

**DETAILED SYLLABUS FOR  
ASSISTANT PROFESSOR IN PHYSIOLOGY  
MEDICAL EDUCATION (CATEGORY NO. 644/2021 &  
236/21)**

**I GENERAL PHYSIOLOGY (5 marks)**

- Homeostasis
- Cell organelles: Structure, functions and applied aspects
- Control of cell growth and cell reproduction
- Intercellular connections and communications
- Transport processes across cell membrane
- Study of ion channels, Channelopathies
- Body fluid compartments and their measurements
- Apoptosis and aging

**II HEMATOLOGY (10 marks)**

- Plasma proteins, plasmapheresis
- Red blood cells - morphology, erythropoiesis and factors affecting it
- RBC destruction and jaundice
- Hemoglobin, types, hemoglobinopathies
- Anemia - classification, investigations and management
- Bone marrow studies
- Leukocytes - structure, contents of granules, properties and functions
- Leukopoiesis, leukemia
- Immunity - types, mechanism of immune response, disorders associated with immunity
- Platelets - properties, functions, variations
- Reticuloendothelial system

- Hemostasis – primary and secondary and the applied aspects
- In vivo anticlotting mechanisms
- Bleeding disorders and investigations
- Blood groups – inheritance, Landsteiner’s laws, grouping and cross matching, Coomb’s test
- Blood banking, blood transfusion and its complications
- Formation and functions of lymph and tissue fluid, edema

### **III CARDIOVASCULAR SYSTEM (10 MARKS)**

- Functional anatomy of & innervation heart and blood vessels
- Properties of cardiac muscle
- Conducting system of heart, origin and spread of cardiac impulse, abnormal pace makers and conduction defects
- Cardiac cycle, volume and pressure changes in different chambers and in major vessels
- Heart sounds and its abnormalities
- Arterial pulse, jugular venous pulse and their abnormalities
- ECG in all leads, ECG abnormalities and cardiac arrhythmias
- Myocardial infarction and ECG changes in different stages
- Heart rate – regulation, cardiovascular reflexes
- Cardiac output – measurement, regulation, cardiac failure
- Hemodynamics – physical laws governing flow of blood in heart and blood vessels
- Peripheral resistance and its regulation
- Blood pressure – measurement, determinants, regulation; hypertension and hypotension
- Classification, pathophysiology and compensatory mechanisms of circulatory shock
- Regional circulation – coronary, pulmonary, cerebral, cutaneous, splanchnic circulation and their regulation
- Cardiovascular adjustments in exercise

#### **IV RESPIRATORY SYSTEM (10 marks)**

- Functional anatomy of respiratory system
- Non-respiratory functions of lung and its applied aspects
- Surfactant, its functions and its clinical importance
- Application of law of Laplace in respiration
- Ventilation – pulmonary and alveolar ventilation, respiratory dead space
- Compliance of respiratory system
- Pulmonary circulation, features and regulation
- Ventilation-perfusion ratio
- Pulmonary gas exchange – blood gas barrier, factors affecting diffusion of gases across respiratory membrane
- Transport of gases – oxygen transport and oxygen hemoglobin dissociation curve; carbon dioxide transport and CO<sub>2</sub> dissociation curve
- Regulation of respiration – neural control, reflex control, chemical control and abnormalities in regulation of respiration
- Hypoxia, cyanosis, asphyxia, oxygen toxicity, CO<sub>2</sub> narcosis
- High altitude physiology, acclimatization, mountain sickness
- Effects of increased barometric pressure on respiratory system – Nitrogen narcosis, decompression sickness, high pressure nervous syndrome
- Pulmonary function tests
- Artificial respiration, Cardio-pulmonary resuscitation
- Pulmonary adjustments during exercise

#### **V GASTROINTESTINAL SYSTEM (10)**

- Organization of gastrointestinal tract
- Enteric nervous system, gut microbiota
- Salivary secretion – composition, functions and regulation of secretion, abnormalities
- Gastric secretion – structure of gastric glands, composition, functions and regulation of gastric juice secretion, gastric mucosal barrier

