

Thematic plan for seminar-type classes in discipline «Normal physiology – Physiology of the maxillofacial region» for students of 2026 year of admission under the educational programme 31.05.03 Dentistry, specialisation (specialist's), form of study full-time for the 2026-2027 academic year

№	Thematic blocks	Practice within the thematic block	Hours (academic)
2 semester			
1	Physiology of excitable tissues¹ Excitable tissues. General and specific properties of excitable tissues. Stimuli and their classification. Biological membranes, their structure and functions. Types of transport of substances through the membrane. Ion channels, their classification. Resting membrane potential. Action potential and its phases. Conditions for occurrence of action potential. Excitability. Changes of excitability during excitation, phases of excitability. Ratio of between phases of action potential and phases of excitability changes during single excitation cycle. Electrical phenomena in oral cavity. Electro-chemical potentials (ECP), a potentiometric method for their registration ²	P	2
2	Laws of irritation of excitable tissues¹ . «All-or-none» law, its relative nature. Law of force. Law of «Force-duration». Concept of rheobase, useful time and chronaxia. Chronaxia as a measure of excitability. Law of gradient (rate of increase in the strength of stimulus in time). Phenomenon of accommodation in excitable tissues. Critical slope as a measure of accommodation. Electrodiagnostics in dentistry. Electroodontodiagnostics ²		2
3	Physiology of synapses. Physiology of nerves and nerve fibers¹ . Types of nerve fibers. Mechanism of excitation conduction along myelinated and unmyelinated nerve fibers. Laws of conduction excitation along nerve fibers and whole nerves. Lability and parabiosis of nerve fibers. Usage of phenomena of parabiosis in dental practice for drug-induced local anesthesia. Synapse, classification of synapses. Electrical synapses: structure and properties. Chemical synapses, structure. Mechanism of signal transmission in chemical excitatory synapses. Characteristic of the exciting postsynaptic potential. Physiological properties of chemical synapses. Myoneural synapse, its features. The concept of the potential of the end plate, its role in generating an action potential on the muscle membrane ²		2

4	Physiology of muscle contraction¹ Structural and functional organization of muscles. Physical and physiological properties of skeletal muscles. The submicroscopic structure of the myofibril. The concept of sarcomere. Contractile and regulatory proteins. Mechanism of muscle contraction. The role of calcium in the coupling of Electromechanical processes. Single muscle contraction of its phase. Summation of abbreviations, tetanus. Modes of muscle contractions. The features of muscles of the maxillofacial region ²	P	2
5	Concluding class on the topics: Physiology of excitable tissues. Physiology of synapses. Physiology of muscle contraction		2
6	Physiology of central nervous system¹ Functional organization of the central nervous system. Neuron as a structural and functional unit of the central nervous system, structure, properties. Classification of neurons. The concept of reflex. Classification of reflexes. Reflex arc as a morphological substrate of the reflex. Nerve center. Anatomical and physiological concept of the nerve center. Properties of nerve centers ²	P	2
7	Concept of inhibition in the central nervous system¹ , its role in the coordination of reflex activity. Classification of central inhibition. Inhibitory synapses, features of signal transmission in the inhibitory chemical synapse, the concept of IPSP. Primary inhibition: pre- and postsynaptic, mechanisms of formation, mediators and receptors to them. Secondary inhibition (pessimal inhibition by Vvedensky and inhibition following excitation – induction). Principles underlying the coordination activities of the central nervous system ²		2
8	Physiology of autonomic nervous system¹ Autonomic nervous system, its structure and functions. Differences in the organization of the autonomic and somatic nervous systems. Sympathetic division of autonomous nervous system, its structural and functional features (centers, characteristics of fibers and ganglia, mediators, receptors to them, objects of innervation and influence on them). Parasympathetic division of autonomous nervous system, its structural and functional features (centers, characteristics of fibers and ganglia, mediators, receptors to them, objects of innervation and influence on them) Metasympathetic division of autonomic nervous system, its structural and functional features, its role in regulating the activity of internal organs. Types of visceral reflexes: viscerovisceral, viscerosomatic, somatovisceral and viscerosensory ²	P	2
9	Physiology of endocrine system¹ (part 1) Concept of endocrine system. Representation of main components of endocrine system (true endocrine glands, mixed secretions, diffuse endocrine system, cells of non-endocrine organs that have endocrine function) ²		2

