

अखिल भारतीय आयुर्विज्ञान संस्थान, नागपुर  
**ALL INDIA INSTITUTE OF MEDICAL SCIENCES,  
NAGPUR**



**DEPARTMENT OF PHYSIOLOGY**

*“Educate and Explore with Empathy”*

**MBBS**

**Competency Based Curriculum**

## **Mission Statement**

*To Promote the health and wellbeing of community through evidence based educational programs, innovative research and integrated health services.*

*“Educate and Explore with  
Empathy”*



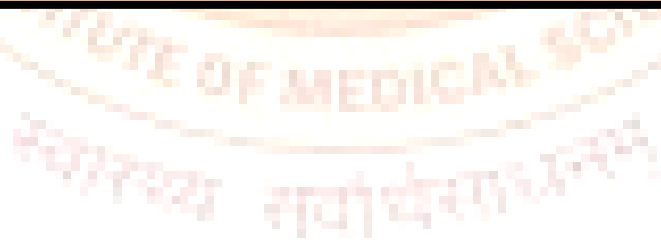
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## 1. Goal

To impart knowledge, skills, attitude and values; by use of appropriate resources; to inculcate motivated self directed learning about the processes and phenomena occurring in human body pertaining to functions of organ systems so as to understand the physiological basis of health and diseases.

## 2. Objectives

At the end of the Physiology course; the first year MBBS student should be able to:

2.1 Explain the functioning of all the organ systems of the body along with their interaction and contribution to the maintenance of homeostasis under routine and challenging situation and comprehend the physiological principles underlying pathogenesis and management of disease.

2.2 Perform experiments designed primarily for the study of physiological phenomena or for assessment of function; analyze and interpret experimental/ investigative data critically and distinguish between normal and abnormal data.

2.3 Develop attitude of self-directed learning and an empathetic attitude during clinical examination

### 3. Course outcomes

At the end of the Physiology course; the first year MBBS student should be able to:

<i>S.No.</i>	<i>Description of Outcome</i>
<b>CO 3.1</b>	Describe the functions of each organ system along with the regulation of their functions and the individual and integrated contribution of the systems in maintenance of homeostasis.
<b>CO 3.2</b>	Describe the body responses and adaptations and correlate the regulatory mechanisms under different environmental conditions, during exercise and physical training.
<b>CO 3.3</b>	Describe the process of normal growth & development and the mechanisms of aging.
<b>CO 3.4</b>	Understand and elucidate the physiological principles underlying the pathogenesis of diseases and their management.
<b>CO 3.5</b>	Interpret the observations derived by empathetically performing human experiments to understand various physiological phenomena
<b>CO 3.6</b>	Perform and interpret basic laboratory tests to study blood parameters.
<b>CO 3.7</b>	Perform clinical examination on human subjects empathetically and identify and interpret the findings.
<b>CO 3.8</b>	Record and describe the finding of electrophysiological and clinical investigations and to distinguish between the normal and abnormal.
<b>CO 3.9</b>	Collaborate the role of physiology in National Health Programs and to contribute to community welfare.
<b>CO 3.10</b>	Inculcate a habit of healthy life style with a scientific understanding of healthy diet adequate sleep, regular exercise and practices for holistic growth.
<b>CO 3.11</b>	Critically analyze self-knowledge and be a lifelong learner.
<b>CO 3.12</b>	Work in tandem as a team with full involvement and spirit of unity and upliftment of all.
<b>CO 3.13</b>	Develop quest for search and research.

### 4. Syllabus

#### 4a. Paper wise distribution of Systemic Physiology

<b>Physiology Paper I</b>	<b>Physiology Paper II</b>
<ol style="list-style-type: none"> <li>1. General Physiology</li> <li>2. Haematology</li> <li>3. Nerve and Muscle Physiology</li> <li>4. Gastrointestinal System</li> <li>5. Cardiovascular System</li> <li>6. Respiratory system</li> <li>7. Environmental Physiology</li> <li>8. Exercise and sports Physiology</li> <li>9. Molecular physiology</li> </ol>	<ol style="list-style-type: none"> <li>1. Renal Physiology</li> <li>2. Endocrine System</li> <li>3. Reproductive system</li> <li>4. Neurophysiology</li> <li>5. Special Senses</li> <li>6. Autonomic Nervous System</li> <li>7. Meditation , Lifestyle and ageing</li> </ol>

## 4b. Detailed Syllabus- (Theory)

Physiology Paper I			
No.	Systems	Course content	Teaching Hours
1.	<b>General Physiology</b>	<p><b>Must Know</b></p> <ul style="list-style-type: none"> <li>• General introduction to Physiology; Functional organization of human body</li> <li>• Cell and cell organelles; Intercellular junctions;</li> <li>• Cell membrane and transport mechanisms across cell membrane</li> <li>• Homeostasis: Milieu interieur, Control Systems, feedback mechanism</li> <li>• Body fluid Compartments: Normal volumes; Basic regulatory mechanisms of their homeostasis in terms of composition and volume; basic concepts of electrolyte imbalances</li> <li>• Aging; Programmed cell death/ Apoptosis</li> <li>• Concept of PH and Buffer system</li> <li>• Resting Membrane Potential: Production &amp; maintenance, sodium potassium pump.</li> <li>• The methods to demonstrate the functions of the cells and its products, its communications and their applications in clinical care and research.</li> </ul> <p><b>Desirable to Know</b> Cytoskeleton; Molecular Motors; Basis of Cancerous growth; Measurement of body water; Physiological basis of therapeutic uses of various replacement fluids</p> <p><b>Nice to know</b> Genes and Genetic control of protein synthesis , Cell cycle and cell division, Patch clamp technique, Cytoskeleton related diseases.</p>	6 hours
2.	<b>Haematology</b>	<p><b>Must know</b></p> <ul style="list-style-type: none"> <li>• <b>Blood:</b> Composition &amp; Functions of blood; Plasma proteins: Types, concentration, functions</li> <li>• <b>Haemopoiesis:</b> Bone marrow and General concepts of haemopoiesis</li> <li>• <b>Haemoglobin (Hb):</b> Synthesis, Types, Functions, Normal values, Physiological variations, HbA1C, Catabolism of Hb, bilirubin metabolism, jaundice.</li> <li>• <b>Erythrocytes:</b> Morphology, functions, normal count, anaemia, polycythemia; Erythropoiesis: sites, stages, regulation, reticulocyte, polycythemia</li> <li>• Physiological basis of anaemia; nutritional anaemia.</li> <li>• Sickle cell anemia; Thalassaemia</li> <li>• <b>Leukocytes:</b> Classification of leukocytes, normal count &amp; differential leukocyte counts, physiological variations, Morphology, functions of WBCs; Leucopoiesis: stages, regulation; Monocyte-macrophage system; functions of spleen.</li> <li>• <b>Platelets:</b> Formation, Structure, Normal count &amp;</li> </ul>	12 hours