- Pathophysiology of peptic ulcer and its management
- Pancreatic juice - composition, functions and regulation of secretion
- Liver - functions, composition and functions of bile, functions of gall bladder
- Small intestinal juice - composition and functions
- Functions of large intestine
- Movements of GIT - mastication, deglutition, gastric motility and factors affecting gastric emptying, peristalsis, defecation reflex and their abnormalities
- Mechanism of absorption of carbohydrates, proteins, fat, iron, electrolytes and their abnormalities
- Functions of dietary fiber
- Incretins and their clinical significance
- Hormones produced by the GIT and their actions

## **VI RENAL PHYSIOLOGY, SKIN AND TEMPERATURE REGULATION (10 Marks)**

- Functions of kidney
- Histology of renal tubules
- Renal circulation and its measurement and special features
- Juxtaglomerular apparatus
- Glomerular filtration and factors affecting
- Tubular reabsorption - reabsorption of sodium, glucose, water, electrolytes, urea
- Tubular secretion and factors affecting
- Concentration of urine - countercurrent system
- Role of kidney in acid-base balance
- Anion gap
- Diuretics and diuresis
- Innervation of bladder, micturition reflex, control and its abnormalities

- Dialysis, renal transplantation
- Renal function tests
- Functions of skin
- Regulation of body temperature, fever, hyperthermia, hypothermia, heat stroke, frost bite

## **VII NERVE-MUSCLE PHYSIOLOGY (5 marks)**

- Neuron - structure, types, properties and functions
- Types, classification and functions of nerve fibers
- Resting membrane potential and its ionic basis
- Ionic basis of Nerve action potential, refractory period
- Transmission of nerve impulses
- Peripheral nerve injury - degeneration and regeneration
- Neuromuscular junction and transmission across NMJ, diseases affecting NMJ
- Neuromuscular blocking agents
- Skeletal muscle structure in detail, types
- Molecular basis of skeletal muscle contraction, length-tension relationship
- Electromyography and its clinical application
- Smooth muscle, types, mechanism of contraction and relaxation, plasticity in smooth muscle
- Cardiac muscle - ventricular action potential, length tension relationship

## **VIII NERVOUS SYSTEM (15 marks)**

- Functional anatomy of brain and spinal cord
- Neuroglia, their functions and applied aspects
- Synapse - classification, structure of chemical synapse and synaptic transmission
- Properties of synapses
- Neurotransmitters and neuromodulators; growth factors

- Reflex action – components, properties, classification
- Structure of muscle spindle, stretch reflex, inverse stretch reflex
- Sensory receptors, classification, receptor potential
- Dorsal column and spinothalamic tracts
- Ascending sensory pathways for touch, pain, temperature, proprioception, itching and tickling
- Visceral pain and Referred pain
- Modulation of pain sensation
- Thalamus – structure, functions and lesions
- Sensory cortex and sensory homunculus
- Lesions of sensory cortex
- Motor system – motor cortex, motor homunculus
- Descending tracts – pyramidal and extrapyramidal tracts and their lesions
- Spinal cord injuries at various levels – complete transection, incomplete transection, hemisection injury to anterior and posterior nerve roots and their management
- Basal ganglia – connections, functions and lesions
- Cerebellum - connections, functions and lesions
- Reticular formation, functions, ascending reticular activating system
- Muscle tone and its abnormalities, maintenance of posture and equilibrium and the applied aspects
- Vestibular apparatus – connections, functions, vestibular pathway and applied aspects
- Hypothalamus – connections, functions and lesions
- Limbic system - connections, functions and lesions
- Pathophysiology of EEG and sleep, theories of sleep
- Higher functions of brain – physiology of learning, memory and speech and their abnormalities
- Cortical plasticity

- Conditioned reflexes
- Autonomic nervous system and its functions. Stress and General adaptation syndrome (GAS)
- Physiological basis of yoga and its applications
- Cerebrospinal fluid – formation, compositions, functions, blood brain barrier and applied aspects

## **IX SPECIAL SENSES (5 marks)**

### **Vision**

- Functional anatomy of eye, structure of retina, functions of aqueous humor, glaucoma
- Optical system of eye, image formation on retina, errors of refraction and their correction
- Accommodation and accommodation reflex
- Structure of visual receptors, phototransduction, dark and light adaptation, lateral inhibition in the eye
- Color vision, theories of color vision and abnormalities (color blindness)
- Visual pathway and lesions at various levels, macular sparing
- Visual cortex and functions of each area
- Pupillary reflexes and abnormalities
- Tests of vision – field of vision, visual acuity, color vision
- Visual evoked potential