10	Physiology of endocrine system¹ (part 2) Hormones, their role and functions. Classification of hormones. Properties and features of the action of hormones. Pathways and mechanisms of action of hormones on target cells (membrane and intracellular). Hypothalamic-pituitary system and its functions. Pituitary gland and its hormones their role. Role of endocrine glands in development and formation of the maxillofacial region ²		2
11	Concluding class on the topics: Physiology of central nervous system. Physiology of autonomic nervous system. Physiology of endocrine system		2
12	Physiology of sensory systems¹ (part 1) General principles of analyzers structure. Main functions of the analyzers: detection, signal discrimination, signal conversion, encoding and conducting information, detection and identification of images. Visual analyzer: receptor, conductor, cortical departments. Optical system of the eye. Concept of refraction. Accommodative system of the eye. Accommodation and its mechanisms ²	P	2
13	Physiology of sensory systems¹ (part 2) Taste analyzer: receptor, conduction, cortical parts. Signal conversion and transmission mechanisms. Olfactory analyzer: receptor, conductor, cortical. Signal conversion and transmission mechanisms. Pain analyzer: receptor, conductor, cortical. Types of pain. Theories of pain. Conductors and central mechanisms of dental pain. Antinociceptive system: nervous and humoral mechanisms. Physiological basis and methods of anesthesia ²	P	2
14	Higher nervous activity (part 1)¹ Unconditional and conditional reflexes, their comparative characteristics. Conditioned reflexes: types, methods and rules for developing conditioned reflexes in animals and humans. Inhibition of conditioned reflexes: types and their characteristics. I. P. Pavlov's concept about the types of HNA. Role of heredity and environment in the formation of the type of HNA. First and second signaling systems in humans, their role ²		2
15	Higher nervous activity¹ (part 2) Structure and functional significance of individual regions of the cerebral cortex. Sleep: types of sleep, sleeping patterns, understanding the mechanisms of sleep. Emotions: functions, types, theories, mechanisms of emotions ²	P	2
16	Concluding class on the topics: Physiology of sensory systems. Higher nervous activity		2
17	Metabolism and energy¹ (part 1) Methods of direct and indirect (complete and incomplete gas analysis) calorimetry. Concept of caloric value, respiratory coefficient and caloric equivalent of oxygen utilization, their values for different types of oxidized nutrients. Specific dynamic action of nutrients. Basal metabolism, conditions determining basal metabolism, factors affecting its value. General metabolism, working increase. Value of general metabolism for different types of labor ²	P	2

18	Metabolism and energy¹ (part 2) Principles of food ration preparation. Role of proteins, fats, and carbohydrates in nutrition, and daily need for nutrients. Importance of water, minerals and vitamins in nutrition. Thermoregulatory system: thermoreceptors, their classification; concept of isothermal conditions; mechanisms of heat production and heat loss ²		2
			36
3 semester			
19	Physiology of the digestive system (digestion in the oral cavity)¹ The essence of the digestive process. A functional system that maintains a constant level of nutrients in the blood. Methods of studying the functions of the digestive glands. The essence of the chronic research method created by I.P. Pavlov, its advantages. The role of the oral cavity in the digestive process. Composition and properties of saliva. Schemes of the reflex arc of the unconditional salivation reflex. Adaptive nature of salivation to various food and rejected substances ²		2
20	Digestion in the stomach¹ General characteristics of digestive processes in the stomach. Composition and properties of gastric juice. Regulation of gastric secretion: a) cephalic phase, b) the second phase is gastric (neurohumoral); main foods that stimulate gastric secretion; c) third phase – intestinal ²	P	2
21	Digestion in the intestine (part 1)¹ Pancreatic secretion. Composition and properties of pancreatic juice. Regulation of pancreatic secretion: a) complex reflex phase; b) humoral phase. Liver functions. The role of bile in digestion. Composition and properties of bile. Regulation of bile formation. Basic foods that stimulate bile formation. The mechanism of bile secretion, its reflex and humoral regulation. Intestinal juice, its composition and properties. Types of contractions of the gastrointestinal tract muscles, their characteristics. Regulation of the motor function of the gastrointestinal tract: Absorption of basic nutrients, mechanism of absorption, its regulation. Food center. Modern ideas about the mechanisms of hunger, thirst, satiety ²		2
22	Concluding class on the topics: Metabolism and energy. Physiology of the digestive system (digestion in the oral cavity). Digestion in the stomach. Digestion in the intestine		2