		<ul style="list-style-type: none"> <li>• Smooth muscle: Structure, Types, Distribution,</li> <li>• Action potential and its properties in different muscle types</li> <li>• Action potential: Phases, ionic basis of depolarization &amp; repolarisation, Production &amp; propagation of Action potential, Properties of Action potential</li> <li>• Saltatory conduction , Excitation – contraction coupling.</li> <li>• Molecular basis of skeletal muscle contraction: sliding filament theory, power stroke; role of calcium</li> <li>• Muscle relaxation</li> <li>• Molecular mechanism of smooth muscle contraction and relaxation, Properties, Regulation, and disorders</li> <li>• Types of muscle contraction: Isometric and isotonic; Free load and after load</li> <li>• Energetics: fuel used by skeletal; White/ Fast and Red/Slow muscle fibers; Rigor mortis</li> <li>• Gradation of muscular activity</li> <li>• Muscular Dystrophy and myopathy.</li> <li>• Properties of skeletal muscle: excitability, refractory period (absolute, relative), conductivity, contractility</li> <li>• Strength of muscle contraction: Length-Tension relationship; Motor unit recruitment</li> <li>• Computer assisted learning (i) amphibian nerve - muscle experiments (ii) amphibian cardiac experiments</li> </ul> <p><b>Desirable to know</b>                  Electromyography (EMG) in brief</p>	
4	<b>Gastro-intestinal System</b>	<p><b>Must know</b></p> <ul style="list-style-type: none"> <li>• General introduction &amp; organizational plan of GI system, Relevant histology, Innervations and splanchnic circulation; GI Smooth muscle: syncytium, Electric activity and control of contraction, Oesophageal histological feature, peristalsis; Lower oesophageal sphincter, Functional anatomy and histology, functions of stomach, structure of pancreas; Small Intestine: Duodenum, jejunum and ileum; microscopic details of Villi and Crypts; Colon: Parts, Microscopic features</li> <li>• Function of GIT</li> <li>• Salivary secretion: Salivary Glands; mechanism of secretion, composition, functions and regulation of salivary secretion</li> <li>• Gastric secretion: Composition of gastric juice; Mechanism of secretion of gastric acid and proton pump; phases of gastric secretion; regulation of gastric secretion; Gastric mucosal barrier</li> <li>• Pancreatic juice: composition, mechanism of secretion, function and Regulation.</li> <li>• composition and formation of bile, concentration &amp; storage of bile in gall bladder; control of secretion</li> <li>• Intestinal secretion: Composition &amp; mechanism of</li> </ul>	10 Hours

		<p>secretion of small intestinal juice, regulation of secretion;</p> <ul style="list-style-type: none"> <li>• Mastication and deglutition: Phases of deglutition, mechanism &amp; control.</li> <li>• Gastric Motility: Electrical activity of stomach, Filling and emptying of Stomach, factors affecting gastric emptying.</li> <li>• Motility of small intestine and their control: Mixing and Propulsive movements</li> <li>• Colon: Motility of large intestine: Mixing &amp; mass movements, defecation reflex' and its control, role of dietary fibers</li> <li>• Digestion &amp; absorption of Carbohydrate, Proteins and Fats; Absorption of water, electrolytes and vitamins.</li> <li>• Gastrointestinal hormones</li> <li>• Gut Brain Axis</li> <li>• Hepatobiliary system: Microscopic structure, functions of liver, enterohepatic circulation of bile salts,</li> <li>• Function Test- Gastric, pancreatic and Liver.</li> <li>• Physiological Aspect of: peptic ulcer, gastro-oesophageal reflux disease, vomiting, diarrhoea, constipation, Adynamic ileus, Hirschsprung's disease</li> </ul> <p><b>Desirable to know</b>                  Achalasia cardia; Zollinger Ellison Syndrome; hepatic and post hepatic Jaundice</p> <p><b>Nice to know</b>                  Paralytic ileus, irritable bowel syndrome, liver cirrhosis, Gall stones; Basic concepts of Bariatric surgery, Gut flora</p>	
5	<b>Cardiovascular System</b>	<p><b>Must Know</b></p> <ul style="list-style-type: none"> <li>• Introduction to cardiovascular system, its functions &amp; importance. Structure of heart, pericardium, myocardium, endocardium, Nerve supply</li> <li>• Cardiac Muscle: Structure, Functional syncytium, Intercalated discs, E-C Coupling, Action potential of cardiac muscle.</li> <li>• Properties of cardiac muscle: autorhythmicity, excitability, conductivity, contractility, all or none law, long refractory period.</li> <li>• Cardiac Cycle: Systole, Diastole, Heart Sounds, Correlation of pressure changes, volume changes, ECG, Heart sounds in cardiac cycle.</li> <li>• Excitatory and Conducting Tissue: Sinoatrial Node, Atrio-ventricular node, Bundle of His and its branches and Purkinje fibers, Pacemaker potential, Generation &amp; conduction of cardiac impulse.</li> <li>• Electrocardiography (ECG): Definition, Arrangement of ECG leads, Normal ECG waves, segments &amp; intervals and their significance, abnormal ECG- arrhythmia, heart block and Myocardial infarction</li> <li>• Haemodynamic Principle of Blood Circulation</li> </ul>	20 Hours

		<p>related to blood flow and vascular resistance</p> <ul style="list-style-type: none"> <li>• Local and systemic regulatory mechanisms</li> <li>• Heart rate and its regulation and factors affecting.</li> <li>• Cardiac Output: Heart as a pump, Frank Starling’s Law, Metabolism and energetic; Definition, Normal values, physiological variations, Determinants of Cardiac output, Regulation of Cardiac Output- Homometric and Heterometric, factors affecting cardiac output, Measurement of Cardiac Output.</li> <li>• Blood pressure: Definition, Normal values, measurement, Regulation of BP- Neural &amp; Long term, Pathophysiology aspects of Hypertension, factors affecting</li> <li>• Venous Return and Factor affecting VR</li> <li>• Microcirculation: Structure, exchange across capillaries, Starling’s forces, Regulation of blood flow in the tissues</li> <li>• Coronary circulation: Coronary arteries and venous drainage of heart, special features of coronary blood flow. Basic Knowledge of ischemic heart disease, Angina pectoris, Myocardial infarction.</li> <li>• Regional circulation: Functional anatomy, special features, regulation and factors affecting- cerebral, cutaneous, coronary, pulmonary, splanchnic, fetal skeletal muscle circulations</li> <li>• Lymphatic system: its function, formation and composition of lymph, lymph flow &amp; factors affecting it. Physiological basis of Edema</li> <li>• Circulatory shock – causes, stages &amp; compensatory mechanisms, effects on body, physiological basis of treatment.</li> <li>• Heart Failure: Causes, Compensated and Congestive cardiac Failure, Physiological basis of treatment.</li> <li>• Pathophysiology of syncope</li> </ul> <p><b>Desirable to know</b></p> <ul style="list-style-type: none"> <li>• Heart blocks, Arrhythmias, Mean Electric Axis deviation, ECG changes in ischaemia and infarctions. Murmurs &amp; their clinical significance.</li> <li>• Congenital heart diseases</li> </ul> <p><b>Nice to know</b></p> <ul style="list-style-type: none"> <li>• Heart transplant in general</li> <li>• Important ion channel &amp; receptors in cardiovascular system: Their Physiological, pharmacological &amp; clinical significance</li> </ul>	
6	<b>Respiratory System</b>	<p><b>Must Know</b></p> <ul style="list-style-type: none"> <li>• Introduction to the Respiratory System; Functional anatomy of respiratory system.</li> <li>• Pulmonary Ventilation: Mechanics of Inspiration and Expiration, Intrapleural pressure; Lung volumes and Capacities, Alveolar Ventilation; Dead Space; Lung compliance, Surfactant, Hyaline membrane disease</li> </ul>	14 Hours

