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(DEEMED TO BE UNIVERSITY), PUNE, INDIA
PhD Entrance Test – 2026
SECTION-II: Medical Physiology - 35 Marks

Theory Syllabus:

Topics of theory are as follow:

Theory topics- System wise

1.General & Cellular Physiology

- Structure and functions of mammalian cell
- The internal environment –principles of homeostasis
- Intercellular communication
- Organization of a cell -Physical structure of a cell
- Transport mechanisms across cell membranes
- Molecular basis of resting membrane potential and action potential in excitable tissue
- Fluid compartments of the body, its ionic composition & measurements
- pH & Buffer systems in the body
- Genetic code, its expression, and regulation of gene expression

2. Nerve & Muscle Physiology

- Structure and functions of a neuron and neuroglia
- Nerve Growth Factor & other growth factors/cytokines
- Classification**,** functions & properties of nerve fibers
- Nerve conduction
- Degeneration and regeneration in peripheral nerves
- Different types of muscle fibers and their structure
- Action potential and its properties in different muscle types (skeletal & smooth)
- Structure of neuro-muscular junction and transmission of impulses
- Action of neuro-muscular blocking agents
- Molecular basis of muscle contraction in skeletal and in smooth muscles
- Mode of muscle contraction (isometric and isotonic)

3. Blood

i) Composition and functions of blood

- Body fluid compartments
- Plasma proteins- Origin, forms, variations and functions

ii) Erythrocytes

- RBC formation (erythropoiesis & its regulation) and its functions
- Synthesis, functions and fate of Haemoglobin
- Variants of haemoglobin
- Destruction & fate of RBCs
- Different types of anemias, blood indices & Jaundice
- Polycythemias

iii) Leucocytes

- Describe WBC formation (Leucopoiesis)and its regulation

- General characteristics & life span of WBCs
- Classification & functions of each type of WBC
- Leukopenia — leukemias

iv) Blood groups

- Classification, Antigen-Antibody
- Blood typing
- Clinical importance of blood grouping, blood banking and transfusion

iv) Hemostasis

- formation of platelets, functions and variations
- Physiological basis of hemostasis and anticoagulants.
- Mechanisms of coagulation
- Coagulation tests
- Bleeding & clotting disorders (Hemophilia, purpura)

v) Immunity

- Define and classify different types of immunity
- Development of immunity and its regulation
- Innate immunity
- Acquired immunity
- Allergy, hypersensitivity and immunodeficiency

4. Cardio-vascular Physiology

- Functional anatomy of heart including chambers and Pacemaker tissue and conducting system
- Innervation, Nutrition & metabolism of heart
- Properties of cardiac muscle
- Generation and conduction of cardiac impulse
- Cardiac cycle and hear sounds
- Physiology of electrocardiogram (E.C.G), its applications and the cardiac axis
- Abnormal ECG, arrhythmias, heart block and myocardial Infarction
- Principles of Hemodynamics
- Factors affecting heart rate, regulation of cardiac output & blood pressure
- Local and systemic cardiovascular regulatory mechanisms
- Tissue fluid formation
- Regional circulation including microcirculation, lymphatic circulation, coronary, cerebral, capillary, skin, foetal, pulmonary and splanchnic circulation
- Patho -physiology of shock, syncope and heart failure

5. Respiratory system

- Functional anatomy of respiratory system
- Pulmonary ventilation, Alveolar ventilation
- Mechanics of respiration normal respiration, pressure changes during ventilation, lung volume and capacities, alveolar surface tension, compliance, airway resistance, ventilation,
- Principles of gas exchange
- V/P ratio, diffusion capacity of lungs
- Oxygen & carbon-dioxide transport
- Regulation of respiration
- Pulmonary circulation

- Pleural fluid -Lung edema
- Principles of artificial respiration, oxygen therapy, acclimatization and decompression sickness
- Physiology of high altitude and deep sea diving
- Pathophysiology of dyspnoea, hypoxia, cyanosis, asphyxia, drowning, periodic breathing
- Oxygen therapy & toxicity
- Hyperbaric conditions

6. Renal Physiology & Fluid Balance

- Functional anatomy of excretory system
- Mechanism of urine formation involving processes of filtration, tubular reabsorption & secretion; concentration and diluting mechanism Urine formation
- Renal mechanisms for the control of blood volume, blood pressure
- Renal regulation of fluid and electrolytes & acid-base balance
- Innervations of urinary bladder, physiology of micturition and its abnormalities
- Significance & implication of Renal clearance
- Renal failure
- Artificial kidney, dialysis and renal transplantation
- Renal Function Tests

