salivary Glands: Types, Histology; Innervation, Composition Functions, Mechanism, and Control of Salivary Secretion  
Applied: Aptyalism; Sialorrhoea
- 3. Mouth and Oesophagus**  
Mastication; Swallowing (Deglutition) and Stages; Upper and lower oesophageal sphincters, Applied: Aerophagia; achalasia cardia
- 4. The Stomach**  
Structure, function Innervation; Composition, Functions, Mechanism of Secretion and regulation of Gastric Juice; Regulation of f Gastric motility and emptying, gastric function tests,  
Applied: Total gastrectomy, Pathophysiology of peptic ulcer, Physiology of vomiting.
- 5. Pancreas**  
Physiological Anatomy of Pancreas: Structure; Nerve supply; Composition, functions and regulation of Pancreatic Juice; Pancreatic Exocrine function tests  
Applied : Total removal of pancreas.
- 6. Liver and Gall Bladder**  
Liver Structure, Functions of the Liver and Signs of Liver Insufficiency; bile: Composition, function and control of bile secretion, bilirubin metabolism, excretion and Jaundice; functions of gall bladder; Cholecystectomy; gall stones liver function test;
- 7. Small Intestine**  
Structure. Intestinal Juice ( Succus Entericus): Composition, functions and control; digestion in the Small Intestine; Malabsorption Syndrome



movements in small Intestine: adynamic (paralytic) ileus, ileo-caecal valve and gastro-ileal reflex

## **8. Large Intestine (Colon)**

Structure; movements, disorders, Hirschsprung's disease; defecation, Absorption and Secretion in Large Intestine, colonic bacterial flora faeces, dietary fibers

## **9. Digestion and Absorption in the GIT**

Digestion and Absorption of Carbohydrates, fats and proteins  
Absorption of water and electrolytes, vitamins and Minerals

## **Endocrine**

### **1. General Principles of Endocrinology**

Definition, Chemistry and characteristics of a hormone; Hormone assays  
Mechanisms of action and regulation of secretion of hormones. Control versus regulation

### **2. The Pituitary Gland**

Physiological anatomy, the pituitary hormones; Anterior pituitary: Actions and Control of secretion Growth hormone, gigantism, acromegaly, dwarfism, Physiology of growth Actions and Control of secretion of Prolactin, Posterior pituitary: Actions and Control of secretion of ADH and oxytocin, SIADH; Diabetes insipidus, Milk - let down reflex, Intermediate pituitary: MSH; Effects of hypophysectomy, Pituitary insufficiency.

### **3. The Thyroid Gland**

Physiological anatomy.; Formation, secretion, transport, metabolism regulation of secretion and actions of thyroid hormones, Goiter, myxoedema; Cretinism; Grave's disease, Anti-thyroid drugs, Thyroid.

### **4. The Parathyroids, Calcitonin and Vitamin D**

Calcium metabolism, Phosphate metabolism, Physiology of bone, Hormones regulating calcium metabolism, (Parathormone; Calcitonin and Vitamin D),  
Rickets, Osteomalacia tetany, hypo and hyperparathyroidism.

### **5. The Adrenal Cortex**

Physiological anatomy; Biosynthesis, transport, metabolism and excretion of adrenocortical hormones, Regulation of glucocorticoids secretion,

Actions of glucocorticoids, Cushing's syndrome; Mineralocorticoids: Aldosterone actions and regulation of secretion, Applied aspect: Primary and secondary hyperaldosteronism and Adrenocortical insufficiency, Sex hormones: Adrenal virilism, adrenal cortex functions tests

## **6. The Adrenal Medulla**

Physiological anatomy, catecholamines biosynthesis, metabolism, excretion regulation of secretion and action,  
Applied : Hypo and Hypersecretion (Pheochromocytoma)

## **7. The Pancreas**

Physiological anatomy, Glucagon, actions and regulation of secretion, Insulin Structure and species specificity regulation of secretion, Mechanism of action,  
Applied : pathophysiology of diabetes mellitus, Glucose tolerance test, clinical types, Hypoglycemia, Hyperglycemic versus hypoglycemic coma.

**Course Outcome** – This section help in basic understanding organization of GIT system and Endocrine system. System based knowledge help in therapy based on system organization.