		<ul style="list-style-type: none"> <li>• special features of Pulmonary circulation ; Blood flow through pulmonary capillaries, Ventilation-Perfusion Ratio</li> <li>• Diffusion of gases: Principles of diffusion, Respiratory membrane; Factors affecting diffusion Composition of air in respiratory passage</li> <li>• Transport of oxygen; Oxygen Haemoglobin dissociation curve, Bohr’s effect</li> <li>• Transport of carbon dioxide, Haldane’s effect, Chloride Shift</li> <li>• Regulation of respiration- Neural and Chemical control; Respiratory acidosis and alkalosis; Periodic breathing,</li> <li>• Hypobaric Condition: Acute and chronic Acclimatization to High altitude, Mountain sickness</li> <li>• Hyperbaric conditions: deep sea diving and other condition; Effect of high partial pressures of different gases; Decompression sickness or Caissons disease, SCUBA diving</li> <li>• the principles of artificial respiration, oxygen therapy</li> <li>• Hypoxia; Principles of oxygen therapy; Cyanosis; Dyspnea, drowning, periodic breathing, asphyxia</li> <li>• Pulmonary function tests and their clinical significance. obstructive and restrictive disorders;</li> </ul> <p><b>Desirable to know</b></p> <ul style="list-style-type: none"> <li>• Positive pressure respiration;</li> </ul> <p><b>Nice to know</b></p> <ul style="list-style-type: none"> <li>• Measurement of FRC and residual volume, Pulmonary Hypertension, Cor Pulmonale. Hyaline membrane disease, Pulmonary edema, pleural effusion</li> </ul>	
7	<b>Environmental Physiology</b>	<p><b>Must Know</b></p> <ul style="list-style-type: none"> <li>• Normal body temperature</li> <li>• Balance between heat gain &amp; heat loss</li> <li>• Role of Skin in regulation of body temperature; cutaneous circulation; sweating mechanism</li> <li>• Role of Hypothalamus in regulation of body temperature</li> <li>• Hyperthermia; fever, heat stroke, Hypothermia-cold injury</li> <li>• Regulation of Body temperature to in hot and Cold environment</li> </ul>	1 Hours
8.	<b>Exercise and Sports Physiology</b>	<ul style="list-style-type: none"> <li>• Cardiovascular response and to muscular training and Aerobic exercise</li> <li>• Respiratory adjustments to Muscular Exercise</li> <li>• Metabolic adjustment during exercise</li> <li>• Muscle response to athletic training; Fast and Slow twitch fibres, Muscle hypertrophy</li> <li>• Vo2 max, Oxygen debt; Lactate tolerance</li> <li>• Doping in Sports</li> <li>•</li> </ul>	2 Hours



9.	<b>Molecular physiology</b>	<ul style="list-style-type: none"> <li>The structure &amp; functions of DNA &amp; RNA</li> <li>The cell cycle</li> <li>Replication &amp; repair of DNA &amp; transcription &amp; Translation mechanisms</li> <li>The gene mutations &amp; basic mechanism of regulation of gene expression</li> </ul>	3 hours
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<b>Physiology Paper II</b>			
<b>S. No.</b>	<b>System</b>	<b>Course content</b>	<b>Teaching Hours</b>
1.	<b>Renal Physiology</b>	<p><b>Must Know:</b></p> <ul style="list-style-type: none"> <li>Structure, Functional organization and Functions of the kidneys; Details of Functional unit-The Nephron; Juxtaglomerular apparatus; Innervations of kidneys</li> <li>Renal Blood flow; Concept of Clearance.</li> <li>Steps of urine formation in detail: Glomerular filtration and its control; Tubular Secretion; and Tubular Reabsorption; Mechanisms of Urine concentration and dilution; Countercurrent multiplier and exchanger mechanisms; Transport maximum of substances, T<sub>max</sub> of Glucose</li> <li>Renin –angiotensin-aldosterone System (RAAS)</li> <li>Regulation of Extracellular fluid Volume</li> <li>Regulation of Extracellular Fluid osmolarity</li> <li>Role of Kidney in maintenance of acid base balance</li> <li>Innervations of bladder and Micturition: mechanism; Micturition reflex; Micturition disorders, Cystometrogram.</li> <li>Diuretics: Mechanism and site of action</li> <li>Principles of Artificial kidney and Dialysis, Renal transplant</li> <li>Renal Function tests</li> </ul> <p><b>Desirable to Know:</b> Metabolic acidosis, Metabolic alkalosis; minimal change diseases</p> <p><b>Nice to Know:</b> Anion gap in acid base disorders; Kidney stones; Pathophysiology of Nephrotic Syndrome, Acute and chronic Renal failure;</p>	11 Hours
2.	<b>Endocrine System</b>	<p><b>Must know:</b></p> <ul style="list-style-type: none"> <li>General consideration of hormones; Mechanism of action of Hormones-steroid, protein and amine hormones</li> <li>Endocrine functions of Hypothalamus – releasing and inhibiting hormones and their functions</li> <li>Anterior pituitary hormones: Functions, Hypothalamic and feedback regulation; Growth hormone: function, regulation and disorders</li> <li>Posterior pituitary hormones: Antidiuretic hormone and Oxytocin: functions, regulation and disorders</li> <li>Thyroid hormone: synthesis, Secretion, Functions,</li> </ul>	9 hours

		<p>regulation, Disorders- Goiter, Hypothyroidism, Hyperthyroidism.</p> <ul style="list-style-type: none"> <li>• Adrenal cortex and medulla: Mineralocorticoids, Glucocorticoids, Sex Steroids and Adrenaline hormone: Synthesis, Secretion, Functions, Regulation, Disorders</li> <li>• Pancreatic hormones: Insulin and Glucagon-secretion, functions, regulation, disorders.</li> <li>• Parathyroid hormone: Synthesis, Functions, Regulation, Disorders; Vitamin D and Calcitonin</li> <li>• Pineal Gland , thymus and endocrine function of other organs viz - heart, kidneys, Adipose tissue (Leptin, Adiponectin)</li> <li>• Functions test- thyroid, adrenal cortex, adrenal medulla and pancreas</li> <li>• Metabolic and endocrine consequences and psychiatric component of of obesity, metabolic syndrome, stress</li> </ul> <p><b>Desirable to know:</b>                  Relevant physiological aspects of Diabetes mellitus;</p> <p><b>Nice to know</b>                  ELISA</p>	
<p>3.</p>	<p><b>Reproductive System</b></p>	<p><b>Male Reproductive System</b>  <b>Must Know</b></p> <ul style="list-style-type: none"> <li>• Sex chromosomes, sex determination, sex differentiation and abnormalities of sexual differentiation, its psychiatric and practical implication.</li> <li>• Puberty: onset, progression, stages, Changes in males &amp; females and its control; Disorders related to puberty, early and delayed puberty, adolescent clinical and psychological association.</li> <li>• Functional anatomy of Male reproductive system</li> <li>• Spermatogenesis- Stages &amp; regulation; Blood- testis barrier; Structure of Spermatozoa, factors modifying</li> <li>• Semen: Composition; Prostate gland and its secretions</li> <li>• Testicular hormonal Functions: Testosterone-Actions, Regulation and mechanism of action; and Control of testicular function</li> <li>• Abnormalities of testicular and Prostate function</li> <li>• Contraceptive methods for male</li> <li>• Effects of removal of gonads n physiological function</li> <li>• Semen analysis</li> </ul> <p><b>Female Reproductive System</b>  <b>Must Know</b></p> <ul style="list-style-type: none"> <li>• Functional anatomy of female reproductive system; Oogenesis</li> <li>• Menstrual cycle: Cyclical changes in hormones, ovary, uterus, cervix, vagina and breast during menstrual cycle; hormonal regulation of the</li> </ul>	<p>8 hours</p>

