

**EXAMINATION SYLLABUS OF HUMAN PHYSIOLOGY  
FOR DENTAL MEDICINE STUDENTS  
2017**

1. Cell physiology. Structural and functional organization of the cell. Cell membrane – specific characteristics. Junctions between the cells and intercellular signalization. Transport of substances through the cell membrane.
2. The human body. Homeostasis. General principles of the homeostatic regulation – regulatory systems and elements of the homeostatic regulatory system. Levels of physiological regulation.
3. Physiology of the excitable cells. Irritability and Excitability. General and specific properties of the excitable cells. Membrane potential – ionic basis of the membrane potentials. Measurement of excitability. Changes in the excitability during excitation. Inhibition. Conduction of the excitation.
4. Transmission of the excitation (inhibition) from one excitable cell to another. Synapses - types of synapses. Chemical synapses. Neurotransmitters and modulators. Postsynaptic potentials. Summation of the postsynaptic potentials.
5. Functions of the nervous system – functional morphology of the nervous system. Physiology of the nerve cell. Neuroglial cells. Neuronal circuits and processing of information from groups of nerve cells – convergence, divergence, reverberating circuits, inhibition.
6. Reflex regulation of the physiological functions. Type of reflexes according to the mechanism of formation and the characteristics of the reflex arc. Nerve centers -types and properties. Cerebral blood flow. Cerebrospinal fluid.
7. The autonomic nervous system (ANS) – general organization. Autonomic nerve centers, ganglia, neurotransmitters and receptors in the autonomic nervous system; effects on different organs and systems. Autonomic reflexes.
8. Role of the hypothalamus, reticular formation, cerebellum, basal ganglia and cerebral cortex in the control of autonomic functions. Integration of the central nervous system in the adaptation processes of the body – “alarm” or “stress” response of the sympathetic branch of the ANS.
9. General principles of humoral control of the physiological functions. Telecrine and paracrine functions. Classification, synthesis and mechanism of action of the hormones. Control of the hormonal secretion.
10. Hypothalamo-neurohypophysial system. Neurosecretion. Hormones of the neurohypophysis. Physiological effects and control of secretion.
11. Hypothalamo-adenohypophysial system. Hormones of the adenohypophysis. Physiological effects and control of secretion.
12. Functional morphology of the thyroid gland. Iodine containing thyroid hormones. Physiological effects and control of secretion. Hyperthyroidism and hypothyroidism.
13. Functional morphology of adrenal glands. Hormones of the adrenal medulla. Physiological effects and control of secretion of adrenaline (epinephrine) and noradrenaline (norepinephrine).

14. Hormones of adrenal cortex – glucocorticoids. Physiological effects and control of secretion. Pharmacological effects of glucocorticoids. Mineralcorticoids and adrenal sex hormones – physiological effects and control secretion. Abnormalities of adrenocortical secretion.
15. Endocrine functions of the pancreas – type of hormones, physiological effects and control of secretion. Disorders of endocrine pancreas secretion.
16. Calcium-phosphate homeostasis. Parathyroid hormone, calcitonin, vitamin D - physiological effects and control of secretion. Impairment of the calcium and phosphate homeostasis.
17. Physiology of reproduction. Male reproductive system. Spermatogenesis. Hormonal activity of the testes. Androgens – types, physiological effects and control of secretion. Erection and ejaculation.
18. Physiology of reproduction. Female reproductive system. Ovogenesis. Hormonal activity of the ovaries. Estrogens and progesterone – types, physiological effects and control of secretion. Female monthly cycle. Pregnancy, delivery and lactation. Tests for early pregnancy.
19. Physiology of skeletal muscles – functional morphology, mechanism and energetics of muscle contraction. Types of muscle contractions. Types of muscle fibers. Muscle work and muscle fatigue. Electromyography.
20. Functional morphology of smooth muscles. Excitation, electrophysiological characteristics and mechanism of contraction of the smooth muscles.
21. Physiology of the blood - functions. Composition and volume of the circulating blood – regulation of the volume. Blood plasma – composition and regulation. Hematocrit. Blood reservoirs.
22. Erythrocytes (RBC) - number and functions. Erythrocyte sedimentation rate. Hemoglobin. Erythrocyte indices. Iron metabolism. Hemolysis. Control of erythropoiesis and erythrocyte count.
23. Blood types. Physiological and clinical significance. The ABO and Rh blood type systems. Methods of analysis. Principles of blood transfusion.
24. Leukocytes (WBC). Number and functions of the different leukocyte types. Control of leukopoiesis and leukocyte count. Immunity.
25. Hemostasis and hemocoagulation. Vascular, thrombocyte and coagulation hemostasis. Fibrinolysis and anticoagulation mechanisms. Control of hemostasis.
26. Physiology of the lymphatic system. Formation, composition and functions of lymph. Physiological role of the spleen.
27. Cardiovascular system. Systemic and pulmonary circulation. The heart as an organ – functional morphology of the endocardium, myocardium and pericardium. Nerve supply. Myocardial blood supply.
28. Physiological characteristics of the working myocardium. Excitation and contraction. Refractory periods. Extrasystoles, flutter and fibrillation. Myocardial metabolism. Functional morphology and physiological characteristics of the conduction system of the heart. Automaticity. Cardiac rhythm. Abnormalities of conductivity.