23	External respiration¹ Principles of organization of the functional respiratory system. Breathing, its main stages. The mechanism of external respiration. Biomechanics of inhalation and exhalation. Pressure in the pleural cavity and its origin and role in the mechanism of external respiration. Changes in intrapleural pressure during different phases of the respiratory cycle. Methods for their determination. Residual volume. Minute volume of pulmonary ventilation and its changes under various loads, methods for its determination. «Dead space» and effective pulmonary ventilation. Composition of atmospheric and exhaled air. Alveolar air as the internal environment of the body. The concept of partial pressure of gases. Gas exchange in the lungs. Partial pressure of gases (O ₂ and CO ₂) in the alveolar air and gas tension in the blood. Basic laws of gas transport through a membrane. Gas exchange between blood and tissues. O ₂ and CO ₂ tension in the blood, tissue fluid and cells. Transport of gases by blood: a) transport of O ₂ by blood; oxyhemoglobin dissociation curve, its characteristics; blood oxygen capacity; b) transport of carbon dioxide in the blood; carbonic anhydrase value; relationship between O ₂ and CO ₂ transport ²	P	2
24	Regulation of respiration¹ Innervation of the respiratory muscles. Respiratory center. Modern concept about structure and localization of respiratory center. Automation of the respiratory center. Dependence of the respiratory center activity on the gas composition of the blood. The role of chemoreceptors in the regulation of respiration. The role of mechanoreceptors in the regulation of respiration. The role of carbon dioxide in the regulation of respiration. The mechanism of the first breath of a newborn. The mechanism of periodic activity of the respiratory center. Theories of the origin of periodic activity of the respiratory center. The influence of irritation of various receptors and parts of the central nervous system on the respiratory center. Conditioned reflex regulation of breathing. Protective breathing reflexes. Features of breathing in various conditions: a) breathing during muscle work; b) breathing at low atmospheric pressure (altitude sickness (disease)); c) breathing at high atmospheric pressure (caisson disease); d) artificial respiration; e) periodic breathing ²	P	2
25	Physiology of blood. Hemostasis¹ (part 1). Blood functions. Blood composition. The amount of blood in the body, its relative constancy. Blood plasma, its quantity, composition. Electrolyte composition. Osmotic pressure. Osmotic resistance of erythrocytes. Regulation of constancy. Blood plasma proteins, their physiological role. Oncotic pressure, its role. Erythrocyte sedimentation rate (ESR). Mechanism, clinical significance, indicators. Blood pH. Blood buffer systems. Regulation of blood pH constancy ²		