		<p>menstrual cycle by ovarian hormones and Gonadotropins; Ovulation; Indicators of Ovulation; anovulatory cycles; Corpus luteum; Abnormalities of Menstrual cycle</p> <ul style="list-style-type: none"> <li>• Ovarian hormones: Estrogen and Progesterone-Functions, Mechanism of action and regulation of secretion; Abnormalities of secretion</li> <li>• Contraception: Principles and methods of contraception in female.</li> <li>• Effects of removal of gonads n physiological function</li> <li>• Menopause</li> </ul> <p><b>Nice to Know</b>                  Male and female sexual act.</p> <p><b>Pregnancy and Lactation</b></p> <ul style="list-style-type: none"> <li>• Physiological basis of pregnancy test</li> <li>• Fertilization and implantation of Ovum</li> <li>• Placenta and its functions</li> <li>• Physiological changes during pregnancy and hormonal control of pregnancy</li> <li>• Parturition: Mechanics and Control; labor pains</li> <li>• Lactation: Development of breast; Control of milk secretion and milk ejection; Composition of milk; effect of lactation on menstrual cycle</li> <li>• Psychology and Psychiatric disorder associated with pregnancy, parturition and lactation</li> <li>• Common cause of infertility in a couple, role of IVF in managing case of infertility.</li> </ul> <p><b>Fetal and Neonatal Physiology</b>  <b>Must know</b></p> <ul style="list-style-type: none"> <li>• Adjustments after birth</li> <li>• Physiology of Growth and development of the fetus and neonate;</li> <li>• Physiology of infancy</li> <li>• Interpretation of growth chart</li> <li>• Interpret anthropometric assessment of infants</li> </ul>	
4.	<b>Central Nervous System</b>	<p><b>Must Know:</b></p> <ul style="list-style-type: none"> <li>• Organization of the central nervous system.</li> <li>• Neuron and Neuroglia</li> <li>• Spinal cord: organization &amp; Functions</li> <li>• Synapses: Synaptic transmission and properties, Neurotransmitters, Synaptic plasticity</li> <li>• Sensory Receptors: Classification, mechanism of action, Sensory modalities; sensory coding;</li> <li>• <b>Somatosensory Systems:</b> Ascending Tracts, Somatosensory Cortex; Effect of their lesions; Phantom limb, Cortical plasticity</li> <li>• Physiology of Pain: Pain Pathways; Internal analgesia system; Referred pain; Visceral pain</li> <li>• Thalamus: Nuclei, their functions and connections; Thalamic syndrome</li> </ul>	30 Hours

		<ul style="list-style-type: none"> <li>• <b>Motor System:</b> Reflexes; Muscle spindles, Stretch reflex; Golgi tendon organs; Spinal cord and other reflexes; Role of Spinal cord, Brain stem, Motor cortex, Cerebellum and Basal ganglia in control of motor Movements; Descending/ Motor tracts and their functions; Control of Posture and Equilibrium and muscle tone</li> <li>• <b>Basal Ganglia:</b> Components, Connections and function; Parkinson's disease</li> <li>• <b>Cerebellum:</b> Physiological anatomy and Cerebellar Circuitry; Connections and functions of cerebellar lobes; effect of their lesions.</li> <li>• Spinal cord injury; Complete transection and Brown Sequard Syndrome; Concepts of Upper and Lower motor neuron lesions</li> <li>• <b>Higher functions:</b> Cortical Association Areas, Categorical and Representational Cortex, Language and its disorders; Memory and Learning, Conditioned Learning, pathophysiologic basis of Alzheimer's disease.</li> <li>• Electroencephalography: waves interpretation and their significance, the concept, criteria for diagnosis of Brain death and its implications.</li> <li>• Reticular Arousal System: Components, Wakefulness, Sleep</li> <li>• Hypothalamic Functions</li> <li>• Limbic system: Components and its functions; Motivation and behavior</li> <li>• <b>Cerebrospinal fluid:</b> CSF Formation, Circulation and functions, Blood brain barrier.</li> </ul> <p><b>Desirable to know</b>                  Receptors of Neurotransmitters Glutamate and GABA; Experimental sections and Clinical lesions in brain stem and sub-cortical levels; Decorticate and decerebrate rigidity; Huntington's disease; Hydrocephalus; Stroke Kluver- Bucy Syndrome; Basic knowledge of Epilepsy, Psychosis and Depression; Coma</p>	
5.	<b>Special senses</b>	<p><b>Vision</b></p> <p><b>Must know</b></p> <ul style="list-style-type: none"> <li>• Functional anatomy of the eye; Aqueous Humour; Intraocular tension</li> <li>• Principles of optics; visual optics; Refractory media and image formation; Errors of refraction; Visual acuity; Depth Perception</li> <li>• Structure and functions of retina. Photoreceptors(Rod and cone) and their Photochemistry of vision; Electrical responses in rods and cones; Dark adaptation; Light Adaptation</li> <li>• Colour vision: Its theories; Retinal and neural mechanisms of colour perception; Colour blindness</li> <li>• Visual pathways; Field of vision; and effect of lesion at various levels of visual pathway</li> </ul>	10 Hours

	<ul style="list-style-type: none"><li>• Visual cortex: structure; functions;</li><li>• Accommodation reflex and the Near response; Light reflex;</li><li>• Eye movements and their control</li><li>• Visual Evoked Potential (VEP)</li></ul> <p><b>Desirable to know</b> Glaucoma; Electrophysiology of vision, and colour vision; Lateral inhibition; Processing of visual information at different components of visual pathway;</p> <p><b>Nice to know</b> Macular degeneration, Retinitis pigmentosa; Critical fusion frequency;</p> <p><b>Hearing</b></p> <p><b>Must Know</b></p> <ul style="list-style-type: none"><li>• Functional anatomy of external, middle and internal ear( Cochlea and Organ of Corti)</li><li>• Functions of external ear, middle ear and Cochlea</li><li>• Perception of intensity, frequency and direction of sound</li><li>• Generation of electrical potentials in cochlea and genesis of action potentials in Cochlear nerve fibers.</li><li>• Auditory pathways</li><li>• Role of auditory cortex in hearing.</li><li>• Types of deafness; Tests for hearing</li><li>• Brain Stem Evoked Response Audiometry (BERA)</li></ul> <p><b>Desirable to know</b> Audiometry</p> <p><b>Nice to know</b> Basic knowledge of Cochlear transplant.</p> <p><b>Taste</b></p> <ul style="list-style-type: none"><li>• Taste buds</li><li>• Receptors and pathways for taste</li><li>• Basic taste modalities and receptor stimulation</li><li>• Taste threshold and intensity discrimination</li><li>• Abnormalities of taste sensation</li></ul> <p><b>Smell</b></p> <ul style="list-style-type: none"><li>• Olfactory Membrane</li><li>• Receptors and pathways for smell Cortical and limbic areas associated with smell</li><li>• Physiology of olfaction.</li><li>• Abnormalities of olfaction.</li></ul> <p><b>Equilibrium</b></p> <ul style="list-style-type: none"><li>• Vestibular Apparatus (Semicircular canals</li><li>• Utricle and saccule): Structure and functions</li><li>• Central Connections and their integrated role in maintenance of equilibrium</li><li>• Lesions of Vestibular System</li></ul>	
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6.	<b>Autonomic Nervous System</b>	<p><b>Must know</b></p> <ul style="list-style-type: none"> <li>• Functional Organization and functional anatomy of Autonomic nervous system</li> <li>• Effects of Sympathetic stimulation on various organs and systems</li> <li>• Effects of Parasympathetic stimulation on various organs and systems</li> <li>• Sympathetic and Parasympathetic neurotransmitters Adrenergic receptors and Cholinergic receptors</li> <li>• Central control of autonomic output</li> </ul> <p><b>Desirable to know</b> Drugs acting on Autonomic nervous system and physiological basis of their clinical use</p> <p><b>Nice to know</b> Autonomic dysfunctions Autonomic function test Heart rate variability</p>	2 Hours
7.	<b>Meditation, lifestyle and ageing</b>	<p><b>Must Know</b></p> <ul style="list-style-type: none"> <li>• Meditation: principles and practice</li> <li>• Physiological consequences of sedentary lifestyle</li> <li>• Physiology of aging; free radicals and antioxidants</li> </ul> <p><b>Nice to know</b></p> <ul style="list-style-type: none"> <li>• Introduction to yoga</li> <li>• Basic knowledge of yogic practices</li> <li>• Physiological effects of yoga</li> <li>• Benefits of Yoga in health and disease</li> </ul>	1 Hours