## **Practical (MMScPHY - 403)**

### **Haematology Lab**

1. Collection of Blood, Microscope
2. Preparation and Staining of Blood Smear
3. Identification of cell
4. Differential WBC Count
5. Arneth's Count
6. Haemocytometer
7. Total WBC Count of Blood
8. Total RBC Count of Blood
9. Haemoglobin Estimation
10. Blood Groups
11. Platelet Count
12. Bleeding and Coagulation Time
13. ESR & PCV (Demonstration)
14. Osmotic effects on RBC (Demonstration)

### **Amphibian/ Experimental Lab Experiments**

1. An Introduction to the Amphibian (Frog) Experiments and study of Apparatus
2. Gastrocnemius Muscle and Sciatic Nerve Preparation of Frog
3. Recording of Simple Muscle of Twitch (Effect of a single stimulus)
4. Effect of changing the strength of stimulus on Skeletal Muscle contraction
5. Effect of Temperature on Muscle Contraction
6. Determination of Conduction Velocity of the Sciatic Nerve
7. Effect of two Successive stimuli on Skeletal Muscle Contraction
8. Genesis of Tetanus (Effect of many Successive Stimuli)
9. Phenomenon of Fatigue and its site (Effect of Continued stimulation)
10. Effect of load and Length on Muscle Contraction (Free- and After- loading)
11. Recording of Normal Cardiogram
12. Effect of Temperature on Frog's Heart
13. Properties of Cardiac Muscle
14. Effect of Stimulation of Vagus nerve and white crescentic line (WCL) on the cardiogram
15. Effect of Adrenalin, Acetylcholine, and Atropine on Heart
16. Effect of Stimulation of Vagosympathetic Trunk and Crescent, Vagal Escape, Effect of Nicotine and Atropine

**Course outcome** - At the end of Semester student will able to perform, analysis and report on experiments and observation in Physiology.

**Third Year**  
**SEMESTER-V**

**Paper-one (MMScPHY - 501)**

**Central Nervous System (CNS)**

**1. Organization of the Nervous System**

Central nervous system: Brain and spinal cord, Peripheral nervous system: Somatic Autonomic and enteric nervous system

**2. The Synapse**

Physiological anatomy, Structure, types and Classification of synapses, Electrical events at synapses, Inhibition at synapses; Properties of synapses

**3. Sensory Receptors**

Definition, function and Classifications; Cutaneous receptors, electrical and ionic events in receptors, Properties of Receptors

**4. Reflexes**

The Reflex arc; classification, Monosynaptic of reflex, Muscle spindle, Higher control of Muscle tone and Inhibition of Polysynaptic reflexes, the withdrawal reflex; General properties of reflexes.

**5. The Sensory System**

Important terminology; Ascending (sensory) tracts in the spinal cord; Somatosensory cortex Somatic sensation; touch-pressure proprioception and kinesthesia, temperature, Pain and others: (Itch, vibratory sense, two-point discrimination, stereognosis)

**6. The Motor Areas and Descending Tracts**

Motor areas, Descending tracts: Pyramidal and Extrapyrmidal tracts, Applied : Lower versus upper motor neuron lesion; Lesion of the pyramidal tracts: hemiplegia

**7. Spinal Cord Lesions**

Functions of the spinal cord; Transection of the spinal cord: Complete, Incomplete, Hemisection (Brown sequard syndrome); Sensory disturbances.

## **8. The Vestibular Apparatus (Labyrinth)**

Physiological anatomy; The vestibular pathways; Functioning: Mode of action of semicircular canals and otolith organ; Role in regulation of posture, Vestibular dysfunctions.

## **9. Control of Body Movement and Posture**

Introduction; Control of body movement: Levels of motor control system; Control of body posture: Postural reflexes; Mechanism of normal standing posture; Walking

## **10. The Reticular Formation**

Ascending reticular system: (Reticular activating system), Descending reticular system: Inhibitory reticular projection projections; Functions of the reticular formation.