26	Physiology of blood. Hemostasis¹ (part 2). Red blood cells, structure and functions. Normal content in circulating blood. Hemolysis of erythrocytes, its types. Erythropoiesis, its regulation. Hemoglobin, physiological significance, types and compounds. Color index, clinical significance, magnitude. The role of white blood in the body. Leukocytes, their characteristics. Specific and nonspecific immunity. Its mechanisms. Leukopoiesis, its regulation. Leukocyte formula, clinical significance ²		
27	Physiology of blood. Hemostasis¹ (part 2). Platelets. Structure and functions. The system for regulating the state of blood aggregation (RAS), its main elements. Clinical and physiological role. The concept of hemostasis, the process of blood coagulation, its phases. Vascular-platelet hemostasis. Coagulation hemostasis. External and internal coagulation pathways. Anticoagulant blood system. Physiological anticoagulants. Their role is in maintaining the fluid state of the blood. Fibrinolysis, its phases. Blood groups. AB0 system. RH factor, its significance for medical practice. Physiological and clinical basis of blood transfusion ²		
28	Concluding class on the topics: External respiration. Regulation of respiration. Physiology of blood. Hemostasis		2
29	Properties of the heart muscle¹ Anatomical and histological features of the structure of the heart. The main physiological properties of the heart. Automatism. Anatomical substrate and the nature of automatism, the action potential of the pacemaker cells. The leading role of the sinoatrial node. The gradient of automatism. Features of excitation in the heart muscle. Cardiomyocyte action potential, its phases and origin. Features of excitability of the heart muscle. The refractory period. Normal human ECG. Cardiac cycle, its phases. Blood pressure in the cavities of the heart in various phases of the cardiac cycle, valve function. Normal human ECG, its genesis, clinical significance ²	P	2
30	Regulation of heart activity¹ Intracardiac mechanisms of heart regulation: Intracardiac heterometric and homeometric mechanisms. Intercellular regulation. The «All-or-none law», creative connections. Frank-Starling law. Intracardiac nervous regulation. The concept of peripheral intracardiac reflexes. Cholinergic and adrenergic mechanisms. Extracardiac regulation. Innervation of the heart. The influence of sympathetic and parasympathetic nerves on the heart. Central reflexes. The most important reflexogenic zones, chemo- and baroreceptive mechanisms. Conjugate reflexes – Danini-Aschner, Goltz. Humoral regulation. The influence of hormones, electrolytes, metabolites on heart function. Interaction of nervous and humoral mechanisms ²	P	2

31	Basic principles of hemodynamics¹ Morpho-functional classification of blood vessels. Volumetric blood flow velocity. Factors on which it depends. Linear velocity of blood flow. Velocity in arteries, capillaries, veins. Time for complete blood circulation. The importance of vascular elasticity for blood flow. Vascular resistance. Factors influencing its value. Total peripheral resistance. Blood pressure in different parts of the vascular system. Arterial pressure. Factors influencing its value. Main indicators of blood pressure: systolic, diastolic, pulse and mean hemodynamic pressure. Arterial pulse, its origin, pulse characteristics, registration ²	P	2
32	Regulation of vascular tone. Regional blood circulation¹. The concept of vascular tone, its types. Basal tone, its origin. Innervation of blood vessels. Vasoconstrictor nerves. Neurogenic mechanisms of vasodilation. Vasomotor center, its structure and functions. Reflexogenic zones and depressor reflexes. Intrinsic and conjugate reflexes of the cardiovascular system. Humoral regulation of vascular tone. Regional blood flow. Mechanisms of regulation. Features of coronary, cerebral blood flow, blood circulation in the pulmonary circuit ²		2
33	Physiology of the excretory system¹ Organs and processes of excretion. Water-salt exchange. Kidneys and their function. The structure of the nephron. Features of the nephron blood supply. The process of urine formation. Glomerular filtration. Tubular reabsorption. Tubular secretion. Osmotic dilution and concentration of urine. Homeostatic function of the kidneys. The role of the kidneys in osmoregulation and volume regulation. The role of the kidneys in the regulation of the ionic composition of the blood. The role of the kidneys in the regulation of acid-base state. Excretory function of the kidneys. Endocrine function of the kidneys. Metabolic kidney function. Nervous regulation of kidney activity. Diuresis. Composition of urine. Urination. Hemodialysis. Artificial kidney ²	P	2
			30

¹ - subject

² - essential content

Considered at the meeting of the department of normal physiology «25» May 2026, protocol № 9

Head of the Department



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