#### 4c. Detailed Competency based Syllabus

Comp. No.	Competency
<b>General Physiology</b>	
1.1	Describe the structure and functions of a mammalian cell
1.2	Describe and discuss the principles of homeostasis
1.3	Describe intercellular communication
1.4	Describe apoptosis – programmed cell death
1.5	Describe and discuss transport mechanisms across cell membranes
1.6	Describe the fluid compartments of the body, its ionic composition & measurements
1.7	Describe the concept of pH & Buffer systems in the body
1.8	Describe and discuss the molecular basis of resting membrane potential and action potential in excitable tissue
1.9	Demonstrate the ability to describe and discuss the methods used to demonstrate the functions of the cells and its products, its communications and their applications in clinical care and research.
<b>Haematology</b>	
2.1	Describe the composition and functions of blood components
2.2	Discuss the origin, forms, variations and functions of plasma proteins
2.3	Describe and discuss the synthesis and functions of Hemoglobin and explain its breakdown. Describe variants of hemoglobin
2.4	Describe RBC formation (erythropoiesis & its regulation) and its functions
2.5	Describe different types of anemias & Jaundice



2.6	Describe WBC formation (granulopoiesis) and its regulation
2.7	Describe the formation of platelets, functions and variations.
2.8	Describe the physiological basis of hemostasis and, anticoagulants. Describe bleeding & clotting disorders (Hemophilia, purpura)
2.9	Describe different blood groups and discuss the clinical importance of blood grouping, blood banking and transfusion
2.10	Define and classify different types of immunity. Describe the development of immunity and its regulation
<b>Nerve and Muscle Physiology</b>	
3.1	Describe the structure and functions of a neuron and neuroglia; Discuss Nerve Growth Factor & other growth factors/cytokines
3.2	Describe the types, functions & properties of nerve fibers
3.3	Describe the degeneration and regeneration in peripheral nerves
3.4	Describe the structure of neuro-muscular junction and transmission of impulses
3.5	Discuss the action of neuro- muscular blocking agents
3.6	Describe the pathophysiology of Myasthenia gravis
3.7	Describe the different types of muscle fibres and their structure
3.8	Describe action potential and its properties in different muscle types (skeletal & smooth)
3.9	Describe the molecular basis of muscle contraction in skeletal and in smooth muscles
3.10	Describe the mode of muscle contraction (isometric and isotonic)
3.11	Explain energy source and muscle metabolism
3.12	Explain the gradation of muscular activity
3.13	Describe muscular dystrophy: myopathies
3.14	Observe with Computer assisted learning (i) amphibian nerve - muscle experiments (ii) amphibian cardiac experiments
<b>Gastro-intestinal Physiology</b>	
4.1	Describe the structure and functions of digestive system
4.2	Describe the composition, mechanism of secretion, functions, and regulation of saliva, gastric, pancreatic, intestinal juices and bile secretion
4.3	Describe GIT movements, regulation and functions. Describe defecation reflex. Explain role of dietary fibre.
4.4	Describe the physiology of digestion and absorption of nutrients
4.5	Describe the source of GIT hormones, their regulation and functions
4.6	Describe the Gut-Brain Axis
4.7	Describe & discuss the structure and functions of liver and gall bladder
4.8	Describe & discuss gastric function tests, pancreatic exocrine function tests & liver function tests
4.9	Discuss the physiology aspects of: peptic ulcer, gastro- oesophageal reflux disease, vomiting, diarrhoea, constipation, Adynamic ileus, Hirschsprung's disease
<b>Cardiovascular System</b>	
5.1	Describe the functional anatomy of heart including chambers, sounds; and Pacemaker tissue and conducting system.
5.2	Describe the properties of cardiac muscle including its morphology, electrical, mechanical and metabolic functions
5.3	Discuss the events occurring during the cardiac cycle
5.4	Describe generation, conduction of cardiac impulse
5.5	Describe the physiology of ECG its application and cardiac axis
5.6	Describe abnormal ECG, arrhythmias, heart block and myocardial Infarction
5.7	Describe and discuss haemodynamics of circulatory system
5.8	Describe and discuss local and systemic cardiovascular regulatory mechanisms
5.9	Describe the factors affecting heart rate, regulation of cardiac output & blood pressure
5.10	Describe & discuss regional circulation including microcirculation, lymphatic circulation,



	coronary, cerebral, capillary, skin, foetal, pulmonary and splanchnic circulation
<b>5.11</b>	Describe the patho- physiology of shock, syncope and heart failure
<b>Respiratory Physiology</b>	
<b>6.1</b>	Describe the functional anatomy of respiratory tract
<b>6.2</b>	Describe the mechanics of normal respiration, pressure changes during ventilation, lung volume and capacities, alveolar surface tension, compliance, airway resistance, ventilation, V/P ratio, diffusion capacity of lungs
<b>6.3</b>	Describe and discuss the transport of respiratory gases: Oxygen and Carbon dioxide
<b>6.4</b>	Describe and discuss the physiology of high altitude and deep sea diving
<b>6.5</b>	Describe and discuss the principles of artificial respiration, oxygen therapy, acclimatization and decompression sickness.
<b>6.6</b>	Describe and discuss the pathophysiology of dyspnoea, hypoxia, cyanosis asphyxia; drowning, periodic breathing
<b>Renal Physiology</b>	
<b>7.1</b>	Describe structure and function of kidney
<b>7.2</b>	Describe the structure and functions of juxta glomerular apparatus and role of renin-Angiotensin system
<b>7.3</b>	Describe the mechanism of urine formation involving processes of filtration, tubular reabsorption & secretion; concentration and diluting mechanism
<b>7.4</b>	Describe & discuss the significance & implication of Renal clearance
<b>7.5</b>	Describe the renal regulation of fluid and electrolytes & acid-base balance
<b>7.6</b>	Describe the innervations of urinary bladder, physiology of micturition and its abnormalities
<b>7.7</b>	Describe artificial kidney, dialysis and renal transplantation
<b>7.8</b>	Describe & discuss Renal Function Tests
<b>7.9</b>	Describe cystometry and discuss the normal cystometrogram
<b>Endocrine Physiology</b>	
<b>8.1</b>	Describe the physiology of bone and calcium metabolism
<b>8.2</b>	Describe the synthesis, secretion, transport, Physiological actions, regulation and effect of altered (hypo and hyper) secretion of pituitary gland, thyroid gland, parathyroid gland, adrenal gland, pancreas and hypothalamus
<b>8.3</b>	Describe the physiology of Thymus & Pineal Gland
<b>8.4</b>	Describe function tests: Thyroid gland; Adrenal cortex, Adrenal medulla and pancreas
<b>8.5</b>	Describe the metabolic and endocrine consequences of obesity & metabolic syndrome, Stress response. Outline the psychiatry component pertaining to metabolic syndrome.
<b>8.6</b>	Describe & differentiate the mechanism of action of steroid, protein and amine hormones
<b>Reproductive Physiology</b>	
<b>9.1</b>	Describe and discuss sex determination; sex differentiation and their abnormalities and outline psychiatry and practical implication of sex determination.
<b>9.2</b>	Describe and discuss puberty: onset, progression, stages; early and delayed puberty and outline adolescent clinical and psychological association.
<b>9.3</b>	Describe male reproductive system: functions of testis and control of spermatogenesis & factors modifying it and outline its association with psychiatric illness
<b>9.4</b>	Describe female reproductive system: (a) functions of ovary and its control; (b) menstrual cycle - hormonal, uterine and ovarian changes
<b>9.5</b>	Describe and discuss the physiological effects of sex hormones
<b>9.6</b>	Enumerate the contraceptive methods for male and female. Discuss their advantages & disadvantages
<b>9.7</b>	Describe and discuss the effects of removal of gonads on physiological functions
<b>9.8</b>	Describe and discuss the physiology of pregnancy, parturition & lactation and outline the psychology and psychiatry-disorders associated with it.
<b>9.9</b>	Interpret a normal semen analysis report including (a) sperm count, b) sperm morphology,