29. Electrical events during cardiac performance. Origin, registration and evaluation of the electrocardiogram (ECG).

30. Dynamics of the cardiac contractions – cardiac cycle. Role of the valves during the cardiac cycle; functions of the valves. Heart sounds. Methods of examination. Stenosis and insufficiency. Correlation between a synchronous phonocardiographic and electrocardiographic record.

31. Heart rate. Stroke volume and cardiac output and their changes during different physiological conditions.

32. Control of the cardiac performance. Intrinsic (self-control) regulation. Energetics of the heart. Extracardial neural regulation of the cardiac performance – characteristics of the sympathetic and parasympathetic effects. Humoral factors affecting cardiac performance.

33. Functional characteristics of the blood vessels. Hemodynamic principles – characteristics of the vessels and the blood. Hemodynamic indices. Volume and linear velocity of the blood flow through the different parts of vascular system and determining factors.

34. Blood pressure in different parts of the cardiovascular system. Arterial blood pressure – methods of measurements and referent values. Factors, determining blood pressure levels.

35. Arterial blood flow. Arterial pulse. Sphygmography. Characteristics of the arterial pulse. Venous blood flow. Venous pulse. Phlebography.

36. Physiology of microcirculation. Functional organization of the microcirculatory unit. Organ-related peculiarities of the capillaries. Control of microcirculation.

37. Vascular tone. Basal vascular tone. Local, neural and humoral regulatory mechanisms of the vascular tone.

38. Control of circulation. Characteristics and localization of the receptors. Vasomotor center. Supramedullary control of the circulation.

39. Control of the arterial blood pressure. Mechanisms of the quick short-term, quick ongoing, and long-term regulation.

40. Physiology of respiration. External respiration. Functional organization of the air passages, lungs and thoracic cavity. Mechanics of respiration. Intrapleural and intrathoracic pressure. Role of the surfactant. Defensive reflexes – cough and sneeze.

41. Rate and rhythm of breathing. Pulmonary and alveolar ventilation. Elastic and non-elastic resistance to breathing. Air flow during breathing. Work of breathing. Static lung volumes and capacities and their functional value. Anatomical and physiological dead space. Estimation of the external respiration.

42. Physical basis of gas exchange. Solubility, diffusion coefficient and diffusion capacity of the gases. Composition of the gases in air, lungs and blood. Diffusion of gases across the alveolo-capillary barrier. Ventilation-perfusion ratio.