7. Nervous system

- organization of nervous system and spinal cord
- Synapse and interneuronal communication
- Sensory receptors
- Reflexes & reflex action
- Classification of somatic senses
- Sensory transduction
- Dorsal column & medial and lateral lemniscal system
- Pain physiology and analgesia system
- Descending (motor) tracts
- Lesions of spinal cord
- Somatosensory cortex and motor cortex and abnormalities
- Thalamus - functions
- Functions of cerebellum, Cerebellar signs
- Basal ganglia- functions of and circuits
- Limbic system functions and their abnormalities
- Hypothalamus- nuclei and functions
- Autonomic nervous system
- Structure and functions of reticular activating system
- Normal EEG forms
- EEG characteristics during sleep and mechanism responsible for its production Sleep
- Physiological basis of memory and learning
- Stretch reflex
- Mechanism of maintenance of tone, control of body movements, posture and equilibrium
- CSF

8. Special Senses

i) Eye

- Functional anatomy of eye,

- Optics of vision and refractive errors
- Physiology of image formation
- Neurophysiology of vision
- Physiology of pupil and accommodation and light reflex
- Colour vision, colour blindness
- Visual pathway and physiological basis of lesion in visual pathway
- Cortical visual function

ii) Ear

- Functional anatomy of ear
- Functions of external and middle ear
- Physiology of hearing, Cochlea
- Auditory pathways
- Vestibular apparatus
- Auditory pathways -Cortical auditory function
- Pathophysiology of deafness & hearing aids

iii) Taste

- Primary taste sensations
- Taste buds transduction & transmission of taste signals
- Perception of taste
- Patho -physiology of altered taste sensation

iv) Olfaction

- Peripheral olfactory mechanisms
- Olfactory pathways
- Olfactory perception
- Patho -physiology of altered smell sensation

9. Gastro-intestinal System

- The structure and functions of digestive system
- General principles of G-I function
- Mastication & swallowing
- Structure and functions of stomach, Gastric mucosal barrier
- Structure and functions of liver and gall bladder
- Composition, mechanism of secretion, functions, and regulation of saliva, gastric, pancreatic, intestinal juices and bile secretion Salivary secretion
- GIT movements, regulation and functions,
- Defecation reflex.
- Physiology of digestion and absorption of nutrients, role of dietary fibre
- GIT hormones, their regulation and functions
- Gut-Brain Axis

10. Nutrition & Metabolism

- Recommended Dietary Allowances, Balanced diet, Diet for infants, children, pregnant & lactating mothers
- Obesity & Starvation

11. Endocrines system

- Classification of Hormones

- Mechanism of action of steroid, protein and amine hormones Endocrine functions of the hypothalamus
- Pituitary gland and hormones anterior and posterior pituitary Synthesis, secretion, transport, physiological actions, regulation and effect of altered (hypo and hyper) secretion
- Thyroid gland and synthesis, secretion, transport, physiological actions, regulation and effect of altered (hypo and hyper) secretion of thyroid hormones
- Adrenal gland - Synthesis, secretion, transport, physiological actions, regulation and effect of altered (hypo and hyper) secretion of hormones of cortex and medulla
- Endocrine pancreas -Pathophysiology of diabetes
- Parathyroid gland, Physiology of bone and calcium metabolism
- secretion of pituitary gland, thyroid gland, parathyroid gland, adrenal gland, pancreas and hypothalamus
- Physiology of Thymus & Pineal Gland
- Function tests: Thyroid gland; Adrenal cortex, Adrenal medulla and pancreas
- Metabolic and endocrine consequences of obesity & metabolic syndrome, Stress response

12. Reproductive system

- Puberty: onset, progression, stages; early and delayed puberty and outline of adolescent clinical and psychological association
- Male reproductive system: functions of testis and control of spermatogenesis & factors modifying it and its association with psychiatric illness
- Female reproductive system: (a) functions of ovary and its control; (b) menstrual cycle - hormonal, uterine and ovarian changes
- Physiology of pregnancy, parturition & lactation and outline the psychology and psychiatry-disorders associated with it Pregnancy & lactation
- Physiological effects of sex hormones
- Contraceptive methods for male and female, their advantages & disadvantages
- Fetal circulation and Neonatal physiology

13. Other topics

- Physiology of growth & senescence.
- Physiology of Aging
- Psychiatry component pertaining to metabolic syndrome.
- Yoga and Meditation

Books:

- Text book of Medical Physiology - Guyton & Hall
- Text book of Medical Physiology -Indu Khurana
- Review of Medical Physiology -William F. Ganong
- Samson Wright's Applied Physiology
- Textbook of Physiology- A.K. Jain
- Vander, Sherman, Luciano's Human Physiology

Reference Books:

- Human Physiology - Vander Sherman
- Physiological basis of medicine - Best & Taylor.
- Bern & Levy- Physiology
- Fundamentals of Anatomy & Physiology – Martini
- Text book of Medicine –Harrison