	c) sperm motility, as per WHO guidelines and discuss the results
9.10	Discuss the physiological basis of various pregnancy tests
9.11	Discuss the hormonal changes and their effects during perimenopause and menopause
9.12	Discuss the common causes of infertility in a couple and role of IVF in managing a case of infertility.
<b>Neurophysiology</b>	
10.1	Describe and discuss the organization of nervous system
10.2	Describe and discuss the functions and properties of synapse, reflex, receptors
10.3	Describe and discuss somatic sensations & sensory tracts
10.4	Describe and discuss motor tracts, mechanism of maintenance of tone, control of body movements, posture and equilibrium & vestibular apparatus
10.5	Describe and discuss structure and functions of reticular activating system, autonomic nervous system (ANS)
10.6	Describe and discuss Spinal cord, its functions, lesion & sensory disturbances
10.7	Describe and discuss functions of cerebral cortex, basal ganglia, thalamus, hypothalamus, cerebellum and limbic system and their abnormalities
10.8	Describe and discuss behavioral and EEG characteristics during sleep and mechanism responsible for its production
10.9	Describe and discuss the physiological basis of memory, learning and speech
10.10	Describe and discuss chemical transmission in the nervous system. (Outline the psychiatry element).
10.11	Demonstrate the correct clinical examination of the nervous system: Higher functions, sensory system, motor system, reflexes, cranial nerves in a normal volunteer or simulated environment
10.12	Identify normal EEG forms
10.13	Describe and discuss perception of smell and taste sensation
10.14	Describe and discuss patho-physiology of altered smell and taste sensation
10.15	Describe and discuss functional anatomy of ear, auditory pathways & physiology of hearing
10.16	Describe and discuss pathophysiology of deafness. Describe hearing Tests.
10.17	Describe and discuss functional anatomy of eye, physiology of image formation, physiology of vision including colour vision, refractive errors, colour blindness, physiology of pupil and light reflex
10.18	Describe and discuss the physiological basis of lesion in visual pathway
10.19	Describe and discuss auditory & visual evoke potentials
<b>Integrated Physiology</b>	
11.1	Describe and discuss mechanism of temperature regulation
11.2	Describe and discuss adaptation to altered temperature (heat and cold)
11.3	Describe and discuss mechanism of fever, cold injuries and heat stroke
11.4	Describe and discuss cardio- respiratory and metabolic adjustments during exercise; physical training effects
11.5	Describe and discuss physiological consequences of sedentary lifestyle
11.6	Describe physiology of Infancy
11.7	Describe and discuss physiology of aging; free radicals and antioxidants
11.8	Discuss & compare cardio- respiratory changes in exercise (isometric and isotonic) with that in the resting state and under different environmental conditions (heat & cold)
11.9	Interpret growth charts
11.10	Interpret anthropometric assessment of infants
11.11	Discuss the concept, criteria for diagnosis of Brain death and its implications
11.12	Discuss the physiological effects of meditation
11.13	Obtain history and perform general examination in the volunteer / simulated environment



<b>11.14</b>	Demonstrate Basic Life Support in a simulated environment
<b>Molecular Physiology</b>	
<b>12.1</b>	Describe the structure & functions of DNA & RNA & Outline the cell cycle
<b>12.2</b>	Describe the process involved in replication & repair of DNA & transcription & Translation mechanisms.
<b>12.3</b>	Describe the gene mutations & basic mechanism of regulation of gene expression

#### 4d. Specific learning objectives as Annexure

#### 4 e. Topics of Theory Lectures, Tutorials, Small group Discussion, Seminar etc

	<b>General physiology</b>	<b>Hours</b>
<b>1</b>	Homeostasis	6 hours
<b>2</b>	Cell & Cell Organelles	
<b>3</b>	Cell Membrane	
<b>4</b>	Transport across the cell membrane	
<b>5</b>	Body fluid compartments and oedema	

	<b>Heamatology</b>	<b>Hours</b>
<b>1</b>	Blood constituents (Plasma proteins) and their functions	12
<b>2</b>	Red blood cell	
<b>3</b>	Haemoglobin	
<b>4</b>	Anaemia, Sickle cell disease, Thalasemia	
<b>5</b>	White blood cell	
<b>6</b>	Platelets	
<b>7</b>	Blood grouping	
<b>8</b>	Blood transfusion and transfusion reaction	
<b>9</b>	Homeostasis	
<b>10</b>	Immunity	

	<b>Nerve and muscle Physiology</b>	<b>Hours</b>
<b>1</b>	Neuron, Myelination, Classification of nerves	11
<b>2</b>	Resting Membrane Potential	
<b>3</b>	Action Potential	
<b>4</b>	Properties of Nerves, Degeneration & Regeneration of Nerve fibers	
<b>5</b>	Structure of Skeletal muscle	
<b>6</b>	Excitation-Contraction coupling	
<b>7</b>	Molecular basis of muscle contraction	
<b>8</b>	Properties of Skeletal muscle, Energetic, Isometric & Isotonic contraction	
<b>9</b>	Smooth Muscle	
<b>10</b>	Cardiac muscle	
<b>11</b>	Amphibian Experiments (Computer Assisted Learning )	

	<b>Gastro Intestinal System</b>	<b>Hours</b>
<b>1</b>	Introduction to of Gastro-Intestinal system	10
<b>2</b>	Salivary Secretion	
<b>3</b>	Gastric Secretion	
<b>4</b>	Pancreatic secretion	
<b>5</b>	Liver and Biliary System	
<b>6</b>	Intestinal Secretion	
<b>7</b>	Gastric and Intestinal motility	
<b>8</b>	Gastrointestinal hormones	



9	Digestion and absorption of carbohydrate, proteins and fats	
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<b>Cardiovascular system</b>		<b>Hours</b>
1	Introduction to cardiovascular system	20
2	Cardiac Muscle	
3	Conducting System of Heart	
4	Cardiac Cycle	
5	Heart as pump	
6	Heart Rate Regulation	
7	Electrocardiogram	
8	Biophysical laws of Circulation	
9	Arterial Circulation & Blood Pressure	
10	Microcirculation	
11	Regulation of Local blood flow	
12	Venous return & Cardiac output	
13	Coronary Circulation	
14	Ischemic heart disease	
15	Cardiac Failure	
16	Circulatory shock	
17	Regional circulation	

<b>Respiratory system</b>		<b>Hours</b>
1	Functional organization of Respiratory System	14
2	Mechanics of Respiration	
3	Lung Volumes & Capacities	
4	Compliance & Surfactant	
5	Airway resistance & Ventilation perfusion ratio	
6	Pulmonary Circulation	
7	Transport of oxygen	
8	Transport of carbon dioxide	
9	Hypoxia	
10	Neural regulation of Respiration	
11	Chemical regulation of Respiration	
12	High Altitude Physiology	
13	Deep Sea Physiology	