## **11. The Cerebellum**

Physiological anatomy: Divisions-lobes; The Cerebellar cortex; Structure Inputs: Neural circuits; Connections, Functions and lesions of the cerebellum

## **12. The Thalamus**

Introduction; Classification of thalamic nuclei; Connections AND Functions; Thalamic syndrome

## **13. The Electroencephalogram and Sleep**

Electroencephalogram (EEG): Normal EEG; Physiological basis; Uses. Sleep: factors affecting physiological changes; Types: (NREM versus REM sleep cycle)  
Genesis: Control of 'sleep-waiting' cycle Sleep disorders.

## **14. The Basal Ganglia**

Physiological Anatomy; Connections and functions; Control of food and water intake.

## **15. The Hypothalamus**

Physiological Anatomy; hypothalamic nuclei; connections and functions control of food and water intake.

## **16. The Cerebral Hemisphere (Cerebrum)**

Physiological anatomy: Structure, Parietal, frontal, prefrontal, occipital and temporal lobes.

## **17.The Limbic System: Emotion and Motivation**

The limbic system: structure, connections, functions unique features.  
Emotions  
: fear and rage; Motivation: reward and punishment system. Sexual behavior.

## **18.Higher functions of the Nervous System**

Language: dominant versus representational hemisphere, speech centres, speech pathway, speech disorders – aphasia. Learning: conditioned reflexes; Memory: Alzheimer' disease and senile dementia.

## **19.Chemical transmission in the Nervous System**

Introduction: Neurotransmitter classification; A-ch; Biogenic amines: Catecholamine, Serotonin, histamine; Amino-acid neurotransmitters: excitatory and inhibitory; Polypeptides: Enkephalins, Endorphins and substance P, CGRP, Neuropeptide Y; Purinergic neurotransmitters: Adenosine, ATP; Nitric oxide, prostaglandins.

**Course outcome** – Physiological system based knowledge help in system based design of therapy. Basic knowledge of physiological processes about central Nervous system.

## **Paper two (MMScPHY -502)**

### **Special Senses**

#### **1. The Smell**

Introduction: general versus special sensibility; The common chemical senses; The sense of smell (olfaction): olfactory receptors, olfactory pathway, physiology of olfaction; Applied: Anosmia, Parosmia, Hyposmia, Unitwue features

#### **2. The Taste**

Taste receptors or taste buds; Taste pathway; physiology of taste; Applied: Ageusia, hypogeusia; dysgeusia.

#### **3. The Ear**

Physiological anatomy; Auditory pathway; Physical properties of sound; Mechanism of hearing; Electro-physiology of hearing : Electrical activity of cochlea, action potential of the auditory nerve fibers, auditory cortex; Applied aspect: Deafness, tinnitus, Tests for hearing.

#### **4. The Eye**

Physiological anatomy; Visual pathway and effect of lesions; The image forming mechanism: Visual acuity, visual reflexes, defects of forming mechanism; Photochemistry of vision; Electrophysiology of vision; Physiology of colour vision; Eye movements and Nystagmus.

### **The Autonomic Nervous System**

Difference between Somatic and Autonomic Nervous System; Organization of ANS, Sympathetic and Parasympathetic division, Chemical transmission at autonomic junctions; Responses of effector organs to autonomic nerve impulse.

**Course Outcome** – Physiological system based knowledge help in system based design of therapy. Basic knowledge of physiological processes about Special Senses is learnt here.

## **Practical (MMScPHY -503)**

### **Haematology Lab**

1. Determination of RBC Indices (Blood Standards)
2. Determination of the Specific Gravity of Blood
3. Determination of Erythrocyte Sedimentation Rate (ESR) and Packed Cell Volume (PCV)
4. Determination of Osmotic Fragility of Red Blood Cells
5. Determination of Platelet Count
6. Determination of Reticulocyte Count
7. Determination of Absolute Eosinophil Count
8. Study of the Haemopoietic cells present in the bone Marrow

### **Human Lab**

1. Phenomenon of Human Fatigue by Mosso's Ergograph and HandGrip Spring Dynamometer
2. Electromyography (EMG)
3. Recording of a 12-Lead Electrocardiogram (ECG)
4. Cardiorespiratory Response to steady state exercise
5. Autonomic nervous System (ANS) testing
6. Clinical Examination of abdomen, respiratory system, Cardiovascular system and Nervous system
7. Perimetry
8. Spirometry
9. Measurement of basal metabolic rate (BMR)
10. Stethography – study of Respiratory movement
11. Pregnancy Diagnostic tests

### **Dissertation Work**

**Course outcome** - At the end of Semester student will able to perform, analysis and report on experiments and observation in Physiology.