### **Audition**

- Properties of sound
- Functional anatomy of ear
- Functions of different parts of ear
- Structure and functions of organ of corti
- Theories of hearing
- Auditory pathway
- Endocochlear potential

- Deafness, tests of hearing
- Audiometry
- Cochlear implantation
- Auditory evoked potential
- Cochlear microphonic potentials

### **Olfaction**

- Structure of olfactory epithelium
- Olfactory pathway
- Abnormalities of olfaction

### **Taste**

- Structure and function of taste buds
- Primary taste sensations
- Taste pathway
- Abnormalities of taste

## **X ENDOCRINE SYSTEM (10 Marks)**

- Hormone – classification, mechanism of action of hormones
- Positive and negative feed back regulation of hormone secretion
- Hypothalamus as an endocrine organ
- Pituitary gland – structure, connections of pituitary and hypothalamus, hormones of pituitary, physiological actions of each hormone, regulation of secretion and the applied aspects
- Physiology of growth and development
- Thyroid gland – synthesis of thyroid hormones, actions, regulation of secretion, and hyperthyroidism and hypothyroidism, thyroid function tests
- Endocrine Pancreas – histology of islets of Langerhans, hormones of pancreas, their physiological actions, regulation of secretion; pathophysiology of diabetes mellitus

- Adrenal cortex – hormones, biosynthesis, physiological actions, regulation of secretion, and hypersecretion and hyposecretion of hormones
- Adrenal medulla – structure, hormones produced, actions of various systems, regulation of secretion, applied aspects
- Calcium homeostasis – structure of bone, hormone produced by parathyroid gland, its actions and abnormalities, physiological actions of calcitonin and calcitriol. Osteoporosis, osteomalacia, rickets, hypocalcemia and tetany
- Local hormones and their actions
- Actions of hormones produced by kidney, pineal gland, thymus, adipose tissue, heart and endothelium

## **XI REPRODUCTIVE SYSTEM (5 marks)**

- Sex determination and sex differentiation in the embryo
- Aberrant sexual differentiation
- Chromosomal developmental abnormalities
- Physiology of puberty, pathophysiology of precocious and delayed puberty, effects of castration
- Functional anatomy of male reproductive system
- Spermatogenesis and factors affecting it, composition of sperm and its abnormalities
- Role of trace elements in maintaining normal male reproductive functions
- Endocrine function of testis, actions of testosterone
- Physiology of erection and ejaculation
- Functional anatomy of female reproductive system
- Menstrual cycle – ovarian, uterine and vaginal cycle and its regulation; tests of ovulation
- Actions of progesterone and estrogen; FSH and LH
- Hypothalamo-pituitary-gonadal axis
- Menarche, menopause, precocious puberty, delayed puberty in girls

- Physiology of pregnancy and parturition
- Functions of placenta, fetoplacental unit, tests of pregnancy
- Physiology of lactation – milk secretion and milk ejection
- Contraception in males and females and their mechanism of action
- Infertility

## **XII BIOCHEMISTRY, BIOPHYSICS AND RADIATION PHYSIOLOGY (5 marks)**

- Principles of physics in physiology - Beroulli principle, application of law of Laplace in the body, Nernst equation, Gibbs-Donnan membrane equilibrium, Henderson Hasselbalch equation, Goldman-Hodgkin-Katz equation
- Bioelectricity and its fundamental principles
- Genetic mutation and its consequences
- Polymerase chain reaction
- Protein synthesis and its genetic control
- Western Blot test
- Genetic engineering, gene therapy and role of spliceosomes
- Metabolism of carbohydrates, proteins, fats, nucleic acids in the body
- Effects of ultraviolet rays and ionizing radiation in the body
- Effects of weightlessness and gravity in the body
- Effects of radiation on biological molecules, cells, and humans including cancer and mutagenesis
- Use of radiation in treatment of disease.

**NOTE: - It may be noted that apart from the topics detailed above, questions from other topics prescribed for the educational qualification of the post may also appear in the question paper. There is no undertaking that all the topics above may be covered in the question paper**