<b>Renal Physiology</b>		<b>Hours</b>
1	Introduction to renal Physiology	11
2	Renal Blood Flow	
3	Glomerular filtration rate	
4	Tubular Reabsorption and secretion	
5	Concentration and dilution of urine	
6	Role of Kidney in acid base Regulation	
7	Micturition	
8	Renal Replacement Therapy	
9	Regulation of Extracellular Fluid volume	

<b>Endocrine</b>		<b>Hours</b>
1	Mechanism of Action of Hormones	9
2	Hypothalamus	
3	Anterior Pituitary gland	
4	Posterior Pituitary gland	



5	Thyroid gland	
6	Adrenal gland	
7	Pancreas	
8	Parathyroid Hormones & Calcium Homeostasis	
10	Pineal Gland	

K	Reproductive system	Hours
	<b>Male reproductive system</b>	8
1	Sex determination and differentiation	
2	Puberty in male and spermatogenesis	
3	Testicular hormones	
4	Applied and male sexual act	
	<b>Female reproductive system</b>	
1	Oogenesis and follicular development	
2	Menstrual cycle and its regulation	
3	Ovarian hormones	
4	Female puberty, Contraception and menopause	
5	Physiology of pregnancy	
6	Lactation	
7	Fetal Circulation	

I	Neurophysiology	Hours
1	Introduction to central nervous system	30
2	Receptors	
3	Synapse and synaptic transmission, neurotransmitters	
4	Ascending tracts	
5	Pain	
6	Somatosensory cortex & Motor Cortex	
7	Cerebrospinal fluid & Cerebral Circulation	
8	Reflex	
10	Descending Tracts	
11	Spinal cord injury	
12	Cerebellum	
13	Basal Ganglia	
14	Tone	
15	Posture & Equilibrium	
16	Hypothalamus	
17	Limbic System	
18	Learning & Memory	
19	Speech	
20	Electroencephalogram, Reticular Activating system	
21	Sleep	

J	Special senses	Hours
1	Vision	10
2	Hearing	
3	Smell Taste	
4	Taste	
5	Vestibular Apparatus and equilibrium	

L	Integrated Physiology and Molecular Physiology	Hours
1	Sport and Exercise Physiology	9
2	Meditation, Lifestyle and ageing	
3	Autonomic nervous system	
4	Regulation of food intake and obesity	
5	Body temperature regulation	
6	Cell cycle	
7	Structure, function, replication and mutation of DNA and RNA, and regulation of gene expression	

#### 4f. List of Practicals

Sr. no	Hematology	51 Hours
1	Study of Compound Microscope and collection of Blood	3
2	Determination of hemoglobin concentration of blood	3
3	Determination of total Red blood cell count	3
4	Determination of total Leukocyte count	3
5	Preparation and examination of peripheral blood smear	3
6	Determination of differential Leucocyte count	3
7	Determination of ABO and Rh blood groups	3
8	Determination of Bleeding time and Clotting time	3
9	Determination of Platelet count	3
10	Determination of Reticulocytes count	3
11	Determination of Eosinophil count	3
12	Demonstration of bone marrow smear	3
13	Demonstration of erythrocyte sedimentation rate	3
14	Demonstration of packed cell volume	
16	Calculation of the blood indices values	
17	Visit to Transfusion Medicine	3
18	Visit to Dialysis unit	3
19	Visit to Pathology Laboratory	3

Sr. no	Experiments in clinical Physiology	Laboratory	57 Hours
1	Perform Spirometry using Digital Spirometer	PFT Laboratory	3
2	Demonstration of Electromyography with surface electrodes	Electrophysiology Laboratory	3
3	Estimation of Nerve Conduction Velocity		3
4	Demonstration of Brain Evoked Response Potentials		3
5	Demonstration of Visual Evoked Potentials		3
6	Demonstration of Electroencephalography	EEG Laboratory	3
7	Demonstration of Autonomic Function Test	AFT Laboratory	3
8	Perform Cold Stress test and cold Pressor test		3
9	Demonstration of Pure tone Audiometry	Audiometry Laboratory	3



10	Demonstration of Semen Analysis	Andrology Laboratory	3
11	Record Arterial pulse tracing using finger plethysmography	Clinical Physiology Laboratory	3
12	Record and interpret normal Electrocardiogram ECG.		3
13	Perform Mosso's Ergography.		3
14	Perform Stethography		3
15	Perform fitness test by Harvard Step test using Multipara		3
16	Cardiopulmonary exercise testing on treadmill		3
17	Demonstration of Basic Life Support on Mannequin		3
18	Interpretation of X ray and Demonstration of ultrasonography and Doppler	Radiodiagnosis	3
19	Demonstration of electrocardiography	Cardiology	3

Sr. no	Clinical Examination	48 Hours
1	Introduction to Clinical Examination and history taking	3
2	Examination of Arterial Pulse	3
3	Measurement of Arterial Blood pressure	3
4	Study the effect of change of posture and Exercise on Blood pressure	3
5	Clinical examination of the cardiovascular system	3
6	Clinical examination of the Respiratory system.	3
7	Clinical examination of the Abdomen	3
8	Clinical Examination of Higher functions	3
9	Clinical examination of the Motor system Part I	3
10	Clinical examination of the Motor system Part II – Reflexes	3
11	Clinical Examination of sensory system	3
12	Clinical Examination of Cranial nerves part I	3
13	Clinical Examination of Cranial nerves part II	3
14	Testing of visual acuity and color vision	3
15	Perimetry : Mapping the field of vision	3
16	Tests of hearing	3

#### 4g. Topics for integration

	Topics for Horizontal integration	Department
1	Describe the concept of ph & Buffer systems in the body	Biochemistry
2	Describe and discuss the synthesis and functions of Haemoglobin and explain its breakdown. Describe variants of hemoglobin.	Biochemistry
3	Describe different types of Jaundice	Biochemistry
4	Define and classify different types of immunity. Describe the	Biochemistry



	development of immunity and its regulation	
5	Describe the physiology of digestion and absorption of nutrients	Biochemistry
6	Describe & discuss gastric function tests, pancreatic exocrine function tests & liver function tests	Biochemistry
7	Describe the Coronary circulation	Anatomy
8	Describe the Renal Function Tests	Biochemistry
9	Describe Acidosis and alkalosis	Biochemistry
10	Describe function tests: Thyroid gland; Adrenal cortex, Adrenal medulla and pancreas	Biochemistry
11	Describe the structure & functions of DNA & RNA & Outline the cell cycle	Biochemistry
12	Describe the process involved in replication & repair of DNA & transcription & Translation mechanisms	Biochemistry
13	Describe the gene mutations & basic mechanism of regulation of gene expression	Biochemistry
14	Describe and discuss the organization of nervous system	Anatomy
15	Describe and discuss somatic sensations & sensory tracts	Anatomy

Sr. No	Topics for Vertical integration	Department
1	Blood banking and transfusion	Pathology
2	Discuss the action of neuron-muscular blocking agents	Anaesthesiology
3	Describe muscular dystrophy: myopathies	Pediatrics
4	Describe abnormal ECG, arrhythmias, heart block and myocardial Infarction	Medicine / Cardiology
5	Describe artificial kidney, dialysis and renal transplantation	Medicine / Nephrology
6	Outline the psychiatry component pertaining to metabolic syndrome.	Psychiatry
7	Describe and discuss sex determination; sex differentiation and their abnormalities and outline psychiatry and practical implication of sex determination.	Community medicine
8	Enumerate the contraceptive methods for male and female. Discuss their advantages & disadvantages	Obstetrics & Gynecology
9	Discuss the hormonal changes and their effects during perimenopause and menopause	Obstetrics & Gynecology
10	Discuss the common causes of infertility in a couple and role of IVF in managing a case of infertility.	Obstetrics & Gynecology
11	Approach a case of paraplegia/ quadriplegia/ Unconscious patient	Medicine
12	Interpret growth charts	Pediatrics
13	Interpret anthropometric assessment of infants	Pediatrics
14	Artificial Respiration	Medicine
15	Demonstration of Pure tone Audiometry	ENT
16	Interpretation of X ray and Demonstration of ultrasonography and Doppler	Radiodiagnosis

#### 4h. Short Research Project

Every student has to conduct a short research project and submit it before pre-professional Exam.