43. Transport of O<sub>2</sub> in the blood. Oxyhemoglobin dissociation curves. Oxygen exchange in the lungs and tissues. Transport of CO<sub>2</sub> in the blood. Carbon dioxide exchange in the lungs and tissues.
44. Control of respiration. Respiratory center and rhythm of breathing. Chemical control of respiration. Reflex control of respiration. Effects of the cerebral cortex on the respiratory functions.
45. The gastrointestinal system – functions. Digestion in the mouth. Biomechanics of mastication: basic cycles of mastication, phases of mastication within the mastication cycle. Control of mastication. Swallowing – phases and regulation.
46. Secretion, enzyme breakdown and reabsorption in the mouth. Control of the secretion. Swallowing – phases and control.
47. Motor functions of the stomach – hunger contractions, storage function, mixing and propulsion of food. Emptying of the stomach; control of its motor activity. Vomiting.
48. Secretion, enzyme breakdown and absorption in the stomach. Gastric juice - composition, secretion and functions. Gastric secretion and its control - cephalic, gastric and intestinal phases. Protective effect of the gastric barrier.
49. Small intestine – motor activity: types of movement and regulation. Secretion, digestion and absorption in the small intestine.
50. Colon – types of movement and their regulation; secretion, digestion and absorption in the colon. Defecation.
51. Pancreatic juice – composition and functions. Control of the pancreatic secretion. Formation and secretion of bile; composition and functions. Regulation of the bile secretion. Functions of the liver.
52. Digestion and absorption of proteins, fats and carbohydrates in the gastrointestinal tract. Absorption of salts, water and vitamins.
53. Nutrient metabolism – carbohydrates; levels and regulation of blood glucose. Protein metabolism and its control. Lipid metabolism and its control.
54. Energy metabolism. Energy values of the nutrients. The Energy equivalent of oxygen. Measurement of the metabolic rate: direct and indirect calorimetry. Basal metabolic rate and daily energy needs in different physiological conditions.
55. Nutrition – general principles in defining physiological standards– plastic and energy needs of the body. Physiology of starvation and satiety.
56. Temperature regulation. Body temperature and isothermia. Mechanisms of heat production and loss. Neurophysiology of temperature regulation. Hyperthermia and hypothermia. Acclimatization. Regulation of body temperature during exercise.
57. Excretion functions of the body and systems, accomplishing them. The kidneys – functional structure, blood supply and innervation. Mechanism and control of glomerular filtration. Methods of glomerular functional assessment.
58. Functions of the renal tubules. Transport in the different parts of the tubules. Excretion of diluted or concentrated urine. Renal excretion.

59. Renal clearance tests. Volume of the urine and its components. Micturition. Endocrine and metabolic functions of the kidneys. Control of the renal functions.

60. The water and electrolyte balance of the body. Body fluids and electrolytes. Dynamics of body fluids volume and osmolality. Control of water-salts homeostasis. Physiology of thirst.

61. The acid-base balance. Buffer systems of the body fluids. Respiratory regulation of the pH. Renal regulation of the pH. Abnormalities of the acid-base balance.

62. The sensory systems. Functional morphology. General principles of sensory systems information coding and processing. Sensory adaptation. General sensation. The somatosensory system – organization and modalities. Mechanisms of thermo- and mechanoreception.

63. Pain sensation. Itch – peripheral and central mechanisms. Tooth pain.

64. Vision . Functional morphology of the eye – the optics of the eye; mechanism of accommodation; errors of refraction. The pupillary reflex. Eye movements and their control. Protective structures of the eye. Detection, transmission and processing of information in the retina. Central neurophysiology of vision. Light and dark adaptation. Visual acuity. Colour vision.

65. The sense of hearing. Functional morphology of the external, middle and inner ear. Processing of the sound signals. Central auditory mechanisms. The vestibular apparatus. Central mechanisms for maintaining equilibrium. Vestibular reflexes.

66. Physiology of the chemical senses - taste and smell. Peripheral and central mechanisms of taste and smell.

67. General characteristics of motor control. Muscle receptors – functions of the muscle spindles and tendon receptors. Spinal cord control of motor activity. The spinal cord reflexes. Motor control at higher levels of the brain.

68. States of brain activity and sleep. The role of the different neuronal structures in the maintenance of brain activity. Physiological changes during sleep. Electroencephalography (EEG).

69. Higher nervous activity – types and characteristics. Learning and memory: types and physiology. Primary and secondary signalling systems. Human communication - reading, writing and speech. Auditory and visual gnosis.