## SEMESTER –VI

### Paper- One (MMScPHY - 601)

#### Reproduction

##### **1. Physiology of Reproduction**

Sex determination and sex differentiation; Abnormalities of human sex development:

Klinefelter's syndrome, Turner's syndrome; Hermaphroditism; Puberty: control of the onset; stages; delayed and precocious puberty; Reproductive hormones: gonadotrophins (FSH, LH)

##### **2. Male Reproductive System**

Testes: structure and function, spermatogenesis, structure of the sperm, seminal tracts and related glands, supporting structures; seminal fluid (semen); Endocrine functions of testes: Testosterone; Control of testicular activity; Cryptorchidism and removal of testis.

##### **3. Female Reproductive System**

The female reproductive tract: The uterus and related structures, The ovaries: ovarian hormones (oestrogen, progesterone, relaxin); removal of ovaries and menopause.

Female sexual cycles : Changes in the ovaries uterus (menstrual cycle) vagina and gonadotrophin secretion.

##### **4. Physiology of Coitus**

##### **5. Contraceptive Measures**

##### **6. Physiology of Pregnancy**

Fertilization and implantation of the ovum; Endocrinology of pregnancy: placental hormones; pregnancy diagnostic tests; Infertility and role of IVF. Maternal physiology in pregnancy; Parturition.

##### **7. Physiology of Foetus and Newborn**

The Placenta; Growth and functional development of the foetus; Respiratory and cardiovascular adjustments of the infant to extra-uterine life; Nutrition of the new born infant, the breast and lactation.

**Course Outcome** – Above course content helps in understanding of organization of male and female reproductive system. Basic knowledge of reproductive system help in understanding disease processes.

## **Paper-two (MMScPHY - 602)**

### **Skin, body Temperature**

#### **1. Regulation of Body Temperature in Human**

Introduction, Normal Body temperature, Factors affecting body temperature, Temperature regulating mechanism

Applied aspect: fever, hypothermia; heat stroke; cold injuries.

### **Yoga**

#### **1. Physiology of Yoga**

General, Types of yogic exercises, The health benefits of yoga practice, Yoga in health and disease, Yoga versus conventional exercise.

### **Miscellaneous Topic:**

#### **1. Physiology of Aging**

Physiology of infancy, Aging and free radical and antioxidants, Brain death.

#### **2. Physiology of Exercise**

Grading, Cardio-respiratory adaptation to exercise, Physiological effects of physical training, Exercise under heat and cold, Consequences of sedentary life style.

**Course outcome** – Physiological system based knowledge helps in therapy based on system organization. Basic understanding of physiological processes of skin, body temperature, Yoga, biophysical principles of understanding of physiological parameters. Normal balance diet, Geriatric physiology & sport physiology is learnt here.

## **Practical (MMScPHY - 603)**

### **Haematology Lab**

1. Determination of RBC Indices (Blood Standards)
2. Determination of the Specific Gravity of Blood
3. Determination of Erythrocyte Sedimentation Rate (ESR) and Packed Cell Volume (PCV)
4. Determination of Osmotic Fragility of Red Blood Cells
5. Determination of Platelet Count
6. Determination of Reticulocyte Count
7. Determination of Absolute Eosinophil Count
8. Study of the Haemopoietic cells present in the bone Marrow

### **Human Lab**

1. Phenomenon of Human Fatigue by Mosso's Ergograph and HandGrip Spring Dynamometer
2. Electromyography (EMG)
3. Recording of a 12-Lead Electrocardiogram (ECG)
4. Cardiorespiratory Response to steady state exercise
5. Autonomic nervous System (ANS) testing
6. Clinical Examination of abdomen, respiratory system, Cardiovascular system and Nervous system
7. Perimetry
8. Spirometry
9. Measurement of basal metabolic rate (BMR)
10. Stethography – study of Respiratory movement
11. Pregnancy Diagnostic tests

### **Research Lab**

1. PFT
2. Physiograph
3. Polyrite

**Course outcome** - At the end of Semester student will be able to perform, analysis and report on experiment. This would provide hands on experience with computer software.