#### 5. Teaching Learning Methodology

	Method	No. of session	Hours/session	Total hours
Theory	Didactic lectures	105	1	105
	Tutorial	45	1	45
	<b>Total</b>	<b>150 session</b>		<b>150 hours</b>
Practicals	Practicals	52	3	156
	Group Discussion	15	3	45
	Seminar	15	3	45
	Problem Based learning (PBL)/ Case based Learning (CBL)	15	3	45
	Other teaching methods (ECE/ SDL)	13	3	39
	<b>Total</b>	<b>110 session</b>		<b>330 hrs</b>
	<b>Grand total</b>	<b>260 session</b>		<b>480 hrs</b>

#### 6. The syllabus to be completed by the end of 1<sup>st</sup> and 2<sup>nd</sup> Semester is as follows:

Physiology Paper 1 to be completed by the end of 1<sup>st</sup> Semester

Physiology Paper 2 to be completed by the end of 2<sup>nd</sup> Semester

#### 7. Books Recommended

##### Textbooks

- Guyton and Hall Textbook of Medical Physiology - Hall John E
- Comprehensive Textbook of Medical Physiology- G K PAL
- Textbook of Practical Physiology by Dr G K Pal and Dr Pravati Pal
- Hutchison’s Clinical Methods: An integrated approach to Clinical Practice

##### Reference book

- Ganong’s Review of Medical Physiology- Barrett Kim E, Barman SM
- Vander’s Human Physiology: The mechanism of body function- Eric P. Widmaier, Hershel Raff, Kevin T. Strang
- Berne and Levy Physiology- Koeppen Bruce M, Stanton Bruce
- Medical Physiology: A cellular and molecular approach- Boron Walter F, B Emile
- Physiological basis of medical practice- Best and Taylor

#### 8. Assessment

##### 8a. Formative Assessment

Three Internal examinations will be conducted.

Sr. No.	Formative Assessment	Format of Examination			
		Theory Examination		Practical examination	Total marks
1	1 <sup>st</sup> Internal Assessment Examination	One theory paper including Viva	(40+10) marks Total 50 marks	50 marks	100 marks
2	2 <sup>nd</sup> Internal Assessment Examination	One theory paper including Viva	(40+10) marks Total 50 marks	50 marks	100 marks
3	Pre-professional Examination	Two theory papers including theory viva	2 X (40+10) Total 100 marks	100 marks	200 marks

**8.a (i) Internal Examination Pattern**

<i>1<sup>st</sup> Internal Assessment examination pattern</i>	<i>Theory Examination 50 marks (2:30 hours)</i>				<i>Practical Examination 50 marks</i>			
	<b>Question pattern</b>	<b>Marks</b>	<b>No. of Q.</b>	<b>Total Marks</b>	<b>Sections</b>	<b>Marks</b>	<b>No. of Q.</b>	<b>Total Marks</b>
	MCQ	0.5	16	8	<b>OSPE-1</b> ( <i>Spotting-Calculation/ Recall / Image based</i> )	4	5	20
	SAQ	2	7	14	<b>OSPE -2</b> ( <i>Cased based Haematology Practical</i> )	10	2	20
	BAQ	5	2	10	<b>OSCE -3</b> ( <i>Clinical Examination</i> )	10	1	10
	LAQ	8	1	8				
	<b>Total</b>				<b>Total Practical</b>			
	<b>Grand Viva</b>				<b>50</b>			
<b>Total Theory</b>				<b>50</b>				

<i>2<sup>nd</sup> Internal Assessment examination pattern</i>	<i>Theory Examination 50 marks (2:30 hours)</i>				<i>Practical Examination 50 marks</i>			
	<b>Question pattern</b>	<b>Marks</b>	<b>No. of Q.</b>	<b>Total Marks</b>	<b>Sections</b>	<b>Marks</b>	<b>No. of Q.</b>	<b>Total Marks</b>
	MCQ	0.5	16	8	<b>OSPE-1</b> ( <i>Spotting-Calculation/ Recall / Image based</i> )	4	5	20
	SAQ	2	7	14	<b>OSCE -3</b> ( <i>Clinical Examination</i> )	5	2	20
	BAQ	5	2	10	<b>OSPE -4</b> ( <i>Clinical physiology experiments</i> )	10	2	10
	LAQ	8	1	8				
	<b>Total</b>				<b>Total Practical</b>			
	<b>Grand Viva</b>				<b>50</b>			
<b>Total Theory</b>				<b>50</b>				

<i>Pre - professional examination pattern</i>	<i>Theory Examination 2 papers each of 50 marks (2:30 hours)</i>				<i>Practical Examination 100 marks</i>			
	<b>Question pattern</b>	<b>Marks</b>	<b>No. of Q.</b>	<b>Total Marks</b>	<b>Sections</b>	<b>Marks</b>	<b>No. of Q.</b>	<b>Total Marks</b>
	MCQ	0.5	16	8	<b>OSPE-1</b> ( <i>Spotting-Calculation/ Recall / Image based</i> )	4	5	20
	SAQ	2	7	14	<b>OSPE -2</b> ( <i>Cased based Haematology Practical</i> )	20	1	20
	BAQ	5	2	10	<b>OSCE -3</b> ( <i>Clinical Examination</i> )	10	4	40
	LAQ	8	1	8	<b>OSPE -4</b> ( <i>Clinical physiology experiments</i> )	20	1	20
	<b>Total Paper I</b>				<b>Total Practical</b>			
	<b>Total Paper II</b>				<b>50</b>			
<b>Grand Viva</b>				<b>20</b>				
<b>Total Theory</b>				<b>100</b>				

**8 a. (ii) Internal Assessment marks Calculation**

<i>Sr. no</i>	<i>Examination</i>	<i>Percentage</i>	<i>Theory Marks</i>	<i>Practical Marks</i>
1	<b>1<sup>st</sup> Semester</b>	25%	25	25
2	<b>2<sup>nd</sup> Semester</b>	25%	25	25
3	<b>Pre Professional Examination</b>	50%	50	50
	<b>Total</b>	<b>100%</b>	<b>100</b>	<b>100</b>

**8a. (iii) Eligibility criteria for appearing in Professional Examination**

<i>Sr. no</i>	<i>Parameters</i>	<i>Theory</i>	<i>Practical</i>
1	<b>Attendance</b>	75%	80%
2	<b>Internal Marks</b>	50%	50%

**8b. Summative Assessment**

One Professional examination will be conducted at the end of 2<sup>nd</sup> Semester. Examination Pattern will be similar to Pre-professional Examination.

**8 b. (i). Calculation of Total Marks in Professional Examination.**

<b>Subject Total (400 marks)</b>	<i>Examination</i>	<i>Theory marks</i>	<i>Practical marks</i>
	<b>Internal Examination</b>	100	100
	<b>Professional Examination</b>	100	100
		200	200

**8 b. (ii).. Minimum percentage required for passing in Physiology**

<i>Sr. No</i>	<i>Parameters</i>	<i>Theory</i>	<i>Practical</i>
1	<b>Internal Marks</b>	50%	50%
2	<b>Professional Examination</b>	50%	50%

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